INVESTIGATION OF GENERALIZED CORRELATIONS AND PREDICTIONS OF RESIDUAL ENTHALPY OF SUPERHEATED VAPOR FOR PURE COMPONENTS AND MIXTURES

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Certification

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Abstract

Prediction of accurate values of enthalpy (H) or enthalpy departure (H^R) for gases is very important in process design calculations and other industrial applications. Experimental measurements of enthalpy or enthalpy departure for superheated vapor are not easy to perform. So in order to obtain accurate H or H^R values, attention has been turned to calculate them using equations of state.

In this study cubic equations of state were used to calculate enthalpy and enthalpy departure for pure superheated vapor, they were Soave-Redlich-Kwong equation of state, and Peng-Robinson equation of state. In addition to those equations, Virial, Lee-Kesler correlation was also used. These methods were tested against 2177 experimental data points of pure superheated vapors and it was found that Soave-Redlich-Kowng equation was the best compared with the others. Noting that Soave equation of state was developed primarily for calculating vapor-liquid equilibrium and that the present use is somewhat outside their usual application. To overcome this problem effort were directed to modify Soave-Redlich-Kowng equation of state to predict enthalpy departure of pure components and to develop new correlation for mixture. A modification of Soave equation was made to improve its accuracy and this was done by introducing a new expression to calculate the m parameter in Soave equation. The new m parameter became a function of reduced temperature and reduced pressure as well as acentric factor as follows:

$$\boldsymbol{m} = \boldsymbol{a}_f + \boldsymbol{b}_f\omega + \boldsymbol{c}_f\omega^2$$

Where:

$$a_f = 3.192426$$

$$b_f = -14.6167 \times T_r - 5.7701 \times T_r^2 - 10.3125 \times P_r + 6.91052 \times T_r \times P_r + 0.97196 \times P_r^2$$

$$c_f = 95.60639 \times T_r + 57.877 \times T_r^2 - 4.94924 \times P_r + 21.14243 \times T_r \times P_r - 4.58519 \times P_r^2$$

Predicted values using this method were in agreement with experimental data where the average absolute deviation for 8 pure components with 1032 experimental data points was 6.43503 J/g for H^R and 0.731214 for H, as compared with Soave-Redlich-Kwong correlation where the AAD was 10.64125 J/g for H^R and AA%D was 1.205065 for H for the same data points. This correlation was applied for pure components at pressure up to 138 bar. For high pressure of nitrogen up to 10000 bar and ammonia up to 5000 bar another modified m parameter was obtained in the same way as pure components as follows:

$$m = a_f + b_f \omega + c_f \omega^2$$

Where:

$$a_f = 1.08047$$

$$b_f = -8.3078 - 2.06477 \times T_r - 0.1202866 \times P_r$$

$$c_f = -2.2745 + 37.73731 \times T_r + 1.034199 \times P_r$$

The average absolute percentage deviation of 1145 experimental data points of nitrogen and ammonia obtained from this correlation was 2.48739 for H^R and 4.61104 for H.

To extend the application to mixtures, a new simple relation was developed for prediction of the enthalpy and enthalpy departure of mixtures. This relation was based on the principle of corresponding states (reduced temperature, reduced pressure, acentric factor, and composition).

$$\frac{H^R}{RT_{CM}} = -0.12579 - 0.78614 \times T_r - \frac{0.34704}{P_r} + 0.6758\frac{T_r}{P_r} - 0.168728\frac{T_r^2}{P_r^2} - 1.109548\frac{P_r^{(4.36269)}}{T_r^{(14.1992)}}$$

For binary non-polar mixtures, using the above equation with suitable mixing rules, it was found that Lee-Kesler mixing rules were the most suitable ones. These mixing rules with the correlation presented by the present work gave the AAD 5.334148 J/g for H^R and AA%D 0.5240545 for H for 754 data points of five binary non-polar mixtures, as compared with Lee- Kesler where the AAD was 10.64685 J/g for H^R and AA%D was 1.056132 for H for the same conditions and for the same mixtures.

contents

Nomenclature

Symbol	Definition	Units
a, b	Constants used in the cubic equation of state	---
A, B	Constants used in the cubic equation of state	---
A, B	Coefficients of equation (2-20)	J/mol· K
a_f, b_f	Coefficients of equations (4-4), (4-8)	---
$\boldsymbol{B}$, $\boldsymbol{B'}$	Second virial coefficient	cm^3/mol^2
$\boldsymbol{C}$, $\boldsymbol{C'}$	Third virial coefficient	cm^6/mol^3
C	Coefficient of equation (2-20)	K
c_f	Coefficient of equations (4-4), (4-8)	---
C_P	Heat capacity at constant pressure	J/mol· K
C_V	Heat capacity at constant volume	J/mol· K
$\boldsymbol{D}$, $\boldsymbol{D'}$	Fourth virial coefficient	cm^6/mol^3
h	Constant in equation (3-5)	---
H	Enthalpy	kJ/kg
LK	Lee-Kesler	---
m	Constant used in equation (3-13),(3-21), (3-26),(3-32)	---
Mwt.	Molecular weigh	kg/kmol
n	Constant Equation (3-27)	---
n	Coefficient of equation (2-20)	---
P	Pressure	bar
P_C	Critical Pressure	bar
P_r	Reduced Pressure	---
PR	Peng-Robinson	---
R	Universal Gas Constant	J/mol· K

RK	Redlich-Kwong	---
SRK	Soave-Redlich-Kwong	---
T	Absolute Temperature	K
T_b	Normal Boiling Point Temperature	K
T_C	Critical absolute Temperature	K
T_r	Reduced Temperature	---
T_{rn}	Reduced Normal Boiling Point Temperature	K
V	Volume	m^3
V_C	Critical Molal Volume	cm^3/mol
U	Internal Energy	kJ/kg
x,y	Mole Fraction	---
Z	Compressibility Factor	---
Z_C	Critical Compressibility Factor	---

Greek Letter

Symbol	Definition
α	Constant used in cubic equation of state
ω	Riedel's third parameter equation (2-4) Acentric factor
Δ	Difference
β	Parameter used in equation (3-36)
γ	Parameter used in equation (3-36)
∂	Derivative

Superscript

Symbol	Definition
ig	Ideal gas
R	Residual
sat	Saturated
(0)	Simple Fluid Equation (3-35)
(r)	Reference Fluid Equation (3-35)

Subscript

Symbol	Definition
i	Component i
ij	Component i and j
m	Mixture
vap	Vaporization

Chapter one

Introduction

In practice, the analysis of phase equilibrium usually requires evaluation of changes in enthalpy or entropy or other properties that may result from changes in primary variables such as temperature, pressure, and composition. Thus the design of separation equipment requires enthalpy balances. Enthalpy is one of the most important thermodynamic properties of a compound. In almost all design calculations, there is a need for the values of enthalpy. For saturated liquid or vapor and for gas phase, there are two sources for enthalpy data. First, the large quantity of experimental enthalpy data available in literature, and second from the accurate recommended methods – based on equation of state – that predict enthalpy. But for superheated vapor, there is a shortage in experimental data, and there is no accurate recommended method for calculating enthalpy or enthalpy departure.

For many pure substances and mixtures, charts or tables of energy functions are available that are based on more or less complete experimental data. This class of substances includes the lighter hydrocarbons, common gases, and refrigerants. On the other hand correlations have been devised for heavier petroleum fractions. Because data are so limited, particularly for mixtures, the only feasible method for evaluating changes in energy functions is based on equations of state to find the effect of pressure and ideal gas heat capacities to find the effect of temperature. Many such heat-capacity data have been measured, and satisfactory estimates usually can be made from

molecular group contributions. Values of these properties can be obtained from direct experimental data. Thus calorimetric measurements of enthalpy lead directly to residual enthalpy, however such data are not abundant, particularly for mixtures. To evaluate any correlation or prediction of residual enthalpy comparison of results with those obtained from experimental data is made. In practice, residual properties are found with the aid of equation of state, which are based on experimented PVT and other data.

The principal aim of this work is to study the existing methods for calculating the enthalpy departure, and to modify or improve the best method in order to come out with methods that may predict the enthalpy departure for pure gases and to develop these methods further to extend their application to high pressure and temperature with good accuracy.

This study also includes a new correlation for non polar superheated mixtures to be an accurately applicable for calculating enthalpy departure as a function of T_r, P_r, and with Lee-Kesler mixing rules.

Chapter Two

Theories and Definitions

2-1 Equation of state

There are many types of equations of state; in general, they are thermodynamic relationships between three properties of a pure (or one-component) substance [35].The term EOS most commonly refers to the relationship of the properties P, V, and T of a gas. Solids and liquids are also described by P-V-T equations of state, although the quantitative forms are very different from the ideal gas law or its modifications for non ideality that are commonly used to represent the behavior of gases. In functional mathematical form, the EOS can be written as V = *f* (P, T). This form indicates that the volume is expressed as a function of pressure and temperature. However, the EOS can be equally well be written as P (V, T) or even T (P, V). Since pressure and temperature are usually specified in an experiment or in a process, the form V (P, T) is most commonly employed [41].

2-2 Law of corresponding states

The principle of corresponding states is useful for the correlation of thermodynamic data and for making predictive calculations for normal fluids and their mixtures [19].Both the van der Waals and Redlich-Kwong equations of state have been written in the form:

$$Z=f\ (T_r, P_r) \qquad (2\text{-}1)$$

van der Waals first recognized this functional relationship in 1873. Thus the prediction of unique relationship among Z, T_r and P_r is known as the van der Waals two-parameter theorem of corresponding states. It states that any pure gas at the same reduced temperature and pressure should have the same compressibility factor; expressions such as equation (2-1) are known as generalized equations, because of their general applicability to all substances. Since, the van der Waals and Redlich-Kwong equations apply to both the liquid and gas phases, the theorem expressed by equation (2-1) should also apply to both single phases, up to and including the saturated-vapor and saturated-liquid states [57].

Three alternate parameters have been proposed: critical compressibility factor (Lydersen, Hougen, and Greenkorn) [23], alpha (Riedel) [36], and acentric factor (Pitzer) [33]. In actuality, the critical compressibility can vary greatly between substances. This would suggest that utilizing Z_c as a third parameter could increase the accuracy of the principle of corresponding states [35].

$$Z=f\,(T_r, P_r, Z_c) \qquad (2\text{-}2)$$

To calculate Z_c, the critical volume (V_c) must be known, since the differential compressibility, $\left(\frac{\partial V}{\partial P}\right)_T$ approaches infinity at the critical point and hence the critical volume cannot be accurately measured. Pitzer acentric factor has been widely used, and the law is as of corresponding states of three parameters, i.e., [40].

$$Z=f\,(T_r, P_r, \omega) \qquad (2\text{-}3)$$

With three parameters (P_r, T_r, and ω), the principle of corresponding states becomes highly accurate for subcooled and superheated nonpolar and slightly polar substances. While the accuracy is lessened in the saturated region and near the critical point, the three-parameter model still provides a reasonable approximation [43].

2-3 Third parameter

2-3-1 Critical compressibility factor (Z_c):

In 1951, Meissner and sepherian [26] first proposed the use of critical compressibility factor as a third parameter. The authors have correlated the compressibility factor with T_r, P_r and Z_c using Z_c= 0.27 as a reference. The usefulness of Z_c as a third parameter was again demonstrated by Lyderson [23]in their thermodynamic property correlations [12].

2-3-2 Alpha:

Riedel [36]studied in 1954 the slopes of reduced vapor pressure of a fluid at the critical point of spherical molecular fluids which lead to a third parameter [12], that is defined as

$$\alpha = \left[\frac{d(\ln P)}{d(\ln T)}\right] \qquad \text{(At critical point)} \qquad (2\text{-}4)$$

2-3-3 Acentric factor:

The following year, basically Martin and Hou [25] independently introduced the same parameter in their development of an equation of state. In the same year Pitzer [33] proposed another third parameter known as "acentric factor". Among the third parameters proposed, Pitzer's acentric factor has gained widest acceptance in both academic and industrial areas, because it is a simple extension of two parameter corresponding states

principles and gives good accuracy for normal fluids including hydrocarbons [12].

As originally proposed, ω represents the acentricity or non-sphericity of a molecule force field. For monatomic gases ω is therefore essentially zero. For methane it is still very small. However, for higher molecular-weight hydrocarbons, ω increases. It also rises with polarity. At present, ω is very widely used as a parameter, which in some manner is supposed to measure the complexity of a molecule with respect to both the geometry and polarity, but the large values of ω for some polar compounds ($\omega > 0.4$) are not meaningful in the context of the original meaning of this property [35]. Deviations from simple fluid behavior are evident when $\omega > 0$ [43].The acentric factor was defined as

$$\omega = -1 - \log_{10}(P_r^{sat})_{Tr=0.7} \qquad (2\text{-}5)$$

2-4 Enthalpy departure

It is a thermodynamic property, which depends on the positions of the molecules relative to one another. In the ideal gas state all molecules are effectively infinity far apart and therefore a residual property is a property relative to what it would be in the ideal gas state at the same temperature (T), pressure (P), and composition (x) [3]. Sometime it is more convenient to define a residual property as a property relative to ideal-gas state at the same T, V and χ. All residual properties become zero for ideal gases [12].

Enthalpy departure or residual enthalpy is a measure of deviation of actual enthalpy from ideal gas enthalpy, i.e.,

$$H^R = H - H^{ig} \qquad (2\text{-}6)$$

Where H^{ig} is the enthalpy of ideal gas.

In order to obtain enthalpy departure by using an equation of state the following derivation is used [43]:

H=U+PV or $$\frac{H}{RT}=\frac{U}{RT}+\frac{PV}{RT} \tag{2-7}$$

But $\frac{PV}{RT}=1$ for ideal gas, and $\frac{PV}{RT}=Z$ for real gas

$$\frac{H^{ig}}{RT}=\frac{U^{ig}}{RT}+1 \tag{2-8}$$

$$\frac{H}{RT}=\frac{U}{RT}+Z \tag{2-9}$$

Subtract equation (2-9) from equation (2-8)

$$\frac{H-H^{ig}}{RT}=\frac{U-U^{ig}}{RT}+Z-1 \tag{2-10}$$

But

$$dU=\left(\frac{\partial U}{\partial T}\right)_V dT+\left(\frac{\partial U}{\partial V}\right)_T dV \tag{2-11}$$

The first term is the heat capacity at constant volume, i.e.,

$$\left(\frac{\partial U}{\partial T}\right)_V=C_V \tag{2-12}$$

And the second term is to be found from Maxwell relation as:

$$\left(\frac{\partial U}{\partial V}\right)_T=\left[T\left(\frac{\partial P}{\partial T}\right)_V-P\right] \tag{2-13}$$

Combining equations (2-11), (2-12) and (2-13) gives:

$$dU=C_V dT+\left[T\left(\frac{\partial P}{\partial T}\right)_V-P\right]dV \tag{2-14}$$

At constant temperature, equation (2-14) becomes:

$$\left\{dU=\left[T\left(\frac{\partial P}{\partial T}\right)_V-P\right]dV\right\}_T \tag{2-15}$$

Integration of equation (2-15) between ideal gas and actual gas gives:

$$\frac{U - U^{ig}}{RT} = \frac{1}{RT}\int_{\infty}^{V}\left[T\left(\frac{dP}{dT}\right)_V - P\right]dV \qquad (2\text{-}16)$$

Substituting equation (2-16) into equation (2-10) gives:

$$\frac{H - H^{ig}}{RT} = Z - 1 + \frac{1}{RT}\int_{\infty}^{V}\left[T\left(\frac{dP}{dT}\right)_V - P\right]dV \qquad (2\text{-}17)$$

2-5 Ideal gas state thermal properties

The thermodynamic property calculation methods are for calculating the isothermal departures of the properties from their ideal gas state values for pure fluids or mixtures. Therefore, it is imperative to know the ideal state properties of pure components for the calculation of thermodynamic properties of real fluids at given temperature and pressure. The most fundamental ideal gas state thermal property is the heat capacity [12].Once this property is accurately known; all other ideal gas state thermal properties can be calculated from the thermodynamic relationships. The data compilation tabulates cp^{ig}, $(H^{ig}\text{-}H_o^{ig})$, as function of temperature over 298.15-1500 K for many hydrocarbons and associated gasses are available.

The molar or specific enthalpy of a substance may therefore be expressed as a function of two other state variables

H=*f* (T, P)

$$\Delta H = \int_{T1}^{T2} c_P dT \qquad (2\text{-}18)$$

The ideal gas is a hypothetical state often used as a reference point for calculating thermodynamic properties such as enthalpy. It represents the enthalpy of pure species [44]

$$H^{ig} - H_o^{ig} = \int c_P{}^{ig} dT \qquad (2\text{-}19)$$

Where

H^{ig} = ideal gas state enthalpy at T

H_o^{ig} = ideal gas state enthalpy at absolute zero temperature

Since ideal gas state properties are monatomic functions of temperature, many such equations have been proposed. The most notable ones are the polynomials with varying number of terms depending on the temperature range covered and the accuracy desired. For relatively short temperature range, the first or second order polynomials are sufficient, but for wide temperature ranges higher order of polynomials are needed [12].

Thinh [51] method used a third order polynomial to fit the c_p^{ig} data over the temperature range of 300-5000^{o}k. Passut & Danner [30] used a fourth order polynomial for cp^{ig} to fit simultaneously the (H^{ig}-H_o^{ig}), c_p^{ig} data using the relationships of equation (2-19). Duran et al. [11] showed that the Yuan-Mok expression,

$$C_P^{ig} = A + B\,exp\left(\frac{-C}{T^n}\right) \qquad (2\text{-}20)$$

Gave better results than the polynomial with the same number of coefficients. But such exponential expression cannot be analytically integrated to obtain H^{ig}. From theoretical considerations, Aly and Lee [4] proposed a more accurate but substantially more complex expression involving hydrobolic functions. For engineering applications, however, the Passut-Danner equations are sufficiently accurate and easy to use [9].

2-6 Enthalpy of vaporization

The enthalpy of vaporization ($\Delta H_{vap.}$) is a special form of latent heat of vaporization. It is the difference between the enthalpy of the saturated vapor

and that of saturated liquid at the same temperature [3]. The enthalpy change accompanying material transfer between phases is obtained by differencing the enthalpies of each state. [38] For pure substances, the enthalpy of vaporization can be found by empirical methods which are simpler than the application of equations of state to both phases even when they are valid [24].

1. Riedel equation

An often-satisfactory equation, requiring knowledge of only the atmospheric point, T_b, and the critical temperature and pressure, is a combination of results by Riedel [36]

$$\Delta H_{vap.} = \frac{1.1093 R T_b(-1+\ln P_c)}{0.93-\frac{T_b}{T_c}}\left[\frac{T_c-T}{T_c-T_b}\right]^{0.38} \qquad (2\text{-}21)$$

Riedel [36] has proposed the following dimensionless relation for the enthalpy of vaporization ΔH_{vap} at the reduced normal boiling point,

$$\frac{\Delta H_{vap.}}{RT_c} = \frac{1.093 T_{rn}(\ln P_c - 1.013)}{0.93 - T_{rn}} \qquad (2\text{-}22)$$

2. Watson equation[58]

If the enthalpy of vaporization is known at one temperature, the value at another temperature is obtained from

$$\frac{\Delta H_{vap.1}}{\Delta H_{vap.2}} = \left(\frac{1-T_{r1}}{1-T_{r2}}\right)^{0.38} \qquad (2\text{-}32)$$

Once the heat of vaporization value at a temperature is known, the value at another temperature may be calculated with good accuracy using the following Watson [46] equation:

$$\Delta H_{vap.2} = \Delta H_{vap.1}\left(\frac{T_2 - T_c}{T_1 - T_c}\right)^n \qquad (2\text{-}24)$$

Silverberg and Wenzel **[**42**]** studied the values of n for many different substances. For hydrocarbons, however the original constant of 0.38 appears to be quite adequate.

3. Carruth and Kobayashi

Carruth and Kobayashi [8] presented the following correlation:

$$\frac{\Delta H_{vap.}}{RT_c} = 7.08(1 - T_r)^{0.354} + 10.95\omega(1 - T_r)^{0.456} \qquad (2\text{-}25)$$

2-7 Mixing rules (Combining rules)

These have the purpose of representing a property of a mixture in terms of the composition and the properties of the pure components. Depending on the property, the composition may be in mole or weigh fractions. Some of the combining rules have a rational basis, but most are a property which can be improved by incorporating a limited amount of experimental data on the mixture or on component pairs of the mixture [40].

The equation of state are generally developed for pure fluids first, and then extended to mixtures [6]. The mixture extension requires the so-called mixing rules, which are simply means of calculating mixture parameters equivalent to those of pure substances. Except for those of virial coefficients, the mixing rules are more or less arbitrary rules that are to reflect the composition effect on the system properties. Most of the simple equations of state evolved from the van der Waals' equation use van der Waals' mixing rules with or without modifications [56].

Chapter Three

Literature Survey

Equation of state

Different equations of states have been proposed. The following are the most important cubic equations of state.

3-1 Redlich-Kwong Equation

Although the van der Waals equation was developed in 1873, no major improvement, in cubic equations of state occurred until the publication of the Redlich-Kwong [34] equation in 1949 [59]. It has proven to be one of the more useful and widely accepted cubic equations of state and is considerably more accurate than the van der Waals equation [15].

$$P = \frac{RT}{V-b} - \frac{a}{T^{1/2}V(V+b)} \qquad (3\text{-}1)$$

The constants a and b can be accurately determined by fitting the constants, using experimental PVT data. However, as this information is not usually available, the criteria of the critical point (at the critical point the first and second derivatives of pressure with respect to volume equal to zero) are used to determine values for a and b as a function of the critical temperature and critical pressure of the compound concerned[7]. The results of this derivation are [43]

$$a = \frac{0.42748 R^2 T_C^{2.5}}{P_C} \tag{3-2}$$

$$b = \frac{0.08664 R T_C}{P_C} \tag{3-3}$$

The compressibility factor equation:

$$Z = \frac{1}{1-h} - \frac{A}{B}\left(\frac{h}{1+h}\right) \tag{3-4}$$

Where

$$h = \frac{b}{V} = \frac{bP}{ZRT} \tag{3-5}$$

$$A = \frac{aP}{R^2 T^{2.5}} \tag{3-6}$$

$$B = \frac{bP}{RT} \tag{3-7}$$

Equation (3-1) can be written in terms of compressibility factor as:

$$Z^3 - Z^2 + (A - B - B^2)Z - AB = 0 \tag{3-8}$$

Equations (3-4) and (3-5) are arranged for convenient iterative solution for the compressibility factor Z for any gas at any condition of T_r and P_r. For an initial value of Z=1, h is calculated by equation(3-4), with this value of h, equation(3-5) yields a new value of Z for substitution into equation(3-4). This procedure is continued until a new iteration produces a change in Z less than some small preset tolerance[39,43].

3-2 Soave-Redlich-Kwong Equation

Soave [45] equation is a modification of the Redlich-Kwong EOS. The temperature dependent term $a/T^{0.5}$ of the RK equation was replaced by a function a=f(T, ω) involving the temperature and the acentric factor by Soave [43].

$$P = \frac{RT}{V-b} - \frac{a}{V(V+b)} \tag{3-9}$$

The parameter a (T, ω) was formulated primarily to make the equation fit the vapor pressure data of hydrocarbons with the result [41].

$$a = a_C \alpha \tag{3-10}$$

$$a_C = 0.42747 \frac{R^2 T_C^2}{P_C} \tag{3-11}$$

$$\alpha = \left[1 + m\left(1 - T_r^{0.5}\right)\right]^2 \tag{3-12}$$

$$m = 0.48 + 1.574\omega - 0.176\omega^2 \tag{3-13}$$

Mixing rules

$$a = \sum_i^N \sum_j^N \chi_i \chi_j a_{ij} \left(1 - K_{ij}\right) \tag{3-14}$$

$$b = \sum^N \chi_i b_i \tag{3-15}$$

3-2-1 Mollerup and Michelsen

Mollerup and Michelsen [28] recommended expressing pressure as a function of total volume, temperature and mole numbers because their derivatives with respect to mole fractions are best avoided. The SRK equation of state expressed with mole numbers

$$P = \frac{nRT}{V-B} - \frac{D}{V(V+B)} \tag{2-16}$$

where the attraction a and covolume b parameters must be expressed with mole numbers

$$B = nb = \sum_{i=1}^{C} n_i b_i \tag{2-17}$$

$$D = n^2 a(T) = \sum_{i=1}^{C} \sum_{i=1}^{C} n_i n_j a_{ij}(T) \tag{3-18}$$

The parameter derivatives B_i and D_i of SRK with respect to mole numbers are

$$B_i = b_i \tag{3-19}$$

$$D_i = 2\sum_{j=1}^{C} n_j a_{ij} \tag{3-20}$$

3-2-2 Faiq Hussam Sirri

A modification on Soave-Redlich-Kowing [43] was made by introducing a new equation to calculate the m value in soave equation. The new m equation becomes function of reduced temperature and pressure as well as acentric factor as follows:

$$m = a_f + b_f \times \omega + c_f \times \omega^2 \tag{3-21}$$

Where: $\mathbf{a_f = 0.4775746}$

$$\mathbf{b_f = 2.509442 - 0.888598 \times T_r - 0.1387515 \times P_r}$$

$$\mathbf{c_f = -3.278222 + 3.245485 \times T_r + 0.0930755 \times P_r}$$

To extend the application of the proposed modified Soave equation to be applicable for mixtures, it was found that "the enthalpy departure of a mixture of compressed liquid is equal to the molal average of enthalpy departure of pure compounds at the same reduced temperature and pressure", or mathematically as:

$$T_r = \frac{T}{T_{Cm}} = \frac{T_i}{T_{Ci}} \tag{3-22}$$

$$P_r = \frac{P}{P_{Cm}} = \frac{P_i}{P_{Ci}} \tag{3-23}$$

$$\left(H - H^{ig}\right)_{mixture} = \sum x_i \left(H - H^{ig}\right)_i \tag{3-24}$$

3-2-3 Twu-Sim-Tassone

An attempt was made by Twu-Sim-Tassone to modified Soave's equations (3-12) and (3-13). The Soave $\alpha(T)$ defined as a function of both T_r and ω, Twu-Sim-Tassone [54] proposed anew $\alpha(T)$ function as follows:

$$\alpha(T) = 1 + (1 - T_r)(m + n/T_r) \tag{3-25}$$

Where

$$m = .484 + 1.515\omega - .44\omega^2 \tag{3-26}$$

$$n = 2.756m - .700 \tag{3-27}$$

3-3 Peng-Robinson Equation

This equation of state was developed primarily for vapor liquid equilibrium predictions. Peng-Robinson [32] modified the standard form as follows [41]:

$$P = \frac{RT}{V - b} - \frac{a\alpha}{V^2 + 2bV - b^2} \tag{3-28}$$

the cubic form in terms of compressibility factor equation is:

$$Z^3 - (1 - B)Z^2 + (A - 3B^2 - 2B)Z - (AB - B^2 - B^3) = 0 \tag{3-29}$$

where A and B are the same as in equations (3-15) and (3-5) respectively. The difference is in the values of a_c, b and m. These values are calculated from the following equations [7]:

$$a = \frac{0.45724(RT_c)^2}{P_c} \tag{3-30}$$

$$b = \frac{0.077809RT_C}{P_C} \tag{3-31}$$

$$\mathrm{m} = 0.37464 + 1.54226\omega - 0.26992\omega^2 \tag{3-32}$$

Mixing rules

$$a = \sum_{i}^{N}\sum_{j}^{N} \chi_i \chi_j \left(a_i a_j\right)^{0.5}\left(1 - K_{ij}\right) \tag{3-33}$$

$$b = \sum_{i}^{N} \chi_i b_i \tag{3-34}$$

3-4 Lee-Kesler Equation

Lee and Kesler developed a three-parameter corresponding-states correlation for pure, nonpolar, nonhydrogen-bonding fluids especially, hydrocarbons. Values provided for the correlation were based on the Benedict-Webb-Rubin equation of state. The correlation takes the form [40]:

$$Z = Z^o + \frac{\omega}{\omega^r}\left(Z^r - Z^o\right) = Z^o + \omega Z^1 \tag{3-35}$$

where Z^o is the compressibility factor for simple fluids, ω is the acentric factor for pure compound, Z^1 corrects Z for the effects of nonspherical intermolecular forces (primarily dispersion and overlap), and ω^r is the acentric factor reference to n-octane [60].

$\omega^r = .3978$

The function for both the simple fluid Z^o and the reference fluid Z^r are derived from a reduced form of the modified BWR equation of state with a different set of constants [22].

$$Z = \left(\frac{P_r V_r}{T_r}\right) = 1 + \frac{B}{V_r} + \frac{C}{V_r^2} + \frac{D}{V_r^5} + \frac{c_4}{T_r^3 V_r^2}\left(\beta + \frac{\gamma}{V_r^2}\right) exp\left(-\frac{\gamma}{V_r^2}\right) \tag{3-36}$$

$$B = b_1 - \frac{b_2}{T_r} - \frac{b_3}{T_r^2} - \frac{b_4}{T_r^3} \tag{3-37}$$

$$C = c_1 - \frac{c_2}{T_r} + \frac{c_3}{T_r^3} \tag{3-38}$$

$$D = d_1 + \frac{d_2}{T_r} \tag{3-39}$$

Table 3-1: Constants for equation (3-36)

Constant	Simple fluids	Reference fluids	Constants	Simple fluids	Reference fluids
b_1	0.1181193	0.2026579	c_3	0.0	0.016901
b_2	0.265728	0.331511	c_4	0.042724	0.041577
b_3	0.15479	0.027655	$d_1 \times 10^4$	0.155488	0.48736
b_4	0.030323	0.203488	$d_2 \times 10^4$	0.623689	0.0740336
c_1	0.0236744	0.0313385	β	0.65392	1.226
c_2	0.0186984	0.0503618	γ	0.060167	0.03754

The enthalpy departure is derived from equation (3-36)

$$\frac{H - H^o}{RT_c} = T_r \left\{ Z - 1 - \frac{b_2 + \left(2b_3 / T_r\right) + \left(3b_4 / T_r^2\right)}{T_r V_r} - \frac{c_2 - \left(3c_3 / T_r^2\right)}{2T_r V_r^2} + \frac{d_2}{5T_r V_r^5} + 8E \right\} \tag{3-40}$$

where: $$E = \frac{c_4}{2T_r^3 \gamma} \left\{ \beta + 1 - \left(\beta + 1 + \frac{\gamma}{V_r^2} \right) exp\left(- \frac{\gamma}{V_r^2} \right) \right\} \tag{3-41}$$

Mixing rules

For mixtures, the properties T_c, P_c and ω are to be calculated from the following equations. For a binary system which contains x_i of component i and x_j of component j, the critical volume of the mixture [6].

$$V_c = \frac{1}{8} \sum \sum X_i X_j \left(V_{ci}^{1/3} + V_{cj}^{1/3} \right)^3 \tag{3-42}$$

$$T_c = \frac{1}{8V_c}\sum\sum X_i X_j \left(V_{ci}^{1/3} + V_{cj}^{1/3}\right)^3 \left(T_{ci}T_{cj}\right)^{0.5}\left(1 - K_{ij}\right) \quad (3\text{-}43)$$

$$\omega = X_i \omega_i \quad (3\text{-}44)$$

$K_{ij} = 0$ For hydrocarbon mixtures

$$P_c = \frac{Z_c RT_c}{V_c} = \left(0.2905 - 0.085\omega\right)\frac{RT_c}{V_c} \quad (3\text{-}45)$$

3-5 Teja Method

Teja [49] proposed a generalized corresponding state principle for thermodynamic properties which no longer retains the simple spherical fluid as one of the reference equation Lee-Kesler which is written as

$$\frac{H^R}{RT_C} = \left(\frac{H^R}{RT_C}\right)_{r_1} + \frac{\omega - \omega_{r_1}}{\omega_{r_2} - \omega_{r_1}}\left[\left(\frac{H^R}{RT_C}\right)_{r_2} - \left(\frac{H^R}{RT_C}\right)_{r_1}\right] \quad (3\text{-}46)$$

where the superscripts r_1 and r_2 refer to two (non spherical) reference fluids chosen so that they are similar to the pure component of interest or, in the case of mixtures, to the key component of interest [50]. Equation (3-46) provides a method for generalizing equations of state using the known equation of two pure components. Thermodynamic properties can then be predicted with considerable success [40].

3-6 Virial Equation

The Virial equations are ones of the most important equations of state which are used to describe the (PVT) properties of a fluid. Virial coefficients are classified into many truncated forms according to the order of the term series [47,7]:

$$Z = \frac{PV}{RT} = 1 + \frac{B(T)}{V} + \frac{C(T)}{V^2} + \frac{D(T)}{V^3} = 1 + B'P + C'P^2 + D'P^3 \qquad (3\text{-}47)$$

Relations between the coefficients [5]

Where B(T), C(T), D(T) are temperature dependent and are called virial coefficients.

$$B = RTB' \qquad (3\text{-}48)$$

$$C = (RT)^2\left(C' + B'^2\right) \quad \text{or} \quad C' = \frac{\left(C - B^2\right)}{(RT)^2} \qquad (3\text{-}49)$$

3-6-1 Second Virial correlation

Correlation of second Virial [10] coefficient of both polar and nonpolar systems is presented by [1].

$$Z = 1 + \frac{B}{V} = 1 + B'P = 1 + \frac{BP}{RT} \qquad (3\text{-}50)$$

Tsonopoulos correlation for B

$$B = \frac{RT_c}{P_c}\left(B^{(0)} + \omega B^{(1)}\right) \qquad (3\text{-}51)$$

$$B^0 = 0.1445 - \frac{0.33}{T_r} - \frac{0.1385}{T_r^2} - \frac{0.0121}{T_r^3} - \frac{0.000607}{T_r^8} \qquad (3\text{-}52)$$

$$B^{(1)} = 0.0637 + \frac{0.331}{T_r^2} - \frac{0.423}{T_r^3} - \frac{0.008}{T_r^8} \qquad (3\text{-}53)$$

3-6-2 Third Virial correlation

For high pressure above 15 bar, equation (3-47) may be truncated after three terms [29].

$$Z = \frac{PV}{RT} = 1 + \frac{B}{V} + \frac{C}{V^2} = 1 + B'P + C'P^2$$

Orbey-Vera correlation for C

$$C = \left(\frac{RT_C}{P_C} \right)^2 \left(C^0 + \omega C' \right) \tag{3-54}$$

$$C^o = 0.01407 + \frac{0.04232}{T_r^{2.8}} - \frac{0.00313}{T_r^{10.5}} \tag{3-55}$$

$$C' = -0.02676 + \frac{0.0177}{T_r^{2.8}} + \frac{0.04}{T_r^{3}} - \frac{0.003}{T_r^{6}} - \frac{0.00228}{T_r^{10.5}} \tag{3-56}$$

By using the residual properties, the final expression of residual enthalpy after derivation can be expressed as [37]:

$$H^R = PT_r \left[\frac{B}{T_r} - \frac{\partial B}{\partial T_r} \right] + \frac{P^2}{RT_c} \left[B \frac{\partial B}{\partial T_r} + \frac{C - B^2}{T_r} - \frac{\partial C}{2 \partial T_r} \right] \tag{3-57}$$

Chapter Four

Investigation and Development

4.1 Development of equations of state

The term equation of state is used to describe an empirically derived function, which provides a relation between pressure, volume, temperature and (for mixture) composition. Such relation provides means for the calculation at all the configurational and residual thermodynamic properties of the system within some domain of applicability. Sometimes, the term equation of state is attached to a more fundamental relation, which may be used to obtain both perfect-gas and residual properties. Many equations of state can represent adequately the properties of the gas phase, some are applied only to the liquid, but the most important category of equation-of-state models contain those that may be applied in the same form to both gaseous and liquid phases [7].

van der Waals' equation was the first equation of state capable of predicting both gaseous and liquid phases and the majority of equation-of-state models in use today are simple empirical modifications which retains its basic cubic form.

van der Waals equation has a semi-theoretical basis. More rigorous statistical-mechanical analysis led in 1912 to a derivation of the virial equation of state which had itself been proposed on purely empirical grounds by Thiesen in 1885.Mean while, scores of empirical modifications of van der Waals' equation had been proposed. The modern development

in this field started with the equation of Redlich and Kwong (1949), and led to such workhorses as the Soave equation (1972) and the equation of Peng and Robinson (1976). These are cubic equations whose parameters are determined for a pure fluid from the critical constants and the acentric factor while, for mixture, combining rules are used to express the parameters in terms of pure-component values. Vapor properties and vapor-liquid equilibrium conditions predicted by these models are usually in fair agreement with experimental observations [2].

Today the development of equations of states remains an active field of research, primarily in areas of:

1- Highly accurate equations, often with many constants, for important pure substances such as water, ammonia, carbon dioxide, etc.
2- Accurate equation of state models for specific mixtures such as those encountered in the natural gas and petroleum industries.
3- Simple equations of state that combine satisfactory predictive capabilities with the computational efficiency required for detailed simulations of chemical processing operations such as multistage separation processes for mixtures.
4- Models for complex system such as electrolytes, polymers, coal liquids and highly polar substances.

4.2 Experimental Data

It is a well known fact that the evaluation of any correlation or prediction method is done by comparison of the results with the results of experimental dependable data. The deviation between the experimental results and the results of prediction or correlation determines the accuracy of the method. The

experimental data of the enthalpy of superheated vapor, obtained from literature for the purpose of this investigation consists of 2177 values of pure components at low and high pressures as shown in table 4-1 and for mixtures shown in table 4-2.

Table 4-1: The Pure component enthalpy data

	Components	No. of pressure points	No. of data points	Data Reference
1	Benzene	11	82	[18]
2	Cis-2-Pentene	15	67	[21]
3	Cyclohexane	6	68	[20]
4	n-Heptane	10	25	[53]
5	Methylcyclohexane	3	15	[13]
6	Isobutene	11	220	[59]
7	Propane	19	544	[62]
8	Toluene	2	11	[13]
9	Nitrogen	24	936	[17]
10	Ammonia	11	209	[14]
	$\sum$	112	2177	

Table 4-2: The Mixtures enthalpy data

	Mixture	No. of composition	No. of Data points	Data Reference
1	Benzene – Hexadecane	3	58	[16]
2	Benzene – n-octane	6	283	[18]
3	Benzene – cyclohexane	4	208	[19]
4	Cis-2-pentene – n-pentane	1	27	[21]
5	n-pentane – cyclohexane	4	178	[20]
	$\sum$	18	754	

4.3Applying EOS to pure components at pressure up to 138 bar

Different equations of state were used for calculating enthalpy departure (H^R) and enthalpy for all the experimental data of pure components. The following are some of these equations that are employed to experimental data for pure components.

1-Soave-Redlich-Kwong equation was used for calculating enthalpy departure (H^R) and enthalpy for experimental data .It was found that the overall average deviation was 10.64125 J/g for enthalpy departure and the AA% deviation was 1.205065 for enthalpy.

2-Using Soave-Redlich-Kwong equation with modified α function by Twu-Sim-Tassone where it was found that the overall average enthalpy deviation was 10.8559 J/g for enthalpy departure and the AA% deviation was 1.21288 for enthalpy.

3-Peng-Robinson equations was used also for calculating enthalpy departure (H^R) and enthalpy for experimental data .It was found that the overall average deviation was 11.34247 J/g for enthalpy departure and the AA% deviation was 1.312621 for enthalpy.

4-Lee-Kesler is very important for calculating thermodynamic properties. This method was used for calculating enthalpy departure (H^R) and enthalpy for experimental data, and it was found that the overall average deviation was 13.57428 J/g for enthalpy departure and the AA% deviation was 1.562556 for enthalpy.

5-Virial equations truncated to two terms and to three terms were applied to some pure components. It was found that these virial equations

which are failed for accuracy, lose this accuracy when calculating enthalpy departure for higher temperature and pressure. It was found that the overall average deviation of H^R for the enthalpy departure was 45.859 J/g.

4.4 Modified Soave-Redlich-Kwong Equation

All the methods tried above did not lead to very successful results, although Soave-Redlich-Kwong equation of state proved to be better than Peng-Robinson, Lee-Kesler and Virial equations for prediction of enthalpy of superheated vapor. There is still room for improving it for predicting H^R and H for superheated vapor. Soave-Redlich-Kwong equation was derived mainly to calculate vapor liquid equilibrium; so all the attention was concentrated on that purpose in its derivation. Sirri F.H. [43] had modified m parameter in Soave-Redlich-Kwong equation for determining H^R for compressed liquid and obtained higher accuracy than Soave-Redlich-Kwong equation without modification of m parameter.

On the same line a new equation was derived for m parameter of Soave-Redlich-Kwong equation to be used to calculate H^R and H for superheated vapor. Different equations for m parameter had been tried to calculate H^R and H of superheated vapor. It was found that the following equations gave the least deviation from experimental values of superheated vapor.

$$m = a_f + b_f \omega + c_f \omega^2 \tag{4-4}$$

a_f =constant (4-5)

$$b_f = b_1 T_r + b_2 T_r^2 + b_3 P_r + b_4 T_r P_r + b_5 P_r^2 \tag{4-6}$$

$$c_f = c_1 T_r + c_2 T_r^2 + c_3 P_r + c_4 T_r P_r + c_5 P_r^2 \tag{4-7}$$

The coefficients of the equations were predicted using the statistical analysis as shown in table 4-3.

Table 4-3: Coefficients of equations (4-5 to 4-7)

Coefficients	Value	Coefficients	Value
a_f	3.192426	c_1	95.60639
b_1	-14.6167	c_2	-4.94924
b_2	-10.3125	c_3	-57.877
b_3	-5.77010	c_4	21.14243
b_4	6.910520	c_5	-4.58519
b_5	0.971968		

The overall average derivation of H^R using the equations above gave higher accuracy where AAD 6.43503 J/g for H^R and AA%D 0.731214 for H. Table 4-4 summarizes the comparison of AAD for enthalpy departure (H^R) and AA%D for enthalpy (H) using different methods employed and presents work for 1032 data points of 8 pure compounds.

Table 4-4: Comparison of the deviations results for pure components

Equations used	AAD H^R J/g	AA%D H
Soave-Redlich-Kwong	10.64125	1.205065
Peng-Robinson	11.34247	1.312621
Lee-Kesler	13.57428	1.562556
Virial B truncated	10.87495	1.221519
Virial C truncated	45.86936	5.28232
Twu-Sim-Tassone	10.85590	1.21288
This work	6.43503	0.731214

Figures 4.1 to 4.6 show the relation between reduced temperature and the values of parameter m in Soave-Redlich-Kowng equation, in the present work and the actual values obtained from experimental data for different components. All figures show the values of parameter m for different components as function of reduced temperature at constant pressure.

4.5 Correlation for H^R and H at very high pressure and temperature

Several equations as SRK, PR, and LK were applied to predict H^R and H for nitrogen at high pressure up to 10000 bar and high temperature up to 1200 K and also for ammonia at high pressure up to 5000 bar and high temperature up to 600 K.

Using SRK and also with modified m parameter, the modification of m parameter was done on the same line that is used for pure components at relatively lower pressure and temperature. The equations obtained for m parameter are.

$$m = a_f + b_f \omega + c_f \omega^2 \qquad (4\text{-}8)$$

a_f=constant (4-9)

$$b_f = b_o + b_1 T_r + b_2 P_r \qquad (4\text{-}10)$$

$$c_f = c_o + c_1 T_r + c_2 P_r \qquad (4\text{-}11)$$

These coefficients were predicted by the same way as the components at pressure up to 138 bar as shown in table 4-5.

Table 4-5: Constant of equations (4-8 to 4-11)

Coefficients	Value	Coefficients	Value
a	0.737204	c_o	-1.470248
b_o	-4.544561	c_1	22.70556
b_1	-0.579987	c_2	0.311561
b_2	-0.048982		

The equations above give a higher accuracy where the AAD 2.70047 J/g for H^R and AA%D 10.98738 for H. Table 4-6 summarizes the comparison of AAD of H^R and AA%D of H using Soave-Redlich-Kwong equation, Peng-Robinson equation, Lee-Kesler equation, and modification of Soave-Redlich-Kwong equation for 1145 data points of nitrogen and ammonia.

Table 4-6: Comparison of the results of deviations for nitrogen and ammonia at very high pressure and temperature

Equations used	AA%D H^R	AA%D H
Soave-Redlich-Kowng	8.622075	24.38116
Lee-kesler	5.35934	22.40604
Peng-Robinson	9.46573	12.47324
This work	2.70047	10.98738

Figures 4-5 to 4-6 show the relation between the values of m parameter for nitrogen and ammonia with reduced temperature for Soave equation, modified Soave equation and actual values from experimental data which indicate that the effect of temperature on m parameter was much more than the effect of pressure as indicated in equation (4-10) and (4-11). It was to be noted that the values of m parameter for ammonia and nitrogen at very high pressure and temperature were different from other pure components up to 138 bar.

4.6 Sample of calculation:

Calculation of the enthalpy for cyclohexane at 610.8 K and 13.78 bar on the bases that H_o=0 Btu/Lb at 200 F (144.22 K) for saturated liquid.

Data required

Tc(K)	553.46
Pc(bar)	40.7327
ω	0.210222
Mwt g/mol	84.162

$$T_r = \frac{T}{T_C} = \frac{610.8}{553.46} = 1.103763$$

$$P_r = \frac{P}{P_C} = \frac{13.78}{40.7327} = 0.3385356$$

$a_f = 3.192426$

$b_f = -14.6167 \times T_r - 10.3125 \times P_r - 5.77010 \times T_r^2 + 6.910520 \times T_r \times P_r + 0.971968 \times P_r^2$

$= -14.6167 \times 1.103763 - 10.3125 \times 0.33853 - 5.77010 \times (1.103763)^2 + 6.910520 \times 1.103763 \times 0.33853 + 0.971968 \times (0.33853)^2$

$= -23.9606$

$c_f = 95.60639 \times T_r - 4.94924 \times P_r - 57.877 \times T_r^2 + 21.14243 \times T_r \times P_r - 4.58519 \times P_r^2$

$= 95.60639 \times 1.103763 - 4.94924 \times 0.33853 - 57.877 \times (1.103763)^2 + 21.14243 \times 1.103763 \times 0.33853 - 4.58519 \times (0.33853)^2$

$= 40.71782$

$$\mathbf{m = a_f + b_f \times \omega + c_f \times \omega^2}$$

$m = 3.192426 - 23.9606 \times 0.210222 + 40.71782 \times (0.210222)^2$

$= -4.529774E-02$

$$\alpha = \left[1 + m\left(1 - T_r^{0.5}\right)\right]^2 = [1-4.529774E-02\ (1-(1.103763)^{0.5})]^2$$

=1.00459

$$a_C = 0.42747\frac{RT_C^2}{P_C} = 0.42747\frac{(8.314\times 553.46)^2}{(40.7327)}$$

a_c = 2.222056

$a = a_C \times \alpha$ =2.222056×1.00459 = 2.232255

$$b = \frac{0.08664RT_C}{P_C} = \frac{0.08664(8.314\times 553.46)}{40.7327} = 9.787494\text{E-}05$$

$$A = \frac{aP}{(RT)^2} = \frac{2.222056\times 13.78}{(8.314\times 610.8)^2} = 0.1193292$$

$$B = \frac{bP}{RT} = \frac{9.787494\text{E}-05\times 13.78}{8.314\times 610.8} = 2.657338\text{E-}02$$

$$Z^3 - Z^2 + (A - B - B^2)Z - AB = 0$$

$$Z^3 - Z^2 + (0.092049)Z - 0.0031709 = 0$$

By Newton – Raphson method, the value of Z is found starting with Z_o= 6 (for vapor). Z= 0.9018289

$$D = -m\times a\sqrt{\left(\frac{T_r}{\alpha}\right)}$$

$$D = -4.529774\text{E}-02\times 2.232255\sqrt{\left(\frac{1.10763}{1.00459}\right)} = -0.1059898$$

$$\frac{H^R}{RT} = Z - 1 - \frac{A}{B}\left(1 - \frac{D}{a}\right)\ln\left(1 + B/Z\right)$$

$$\frac{H^R}{8.314\times 610.8} = 0.901828 - 1 - \frac{0.119329}{2.65733\text{E}-02}\left(1 + \frac{-0.1059898}{2.232255}\right)\ln\left(1 + \frac{2.65733\text{E}-02}{0.901828}\right)$$

H^R= -1129.485 J/mole

To calculate the enthalpy, the value of ideal gas enthalpy has to be known. An accurate equation is that of Passut-Danner equation, which gives

the value of ideal gas enthalpy from a polynomial equation of five degrees, as shown

$$H^{ig} = a_0 + a_1 T + a_2 T^2 + a_3 T^3 + a_4 T^4 + a_5 T^5$$

$$\mathbf{H^{ig} = -52.7681 + -52.7681T + .289848T^2 + 4.41991E-05T^3 - 3.67868TE-08T^4 + 1.40234E-11T^5}$$

At T=610.8 K ΔH^{ig} = 63654.32J/mole

$H = H^{ig} + H^R + H_{vap}$

H =63654.32-1129.485 +39383.93

H = 101908.8 J/mole

The actual enthalpy was 102069 J/mole

$$A\%E = \left| \frac{H_{actual} \quad H_{calculate}}{H_{actual}} \right| \times 100\%$$

$$= \left| \frac{(102069 \quad 102137)}{102069} \right| \times 100\% = 0.8081838\%$$

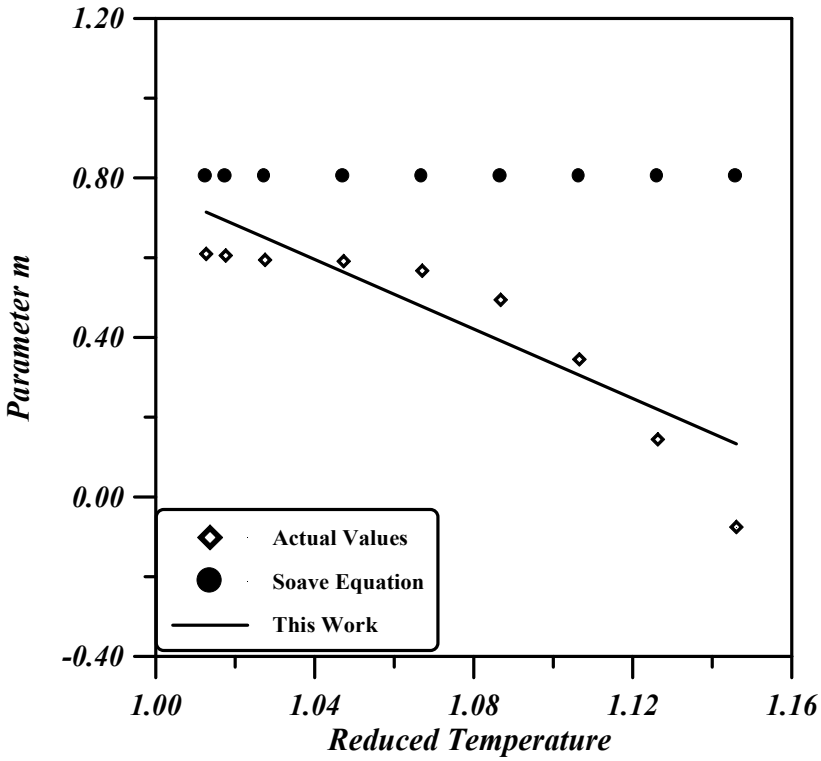

Figure 4-1: The relation between values of parameter m and reduced temperature for benzene at 96.5 bar

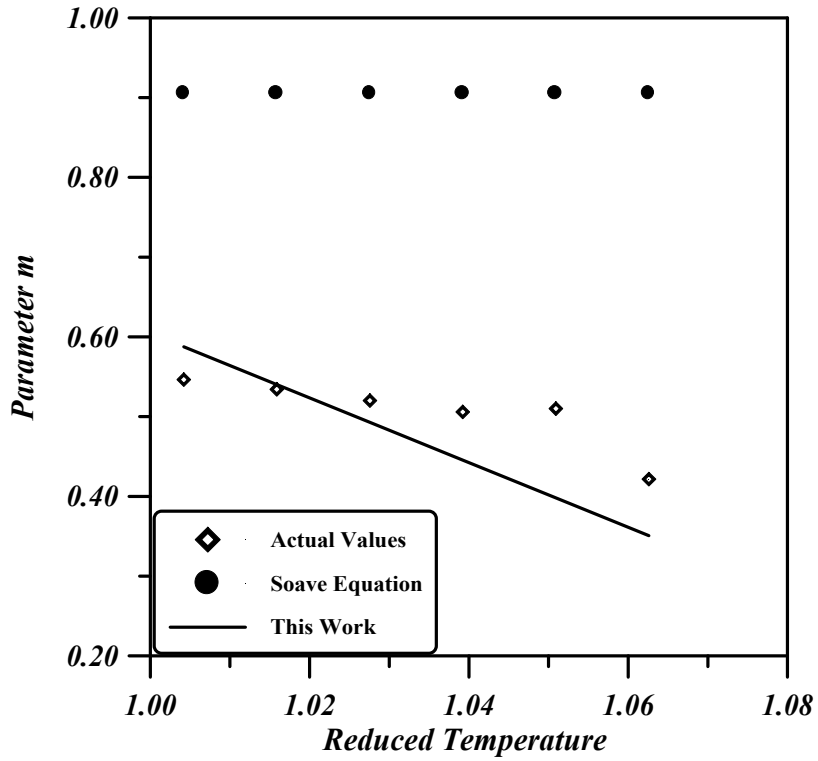

Figure 4-2: The relation between values of parameter m and reduced temperature for cis-2-pentene at 55.15 bar

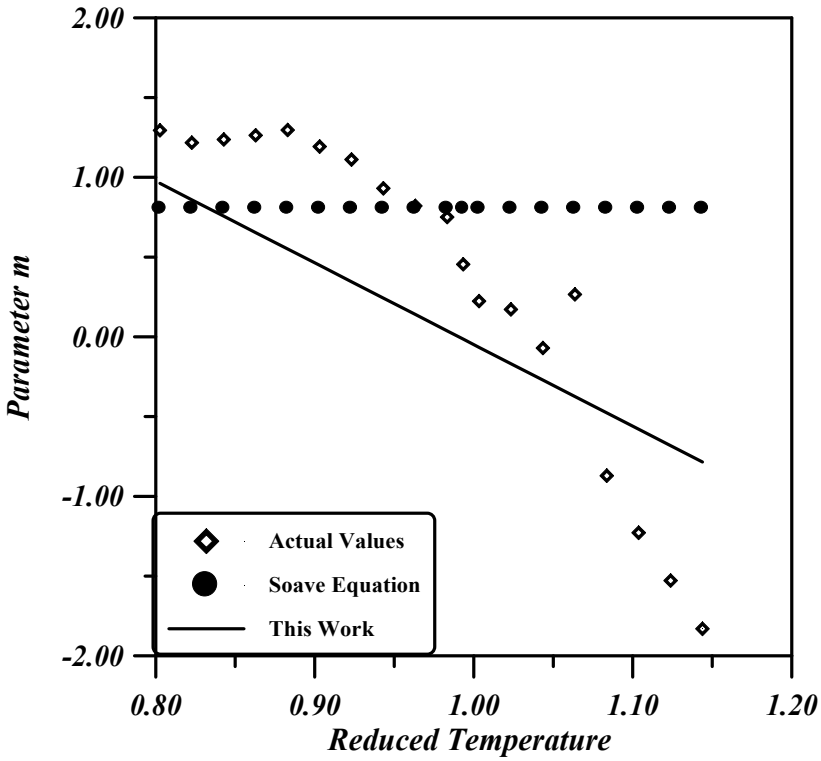

Figure 4-3: The relation between values of parameter m and reduced temperature for cyclohexane at 6.89 bar

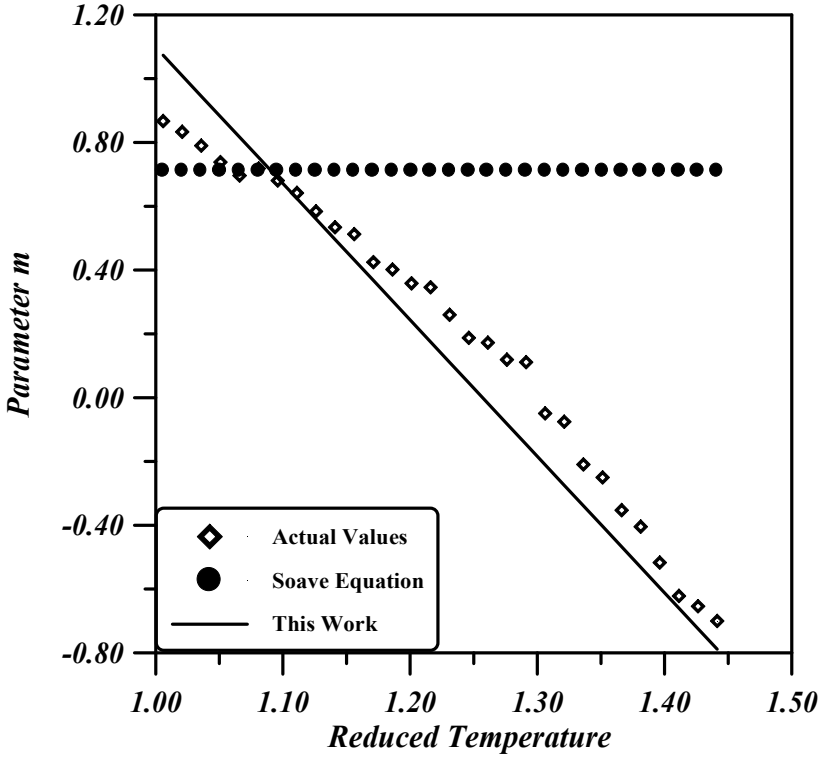

Figure 4-4: The relation between values of parameter m and reduced temperature for propane at 41.36 bar

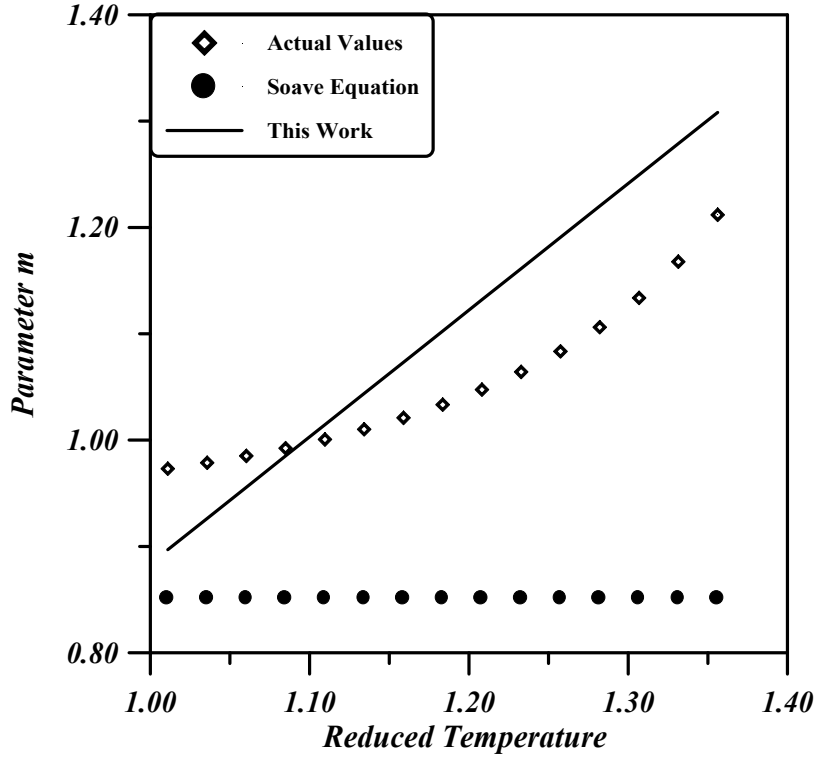

Figure 4-5: The relation between values of parameter m and reduced temperature for ammonia at 2500 bar

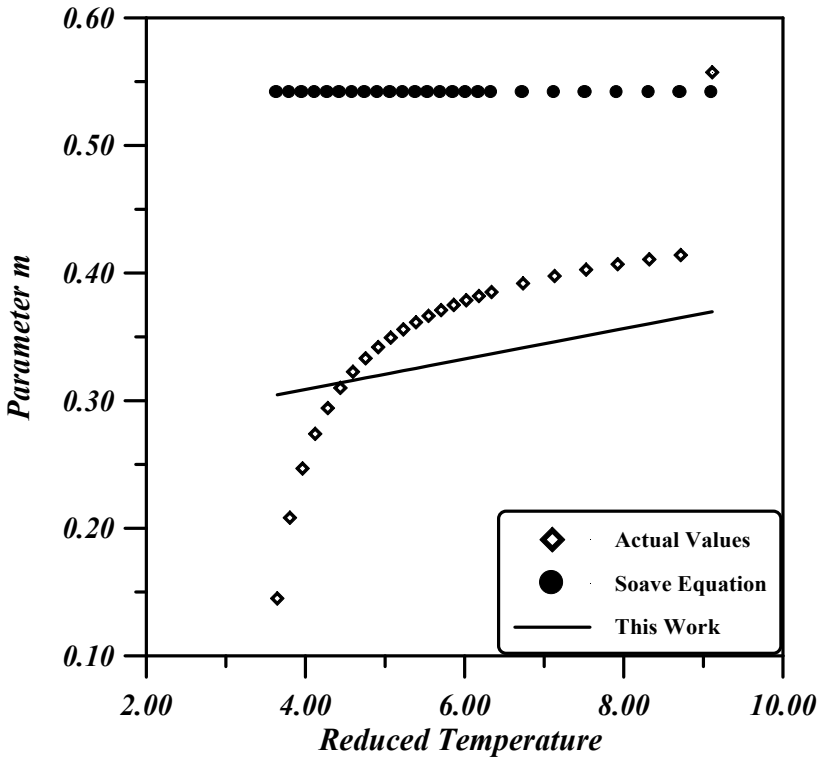

Figure 4-6: The relation between values of parameter m and reduced temperature for nitrogen at 7000 bar

4.7 Applications for mixtures

Many methods were tried for finding suitable method that may give the most accurate results for pure components and mixtures. The followings are some of these methods that are employed for pure components and tried to use them for mixtures also.

1) Soave-Redlich-Kwong EOS was used as with the mixing rules that are discussed in chapter three to determine the departure enthalpy of superheated mixtures. The overall average deviation of 754 data point is 16.6792 J/g for H^R and AA% deviation 1.63459 for H.

2) The modified Soave-Redlich-Kowing equation by Mollerup and Michelsen was used to calculate enthalpy departure and enthalpy for the

experimental data available for pure components. It was found that the derivation for H^R and H were the same as those when using SRK equation

3) Peng-Robinson EOS was used as with the mixing rules to determine the enthalpy departure of superheated mixtures. The overall average deviation of 754 data point was 17.89331 J/g for H^R and AA% deviation was 1.76202 for H.

4) Lee-Kesler EOS was used as with the mixing rules to determine the enthalpy departure of superheated mixtures. The overall average deviation of 750 data point was 10.64685 J/g for H^R and AA% deviation was 1.056132 for H.

5) Modified Sirri method for Soave equation: The Sirri modification of SRK equation for enthalpy departure of mixture for compressed liquid which was derived for determining enthalpy departure (H^R) of pure components was used to find the average molal enthalpy departure for the mixture. When this method was used for superheated vapor mixture, it was found that results of overall average deviation of 754 data point was 20.65012 J/g for H^R and AA% deviation was 2.02336 for H.

6)Two Reference Fluids: Enthalpy departure estimation with two reference fluids used either any pure compound as a reference fluid .All enthalpy departures were calculated at the reduced temperature and reduced pressure of the substance whose enthalpy departure was being predicted (H^R/RT_c) .For the reference the expression for the enthalpy departure was derived using the following equation.

$$\frac{H^R}{RT_C} = A_o + A_1 T_r + \frac{A_2}{P_r} + A_3 \frac{T_r}{P_r^2} + A_4 \frac{T_r^{A5}}{P_r^{A6}} \qquad (4\text{-}12)$$

Where the values of the constants A_0, A_1, A_2, A_3, A_4, $A_5$and A_6 for these reference fluids are given in table 4-7. All components were tried as a two reference to minimize the overall average deviation, but unfortunately, no improvement in enthalpy departure resulted. For example propane and cyclohexane were taken as reference fluids.

$$\frac{H^R}{RT_c} = \left(\frac{H^R}{RT_c}\right)^1_{cyclohexane} + \frac{\omega_m - \omega_1}{\omega_2 - \omega_1}\left[\left(\frac{H^R}{RT_c}\right)^2_{propane} - \left(\frac{H^R}{RT_c}\right)^1_{cyclohexane}\right] \qquad (4\text{-}13)$$

The results when applying the two reference fluid method gave an overall average deviation of 20.08221 J/g for departure enthalpy and AA% deviation 1.991403 for enthalpy.

Table 4-7 coefficients of equation (4-12) for each component

coefficients	propane	cyclohexane
A0	27.98237	-21.0773
A1	-18.01648	12.82726
A2	-1.410835	13.80859
A3	0.110647	2.137357
A4	-10.56484	-9.96303
A5	-3.304501	0.575151
A6	-0.404313	1.520139

4.8 Development of the correlation for mixtures:

Several methods were used to describe the enthalpy departure of mixtures. In order to develop the correlation that was necessary to determine

the parameter that affect the term $\frac{H^R}{RT_C}$,it was concluded that the term was function T_r , P_r and then using suitable mixing rules so to complete the correlation.[61,52]

4.8.1 Mixing rules

To apply the corresponding states correlations to mixtures, the appropriate scaling factors must be determined. These scaling factors are called pseudo critical properties which were derived from critical properties of pure component.

1-Using Key‘s rules for calculating mixing rule of superheated mixture.

$$T_{CM} = \sum Y_i T_{Ci} \tag{4-14}$$

$$P_{CM} = \sum Y_i P_{Ci} \tag{4-15}$$

$$\omega_M = \sum Y_i \omega_i \tag{4-16}$$

But these mixing rules gave large deviation when used for mixtures.

2- Using Lee-Kesler mixing rules which are given below.

$$\omega = \sum x_i \omega_i \tag{4-17}$$

$$V_{cm} = \frac{1}{8}\sum\sum x_i x_j \left(V_{ci}^{1/3} + V_{cj}^{1/3}\right)^3 \tag{4-18}$$

$$T_{cm} = \frac{1}{8V_c}\sum\sum x_i x_j \left(V_{ci}^{1/3} + V_{cj}^{1/3}\right)^3 \left(T_{ci}T_{cj}\right)^{0.5}\left(1 - K_{ij}\right) \tag{4-19}$$

$$Z_{cm} = 0.2905 - 0.085\omega_m \tag{4-20}$$

$$P_{cm} = \frac{Z_{cm}RT_{cm}}{V_{cm}} = \left(0.2905 - 0.085\omega\right)\frac{RT_{cm}}{V_{cm}} \tag{4-21}$$

These mixing rules gave more accurate results when used with equation (4-22) for mixtures. It was found that AAD 5.334148 J/g for enthalpy departure and AA%D for enthalpy was 0.524054.

4.8.2 Choice of the form of equation

To facilitate machine computation, the values of $\frac{H^R}{RT_C}$ were taken from enthalpy data literature and converted into analytical expressions representing the superheated vapor region, the process of curve fitting was done by trial and error with the aid of computer program on non-linear estimation and the final equations were developed according to the least- squares criterion and represent the values in $\frac{H^R}{RT_C}$. In order to obtain most accurate results the following form of expression was obtained for $\frac{H^R}{RT_C}$ after great many manipulations.

$$\frac{H^R}{RT_{CM}} = a_o + a_1 T_r + \frac{a_2}{P_r} + a_3 \frac{T_r}{P_r} + a_4 \frac{T_r^2}{P_r^2} + a_5 \frac{T_r^{a6}}{P_r^{a7}} \qquad (4\text{-}22)$$

These coefficients of equation (4-22) were calculated by computer program, as shown in table 4-8.

Table 4-8: Constant of equation (4-22)

Coefficients	Value	Coefficients	Value
a_o	-0.125799	a_4	-0.168728
a_1	-0.786147	a_5	-1.109548
a_2	-0.347042	a_6	-14.19925
a_3	0.635731	a_7	-4.382698

One of the important equations of state is that of Lee-Kesler. This equation is considered one of the accurate equations that are currently used to determine the H^R of gas at normal condition. As shown in Table 4-9 Lee-Kesler method

of predicting enthalpy departure gave least deviation than those of Soave-Redlich-Kwong, Peng-Robinson, Teja, and Sirri methods. Comparing Lee-Kesler method for correlation and predication H^R with the method derived in this work as seem from the table, LK method gave AAD to be 10.64685 J/g for H^R, AA%D to be 1.056132 for H while the method in this work gave AAD to be 5.334148 J/g for H^R, AA%D to be 0.524054 for H for this mixture using 754 data points. Thus this method can be considered more accurate than the current equations of states shown in Table 4-9 which is used for predicting enthalpy departure and enthalpy for superheated vapor mixtures.

Table 4-9: Comparison of the results of deviations for H^R and H for binary mixture

Equations used	AAD H^R J/g	AA%D H
Soave-Redlich-Kowing	16.6792	1.63459
Peng-Robinson	17.89331	1.76202
Lee-Kesler	10.64685	1.056132
Teja method	20.08221	1.991403
Sirri F.H.	20.65012	2.02336
This work	5.334148	0.524054

The steps that must be followed using the equation derived in this work is as follows

a) The mixing rule of Lee Kesler method is used to obtain the reduced temperature (T_r) and the reduced pressure (P_r) for binary mixture.

$$\omega = \sum x_i \omega_i \tag{4-17}$$

$$V_{cm} = \frac{1}{8}\sum\sum x_i x_j \left(V_{ci}^{1/3} + V_{cj}^{1/3}\right)^3 \tag{4-18}$$

$$T_{cm} = \frac{1}{8V_c}\sum\sum x_i x_j \left(V_{ci}^{1/3} + V_{cj}^{1/3}\right)^3 \left(T_{ci}T_{cj}\right)^{0.5}\left(1 - K_{ij}\right) \tag{4-19}$$

$$Z_{cm} = 0.2905 - 0.085\omega_m \quad (4\text{-}20)$$

$$P_{cm} = \frac{Z_{cm} R T_{cm}}{V_{cm}} = \left(0.2905 - 0.085\omega\right)\frac{R T_{cm}}{V_{cm}} \quad (4\text{-}21)$$

b) The reduced temperature and reduced pressure of Binary mixture are calculated according to:

$$T_{rm} = \frac{T}{T_{cm}} \qquad P_{rm} = \frac{P}{P_{cm}}$$

c) The enthalpy departure of mixture is determined using equation (4-22) with constants

$$\frac{H^R}{RT_{CM}} = -0.12579 - 0.78614 \times T_r - \frac{0.34704}{P_r} + 0.6758\frac{T_r}{P_r} - 0.168728\frac{T_r^2}{P_r^2} - 1.109548\frac{P_r^{(4.36269)}}{T_r^{(14.1992)}}$$

4.9 Sample calculation for mixture

Calculation of the enthalpy for mixture of 44.6 mole % benzene with 55.4mole% n-octane at 300 pisa (20.68 bar) and 570 ^{o}F(572 K) on the basis H_o=0 Btu/Lb at 200 F(144.22 K) , Saturated liquid.

Data required

Component	Benzene (1)	n-octane(2)
x	0.446	0.554
T_c(K)	562.1	569.4
P_c(bar)	48.94	24.926
ω	0.210503	0.394001
Mwt	78.114	114.232
V_c	2.5698E-4	4.90022E-4

Using the Lee-Kesler mixing rules to gives:

ω_m= 0.31216

T_{cm}= 566.6989 K

P_{cm}= 32.7582 bar

Z_{cm}= 0.2639

V_{cm}= 3.796563E-04 cm^3/mole

$$T_r = \frac{572}{566.69} = 1.009354$$

$$P_r = \frac{20.68}{32.7582} = .6314201$$

Applying a new equation to calculate enthalpy departure of mixture

$$\frac{H^R}{RT_{CM}} = -0.12579 - 0.78614 \times T_r - \frac{0.34704}{P_r} + 0.6758\frac{T_r}{P_r} - 0.168728\frac{T_r^2}{P_r^2} - 1.109548\frac{P_r^{(4.36269)}}{T_r^{(14.1992)}}$$

With T_r and P_r of mixture using above equation, the value of

$$\frac{H^R}{RT_{CM}} = -0.6525698$$

To calculate the enthalpy, the value of the ideal gas enthalpy need to be known. An accurate equation is that of Passut-Danner equation, which gives the value of ideal gas enthalpy from a polynomial equation of five degrees, as shown

$$H^{ig} = a_0 + a_1T + a_2T^2 + a_3T^3 + a_4T^4 + a_5T^5$$

For Benzene:

H^{ig}=(-40.0895)×T+(.253602)×T^2-(1.20521E-04)×T^3+(2.84953E-08)×T^4+(1.93768E-12) ×T^5

At T^o= 200 ^oF (144.22 K) H^{ig} = - 856.0104 J/mole

At T = 570 ^oF (572 K) H^{ig} = 40656.9596 J/mole

ΔH^{ig} = 41512.97 J/mole

For n-Octane:

H^{ig}=(-10.7076)×T+(.395522)×T^2-(1.51863E-04)×T^3+(2.92008E-08)×T^4+(1.57327E-12)×T^5

At T^o= 200 ^oF (144.22 K) H^{ig} = 6240.308 J/mole

At T = 570 ^oF (572 K) H^{ig} =97892.27 J/mole

ΔH^{ig} = 91652.96 J/mole

$$H_M^{ig} = \sum x_i H_i^{ig} = x_1 H_1^{ig} + x_2 H_2^{ig}$$

H^{ig}_m=0.446*41512.97+0.554*91652.96=69290.49 J/mole

$H^R{}_m$ =-0.6525698*(8.314*566.6989)=-3074.6052 J/mole

$H = H^{ig}_m + H^R + H_{vap}$

=69290.49-3074.6052+44828.74

=111044.6 J/mole

The actual enthalpy at 570K and 20.68 bar is 486.3 Btu /lb (110988.7 J/mole)

$$A\%D = \left|\frac{H_{actual} - H_{calculate}}{H_{actual}}\right| \times 100\%$$

$$= \left|\frac{(110988.7 - 111044.6)}{110988.7}\right| \times 100\% = 0.0503852\%$$

Chapter Five

Discussion

5.1 Discussion

The enthalpy of pure compound is function of both temperature and pressure –at zero pressure all gasses behave ideally, and the enthalpy becomes independent of pressure. The calculation of vapor enthalpy at zero pressure can be easily made from ideal gas heat capacities which are available for many compounds. At elevated pressure the enthalpy of a fluid relative to its enthalpy as an ideal gas can be calculated from the pressure–volume-temperature data by using thermodynamic relationships. In the absence of P-V-T data for the compounds of interest, or if the data do not cover the conditions under which engineering calculations are to be made, generalized correlations have been found of great value in estimating enthalpy departure and enthalpy which are based on a modified theory of corresponding states.

The usual method available for prediction the enthalpy of superheated vapor for pure components is by using the equation of state (Lee-Kesler, Peng-Robinson, Soave-Redlich-Kwong, or Virial). Soave-Redlich-Kwong equation when it is applied to calculate the enthalpy departure of pure superheated vapor shows better results (more accuracy) than by using any other method as shown in tables 4-4, 4-6. However our proposed modified Soave equation gives more accurate results than by using Soave-Redlich-Kwong method for pure components up to 138 bar as shown in table 5-1. It is

found that the modified Soave equation while was derived for pure components up to 138 bar did not give as accurate results when it is applied at very high pressure (ammonia up to 5000 bar and nitrogen up to 10000 bar). So another modified expression for m value of Soave equation was derived specially for these two components at very high pressure as given in equations (4-8) to (4-11) and the results are shown in table 5-2.

For comparing these results, tables 5-1 and 5-2 show that our proposed methods improve the accuracy for H^R as compared with, Soave-Redlich-Kwong for pure components for the same number of data points.

Table 5-1: Summary of results of H^R deviations for components

	Component	No. of points	Soave-Redlich-Kwong Equation		Modified Soave Equation	
			AAD J/g H^R	AA%D H	AAD J/g H^R	AA%D H
1	Benzene	82	21.61902	2.11072	12.19675	1.27421
2	CIS-2-Pentene	67	28.7305	3.1376	17.79620	1.90714
3	Cyclohexane	68	4.1007	0.37117	3.09861	0.28602
4	Heptane	25	7.40144	0.86061	5.38343	0.61703
5	Methylcyclohexane	15	6.38576	0.96415	4.31843	0.62755
6	Isobutane	220	4.18282	0.48329	2.55183	0.29039
7	Propane	544	4.70159	0.45433	2.02104	0.20489
8	Toluene	11	8.00819	1.25865	4.11395	0.64248
Overall		1032	10.64125	1.20506	6.43503	0.73121

Table 5-2 Summary of the results of H^R and H deviations for pure components at very high pressure and temperature

	Component	No. of points	Soave-Redlich-Kowing Equation		Modified Soave Equation	
			AA% D H^R	AA%D H	AA%D H^R	AA%D H
1	ammonia	209	12.5099	46.8074	3.03607	21.0298
2	nitrogen	936	4.73418	1.95488	2.36487	0.94486
Overall AA%D		1145	8.62207	24.3811	2.70047	10.9873

In discussing the results of this work, we can see there is a difference in the values of average absolute deviation for enthalpy departure and for enthalpy. It is well known that the evaluation of any correlation or prediction method is done by comparison of the values with those of experimental data. The available experimental data in the literature are normally limited in ranges of temperatures and pressures for any certain compound. The deviation between the experimental results and those of prediction or correlation method determines the accuracy of the method, i.e. average (overall) absolute deviation (which is difference between calculated and experimental divided by molecular weight), which is defined as follows:

$$AAD = \frac{\sum \left| H^R_{\text{exp.}} - H^R_{calc.} \right| / Mwt}{n} \qquad (5\text{-}1)$$

And all deviations of enthalpy departure are in Joules per gram which is suitable method for estimating the vapor enthalpies of pure component or

mixture. For enthalpy calculation the average (overall) absolute percentage deviation AA%D, is a follows:

$$AA\%D = \frac{\sum \left| \left(H_{\exp.} - H_{calc.} \right) / H_{\exp.} \right| \times 100}{n} \qquad (5\text{-}2)$$

The results of enthalpy departure show higher deviations than those for enthalpy this can be explained as follows: The value of enthalpy is equal to the value of enthalpy departure plus the ideal gas enthalpy, and the value of enthalpy is higher than that of enthalpy departure. The deviation is calculated by determined the difference between actual and calculated values divided by the actual value. This difference between actual and calculated values is the same for enthalpy and enthalpy departure. Thus the deviation is higher for enthalpy departure than for enthalpy because the denominator in equation (5-2) is higher for enthalpy than for enthalpy departure.

It is convent to express the deviation of calculated enthalpy departure in the units of j/g. this is usually adopted in literature and recommended for superheated vapor of pure components and mixtures cited in [48, 35].

Tables 5-3 and 5-4 show summarized results obtained for the eight pure components calculated by Soave-Redlich-Kwong, Peng-Robinson, Lee-Kesler, and the present work. They indicate that the AAD J/g for each pure component by these methods and also show that this method is more accurate than all the other methods for all components.

Table 5-3: Summary of results of H^R deviations for pure components at different method

components	No. of points	Lee Kesler AAD J/g	Peng Robinson AAD J/g	Soave AAD J/g	This Work AAD J/g
benzene	82	26.38458	23.14831	21.319	12.1967
cis-2-pentene	67	35.09373	29.95215	28.7305	17.7962
cyclohexane	68	9.18271	4.54020	4.1007	3.09861
n-heptane	25	7.56641	7.5265	7.40144	5.38343
methylcyclohexane	15	15.9491	6.27204	6.38576	4.31843
Isobutane	220	4.10881	4.78170	4.18282	2.55183
propane	544	4.71368	6.6243	4.70159	2.02104
toluene	11	5.53518	7.89457	8.00819	4.11395
Overall		13.57428	11.34247	10.6412	6.43503

Table 5-4 Summary of results of H^R deviations at high pressure and temperature of pure components

Components	no. of points	Lee-Kesler AA%D	Peng-Robinson AA%D	Soave AA%D	This Work AA%D
ammonia	209	8.54290	4.67995	12.50997	3.03607
nitrogen	936	2.17578	14.25151	4.73418	2.36487
Overall AA%D	1145	5.35934	9.46573	8.622075	2.70047

The pressure explicit Virial equation of state, truncated after the second virial coefficient ,is useful expression for the calculation of enthalpy and enthalpy departure up to 15 bar, the addition of the third Virial coefficient extends further the applicability of the Virial equation to conditions of higher temperature and pressure. Some of results obtained by applying the Virial truncated equation have indicated that the use of the third Virial coefficient does not improve the results appreciably. For very high pressure and temperature, Virial equation can not be applied for enthalpy departure and enthalpy of pure components calculation because it gives very large deviations (it gives more than 45.25 J/g deviations for enthalpy departure).

The enthalpy of a mixture is determined using an equation of state by combining the departure function for the mixture with the enthalpy of an ideal gas mixture

$$\boldsymbol{H} = \left(\boldsymbol{H} - \boldsymbol{H}^{ig}\right) + \boldsymbol{H}^{ig} = \left(\boldsymbol{H} - \boldsymbol{H}^{ig}\right) + \sum_{i} \chi_i \boldsymbol{H}_i^{ig} \tag{5-3}$$

Where the first term on the right side represents the enthalpy departure that can be estimated by any one of the methods used to calculate enthalpy departure of gases, as virial equation of state, lee kesler equation of state, and cubic equation of state. The equations of state parameters depend on composition and the summation of the ideal gas enthalpies. Equation (5-3) is easily calculated after selecting a reference state for each component. For a fluid that is not an ideal gas at the reference state

$$\boldsymbol{H}_i^{ig} = \int_{T_R}^{T} \boldsymbol{C}_P^{ig} d\boldsymbol{T} - \left(\boldsymbol{H} - \boldsymbol{H}^{ig}\right)_R + \boldsymbol{H}_R \tag{5-4}$$

Each component may have a different reference state of temperature, pressure and state of aggregation. For components that are liquids at the reference state, the latent heat of vaporization must be included in the enthalpy calculation by modifying Equation (5-4). One such modification might result in

$$\boldsymbol{H}_i^{ig} = \int_{T_o}^{T} \boldsymbol{C}_P^{ig} d\boldsymbol{T} - \left(\boldsymbol{H} - \boldsymbol{H}^{ig}\right) + \boldsymbol{H}_{vap.} \tag{5-5}$$

For mixture, Soave-Redlich-Kowing, Peng-Robinson, Lee-Kesler and Teja have proposed many correlation procedures based on different mixing rules. Lee-Kesler method, however proved to be more accurate (less deviation for

experimental values) than those of others in prediction of enthalpy and enthalpy departure. New correlation for calculating enthalpy departure was developed in this work. This correlation is based on the fact that enthalpy departure is function T_r, P_r and composition. The results of this correlation by using equation (4-22) are shown in table 5-5. As the table indicates the results of this new correlation are more superior than those even of lee kesler for total of 6 mixtures at 754 data points. The average deviation for enthalpy departure AAD is 5.334148 J/g as compares with lee kesler method of 10.64685 J/g

Table 5-5 Summary of results of H^R and H deviations for mixtures

	Mixture	No. of Data points	Lee-kesler		This work	
			AAD J/g H^R	AA%D H	AAD J/g H^R	AA%D H
1	Benzene– Hexadecane	58	13.81594	1.32109	4.95274	0.47729
2	Benzene– n – octane	283	10.89077	1.04922	6.34096	0.61209
3	Benzene– cyclohexane	208	8.13325	0.82584	4.4759	0.45649
4	CIS–2–pentene –n- pentane	27	12.38609	1.32199	4.08461	0.4346
5	n–pentane– cyclohexane	178	8.00819	0.76192	6.81653	0.63980
	Overall deviation	754	10.64685	1.056132	5.334148	0.524054

When Teja method for prediction of enthalpy departure was applied it showed large deviations from experimental data. This is because it is very difficult to obtain from experimental data the relation of H^R as a function of T_r

and P_r at the same range of condition of T_r and P_r for both the mixture and the pure components which represent the two non-spherical reference fluids.

The main features of the developed correlation in this work for enthalpy and enthalpy departure for mixture are:

1. It is rather a simple equations
2. it uses Lee-Kesler mixing rules
3. It needs only a few well-known properties of pure components in mixture (T_c, P_c, V_c, ω) for each component.

This new development method gives very good results for the mixtures that are shown in tables 4-2. Where all the mixture are non polar and with conditions where this method is tested were up to 51.7 bar and for temperature up to 633 K for mixtures.

Figures 5-1 to 5-4 show the relation either between enthalpy departure and temperature at constant pressure or between enthalpy departure and pressure at constant temperature for the results obtained using this new method of correlation. The figures also show the enthalpy departure calculated from experimental data. Figures 5-1, 5-2 show that the enthalpy departure increases with decreasing temperature at constant pressure, while figures 5-3, 5-4 indicate that the enthalpy departures increases with increasing pressure at constant temperature. This is logical since the gas deviate from ideal gas behavior increases as the pressure increases or the temperature decreases. From these figures that the new correlation gives very well fit to the experimental data and give high accuracy compared with the other available correlation in literature.

Figures 5-5, 5-6 show the relation between the values of enthalpy departure for nitrogen and ammonia with pressure which indicate that the value of enthalpy departure of nitrogen was very high in comparison with enthalpy departure of ammonia this is because the values of heat capacity of nitrogen at different temperature was less than the values of heat capacity of ammonia.

Figures 5-7 to 5-9 show the relation between the values of enthalpy departure for different pure components with temperature. From these figures indicate that the modified of Soave equation give high accuracy to the experimental data.

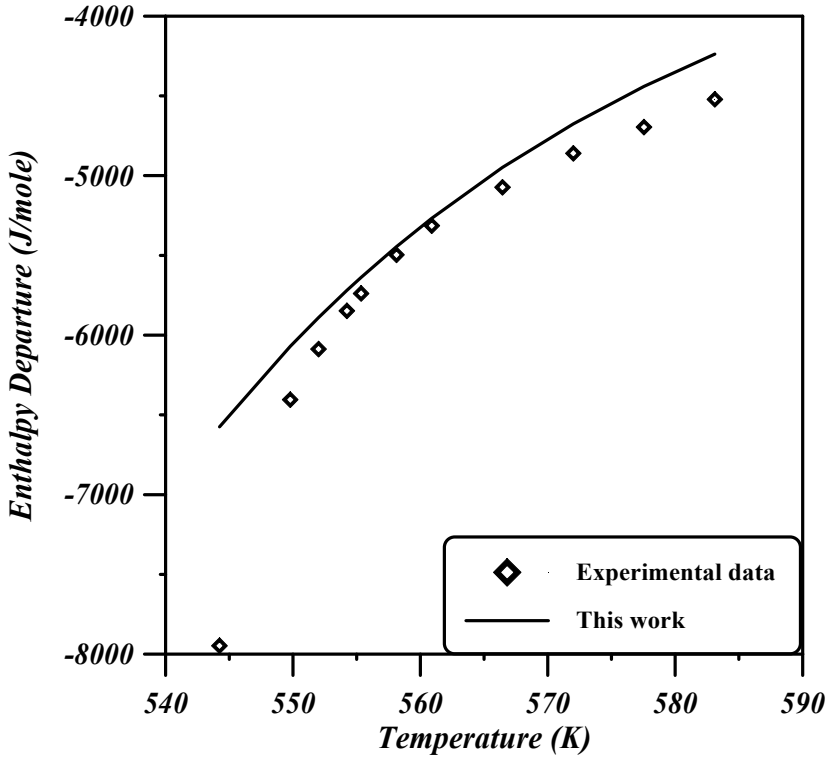

Figure 5-1: The relation between H^R and temperature for mixture 21.1mole % Benzene with cyclohexane at 37.09 Bar

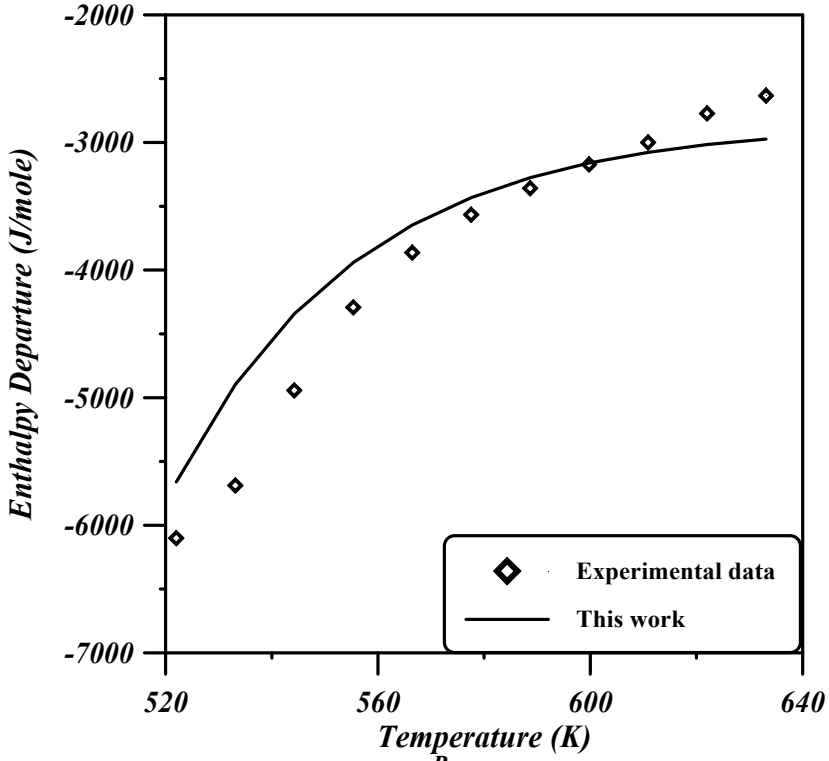

Figure 5- 2: The relation between H^R and temperature for the mixture 38.5mole % pentane with cyclohexane at 34.47 Bar

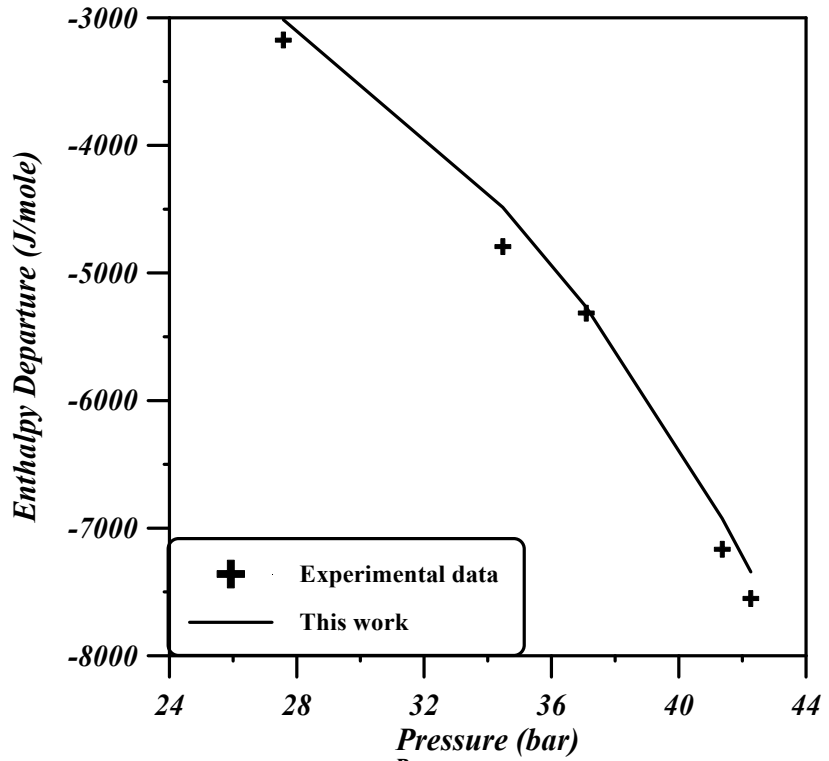

Figure 5-3: The relation between, H^R and pressure for mixture 21.1mole % Benzene with cyclohexane at 560.89 K

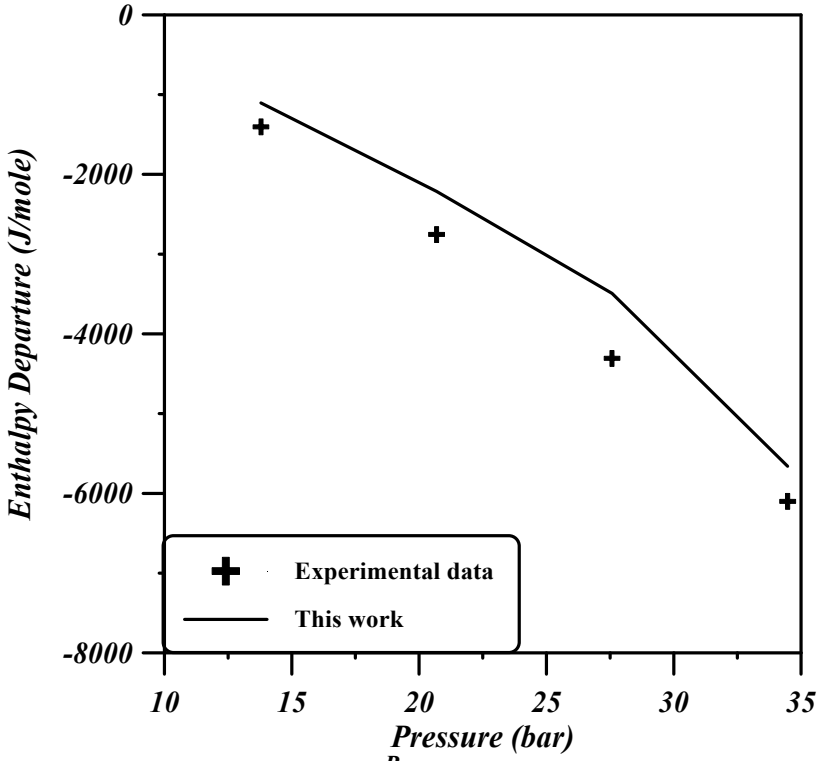

Figure 5-4: The relation between, H^R and pressure for mixture 38.5 mole % pentane with cyclohexane at 522 K

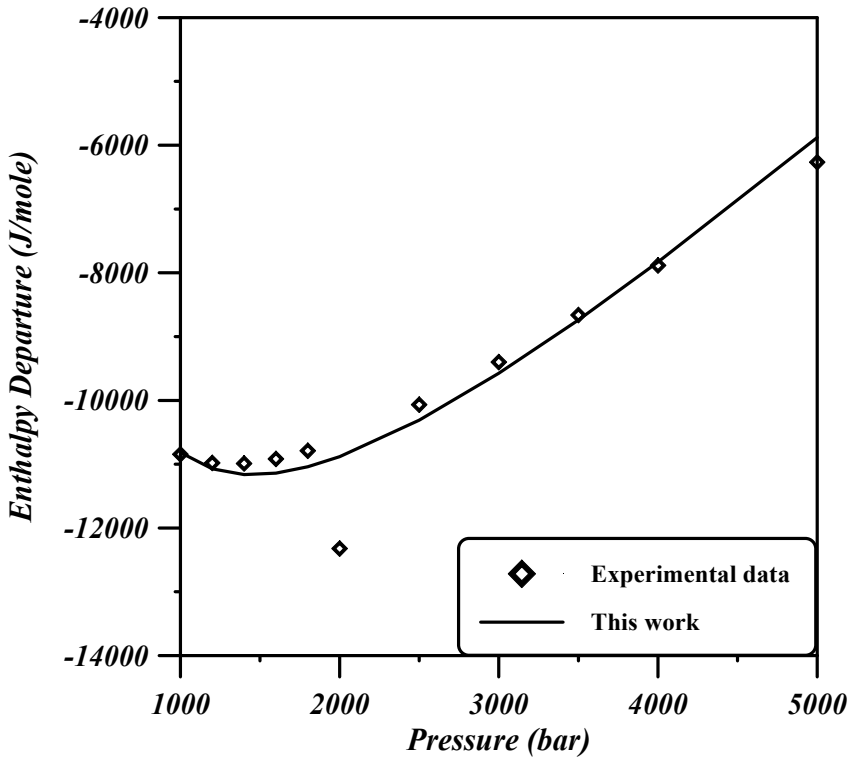

Figure 5- 5: The relation between, H^R and pressure for ammonia at 550 K

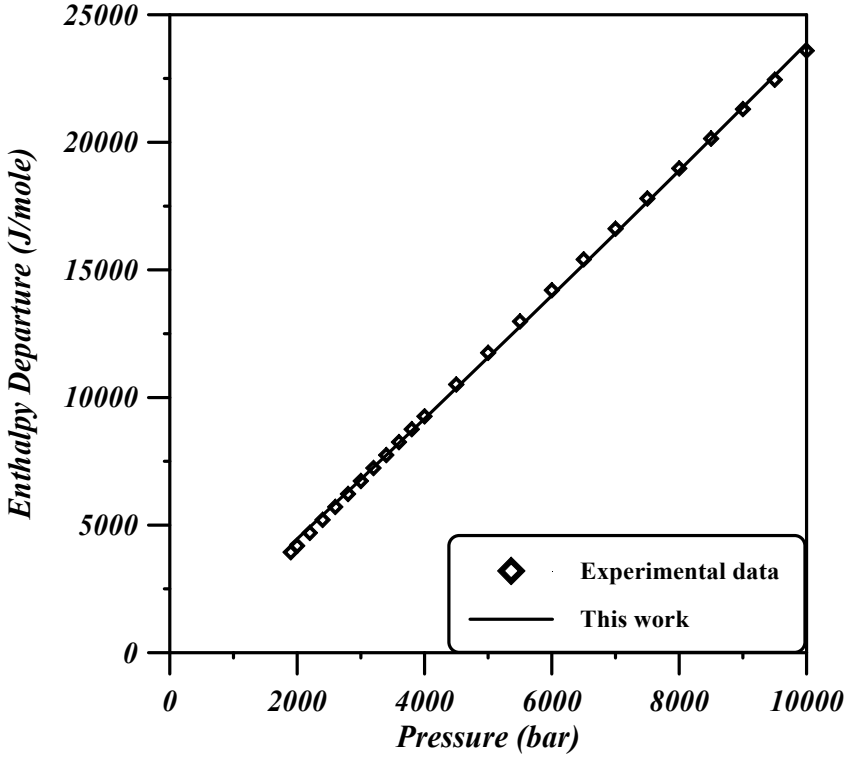

Figure 5- 6: The relation between, H^R and Pressure for nitrogen at 700 K

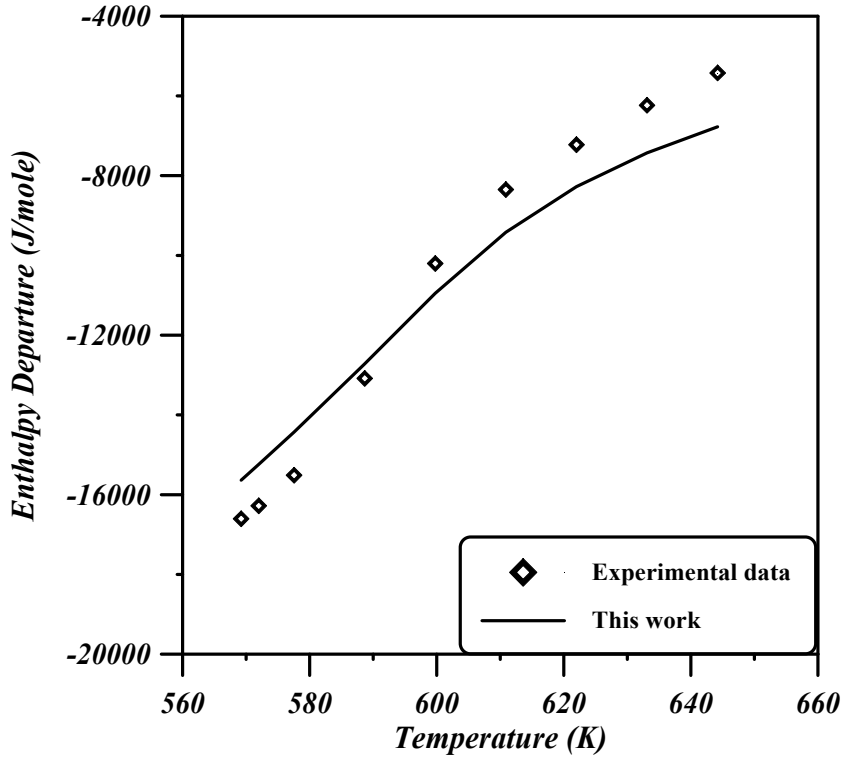

Figure 5- 7: The relation between, H^R and temperature for benzene at 68.947 Bar

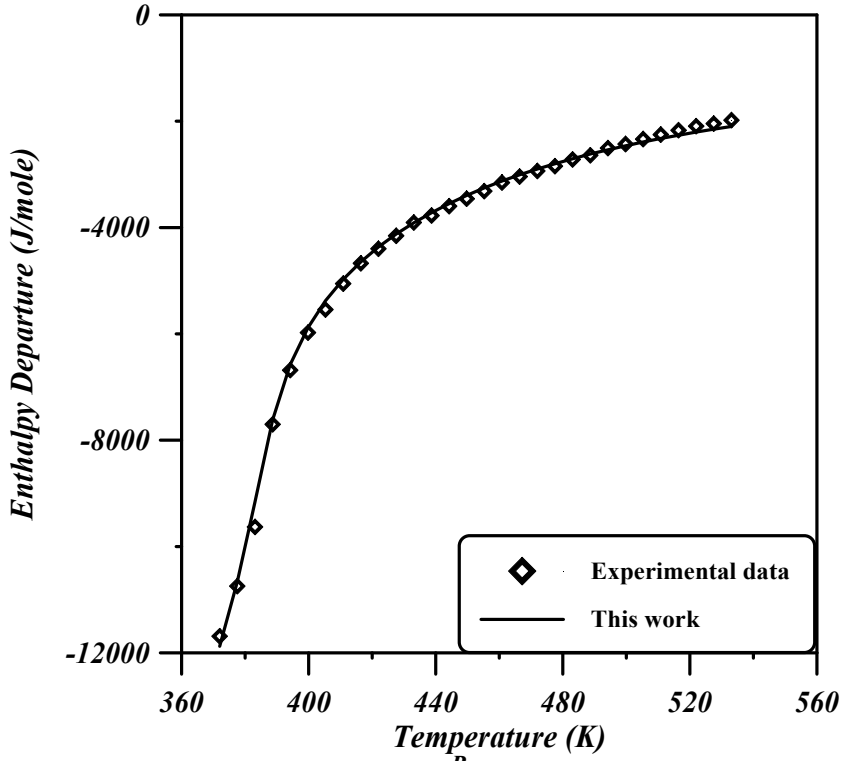

Figure 5- 8: The relation between, H^R and temperature for propane at 55.157 Bar

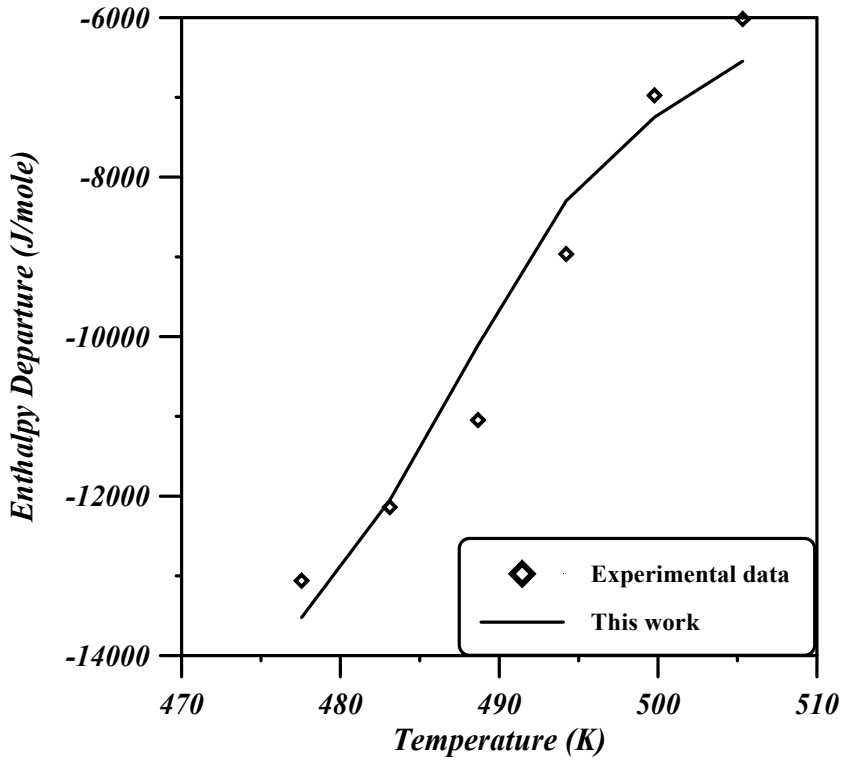

Figure 5- 9: The relation between, H^R and temperature for cis-2-pentenee at 48.263 Bar

5.2 Conclusions

1. For pure components, a new modified correlation is proposed to predict the enthalpy departure for superheated vapor. This correlation is modification of Soave-Redlich-Kowing equation of state. The modification was made by redefining the parameter m in Soave equation to be a function of reduced temperature, reduced pressure and acentric factor. This correlation applied in this work to predict the enthalpy departure for pure components at pressure up to 138 bar. This correlation is as follows:

$$m = a_f + b_f\omega + c_f\omega^2$$

Where:

$a_f = 3.192426$

$b_f = -14.6167 \times T_r - 5.7701 \times T_r^2 - 10.3125 \times P_r + 6.91052 \times T_r \times P_r + 0.97196 \times P_r^2$

$c_f = 95.60639 \times T_r + 57.877 \times T_r^2 - 4.94924 \times P_r + 21.14243 \times T_r \times P_r - 4.58519 \times P_r^2$

The results of this correlation were compared with the results obtained from Soave-Redlich-Kwong, Peng-Robinson, and Lee-Kesler methods. The average absolute deviation of 1032 data points of 8 pure components obtained from this correlation was 6.43503 J/g in comparison with there obtained from Soave-Redlich-Kwong, Peng-Robinson, and Lee-Kesler methods which were 10.64125J/g, 11.34247J/g, and 13.57428 J/g respectively.

2. For high pressure of nitrogen up to 10000 bar and ammonia up to 5000 bar, the modified m parameter equation was obtained in the same way as pure components as follows:

$$m = a_f + b_f\omega + c_f\omega^2$$

Where:

$$a_f = 1.08047$$

$$b_f = -8.3078 - 2.06477 \times T_r - 0.1202866 \times P_r$$

$$c_f = -2.2745 + 37.73731 \times T_r + 1.034199 \times P_r$$

The results of this correlation were compared with the results obtained from Soave-Redlich-Kwong, Peng-Robinson, and Lee-Kesler methods. The average absolute deviation of 1145 data points of nitrogen and ammonia obtained from this correlation was 2.70047 in comparison with there obtained from Soave-Redlich-Kwong, Peng-Robinson, and Lee-Kesler which were 8.622075, 9.46573, and 5.35934 respectively.

3. For mixture, a new correlation was developed to predict enthalpy departure of mixture superheated vapor. This prediction was based on the law of corresponding states. It was found that the enthalpy departure (H^R) was influenced by changing the reduced temperature, reduced pressure and were applied to binary mixture using mixing rules of Lee-Kesler as follows:

$$\frac{H^R}{RT_{CM}} = -0.12579 - 0.78614 \times T_r - \frac{0.34704}{P_r} + 0.6758\frac{T_r}{P_r} - 0.168728\frac{T_r^2}{P_r^2} - 1.109548\frac{P_r^{(4.36269)}}{T_r^{(14.1992)}}$$

The results of this method were compared with the results obtained from Soave-Redlich-Kwong, Peng-Robinson, and Lee-Kesler methods. The average absolute deviation of 754 data points of 5 nonpolar binary mixtures was 5.334148 J/g in comparison with those obtained from Soave-Redlich-Kwong, Peng-Robinson, and Lee-Kesler methods which were 16.6792J/g, 17.89331 J/g, and 10.64685 J/g respectively.

Recommendations

For those who would carry future work on related subject, the following recommendations may be considered:

1. Applying this correlation to study other thermodynamic properties such as compressibility factor and entropy.
2. Study the possibility of applying this method to ternary mixture
3. Study the possibility of applying this method to polar mixture.
4. Studying the possibility of applying this method to liquid phase.

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Appendix A

Results for pure superheated vapors

T = Temperature, Kelvin

P = pressure, bar

AA%D = average absolute percentage deviations for enthalpy.

AAD = average absolute deviations for enthalpy departure, Joule/gram.

Table A-1: Benzene

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
569.222	13.78947	2.218513	23.02492	2.164009	22.45927	2.100282	21.79791	5.54544	57.55364
572	13.78947	2.243151	23.41629	2.195266	22.91644	2.131592	22.25169	5.446997	56.86127
577.556	13.78947	2.222962	23.45894	2.187422	23.08388	2.12381	22.41257	5.192888	54.80047
588.667	13.78947	2.125669	22.90686	2.111776	22.75714	2.048341	22.07349	4.6641	50.26173
599.778	13.78947	2.032006	22.35593	2.036252	22.40264	1.973081	21.70763	4.177572	45.96128

Continued ...

610.889	**13.78947**	**1.961881**	**22.0362**	**1.981319**	**22.25449**	**1.918509**	**21.549**	**3.746176**	**42.07769**
622	**13.78947**	**1.874182**	**21.48272**	**1.906292**	**21.85077**	**1.843897**	**21.13561**	**3.324478**	**38.10671**
633.111	**13.78947**	**1.828543**	**21.39341**	**1.871174**	**21.89218**	**1.809283**	**21.16808**	**2.967245**	**34.71585**
644.222	**13.78947**	**1.726884**	**20.60566**	**1.778231**	**21.21843**	**1.716859**	**20.48604**	**2.574367**	**30.71816**
569.222	**27.57893**	**2.449765**	**24.8324**	**2.309246**	**23.40801**	**2.181158**	**22.10961**	**9.937559**	**100.7334**
572	**27.57893**	**2.449125**	**24.97972**	**2.324591**	**23.7095**	**2.196684**	**22.40499**	**9.57283**	**97.63757**
577.556	**27.57893**	**2.448915**	**25.28514**	**2.353754**	**24.30264**	**2.22626**	**22.98624**	**8.907131**	**91.96654**
588.667	**27.57893**	**2.320807**	**24.51301**	**2.275573**	**24.03527**	**2.148813**	**22.69644**	**7.645976**	**80.75903**
599.778	**27.57893**	**2.21664**	**23.94386**	**2.211881**	**23.89242**	**2.086034**	**22.53304**	**6.586025**	**71.14137**
610.889	**27.57893**	**2.131166**	**23.53613**	**2.159403**	**23.84797**	**2.034573**	**22.46932**	**5.669367**	**62.61123**
622	**27.57893**	**2.000064**	**22.56277**	**2.055253**	**23.18533**	**1.931461**	**21.78888**	**4.801117**	**54.16148**
633.111	**27.57893**	**1.863744**	**21.46717**	**1.940954**	**22.35641**	**1.818279**	**20.94349**	**3.998183**	**46.0522**
644.222	**27.57893**	**1.779404**	**20.93025**	**1.87449**	**22.04873**	**1.753079**	**20.62056**	**3.301743**	**38.8368**
569.222	**34.47367**	**2.537087**	**25.31625**	**2.327096**	**23.22089**	**2.166939**	**21.6227**	**12.58728**	**125.6019**
572	**34.47367**	**2.512729**	**25.23689**	**2.326077**	**23.36218**	**2.166301**	**21.75746**	**11.97723**	**120.2945**
577.556	**34.47367**	**2.429942**	**24.71061**	**2.285368**	**23.24036**	**2.126277**	**21.62258**	**10.87282**	**110.568**
588.667	**34.47367**	**2.341207**	**24.40724**	**2.266339**	**23.62671**	**2.108706**	**21.98341**	**9.131589**	**95.1974**
599.778	**34.47367**	**2.257281**	**24.10458**	**2.237323**	**23.89143**	**2.081147**	**22.22371**	**7.729033**	**82.53525**
610.889	**34.47367**	**2.208743**	**24.15143**	**2.232643**	**24.41277**	**2.077991**	**22.72171**	**6.571733**	**71.85836**
622	**34.47367**	**2.165972**	**24.2379**	**2.225085**	**24.89941**	**2.072048**	**23.18683**	**5.56615**	**62.28694**
633.111	**34.47367**	**2.064134**	**23.61205**	**2.151705**	**24.6138**	**2.000213**	**22.88085**	**4.60947**	**52.72863**
644.222	**34.47367**	**1.903531**	**22.23538**	**2.014136**	**23.52733**	**1.864163**	**21.77545**	**3.674624**	**42.92366**

Continued ...

569.222	41.3684	2.754812	26.96338	2.431056	23.79454	2.240515	21.92962	15.81573	154.8003
572	41.3684	2.703383	26.65491	2.416351	23.82488	2.226707	21.95502	14.8097	146.0215
577.556	41.3684	2.618935	26.19385	2.395412	23.95825	2.207178	22.07557	13.16744	131.6973
588.667	41.3684	2.427405	24.93326	2.302995	23.65533	2.116843	21.74329	10.67304	109.6286
599.778	41.3684	2.306199	24.30508	2.25632	23.77946	2.071999	21.83688	8.825559	93.01287
610.889	41.3684	2.321656	25.11064	2.329534	25.19587	2.14722	23.22396	7.435751	80.42383
622	41.3684	2.281191	25.28316	2.334548	25.87456	2.154144	23.87508	6.205361	68.77596
633.111	41.3684	2.15725	24.46144	2.246873	25.47766	2.068237	23.45214	5.040326	57.15312
644.222	41.3684	2.045879	23.72208	2.164464	25.09702	1.987717	23.04763	3.992538	46.29363
569.222	44.81577	2.848035	27.50484	2.427732	23.44583	2.224421	21.48231	17.61416	170.1085
572	44.81577	2.788346	27.15543	2.418776	23.55624	2.216723	21.58843	16.32118	158.9503
577.556	44.81577	2.66655	26.37861	2.380381	23.54768	2.179917	21.56466	14.29025	141.3651
569.222	48.26313	3.114575	29.57183	2.523107	23.95605	2.314414	21.97459	19.61397	186.2283
572	48.26313	3.036924	29.14542	2.531946	24.29915	2.323831	22.30187	17.96214	172.3829
577.556	48.26313	2.924876	28.60754	2.544494	24.8871	2.336761	22.85536	15.54897	152.0808
588.667	48.26313	2.698999	27.2583	2.481272	25.05941	2.273964	22.96575	12.26678	123.8874
599.778	48.26313	2.566708	26.68649	2.457596	25.55204	2.251039	23.4044	9.993382	103.9028
610.889	48.26313	2.490643	26.6139	2.460926	26.29643	2.255461	24.10086	8.235419	88.00017
622	48.26313	2.451777	26.89435	2.48244	27.23078	2.278515	24.9938	6.791754	74.50105
633.111	48.26313	2.317759	26.04425	2.395461	26.91741	2.193053	24.64296	5.441614	61.14656
644.222	48.26313	2.216575	25.50015	2.331357	26.8207	2.130682	24.51204	4.252557	48.9228
569.222	49.2284	2.833128	26.62289	2.160583	20.30298	1.953828	18.36012	19.84285	186.4629

Continued ...

572	**49.2284**	**2.728402**	**25.94339**	**2.163888**	**20.57564**	**1.956163**	**18.60044**	**18.07063**	**171.8269**
577.556	**49.2284**	**2.629117**	**25.51907**	**2.210559**	**21.45637**	**2.001727**	**19.42943**	**15.55815**	**151.0125**
569.222	**51.7105**	**4.000494**	**36.94124**	**2.932017**	**27.0747**	**2.782713**	**25.69604**	**21.472**	**198.2759**
572	**51.7105**	**3.466933**	**32.53838**	**2.663568**	**24.99857**	**2.479703**	**23.27288**	**19.4002**	**182.0776**
577.556	**51.7105**	**3.090783**	**29.727**	**2.543645**	**24.46461**	**2.341983**	**22.52505**	**16.54172**	**159.0974**
588.667	**51.7105**	**2.882447**	**28.80931**	**2.581737**	**25.80385**	**2.371037**	**23.69789**	**12.9858**	**129.7898**
569.222	**55.15787**	**2.803324**	**23.98886**	**1.103903**	**9.446418**	**1.053249**	**9.013007**	**20.67176**	**176.8944**
572	**55.15787**	**2.019763**	**17.76294**	**0.86012**	**7.564353**	**0.865635**	**7.612847**	**17.95336**	**157.8917**
577.556	**55.15787**	**3.797208**	**35.77946**	**2.910403**	**27.42346**	**2.769371**	**26.0946**	**17.44761**	**164.4013**
588.667	**55.15787**	**3.313056**	**32.76646**	**2.879096**	**28.47455**	**2.677643**	**26.48215**	**13.76128**	**136.1003**
599.778	**55.15787**	**3.000931**	**30.71248**	**2.767194**	**28.32036**	**2.55312**	**26.12947**	**11.06475**	**113.2403**
610.889	**55.15787**	**2.801433**	**29.54395**	**2.692125**	**28.39119**	**2.47332**	**26.08366**	**8.982846**	**94.73325**
622	**55.15787**	**2.670672**	**28.96003**	**2.648666**	**28.72143**	**2.428249**	**26.33134**	**7.279519**	**78.93719**
633.111	**55.15787**	**2.606615**	**29.02941**	**2.64964**	**29.50854**	**2.42908**	**27.05218**	**5.848797**	**65.137**
644.222	**55.15787**	**2.447037**	**27.92386**	**2.539783**	**28.98215**	**2.319724**	**26.47101**	**4.471258**	**51.02283**
569.222	**68.94733**	**3.434762**	**28.28181**	**1.634955**	**13.4622**	**1.542909**	**12.70426**	**44.52248**	**366.5975**
572	**68.94733**	**3.291974**	**27.42001**	**1.486045**	**12.37779**	**1.401777**	**11.67589**	**34.53695**	**287.6704**
577.556	**68.94733**	**2.927267**	**24.98819**	**1.236965**	**10.55917**	**1.175478**	**10.0343**	**22.28157**	**190.2036**
588.667	**68.94733**	**2.478398**	**22.47088**	**1.427194**	**12.93995**	**1.405099**	**12.73961**	**13.70563**	**124.2647**
599.778	**68.94733**	**2.932572**	**28.32128**	**2.172879**	**20.98457**	**2.0784**	**20.07208**	**11.16173**	**107.7943**
610.889	**68.94733**	**2.974107**	**30.09908**	**2.47106**	**25.00805**	**2.300242**	**23.27928**	**9.230427**	**93.41525**
622	**68.94733**	**2.778714**	**29.15574**	**2.485835**	**26.0827**	**2.277686**	**23.89869**	**7.357354**	**77.19714**

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633.111	68.94733	2.815012	30.54489	2.670097	28.97248	2.443703	26.51588	5.868207	63.67427

Table A-2: Cis-2-Pentene

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
488.67	13.78947	4.240209	43.27737	4.168068	42.5411	4.092696	41.77178	10.00485	102.1137
499.78	13.78947	4.100343	42.91802	4.062744	42.52444	3.98763	41.73826	8.443192	88.37436
477.56	20.6842	4.33613	42.4006	4.140935	40.49192	4.026711	39.37494	16.51419	161.483
483.11	20.6842	4.298724	42.63478	4.141912	41.07951	4.027981	39.94946	14.78011	146.5891
488.67	20.6842	4.281433	43.07071	4.158579	41.8348	4.044982	40.69204	13.30477	133.8445
499.78	20.6842	4.223197	43.6735	4.156888	42.98776	4.044099	41.82137	10.80905	111.78
477.56	27.57893	4.308808	41.26151	4.001709	38.32069	3.847981	36.8486	22.36123	214.1329
483.11	27.57893	4.329617	42.14557	4.084323	39.75779	3.931692	38.27203	19.2745	187.6227
488.67	27.57893	4.295722	42.46509	4.103169	40.56157	3.951419	39.06153	16.83488	166.4202
499.78	27.57893	4.241487	43.20157	4.133786	42.10457	3.983793	40.5769	13.07214	133.1462
477.56	31.0263	3.748036	35.22892	3.359627	31.57819	3.184965	29.93646	25.50525	239.7317

Continued …									
483.11	**31.0263**	**3.902961**	**37.39322**	**3.595546**	**34.44796**	**3.423005**	**32.79488**	**21.39626**	**204.9918**
488.67	**31.0263**	**3.92668**	**38.26891**	**3.685925**	**35.92252**	**3.514937**	**34.25609**	**18.36239**	**178.9576**
499.78	**31.0263**	**4.088529**	**41.21575**	**3.95204**	**39.83978**	**3.783849**	**38.14432**	**14.03373**	**141.4714**
477.56	**33.09472**	**3.46232**	**32.15686**	**3.010732**	**27.96264**	**2.823578**	**26.22444**	**27.74926**	**257.7257**
483.11	**33.09472**	**3.691741**	**35.01748**	**3.337794**	**31.66019**	**3.153719**	**29.91417**	**22.79595**	**216.228**
488.67	**33.09472**	**3.809532**	**36.82596**	**3.533454**	**34.15717**	**3.351514**	**32.3984**	**19.39063**	**187.4452**
499.78	**33.09472**	**4.055986**	**40.64233**	**3.898397**	**39.06324**	**3.719842**	**37.27412**	**14.64884**	**146.7864**
477.56	**34.47367**	**3.095566**	**28.44817**	**2.591547**	**23.81622**	**2.39578**	**22.01711**	**29.28444**	**269.123**
483.11	**34.47367**	**3.580303**	**33.72731**	**3.189671**	**30.04746**	**2.998157**	**28.24335**	**23.78792**	**224.0879**
488.67	**34.47367**	**3.802676**	**36.57393**	**3.499409**	**33.65714**	**3.310615**	**31.84134**	**20.1399**	**193.7045**
499.78	**34.47367**	**3.993408**	**39.82952**	**3.819515**	**38.0952**	**3.63432**	**36.24802**	**15.0135**	**149.742**
477.56	**35.78367**	**2.787882**	**25.35466**	**2.22313**	**20.21848**	**2.019357**	**18.36523**	**30.92756**	**281.2738**
483.11	**35.78367**	**3.219467**	**30.03613**	**2.787278**	**26.00398**	**2.588534**	**24.14982**	**24.555**	**229.0865**
488.67	**35.78367**	**3.54362**	**33.81861**	**3.210179**	**30.63641**	**3.014661**	**28.77046**	**20.64315**	**197.0082**
499.78	**35.78367**	**3.881961**	**38.51938**	**3.69059**	**36.62048**	**3.499208**	**34.72141**	**15.30582**	**151.8743**
477.56	**37.23156**	**0.798796**	**7.052937**	**0.137527**	**1.214288**	**7.821297E-**	**0.6905975**	**31.81786**	**280.9338**
483.11	**37.23156**	**2.880924**	**26.58953**	**2.393728**	**22.09292**	**2.187823**	**20.19254**	**25.47664**	**235.1368**
488.67	**37.23156**	**3.350191**	**31.71547**	**2.978117**	**28.19314**	**2.776065**	**26.28032**	**21.27377**	**201.3936**
494.22	**37.23156**	**3.631898**	**35.14258**	**3.347814**	**32.39375**	**3.148183**	**30.46214**	**18.18026**	**175.914**
499.78	**37.23156**	**3.785271**	**37.34867**	**3.571864**	**35.24292**	**3.374127**	**33.29197**	**15.64101**	**154.3272**
477.56	**39.29998**	**5.689011**	**46.32719**	**6.595638**	**53.7101**	**6.834741**	**55.65718**	**31.3211**	**255.0563**
483.11	**39.29998**	**1.761415**	**15.87596**	**1.16648**	**10.51368**	**0.951208**	**8.573414**	**26.34088**	**237.4154**

Continued …									
488.67	39.29998	3.072522	28.72232	2.631487	24.59947	2.421724	22.63857	22.15381	207.0967
494.22	39.29998	3.490442	33.44913	3.156482	30.24876	2.949205	28.26241	18.84503	180.593
499.78	39.29998	3.741308	36.63632	3.490526	34.18056	3.285007	32.16808	16.17586	158.4005
477.56	41.3684	4.086407	32.69695	5.496667	43.98097	5.714367	45.72285	36.61367	292.9602
483.11	41.3684	1.263911	10.87738	2.041722	17.57134	2.262685	19.47296	25.78012	221.8675
488.67	41.3684	2.109119	19.29935	1.569719	14.36359	1.354936	12.39825	22.43468	205.2868
494.22	41.3684	2.964905	27.99908	2.564784	24.22054	2.351695	22.20824	19.14135	180.7613
499.78	41.3684	3.52809	34.20379	3.229568	31.30971	3.017887	29.25749	16.52292	160.1849
477.56	44.81577	5.211216	41.45457	2.467944	19.63217	2.340082	18.61503	52.58182	418.2814
483.11	44.81577	0.582018	4.800452	1.968516	16.23622	2.040575	16.83056	28.01088	231.0321
488.67	44.81577	0.673202	5.835955	1.517259	13.15306	1.714108	14.8595	21.67988	187.9417
494.22	44.81577	1.921635	17.61954	1.350109	12.37922	1.139972	10.45243	19.31964	177.1424
499.78	44.81577	2.94618	27.96613	2.531888	24.03357	2.317162	21.99532	16.77846	159.267
477.56	48.26313	5.990741	47.39083	3.540593	28.00847	3.417629	27.03578	77.1006	609.9178
483.11	48.26313	4.09505	33.43283	2.112075	17.24345	2.061538	16.83084	33.29351	271.8152
488.67	48.26313	0.723514	6.10888	0.491444	4.149405	0.534031	4.508994	23.35853	197.2237
494.22	48.26313	1.10746	9.816907	0.230945	2.047154	6.803425E-	0.6030779	19.26937	170.81
499.78	48.26313	2.497489	23.16097	1.892829	17.55355	1.69549	15.72346	16.90433	156.7657
505.33	48.26313	2.78496	26.55886	2.348848	22.3999	2.136898	20.37859	14.20358	135.453
477.56	55.15787	6.474744	50.82801	4.476835	35.14404	4.364672	34.26355	98.18687	770.7866
483.11	55.15787	5.933969	47.88026	3.857709	31.12723	3.770005	30.41956	46.18469	372.657
488.67	55.15787	4.853832	40.30511	3.047754	25.30783	3.001829	24.92648	30.06229	249.6301

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494.22	55.15787	3.310275	28.327	2.040874	17.46437	2.028267	17.35649	22.09127	189.0416
499.78	55.15787	2.22566	19.64097	1.204265	10.62738	1.145999	10.11317	17.06295	150.5769
505.33	55.15787	2.016804	18.38424	1.192256	10.86806	1.061348	9.674743	13.70278	124.9081
477.56	68.94733	6.721347	52.24804	5.288032	41.10624	5.183926	40.29698	114.6409	891.1544
483.11	68.94733	6.480205	51.62452	4.928263	39.261	4.831364	38.48908	72.45531	577.2151

Table A-3: Cyclohexane

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
466.445	6.894733	6.95E-02	0.595528	0.368475	3.156585	0.399856	3.42542	5.226614	44.77431
477.556	6.894733	0.105608	0.930502	0.34702	3.057528	0.379311	3.342026	4.456716	39.26735
488.667	6.894733	0.1382	1.252087	0.331872	3.006632	0.364834	3.305309	3.83578	34.75105
499.778	6.894733	6.84E-02	0.638084	0.222166	2.071199	0.255593	2.38277	3.410985	31.79902
510.889	6.894733	2.67E-02	0.256429	0.147164	1.410981	0.180886	1.734277	3.029979	29.05058
522	6.894733	5.96E-02	0.587937	3.29E-02	0.324276	6.68E-02	0.6583351	2.746111	27.08258
533.111	6.894733	9.51E-02	0.964288	2.60E-02	0.263478	7.94E-03	8.04E-02	2.455115	24.8866
544.222	6.894733	0.106185	1.105741	0.056632	0.589756	0.02274	0.236763	2.174286	22.64182

Continued …

549.778	6.894733	0.21593	2.281256	0.175002	1.848867	0.141192	1.491615	2.146922	22.68144
555.333	6.894733	0.290079	3.10779	0.257024	2.753663	0.223301	2.39232	2.091279	22.40488
566.445	6.894733	0.274524	3.019021	0.255228	2.806817	0.221675	2.43778	1.836397	20.19537
577.556	6.894733	0.321842	3.634481	0.314082	3.546802	0.280774	3.170665	1.66357	18.78613
588.667	6.894733	0.187246	2.166778	0.189115	2.188406	0.156041	1.805706	1.328433	15.37236
599.778	6.894733	0.489733	5.831097	0.499603	5.948659	0.466952	5.559892	1.440813	17.15535
610.889	6.894733	0.550387	6.724802	0.566896	6.926513	0.534615	6.532127	1.327599	16.22112
622	6.894733	0.591334	7.410817	0.613311	7.686271	0.581431	7.286685	1.206734	15.12327
633.111	6.894733	0.632529	8.128652	0.658981	8.468621	0.627516	8.064219	1.096676	14.09344
499.778	13.78947	8.61E-02	0.786839	0.449231	4.106478	0.516558	4.721935	10.1095	92.41222
510.889	13.78947	8.77E-02	0.826093	0.366345	3.449364	0.434322	4.089386	7.769342	73.15292
522	13.78947	0.117887	1.142331	0.328858	3.186641	0.397199	3.848836	6.32236	61.26401
533.111	13.78947	8.49E-02	0.847223	0.241043	2.404127	0.309441	3.086318	5.313081	52.99169
544.222	13.78947	2.56E-02	0.262874	8.57E-02	0.879866	0.153877	1.580184	4.592803	47.16452
549.778	13.78947	5.42E-02	0.565011	3.78E-02	0.393773	0.10585	1.102533	4.263194	44.40436
555.333	13.78947	7.32E-02	0.77296	1.46E-03	1.54E-02	6.93E-02	0.7322289	3.953198	41.75483
566.445	13.78947	0.147312	1.600184	0.102797	1.116598	3.54E-02	0.3847024	3.438519	37.35042
577.556	13.78947	0.244896	2.735299	0.225149	2.514745	0.158388	1.769133	3.021098	33.74384
588.667	13.78947	0.343137	3.939549	0.343768	3.946795	0.277719	3.188488	2.662431	30.56753
599.778	13.78947	0.500474	5.907756	0.517822	6.11255	0.452592	5.342566	2.408234	28.42773
610.889	13.78947	0.616326	7.474642	0.647356	7.850923	0.582977	7.070185	2.151731	26.0955
622	13.78947	0.76821	9.572097	0.810354	10.09727	0.746903	9.306621	1.962653	24.45525

633.111	13.78947	0.754581	9.640969	0.805795	10.29536	0.743196	9.495564	1.636684	20.91133
510.889	20.6842	9.38E-04	8.62E-03	0.528795	4.86823	0.633104	5.828542	117.1127	1078.168
522	20.6842	0.192295	1.824858	0.574782	5.454696	0.678975	6.443497	14.8739	141.1535
533.111	20.6842	0.204219	1.998828	0.479795	4.696082	0.583588	5.712041	9.798001	95.90028
544.222	20.6842	5.21E-02	0.52668	0.245802	2.483036	0.348849	3.523954	7.764002	78.43002
549.778	20.6842	5.58E-03	5.73E-02	0.154205	1.581788	0.256836	2.634547	7.026629	72.07632
555.333	20.6842	0.102378	1.066593	2.73E-02	0.284233	0.12942	1.348323	6.440298	67.09558
566.445	20.6842	0.251487	2.700179	0.17256	1.852776	7.15E-02	0.7675859	5.460871	58.63203
577.556	20.6842	0.28589	3.157963	0.247553	2.73451	0.147533	1.629701	4.583234	50.62691
588.667	20.6842	0.334419	3.79902	0.328813	3.735393	0.229981	2.612573	3.860206	43.85241
599.778	20.6842	0.45319	5.295831	0.474027	5.539386	0.376527	4.399979	3.307279	38.64803
610.889	20.6842	0.557686	6.699859	0.599858	7.206543	0.503753	6.051988	2.818223	33.85737
622	20.6842	0.629287	7.76649	0.688676	8.499399	0.593982	7.330705	2.357612	29.09688
633.111	20.6842	0.706359	8.952635	0.779541	9.880136	0.686298	8.698376	1.950836	24.72546
566.445	27.57893	0.344262	3.644153	0.214442	2.269961	8.01E-02	0.8483279	7.699195	81.50029
577.556	27.57893	0.351637	3.835179	0.283097	3.087606	0.150613	1.642668	6.240806	68.06564
588.667	27.57893	0.438913	4.931996	0.418293	4.700335	0.287704	3.232872	5.164499	58.03259
599.778	27.57893	0.510787	5.908324	0.527977	6.10722	0.399319	4.618952	4.26903	49.38036
610.889	27.57893	0.602085	7.166085	0.649332	7.728358	0.522626	6.220353	3.527629	41.98611
622	27.57893	0.688633	8.428404	0.759766	9.299019	0.635065	7.772727	2.880946	35.26086
633.111	27.57893	0.749998	9.432425	0.840111	10.56571	0.717396	9.022447	2.285185	28.73985
588.667	34.47367	0.408171	4.521037	0.355189	3.934173	0.195219	2.162316	6.283048	69.59319
599.778	34.47367	0.614084	7.023198	0.614084	7.023221	0.456754	5.223812	5.191201	59.37103

610.889	34.47367	0.660038	7.774406	0.701073	8.257808	0.546104	6.432465	4.15965	48.99561
622	34.47367	0.739875	8.971264	0.813063	9.858666	0.660502	8.008858	3.30594	40.08569
633.111	34.47367	0.714169	8.898746	0.81267	10.12608	0.662415	8.253872	2.454341	30.58187
588.667	40.54103	0.353219	3.851569	0.240022	2.617267	6.00E-02	0.6546445	7.109342	77.5218
599.778	40.54103	0.61872	6.986944	0.5808	6.55882	0.402843	4.549134	5.796594	65.45892
610.889	40.54103	0.787446	9.185428	0.805471	9.395675	0.629642	7.344675	4.678687	54.57603
622	40.54103	0.781986	9.394555	0.842749	10.12451	0.668997	8.037129	3.578976	42.99681
633.111	40.54103	0.638042	7.875988	0.73202	9.036057	0.560285	6.916128	2.472171	30.51651
622	96.52626	7.92E-02	0.851629	0.538728	5.795498	0.638331	6.866953	3.019787	32.4859
633.111	96.52626	0.047613	0.531759	0.564963	6.31027	0.680641	7.60234	0.359876	4.019568

Table A-4: n-Heptane

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
590.389	3.447367	0.966667	9.956191	0.964018	9.928855	0.939976	9.681284	1.260914	12.98671
537.611	6.205259	1.664873	14.69211	1.565437	13.81464	1.519982	13.41352	9.327616	82.31422
581.111	6.205259	0.878505	8.759982	0.86182	8.593619	0.817956	8.156212	2.387846	23.8104
563.667	10.3421	0.373372	3.485148	0.295484	2.758103	0.220201	2.055432	6.545767	61.09937

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582.78	10.3421	0.629949	6.241966	0.601835	5.963424	0.528636	5.238091	2.692859	26.68271
603.945	10.3421	0.768532	8.103143	0.777834	8.201214	0.707009	7.454467	1.021283	10.76808
559.67	15.85789	0.240984	2.1838	0.081561	0.739095	3.49E-02	0.3163607	11.39468	103.259
601	15.85789	0.113038	1.161566	0.113076	1.161978	4.04E-03	4.15E-02	2.224247	22.85681
545.167	24.13157	1.813745	15.25496	1.252048	10.53067	1.073894	9.03225	34.86513	293.2423
550.78	24.13157	0.557578	4.741525	9.86E-02	0.838861	7.80E-02	0.6635664	25.84143	219.7504
591.67	24.13157	0.402151	3.949248	0.328364	3.224664	0.165595	1.626173	8.90E-02	0.8741016
541.56	27.37209	0.903259	6.922713	2.280781	17.48015	2.474501	18.96484	56.03227	429.438
542.56	27.37209	0.477221	3.715167	1.665235	12.964	1.857387	14.45987	49.88206	388.3354
570.889	27.37209	0.683189	6.189523	0.39038	3.536734	0.206666	1.872363	11.12109	100.7538
587.05	27.37209	0.165768	1.583521	2.28E-02	0.217932	0.157974	1.509123	1.475204	14.09235
587.67	27.37209	1.180476	11.41692	1.043465	10.09183	0.864663	8.362514	2.165584	20.94433
581.5	34.47367	0.380644	3.46448	4.47E-02	0.407134	0.227019	2.066223	4.086927	37.19749
587.22	41.3684	0.433606	3.910216	0.234358	2.113373	0.360377	3.249812	1.413928	12.75056
590.56	55.15787	0.894549	7.833853	0.131041	1.14755	0.19588	1.715409	6.756448	59.16848
582.78	68.94733	1.430903	11.89185	0.35297	2.933439	0.260874	2.168075	3.812334	31.68329
585.5	103.421	1.286856	10.61689	0.680713	5.616045	0.516462	4.260952	5.640194	46.53308

Table A-5: Methylcyclohexane

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
373.15	1.1	0.373028	1.74911	0.733118	3.437581	2.475692	11.60842	2.475692	11.60842
393.15	1.1	0.358722	1.81393	0.617148	3.120703	1.996759	10.09684	1.996759	10.09684
413.15	1.1	0.521095	2.83135	0.70743	3.843794	1.445115	7.851965	1.445115	7.851965
433.15	1.1	0.731949	4.263251	0.866315	5.045883	0.916394	5.337584	0.916394	5.337584
453.15	1.1	0.875975	5.462572	0.972416	6.063981	0.506313	3.157349	0.506313	3.157349
473.15	1.1	1.019876	6.796181	1.088508	7.253547	0.137587	0.91686	0.137587	0.91686
493.15	1.1	0.881948	6.285749	0.929953	6.627909	8.08E-02	0.5758494	8.08E-02	0.5758494
513.15	1.1	0.308668	2.358687	0.341332	2.608254	0.48338	3.693718	0.48338	3.693718
453.15	3.4	0.159736	0.991716	0.481053	2.986632	5.067795	31.4634	5.067795	31.4634
473.15	3.4	0.68503	4.536251	0.911066	6.033051	3.451017	22.85259	3.451017	22.85259
493.15	3.4	1.023311	7.224479	1.180294	8.332813	2.294883	16.20171	2.294883	16.20171
513.15	3.4	1.106198	8.329009	1.212729	9.131183	1.562056	11.7614	1.562056	11.7614
473.15	6.9	25.40262	166.1462	0.75647	4.94769	236.907	1549.493	236.907	1549.493
493.15	6.9	1.040219	7.242159	1.392696	9.696169	7.750501	53.96019	7.750501	53.96019
513.15	6.9	1.786039	13.2059	2.022103	14.9514	4.616025	34.13083	4.616025	34.13083

Table A-6: Propane

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
372	6.894733	0.157476	1.457806	0.131093	1.213619	8.44E-02	0.7815487	1.595183	14.76725
377.556	6.894733	0.162837	1.52638	0.148897	1.395758	0.102078	0.9568195	1.486866	13.93746
383.111	6.894733	0.205138	1.947754	0.202255	1.920387	0.155351	1.474968	1.421908	13.50051
388.667	6.894733	0.162055	1.557091	0.16897	1.623613	0.121986	1.172083	1.278823	12.28776
394.222	6.894733	0.179699	1.748368	0.195305	1.900275	0.148304	1.442966	1.201475	11.68989
399.778	6.894733	0.185002	1.822331	0.208303	2.051883	0.161322	1.589124	1.117178	11.00479
405.333	6.894733	0.178324	1.778148	0.208424	2.078283	0.161498	1.61037	1.025836	10.22912
410.889	6.894733	0.205989	2.079909	0.242067	2.444176	0.195242	1.971394	0.973023	9.82475
416.445	6.894733	0.24389	2.493813	0.285217	2.916326	0.238527	2.438944	0.934563	9.55593
422	6.894733	0.291613	3.019753	0.337519	3.495108	0.290997	3.013367	0.909761	9.420815
427.556	6.894733	0.304398	3.191088	0.354316	3.714344	0.307964	3.22849	0.853863	8.951193
433.111	6.894733	0.239782	2.542691	0.293215	3.109307	0.247033	2.619553	0.724291	7.680543
438.667	6.894733	0.294918	3.167151	0.351327	3.772961	0.305379	3.279524	0.717024	7.700193
444.222	6.894733	0.273398	2.971042	0.332403	3.612221	0.286678	3.115295	0.636387	6.915583
449.778	6.894733	0.304428	3.349267	0.3656	4.022285	0.32013	3.522069	0.610853	6.720552
455.333	6.894733	0.323634	3.604274	0.386634	4.305886	0.341436	3.802548	0.576161	6.416632
460.889	6.894733	0.310841	3.502953	0.375365	4.23017	0.330447	3.723889	0.511989	5.769825
466.445	6.894733	0.348472	3.975664	0.41421	4.725729	0.369593	4.216662	0.500454	5.709702
472	6.894733	0.33437	3.85995	0.401104	4.630323	0.356778	4.118627	0.439459	5.07309

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477.556	6.894733	0.32985	3.852983	0.397332	4.641309	0.353315	4.127125	0.390074	4.556467
483.111	6.894733	0.354207	4.187819	0.422221	4.991941	0.378537	4.475411	0.371509	4.392304
488.667	6.894733	0.367718	4.399665	0.436072	5.217577	0.392721	4.698834	0.343943	4.11521
494.222	6.894733	0.351578	4.255668	0.42014	5.08552	0.377105	4.564684	0.288475	3.491792
499.778	6.894733	0.38253	4.68638	0.451104	5.526471	0.408433	5.003664	0.281785	3.452121
505.333	6.894733	0.384219	4.762443	0.452688	5.611172	0.410363	5.086511	0.247381	3.066368
510.889	6.894733	0.413036	5.181093	0.481264	6.037013	0.4393	5.510605	0.241656	3.031354
516.445	6.894733	0.37681	4.78018	0.444736	5.641932	0.403116	5.113885	0.1722	2.184502
522	6.894733	0.368089	4.723521	0.435605	5.589858	0.394336	5.060272	0.131643	1.6893
527.556	6.894733	0.385937	5.010828	0.45292	5.880589	0.412022	5.349556	0.119002	1.545051
533.111	6.894733	0.920589	12.15602	0.986632	13.02814	0.946318	12.49575	0.625945	8.265383
372	13.78947	0.268229	2.446309	0.20614	1.880058	0.112356	1.024741	3.331797	30.38662
377.556	13.78947	0.259254	2.395786	0.224159	2.071472	0.130126	1.202517	3.049008	28.17632
383.111	13.78947	0.292408	2.738925	0.281021	2.63226	0.186878	1.750411	2.830543	26.51297
388.667	13.78947	0.267625	2.539114	0.277037	2.628415	0.182814	1.734473	2.575583	24.43635
394.222	13.78947	0.28313	2.721843	0.310794	2.987785	0.216623	2.082487	2.377264	22.85336
399.778	13.78947	0.289212	2.816639	0.332884	3.241928	0.238827	2.325945	2.184906	21.27855
405.333	13.78947	0.262394	2.587761	0.320099	3.156866	0.226203	2.230838	1.973602	19.46403
410.889	13.78947	0.296387	2.961591	0.366328	3.660526	0.272707	2.725033	1.833996	18.32609
416.445	13.78947	0.296903	3.004738	0.377541	3.820864	0.284228	2.876447	1.672166	16.92294
422	13.78947	0.332853	3.412749	0.422764	4.334611	0.329837	3.381783	1.554972	15.94307
427.556	13.78947	0.335648	3.485115	0.43362	4.502341	0.341091	3.541582	1.413816	14.6799

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433.111	13.78947	0.284268	2.987331	0.389238	4.090464	0.297107	3.122219	1.226952	12.89378
438.667	13.78947	0.333078	3.545916	0.443951	4.726361	0.352342	3.751043	1.146604	12.20674
444.222	13.78947	0.327592	3.530993	0.443553	4.780898	0.352446	3.798912	1.019153	10.98503
449.778	13.78947	0.354678	3.871652	0.474895	5.183841	0.384357	4.195551	0.930232	10.15429
455.333	13.78947	0.371097	4.101748	0.494855	5.469657	0.404904	4.47541	0.836457	9.245417
460.889	13.78947	0.377083	4.219662	0.503764	5.637273	0.41441	4.637408	0.737613	8.254081
466.445	13.78947	0.372992	4.225122	0.502041	5.686929	0.413307	4.681756	0.633647	7.177678
472	13.78947	0.359116	4.117166	0.490028	5.618101	0.401916	4.607916	0.524483	6.013114
477.556	13.78947	0.355705	4.127716	0.48802	5.663124	0.400556	4.64821	0.430046	4.990398
483.111	13.78947	0.382119	4.489348	0.515381	6.054952	0.428613	5.03558	0.369444	4.340421
488.667	13.78947	0.398216	4.735894	0.532067	6.327758	0.446001	5.304173	0.302318	3.595418
494.222	13.78947	0.385129	4.634884	0.519279	6.24938	0.433897	5.22183	0.209521	2.521529
499.778	13.78947	0.400903	4.883515	0.535025	6.517219	0.450364	5.48601	0.148972	1.814649
505.333	13.78947	0.40696	5.016886	0.540796	6.666816	0.456861	5.632073	8.18E-02	1.008731
510.889	13.78947	0.422171	5.267216	0.555481	6.930521	0.472278	5.892458	2.68E-02	0.3348746
516.445	13.78947	0.409508	5.169256	0.542127	6.843312	0.459644	5.802134	5.33E-02	0.673164
522	13.78947	0.424398	5.421387	0.5561	7.103788	0.474364	6.059678	0.103164	1.317883
527.556	13.78947	0.412092	5.325546	0.54275	7.01406	0.461743	5.967192	0.177841	2.298233
533.111	13.78947	0.426711	5.580005	0.556146	7.272576	0.475894	6.223129	0.223047	2.916701
372	17.23683	0.314049	2.840091	0.228981	2.070799	0.111488	1.008214	4.285158	38.75254
377.556	17.23683	0.313689	2.876238	0.264105	2.421598	0.146357	1.341915	3.90242	35.78144
383.111	17.23683	0.334205	3.107046	0.315499	2.933181	0.197647	1.837527	3.578808	33.27205

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388.667	17.23683	0.299757	2.823796	0.307966	2.901139	0.190076	1.790533	3.234051	30.46556
394.222	17.23683	0.333022	3.1805	0.364699	3.483035	0.246942	2.358415	2.981896	28.47859
399.778	17.23683	0.310727	3.006644	0.362886	3.511364	0.245302	2.373586	2.698591	26.11185
405.333	17.23683	0.305326	2.993405	0.375337	3.679838	0.258023	2.529694	2.451447	24.03406
410.889	17.23683	0.338911	3.367609	0.424437	4.21748	0.30752	3.055692	2.259723	22.45402
416.445	17.23683	0.340369	3.426462	0.439397	4.423381	0.322901	3.25064	2.05172	20.65442
422	17.23683	0.356078	3.63177	0.466786	4.760988	0.350797	3.577916	1.871192	19.08514
427.556	17.23683	0.340165	3.513758	0.460986	4.761847	0.345525	3.56916	1.671528	17.26641
433.111	17.23683	0.360016	3.767456	0.489506	5.122512	0.374654	3.920626	1.517975	15.88501
438.667	17.23683	0.348382	3.691828	0.485313	5.14293	0.371078	3.932373	1.343067	14.23275
444.222	17.23683	0.371046	3.982993	0.514257	5.520214	0.400715	4.301466	1.211034	12.99976
449.778	17.23683	0.362488	3.939993	0.511004	5.554285	0.398171	4.327811	1.056167	11.47982
455.333	17.23683	0.386951	4.259859	0.539837	5.942995	0.427766	4.709215	0.941562	10.36551
460.889	17.23683	0.380597	4.242177	0.537101	5.986618	0.425797	4.74595	0.803183	8.952385
466.445	17.23683	0.385569	4.351395	0.544957	6.150253	0.434449	4.903079	0.682413	7.701464
472	17.23683	0.381046	4.353499	0.542697	6.200458	0.433004	4.947149	0.558034	6.375651
477.556	17.23683	0.38727	4.4796	0.5506	6.368887	0.441754	5.109779	0.449834	5.20332
483.111	17.23683	0.403863	4.729772	0.568343	6.656076	0.460369	5.391497	0.3571	4.182126
488.667	17.23683	0.410749	4.869671	0.575941	6.828107	0.46884	5.558367	0.259411	3.075491
494.222	17.23683	0.408301	4.899473	0.573811	6.885568	0.46759	5.610964	0.156806	1.881664
499.778	17.23683	0.43488	5.283172	0.600302	7.292793	0.495003	6.013603	8.75E-02	1.062807
505.333	17.23683	0.225307	2.764427	0.390708	4.793783	0.286095	3.510266	0.215084	2.638988

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510.889	17.23683	0.440653	5.483532	0.605038	7.52913	0.50157	6.241537	8.72E-02	1.084968
516.445	17.23683	0.42091	5.299473	0.584409	7.35808	0.481843	6.066676	0.19201	2.417497
522	17.23683	0.429209	5.468896	0.591561	7.537547	0.489927	6.242538	0.265356	3.381122
527.556	17.23683	0.428615	5.526138	0.589633	7.602103	0.48893	6.303719	0.344588	4.442704
533.111	17.23683	0.45495	5.936508	0.614405	8.01726	0.51466	6.715709	0.393753	5.137959
372	20.6842	0.351847	3.152489	0.238962	2.141022	9.76E-02	0.8746794	5.312623	47.59946
377.556	20.6842	0.350665	3.18751	0.282892	2.571502	0.141354	1.284919	4.79231	43.56182
383.111	20.6842	0.325645	3.001713	0.296736	2.735259	0.155115	1.42979	4.312825	39.75507
388.667	20.6842	0.300485	2.80824	0.305177	2.852103	0.163599	1.528952	3.883065	36.29037
394.222	20.6842	0.322564	3.05735	0.356342	3.377586	0.215005	2.037869	3.539261	33.5465
399.778	20.6842	0.364381	3.502917	0.423368	4.069949	0.282393	2.714687	3.248126	31.2252
405.333	20.6842	0.376531	3.6696	0.45735	4.457261	0.316802	3.08755	2.956339	28.81214
410.889	20.6842	0.359303	3.548541	0.459086	4.534029	0.319001	3.150537	2.659774	26.26832
416.445	20.6842	0.359385	3.596949	0.475566	4.759806	0.336045	3.363351	2.40065	24.02738
422	20.6842	0.375496	3.808896	0.505817	5.130845	0.366946	3.722184	2.175223	22.06464
427.556	20.6842	0.338762	3.480399	0.481322	4.945065	0.343091	3.524896	1.913666	19.66073
433.111	20.6842	0.339853	3.537498	0.492864	5.130139	0.355385	3.699112	1.703298	17.72922
438.667	20.6842	0.354919	3.742949	0.516809	5.450245	0.380145	4.008983	1.519277	16.02234
444.222	20.6842	0.383106	4.093732	0.55249	5.903653	0.416707	4.452732	1.359623	14.52836
449.778	20.6842	0.38072	4.120494	0.556428	6.022105	0.421524	4.562067	1.179952	12.77039
455.333	20.6842	0.391025	4.286549	0.571947	6.269925	0.437977	4.80126	1.022176	11.20544
460.889	20.6842	0.392414	4.35656	0.577613	6.412644	0.444592	4.935852	0.864049	9.592593

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466.445	20.6842	0.385012	4.328111	0.573633	6.448512	0.441595	4.964176	0.704947	7.924695
472	20.6842	0.389381	4.43245	0.580655	6.609783	0.449616	5.118174	0.564756	6.428795
477.556	20.6842	0.364684	4.202232	0.557985	6.429595	0.427941	4.931124	0.40214	4.633846
483.111	20.6842	0.411205	4.799494	0.605782	7.070555	0.476843	5.56561	0.316883	3.698641
488.667	20.6842	0.40854	4.827331	0.603952	7.136293	0.476069	5.625237	0.188162	2.223336
494.222	20.6842	0.41651	4.98254	0.612254	7.324091	0.485456	5.807261	7.54E-02	0.9021476
499.778	20.6842	0.434644	5.2641	0.630263	7.633339	0.50457	6.111074	2.22E-02	0.2683102
505.333	20.6842	0.424707	5.205992	0.619874	7.598424	0.495272	6.071024	0.143263	1.756147
510.889	20.6842	0.443691	5.505828	0.638022	7.917323	0.514546	6.385092	0.230933	2.865711
516.445	20.6842	0.416717	5.23216	0.609994	7.6589	0.487599	6.122131	0.360808	4.530203
522	20.6842	0.454783	5.781	0.646617	8.219485	0.525388	6.678442	0.421282	5.355163
527.556	20.6842	0.44746	5.75558	0.637701	8.202579	0.517587	6.657524	0.523909	6.738912
533.111	20.6842	0.467554	6.086879	0.655946	8.539432	0.53697	6.9906	0.595438	7.751748
372	24.13157	0.373564	3.312248	0.226182	2.005509	6.09E-02	0.5397072	6.427374	56.98934
377.556	24.13157	0.383366	3.451777	0.292425	2.632958	0.12711	1.144467	5.739937	51.68175
383.111	24.13157	0.351808	3.214308	0.308834	2.821686	0.143552	1.311596	5.117117	46.75241
388.667	24.13157	0.351934	3.262949	0.350004	3.245004	0.184939	1.714654	4.601289	42.6603
394.222	24.13157	0.33027	3.105836	0.363571	3.418979	0.198808	1.869602	4.123927	38.78119
399.778	24.13157	0.382668	3.65196	0.446245	4.25871	0.282044	2.691651	3.765211	35.93332
405.333	24.13157	0.408458	3.954138	0.498147	4.822411	0.334526	3.238498	3.419651	33.10483
410.889	24.13157	0.360036	3.53234	0.472319	4.63388	0.309254	3.034101	3.034116	29.76774
416.445	24.13157	0.37906	3.770972	0.510738	5.0809	0.348426	3.466192	2.741202	27.27015

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422	24.13157	0.369903	3.729794	0.518296	5.226062	0.356759	3.59727	2.444043	24.64366
427.556	24.13157	0.332834	3.400123	0.495622	5.063108	0.33488	3.421041	2.13956	21.85719
433.111	24.13157	0.357837	3.705468	0.532812	5.517407	0.373048	3.863013	1.913644	19.81635
438.667	24.13157	0.353486	3.70892	0.538888	5.654266	0.380082	3.98802	1.674482	17.56949
444.222	24.13157	0.385891	4.103676	0.580023	6.168205	0.422286	4.490777	1.485532	15.79774
449.778	24.13157	0.3671	3.954229	0.568628	6.125084	0.411922	4.437109	1.258433	13.5554
455.333	24.13157	0.383676	4.18728	0.59127	6.452831	0.435684	4.75487	1.077622	11.76068
460.889	24.13157	0.412953	4.566366	0.625451	6.916028	0.471045	5.208657	0.919689	10.16972
466.445	24.13157	0.392149	4.390985	0.608644	6.81513	0.455363	5.098856	0.721227	8.075778
472	24.13157	0.384203	4.356515	0.603778	6.846371	0.451681	5.12169	0.544027	6.168808
477.556	24.13157	0.368228	4.227637	0.59012	6.775179	0.439209	5.042563	0.366577	4.208654
483.111	24.13157	0.404154	4.700236	0.627532	7.298154	0.477912	5.558042	0.248249	2.887118
488.667	24.13157	0.411183	4.842319	0.635499	7.483898	0.487131	5.736698	0.107708	1.268446
494.222	24.13157	0.429146	5.117743	0.653804	7.796833	0.506731	6.042956	1.57E-02	0.1867764
499.778	24.13157	0.43828	5.291875	0.662802	8.002833	0.517021	6.242653	0.142134	1.716163
505.333	24.13157	0.438878	5.364471	0.662854	8.102122	0.518364	6.335984	0.271825	3.322547
510.889	24.13157	0.449867	5.566731	0.672861	8.326161	0.529692	6.554559	0.386058	4.777188
516.445	24.13157	0.433788	5.432403	0.655539	8.209395	0.513654	6.432502	0.522914	6.548514
522	24.13157	0.464692	5.891788	0.684779	8.682309	0.544247	6.900435	0.607948	7.708159
527.556	24.13157	0.450564	5.780829	0.668831	8.58118	0.529582	6.794613	0.734371	9.422102
533.111	24.13157	0.464354	6.030103	0.680492	8.836862	0.542574	7.045892	0.828692	10.76136
372	27.57893	0.380028	3.329817	0.188432	1.651036	8.80E-04	7.73E-03	7.660173	67.11829

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377.556	27.57893	0.405092	3.608768	0.28399	2.529923	9.50E-02	0.8459821	6.748789	60.1217
383.111	27.57893	0.325138	2.940324	0.262689	2.375645	7.39E-02	0.6680895	5.909623	53.44323
388.667	27.57893	0.364746	3.351128	0.351883	3.233006	0.163551	1.502671	5.30066	48.70057
394.222	27.57893	0.364312	3.398014	0.393556	3.670752	0.205735	1.918968	4.739954	44.21054
399.778	27.57893	0.370677	3.509083	0.435826	4.125823	0.248659	2.35403	4.251498	40.24792
405.333	27.57893	0.404765	3.889268	0.500659	4.810629	0.314264	3.019683	3.841771	36.91419
410.889	27.57893	0.367957	3.585192	0.490272	4.776987	0.304612	2.967991	3.405603	33.18269
416.445	27.57893	0.402079	3.97476	0.546988	5.407177	0.362272	3.581177	3.072972	30.37762
422	27.57893	0.387161	3.880401	0.551458	5.527055	0.367688	3.685245	2.721941	27.2811
427.556	27.57893	0.323851	3.288806	0.504854	5.126889	0.321993	3.269895	2.348388	23.84845
433.111	27.57893	0.370787	3.818873	0.565839	5.827831	0.384144	3.956513	2.104395	21.6741
438.667	27.57893	0.367162	3.832784	0.574212	5.994241	0.393656	4.109404	1.829716	19.10041
444.222	27.57893	0.401945	4.253896	0.619031	6.551386	0.43973	4.65379	1.609604	17.03478
449.778	27.57893	0.364968	3.912664	0.590588	6.331364	0.412459	4.421711	1.333374	14.29436
455.333	27.57893	0.386502	4.19917	0.619042	6.72568	0.442225	4.804638	1.128267	12.25825
460.889	27.57893	0.400671	4.410942	0.63884	7.032935	0.463382	5.101337	0.92785	10.21461
466.445	27.57893	0.386587	4.310742	0.629321	7.017443	0.455182	5.07564	0.71011	7.918317
472	27.57893	0.406619	4.593666	0.652814	7.375061	0.480079	5.423599	0.536202	6.057632
477.556	27.57893	0.357839	4.092547	0.606762	6.939492	0.435337	4.978929	0.302478	3.459442
483.111	27.57893	0.422661	4.898783	0.673225	7.802951	0.503329	5.833789	0.190678	2.210067
488.667	27.57893	0.418856	4.916097	0.670526	7.869872	0.502056	5.892568	1.78E-02	0.2086385
494.222	27.57893	0.426825	5.073127	0.67892	8.069528	0.51192	6.084555	0.136315	1.620208

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499.778	27.57893	0.44592	5.367531	0.697867	8.400172	0.532353	6.407938	0.272694	3.282434
505.333	27.57893	0.437667	5.333341	0.689029	8.396346	0.524977	6.397266	0.430593	5.247135
510.889	27.57893	0.45918	5.665977	0.709433	8.753973	0.546905	6.748436	0.552857	6.821881
516.445	27.57893	0.435178	5.434623	0.684057	8.542663	0.522978	6.531049	0.71588	8.940105
522	27.57893	0.477124	6.033901	0.724117	9.157424	0.564597	7.140083	0.80731	10.20953
527.556	27.57893	0.455905	5.83444	0.700859	8.969277	0.542802	6.946535	0.958135	12.26183
533.111	27.57893	0.463093	5.998662	0.705682	9.140952	0.549135	7.113135	1.0759	13.93654
372	31.0263	0.362803	3.134971	0.111923	0.967111	0.101353	0.8758144	9.048257	78.18633
377.556	31.0263	0.419035	3.688116	0.257327	2.26487	4.49E-02	0.395473	7.832489	68.93783
383.111	31.0263	0.341909	3.058607	0.252258	2.256648	4.04E-02	0.3615378	6.780823	60.65946
388.667	31.0263	0.403007	3.667042	0.373108	3.394974	0.162102	1.474965	6.037846	54.9399
394.222	31.0263	0.360266	3.329247	0.380426	3.515594	0.170043	1.571394	5.320148	49.1642
399.778	31.0263	0.384387	3.608529	0.446811	4.194519	0.237306	2.227729	4.755556	44.64363
405.333	31.0263	0.418759	3.992525	0.517093	4.930036	0.308522	2.941481	4.269467	40.70599
410.889	31.0263	0.602406	5.840151	0.731123	7.088023	0.523884	5.078938	3.981772	38.60212
416.445	31.0263	0.360881	3.541395	0.516026	5.063944	0.309352	3.035784	3.32668	32.64581
422	31.0263	0.383554	3.819244	0.560998	5.586133	0.355467	3.539613	2.963024	29.50448
427.556	31.0263	0.336629	3.398163	0.533188	5.382439	0.328748	3.318621	2.561771	25.86047
433.111	31.0263	0.380063	3.892336	0.592719	6.070206	0.389604	3.990072	2.274676	23.29568
438.667	31.0263	0.35262	3.660481	0.579033	6.010818	0.377164	3.915297	1.940426	20.14331
444.222	31.0263	0.410347	4.320806	0.648122	6.824526	0.447753	4.714695	1.709553	18.00116
449.778	31.0263	0.375188	4.003022	0.622673	6.643519	0.423637	4.519901	1.404244	14.98225

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455.333	31.0263	0.378778	4.095878	0.634203	6.857921	0.436609	4.721278	1.152424	12.46172
460.889	31.0263	0.418889	4.592041	0.68068	7.461878	0.484654	5.312946	0.950584	10.42066
466.445	31.0263	0.389348	4.323413	0.656378	7.288622	0.461812	5.128052	0.691752	7.681376
472	31.0263	0.395371	4.448246	0.666404	7.497521	0.473387	5.325971	0.479427	5.393888
477.556	31.0263	0.353869	4.031487	0.627996	7.154556	0.436473	4.97262	0.229617	2.615963
483.111	31.0263	0.42697	4.930892	0.702982	8.118387	0.513193	5.92665	0.103851	1.199278
488.667	31.0263	0.411826	4.816293	0.689136	8.059464	0.500953	5.858655	0.101906	1.19179
494.222	31.0263	0.448502	5.314067	0.72628	8.605345	0.539794	6.395749	0.247758	2.935598
499.778	31.0263	0.418969	5.02554	0.696765	8.357769	0.511863	6.13987	0.453112	5.435095
505.333	31.0263	0.459002	5.577293	0.736071	8.943919	0.552892	6.718172	0.581632	7.067419
510.889	31.0263	0.452893	5.571527	0.728861	8.966539	0.547336	6.733376	0.750587	9.233844
516.445	31.0263	0.457944	5.704022	0.732346	9.121881	0.552503	6.881749	0.902538	11.24171
522	31.0263	0.492079	6.206982	0.764453	9.64263	0.586338	7.395912	1.01964	12.86155
527.556	31.0263	0.463426	5.915609	0.7336	9.364385	0.557109	7.111458	1.195526	15.26088
533.111	31.0263	0.463746	5.992015	0.731347	9.449611	0.556532	7.190853	1.337369	17.27991
372	34.47367	0.296632	2.519736	3.98E-02	0.338145	0.276828	2.351494	10.64137	90.3931
377.556	34.47367	0.31384	2.72065	9.45E-02	0.819499	0.140595	1.218837	8.897925	77.13564
383.111	34.47367	0.276841	2.444308	0.147942	1.306236	8.61E-02	0.7603496	7.607361	67.16875
388.667	34.47367	0.384639	3.460547	0.328601	2.956375	9.58E-02	0.8615571	6.726296	60.51588
394.222	34.47367	0.356067	3.257368	0.359815	3.291618	0.127837	1.169471	5.892112	53.9016
399.778	34.47367	0.359328	3.341494	0.412981	3.840434	0.181917	1.691709	5.207917	48.4299
405.333	34.47367	0.384167	3.630588	0.479745	4.533849	0.249762	2.360375	4.632595	43.78022

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410.889	34.47367	0.375089	3.599693	0.506195	4.857991	0.27725	2.660764	4.092376	39.27457
416.445	34.47367	0.352821	3.436904	0.51408	5.007801	0.28626	2.788532	3.592684	34.99716
422	34.47367	0.384809	3.805834	0.571659	5.653737	0.345118	3.413285	3.188858	31.5381
427.556	34.47367	0.327367	3.283335	0.536102	5.376902	0.310735	3.116539	2.733879	27.41987
433.111	34.47367	0.387167	3.941724	0.614208	6.253153	0.390378	3.974369	2.423558	24.67387
438.667	34.47367	0.37795	3.902319	0.620619	6.407891	0.39819	4.111334	2.071638	21.38974
444.222	34.47367	0.389716	4.080981	0.645478	6.759208	0.424571	4.445907	1.762699	18.45828
449.778	34.47367	0.376787	3.999883	0.643527	6.831563	0.424128	4.502488	1.448915	15.38137
455.333	34.47367	0.403836	4.347147	0.679545	7.31511	0.461806	4.971141	1.191939	12.83084
460.889	34.47367	0.404737	4.416208	0.687794	7.50468	0.471712	5.146955	0.924401	10.08633
466.445	34.47367	0.379826	4.199162	0.668862	7.394558	0.454388	5.023481	0.644806	7.128625
472	34.47367	0.391636	4.387973	0.685245	7.677623	0.47249	5.293941	0.414123	4.639967
477.556	34.47367	0.336089	3.813348	0.633319	7.185776	0.422187	4.790195	0.127159	1.442774
483.111	34.47367	0.417021	4.797562	0.716456	8.242304	0.507248	5.835503	1.29E-02	0.147811
488.667	34.47367	0.429785	5.009378	0.730724	8.516935	0.523318	6.099504	0.21186	2.469309
494.222	34.47367	0.435656	5.143638	0.737319	8.70531	0.531721	6.277864	0.40929	4.832353
499.778	34.47367	0.415219	4.964173	0.716994	8.572021	0.513156	6.135089	0.625482	7.47802
505.333	34.47367	0.445791	5.399118	0.746886	9.045879	0.544939	6.599991	0.782939	9.482462
510.889	34.47367	0.449637	5.514769	0.7496	9.193762	0.549488	6.739425	0.960742	11.78342
516.445	34.47367	0.46495	5.775005	0.763232	9.479899	0.565003	7.017794	1.120748	13.92058
522	34.47367	0.491134	6.177975	0.787299	9.903411	0.590971	7.433748	1.263933	15.89895
527.556	34.47367	0.473113	6.023846	0.766911	9.764658	0.572386	7.287869	1.446822	18.42154

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533.111	34.47367	0.466272	6.009456	0.757349	9.76091	0.564654	7.277396	1.613417	20.79419
372	37.92103	0.173902	1.444479	0.302582	2.513318	0.561862	4.666865	12.55921	104.318
377.556	37.92103	0.255999	2.180544	5.10E-02	0.434308	0.306587	2.61142	10.09571	85.99279
383.111	37.92103	0.229702	1.998211	4.17E-02	0.363055	0.2124	1.847731	8.464612	73.6352
388.667	37.92103	0.363714	3.230891	0.267176	2.373292	0.014421	0.1281276	7.400144	65.73501
394.222	37.92103	0.396323	3.586897	0.372665	3.372766	0.120858	1.093777	6.48365	58.67969
399.778	37.92103	0.281717	2.591609	0.317637	2.921991	6.64E-02	0.6110547	5.585015	51.37803
405.333	37.92103	0.333032	3.117103	0.418396	3.916067	0.168295	1.575237	4.953631	46.36486
410.889	37.92103	0.336495	3.201202	0.463382	4.408279	0.21431	2.038796	4.359347	41.47165
416.445	37.92103	0.334952	3.237142	0.496768	4.800983	0.248879	2.405289	3.823972	36.95667
422	37.92103	0.394146	3.870676	0.58541	5.748904	0.338902	3.328123	3.398333	33.37266
427.556	37.92103	0.344399	3.431777	0.560775	5.587877	0.315487	3.143663	2.908612	28.98288
433.111	37.92103	0.416608	4.216262	0.653943	6.61813	0.410288	4.152256	2.572381	26.0334
438.667	37.92103	0.399833	4.105016	0.655042	6.725251	0.412845	4.238669	2.178562	22.3671
444.222	37.92103	0.407183	4.241095	0.677362	7.055201	0.436756	4.549169	1.833521	19.09748
449.778	37.92103	0.392215	4.142655	0.674901	7.128531	0.435947	4.604565	1.488217	15.71901
455.333	37.92103	0.397814	4.261022	0.690838	7.399658	0.453584	4.858378	1.182318	12.66403
460.889	37.92103	0.443383	4.817223	0.744726	8.091228	0.509332	5.533682	0.933096	10.13777
466.445	37.92103	0.40022	4.405948	0.708487	7.79966	0.474776	5.226759	0.610587	6.721912
472	37.92103	0.41639	4.646955	0.729943	8.146232	0.498104	5.558853	0.360681	4.025189
477.556	37.92103	0.386493	4.369931	0.704185	7.961988	0.474145	5.360956	7.68E-02	0.8678414
483.111	37.92103	0.433121	4.964638	0.75355	8.637569	0.52554	6.023937	0.119384	1.368412

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488.667	37.92103	0.433119	5.030097	0.755464	8.773675	0.529362	6.147818	0.352316	4.091637
494.222	37.92103	0.466615	5.491799	0.789871	9.296382	0.565784	6.658986	0.542292	6.382507
499.778	37.92103	0.454298	5.415513	0.777831	9.272302	0.555672	6.624018	0.770162	9.18084
505.333	37.92103	0.455133	5.495381	0.778214	9.396333	0.558028	6.737767	0.977063	11.79726
510.889	37.92103	0.468391	5.728456	0.790368	9.666211	0.572192	6.997925	1.164289	14.2393
516.445	37.92103	0.474679	5.879316	0.795029	9.847127	0.578861	7.169686	1.352054	16.7464
522	37.92103	0.511007	6.411277	0.829159	10.40294	0.615065	7.716848	1.503133	18.85886
527.556	37.92103	0.484908	6.15831	0.800651	10.16815	0.588503	7.473896	1.712326	21.74631
533.111	37.92103	0.488644	6.283011	0.801509	10.30581	0.591371	7.60385	1.88592	24.24923
372	41.3684	9.15E-02	0.73477	0.693801	5.572357	0.96707	7.767175	15.07194	121.0522
377.556	41.3684	0.142809	1.188534	0.316627	2.635117	0.586161	4.878206	11.27412	93.82747
383.111	41.3684	0.236768	2.024461	4.68E-02	0.400246	0.315863	2.700773	9.33707	79.8349
388.667	41.3684	0.334147	2.924693	0.173035	1.514509	9.59E-02	0.8392493	8.021128	70.20634
394.222	41.3684	0.380421	3.399575	0.311802	2.786406	4.31E-02	0.3849032	6.977602	62.35493
399.778	41.3684	0.243025	2.210249	0.247729	2.252994	2.11E-02	0.1920613	5.957865	54.18438
405.333	41.3684	0.275636	2.553006	0.340045	3.149538	0.071822	0.6652159	5.231119	48.45101
410.889	41.3684	0.302701	2.852925	0.416379	3.924305	0.148991	1.404188	4.596518	43.32171
416.445	41.3684	0.360475	3.456084	0.51515	4.939083	0.248876	2.386182	4.065531	38.97913
422	41.3684	0.391448	3.815014	0.580573	5.658216	0.315456	3.074392	3.56719	34.76536
427.556	41.3684	0.36736	3.635782	0.585515	5.794904	0.32162	3.183124	3.062369	30.30845
433.111	41.3684	0.447519	4.500988	0.689965	6.939354	0.42763	4.300948	2.697842	27.13374
438.667	41.3684	0.419518	4.28179	0.68261	6.967005	0.421688	4.303905	2.260241	23.069

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444.222	41.3684	0.419604	4.346084	0.699905	7.249377	0.44061	4.563637	1.877702	19.44853
449.778	41.3684	0.378211	3.972769	0.673054	7.069868	0.415311	4.362473	1.477969	15.52483
455.333	41.3684	0.425885	4.539928	0.732532	7.80874	0.476645	5.081058	1.187121	12.65466
460.889	41.3684	0.450225	4.868488	0.766576	8.289336	0.512569	5.542663	0.891601	9.641367
466.445	41.3684	0.408826	4.480723	0.733178	8.035639	0.480966	5.271447	0.546785	5.992795
472	41.3684	0.407609	4.529004	0.738222	8.202597	0.487928	5.421517	0.256426	2.849199
477.556	41.3684	0.36184	4.073545	0.697428	7.851479	0.448983	5.054537	6.57E-02	0.7397277
483.111	41.3684	0.455334	5.200211	0.794135	9.06953	0.547929	6.257649	0.236146	2.696897
488.667	41.3684	0.421649	4.87825	0.762975	8.827228	0.518719	6.001256	0.523872	6.060915
494.222	41.3684	0.48259	5.660714	0.825122	9.678636	0.583068	6.839392	0.706353	8.285516
499.778	41.3684	0.458577	5.448435	0.801715	9.525277	0.561712	6.673813	0.965903	11.47597
505.333	41.3684	0.487232	5.865952	0.830049	9.993188	0.592213	7.129835	1.163948	14.01311
510.889	41.3684	0.471267	5.746089	0.813234	9.915573	0.57747	7.041016	1.399931	17.06911
516.445	41.3684	0.50582	6.248508	0.846155	10.4528	0.612608	7.567689	1.577619	19.48882
522	41.3684	0.533242	6.672928	0.871457	10.9052	0.640105	8.010112	1.756187	21.97658
527.556	41.3684	0.498764	6.317981	0.834586	10.57199	0.605296	7.667496	1.99235	25.23773
533.111	41.3684	0.47673	6.113196	0.809721	10.38319	0.582527	7.469823	2.210557	28.34633
372	42.5405	0.540567	4.278778	0.488826	3.869209	0.753262	5.962304	16.38484	129.6914
377.556	42.5405	0.22356	1.844404	0.317751	2.621541	0.587397	4.846203	11.74772	96.92188
383.111	42.5405	0.295237	2.508579	3.46E-02	0.294315	0.306466	2.603989	9.658473	82.06631
388.667	42.5405	0.404889	3.526955	0.213347	1.85839	5.94E-02	0.5177703	8.286482	72.18196
394.222	42.5405	0.401081	3.568382	0.311455	2.770969	3.81E-02	0.3389753	7.153872	63.64725

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399.778	42.5405	0.210901	1.909705	0.200765	1.817949	7.33E-02	0.6639757	6.053627	54.81593
405.333	42.5405	0.256075	2.362817	0.31009	2.861225	3.63E-02	0.3352767	5.314312	49.03617
410.889	42.5405	0.278378	2.614576	0.38498	3.615833	0.111827	1.050302	4.655286	43.72399
416.445	42.5405	0.385518	3.686388	0.535604	5.121494	0.26355	2.520051	4.154927	39.7299
422	42.5405	0.420239	4.085798	0.606709	5.898836	0.335774	3.264565	3.645838	35.44706
427.556	42.5405	0.379028	3.742421	0.596235	5.887064	0.326317	3.221987	3.111609	30.72346
433.111	42.5405	0.468109	4.698276	0.710832	7.134367	0.442521	4.441384	2.744186	27.54234
438.667	42.5405	0.404739	4.121505	0.669284	6.815467	0.402233	4.096008	2.261271	23.02688
444.222	42.5405	0.416709	4.307371	0.699394	7.229428	0.433926	4.485396	1.880476	19.43787
449.778	42.5405	0.387888	4.06725	0.685781	7.190809	0.421936	4.424264	1.48387	15.55917
455.333	42.5405	0.427063	4.544573	0.737409	7.847094	0.475406	5.059011	1.175835	12.51253
460.889	42.5405	0.465303	5.024018	0.785849	8.484946	0.525756	5.676737	0.885832	9.564494
466.445	42.5405	0.416833	4.561716	0.745868	8.162626	0.487543	5.335536	0.525985	5.756285
472	42.5405	0.409356	4.541794	0.745015	8.265865	0.488636	5.421379	0.221694	2.459639
477.556	42.5405	0.399087	4.488181	0.739899	8.320996	0.485478	5.459766	7.22E-02	0.8122462
483.111	42.5405	0.44643	5.091179	0.790865	9.01925	0.53859	6.142268	0.296227	3.37822
488.667	42.5405	0.428123	4.947217	0.775243	8.95835	0.524988	6.066535	0.575472	6.649858
494.222	42.5405	0.464936	5.446112	0.813518	9.529236	0.565447	6.623451	0.789188	9.24431
499.778	42.5405	0.456653	5.419147	0.805935	9.56419	0.559969	6.645227	1.039554	12.33659
505.333	42.5405	0.481653	5.792091	0.830703	9.989517	0.586963	7.058451	1.247904	15.00643
510.889	42.5405	0.481288	5.862667	0.829515	10.10446	0.587926	7.161608	1.474517	17.96132
516.445	42.5405	0.51252	6.32539	0.859191	10.60382	0.619839	7.649875	1.661962	20.51138

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522	42.5405	0.536899	6.712367	0.881479	11.02039	0.644364	8.055973	1.849973	23.12869
527.556	42.5405	0.499537	6.32197	0.841765	10.65314	0.606749	7.678838	2.095428	26.51904
533.111	42.5405	0.492922	6.31621	0.832266	10.66456	0.599425	7.680939	2.304077	29.52415
372	48.26313	0.647261	4.44279	2.379485	16.33276	2.512963	17.24893	32.39846	222.3824
377.556	48.26313	0.778758	5.908741	0.602289	4.569816	0.606259	4.599903	12.06203	91.51894
383.111	48.26313	0.869268	7.086744	5.20E-02	0.424076	0.171341	1.396852	10.81373	88.15975
388.667	48.26313	0.458932	3.868489	4.09E-02	3.45E-02	0.270075	2.276586	8.989476	75.77561
394.222	48.26313	0.512092	4.44166	0.247314	2.145076	3.33E-02	0.2890442	7.819627	67.82432
399.778	48.26313	0.334518	2.966064	0.203322	1.8028	8.52E-02	0.7557097	6.639589	58.87096
405.333	48.26313	0.250407	2.266321	0.218184	1.974674	7.46E-02	0.6747614	5.694547	51.53799
410.889	48.26313	0.31112	2.873677	0.355805	3.286358	6.09E-02	0.56284	4.997169	46.15626
416.445	48.26313	0.470877	4.437929	0.576856	5.436793	0.28143	2.652414	4.48066	42.22976
422	48.26313	0.485036	4.653782	0.641039	6.150589	0.345301	3.313029	3.892121	37.34365
427.556	48.26313	0.465557	4.542713	0.662936	6.468597	0.367267	3.583597	3.324604	32.43986
433.111	48.26313	0.54428	5.403196	0.775727	7.700911	0.480921	4.77423	2.896751	28.75693
438.667	48.26313	0.456944	4.605346	0.717143	7.227756	0.423033	4.263546	2.343481	23.61871
444.222	48.26313	0.454687	4.654446	0.738758	7.562396	0.445782	4.563349	1.904371	19.49442
449.778	48.26313	0.395971	4.113244	0.700085	7.272366	0.408311	4.241488	1.436107	14.91804
455.333	48.26313	0.434021	4.578182	0.75447	7.958423	0.464398	4.898653	1.08671	11.46299
460.889	48.26313	0.497113	5.324678	0.830969	8.900613	0.542767	5.813668	0.782875	8.385494
466.445	48.26313	0.45448	4.936724	0.799568	8.685181	0.513062	5.57301	0.391576	4.253403
472	48.26313	0.435014	4.792031	0.789069	8.692307	0.504464	5.557076	3.91E-02	0.4312686

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477.556	48.26313	0.394964	4.410554	0.756237	8.444899	0.47351	5.287676	0.319933	3.572701
483.111	48.26313	0.456869	5.176258	0.823333	9.328299	0.542863	6.150562	0.563497	6.384337
488.667	48.26313	0.434075	4.984629	0.804604	9.239594	0.526202	6.042616	0.881017	10.11705
494.222	48.26313	0.488426	5.688298	0.861435	10.03246	0.585419	6.817871	1.109878	12.92583
499.778	48.26313	0.478786	5.650642	0.853446	10.07243	0.579633	6.840815	1.394196	16.45436
505.333	48.26313	0.484639	5.796421	0.859921	10.28486	0.588389	7.037251	1.65415	19.78399
510.889	48.26313	0.523926	6.351543	0.898838	10.89661	0.62971	7.633976	1.872037	22.69479
516.445	48.26313	0.519574	6.381026	0.89353	10.97359	0.626714	7.696825	2.127403	26.12704
522	48.26313	0.54736	6.811343	0.919563	11.4431	0.655177	8.15302	2.343224	29.15913
527.556	48.26313	0.513907	6.475194	0.884017	11.13851	0.621903	7.835876	2.616165	32.96333
533.111	48.26313	0.511942	6.532561	0.879327	11.22049	0.619579	7.906025	2.851339	36.38409
410.889	55.15787	0.532351	4.810524	0.413572	3.737255	0.114388	1.033636	5.323368	48.10436
416.445	55.15787	0.635389	5.873206	0.620496	5.73556	0.313099	2.894074	4.727767	43.70093
422	55.15787	0.600263	5.658853	0.665818	6.276807	0.352854	3.326467	4.05689	38.24521
427.556	55.15787	0.594466	5.710645	0.723943	6.954392	0.407722	3.916703	3.463328	33.26982
433.111	55.15787	0.66678	6.526307	0.847801	8.298035	0.529865	5.186186	2.988016	29.24595
438.667	55.15787	0.520501	5.175655	0.744059	7.3986	0.424709	4.2231	2.334961	23.21792
444.222	55.15787	0.522341	5.28143	0.780844	7.895159	0.461185	4.663111	1.857821	18.78452
449.778	55.15787	0.478102	4.910856	0.765512	7.862962	0.446036	4.58151	1.362014	13.99002
455.333	55.15787	0.473333	4.93895	0.784658	8.187448	0.465862	4.861008	0.928795	9.691364
460.889	55.15787	0.524006	5.55547	0.854854	9.063029	0.537309	5.696504	0.571719	6.061286
466.445	55.15787	0.495457	5.331162	0.84265	9.066911	0.526323	5.663249	0.153944	1.656468

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472	55.15787	0.473407	5.168767	0.833884	9.104456	0.51908	5.667402	0.241154	2.632986
477.556	55.15787	0.434681	4.813646	0.806005	8.925744	0.4928	5.45728	0.638691	7.072864
483.111	55.15787	0.481357	5.410067	0.861034	9.677268	0.549846	6.179807	0.936759	10.52835
488.667	55.15787	0.445993	5.082071	0.832396	9.48514	0.523107	5.960815	1.306245	14.88464
494.222	55.15787	0.531131	6.1424	0.922086	10.66377	0.615225	7.11491	1.542336	17.83682
499.778	55.15787	0.513627	6.021205	0.908142	10.64611	0.603418	7.07386	1.873429	21.96209
505.333	55.15787	0.533229	6.337883	0.929897	11.05256	0.627514	7.45847	2.157847	25.64767
510.889	55.15787	0.549309	6.61839	0.947014	11.41018	0.647018	7.795662	2.437984	29.37433
516.445	55.15787	0.56142	6.855731	0.959212	11.71336	0.66165	8.079729	2.715076	33.15492
522	55.15787	0.569311	7.044825	0.966329	11.95757	0.671264	8.306396	2.990101	37.00024
527.556	55.15787	0.535702	6.713651	0.931393	11.67261	0.638702	8.004495	3.302497	41.38824
533.111	55.15787	0.534805	6.789444	0.92838	11.78599	0.638193	8.101965	3.575923	45.39715
388.667	62.0526	0.422007	3.159687	1.790751	13.40799	1.827441	13.68273	9.164964	68.62124
394.222	62.0526	0.126679	0.999418	0.908826	7.170405	0.979139	7.725107	7.423519	58.56965
399.778	62.0526	0.687791	5.682429	0.128446	1.061187	0.281844	2.328532	6.815507	56.30903
405.333	62.0526	0.57764	4.932267	1.56E-02	0.133592	0.237733	2.029887	5.899915	50.37753
410.889	62.0526	0.82863	7.302879	0.43937	3.872232	0.174662	1.539314	5.426258	47.82241
416.445	62.0526	0.774911	7.002396	0.548459	4.956131	0.256833	2.320892	4.709696	42.55894
422	62.0526	0.735599	6.799505	0.635954	5.878444	0.327053	3.023072	4.042378	37.36556
427.556	62.0526	0.753029	7.111206	0.753395	7.114661	0.433157	4.090549	3.464448	32.71654
433.111	62.0526	0.741426	7.141304	0.821169	7.909394	0.493178	4.750227	2.890332	27.83942
438.667	62.0526	0.631336	6.189613	0.775207	7.600163	0.441707	4.330459	2.248969	22.04893

Continued …

444.222	62.0526	0.597029	5.957476	0.793021	7.913115	0.456029	4.550481	1.708265	17.04586
449.778	62.0526	0.554732	5.629574	0.793458	8.052266	0.454256	4.609913	1.183456	12.01001
455.333	62.0526	0.541293	5.585103	0.815181	8.411085	0.474822	4.899262	0.708777	7.313167
460.889	62.0526	0.570895	5.988831	0.87385	9.166862	0.533163	5.592948	0.296654	3.111959
466.445	62.0526	0.550059	5.861019	0.877001	9.344705	0.536448	5.716032	0.14868	1.584267
472	62.0526	0.52003	5.625771	0.86688	9.37808	0.526843	5.699493	0.587802	6.358957
477.556	62.0526	0.47823	5.250297	0.84141	9.237522	0.502277	5.514298	1.025106	11.2543
483.111	62.0526	0.526682	5.871644	0.902853	10.06539	0.565174	6.300809	1.358177	15.14156
488.667	62.0526	0.495754	5.606464	0.88263	9.981594	0.546398	6.179148	1.760692	19.91159
494.222	62.0526	0.568801	6.53041	0.963673	11.06396	0.629488	7.227175	2.046536	23.49645
499.778	62.0526	0.561167	6.534175	0.96247	11.20684	0.630181	7.337734	2.405778	28.01263
505.333	62.0526	0.553571	6.535803	0.959604	11.32976	0.629361	7.430697	2.756816	32.54891
510.889	62.0526	0.583664	6.988892	0.992829	11.88835	0.664883	7.961451	3.061453	36.65837
516.445	62.0526	0.572914	6.953451	0.984058	11.9435	0.658416	7.991173	3.401828	41.28793
522	62.0526	1.065117	13.16765	1.475085	18.23588	1.153415	14.25926	3.21176	39.70576
527.556	62.0526	0.581327	7.247567	0.993175	12.38222	0.672387	8.382881	4.034784	50.30274
533.111	62.0526	0.562035	7.098565	0.972986	12.28893	0.654657	8.268357	4.368933	55.18007
388.667	68.94733	5.08E-02	0.371011	1.688022	12.3365	1.753383	12.8142	13.16985	96.2485
394.222	68.94733	0.269486	2.048469	1.53714	11.68431	1.594142	12.11762	8.628871	65.59081
399.778	68.94733	5.45E-03	4.32E-02	0.992835	7.8748	1.075498	8.530471	6.6633	52.85069
405.333	68.94733	0.322926	2.664197	0.487654	4.023309	0.626439	5.168258	5.664313	46.73215
410.889	68.94733	0.553606	4.728357	0.082386	0.703642	0.28091	2.399227	4.980814	42.54124

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416.445	68.94733	0.674671	5.938097	0.208803	1.837771	3.74E-02	0.3295406	4.365571	38.42366
422	68.94733	0.736781	6.659634	0.425942	3.849974	0.145476	1.314929	3.776319	34.13331
427.556	68.94733	0.755897	6.997679	0.577684	5.347872	0.272904	2.526385	3.190835	29.53893
433.111	68.94733	0.701204	6.631639	0.632206	5.979081	0.310136	2.933098	2.563557	24.24476
438.667	68.94733	0.691829	6.678104	0.713277	6.885159	0.379069	3.659075	2.006491	19.36833
444.222	68.94733	0.65881	6.481979	0.754117	7.419673	0.411085	4.044582	1.447674	14.24351
449.778	68.94733	0.633329	6.346183	0.789592	7.911974	0.440305	4.412038	0.916486	9.183483
455.333	68.94733	0.603836	6.157378	0.810386	8.263607	0.456711	4.657143	0.399459	4.07334
460.889	68.94733	0.561536	5.822666	0.809928	8.398307	0.45323	4.699687	0.113713	1.179144
466.445	68.94733	0.566554	5.97361	0.849503	8.956861	0.490968	5.176585	0.564201	5.948767
472	68.94733	0.568151	6.088223	0.879665	9.426361	0.52021	5.574455	1.004177	10.76055
477.556	68.94733	0.519797	5.655886	0.855201	9.305404	0.495323	5.389603	1.48237	16.12959
483.111	68.94733	0.588125	6.503318	0.942923	10.42659	0.58351	6.452335	1.830045	20.23615
488.667	68.94733	0.559129	6.275074	0.93009	10.43825	0.571254	6.411091	2.266993	25.44217
494.222	68.94733	0.617673	7.039825	1.001401	11.41331	0.643883	7.338531	2.604541	29.6848
499.778	68.94733	0.598178	6.916442	0.992454	11.47525	0.636212	7.356194	3.014245	34.85209
505.333	68.94733	0.581461	6.819149	0.984015	11.54019	0.629322	7.380417	3.413891	40.03682
510.889	68.94733	0.604987	7.197802	1.013702	12.06042	0.660952	7.863616	3.765179	44.79588
516.445	68.94733	0.589375	7.109362	1.002769	12.09595	0.651954	7.864264	4.151681	50.07992
522	68.94733	0.611097	7.475147	1.027545	12.56927	0.678956	8.305194	4.494219	54.97486
527.556	68.94733	0.593174	7.353879	1.01157	12.54091	0.665189	8.246664	4.874372	60.43004
533.111	68.94733	0.573452	7.204058	0.992624	12.47	0.648603	8.148203	5.253288	65.99519

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399.778	86.18416	0.30418	2.306485	0.969272	7.349666	1.073999	8.143801	11.68093	88.57311
405.333	86.18416	0.399854	3.13424	0.692907	5.431423	0.802669	6.291734	8.454438	66.27068
410.889	86.18416	0.528445	4.279919	0.394781	3.19736	0.520931	4.219058	6.326037	51.23505
416.445	86.18416	0.467736	3.901377	0.311512	2.59832	0.465049	3.878987	4.668661	38.94124
422	86.18416	0.24105	2.063861	0.412156	3.528849	0.601265	5.148015	3.243114	27.76738
427.556	86.18416	0.377407	3.323477	0.156733	1.380252	0.382437	3.367816	2.411113	21.23265
433.111	86.18416	0.391	3.531407	3.09E-02	0.278978	0.291099	2.629127	1.610883	14.54913
438.667	86.18416	0.512253	4.743351	0.197389	1.82776	9.25E-02	0.856491	1.014086	9.390183
444.222	86.18416	0.506438	4.795496	0.291605	2.761257	2.34E-02	0.2216168	0.354943	3.361006
449.778	86.18416	0.61355	5.941021	0.48983	4.743074	0.154964	1.500556	0.148367	1.436683
455.333	86.18416	0.584681	5.775735	0.54194	5.353564	0.190712	1.883981	0.75908	7.498573
460.889	86.18416	0.510804	5.140983	0.540009	5.434911	0.175655	1.767896	1.393788	14.02779
466.445	86.18416	0.545858	5.599211	0.637758	6.541843	0.263446	2.702312	1.901184	19.50161
472	86.18416	0.567179	5.924709	0.713149	7.449517	0.331086	3.458531	2.409403	25.16864
477.556	86.18416	0.548344	5.827449	0.740853	7.873327	0.352725	3.748528	2.948316	31.33301
483.111	86.18416	0.615113	6.652923	0.847614	9.167648	0.455149	4.92281	3.389268	36.65776
488.667	86.18416	0.633643	6.968367	0.900081	9.898397	0.504399	5.547043	3.872795	42.59015
494.222	86.18416	0.64432	7.201113	0.939771	10.50322	0.541791	6.055223	4.358167	48.70843
499.778	86.18416	0.64497	7.322413	0.964833	10.9539	0.565417	6.419225	4.849156	55.0531
505.333	86.18416	0.633749	7.305604	0.974355	11.23193	0.574075	6.617709	5.348718	61.65779
510.889	86.18416	0.629146	7.362323	0.986932	11.54909	0.58648	6.862996	5.838587	68.32336
516.445	86.18416	0.629155	7.47214	1.001287	11.89179	0.601108	7.139034	6.321695	75.07949

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416.445	103.421	0.280982	2.268458	0.623191	5.031354	0.789046	6.370313	6.787424	54.79823
422	103.421	0.318816	2.645914	0.476308	3.952914	0.657637	5.457756	4.743527	39.36709
427.556	103.421	0.338789	2.887297	0.352448	3.003681	0.554045	4.721802	3.115565	26.55214
433.111	103.421	0.33144	2.897109	0.262138	2.291336	0.487851	4.264283	1.762874	15.40933
438.667	103.421	0.386087	3.460137	0.114863	1.029384	0.366495	3.28452	0.683129	6.122197
444.222	103.421	0.42821	3.930291	1.48E-02	0.135619	0.26292	2.413191	0.259687	2.383524
449.778	103.421	0.509319	4.784899	0.179335	1.684777	0.12302	1.155767	1.056631	9.926702
455.333	103.421	0.506156	4.858727	0.254896	2.446821	7.02E-02	0.6739973	1.863287	17.88631
460.889	103.421	0.516575	5.06328	0.339373	3.326467	5.85E-03	0.0573061	2.601855	25.50258
466.445	103.421	0.559479	5.597085	0.452029	4.522121	8.95E-02	0.8952376	3.266514	32.67843
472	103.421	0.562841	5.740676	0.519517	5.298805	0.142098	1.449318	3.943535	40.22186
477.556	103.421	0.547982	5.693624	0.56315	5.851202	0.173142	1.799013	4.619049	47.99277
483.111	103.421	0.578483	6.122241	0.646629	6.843423	0.246199	2.605617	5.231919	55.37064
488.667	103.421	0.606058	6.529618	0.72165	7.775026	0.312768	3.369721	5.837037	62.88803
494.222	103.421	0.607351	6.6566	0.765202	8.386623	0.349263	3.827981	6.463143	70.83636
499.778	103.421	0.622478	6.938258	0.817736	9.114616	0.396294	4.417188	7.070135	78.8046
505.333	103.421	0.608128	6.888648	0.836273	9.472915	0.410406	4.648881	7.707336	87.30527
416.445	120.6578	0.419133	3.328316	0.449087	3.566112	0.650855	5.168424	9.999032	79.40144
422	120.6578	0.580671	4.738036	0.224655	1.833087	0.435001	3.549435	7.272242	59.33825
427.556	120.6578	0.574753	4.808663	0.160214	1.340398	0.382318	3.198733	4.923479	41.19265
433.111	120.6578	0.533762	4.575054	0.126859	1.087365	0.36371	3.117452	2.939189	25.19258
438.667	120.6578	0.550093	4.830146	0.035585	0.312432	0.289338	2.54056	1.308973	11.49353

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444.222	120.6578	0.57612	5.179232	6.46E-02	0.580458	0.208221	1.871889	8.72E-02	0.7840361
449.778	120.6578	0.541059	4.973616	0.101308	0.931249	0.191532	1.76061	1.377155	12.65919
455.333	120.6578	0.526887	4.949907	0.156609	1.471266	0.156685	1.472031	2.520909	23.68311
460.889	120.6578	0.582696	5.594892	0.278721	2.676178	5.41E-02	0.519675	3.498443	33.59087
466.445	120.6578	0.60974	5.977896	0.369355	3.621137	1.79E-02	0.1754951	4.434225	43.47322
472	120.6578	0.609786	6.098909	0.429981	4.300549	6.12E-02	0.6125829	5.345357	53.46286
477.556	120.6578	0.606981	6.18948	0.484138	4.93683	9.96E-02	1.015431	6.221307	63.43937
427.556	137.8947	0.616018	5.086656	0.072408	0.597888	0.328254	2.710518	6.909362	57.05225
433.111	137.8947	0.59091	4.994767	5.42E-02	0.458095	0.320331	2.707617	4.371348	36.94942
438.667	137.8947	0.553272	4.784744	4.20E-02	0.363105	0.320162	2.768787	2.171456	18.77875
444.222	137.8947	0.536199	4.743041	4.57E-03	4.04E-02	0.296361	2.621486	0.266126	2.354079
449.778	137.8947	0.493393	4.460796	8.52E-03	7.71E-02	0.29808	2.69497	1.451979	13.12749
455.333	137.8947	0.531365	4.911648	0.103248	0.954371	0.219128	2.02548	2.921513	27.00485
460.889	137.8947	0.500909	4.728025	0.128808	1.21582	0.21004	1.982514	4.332623	40.89493
466.445	137.8947	0.480709	4.631286	0.163418	1.574451	0.191785	1.847737	5.63414	54.28064
472	137.8947	0.4952	4.868782	0.231422	2.275301	0.139868	1.375169	6.822903	67.08237
477.556	137.8947	0.496674	4.980282	0.284604	2.853833	0.10198	1.022607	7.967883	79.8965
527.556	137.8947	0.654843	7.699526	0.798337	9.38674	0.323146	3.799533	6.534213	76.82835
533.111	137.8947	0.648787	7.74907	0.818572	9.776975	0.338679	4.045157	4.030288	48.13752

Table A-7: Toluene

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
393.15	1.2	0.13804	0.730772	0.444214	2.351694	0.44656	2.36412	2.874665	15.21865
413.15	1.2	2.00E-02	0.112085	0.24592	1.379832	0.249645	1.400764	2.534378	14.22031
433.15	1.2	0.091937	0.545187	0.259154	1.536803	0.263915	1.565025	2.088335	12.38393
453.15	1.2	0.182283	1.141069	0.305836	1.914531	0.311349	1.949039	1.681733	10.52762
473.15	1.2	0.152119	1.005412	0.242848	1.60507	0.24889	1.645031	1.437757	9.50276
493.15	1.2	3.12E-02	0.217377	9.71E-02	0.677631	0.103529	0.7223425	1.318877	9.202253
443.15	3.1	0.839961	5.029298	1.241921	7.436096	1.25497	7.514203	5.800664	34.73184
453.15	3.1	0.899292	5.535844	1.242252	7.64704	1.256315	7.73361	5.003065	30.79777
473.15	3.1	1.049044	6.816337	1.298367	8.436324	1.313999	8.53791	3.72109	24.17835
493.15	3.1	0.989645	6.792317	1.169355	8.02576	1.186032	8.140217	2.913967	19.99971
503.15	3.1	0.74808	5.285412	0.899698	6.356638	0.916715	6.476855	2.783386	19.66532

Table A-8: Isobutene

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
430	1	0.483828	3.319515	0.484455	3.323838	0.474934	3.258516	0.768499	5.272686
440	1	0.463548	3.287037	0.466941	3.311095	0.457549	3.24445	0.703169	4.986176
450	1	0.457146	3.349051	0.462751	3.390118	0.453486	3.32226	0.655322	4.800883
460	1	0.45077	3.41004	0.458125	3.465724	0.449011	3.396753	0.610801	4.620695
470	1	0.445004	3.474604	0.45374	3.542818	0.44478	3.472831	0.569886	4.449683
480	1	0.440352	3.547046	0.450147	3.625961	0.441345	3.55504	0.532796	4.291679
490	1	0.437281	3.632046	0.447872	3.720055	0.439231	3.648279	0.499753	4.150922
500	1	0.436196	3.734298	0.447374	3.829993	0.438904	3.757437	0.470941	4.031712
510	1	0.437415	3.858002	0.448996	3.960137	0.440691	3.886867	0.446474	3.937886
520	1	0.441256	4.007951	0.453095	4.115433	0.444956	4.041512	0.426503	3.873917
530	1	0.447991	4.188704	0.459951	4.300571	0.451987	4.226055	0.411132	3.84407
540	1	0.45783	4.404747	0.469824	4.520153	0.462021	4.445091	0.400432	3.852536
550	1	0.460916	4.560743	0.472856	4.678937	0.465222	4.603391	0.384413	3.803753
560	1	0.468027	4.76123	0.479852	4.881548	0.47238	4.805558	0.373736	3.802017
570	1	0.469725	4.910469	0.48138	5.032333	0.47407	4.95594	0.377467	3.946008
580	1	0.476164	5.113495	0.487604	5.23639	0.480457	5.15964	0.412657	4.431502
590	1	0.478288	5.274073	0.489484	5.397545	0.482493	5.320466	0.443409	4.889433
600	1	0.48568	5.497382	0.496604	5.621038	0.489765	5.543668	0.479321	5.425444
410	1.01325	0.526294	3.375156	0.519179	3.329513	0.509338	3.266387	0.918817	5.892394

420	1.01325	0.507227	3.365459	0.50439	3.34665	0.494636	3.281931	0.845442	5.609529
430	1.01325	0.48708	3.341864	0.487717	3.346242	0.478069	3.280056	0.775542	5.321
440	1.01325	0.466552	3.308299	0.469983	3.332675	0.460468	3.265147	0.709349	5.029982
450	1.01325	0.459907	3.369312	0.465595	3.410916	0.45621	3.342162	0.660707	4.840363
460	1.01325	0.453319	3.429362	0.460782	3.485784	0.451543	3.415898	0.615465	4.656014
470	1.01325	0.447371	3.493058	0.456219	3.562174	0.447138	3.491258	0.573897	4.480991
480	1.01325	0.442547	3.564688	0.452467	3.644645	0.443548	3.572785	0.5362	4.319099
490	1.01325	0.439311	3.64893	0.450048	3.738103	0.441294	3.665377	0.502601	4.17458
500	1.01325	0.438088	3.750478	0.449415	3.847432	0.440827	3.773917	0.473272	4.051715
510	1.01325	0.439175	3.873515	0.450909	3.976997	0.442489	3.902757	0.448341	3.954344
520	1.01325	0.442899	4.022838	0.454885	4.131742	0.446643	4.056837	0.427931	3.886902
530	1.01325	0.449522	4.203004	0.46164	4.316348	0.453569	4.240844	0.41216	3.85367
540	1.01325	0.459255	4.418489	0.471409	4.535417	0.463502	4.45937	0.401081	3.858831
550	1.01325	0.462247	4.573966	0.47435	4.693723	0.466614	4.617177	0.384718	3.806799
560	1.01325	0.469275	4.773959	0.481259	4.895867	0.473695	4.818871	0.373723	3.801881
570	1.01325	0.470895	4.922732	0.482704	5.046206	0.475305	4.968802	0.377428	3.945622
580	1.01325	0.47726	5.125318	0.488856	5.249837	0.481615	5.172065	0.412933	4.434464
590	1.01325	0.479324	5.285476	0.490666	5.410577	0.483584	5.332479	0.444	4.895955
600	1.01325	0.486647	5.50839	0.497721	5.633673	0.490792	5.555284	0.480235	5.435752
410	2	0.552827	3.53589	0.538516	3.444324	0.519056	3.31988	1.335441	8.541467
420	2	0.518197	3.4294	0.512429	3.391241	0.493145	3.263639	1.190993	7.881972
430	2	0.499137	3.416591	0.500285	3.424466	0.481228	3.29398	1.071664	7.335565
440	2	0.480591	3.40068	0.487306	3.448206	0.468491	3.315074	0.961467	6.803318

450	**2**	**0.463103**	**3.385755**	**0.474271**	**3.467391**	**0.45573**	**3.331842**	**0.860002**	**6.287486**
460	**2**	**0.460221**	**3.475132**	**0.474906**	**3.586036**	**0.456661**	**3.448277**	**0.779996**	**5.889763**
470	**2**	**0.445631**	**3.473254**	**0.463074**	**3.609216**	**0.445139**	**3.469433**	**0.694534**	**5.413181**
480	**2**	**0.445619**	**3.583673**	**0.465182**	**3.741006**	**0.447574**	**3.599367**	**0.629201**	**5.060043**
490	**2**	**0.435405**	**3.610847**	**0.456564**	**3.786316**	**0.439287**	**3.642984**	**0.558746**	**4.633689**
500	**2**	**0.439693**	**3.75895**	**0.462011**	**3.94973**	**0.445062**	**3.804846**	**0.507347**	**4.337321**
510	**2**	**0.446353**	**3.931921**	**0.469462**	**4.135517**	**0.452861**	**3.989221**	**0.462481**	**4.073986**
520	**2**	**0.444703**	**4.034316**	**0.468312**	**4.248547**	**0.452044**	**4.100959**	**0.413078**	**3.747443**
530	**2**	**0.446554**	**4.17037**	**0.470424**	**4.393305**	**0.454499**	**4.244545**	**0.37062**	**3.461204**
540	**2**	**0.452067**	**4.34433**	**0.475991**	**4.574276**	**0.460403**	**4.424445**	**0.33495**	**3.218882**
550	**2**	**0.461369**	**4.560658**	**0.485192**	**4.796117**	**0.469935**	**4.645319**	**0.30595**	**3.024327**
560	**2**	**0.464791**	**4.723678**	**0.488372**	**4.96334**	**0.473447**	**4.811661**	**0.273676**	**2.781352**
570	**2**	**0.463205**	**4.837705**	**0.486442**	**5.080406**	**0.471841**	**4.927931**	**0.280469**	**2.929229**
580	**2**	**0.47595**	**5.106931**	**0.498755**	**5.35165**	**0.484481**	**5.198462**	**0.351222**	**3.768599**
590	**2**	**0.475232**	**5.236128**	**0.497545**	**5.481963**	**0.483583**	**5.328137**	**0.408277**	**4.498385**
600	**2**	**0.480029**	**5.429148**	**0.501795**	**5.675299**	**0.488146**	**5.520906**	**0.470694**	**5.323528**
410	**4**	**0.581165**	**3.695598**	**0.551372**	**3.506179**	**0.512332**	**3.2579**	**2.180156**	**13.86358**
420	**4**	**0.543851**	**3.580142**	**0.53158**	**3.499381**	**0.492908**	**3.244786**	**1.911195**	**12.58142**
430	**4**	**0.524947**	**3.575917**	**0.526781**	**3.588423**	**0.488562**	**3.32807**	**1.682938**	**11.4642**
440	**4**	**0.494662**	**3.484398**	**0.5078**	**3.576929**	**0.470095**	**3.311323**	**1.463035**	**10.30562**
450	**4**	**0.481699**	**3.507236**	**0.503824**	**3.668364**	**0.466691**	**3.397968**	**1.27743**	**9.300941**
460	**4**	**0.4716**	**3.547371**	**0.500825**	**3.767196**	**0.464291**	**3.492419**	**1.109783**	**8.347806**
470	**4**	**0.451547**	**3.506741**	**0.486309**	**3.776655**	**0.450413**	**3.497885**	**0.945619**	**7.34369**

480	**4**	**0.44774**	**3.588634**	**0.48673**	**3.901163**	**0.451497**	**3.618736**	**0.809492**	**6.488098**
490	**4**	**0.44702**	**3.695989**	**0.48919**	**4.044595**	**0.454629**	**3.758835**	**0.687068**	**5.680702**
500	**4**	**0.43786**	**3.73233**	**0.48232**	**4.111306**	**0.448441**	**3.822504**	**0.56572**	**4.822206**
510	**4**	**0.444038**	**3.900896**	**0.490068**	**4.305254**	**0.456875**	**4.013674**	**0.468227**	**4.113391**
520	**4**	**0.442662**	**4.005661**	**0.489666**	**4.431015**	**0.457166**	**4.136904**	**0.370874**	**3.356061**
530	**4**	**0.445416**	**4.149932**	**0.492907**	**4.592434**	**0.461097**	**4.296022**	**0.284597**	**2.65162**
540	**4**	**0.452377**	**4.337831**	**0.499958**	**4.794102**	**0.468833**	**4.495608**	**0.208828**	**2.002457**
550	**4**	**0.453466**	**4.473027**	**0.500818**	**4.940074**	**0.47037**	**4.6397**	**0.132878**	**1.310719**
560	**4**	**0.459367**	**4.659357**	**0.506218**	**5.134596**	**0.476435**	**4.832504**	**6.69E-02**	**0.6788734**
570	**4**	**0.460536**	**4.801098**	**0.506687**	**5.282223**	**0.477562**	**4.978587**	**0.10232**	**1.066694**
580	**4**	**0.467019**	**5.002252**	**0.512301**	**5.487241**	**0.483822**	**5.182212**	**0.226789**	**2.429125**
590	**4**	**0.469687**	**5.16654**	**0.513963**	**5.653614**	**0.486122**	**5.347337**	**0.347135**	**3.818501**
600	**4**	**0.478044**	**5.398556**	**0.521219**	**5.886141**	**0.493999**	**5.578755**	**0.473045**	**5.342098**
410	**6**	**0.614344**	**3.883267**	**0.567775**	**3.588876**	**0.509011**	**3.217451**	**3.066933**	**19.38609**
420	**6**	**0.571169**	**3.739439**	**0.551563**	**3.611057**	**0.493381**	**3.230163**	**2.656263**	**17.39055**
430	**6**	**0.549978**	**3.727771**	**0.551961**	**3.741212**	**0.494503**	**3.351709**	**2.30673**	**15.63504**
440	**6**	**0.520123**	**3.647094**	**0.539321**	**3.78172**	**0.482658**	**3.384395**	**1.982235**	**13.89943**
450	**6**	**0.496134**	**3.596989**	**0.528977**	**3.835108**	**0.473191**	**3.43066**	**1.692206**	**12.26848**
460	**6**	**0.47757**	**3.577921**	**0.521129**	**3.904307**	**0.466276**	**3.49337**	**1.432305**	**10.73084**
470	**6**	**0.464046**	**3.590816**	**0.51594**	**3.992321**	**0.462066**	**3.575468**	**1.198998**	**9.277816**
480	**6**	**0.455328**	**3.637184**	**0.513573**	**4.102404**	**0.460712**	**3.680159**	**0.989362**	**7.903026**
490	**6**	**0.451236**	**3.719109**	**0.514217**	**4.238149**	**0.462382**	**3.810982**	**0.80101**	**6.601945**
500	**6**	**0.439908**	**3.738754**	**0.506291**	**4.302994**	**0.455509**	**3.871344**	**0.620205**	**5.271142**

510	**6**	**0.444986**	**3.898554**	**0.513695**	**4.500466**	**0.463956**	**4.064731**	**0.468927**	**4.108283**
520	**6**	**0.443358**	**4.001765**	**0.51349**	**4.634772**	**0.464802**	**4.195322**	**0.322677**	**2.912482**
530	**6**	**0.446614**	**4.151283**	**0.517442**	**4.809629**	**0.469802**	**4.3668**	**0.191827**	**1.783049**
540	**6**	**0.444236**	**4.249974**	**0.515165**	**4.928611**	**0.468563**	**4.482708**	**6.48E-02**	**0.6196538**
550	**6**	**0.447169**	**4.401506**	**0.517727**	**5.096004**	**0.472145**	**4.647325**	**4.84E-02**	**0.4768721**
560	**6**	**0.455348**	**4.609468**	**0.525136**	**5.315938**	**0.480563**	**4.864746**	**0.148718**	**1.50545**
570	**6**	**0.459052**	**4.7769**	**0.527769**	**5.491937**	**0.484188**	**5.038472**	**6.72E-02**	**0.6993837**
580	**6**	**0.459049**	**4.908117**	**0.526443**	**5.628705**	**0.483839**	**5.1732**	**0.11277**	**1.205728**
590	**6**	**0.464967**	**5.106299**	**0.530851**	**5.829813**	**0.489207**	**5.372478**	**0.298496**	**3.278083**
600	**6**	**0.467917**	**5.275745**	**0.532136**	**5.999858**	**0.491431**	**5.540898**	**0.481316**	**5.426828**
410	**8**	**0.654659**	**4.112577**	**0.589808**	**3.705182**	**0.511187**	**3.211306**	**4.00203**	**25.14073**
420	**8**	**0.601721**	**3.917204**	**0.573817**	**3.735566**	**0.49602**	**3.22909**	**3.429244**	**22.32438**
430	**8**	**0.575368**	**3.879731**	**0.576883**	**3.889945**	**0.500079**	**3.372064**	**2.944442**	**19.85436**
440	**8**	**0.529496**	**3.694824**	**0.554344**	**3.868186**	**0.478644**	**3.340006**	**2.491648**	**17.38672**
450	**8**	**0.506927**	**3.658992**	**0.550176**	**3.971189**	**0.475699**	**3.433609**	**2.104337**	**15.1891**
460	**8**	**0.491891**	**3.670521**	**0.54955**	**4.100716**	**0.476355**	**3.554594**	**1.760617**	**13.13771**
470	**8**	**0.470621**	**3.628026**	**0.539413**	**4.158341**	**0.467561**	**3.60444**	**1.441661**	**11.11378**
480	**8**	**0.45622**	**3.631525**	**0.533481**	**4.246534**	**0.463009**	**3.685553**	**1.156213**	**9.20346**
490	**8**	**0.44817**	**3.681736**	**0.531721**	**4.368103**	**0.46265**	**3.800668**	**0.900324**	**7.396139**
500	**8**	**0.445988**	**3.77927**	**0.534035**	**4.525417**	**0.466378**	**3.952116**	**0.670643**	**5.683053**
510	**8**	**0.449347**	**3.925913**	**0.540436**	**4.721782**	**0.474207**	**4.14313**	**0.464477**	**4.058128**
520	**8**	**0.446924**	**4.023625**	**0.539868**	**4.860438**	**0.475059**	**4.276928**	**0.268426**	**2.416619**
530	**8**	**0.439452**	**4.074589**	**0.533295**	**4.944686**	**0.46988**	**4.356761**	**8.14E-02**	**0.754922**

540	8	0.448508	4.281458	0.542438	5.178146	0.480435	4.586213	7.64E-02	0.7293714
550	8	0.442563	4.346838	0.535967	5.26425	0.475331	4.668679	0.238052	2.338136
560	8	0.452724	4.573855	0.545074	5.506854	0.485798	4.907999	0.373378	3.772214
570	8	0.458786	4.765376	0.549672	5.709442	0.491732	5.107629	0.227905	2.367232
580	8	0.461391	4.924871	0.550501	5.876059	0.493873	5.271581	0.018813	0.2007989
590	8	0.461115	5.055648	0.548199	6.010485	0.492854	5.403629	0.262686	2.880108
600	8	0.46731	5.260999	0.55218	6.216444	0.498089	5.60746	0.513568	5.781736
410	10	0.688918	4.299542	0.604042	3.769852	0.505425	3.154364	4.977489	31.06453
420	10	0.637496	4.125911	0.600207	3.88452	0.502681	3.253338	4.233694	27.40051
430	10	0.587622	3.940588	0.587943	3.942751	0.491714	3.29741	3.583196	24.0289
440	10	0.552132	3.834009	0.582134	4.042323	0.487356	3.384175	3.019726	20.96897
450	10	0.528591	3.798438	0.58188	4.181387	0.488675	3.511641	2.527471	18.16238
460	10	0.501784	3.728736	0.573222	4.259596	0.481671	3.579309	2.08137	15.46669
470	10	0.484527	3.721171	0.569934	4.37712	0.480117	3.687265	1.686175	12.94984
480	10	0.475708	3.773781	0.5717	4.535263	0.483637	3.836702	1.334655	10.58783
490	10	0.46224	3.785282	0.566056	4.635451	0.479786	3.928965	1.008894	8.261833
500	10	0.456264	3.854952	0.565651	4.779202	0.481192	4.065573	0.716877	6.056883
510	10	0.445753	3.883417	0.558904	4.869196	0.476239	4.149	0.443277	3.861856
520	10	0.442311	3.971525	0.557733	5.007864	0.47686	4.281699	0.196871	1.767679
530	10	0.445474	4.12062	0.561947	5.197976	0.482855	4.466391	2.52E-02	0.2327309
540	10	0.4444	4.232451	0.560951	5.342482	0.48362	4.605985	0.23572	2.244965
550	10	0.439643	4.30894	0.555493	5.444381	0.479894	4.703423	0.436037	4.273572
560	10	0.451529	4.552776	0.566024	5.707246	0.49214	4.962268	0.607122	6.121634

570	10	0.450102	4.666223	0.562764	5.834154	0.490554	5.085538	0.389269	4.035578
580	10	0.455401	4.852318	0.565819	6.028812	0.495252	5.276939	7.36E-02	0.7837789
590	10	0.458054	5.013887	0.565929	6.194676	0.496974	5.439874	0.239971	2.626732
600	10	0.458552	5.15413	0.563653	6.335462	0.496268	5.578056	0.552538	6.210509
410	12	0.720144	4.463463	0.613231	3.800811	0.494434	3.064531	6.002192	37.20159
420	12	0.665221	4.278715	0.617241	3.970074	0.499872	3.215189	5.058642	32.53716
430	12	0.617869	4.120543	0.616146	4.109074	0.500428	3.337335	4.253383	28.3658
440	12	0.574909	3.972011	0.60945	4.210714	0.495554	3.423763	3.552998	24.54767
450	12	0.548073	3.920355	0.610937	4.370045	0.499	3.569351	2.947992	21.08701
460	12	0.521124	3.856348	0.605957	4.484053	0.496067	3.670886	2.407545	17.81581
470	12	0.493218	3.773128	0.594887	4.550901	0.487112	3.726428	1.919484	14.68405
480	12	0.476458	3.765931	0.590837	4.669965	0.485224	3.835202	1.487133	11.75431
490	12	0.469409	3.831282	0.593132	4.841159	0.489714	3.997052	1.102385	8.997681
500	12	0.4591	3.866983	0.589474	4.965134	0.488247	4.112528	0.746968	6.29171
510	12	0.445744	3.872199	0.580573	5.043452	0.48154	4.183111	0.416609	3.619091
520	12	0.440674	3.946212	0.578162	5.177421	0.481305	4.310055	0.118974	1.065395
530	12	0.443234	4.089744	0.581935	5.369488	0.487234	4.495736	0.149583	1.380221
540	12	0.442352	4.203239	0.581099	5.52157	0.48853	4.642029	0.402794	3.827324
550	12	0.438457	4.288134	0.576311	5.636318	0.485852	4.751603	0.642458	6.283268
560	12	0.441898	4.446389	0.578106	5.816925	0.489708	4.927457	0.860066	8.653972
570	12	0.442606	4.57962	0.576582	5.965896	0.490203	5.072142	0.541482	5.602694
580	12	0.450414	4.790639	0.581691	6.186853	0.497299	5.289244	0.154725	1.645658
590	12	0.455839	4.981422	0.58405	6.382511	0.501599	5.481447	0.230717	2.521294

600	**12**	**0.45933**	**5.155056**	**0.584208**	**6.556581**	**0.503649**	**5.65243**	**0.616328**	**6.917062**
410	**14**	**0.752203**	**4.628312**	**0.62084**	**3.820027**	**0.481721**	**2.96403**	**7.086839**	**43.60534**
420	**14**	**0.702907**	**4.492311**	**0.642758**	**4.107877**	**0.505434**	**3.230251**	**5.923281**	**37.85572**
430	**14**	**0.638117**	**4.230741**	**0.633373**	**4.19927**	**0.498071**	**3.302222**	**4.927883**	**32.67186**
440	**14**	**0.598992**	**4.116891**	**0.637391**	**4.3808**	**0.504329**	**3.466245**	**4.091935**	**28.12387**
450	**14**	**0.56621**	**4.030859**	**0.638107**	**4.542679**	**0.507416**	**3.612319**	**3.365918**	**23.96196**
460	**14**	**0.53716**	**3.95783**	**0.634895**	**4.677909**	**0.506695**	**3.733314**	**2.725743**	**20.08326**
470	**14**	**0.510118**	**3.887067**	**0.627595**	**4.782242**	**0.501924**	**3.824637**	**2.154129**	**16.41449**
480	**14**	**0.483845**	**3.810295**	**0.616174**	**4.852364**	**0.493071**	**3.882938**	**1.63826**	**12.90127**
490	**14**	**0.469835**	**3.821638**	**0.613054**	**4.986548**	**0.492548**	**4.006386**	**1.180557**	**9.602639**
500	**14**	**0.454605**	**3.81686**	**0.60553**	**5.084004**	**0.487624**	**4.094079**	**0.760704**	**6.386898**
510	**14**	**0.449443**	**3.893067**	**0.605485**	**5.244708**	**0.490176**	**4.245904**	**0.38434**	**3.329178**
520	**14**	**0.442092**	**3.948312**	**0.601177**	**5.369117**	**0.488438**	**4.362247**	**3.46E-02**	**0.309395**
530	**14**	**0.443517**	**4.082109**	**0.603958**	**5.558807**	**0.493767**	**4.544607**	**0.281191**	**2.588071**
540	**14**	**0.442401**	**4.193963**	**0.60285**	**5.71502**	**0.495165**	**4.694167**	**0.577719**	**5.476781**
550	**14**	**0.439029**	**4.284513**	**0.59841**	**5.839891**	**0.493184**	**4.813008**	**0.857419**	**8.367546**
560	**14**	**0.443602**	**4.454636**	**0.601034**	**6.035583**	**0.498232**	**5.003242**	**1.112303**	**11.16974**
570	**14**	**0.445945**	**4.605722**	**0.600756**	**6.204592**	**0.500325**	**5.167332**	**0.674553**	**6.966781**
580	**14**	**0.446403**	**4.739476**	**0.598057**	**6.34959**	**0.499942**	**5.3079**	**0.224449**	**2.382995**
590	**14**	**0.445316**	**4.857938**	**0.593409**	**6.473465**	**0.497551**	**5.427804**	**0.226098**	**2.466513**
600	**14**	**0.451899**	**5.063556**	**0.59611**	**6.679391**	**0.502473**	**5.630181**	**0.687679**	**7.705411**
410	**16**	**0.789835**	**4.822727**	**0.631166**	**3.85392**	**0.471539**	**2.879222**	**8.244342**	**50.33995**
420	**16**	**0.722562**	**4.586109**	**0.648442**	**4.11565**	**0.491033**	**3.116588**	**6.803168**	**43.17974**

430	16	0.665375	4.384816	0.65639	4.325621	0.501481	3.304786	5.622874	37.05476
440	16	0.625839	4.278251	0.667218	4.561069	0.514993	3.520486	4.637029	31.69873
450	16	0.583921	4.136464	0.664152	4.704844	0.514742	3.646436	3.781152	26.7857
460	16	0.550498	4.037937	0.660574	4.84532	0.514078	3.770774	3.035726	22.26703
470	16	0.522642	3.966346	0.655406	4.97388	0.511883	3.884706	2.377013	18.03915
480	16	0.498276	3.909476	0.648028	5.08446	0.507519	3.981988	1.787823	14.02725
490	16	0.475952	3.858059	0.638129	5.172647	0.500642	4.058191	1.255298	10.17543
500	16	0.466616	3.905588	0.637545	5.336229	0.503077	4.210768	0.781526	6.541368
510	16	0.456969	3.946859	0.633694	5.473236	0.502232	4.337766	0.346361	2.991506
520	16	0.446686	3.978645	0.626844	5.583265	0.498341	4.438696	0.056189	0.5004465
530	16	0.446399	4.098403	0.628054	5.766157	0.502486	4.613317	0.420025	3.856226
540	16	0.444616	4.205157	0.626237	5.922928	0.503551	4.762586	0.760549	7.193248
550	16	0.441384	4.298161	0.621744	6.054563	0.501888	4.887415	1.080995	10.52671
560	16	0.436846	4.377658	0.614989	6.16278	0.497901	4.989468	1.333292	13.36094
570	16	0.440845	4.544261	0.615972	6.349463	0.501609	5.170584	0.807769	8.326469
580	16	0.443405	4.699188	0.614919	6.516927	0.50321	5.333044	0.282424	2.99315
590	16	0.444743	4.843686	0.612192	6.667377	0.503075	5.478993	0.244768	2.665803
600	16	0.445141	4.979808	0.608177	6.80369	0.501587	5.611281	0.775906	8.680064
410	18	7.598755	42.41624	7.80432	43.56373	7.999965	44.65583	1.788939	9.985857
420	18	7.737473	44.91605	7.835462	45.48483	8.028199	46.60369	0.166075	0.9640539
430	18	7.826468	47.2014	7.842347	47.29721	8.031895	48.44032	1.704162	10.27777
440	18	7.897957	49.43334	7.850916	49.13891	8.037049	50.30387	2.976056	18.62716
450	18	7.960414	51.65512	7.865131	51.0368	8.047681	52.22136	4.059659	26.34312

460	18	7.987192	53.69788	7.855051	52.80949	8.033916	54.01199	4.973193	33.43481
470	18	8.000752	55.68522	7.840724	54.57144	8.015835	55.7902	5.767793	40.14385
480	18	8.004721	57.63396	7.82391	56.33214	7.995228	57.56566	6.467974	46.56941
490	18	7.987283	59.45735	7.791372	57.99901	7.958889	59.24597	7.07749	52.68484
500	18	7.96586	61.26544	7.759377	59.67736	7.923096	60.93653	7.625228	58.64561
510	18	7.941745	63.0654	7.728306	61.37045	7.888267	62.64074	8.121688	64.4943
520	18	7.902689	64.76255	7.685237	62.98051	7.841462	64.26079	8.561909	70.16484
530	18	7.863324	66.46083	7.644166	64.6085	7.796731	65.89799	8.966489	75.78475
540	18	7.811668	68.06309	7.59269	66.15513	7.741648	67.453	9.328253	81.27708
550	18	7.761029	69.67072	7.543706	67.71985	7.68913	69.02531	9.6648	86.76091
560	18	7.711426	71.28439	7.496934	69.30167	7.638899	70.61401	9.836446	90.92811
570	18	7.651555	72.80457	7.440841	70.79961	7.579419	72.11816	9.130831	86.87983
580	18	7.593275	74.33057	7.387045	72.31177	7.522315	73.63593	8.425177	82.4741
590	18	7.536431	75.86173	7.335229	73.83641	7.467277	75.1656	7.716863	77.67796
600	18	7.470432	77.29659	7.274681	75.27114	7.403584	76.60485	6.99283	72.35483
410	20	0.859285	5.158279	0.634595	3.809466	0.433404	2.601717	10.80191	64.84385
420	20	0.785876	4.914857	0.67688	4.233179	0.479089	2.996221	8.691146	54.3544
430	20	0.736358	4.790766	0.714303	4.647245	0.520155	3.384106	7.067647	45.98211
440	20	0.679901	4.594778	0.723856	4.89183	0.533407	3.604737	5.733487	38.7469
450	20	0.622497	4.364325	0.716724	5.024956	0.530052	3.716191	4.603263	32.27346
460	20	0.585613	4.255679	0.718027	5.217918	0.53523	3.889499	3.643179	26.47499
470	20	0.549683	4.136338	0.710869	5.349258	0.531982	4.003154	2.799132	21.06348
480	20	0.524351	4.082595	0.706944	5.504251	0.531964	4.141877	2.056197	16.00955

490	**20**	**0.494084**	**3.976858**	**0.692244**	**5.571887**	**0.521145**	**4.194713**	**1.381565**	**11.1202**
500	**20**	**0.481607**	**4.00505**	**0.690658**	**5.743534**	**0.523436**	**4.352906**	**0.784654**	**6.525173**
510	**20**	**0.460927**	**3.957038**	**0.677167**	**5.813495**	**0.51376**	**4.410614**	**0.229602**	**1.971115**
520	**20**	**0.465682**	**4.125462**	**0.686089**	**6.078087**	**0.526477**	**4.664052**	**0.257807**	**2.283904**
530	**20**	**0.449344**	**4.104323**	**0.671598**	**6.13435**	**0.515674**	**4.710166**	**0.73071**	**6.674296**
540	**20**	**0.434493**	**4.089452**	**0.656681**	**6.180688**	**0.504384**	**4.747272**	**1.17174**	**11.02842**
550	**20**	**0.431005**	**4.178165**	**0.651582**	**6.316454**	**0.502862**	**4.874779**	**1.575224**	**15.27025**
560	**20**	**0.437697**	**4.368237**	**0.655469**	**6.541556**	**0.51025**	**5.092267**	**1.714136**	**17.10711**
570	**20**	**0.434276**	**4.459156**	**0.648315**	**6.6569**	**0.506495**	**5.200719**	**1.044525**	**10.72521**
580	**20**	**0.430913**	**4.550032**	**0.640492**	**6.762982**	**0.501995**	**5.300579**	**0.371587**	**3.923587**
590	**20**	**0.436854**	**4.741622**	**0.641399**	**6.961731**	**0.506146**	**5.493731**	**0.316796**	**3.438507**
600	**20**	**0.433548**	**4.834511**	**0.632657**	**7.054765**	**0.500561**	**5.581747**	**1.0049**	**11.20565**

Appendix B

Results for pure superheated vapors at very high pressure and temperature

T = Temperature, Kelvin

P = pressure, bar

AA%D = average absolute percentage deviations for enthalpy.

AA%D = average absolute percentage deviations for enthalpy departure, Joule/gram.

Table B-1: Ammonia

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
410	5000	45.8819	19.6055	37.5121	16.0291	67.934	169.156	218.349	543.689
420	5000	39.4399	20.1223	31.2366	15.937	57.9966	167.338	182.724	527.215
430	5000	34.5494	20.6448	26.553	15.8666	50.5408	165.698	154.814	507.559
440	5000	30.6965	21.1691	22.9389	15.8192	44.7526	164.229	132.097	484.757

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450	5000	27.5728	21.6941	20.0736	15.7938	40.1346	162.91	113.044	458.858
460	5000	24.9825	22.2206	17.7516	15.7891	36.368	161.725	96.6792	429.923
470	5000	22.797	22.7501	15.8396	15.8071	33.244	160.672	82.3478	397.995
480	5000	20.9224	23.282	14.2403	15.8463	30.612	159.73	69.5964	363.147
490	5000	19.2957	23.8186	12.8876	15.9085	28.3685	158.9	58.1	325.435
500	5000	17.8719	24.3641	11.7346	15.9973	26.439	158.19	47.6186	284.912
510	5000	16.6116	24.9175	10.7409	16.1114	24.7616	157.578	37.9747	241.663
520	5000	15.488	25.4815	9.87851	16.2526	23.2924	157.063	29.031	195.759
530	5000	14.4811	26.0605	9.12689	16.4249	21.9984	156.65	20.6797	147.26
540	5000	13.567	26.6467	8.46403	16.6241	20.8472	156.308	12.8398	96.2702
550	5000	12.7406	27.2569	7.87916	16.8565	19.8205	156.053	5.44136	42.8415
560	5000	11.986	27.8861	7.35961	17.1225	18.8989	155.87	1.56962	12.9456
570	5000	11.291	28.5325	6.89234	17.4171	18.0637	155.727	8.23495	70.9935
580	5000	10.649	29.2	6.47117	17.7442	17.3047	155.628	14.5937	131.247
590	5000	10.053	29.8898	6.08892	18.1038	16.6107	155.558	20.677	193.638
600	5000	9.49416	30.5981	5.73689	18.4891	15.9701	155.482	26.5088	258.084
620	5000	8.47277	32.0819	5.10895	19.3449	14.8236	155.289	37.5122	392.97
640	5000	7.54561	33.6441	4.54882	20.2822	13.8093	154.867	47.751	535.514
660	5000	6.68547	35.2831	4.03035	21.2705	12.8886	154.064	57.3486	685.516
680	5000	5.86589	36.976	3.52901	22.2454	12.0271	152.668	66.4028	842.897
700	5000	5.07122	38.7223	3.02858	23.1253	11.2012	150.504	64.2874	863.791
720	5000	4.28354	40.4885	2.51316	23.7548	10.3891	147.35	43.8335	621.696
740	5000	3.4915	42.2461	1.97265	23.8684	9.57622	143.02	23.327	348.386
760	5000	2.68513	43.9392	1.39836	22.8826	8.74999	137.314	2.62354	41.1711
410	4000	61.0227	13.6899	43.4361	9.74451	82.6899	126.019	271.026	413.043

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420	4000	48.1574	13.9622	33.0514	9.58257	64.9515	124.681	211.967	406.892
430	4000	39.6586	14.2213	26.3073	9.43358	53.3747	123.482	171.916	397.727
440	4000	33.6102	14.4686	21.6019	9.29919	45.247	122.425	142.502	385.568
450	4000	29.0726	14.7043	18.1482	9.17899	39.2399	121.498	119.644	370.452
460	4000	25.5327	14.9286	15.5172	9.07269	34.6282	120.693	101.114	352.424
470	4000	22.6856	15.1396	13.4601	8.98283	30.9893	120.019	85.5993	331.518
480	4000	20.3534	15.3474	11.815	8.90904	28.0502	119.463	72.2708	307.794
490	4000	18.3986	15.5463	10.4745	8.85059	25.6305	119.015	60.5839	281.321
500	4000	16.7378	15.7393	9.36881	8.8099	23.611	118.683	50.1641	252.155
510	4000	15.3069	15.9261	8.44508	8.78672	21.9023	118.454	40.748	220.377
520	4000	14.057	16.1045	7.66201	8.77804	20.4369	118.305	32.1456	186.085
530	4000	12.9573	16.2773	6.99422	8.78631	19.1705	118.243	24.2132	149.347
540	4000	11.9753	16.4384	6.41399	8.80443	18.0597	118.224	16.8474	110.288
550	4000	11.0954	16.5916	5.90911	8.83626	17.0815	118.264	9.96205	68.9722
560	4000	10.2961	16.7301	5.46121	8.87392	16.2079	118.318	3.49649	25.5243
570	4000	9.56596	16.8536	5.06105	8.91671	15.4227	118.381	2.6021	19.9732
580	4000	8.89295	16.9579	4.6986	8.95968	14.7097	118.429	8.37416	67.4212
590	4000	8.26466	17.0327	4.36526	8.99642	14.0559	118.437	13.8526	116.724
600	4000	7.67802	17.0828	4.05459	9.02105	13.4503	118.376	19.0649	167.79
620	4000	6.59651	17.0679	3.48091	9.00658	12.3517	117.972	28.7836	274.914
640	4000	5.60524	16.8489	2.94494	8.85226	11.361	117.047	37.6867	388.268
660	4000	4.66887	16.3291	2.41763	8.45548	10.4341	115.37	45.8912	507.419
680	4000	3.76601	15.388	1.88249	7.69192	9.5437	112.766	53.502	632.164
700	4000	2.87832	13.8404	1.32546	6.37349	8.66752	109.037	60.6092	762.458
720	4000	1.99287	11.4041	0.73794	4.22285	7.79076	104.011	58.7159	783.893

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740	4000	1.10203	7.63048	0.11363	0.78675	6.90245	97.5226	40.1918	567.857
760	4000	0.19935	1.71154	0.55005	4.72245	5.99599	89.429	21.6846	323.421
410	3500	78.7414	11.367	51.1317	7.38128	100.549	105.496	331.321	347.622
420	3500	56.7149	11.5557	35.416	7.21605	72.2388	104.428	239.414	346.097
430	3500	44.1262	11.7267	26.5821	7.0643	56.2423	103.503	185.632	341.619
440	3500	35.9627	11.8865	20.9498	6.92435	45.9812	102.699	149.642	334.225
450	3500	30.2217	12.0331	17.0747	6.7985	38.8659	102.027	123.397	323.928
460	3500	25.9555	12.1681	14.2648	6.68741	33.6592	101.486	103.069	310.764
470	3500	22.6484	12.29	12.1434	6.58953	29.6894	101.054	86.6097	294.793
480	3500	20.0118	12.4027	10.5012	6.50837	26.5781	100.75	72.8228	276.049
490	3500	17.8508	12.5034	9.19449	6.44016	24.0736	100.541	60.9668	254.622
500	3500	16.0457	12.5929	8.13612	6.38536	22.0191	100.425	50.5567	230.579
510	3500	14.5117	12.6707	7.26437	6.34281	20.3051	100.388	41.2635	204.007
520	3500	13.191	12.7375	6.53745	6.3127	18.8561	100.427	32.8551	174.986
530	3500	12.0348	12.7883	5.91918	6.28976	17.6112	100.509	25.1676	143.634
540	3500	11.0109	12.8217	5.38505	6.27068	16.5269	100.607	18.0798	110.061
550	3500	10.0972	12.8382	4.92054	6.25624	15.5756	100.729	11.4965	74.3491
560	3500	9.26727	12.8271	4.50707	6.23837	14.7275	100.829	5.35049	36.631
570	3500	8.51184	12.7929	4.13413	6.21342	13.9637	100.89	0.41393	2.99078
580	3500	7.81337	12.7248	3.79081	6.17368	13.2665	100.88	5.83869	44.398
590	3500	7.16531	12.6221	3.47326	6.11834	12.6269	100.799	10.9628	87.5146
600	3500	6.55474	12.4725	3.17104	6.03393	12.0298	100.594	15.8109	132.212
620	3500	5.42668	12.013	2.6008	5.75736	10.9376	99.7703	24.7816	226.052
640	3500	4.38383	11.2693	2.04725	5.26276	9.93487	98.2032	32.9079	325.284
660	3500	3.39591	10.1426	1.49029	4.45106	8.98536	95.7121	40.3165	429.451

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680	3500	2.43984	8.49159	0.91548	3.18623	8.06338	92.1224	47.1144	538.273
700	3500	1.50419	6.13495	0.31473	1.28364	7.15234	87.2864	53.3989	651.675
720	3500	0.57549	2.77543	0.31835	1.53532	6.23941	81.0505	59.2579	769.766
740	3500	0.35268	2.03791	0.98579	5.69626	5.3177	73.2981	46.6901	643.567
760	3500	1.28514	9.06959	1.68857	11.9167	4.38236	63.918	29.3693	428.36
410	3000	124.173	9.36697	72.0747	5.43695	147.275	85.9204	483.64	282.156
420	3000	73.1585	9.49487	40.7291	5.28603	86.8185	85.1776	290.347	284.86
430	3000	51.5256	9.60584	27.6092	5.14714	61.3949	84.5593	206.698	284.685
440	3000	39.5216	9.70109	20.4553	5.02102	47.4407	84.0648	158.942	281.645
450	3000	31.8639	9.78198	15.9886	4.90837	38.6538	83.6932	127.36	275.761
460	3000	26.5353	9.8484	12.9558	4.80846	32.629	83.4322	104.449	267.076
470	3000	22.6087	9.90282	10.7836	4.72329	28.2598	83.2901	86.7311	255.623
480	3000	19.5787	9.94166	9.1549	4.64867	24.9471	83.2336	72.3787	241.484
490	3000	17.1674	9.96725	7.89787	4.58543	22.3558	83.2596	60.34	224.724
500	3000	15.1963	9.9782	6.90195	4.53197	20.2755	83.3545	49.9683	205.425
510	3000	13.5474	9.9721	6.09308	4.48504	18.5666	83.4939	40.8467	183.688
520	3000	12.1387	9.94413	5.4232	4.44274	17.1368	83.6635	32.6931	159.611
530	3000	10.9209	9.89756	4.85442	4.39953	15.9167	83.8285	25.3138	133.32
540	3000	9.85142	9.82769	4.36482	4.3543	14.8622	83.9833	18.5665	104.916
550	3000	8.8973	9.72907	3.93294	4.30062	13.9349	84.0927	12.35	74.5287
560	3000	8.0352	9.59711	3.54381	4.23267	13.1074	84.1311	6.58761	42.2833
570	3000	7.24851	9.4282	3.18828	4.14702	12.3603	84.0824	1.21895	8.29204
580	3000	6.52122	9.21469	2.85537	4.03474	11.6752	83.9097	3.80051	27.3143
590	3000	5.84469	8.95333	2.54081	3.89221	11.0419	83.6067	8.51048	64.4397
600	3000	5.20776	8.63439	2.23707	3.70904	10.4478	83.1362	12.9395	102.963

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620	3000	4.02535	7.79028	1.64642	3.18632	9.34664	81.6055	21.0538	183.821
640	3000	2.93127	6.60389	1.05998	2.38803	8.32443	79.1579	28.312	269.222
660	3000	1.89994	4.98082	0.46337	1.21476	7.35011	75.6503	34.8487	358.677
680	3000	0.9081	2.77554	0.15377	0.46998	6.40125	70.9367	40.7757	451.864
700	3000	5.72E-02	0.20484	0.79607	2.84913	5.4647	64.9064	46.1951	548.678
720	3000	1.00559	4.24481	1.46557	6.18653	4.53136	57.4567	51.1994	649.199
740	3000	1.9442	9.7852	2.16381	10.8905	3.59482	48.4908	51.4915	694.574
760	3000	3.63886	15.0268	3.6261	14.9741	9.53983	127.888	44.5536	597.273
410	2500	474.908	7.64687	240.272	3.86882	512.669	67.5698	1644.07	216.689
420	2500	116.296	7.72543	56.3661	3.74436	126.298	67.1906	419.601	223.228
430	2500	65.5652	7.7889	30.5904	3.63402	71.9257	66.9412	243.827	226.93
440	2500	45.2089	7.83541	20.3999	3.53562	50.2975	66.8001	171.541	227.823
450	2500	34.1884	7.86603	14.9932	3.44961	38.7217	66.764	131.034	225.929
460	2500	27.2557	7.88189	11.6749	3.37617	31.5386	66.8302	104.426	221.279
470	2500	22.4643	7.88015	9.44022	3.31149	26.6493	66.9642	85.1429	213.947
480	2500	18.9433	7.86156	7.8443	3.25541	23.1146	67.1618	70.206	203.99
490	2500	16.2249	7.82054	6.64817	3.20448	20.4386	67.3985	58.0715	191.497
500	2500	14.0651	7.76346	5.72025	3.15738	18.3411	67.6583	47.8615	176.556
510	2500	12.2896	7.68232	4.97281	3.10855	16.6445	67.9062	39.0435	159.29
520	2500	10.7964	7.57537	4.35442	3.0553	15.2393	68.1258	31.2738	139.806
530	2500	9.5145	7.43907	3.82804	2.99302	14.0491	68.291	24.3234	118.234
540	2500	8.39256	7.26837	3.36759	2.9165	13.0201	68.3749	18.034	94.7055
550	2500	7.39853	7.062	2.95628	2.82181	12.1158	68.361	12.2907	69.3478
560	2500	6.50207	6.81211	2.57821	2.70115	11.3054	68.2122	7.01224	42.3091

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570	**2500**	**5.68599**	**6.51578**	**2.22559**	**2.55039**	**10.5706**	**67.9206**	**2.13328**	**13.7072**
580	**2500**	**4.93396**	**6.16632**	**1.89068**	**2.36292**	**9.89439**	**67.459**	**2.39424**	**16.3237**
590	**2500**	**4.23308**	**5.75601**	**1.56647**	**2.13003**	**9.26326**	**66.8002**	**6.60825**	**47.6541**
600	**2500**	**3.57216**	**5.27448**	**1.24893**	**1.84411**	**8.668**	**65.9262**	**10.5409**	**80.1712**
620	**2500**	**2.35894**	**4.08864**	**0.6265**	**1.08589**	**7.56184**	**63.5006**	**17.6713**	**148.395**
640	**2500**	**1.24482**	**2.52324**	**3.06E-03**	**6.21E-03**	**6.52991**	**60.0366**	**23.9579**	**220.271**
660	**2500**	**0.20336**	**0.48136**	**0.62916**	**1.48928**	**5.54713**	**55.4475**	**29.5434**	**295.307**
680	**2500**	**0.78786**	**2.17975**	**1.27833**	**3.53669**	**4.59279**	**49.6149**	**34.5424**	**373.155**
700	**2500**	**1.74466**	**5.65995**	**1.94789**	**6.31924**	**3.65436**	**42.4475**	**39.0572**	**453.673**
720	**2500**	**2.67576**	**10.2394**	**2.64038**	**10.1041**	**2.72249**	**33.8523**	**43.1782**	**536.891**
740	**2500**	**3.59521**	**16.3832**	**3.36064**	**15.3143**	**1.78694**	**23.694**	**46.9825**	**622.964**
760	**2500**	**4.50945**	**24.8151**	**4.10906**	**22.6118**	**0.84333**	**11.8836**	**39.5715**	**557.614**
410	**2000**	**179.254**	**6.15819**	**77.3852**	**2.65853**	**171.881**	**50.8597**	**511.318**	**151.299**
420	**2000**	**481.521**	**6.20181**	**200.078**	**2.57692**	**468.982**	**50.9314**	**1484.46**	**161.212**
430	**2000**	**100.382**	**6.22743**	**40.4241**	**2.5078**	**99.813**	**51.1043**	**328.797**	**168.344**
440	**2000**	**55.071**	**6.23491**	**21.6385**	**2.44982**	**56.1726**	**51.3642**	**188.878**	**172.71**
450	**2000**	**37.3547**	**6.22039**	**14.4222**	**2.40162**	**39.2853**	**51.6955**	**132.486**	**174.339**
460	**2000**	**27.871**	**6.1898**	**10.6277**	**2.36029**	**30.3327**	**52.0722**	**100.94**	**173.284**
470	**2000**	**21.9172**	**6.13771**	**8.29846**	**2.32391**	**24.7899**	**52.4777**	**80.1187**	**169.603**
480	**2000**	**17.806**	**6.06371**	**6.72047**	**2.28861**	**21.0134**	**52.8844**	**64.9187**	**163.381**
490	**2000**	**14.7755**	**5.96562**	**5.57881**	**2.25245**	**18.2686**	**53.275**	**53.0501**	**154.705**
500	**2000**	**12.4269**	**5.83924**	**4.70227**	**2.20953**	**16.1688**	**53.6111**	**43.3388**	**143.699**
510	**2000**	**10.5397**	**5.68249**	**3.99985**	**2.15651**	**14.5007**	**53.8742**	**35.1194**	**130.479**
520	**2000**	**8.97341**	**5.49012**	**3.41068**	**2.08673**	**13.128**	**54.0258**	**27.9918**	**115.195**
530	**2000**	**7.64699**	**5.26195**	**2.90494**	**1.99891**	**11.9733**	**54.0667**	**21.6945**	**97.9635**

Continued …

540	2000	6.49656	4.99165	2.45375	1.88535	10.9748	53.9576	16.0583	78.9507
550	2000	29.9122	17.8511	25.6751	15.3224	35.5927	153.689	9.65841	41.705
560	2000	4.57768	4.31218	1.66035	1.56406	9.30779	53.2424	6.31914	36.1468
570	2000	3.75705	3.89303	1.2978	1.34477	8.58989	52.5976	2.06655	12.6539
580	2000	3.00348	3.41158	0.94982	1.07888	7.92791	51.7454	1.84621	12.0502
590	2000	2.30936	2.86728	0.61102	0.75864	7.30933	50.6661	5.45737	37.8288
600	2000	1.66219	2.25044	0.27876	0.37741	6.72599	49.3506	8.79957	64.5651
620	2000	0.48102	0.7701	0.37313	0.59737	5.64157	45.985	14.7842	120.507
640	2000	0.58953	1.11057	1.02429	1.92959	4.62983	41.5245	19.9709	179.117
660	2000	1.58173	3.49752	1.68154	3.71823	3.66645	35.8971	24.5011	239.883
680	2000	2.51988	6.54075	2.35482	6.11232	2.72883	28.9722	28.485	302.428
700	2000	3.42714	10.4707	3.05187	9.32414	1.80014	20.6095	32.0154	366.538
720	2000	4.31697	15.6116	3.77562	13.6539	0.87077	10.6985	35.1771	432.193
740	2000	5.20471	22.488	4.53255	19.5838	7.089423E-	0.93086	38.0386	499.459
760	2000	6.09737	31.9244	5.32402	27.8753	1.03005	14.4017	40.6669	568.589
410	1800	107.997	5.6191	43.7739	2.27757	98.1073	44.786	274.224	125.183
420	1800	984.48	5.65028	386.376	2.21755	914.011	45.0608	2764.94	136.312
430	1800	133.281	5.65896	51.0917	2.1693	127.24	45.4247	405.245	144.673
440	1800	60.9704	5.65068	22.9858	2.1303	60.1254	45.8516	197.076	150.29
450	1800	38.7814	5.62406	14.4784	2.09966	39.687	46.3345	131.206	153.182
460	1800	27.9358	5.57642	10.394	2.07481	29.8019	46.8456	97.5917	153.405
470	1800	21.4489	5.50452	7.99073	2.0507	23.9596	47.3465	76.432	151.037
480	1800	17.0984	5.40705	6.40201	2.02452	20.0899	47.818	61.4063	146.159
490	1800	13.9536	5.2825	5.26517	1.99326	17.326	48.2406	49.8745	138.866
500	1800	11.5485	5.12635	4.39469	1.9508	15.2332	48.5742	40.5459	129.289

510	**1800**	**9.63599**	**4.93745**	**3.69663**	**1.89414**	**13.5829**	**48.8087**	**32.7115**	**117.545**
520	**1800**	**8.06325**	**4.71163**	**3.11182**	**1.81834**	**12.2325**	**48.913**	**25.9556**	**103.786**
530	**1800**	**6.73584**	**4.44552**	**2.60362**	**1.71833**	**11.095**	**48.8669**	**20.0166**	**88.1612**
540	**1800**	**180.531**	**34.3951**	**171.385**	**32.6525**	**192.544**	**348.659**	**126.563**	**229.181**
550	**1800**	**4.58825**	**3.77895**	**1.73244**	**1.42687**	**9.2485**	**48.2587**	**9.9523**	**51.9311**
560	**1800**	**3.69621**	**3.37195**	**1.34453**	**1.22658**	**8.47438**	**47.6752**	**5.62225**	**31.6297**
570	**1800**	**2.89087**	**2.90836**	**0.97514**	**0.98104**	**7.76835**	**46.8774**	**1.67108**	**10.084**
580	**1800**	**2.15509**	**2.38215**	**0.62075**	**0.68615**	**7.1178**	**45.865**	**1.95132**	**12.5738**
590	**1800**	**1.47995**	**1.79183**	**0.27567**	**0.33376**	**6.50992**	**44.6177**	**5.28163**	**36.1992**
600	**1800**	**0.85306**	**1.12838**	**0.06164**	**8.15E-02**	**5.9377**	**43.135**	**8.35276**	**60.6794**
740	**1800**	**5.82262**	**25.0999**	**5.00901**	**21.5926**	**0.84581**	**11.101**	**34.3709**	**451.105**
760	**1800**	**6.71472**	**35.2289**	**5.83292**	**30.6026**	**1.825**	**25.5248**	**36.5904**	**511.761**
410	**1600**	**74.882**	**5.10499**	**28.7892**	**1.96267**	**64.3831**	**39.1771**	**162.829**	**99.0812**
420	**1600**	**226.483**	**5.12413**	**85.1527**	**1.92656**	**200.658**	**39.6701**	**563.188**	**111.342**
430	**1600**	**206.2**	**5.12329**	**76.5282**	**1.90143**	**189.333**	**40.2333**	**568.694**	**120.847**
440	**1600**	**68.6261**	**5.10219**	**25.3581**	**1.88531**	**65.6518**	**40.8485**	**205.095**	**127.61**
450	**1600**	**40.1485**	**5.05919**	**14.8792**	**1.87495**	**40.2156**	**41.4865**	**127.634**	**131.668**
460	**1600**	**27.7283**	**4.9911**	**10.3635**	**1.86544**	**29.2208**	**42.1072**	**92.3578**	**133.088**
470	**1600**	**20.7143**	**4.8979**	**7.84398**	**1.85471**	**23.0758**	**42.6994**	**71.2957**	**131.926**
480	**1600**	**16.1632**	**4.7769**	**6.22233**	**1.83896**	**19.1291**	**43.2319**	**56.7597**	**128.277**
490	**1600**	**12.9333**	**4.62364**	**5.06734**	**1.81156**	**16.3522**	**43.6619**	**45.791**	**122.267**
500	**1600**	**10.505**	**4.43828**	**4.19176**	**1.77098**	**14.2788**	**43.9872**	**37.0053**	**113.999**
510	**1600**	**8.5919**	**4.21671**	**3.48699**	**1.71134**	**12.6514**	**44.1747**	**29.6773**	**103.624**
520	**1600**	**7.03062**	**3.95554**	**2.89277**	**1.62752**	**11.3234**	**44.2009**	**23.3893**	**91.3**
530	**1600**	**5.7246**	**3.65374**	**2.3767**	**1.51694**	**10.2095**	**44.0631**	**17.8811**	**77.1729**
540	**1600**	**4.60568**	**3.30693**	**1.91245**	**1.37316**	**9.24875**	**43.7373**	**12.9875**	**61.4181**

550	1600	3.63145	2.91313	1.48811	1.19376	8.40434	43.221	8.59352	44.1939
560	1600	2.76981	2.46839	1.09188	0.97306	7.64823	42.5012	4.61886	25.667
570	1600	1.99564	1.96649	0.71407	0.70364	6.95836	41.5553	1.00629	6.00955
580	1600	1.29149	1.40159	0.35227	0.38231	6.32342	40.3909	2.29272	14.6448
490	1000	8.42864	2.78736	5.97236	1.97507	13.73	34.5954	25.9655	65.4252
500	1000	6.31709	2.52617	4.88673	1.95418	11.7518	34.8194	20.2671	60.0493
510	1000	4.71409	2.2308	4.01835	1.90156	10.2206	34.8205	15.487	52.7625
520	1000	3.44942	1.90052	3.29078	1.81312	8.9822	34.594	11.3703	43.7916
530	1000	2.42183	1.53416	2.6595	1.68472	7.94607	34.1371	7.7683	33.3734
540	1000	1.56053	1.12538	2.09028	1.50741	7.04857	33.4173	4.59294	21.7751
550	1000	0.81747	0.66579	1.56342	1.27333	6.25059	32.4156	1.78199	9.24142
560	1000	0.17057	0.15587	1.06773	0.97576	5.52748	31.1247	0.71262	4.01267
570	1000	0.41369	0.42199	0.58746	0.59925	4.85357	29.4903	2.92123	17.7494
580	1000	0.94953	1.07646	0.11969	0.13569	4.21894	27.5121	4.87832	31.812
590	1000	1.45227	1.82348	0.34348	0.43127	3.6102	25.1501	6.60771	46.032

Table B-2: Nitrogen

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
300	1900	1.09466	6.39354	7.34408	42.8942	0.15775	0.92137	1.2543	7.32592
310	1900	1.16357	6.72055	7.12785	41.1689	0.08481	0.48984	1.90624	11.0101

320	1900	1.21758	6.96862	6.9184	39.5965	1.06E-02	6.04E-02	2.48877	14.2442
330	1900	1.25839	7.14927	6.71606	38.1558	6.38E-02	0.3622	3.01054	17.1037
340	1900	1.28647	7.26634	6.51972	36.825	0.13874	0.78365	3.47738	19.6411
350	1900	1.30537	7.33938	6.3311	35.5961	0.21166	1.19007	3.89751	21.9135
360	1900	1.31521	7.3692	6.14911	34.4538	0.28323	1.58694	4.27509	23.9535
370	1900	1.31762	7.36431	5.97415	33.3902	0.35255	1.97042	4.61522	25.795
380	1900	1.31343	7.3289	5.80586	32.3965	0.41952	2.34089	4.92168	27.4628
390	1900	1.30354	7.26731	5.64398	31.4654	0.48408	2.69876	5.19785	28.9782
400	1900	1.28918	7.18543	5.48891	30.5934	0.54544	3.04009	5.44739	30.3619
420	1900	1.24804	6.96471	5.19631	28.9981	0.66045	3.68564	5.87488	32.7849
440	1900	1.19589	6.69412	4.92733	27.5811	0.76329	4.2726	6.22298	34.8337
460	1900	1.13656	6.39072	4.68031	26.3168	0.85401	4.80202	6.50587	36.5817
480	1900	1.07289	6.0671	4.45363	25.1847	0.93313	5.27677	6.73469	38.0839
500	1900	1.00732	5.73403	4.24572	24.1683	1.00094	5.69774	6.91874	39.3842
520	1900	0.94161	5.39967	4.05519	23.2544	1.0581	6.06766	7.06537	40.5162
540	1900	0.87728	5.07098	3.88083	22.4327	1.10511	6.3879	7.18076	41.5075
560	1900	0.81467	4.74923	3.7208	21.691	1.14325	6.66475	7.26937	42.3778
580	1900	0.75515	4.44158	3.57451	21.0241	1.1726	6.8968	7.33586	43.147
600	1900	0.69889	4.14868	3.44063	20.4238	1.19407	7.08809	7.38346	43.8287
620	1900	0.64574	3.86973	3.31767	19.8819	1.20883	7.2442	7.41457	44.4334
640	1900	0.59641	3.60899	3.20522	19.3953	1.21695	7.36394	7.43212	44.973
660	1900	0.5503	3.36311	3.10178	18.9562	1.21969	7.45405	7.43752	45.4537
680	1900	0.50731	3.13176	3.00647	18.5598	1.2177	7.51722	7.43243	45.8825
700	1900	0.46779	2.91737	2.91896	18.2042	1.21109	7.553	7.41867	46.2668
720	1900	0.43088	2.71505	2.83788	17.8822	1.20106	7.56817	7.39684	46.6093

740	1900	0.39664	2.52552	2.76281	17.5916	1.18787	7.56354	7.36817	46.9152
760	1900	0.36514	2.34949	2.69341	17.3307	1.17171	7.53937	7.3338	47.1891
780	1900	0.33575	2.18336	2.62871	17.0943	1.15343	7.50063	7.29407	47.4327
800	1900	0.30792	2.02383	2.56789	16.8779	1.13372	7.45162	7.24933	47.6476
850	1900	0.24573	1.6592	2.43179	16.4197	1.07854	7.28242	7.12087	48.0809
900	1900	0.19038	1.32108	2.31251	16.0465	1.01973	7.07589	6.97265	48.3834
950	1900	0.13904	0.99185	2.20508	15.73	0.96099	6.85522	6.80947	48.5753
1000	1900	9.04E-02	0.66338	2.10671	15.4534	0.90405	6.63149	6.63579	48.6756
1050	1900	4.31E-02	0.32527	2.01485	15.2009	0.46377	3.4989	6.4546	48.6965
1100	1900	3.25E-03	0.02517	1.92831	14.9648	5.98E-02	0.46375	6.26894	48.6509
1150	1900	0.04826	0.38532	1.84679	14.7432	0.52564	4.19624	6.08171	48.551
1200	1900	9.07E-02	0.74433	1.7711	14.542	0.94241	7.73789	5.89613	48.4114
300	2000	1.0546	5.55297	7.4505	39.2303	0.15053	0.79264	1.09231	5.75149
310	2000	1.12992	5.91017	7.24312	37.886	8.61E-02	0.45017	1.74266	9.11517
320	2000	1.18923	6.18881	7.04057	36.6397	1.84E-02	9.59E-02	2.32431	12.0959
330	2000	1.23638	6.40961	6.84494	35.4854	0.0493	0.25559	2.84731	14.761
340	2000	1.27044	6.56867	6.65429	34.4052	0.11851	0.61274	3.3164	17.147
350	2000	1.29428	6.68055	6.46996	33.3952	0.18723	0.96639	3.73879	19.2981
360	2000	1.30958	6.75353	6.29219	32.449	0.25445	1.31224	4.12003	21.2471
370	2000	1.31644	6.78803	6.12005	31.5574	0.32083	1.65433	4.46356	23.0158
380	2000	1.31712	6.7949	5.9547	30.7198	0.38467	1.98446	4.77456	24.6315
390	2000	1.31098	6.77058	5.79453	29.926	0.44734	2.31029	5.05484	26.1059

400	**2000**	**1.30017**	**6.72533**	**5.6407**	**29.1774**	**0.50725**	**2.62383**	**5.30875**	**27.4603**
420	**2000**	**1.26654**	**6.58023**	**5.35063**	**27.7988**	**0.6192**	**3.217**	**5.74671**	**29.8566**
440	**2000**	**1.21983**	**6.37441**	**5.08208**	**26.5573**	**0.72105**	**3.76796**	**6.10489**	**31.9021**
460	**2000**	**1.16472**	**6.12855**	**4.83439**	**25.4377**	**0.8119**	**4.27205**	**6.39789**	**33.6646**
480	**2000**	**1.10466**	**5.85768**	**4.60657**	**24.4274**	**0.89144**	**4.72708**	**6.63723**	**35.1955**
500	**2000**	**1.04169**	**5.57062**	**4.39687**	**23.5131**	**0.96043**	**5.13611**	**6.83149**	**36.5328**
520	**2000**	**0.97805**	**5.27746**	**4.20455**	**22.6874**	**1.01885**	**5.49764**	**6.98844**	**37.709**
540	**2000**	**0.91439**	**4.98074**	**4.02734**	**21.9372**	**1.06812**	**5.81812**	**7.11325**	**38.7462**
560	**2000**	**0.8527**	**4.69025**	**3.86506**	**21.2597**	**1.10789**	**6.0939**	**7.21173**	**39.668**
580	**2000**	**0.79288**	**4.40525**	**3.71571**	**20.6448**	**1.13969**	**6.33216**	**7.28714**	**40.488**
600	**2000**	**0.73624**	**4.13279**	**3.57903**	**20.0903**	**1.16333**	**6.53019**	**7.34363**	**41.2225**
620	**2000**	**0.68216**	**3.86945**	**3.45307**	**19.587**	**1.18045**	**6.69591**	**7.38314**	**41.8797**
640	**2000**	**0.63148**	**3.62008**	**3.33751**	**19.1329**	**1.19105**	**6.82791**	**7.40862**	**42.4712**
660	**2000**	**0.58409**	**3.38439**	**3.23129**	**18.723**	**1.19592**	**6.92947**	**7.42188**	**43.0045**
680	**2000**	**0.53952**	**3.16004**	**3.13314**	**18.3513**	**1.19611**	**7.00583**	**7.42419**	**43.4847**
700	**2000**	**0.49815**	**2.94963**	**3.04275**	**18.0164**	**1.19171**	**7.0562**	**7.41741**	**43.9192**
720	**2000**	**0.45962**	**2.7513**	**2.95917**	**17.7139**	**1.18349**	**7.08449**	**7.40249**	**44.312**
740	**2000**	**0.42359**	**2.56364**	**2.8816**	**17.4398**	**1.17212**	**7.09378**	**7.38033**	**44.6667**
760	**2000**	**0.39017**	**2.38749**	**2.8097**	**17.1928**	**1.15775**	**7.08437**	**7.35207**	**44.988**
780	**2000**	**0.35877**	**2.21974**	**2.74255**	**16.9683**	**1.14121**	**7.06074**	**7.3181**	**45.2776**
800	**2000**	**0.32923**	**2.05964**	**2.67966**	**16.764**	**1.12286**	**7.02464**	**7.27911**	**45.5383**
850	**2000**	**0.26211**	**1.68608**	**2.53807**	**16.3268**	**1.07132**	**6.89153**	**7.16312**	**46.0785**
900	**2000**	**0.20255**	**1.33993**	**2.41433**	**15.972**	**1.01509**	**6.71531**	**7.02621**	**46.4821**
950	**2000**	**0.14747**	**1.00348**	**2.30311**	**15.6719**	**0.95822**	**6.52034**	**6.87306**	**46.769**
1000	**2000**	**9.48E-02**	**0.66391**	**2.20077**	**15.4063**	**0.90331**	**6.32356**	**6.70753**	**46.9555**
1050	**2000**	**4.42E-**	**0.31808**	**2.1056**	**15.1654**	**0.45647**	**3.28768**	**6.53363**	**47.058**

		02							
1100	2000	5.13E-03	3.80E-02	2.01617	14.9409	7.66E-02	0.56733	6.35429	47.0888
1150	2000	5.25E-02	0.40007	1.93235	14.7325	0.55207	4.2091	6.17274	47.0618
1200	2000	9.71E-02	0.76126	1.85442	14.5429	0.97806	7.67026	5.99186	46.9897
300	2200	0.97215	4.3195	7.61303	33.8267	0.10582	0.4702	0.78189	3.47416
310	2200	1.05805	4.69892	7.42366	32.9693	5.82E-02	0.2585	1.42809	6.3423
320	2200	1.12813	5.01211	7.23711	32.1536	5.76E-03	2.56E-02	2.00863	8.92407
330	2200	1.18505	5.27093	7.05484	31.379	4.92E-02	0.21907	2.53209	11.2624
340	2200	1.22893	5.47593	6.87594	30.6382	0.10713	0.47732	3.00367	13.3839
350	2200	1.26232	5.63793	6.70177	29.9322	0.16581	0.74058	3.43014	15.32
360	2200	1.28691	5.7639	6.53288	29.2597	0.22427	1.00448	3.81673	17.0945
370	2200	1.30258	5.85297	6.3684	28.6157	0.28296	1.27146	4.16664	18.7223
380	2200	1.31026	5.90892	6.20826	27.9976	0.34159	1.54047	4.48345	20.2192
390	2200	1.31211	5.94055	6.05374	27.4083	0.39851	1.80426	4.77161	21.6035
400	2200	1.30881	5.95054	5.90454	26.8452	0.45356	2.06214	5.03385	22.8866
420	2200	1.28732	5.90658	5.62007	25.7864	0.55938	2.56658	5.48824	25.1816
440	2200	1.25155	5.79955	5.35507	24.8148	0.65701	3.0445	5.86433	27.1747
460	2200	1.20526	5.64391	5.10868	23.9225	0.74579	3.49229	6.17551	28.9181
480	2200	1.15215	5.4544	4.88035	23.1041	0.82503	3.90576	6.43297	30.4544
500	2200	1.09484	5.24169	4.66917	22.3543	0.89461	4.28305	6.64555	31.8164
520	2200	1.03524	5.01359	4.47407	21.6676	0.95482	4.62412	6.82032	33.0303
540	2200	0.97461	4.77538	4.29366	21.0381	1.00633	4.93085	6.96279	34.1163

560	2200	0.9145	4.53406	4.12736	20.4632	1.04914	5.20159	7.07823	35.0934
580	2200	0.85552	4.29233	3.97393	19.9381	1.08413	5.43928	7.1703	35.9749
600	2200	0.79861	4.0549	3.83255	19.4595	1.11149	5.64346	7.24265	36.774
620	2200	0.74379	3.82201	3.70194	19.0226	1.13223	5.81802	7.29766	37.4994
640	2200	0.69196	3.59842	3.58182	18.6268	1.14632	5.96125	7.33824	38.1614
660	2200	0.6427	3.38244	3.4708	18.2665	1.15493	6.07824	7.36581	38.7655
680	2200	0.59603	3.17455	3.36807	17.9388	1.15859	6.17083	7.38204	39.3178
700	2200	0.55208	2.97571	3.27298	17.6414	1.15778	6.24044	7.38843	39.8238
720	2200	0.5109	2.7867	3.18499	17.3725	1.15283	6.28804	7.38632	40.2885
740	2200	0.47188	2.6046	3.10297	17.1271	1.14474	6.31852	7.37627	40.714
760	2200	0.43338	2.42078	3.02484	16.8961	1.13551	6.34269	7.35776	41.0989
780	2200	0.40067	2.26445	2.95536	16.7026	1.12001	6.32987	7.33664	41.464
800	2200	0.36785	2.10362	2.88841	16.5177	1.10448	6.31611	7.30818	41.7927
850	2200	0.29292	1.725	2.73776	16.1224	1.05887	6.23553	7.21683	42.4992
900	2200	0.22561	1.36798	2.60572	15.7998	1.00766	6.10993	7.10165	43.0608
950	2200	0.16296	1.01733	2.48682	15.5249	0.95514	5.96281	6.96743	43.4967
1000	2200	0.10402	0.66856	2.37829	15.2852	0.903	5.80355	6.8192	43.8268
1050	2200	4.73E-02	0.31265	2.27728	15.0666	0.4445	2.94082	6.66017	44.0639
1100	2200	7.54E-03	5.14E-02	2.18262	14.8634	0.10548	0.71833	6.49382	44.2223
1150	2200	5.98E-02	0.41882	2.09417	14.676	0.59793	4.19029	6.32367	44.3162
1200	2200	0.10886	0.78487	2.01191	14.5054	1.04044	7.50133	6.15251	44.3581
300	2400	0.88897	3.45364	7.71898	29.9883	2.71E-02	0.10542	0.48538	1.8857
310	2400	0.98335	3.83316	7.54751	29.4208	4.02E-03	1.57E-02	1.1266	4.39157

320	2400	1.06203	4.15587	7.37716	28.8679	4.14E-02	0.16215	1.70498	6.67181
330	2400	1.12693	4.42874	7.20883	28.3303	8.35E-02	0.32825	2.22781	8.75516
340	2400	1.17966	4.65759	7.04309	27.8079	0.12891	0.50896	2.70143	10.6659
350	2400	1.22113	4.84535	6.88005	27.2995	0.17704	0.70247	3.13073	12.4225
360	2400	1.25284	4.99728	6.72039	26.8061	0.22672	0.90432	3.52067	14.0432
370	2400	1.27559	5.11602	6.56409	26.3266	0.27756	1.1132	3.87505	15.5416
380	2400	1.29093	5.20702	6.41178	25.8621	0.32853	1.32513	4.19781	16.932
390	2400	1.29935	5.27172	6.26343	25.4119	0.37931	1.53894	4.49195	18.2247
400	2400	1.30168	5.31296	6.11904	24.9755	0.42965	1.75365	4.76008	19.4288
420	2400	1.29126	5.33598	5.84265	24.1441	0.52734	2.17916	5.22818	21.6048
440	2400	1.26516	5.29506	5.58333	23.3678	0.61915	2.59136	5.61905	23.5174
460	2400	1.22779	5.20564	5.34096	22.6451	0.70353	2.98285	5.94613	25.2109
480	2400	1.18155	5.07593	5.11434	21.9711	0.78062	3.35349	6.21913	26.7172
500	2400	1.12969	4.91783	4.90343	21.3458	0.84944	3.69781	6.44718	28.0661
520	2400	1.07426	4.73907	4.70738	20.7664	0.91003	4.01459	6.63719	29.2797
540	2400	1.01753	4.54877	4.526	20.2331	0.96188	4.30001	6.79547	30.3786
560	2400	0.95971	4.34761	4.35741	19.7397	1.00634	4.55884	6.92577	31.3747
580	2400	0.90244	4.14255	4.20137	19.2861	1.04313	4.78842	7.03261	32.2827
600	2400	0.84623	3.93602	4.05687	18.8694	1.07286	4.99014	7.11913	33.1127
620	2400	0.79173	3.73098	3.92314	18.4877	1.09596	5.16465	7.18814	33.8739
640	2400	0.73943	3.5301	3.79951	18.1391	1.11277	5.31246	7.24207	34.5741
660	2400	0.68945	3.33419	3.68518	17.8217	1.12395	5.43544	7.28276	35.2198
680	2400	0.64149	3.14228	3.5788	17.5305	1.1304	5.5372	7.31149	35.8148
700	2400	0.59613	2.95746	3.48028	17.2661	1.13215	5.6167	7.33014	36.3656
720	2400	0.55272	2.77697	3.38835	17.0238	1.13025	5.67863	7.33935	36.8745

740	**2400**	**0.51185**	**2.60409**	**3.30301**	**16.8045**	**1.12454**	**5.72124**	**7.34073**	**37.3469**
760	**2400**	**0.47299**	**2.43661**	**3.22327**	**16.6044**	**1.11589**	**5.74843**	**7.33478**	**37.7846**
780	**2400**	**0.43606**	**2.27434**	**3.14859**	**16.4218**	**1.10469**	**5.76165**	**7.32228**	**38.1903**
800	**2400**	**0.40061**	**2.11535**	**3.0782**	**16.2538**	**1.09162**	**5.76406**	**7.30364**	**38.5654**
850	**2400**	**0.31934**	**1.73842**	**2.91984**	**15.895**	**1.05113**	**5.72215**	**7.23547**	**39.3885**
900	**2400**	**0.24548**	**1.37728**	**2.78062**	**15.6005**	**1.00442**	**5.63519**	**7.14098**	**40.064**
950	**2400**	**0.17706**	**1.02355**	**2.6558**	**15.3519**	**0.95502**	**5.52046**	**7.02582**	**40.6129**
1000	**2400**	**0.11216**	**0.66787**	**2.54147**	**15.1329**	**0.90581**	**5.39356**	**6.89416**	**41.0505**
1050	**2400**	**0.05001**	**0.30667**	**2.43542**	**14.9343**	**0.43743**	**2.68233**	**6.75002**	**41.3919**
1100	**2400**	**9.54E-03**	**6.02E-02**	**2.33643**	**14.7512**	**0.12739**	**0.80431**	**6.59709**	**41.6512**
1150	**2400**	**6.66E-02**	**0.43267**	**2.2436**	**14.5803**	**0.63431**	**4.12212**	**6.43834**	**41.8403**
1200	**2400**	**0.11956**	**0.79944**	**2.15787**	**14.4284**	**1.09173**	**7.29976**	**6.27771**	**41.9752**
300	**2600**	**0.80653**	**2.8083**	**7.77815**	**27.0831**	**7.98E-02**	**0.27784**	**0.19854**	**0.69131**
310	**2600**	**0.90833**	**3.18131**	**7.62514**	**26.7061**	**9.41E-02**	**0.32958**	**0.83534**	**2.92566**
320	**2600**	**0.99418**	**3.50341**	**7.471**	**26.3273**	**0.11667**	**0.41114**	**1.4111**	**4.97263**
330	**2600**	**1.06583**	**3.77997**	**7.31671**	**25.9487**	**0.1458**	**0.51708**	**1.93274**	**6.85446**
340	**2600**	**1.12538**	**4.01747**	**7.16382**	**25.5739**	**0.17926**	**0.63994**	**2.40696**	**8.59254**
350	**2600**	**1.17306**	**4.21601**	**7.01183**	**25.2008**	**0.21715**	**0.78045**	**2.83765**	**10.1987**
360	**2600**	**1.21104**	**4.3826**	**6.86225**	**24.8336**	**0.25749**	**0.93181**	**3.23025**	**11.6899**
370	**2600**	**1.24009**	**4.51924**	**6.71498**	**24.4714**	**0.29981**	**1.0926**	**3.5883**	**13.0768**
380	**2600**	**1.26151**	**4.63001**	**6.57082**	**24.1163**	**0.34303**	**1.25897**	**3.9156**	**14.3711**
390	**2600**	**1.27537**	**4.7146**	**6.42919**	**23.7664**	**0.38746**	**1.43229**	**4.21433**	**15.5788**
400	**2600**	**1.28361**	**4.77943**	**6.29134**	**23.4254**	**0.43146**	**1.60653**	**4.48823**	**16.7116**

420	**2600**	**1.2832**	**4.84821**	**6.02489**	**22.7633**	**0.51956**	**1.96301**	**4.96799**	**18.7701**
440	**2600**	**1.26613**	**4.85452**	**5.77303**	**22.1347**	**0.60394**	**2.31559**	**5.37172**	**20.596**
460	**2600**	**1.23567**	**4.80814**	**5.53518**	**21.538**	**0.68382**	**2.66084**	**5.71132**	**22.2234**
480	**2600**	**1.19642**	**4.72442**	**5.31256**	**20.9782**	**0.75683**	**2.98858**	**5.99828**	**23.686**
500	**2600**	**1.15004**	**4.60838**	**5.10363**	**20.4511**	**0.82344**	**3.29965**	**6.23993**	**25.0044**
520	**2600**	**1.09945**	**4.47037**	**4.90887**	**19.9594**	**0.88244**	**3.58795**	**6.4439**	**26.2008**
540	**2600**	**1.04609**	**4.31536**	**4.72728**	**19.5011**	**0.93413**	**3.85347**	**6.61549**	**27.2904**
560	**2600**	**0.99119**	**4.14794**	**4.55811**	**19.0748**	**0.97873**	**4.09584**	**6.75923**	**28.2862**
580	**2600**	**0.93592**	**3.97269**	**4.40077**	**18.6799**	**1.01636**	**4.31414**	**6.87915**	**29.1998**
600	**2600**	**0.88096**	**3.79236**	**4.2544**	**18.3145**	**1.04747**	**4.50915**	**6.97832**	**30.0404**
620	**2600**	**0.82738**	**3.61163**	**4.11872**	**17.9787**	**1.07197**	**4.67926**	**7.0599**	**30.8173**
640	**2600**	**0.7753**	**3.43118**	**3.99271**	**17.6701**	**1.09056**	**4.82641**	**7.12593**	**31.5365**
660	**2600**	**0.72494**	**3.25228**	**3.87558**	**17.3869**	**1.10383**	**4.9521**	**7.17823**	**32.2034**
680	**2600**	**0.67648**	**3.07602**	**3.76663**	**17.1272**	**1.11223**	**5.05739**	**7.21847**	**32.8231**
700	**2600**	**0.63012**	**2.90366**	**3.66529**	**16.89**	**1.11609**	**5.1431**	**7.2481**	**33.4**
720	**2600**	**0.58605**	**2.73645**	**3.57119**	**16.6748**	**1.11574**	**5.20965**	**7.2685**	**33.9385**
740	**2600**	**0.54343**	**2.57083**	**3.48273**	**16.4758**	**1.11242**	**5.26253**	**7.27991**	**34.4391**
760	**2600**	**0.50288**	**2.41**	**3.40012**	**16.2946**	**1.10589**	**5.29979**	**7.28387**	**34.9069**
780	**2600**	**0.46432**	**2.25389**	**3.32284**	**16.1298**	**1.09649**	**5.32262**	**7.28114**	**35.3442**
800	**2600**	**0.42735**	**2.10101**	**3.25012**	**15.9788**	**1.08493**	**5.3339**	**7.27213**	**35.7524**
850	**2600**	**0.34101**	**1.72997**	**3.08531**	**15.6521**	**1.04878**	**5.32056**	**7.22573**	**36.657**
900	**2600**	**0.26204**	**1.37105**	**2.9403**	**15.3841**	**1.00562**	**5.26151**	**7.15118**	**37.416**
950	**2600**	**0.18818**	**1.015**	**2.80987**	**15.156**	**0.95949**	**5.17541**	**7.05376**	**38.047**
1000	**2600**	**0.11834**	**0.65776**	**2.69076**	**14.9565**	**0.91265**	**5.07299**	**6.93842**	**38.5671**
1050	**2600**	**0.05159**	**0.29545**	**2.5805**	**14.7764**	**0.43571**	**2.49498**	**6.80909**	**38.99**
1100	**2600**	**1.23E-02**	**7.27E-02**	**2.47763**	**14.6103**	**0.14182**	**0.83631**	**6.66939**	**39.3287**

1150	2600	0.07322	0.44449	2.38151	14.4568	0.66194	4.01827	6.52268	39.5957
1200	2600	0.12999	0.81198	2.29254	14.32	1.1324	7.07335	6.37257	39.8052
300	2800	0.7269	2.30979	7.79958	24.7839	0.20883	0.66356	8.009126E-	0.25449
310	2800	0.83345	2.66845	7.66326	24.5354	0.2083	0.66692	0.55081	1.76351
320	2800	0.92539	2.98563	7.52522	24.2791	0.21623	0.69762	1.12392	3.62615
330	2800	1.00263	3.2602	7.38518	24.0139	0.2324	0.75566	1.64417	5.34625
340	2800	1.06818	3.50079	7.24544	23.7458	0.25379	0.83174	2.11871	6.94375
350	2800	1.12142	3.70469	7.10493	23.4716	0.28113	0.92874	2.55046	8.42563
360	2800	1.16497	3.87952	6.96581	23.1971	0.31171	1.03804	2.94529	9.80822
370	2800	1.19963	4.0272	6.82821	22.9225	0.345	1.1582	3.30656	11.1002
380	2800	1.22543	4.14721	6.69177	22.6469	0.38121	1.29012	3.63665	12.3075
390	2800	1.2443	4.24532	6.55767	22.3735	0.41858	1.42811	3.9395	13.4408
400	2800	1.25688	4.32308	6.4261	22.1028	0.45674	1.57097	4.2175	14.5062
420	2800	1.26541	4.42341	6.17095	21.5713	0.53414	1.86715	4.70745	16.4555
440	2800	1.25626	4.4627	5.92768	21.0573	0.61034	2.16815	5.12209	18.1956
460	2800	1.23296	4.45063	5.69658	20.5629	0.6837	2.46794	5.47345	19.7575
480	2800	1.19962	4.39947	5.4785	20.0918	0.75218	2.75854	5.77215	21.1687
500	2800	1.15883	4.31707	5.27336	19.6453	0.81498	3.03611	6.02627	22.4502
520	2800	1.11212	4.2079	5.08036	19.2225	0.87222	3.30022	6.24185	23.6172
540	2800	1.06234	4.08165	4.89995	18.8262	0.92259	3.54469	6.42543	24.6873
560	2800	1.01068	3.94232	4.73158	18.4563	0.96616	3.76865	6.58144	25.672
580	2800	0.95749	3.79106	4.57388	18.1097	1.00388	3.9747	6.71291	26.579
600	2800	0.90479	3.63551	4.42738	17.7896	1.03474	4.15768	6.82416	27.4201
620	2800	0.85237	3.47499	4.29063	17.4924	1.05994	4.32128	6.91705	28.2001
640	2800	0.80089	3.31229	4.16313	17.2178	1.07963	4.46509	6.994	28.9256
660	2800	0.75099	3.15015	4.04453	16.9655	1.09391	4.58858	7.05723	29.6027

680	2800	0.70248	2.98813	3.9338	16.733	1.10359	4.69428	7.10796	30.2348
700	2800	0.65565	2.82764	3.83043	16.5195	1.10897	4.7827	7.1477	30.826
720	2800	0.61073	2.67	3.734	16.3245	1.11031	4.85407	7.1778	31.3802
740	2800	0.56728	2.51366	3.64351	16.1448	1.10845	4.91167	7.19886	31.899
760	2800	0.52593	2.36164	3.55905	15.9818	1.10314	4.9536	7.21238	32.3869
780	2800	0.48595	2.2111	3.47956	15.832	1.09542	4.98414	7.2185	32.8441
800	2800	0.44737	2.06227	3.40448	15.6938	1.08556	5.00415	7.21798	33.273
850	2800	0.35748	1.70159	3.23482	15.3974	1.05252	5.00989	7.19243	34.2353
900	2800	0.27417	1.34672	3.08481	15.1521	1.0125	4.97323	7.1366	35.0538
950	2800	0.19638	0.99484	2.95026	14.9453	0.96853	4.90631	7.05678	35.748
1000	2800	0.12238	0.63905	2.82715	14.7636	0.92362	4.8232	6.95727	36.3312
1050	2800	5.17E-02	0.27813	2.71334	14.6	0.43933	2.36392	6.84241	36.8177
1100	2800	1.61E-02	8.93E-02	2.60716	14.4491	0.14925	0.82717	6.71572	37.2192
1150	2800	8.05E-02	0.45917	2.50818	14.3109	0.68098	3.88548	6.58094	37.5489
1200	2800	0.14053	0.82506	2.41659	14.1882	1.16323	6.82958	6.44157	37.8196
300	3000	0.64842	1.90634	7.78773	22.8959	0.35808	1.05276	0.35446	1.0421
310	3000	0.76051	2.25541	7.66918	22.7441	0.34152	1.01282	0.27247	0.80805
320	3000	0.85701	2.56389	7.54649	22.5767	0.33574	1.00444	0.84235	2.52005
330	3000	0.93929	2.83484	7.42072	22.3962	0.33899	1.0231	1.3613	4.10849
340	3000	1.00882	3.07162	7.29299	22.2053	0.34963	1.06452	1.83475	5.58634
350	3000	1.06758	3.27922	7.16489	22.0079	0.36552	1.12277	2.2681	6.96678
360	3000	1.11561	3.45705	7.03609	21.8034	0.38669	1.19827	2.66435	8.25627
370	3000	1.15432	3.60857	6.90746	21.5938	0.41185	1.28752	3.02739	9.46407
380	3000	1.18479	3.73645	6.7798	21.3814	0.43984	1.38712	3.36068	10.5985

390	**3000**	**1.20837**	**3.84423**	**6.65387**	**21.1683**	**0.46959**	**1.49392**	**3.66739**	**11.6672**
400	**3000**	**1.22504**	**3.93133**	**6.5293**	**20.9535**	**0.50128**	**1.60868**	**3.94925**	**12.6737**
420	**3000**	**1.24115**	**4.05251**	**6.28597**	**20.5246**	**0.56776**	**1.85381**	**4.44768**	**14.5223**
440	**3000**	**1.23866**	**4.11419**	**6.05194**	**20.1014**	**0.63534**	**2.11026**	**4.87163**	**16.1811**
460	**3000**	**1.22178**	**4.12729**	**5.8284**	**19.6889**	**0.70157**	**2.36997**	**5.23324**	**17.6784**
480	**3000**	**1.1937**	**4.10026**	**5.61591**	**19.2902**	**0.76479**	**2.62701**	**5.54226**	**19.0372**
500	**3000**	**1.15764**	**4.04229**	**5.41508**	**18.9087**	**0.82346**	**2.8754**	**5.80707**	**20.2774**
520	**3000**	**1.11555**	**3.95894**	**5.22566**	**18.5452**	**0.87709**	**3.11268**	**6.03396**	**21.4137**
540	**3000**	**1.06927**	**3.85569**	**5.04751**	**18.2009**	**0.9252**	**3.33621**	**6.2284**	**22.4592**
560	**3000**	**1.02009**	**3.73659**	**4.88021**	**17.8763**	**0.96773**	**3.54483**	**6.39476**	**23.4242**
580	**3000**	**0.96968**	**3.60731**	**4.72368**	**17.5725**	**1.00413**	**3.73547**	**6.53728**	**24.3193**
600	**3000**	**0.91873**	**3.47016**	**4.57731**	**17.2891**	**1.03471**	**3.90823**	**6.65892**	**25.1517**
620	**3000**	**0.86753**	**3.32629**	**4.44017**	**17.0245**	**1.06006**	**4.06448**	**6.76197**	**25.9267**
640	**3000**	**0.81719**	**3.17986**	**4.31225**	**16.7799**	**1.0799**	**4.20212**	**6.84918**	**26.6515**
660	**3000**	**0.76795**	**3.032**	**4.19283**	**16.5541**	**1.09468**	**4.32201**	**6.92232**	**27.3306**
680	**3000**	**0.71968**	**2.88244**	**4.08096**	**16.345**	**1.10515**	**4.42634**	**6.98265**	**27.9668**
700	**3000**	**0.67306**	**2.73409**	**3.97654**	**16.1534**	**1.11119**	**4.51385**	**7.03199**	**28.5651**
720	**3000**	**0.62762**	**2.5853**	**3.87848**	**15.9763**	**1.11375**	**4.58777**	**7.07103**	**29.127**
740	**3000**	**0.58404**	**2.43909**	**3.78685**	**15.8148**	**1.11257**	**4.64636**	**7.10134**	**29.657**
760	**3000**	**0.54193**	**2.29418**	**3.70075**	**15.6666**	**1.10843**	**4.69235**	**7.12345**	**30.1562**
780	**3000**	**0.50095**	**2.14939**	**3.61943**	**15.5296**	**1.10196**	**4.72809**	**7.13784**	**30.6257**
800	**3000**	**0.4618**	**2.00785**	**3.54312**	**15.4052**	**1.09278**	**4.75132**	**7.14588**	**31.0697**
850	**3000**	**0.36886**	**1.65688**	**3.36933**	**15.1347**	**1.06252**	**4.77275**	**7.13956**	**32.0702**
900	**3000**	**0.28227**	**1.30892**	**3.21546**	**14.9107**	**1.02481**	**4.75224**	**7.10168**	**32.9319**
950	**3000**	**0.20094**	**0.96134**	**3.07724**	**14.7217**	**0.98284**	**4.70199**	**7.03838**	**33.672**
1000	**3000**	**0.12364**	**0.6099**	**2.95102**	**14.5568**	**0.9393**	**4.63334**	**6.9543**	**34.3042**

1050	3000	4.95E-02	0.25168	2.83418	14.4078	0.44872	2.28113	6.85342	34.8401
1100	3000	2.15E-02	0.11267	2.72533	14.2712	0.14963	0.78356	6.73963	35.292
1150	3000	8.88E-02	0.47888	2.62409	14.1472	0.69181	3.72972	6.61675	35.6726
1200	3000	0.15196	0.84301	2.53015	14.0365	1.18449	6.57118	6.48793	35.9928
300	3200	0.57187	1.57232	7.74867	21.3046	0.52347	1.43926	0.62502	1.71847
310	3200	0.68765	1.90866	7.64622	21.2233	0.49265	1.36745	3.015109E-	8.38E-03
320	3200	0.78839	2.20911	7.53861	21.1238	0.47333	1.3263	0.56404	1.58048
330	3200	0.87528	2.47587	7.42708	21.0088	0.46369	1.31164	1.08194	3.06045
340	3200	0.94908	2.71005	7.31211	20.8795	0.46277	1.32142	1.55512	4.4406
350	3200	1.01176	2.91628	7.19545	20.74	0.4684	1.35012	1.98884	5.73259
360	3200	1.06398	3.0956	7.07729	20.591	0.47987	1.39616	2.38653	6.94349
370	3200	1.10635	3.24894	6.95807	20.4334	0.49651	1.45807	2.75133	8.07967
380	3200	1.14071	3.38098	6.83916	20.2708	0.5165	1.53087	3.08716	9.15012
390	3200	1.16766	3.49283	6.72083	20.104	0.53934	1.61334	3.39649	10.1599
400	3200	1.1878	3.58567	6.60329	19.9336	0.5646	1.70439	3.68151	11.1135
420	3200	1.21081	3.72181	6.37246	19.5877	0.61948	1.90415	4.18769	12.8722
440	3200	1.21463	3.80063	6.14873	19.2397	0.67758	2.12018	4.62023	14.4569
460	3200	1.20374	3.83317	5.93382	18.8955	0.73574	2.34288	4.99133	15.8943
480	3200	1.18088	3.82582	5.72808	18.5578	0.79265	2.56802	5.31	17.2033
500	3200	1.14915	3.78671	5.53232	18.2304	0.84658	2.78969	5.58438	18.4019
520	3200	1.11091	3.72229	5.34694	17.9159	0.89641	3.00359	5.82108	19.5046
540	3200	1.06756	3.63624	5.17146	17.6146	0.942	3.20856	6.025	20.5219
560	3200	1.02175	3.53672	5.00682	17.3309	0.98181	3.39851	6.20167	21.4668

580	3200	0.97334	3.423	4.85151	17.0616	1.01703	3.57664	6.35359	22.3441
600	3200	0.92436	3.30182	4.70623	16.8105	1.04652	3.73814	6.4849	23.1638
620	3200	0.8747	3.17264	4.56962	16.5746	1.07125	3.88556	6.59742	23.9297
640	3200	0.82544	3.03945	4.44175	16.3555	1.09087	4.01683	6.69387	24.6483
660	3200	0.77688	2.90339	4.32201	16.1524	1.10579	4.1326	6.77601	25.3236
680	3200	0.72932	2.76571	4.20985	15.9646	1.1163	4.23323	6.84543	25.9593
700	3200	0.68303	2.62769	4.10483	15.7918	1.12265	4.31896	6.90359	26.559
720	3200	0.63761	2.48801	4.00596	15.6315	1.12571	4.39263	6.95116	27.1239
740	3200	0.59378	2.34959	3.9133	15.4849	1.12523	4.45252	6.98972	27.6582
760	3200	0.55148	2.21246	3.82632	15.3508	1.12158	4.49967	7.0201	28.164
780	3200	0.51006	2.07439	3.74396	15.2264	1.11575	4.53766	7.04247	28.6412
800	3200	0.46993	1.93707	3.66618	15.112	1.10764	4.56569	7.0579	29.0927
850	3200	0.37509	1.59794	3.48949	14.8656	1.07903	4.59675	7.0701	30.1194
900	3200	0.28633	1.25961	3.33297	14.6623	1.04264	4.58678	7.04962	31.0126
950	3200	0.20222	0.918	3.19197	14.4902	1.00213	4.5492	7.00217	31.7869
1000	3200	0.12203	0.5713	3.06309	14.3398	0.95973	4.49296	6.93278	32.4557
1050	3200	4.51E-02	0.21739	2.94385	14.2045	0.46363	2.23709	6.84552	33.0305
1100	3200	2.87E-02	0.14259	2.83291	14.0809	0.14339	0.71271	6.74435	33.5228
1150	3200	0.09873	0.50528	2.72963	13.9688	0.69468	3.55499	6.63296	33.944
1200	3200	0.16434	0.86534	2.63399	13.87	1.19702	6.30323	6.51483	34.3057
300	3400	0.49742	1.28996	7.68656	19.9339	0.70237	1.82149	0.89273	2.31516
310	3400	0.6166	1.61518	7.5999	19.9079	0.65757	1.7225	0.27504	0.72045
320	3400	0.72119	1.90807	7.50726	19.8621	0.62485	1.65319	0.28965	0.76635
330	3400	0.81114	2.16743	7.40867	19.7967	0.60372	1.6132	0.8055	2.15237
340	3400	0.88907	2.39919	7.30653	19.717	0.59119	1.59535	1.27869	3.45061

350	**3400**	**0.95487**	**2.60211**	**7.20075**	**19.6228**	**0.58703**	**1.59971**	**1.71235**	**4.66633**
360	**3400**	**1.01046**	**2.7805**	**7.09297**	**19.5179**	**0.58918**	**1.62126**	**2.11102**	**5.80895**
370	**3400**	**1.05644**	**2.93521**	**6.98345**	**19.4029**	**0.59699**	**1.65869**	**2.47766**	**6.88397**
380	**3400**	**1.09458**	**3.07045**	**6.87368**	**19.2816**	**0.60862**	**1.70725**	**2.81608**	**7.8995**
390	**3400**	**1.12482**	**3.18539**	**6.7634**	**19.1534**	**0.62414**	**1.76752**	**3.12805**	**8.85838**
400	**3400**	**1.14777**	**3.28118**	**6.65287**	**19.019**	**0.64303**	**1.8383**	**3.41574**	**9.76476**
420	**3400**	**1.17666**	**3.42701**	**6.43468**	**18.7409**	**0.68639**	**1.99909**	**3.92855**	**11.4418**
440	**3400**	**1.18636**	**3.51905**	**6.22186**	**18.4556**	**0.73437**	**2.1783**	**4.36908**	**12.9598**
460	**3400**	**1.17974**	**3.56293**	**6.01498**	**18.1657**	**0.78524**	**2.37149**	**4.74766**	**14.3383**
480	**3400**	**1.16153**	**3.57039**	**5.81657**	**17.8794**	**0.83544**	**2.56804**	**5.07499**	**15.5999**
500	**3400**	**1.13412**	**3.54709**	**5.62694**	**17.5989**	**0.88368**	**2.76382**	**5.35847**	**16.7593**
520	**3400**	**1.09946**	**3.49774**	**5.44622**	**17.3262**	**0.92918**	**2.95603**	**5.60412**	**17.8285**
540	**3400**	**1.05933**	**3.4269**	**5.27455**	**17.063**	**0.97121**	**3.14183**	**5.81712**	**18.8182**
560	**3400**	**1.0159**	**3.34077**	**5.11252**	**16.8125**	**1.00861**	**3.3168**	**6.00252**	**19.7393**
580	**3400**	**0.97035**	**3.24282**	**4.95995**	**16.5757**	**1.04114**	**3.47939**	**6.16393**	**20.5993**
600	**3400**	**0.92301**	**3.13387**	**4.81596**	**16.3515**	**1.06931**	**3.63059**	**6.30385**	**21.4032**
620	**3400**	**0.87503**	**3.01756**	**4.68058**	**16.141**	**1.09279**	**3.76849**	**6.42522**	**22.1574**
640	**3400**	**0.82712**	**2.89627**	**4.55357**	**15.945**	**1.11157**	**3.89231**	**6.53035**	**22.867**
660	**3400**	**0.77952**	**2.77097**	**4.43422**	**15.7623**	**1.12597**	**4.0025**	**6.62099**	**23.5357**
680	**3400**	**0.73259**	**2.64296**	**4.32212**	**15.5929**	**1.1363**	**4.0994**	**6.69868**	**24.1668**
700	**3400**	**0.68665**	**2.51357**	**4.21688**	**15.4364**	**1.14269**	**4.18296**	**6.76489**	**24.7637**
720	**3400**	**0.64167**	**2.38283**	**4.11785**	**15.2917**	**1.14569**	**4.25451**	**6.82059**	**25.3283**
740	**3400**	**0.59763**	**2.25093**	**4.02448**	**15.1578**	**1.14566**	**4.31502**	**6.86673**	**25.8628**
760	**3400**	**0.55524**	**2.12058**	**3.93694**	**15.0361**	**1.14229**	**4.36265**	**6.90476**	**26.3708**
780	**3400**	**0.51354**	**1.98849**	**3.85388**	**14.9227**	**1.13686**	**4.40209**	**6.93454**	**26.8515**
800	**3400**	**0.47323**	**1.85743**	**3.77556**	**14.8193**	**1.12895**	**4.43117**	**6.95743**	**27.3083**

850	3400	0.37672	1.52859	3.59657	14.5938	1.10169	4.47034	6.98678	28.3503
900	3400	0.28606	1.19886	3.43787	14.4084	1.06642	4.46939	6.98258	29.2644
950	3400	0.19975	0.86402	3.29462	14.2509	1.02687	4.44171	6.9503	30.0635
1000	3400	0.11746	0.52401	3.16401	14.1152	0.98499	4.39419	6.89529	30.761
1050	3400	3.81E-02	0.17523	3.0429	13.9922	0.48403	2.22573	6.82121	31.3661
1100	3400	3.79E-02	0.17967	2.93029	13.8806	0.13063	0.61881	6.73232	31.8905
1150	3400	0.11012	0.53708	2.82561	13.7802	0.69031	3.36655	6.63239	32.3454
1200	3400	0.17792	0.89282	2.72858	13.692	1.20135	6.02834	6.52472	32.741
300	3600	0.42505	1.04695	7.60496	18.7322	0.89247	2.1983	1.1581	2.85258
310	3600	0.54748	1.36262	7.53385	18.7509	0.8339	2.07548	0.54403	1.35403
320	3600	0.65457	1.64604	7.45475	18.7463	0.78925	1.9847	0.01749	4.40E-02
330	3600	0.74749	1.89903	7.36909	18.7215	0.75661	1.92221	0.53173	1.35088
340	3600	0.82812	2.12533	7.27865	18.6803	0.73368	1.88295	1.00403	2.5768
350	3600	0.89768	2.32712	7.18453	18.625	0.71894	1.86378	1.43853	3.7292
360	3600	0.95602	2.50321	7.08666	18.5555	0.71217	1.86473	1.83782	4.81207
370	3600	1.00557	2.65908	6.9871	18.4765	0.71087	1.87982	2.20649	5.83477
380	3600	1.04628	2.79397	6.8857	18.3876	0.715	1.90935	2.54649	6.80017
390	3600	1.07927	2.91021	6.78337	18.2911	0.72339	1.9506	2.86067	7.71372
400	3600	1.10512	3.00874	6.6803	18.1875	0.73551	2.00246	3.15113	8.5791
420	3600	1.13944	3.16163	6.47524	17.9669	0.76691	2.12793	3.67021	10.1838
440	3600	1.15378	3.26157	6.27302	17.733	0.80527	2.2764	4.11732	11.6391
460	3600	1.15228	3.31738	6.07588	17.4923	0.84717	2.43899	4.50396	12.9668
480	3600	1.13809	3.33581	5.88497	17.2491	0.89045	2.60995	4.83909	14.1837
500	3600	1.11413	3.3235	5.70148	17.0078	0.93314	2.78361	5.13042	15.3043

520	**3600**	**1.08268**	**3.2859**	**5.52592**	**16.771**	**0.97392**	**2.95581**	**5.38423**	**16.341**
540	**3600**	**1.04557**	**3.22744**	**5.35858**	**16.5408**	**1.01194**	**3.12365**	**5.60563**	**17.3034**
560	**3600**	**1.00481**	**3.15358**	**5.20013**	**16.3205**	**1.04601**	**3.28288**	**5.79947**	**18.2015**
580	**3600**	**0.96123**	**3.06639**	**5.0501**	**16.1101**	**1.0762**	**3.43314**	**5.96895**	**19.0413**
600	**3600**	**0.91558**	**2.9679**	**4.90809**	**15.9098**	**1.10254**	**3.57394**	**6.1169**	**19.8283**
620	**3600**	**0.86936**	**2.86273**	**4.77455**	**15.7221**	**1.12423**	**3.70198**	**6.2466**	**20.5694**
640	**3600**	**0.82251**	**2.75061**	**4.64849**	**15.5454**	**1.142**	**3.81905**	**6.35956**	**21.2675**
660	**3600**	**0.77611**	**2.63513**	**4.53014**	**15.3813**	**1.15538**	**3.92287**	**6.45822**	**21.9277**
680	**3600**	**0.73006**	**2.51605**	**4.41877**	**15.2288**	**1.16495**	**4.01487**	**6.54377**	**22.5523**
700	**3600**	**0.68438**	**2.39357**	**4.31356**	**15.0863**	**1.17124**	**4.09631**	**6.61731**	**23.1434**
720	**3600**	**0.63976**	**2.27011**	**4.21464**	**14.955**	**1.17399**	**4.16572**	**6.68048**	**23.7047**
740	**3600**	**0.59622**	**2.14593**	**4.12148**	**14.8343**	**1.17356**	**4.22395**	**6.7342**	**24.2381**
760	**3600**	**0.55374**	**2.02123**	**4.03362**	**14.7232**	**1.17031**	**4.27179**	**6.77928**	**24.7452**
780	**3600**	**0.51209**	**1.89526**	**3.95038**	**14.6204**	**1.16482**	**4.31103**	**6.81621**	**25.227**
800	**3600**	**0.47135**	**1.76848**	**3.87143**	**14.5254**	**1.15728**	**4.34205**	**6.84575**	**25.6849**
850	**3600**	**0.37412**	**1.45139**	**3.69141**	**14.3206**	**1.13029**	**4.3849**	**6.89177**	**26.7362**
900	**3600**	**0.28196**	**1.12998**	**3.53115**	**14.1512**	**1.09568**	**4.39095**	**6.90298**	**27.6638**
950	**3600**	**0.19412**	**0.80293**	**3.38653**	**14.0083**	**1.0565**	**4.37014**	**6.88539**	**28.4811**
1000	**3600**	**0.10985**	**0.46869**	**3.25425**	**13.8841**	**1.01509**	**4.33088**	**6.8439**	**29.1993**
1050	**3600**	**2.87E-02**	**0.12629**	**3.13198**	**13.7735**	**0.50967**	**2.24139**	**6.7827**	**29.8283**
1100	**3600**	**4.93E-02**	**0.22332**	**3.01808**	**13.6726**	**0.11172**	**0.50613**	**6.70571**	**30.3783**
1150	**3600**	**0.12338**	**0.57543**	**2.91229**	**13.5825**	**0.67887**	**3.16618**	**6.6169**	**30.8603**
1200	**3600**	**0.19312**	**0.9267**	**2.81417**	**13.5038**	**1.19777**	**5.7475**	**6.51945**	**31.2836**
300	**3800**	**0.35372**	**0.83229**	**7.50601**	**17.6616**	**1.09285**	**2.57148**	**1.42249**	**3.34711**
310	**3800**	**0.47878**	**1.1386**	**7.44951**	**17.7159**	**1.02134**	**2.4289**	**0.81201**	**1.93106**

320	3800	0.58838	1.41407	7.38385	17.7456	0.9648	2.31871	0.25303	0.60812
330	3800	0.68432	1.66188	7.31111	17.755	0.92065	2.2358	0.26013	0.63172
340	3800	0.76775	1.88384	7.23241	17.7462	0.88724	2.17703	0.73193	1.79597
350	3800	0.83975	2.08168	7.14893	17.7217	0.86301	2.13935	1.16642	2.89146
360	3800	0.90092	2.25609	7.0612	17.6826	0.84711	2.12132	1.56662	3.92311
370	3800	0.953	2.41054	6.97078	17.6322	0.83764	2.11878	1.93642	4.89805
380	3800	0.99638	2.54548	6.87804	17.5713	0.83392	2.13042	2.27826	5.82026
390	3800	1.03223	2.66309	6.78388	17.5021	0.83483	2.15383	2.59484	6.69457
400	3800	1.0605	2.76282	6.68813	17.4241	0.84034	2.18928	2.88768	7.52307
420	3800	1.1	2.92128	6.49658	17.2531	0.85946	2.28248	3.41279	9.06339
440	3800	1.1187	3.02739	6.30547	17.0638	0.88777	2.40246	3.86623	10.4627
460	3800	1.1208	3.0896	6.11728	16.8629	0.92161	2.54052	4.25925	11.7411
480	3800	1.11018	3.11619	5.9342	16.6569	0.95778	2.68842	4.60148	12.9161
500	3800	1.08972	3.1135	5.7575	16.4501	0.9942	2.84061	4.90042	14.0013
520	3800	1.0612	3.08522	5.58752	16.2446	1.02996	2.9944	5.16175	15.0068
540	3800	1.02723	3.03783	5.42533	16.0444	1.06321	3.14424	5.39128	15.9437
560	3800	0.98862	2.97299	5.27053	15.8496	1.09398	3.28983	5.5926	16.8182
580	3800	0.94693	2.89477	5.12351	15.6626	1.12142	3.42818	5.76961	17.6377
600	3800	0.90331	2.80629	4.98435	15.4847	1.14509	3.55741	5.92546	18.4084
620	3800	0.8585	2.70959	4.85279	15.3164	1.16495	3.6768	6.06262	19.1349
640	3800	0.81317	2.60673	4.72864	15.1583	1.18088	3.78548	6.18332	19.8215
660	3800	0.76767	2.49872	4.61144	15.0101	1.19315	3.88365	6.28924	20.4713
680	3800	0.72231	2.38667	4.50083	14.8717	1.20191	3.97133	6.38193	21.0872
700	3800	0.67746	2.27179	4.39648	14.7431	1.20727	4.04843	6.46278	21.6721
720	3800	0.63309	2.15409	4.29791	14.6236	1.20967	4.1159	6.53277	22.2278
740	3800	0.58992	2.03614	4.20512	14.5141	1.20877	4.17211	6.59345	22.7576

760	3800	0.54732	1.91594	4.11711	14.4123	1.20554	4.22008	6.64502	23.2614
780	3800	0.50601	1.7961	4.03417	14.3196	1.19956	4.25794	6.68884	23.7426
800	3800	0.46512	1.67379	3.95508	14.2328	1.19198	4.28947	6.72481	24.2
850	3800	0.36739	1.36715	3.77455	14.0463	1.16488	4.3349	6.7865	25.2548
900	3800	0.27422	1.05425	3.61347	13.892	1.13036	4.34566	6.81248	26.1905
950	3800	0.1851	0.73452	3.46791	13.762	1.09127	4.33055	6.80885	27.0201
1000	3800	9.94E-02	0.40675	3.33466	13.6493	1.04989	4.29737	6.7805	27.7537
1050	3800	1.67E-02	7.05E-02	3.21141	13.549	0.54057	2.28067	6.73168	28.4011
1100	3800	6.28E-02	0.27298	3.09673	13.4583	8.69E-02	0.37786	6.66631	28.9716
1150	3800	0.13858	0.61996	2.99017	13.3778	0.66076	2.95619	6.58825	29.4753
1200	3800	0.20967	0.96507	2.89156	13.3089	1.18714	5.46401	6.50111	29.9225
300	4000	0.28466	0.6429	7.39345	16.6985	1.3005	2.93726	1.6847	3.80499
310	4000	0.41123	0.93884	7.35019	16.7807	1.21749	2.77956	1.0784	2.462
320	4000	0.52352	1.20801	7.29787	16.8397	1.14909	2.65151	0.52136	1.20304
330	4000	0.62194	1.45033	7.23732	16.877	1.09405	2.55127	9.406291E-	2.19E-02
340	4000	0.70763	1.66746	7.16986	16.8951	1.05069	2.47586	0.46176	1.0881
350	4000	0.78172	1.86118	7.09659	16.8962	1.0174	2.42231	0.89605	2.13339
360	4000	0.8458	2.03445	7.01915	16.8835	0.99218	2.38655	1.2975	3.12093
370	4000	0.89988	2.18652	6.93754	16.8569	0.97485	2.36872	1.66818	4.05336
380	4000	0.94608	2.32191	6.85372	16.8207	0.96305	2.36357	2.01209	4.93817
390	4000	0.98385	2.43868	6.76707	16.7736	0.95726	2.37274	2.33025	5.776
400	4000	1.01471	2.53998	6.67898	16.7184	0.95579	2.39249	2.62569	6.57247
420	4000	1.05815	2.70038	6.50014	16.5882	0.96342	2.45863	3.15568	8.05321

440	**4000**	**1.08068**	**2.81057**	**6.32015**	**16.4372**	**0.98174**	**2.55328**	**3.61483**	**9.4013**
460	**4000**	**1.08673**	**2.87925**	**6.14187**	**16.2726**	**1.00657**	**2.66685**	**4.01453**	**10.6363**
480	**4000**	**1.07973**	**2.91318**	**5.96721**	**16.0999**	**1.03506**	**2.79266**	**4.36367**	**11.7735**
500	**4000**	**1.06194**	**2.91669**	**5.79715**	**15.9223**	**1.06555**	**2.9266**	**4.66918**	**12.8243**
520	**4000**	**1.03646**	**2.89688**	**5.63331**	**15.745**	**1.09561**	**3.06219**	**4.93787**	**13.8012**
540	**4000**	**1.00458**	**2.85628**	**5.47578**	**15.569**	**1.12469**	**3.19778**	**5.17419**	**14.7115**
560	**4000**	**0.9683**	**2.79976**	**5.32542**	**15.398**	**1.15144**	**3.32928**	**5.38285**	**15.5641**
580	**4000**	**0.92879**	**2.73012**	**5.18218**	**15.2328**	**1.1754**	**3.45503**	**5.56726**	**16.3647**
600	**4000**	**0.88678**	**2.64914**	**5.0459**	**15.074**	**1.19645**	**3.57425**	**5.73018**	**17.1182**
620	**4000**	**0.84334**	**2.55971**	**4.91673**	**14.9232**	**1.21411**	**3.68504**	**5.87437**	**17.8298**
640	**4000**	**0.79922**	**2.46389**	**4.79456**	**14.7811**	**1.22821**	**3.78643**	**6.00206**	**18.5036**
660	**4000**	**0.75469**	**2.36255**	**4.67898**	**14.6474**	**1.23898**	**3.87858**	**6.11488**	**19.1425**
680	**4000**	**0.71014**	**2.25679**	**4.56962**	**14.5222**	**1.24653**	**3.96146**	**6.21434**	**19.7491**
700	**4000**	**0.66587**	**2.14773**	**4.46625**	**14.4055**	**1.25094**	**4.03481**	**6.30185**	**20.3261**
720	**4000**	**0.62226**	**2.03653**	**4.36862**	**14.2976**	**1.25227**	**4.09842**	**6.3787**	**20.8761**
740	**4000**	**0.57934**	**1.92345**	**4.2763**	**14.1977**	**1.25085**	**4.15294**	**6.44575**	**21.4005**
760	**4000**	**0.53714**	**1.80875**	**4.18896**	**14.1058**	**1.24694**	**4.19889**	**6.50385**	**21.9008**
780	**4000**	**0.49575**	**1.69278**	**4.10612**	**14.0208**	**1.24077**	**4.23672**	**6.55376**	**22.3786**
800	**4000**	**0.45496**	**1.57502**	**4.02727**	**13.9419**	**1.23279**	**4.26777**	**6.59593**	**22.8343**
850	**4000**	**0.35701**	**1.27814**	**3.84692**	**13.7724**	**1.20505**	**4.31422**	**6.67255**	**23.8885**
900	**4000**	**0.26326**	**0.97373**	**3.68566**	**13.6322**	**1.17009**	**4.32787**	**6.71272**	**24.8284**
950	**4000**	**0.17323**	**0.66135**	**3.53972**	**13.5144**	**1.13067**	**4.31681**	**6.72251**	**25.666**
1000	**4000**	**8.62E-02**	**0.33946**	**3.4058**	**13.4118**	**1.08916**	**4.28903**	**6.70664**	**26.4104**
1050	**4000**	**2.42E-03**	**9.83E-03**	**3.28215**	**13.3217**	**0.57625**	**2.3389**	**6.66987**	**27.072**
1100	**4000**	**7.85E-**	**0.32811**	**3.16689**	**13.2399**	**0.05658**	**0.23658**	**6.61565**	**27.6583**

		02							
1150	4000	0.15557	0.66948	3.05979	13.1678	0.63653	2.73928	6.54813	28.1798
1200	4000	0.22792	1.009	2.96092	13.1077	1.16964	5.17789	6.47093	28.6462
300	4500	0.11813	0.24484	7.06197	14.6367	1.84678	3.82766	2.33525	4.84005
310	4500	0.2487	0.52109	7.05051	14.7727	1.73601	3.6374	1.73694	3.63935
320	4500	0.36498	0.77299	7.02781	14.8841	1.64161	3.47674	1.18559	2.51094
330	4500	0.46797	1.00166	6.99539	14.9734	1.56172	3.34281	0.67682	1.44873
340	4500	0.5586	1.20829	6.95455	15.0429	1.49466	3.23299	0.20677	0.44725
350	4500	0.63794	1.39427	6.90648	15.0946	1.43885	3.14471	0.22814	0.49861
360	4500	0.70637	1.55972	6.85183	15.1295	1.3934	3.07678	0.63057	1.39237
370	4500	0.76595	1.70852	6.79263	15.1516	1.35589	3.02446	1.00451	2.24067
380	4500	0.81662	1.83992	6.72894	15.1608	1.32615	2.9879	1.3516	3.04527
390	4500	0.85935	1.95549	6.66159	15.1588	1.30296	2.96495	1.67431	3.80998
400	4500	0.89507	2.05686	6.59154	15.1473	1.28525	2.95349	1.97491	4.53833
420	4500	0.94725	2.21925	6.44475	15.0989	1.26407	2.9615	2.51619	5.89501
440	4500	0.97852	2.33627	6.29308	15.0252	1.25674	3.00054	2.98878	7.13593
460	4500	0.99255	2.41412	6.13935	14.9323	1.25936	3.06307	3.40285	8.27654
480	4500	0.99257	2.4584	5.98578	14.8256	1.26891	3.14285	3.76684	9.32974
500	4500	0.98158	2.47485	5.83426	14.7098	1.28261	3.2338	4.08808	10.3072
520	4500	0.96209	2.46838	5.68629	14.589	1.29835	3.33111	4.37262	11.2186
540	4500	0.93571	2.4421	5.54252	14.4655	1.31497	3.43195	4.62511	12.0711
560	4500	0.90394	2.39912	5.40359	14.3415	1.3314	3.53362	4.84961	12.8712
580	4500	0.86868	2.34379	5.27044	14.2202	1.34622	3.63227	5.05017	13.6259
600	4500	0.83028	2.27666	5.14265	14.1015	1.35959	3.72809	5.22902	14.3383
620	4500	0.79012	2.2012	5.02093	13.9878	1.37054	3.81819	5.3892	15.0138
640	4500	0.74891	2.11913	4.90512	13.8797	1.37883	3.90158	5.5328	15.6558

660	4500	0.70663	2.03034	4.79467	13.7765	1.38489	3.9792	5.66109	16.266
680	4500	0.66425	1.93752	4.68997	13.68	1.38811	4.04892	5.77619	16.8483
700	4500	0.62149	1.83984	4.59021	13.5887	1.38914	4.11237	5.8788	17.4034
720	4500	0.57936	1.74026	4.49588	13.5047	1.38733	4.16726	5.97079	17.935
740	4500	0.53756	1.63802	4.40626	13.4266	1.38326	4.21503	6.05272	18.4437
760	4500	0.49616	1.53338	4.32103	13.3542	1.37714	4.25607	6.12539	18.9306
780	4500	0.45526	1.4267	4.2399	13.2872	1.36914	4.29065	6.18957	19.3971
800	4500	0.41495	1.31839	4.16267	13.2254	1.35939	4.31897	6.24597	19.8444
850	4500	0.3168	1.04083	3.98464	13.0914	1.32873	4.36551	6.35647	20.884
900	4500	0.22248	0.75511	3.82505	12.9823	1.29108	4.38197	6.42948	21.8217
950	4500	0.13123	0.45969	3.68005	12.8911	1.24941	4.37665	6.47052	22.666
1000	4500	4.25E-02	0.15356	3.54662	12.8122	1.20584	4.35613	6.48433	23.4248
1050	4500	4.33E-02	0.16113	3.42324	12.7437	0.68559	2.55226	6.4757	24.1072
1100	4500	0.12634	0.48435	3.3082	12.6824	4.15E-02	0.1589	6.44815	24.7199
1150	4500	0.20564	0.81132	3.20131	12.6298	0.55167	2.17643	6.40587	25.2723
1200	4500	0.2804	1.13767	3.10245	12.5873	1.09923	4.45981	6.35233	25.7728
300	5000	3.93E-02	7.61E-02	6.67914	12.9288	2.41827	4.68105	2.97752	5.76358
310	5000	9.31E-02	0.18212	6.69493	13.0995	2.28392	4.46878	2.38704	4.67054
320	5000	0.21178	0.4188	6.69841	13.2461	2.16673	4.28473	1.84096	3.64052
330	5000	0.31819	0.63585	6.69147	13.3718	2.06437	4.12531	1.33484	2.66744
340	5000	0.41215	0.83219	6.67449	13.4766	1.97629	3.99037	0.86617	1.74891
350	5000	0.49455	1.00883	6.64866	13.5626	1.90085	3.87755	0.43165	0.88053
360	5000	0.56728	1.16895	6.61607	13.6333	1.83566	3.78264	2.733161E-	5.63E-

									02
370	5000	0.63028	1.31184	6.57686	13.6888	1.78039	3.70563	0.34853	0.72541
380	5000	0.68496	1.43981	6.53251	13.7316	1.73327	3.64342	0.6989	1.46912
390	5000	0.73163	1.55305	6.48346	13.7625	1.69368	3.59518	1.02558	2.17701
400	5000	0.77125	1.65305	6.43062	13.7831	1.66046	3.55897	1.33073	2.85221
420	5000	0.8309	1.8152	6.31532	13.7964	1.61098	3.51934	1.88235	4.11219
440	5000	0.86891	1.93396	6.19118	13.7801	1.57889	3.51422	2.36633	5.26688
460	5000	0.88918	2.01564	6.06173	13.7409	1.55969	3.53555	2.79274	6.33068
480	5000	0.89518	2.06592	5.92967	13.6847	1.54981	3.57669	3.16991	7.31562
500	5000	0.88969	2.08965	5.79719	13.6161	1.54633	3.63194	3.50481	8.23192
520	5000	0.87512	2.09116	5.66588	13.539	1.54707	3.69683	3.80323	9.08809
540	5000	0.85297	2.073	5.53665	13.4558	1.5507	3.76868	4.06956	9.89031
560	5000	0.82548	2.03974	5.41083	13.37	1.55527	3.84301	4.30843	10.646
580	5000	0.79336	1.99255	5.28853	13.2824	1.56041	3.91904	4.52265	11.3588
600	5000	0.75829	1.93519	5.17083	13.1961	1.56468	3.99309	4.71577	12.0347
620	5000	0.72098	1.86908	5.05774	13.1118	1.56776	4.06429	4.88999	12.6769
640	5000	0.68208	1.79573	4.94939	13.0304	1.56934	4.13163	5.04734	13.2883
660	5000	0.6419	1.71579	4.84557	12.9521	1.56939	4.19494	5.1894	13.8711
680	5000	0.60111	1.6309	4.74643	12.8778	1.56758	4.25308	5.31786	14.4282
700	5000	0.56003	1.54192	4.65194	12.808	1.56384	4.30567	5.43406	14.9614
720	5000	0.51904	1.44984	4.56187	12.7428	1.5581	4.3523	5.53918	15.4727
740	5000	0.47843	1.35555	4.47625	12.6827	1.55029	4.39249	5.63433	15.9639
760	5000	0.43773	1.25774	4.39425	12.6261	1.54113	4.42818	5.71977	16.4348
780	5000	0.3976	1.15831	4.31617	12.5743	1.53019	4.4579	5.79677	16.8877
800	5000	0.35786	1.05686	4.24159	12.5264	1.51783	4.48252	5.86577	17.323
850	5000	0.26077	0.79618	4.06909	12.4234	1.48141	4.52291	6.00721	18.3407

900	5000	0.16619	0.52402	3.9131	12.3388	1.4397	4.53966	6.10932	19.2639
950	5000	7.45E-02	0.24231	3.77115	12.2697	1.39426	4.53633	6.17858	20.1025
1000	5000	1.48E-02	4.96E-02	3.64038	12.2113	1.34701	4.51841	6.21967	20.8633
1050	5000	0.10154	0.35088	3.51907	12.161	0.82085	2.83664	6.23692	21.5532
1100	5000	0.18548	0.65988	3.40606	12.1175	0.16768	0.59656	6.2343	22.1793
1150	5000	0.26617	0.9742	3.30069	12.0806	0.43588	1.59532	6.21537	22.7483
1200	5000	0.34231	1.28806	3.20329	12.0532	0.99539	3.74542	6.18409	23.2692
300	5500	0.18777	0.34375	6.2626	11.4649	3.00316	5.49785	3.61038	6.60948
310	5500	5.51E-02	0.10195	6.302	11.6592	2.84866	5.27022	3.0274	5.60091
320	5500	6.45E-02	0.12061	6.32823	11.83	2.71187	5.06958	2.48666	4.64856
330	5500	0.17229	0.3254	6.34312	11.9801	2.59059	4.89278	1.98404	3.74722
340	5500	0.2685	0.51227	6.34752	12.1105	2.48368	4.73862	1.51679	2.89388
350	5500	0.35388	0.68196	6.34263	12.2229	2.38966	4.60513	1.08189	2.08493
360	5500	0.42933	0.83559	6.32963	12.3191	2.30714	4.49031	0.67661	1.31687
370	5500	0.49519	0.97325	6.30912	12.4	2.23524	4.39318	0.29886	0.58739
380	5500	0.55273	1.09692	6.28252	12.4678	2.17231	4.311	5.41E-02	0.10744
390	5500	0.60236	1.2069	6.25035	12.5233	2.11762	4.24292	0.3841	0.76959
400	5500	0.64488	1.30438	6.21351	12.568	2.07012	4.18723	0.69301	1.40173
420	5500	0.71094	1.4651	6.12835	12.6292	1.99346	4.10807	1.25415	2.58452
440	5500	0.75477	1.5841	6.03103	12.658	1.93722	4.06585	1.74856	3.66988
460	5500	0.78049	1.66772	5.92559	12.6615	1.89644	4.05222	2.18622	4.67142
480	5500	0.79135	1.72092	5.81481	12.6451	1.86741	4.06096	2.57508	5.59988
500	5500	0.79045	1.74884	5.70138	12.6141	1.84679	4.08597	2.92214	6.46514

520	5500	0.77966	1.7544	5.58668	12.5713	1.83265	4.12387	3.23257	7.27401
540	5500	0.76151	1.74225	5.47274	12.5211	1.82244	4.16956	3.51168	8.03436
560	5500	0.73705	1.71404	5.36006	12.4649	1.81526	4.22142	3.76281	8.75051
580	5500	0.70836	1.6739	5.25019	12.4065	1.8092	4.27526	3.99005	9.42874
600	5500	0.67572	1.6221	5.14288	12.3458	1.80417	4.33099	4.19546	10.0714
620	5500	0.64078	1.5622	5.03929	12.2856	1.79873	4.38523	4.38218	10.6836
640	5500	0.60355	1.49397	4.93898	12.2256	1.79315	4.43862	4.55152	11.2665
660	5500	0.56524	1.42022	4.84274	12.1679	1.78637	4.48845	4.70593	11.8242
680	5500	0.5262	1.34174	4.75048	12.113	1.77832	4.53443	4.84674	12.3585
700	5500	0.48645	1.25849	4.66187	12.0605	1.7692	4.577	4.97493	12.8704
720	5500	0.44663	1.17204	4.57715	12.0114	1.75859	4.6149	5.09197	13.3624
740	5500	0.40678	1.08257	4.49607	11.9655	1.74662	4.64832	5.19868	13.8353
760	5500	0.36697	0.99024	4.41847	11.9229	1.73345	4.67759	5.29579	14.2903
780	5500	0.32759	0.89612	4.34433	11.8838	1.71884	4.70187	5.38435	14.7288
800	5500	0.28846	0.79977	4.27324	11.8478	1.70317	4.72212	5.46472	15.1512
850	5500	0.19216	0.55059	4.1079	11.7701	1.65982	4.75579	5.63369	16.1419
900	5500	9.81E-02	0.29012	3.95779	11.7075	1.61213	4.76882	5.76264	17.0464
950	5500	6.42E-03	1.96E-02	3.82048	11.657	1.56159	4.76471	5.85768	17.8729
1000	5500	8.29E-02	0.26084	3.69377	11.6156	1.50966	4.74734	5.92369	18.6278
1050	5500	0.17016	0.55107	3.57591	11.5807	0.97866	3.16942	5.96473	19.317
1100	5500	0.2546	0.84855	3.466	11.5516	0.31858	1.06176	5.98501	19.9472
1150	5500	0.33581	1.15102	3.3635	11.5286	0.29373	1.00679	5.98807	20.5245
1200	5500	0.41267	1.45367	3.26863	11.5139	0.86327	3.04094	5.97767	21.0567
300	6000	0.32692	0.57132	5.82525	10.1801	3.5926	6.27836	4.23188	7.39554

310	6000	0.19589	0.34587	5.88424	10.3893	3.4218	6.04157	3.6571	6.45703
320	6000	7.64E-02	0.13627	5.93028	10.5771	3.26812	5.82896	3.12167	5.56774
330	6000	3.16E-02	5.69E-02	5.96433	10.7447	3.13041	5.63941	2.62276	4.72488
340	6000	0.12887	0.23446	5.98761	10.8936	3.0071	5.47099	2.15735	3.92498
350	6000	0.21561	0.39611	6.00088	11.0248	2.89723	5.32277	1.72314	3.16574
360	6000	0.29302	0.54354	6.00567	11.1404	2.79897	5.19205	1.31712	2.44324
370	6000	0.36143	0.67687	6.00263	11.2414	2.71152	5.07799	0.93739	1.75549
380	6000	0.42116	0.79619	5.99232	11.3285	2.6341	4.97975	0.58217	1.10059
390	6000	0.47296	0.90252	5.97568	11.4029	2.56559	4.89572	0.24947	0.47604
400	6000	0.51808	0.99779	5.95406	11.4671	2.50447	4.82343	6.31E-02	0.12145
420	6000	0.58873	1.15467	5.89664	11.565	2.40299	4.71294	0.63201	1.23955
440	6000	0.63746	1.27274	5.82493	11.6299	2.32373	4.6395	1.13588	2.26787
460	6000	0.66743	1.35611	5.74221	11.6671	2.26251	4.59701	1.58338	3.21713
480	6000	0.68283	1.41142	5.65252	11.6838	2.21444	4.57725	1.98319	4.09925
500	6000	0.68585	1.44175	5.55791	11.6835	2.1769	4.57614	2.3413	4.92172
520	6000	0.67865	1.45042	5.46017	11.6696	2.14751	4.5897	2.66301	5.69143
540	6000	0.66367	1.44165	5.3614	11.6463	2.12367	4.61313	2.9534	6.41552
560	6000	3.54451	8.24284	1.27046	2.95449	6.40654	14.8985	0.86223	2.00513
580	6000	0.6157	1.38049	5.16454	11.5797	2.08736	4.68019	3.45431	7.74509
600	6000	0.58564	1.3335	5.06857	11.5413	2.0721	4.71822	3.67136	8.35978
620	6000	0.55263	1.27758	4.97487	11.5011	2.05779	4.7573	3.86929	8.94521
640	6000	0.51733	1.21398	4.88375	11.4604	2.04396	4.79642	4.05003	9.5039
660	6000	0.48063	1.14456	4.79566	11.4202	2.02986	4.83381	4.2156	10.0389
680	6000	0.44256	1.06925	4.71033	11.3805	2.01563	4.86988	4.36706	10.5511
700	6000	0.40429	0.99081	4.62863	11.3435	2.00023	4.902	4.50647	11.0441

720	6000	0.3653	0.9079	4.54972	11.3077	1.98438	4.93189	4.63414	11.5175
740	6000	0.32619	0.82199	4.47396	11.2742	1.96762	4.95832	4.75141	11.9734
760	6000	0.28733	0.73402	4.40144	11.2437	1.94971	4.98062	4.8593	12.4133
780	6000	0.24827	0.64281	4.33147	11.2148	1.93129	5.00038	4.958	12.8369
800	6000	0.20963	0.55002	4.26444	11.1887	1.91184	5.01613	5.04866	13.2462
850	6000	0.11418	0.30945	4.10789	11.1332	1.86026	5.04165	5.2428	14.209
900	6000	0.02088	5.84E-02	3.96525	11.09	1.80527	5.04896	5.39647	15.0928
950	6000	7.05E-02	0.20333	3.834	11.0558	1.74859	5.0423	5.51521	15.9038
1000	6000	0.15985	0.47487	3.71245	11.0289	1.69119	5.02416	5.60409	16.6485
1050	6000	0.24701	0.75542	3.59915	11.0073	1.1559	3.53509	5.66733	17.3324
1100	6000	0.33161	1.0433	3.4933	10.9906	0.49028	1.54252	5.7089	17.9612
1150	6000	0.41313	1.33622	3.39447	10.9791	0.12912	0.41761	5.73232	18.5406
1200	6000	0.49027	1.62906	3.303	10.9753	0.7072	2.3499	5.74152	19.0781
300	6500	0.45705	0.76789	5.37572	9.03197	4.18101	7.02468	4.84103	8.13361
310	6500	0.32875	0.55789	5.45128	9.25079	3.99671	6.78239	4.2746	7.25397
320	6500	0.21109	0.36177	5.51385	9.44951	3.82935	6.56266	3.74536	6.41872
330	6500	0.10405	0.18007	5.56429	9.62904	3.6778	6.36447	3.25072	5.6254
340	6500	6.60E-03	1.15E-02	5.60422	9.7916	3.54015	6.18529	2.78748	4.87023
350	6500	8.10E-02	0.14294	5.63395	9.93729	3.41592	6.02507	2.35396	4.15196
360	6500	0.15906	0.2832	5.65423	10.067	3.30423	5.88296	1.94821	3.46866
370	6500	0.22905	0.41159	5.6668	10.1833	3.20299	5.75578	1.56717	2.81622
380	6500	0.29043	0.52671	5.67148	10.2855	3.11228	5.64431	1.21006	2.19451
390	6500	0.34437	0.63022	5.66958	10.3758	3.03062	5.5463	0.87454	1.60049

400	6500	0.39114	0.72227	5.66161	10.4547	2.95735	5.46103	0.55923	1.03269
420	6500	0.46573	0.87538	5.63039	10.5828	2.83241	5.32374	1.694663E-02	3.19E-02
440	6500	0.51839	0.99141	5.58271	10.6769	2.73161	5.2242	0.52917	1.01203
460	6500	0.55242	1.07467	5.52221	10.7428	2.65037	5.15598	0.98608	1.91829
480	6500	0.57149	1.13052	5.4526	10.7864	2.58424	5.11215	1.39564	2.76086
500	6500	0.57763	1.16162	5.376	10.8111	2.5305	5.08883	1.76359	3.54659
520	6500	0.57365	1.17239	5.29498	10.8216	2.48602	5.08081	2.09571	4.28312
540	6500	0.56153	1.16599	5.21136	10.8212	2.44856	5.08434	2.39657	4.9764
560	6500	0.54254	1.1443	5.12612	10.8117	2.41671	5.09718	2.66962	5.63062
580	6500	0.51861	1.11074	5.0409	10.7965	2.38848	5.11561	2.91865	6.25108
600	6500	0.49033	1.06616	4.95601	10.7762	2.36331	5.13872	3.14589	6.84037
620	6500	0.45888	1.01274	4.87236	10.7531	2.34	5.16427	3.354	7.40211
640	6500	0.4252	0.95223	4.79058	10.7284	2.31773	5.19052	3.54508	7.93914
660	6500	0.38985	0.88572	4.71094	10.7032	2.29602	5.21652	3.72084	8.45367
680	6500	0.3531	0.81371	4.63349	10.6777	2.27468	5.24192	3.88256	8.94719
700	6500	0.3156	0.73751	4.5586	10.653	2.25321	5.26555	4.03173	9.42176
720	6500	0.2776	0.65771	4.48625	10.6294	2.23143	5.28701	4.16941	9.87874
740	6500	0.2392	0.57451	4.41633	10.607	2.20939	5.3064	4.29644	10.319
760	6500	0.20072	0.48858	4.34895	10.5861	2.18684	5.32312	4.41378	10.7439
780	6500	0.16225	0.40021	4.28401	10.5668	2.16382	5.33722	4.52211	11.1541
800	6500	0.12417	0.31028	4.22164	10.5497	2.14009	5.348	4.62235	11.5511
850	6500	2.93E-02	7.57E-02	4.07478	10.513	2.07945	5.36504	4.83951	12.4861
900	6500	6.34E-02	0.16882	3.9405	10.4865	2.01655	5.36645	5.01575	13.348
950	6500	0.15466	0.42415	3.8162	10.4664	1.95307	5.35653	5.15628	14.1418

1000	6500	0.24369	0.68825	3.70088	10.4525	1.88932	5.33603	5.2665	14.8743
1050	6500	0.33067	0.96102	3.5931	10.4427	1.35023	3.92421	5.35037	15.5499
1100	6500	0.41517	1.24082	3.49216	10.4369	0.68008	2.03251	5.41183	16.1741
1150	6500	0.49651	1.52492	3.39785	10.4357	5.45E-02	0.16724	5.45456	16.7524
1200	6500	0.57359	1.80913	3.31054	10.4416	0.53106	1.67497	5.48227	17.2914
300	7000	0.57693	0.9371	4.92154	7.99403	4.76288	7.73632	5.43552	8.82888
310	7000	0.45358	0.74393	5.00985	8.21676	4.56889	7.49354	4.87896	8.0021
320	7000	0.33869	0.56083	5.08647	8.42254	4.39017	7.26957	4.35622	7.21336
330	7000	0.23362	0.39052	5.15093	8.61014	4.22705	7.06581	3.86637	6.46292
340	7000	0.13745	0.2319	5.20481	8.78163	4.07771	6.87996	3.40641	5.74733
350	7000	5.01E-02	8.53E-02	5.24881	8.93773	3.94126	6.71123	2.97438	5.06481
360	7000	2.87E-02	4.93E-02	5.28358	9.07915	3.8169	6.55887	2.56853	4.41369
370	7000	9.87E-02	0.17116	5.30934	9.20594	3.70424	6.42284	2.18757	3.79305
380	7000	0.1614	0.28234	5.32786	9.32067	3.60134	6.30027	1.82878	3.1993
390	7000	0.21624	0.38165	5.33885	9.42261	3.50835	6.19192	1.49154	2.63244
400	7000	0.26471	0.47128	5.34393	9.51425	3.42341	6.09499	1.17338	2.08906
420	7000	0.34253	0.62041	5.33713	9.66704	3.27667	5.93496	0.59072	1.06996
440	7000	0.39835	0.73382	5.31192	9.78524	3.15571	5.81323	7.101423E-	0.13082
460	7000	0.43574	0.81611	5.27234	9.87477	3.05565	5.72303	0.39436	0.7386
480	7000	0.45811	0.8721	5.22215	9.94143	2.97203	5.65786	0.81302	1.54776
500	7000	0.46713	0.90364	5.16311	9.98778	2.90251	5.61475	1.19016	2.30232
520	7000	0.46612	0.91601	5.09847	10.0193	2.84323	5.58739	1.53201	3.01064
540	7000	0.45632	0.91075	5.02947	10.0381	2.7926	5.57361	1.84232	3.67698

560	**7000**	**0.43963**	**0.89091**	**4.95781**	**10.047**	**2.7485**	**5.56984**	**2.12509**	**4.30651**
580	**7000**	**0.41755**	**0.85897**	**4.88485**	**10.0488**	**2.7093**	**5.57338**	**2.38364**	**4.90347**
600	**7000**	**0.39128**	**0.8169**	**4.81152**	**10.0452**	**2.67367**	**5.58194**	**2.62076**	**5.47147**
620	**7000**	**0.3614**	**0.76555**	**4.73823**	**10.0371**	**2.64107**	**5.59465**	**2.83843**	**6.01269**
640	**7000**	**0.32904**	**0.70707**	**4.66586**	**10.0264**	**2.61035**	**5.60933**	**3.03897**	**6.53038**
660	**7000**	**0.29476**	**0.64242**	**4.59482**	**10.014**	**2.58093**	**5.62492**	**3.22407**	**7.02658**
680	**7000**	**0.2589**	**0.57214**	**4.52518**	**10.0004**	**2.55258**	**5.64107**	**3.39496**	**7.50267**
700	**7000**	**0.22225**	**0.49793**	**4.45755**	**9.98691**	**2.52454**	**5.65611**	**3.55335**	**7.9611**
720	**7000**	**0.18488**	**0.41985**	**4.39179**	**9.97352**	**2.49684**	**5.67018**	**3.70006**	**8.40265**
740	**7000**	**0.14734**	**0.33911**	**4.32833**	**9.96134**	**2.46894**	**5.68211**	**3.83635**	**8.82912**
760	**7000**	**0.10921**	**0.25467**	**4.26647**	**9.94909**	**2.44143**	**5.69322**	**3.96246**	**9.24017**
780	**7000**	**7.13E-02**	**0.16849**	**4.20692**	**9.93847**	**2.41348**	**5.70164**	**4.07978**	**9.6381**
800	**7000**	**3.35E-02**	**8.02E-02**	**4.14938**	**9.92905**	**2.38535**	**5.70791**	**4.18869**	**10.0231**
850	**7000**	**6.06E-02**	**0.14952**	**4.01337**	**9.90982**	**2.31469**	**5.71544**	**4.42741**	**10.9322**
900	**7000**	**0.153**	**0.38949**	**3.88804**	**9.89753**	**2.24334**	**5.71072**	**4.62444**	**11.7721**
950	**7000**	**0.24389**	**0.63955**	**3.77162**	**9.89029**	**2.17225**	**5.69628**	**4.78537**	**12.5486**
1000	**7000**	**0.33281**	**0.89833**	**3.66315**	**9.8876**	**2.1018**	**5.67319**	**4.91528**	**13.2674**
1050	**7000**	**0.4195**	**1.1647**	**3.56161**	**9.88847**	**1.5592**	**4.32896**	**5.01848**	**13.9333**
1100	**7000**	**0.50394**	**1.43818**	**3.46613**	**9.89197**	**0.88538**	**2.52677**	**5.09848**	**14.5505**
1150	**7000**	**0.58505**	**1.71513**	**3.37695**	**9.89996**	**0.25446**	**0.746**	**5.15929**	**15.1251**
1200	**7000**	**0.66214**	**1.99271**	**3.29415**	**9.91378**	**0.3373**	**1.01512**	**5.20425**	**15.6623**
300	**7500**	**0.68618**	**1.08228**	**4.46789**	**7.04701**	**5.33471**	**8.4142**	**6.01404**	**9.48568**
310	**7500**	**0.56918**	**0.90624**	**4.56603**	**7.26998**	**5.13386**	**8.17409**	**5.46823**	**8.70647**
320	**7500**	**0.45904**	**0.7377**	**4.65333**	**7.47808**	**4.9471**	**7.95019**	**4.95363**	**7.96068**

330	7500	0.35676	0.57861	4.72974	7.67082	4.77438	7.74324	4.46899	7.24795
340	7500	0.26237	0.42938	4.79594	7.84886	4.61486	7.55251	4.01249	6.56668
350	7500	0.17656	0.29154	4.85185	8.01165	4.46851	7.37865	3.58308	5.91657
360	7500	9.84E-02	0.16395	4.89884	8.16102	4.33374	7.21962	3.17833	5.29482
370	7500	2.82E-02	4.74E-02	4.93714	8.29701	4.21022	7.07542	2.79711	4.70064
380	7500	3.44E-02	5.83E-02	4.9673	8.42023	4.09724	6.94536	2.43796	4.13266
390	7500	9.03E-02	0.15443	4.99058	8.53243	3.99337	6.82749	2.09881	3.58835
400	7500	0.13946	0.24047	5.00708	8.63352	3.8984	6.72187	1.77882	3.06716
420	7500	0.21956	0.38495	5.02273	8.80653	3.73172	6.54295	1.19067	2.08765
440	7500	0.27802	0.49554	5.01861	8.94498	3.5919	6.40207	0.66421	1.18386
460	7500	0.31854	0.57698	4.99909	9.05508	3.47377	6.29219	0.19082	0.34564
480	7500	0.34335	0.63188	4.9669	9.1406	3.37396	6.20912	0.2358	0.43393
500	7500	0.35509	0.66376	4.92491	9.20585	3.28907	6.14807	0.62162	1.16196
520	7500	0.35656	0.6768	4.87598	9.25535	3.21562	6.10375	0.97235	1.84566
540	7500	0.34898	0.67251	4.82137	9.29101	3.15203	6.0741	1.29157	2.48892
560	7500	0.3345	0.65425	4.76316	9.31637	3.09578	6.0551	1.58351	3.09723
580	7500	0.31425	0.62372	4.70239	9.3332	3.04556	6.04476	1.85108	3.67398
600	7500	0.28937	0.5827	4.64009	9.3434	3.00004	6.04094	2.09697	4.2225
620	7500	0.26103	0.53314	4.5773	9.3489	2.958	6.04155	2.32367	4.74599
640	7500	0.22976	0.47589	4.51434	9.3504	2.91883	6.04567	2.53293	5.24637
660	7500	0.19664	0.41297	4.45217	9.34984	2.8814	6.05115	2.7269	5.72666
680	7500	0.16173	0.3443	4.39065	9.34709	2.84574	6.0582	2.90652	6.18757
700	7500	0.12581	0.27145	4.33044	9.34358	2.81102	6.06522	3.07346	6.63144

720	7500	8.92E-02	0.19498	4.27167	9.33973	2.777	6.07172	3.22876	7.05946
740	7500	5.19E-02	0.11497	4.21428	9.33555	2.74363	6.07774	3.37319	7.47236
760	7500	1.43E-02	3.21E-02	4.1584	9.3315	2.71068	6.08278	3.50768	7.87127
780	7500	2.31E-02	5.24E-02	4.10449	9.32869	2.67758	6.08561	3.63336	8.25789
800	7500	6.08E-02	0.14004	4.05185	9.32576	2.64507	6.0879	3.75016	8.63138
850	7500	0.15438	0.36645	3.92724	9.32207	2.56394	6.08601	4.00888	9.51585
900	7500	0.24662	0.60321	3.81154	9.32278	2.48362	6.07477	4.2253	10.3348
950	7500	0.33715	0.84907	3.70372	9.32734	2.40438	6.05513	4.40534	11.0943
1000	7500	0.42587	1.10346	3.60267	9.33477	2.32665	6.02853	4.55379	11.7992
1050	7500	0.51249	1.3653	3.50775	9.34476	1.78101	4.74466	4.67491	12.4541
1100	7500	0.59663	1.63312	3.41843	9.35711	1.1039	3.02165	4.77252	13.0636
1150	7500	0.67762	1.90461	3.3347	9.37285	0.46854	1.31693	4.85023	13.6326
1200	7500	0.75443	2.17599	3.25707	9.39431	0.12897	0.372	4.91167	14.1667
300	8000	0.78485	1.20637	4.01823	6.17633	5.8943	9.06	6.57594	10.1077
310	8000	0.6754	1.0477	4.12362	6.39664	5.6891	8.82506	6.04176	9.37212
320	8000	0.57096	0.89372	4.21944	6.6046	5.49641	8.60342	5.53589	8.66521
330	8000	0.47294	0.7469	4.30521	6.7991	5.31664	8.39641	5.05772	7.98752
340	8000	0.38218	0.60889	4.38083	6.97958	5.14987	8.20482	4.60638	7.33893
350	8000	0.29832	0.47943	4.44728	7.14723	4.99485	8.02723	4.1798	6.71736
360	8000	0.22164	0.35926	4.50482	7.30211	4.85131	7.86374	3.77687	6.12213
370	8000	0.15202	0.24852	4.55397	7.44471	4.71853	7.71372	3.39618	5.55197
380	8000	8.93E-02	0.14717	4.59529	7.57562	4.59586	7.57656	3.03636	5.00563

390	8000	3.36E-02	5.58E-02	4.62894	7.69484	4.48304	7.45231	2.69658	4.48262
400	8000	1.61E-02	2.69E-02	4.65608	7.80398	4.37874	7.33914	2.37494	3.9806
420	8000	9.77E-02	0.16641	4.6923	7.99352	4.19384	7.14438	1.78215	3.03597
440	8000	0.15836	0.27412	4.70797	8.14928	4.03635	6.98673	1.24952	2.16286
460	8000	0.20089	0.35324	4.70673	8.27599	3.90189	6.86082	0.76946	1.35297
480	8000	0.2281	0.40731	4.69193	8.3783	3.78645	6.76141	0.33526	0.59866
500	8000	0.24213	0.43899	4.66609	8.45973	3.68697	6.68455	0.05852	0.10611
520	8000	0.24572	0.4522	4.63214	8.52471	3.60002	6.62526	0.41738	0.76811
540	8000	0.24034	0.44888	4.59169	8.57564	3.52365	6.58092	0.74511	1.39162
560	8000	0.22742	0.43095	4.54615	8.61469	3.45602	6.54895	1.04519	1.98058
580	8000	0.209	0.40173	4.49751	8.64521	3.39483	6.5256	1.32133	2.53989
600	8000	0.18556	0.36174	4.44626	8.66799	3.33935	6.51006	1.5756	3.07162
620	8000	0.15851	0.31335	4.3937	8.6853	3.28805	6.4997	1.81067	3.57927
640	8000	0.12839	0.25729	4.34024	8.69796	3.24032	6.49369	2.02823	4.06465
660	8000	9.60E-02	0.19501	4.28664	8.7074	3.19524	6.49046	2.23018	4.53013
680	8000	6.21E-02	0.12787	4.23346	8.71477	3.15202	6.48858	2.41814	4.97784
700	8000	2.68E-02	5.59E-02	4.1807	8.72011	3.11061	6.48812	2.59302	5.40853
720	8000	9.19E-03	1.94E-02	4.12899	8.7248	3.0702	6.48751	2.75633	5.8243
740	8000	4.61E-02	9.86E-02	4.07805	8.72837	3.03102	6.48737	2.90858	6.2253
760	8000	8.30E-02	0.17988	4.02853	8.73223	2.99227	6.48602	3.05114	6.61364

780	8000	0.12038	0.26421	3.97996	8.73554	2.95439	6.48453	3.18421	6.98894
800	8000	0.15767	0.35035	3.93278	8.73932	2.91683	6.48171	3.30883	7.35282
850	8000	0.25094	0.57476	3.8199	8.74952	2.82502	6.47075	3.58613	8.21407
900	8000	0.34287	0.80884	3.71444	8.76238	2.73521	6.45237	3.82086	9.01343
950	8000	0.43317	1.05162	3.61562	8.77765	2.64748	6.42728	4.01881	9.75649
1000	8000	0.52191	1.30303	3.52234	8.79407	2.5623	6.39718	4.18451	10.4473
1050	8000	0.60843	1.56113	3.43445	8.81228	2.01368	5.16681	4.32256	11.091
1100	8000	0.69255	1.82507	3.35142	8.83199	1.33399	3.51545	4.43652	11.6916
1150	8000	0.77327	2.09166	3.27373	8.85526	0.69458	1.8788	4.53033	12.2543
1200	8000	0.84979	2.3579	3.20162	8.88358	9.19E-02	0.25512	4.60738	12.7842
300	8500	0.87255	1.31087	3.57557	5.37173	6.4396	9.67448	7.12036	10.6972
310	8500	0.77212	1.17037	3.68557	5.58653	6.23267	9.44739	6.59894	10.0026
320	8500	0.67492	1.03205	3.78724	5.79123	6.0367	9.23099	6.10317	9.33263
330	8500	0.58237	0.89827	3.88012	5.98482	5.85215	9.02654	5.63258	8.68786
340	8500	0.49511	0.77022	3.96434	6.16715	5.67878	8.83424	5.18605	8.06772
350	8500	0.41458	0.65041	4.03909	6.3367	5.51738	8.65591	4.76364	7.4734
360	8500	0.34005	0.53795	4.10563	6.49504	5.36654	8.48977	4.36318	6.90247
370	8500	0.27181	0.43356	4.16414	6.64216	5.22598	8.33589	3.98372	6.35438
380	8500	0.21007	0.33783	4.21481	6.77811	5.09543	8.1943	3.62441	5.82865
390	8500	0.15464	0.2507	4.2581	6.90333	4.9743	8.06445	3.28407	5.32421
400	8500	0.10531	0.1721	4.29451	7.01834	4.86202	7.94581	2.96161	4.84004
420	8500	2.28E-02	3.78E-02	4.34966	7.22167	4.66045	7.73766	2.36493	3.92645
440	8500	3.92E-02	6.60E-02	4.38326	7.39133	4.48706	7.56636	1.82728	3.08127
460	8500	8.34E-	0.14281	4.39927	7.53248	4.33721	7.42621	1.34109	2.29622

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480	8500	0.11266	0.19583	4.40092	7.64939	4.20696	7.31227	0.89989	1.56414
500	8500	0.1287	0.22704	4.39049	7.74502	4.09364	7.22135	0.49877	0.87985
520	8500	0.1341	0.24004	4.37085	7.82355	3.99382	7.14869	0.13242	0.23701
540	8500	0.1306	0.23715	4.34386	7.8877	3.90523	7.09122	0.20317	0.36894
560	8500	0.1193	0.21972	4.31079	7.93926	3.82634	7.04702	0.51107	0.94125
580	8500	0.10244	0.19131	4.2739	7.9819	3.75456	7.01198	0.79516	1.48503
600	8500	8.02E-02	0.1519	4.23337	8.01576	3.68943	6.98582	1.05718	2.00173
620	8500	5.46E-02	0.10473	4.19107	8.04407	3.62883	6.96496	1.30028	2.49568
640	8500	2.54E-02	4.94E-02	4.14693	8.06667	3.57271	6.94969	1.52557	2.96757
660	8500	5.91E-03	1.16E-02	4.10218	8.08577	3.51959	6.93742	1.73541	3.42064
680	8500	3.91E-02	7.82E-02	4.05701	8.10172	3.46915	6.9278	1.93091	3.85597
700	8500	7.38E-02	0.1492	4.0119	8.1155	3.42084	6.91987	2.11344	4.27517
720	8500	0.10947	0.22428	3.967	8.1274	3.37433	6.91318	2.28398	4.67931
740	8500	0.14576	0.30239	3.92278	8.13842	3.32906	6.90663	2.44378	5.07
760	8500	0.18254	0.38343	3.87921	8.14855	3.28496	6.90028	2.59345	5.44774
780	8500	0.21953	0.46683	3.8365	8.15832	3.24173	6.89353	2.73389	5.8136
800	8500	0.25663	0.55239	3.7947	8.16787	3.1993	6.88631	2.86566	6.16816
850	8500	0.34947	0.77491	3.69402	8.19117	3.09629	6.86575	3.16066	7.0085
900	8500	0.44112	1.00687	3.59927	8.21549	2.9966	6.83989	3.4127	7.78965
950	8500	0.53151	1.24793	3.50953	8.24001	2.90038	6.8098	3.62727	8.51646
1000	8500	0.62013	1.4967	3.42456	8.26513	2.80731	6.77541	3.80942	9.19398

1050	8500	0.70676	1.75228	3.34392	8.29065	2.25598	5.5933	3.96328	9.82625
1100	8500	0.79066	2.01253	3.26775	8.31768	1.5738	4.00592	4.09294	10.4181
1150	8500	0.87125	2.27538	3.19618	8.34726	0.93087	2.43109	4.20189	10.9738
1200	8500	0.94755	2.53754	3.12986	8.38175	0.3237	0.86686	4.29369	11.4985
300	9000	0.9493	1.39736	3.14193	4.6249	6.96942	10.2589	7.64688	11.2561
310	9000	0.85913	1.27565	3.25422	4.83191	6.76309	10.0419	7.13932	10.6006
320	9000	0.76979	1.1528	3.36008	5.03188	6.56544	9.83205	6.65413	9.96487
330	9000	0.68387	1.03279	3.45796	5.22224	6.37815	9.63234	6.19214	9.35142
340	9000	0.60201	0.91675	3.54801	5.40294	6.20104	9.44301	5.75237	8.75977
350	9000	0.525	0.80606	3.63007	5.57346	6.03416	9.2646	5.3342	8.18992
360	9000	0.45358	0.70209	3.70394	5.73321	5.8777	9.0979	4.93714	7.64204
370	9000	0.38738	0.60445	3.77045	5.88318	5.73066	8.94176	4.55959	7.11451
380	9000	0.32728	0.51475	3.82914	6.0224	5.59352	8.79738	4.20147	6.60799
390	9000	0.27283	0.43249	3.88077	6.15179	5.46536	8.66369	3.86131	6.12095
400	9000	0.22386	0.35763	3.92583	6.27189	5.34565	8.54019	3.53813	5.65251
420	9000	0.14155	0.22964	3.99782	6.48582	5.12948	8.32177	2.93885	4.76782
440	9000	7.89E-02	0.12999	4.04799	6.66721	4.94148	8.13883	2.3969	3.9478
460	9000	3.35E-02	5.60E-02	4.07992	6.82044	4.77745	7.98651	1.90536	3.18521
480	9000	2.74E-03	4.66E-03	4.09687	6.94973	4.63351	7.8601	1.458	2.47329
500	9000	1.50E-02	2.58E-02	4.10107	7.05791	4.50702	7.75653	1.05008	1.80716
520	9000	2.23E-02	3.89E-02	4.09534	7.14886	4.39463	7.67131	0.67647	1.18084
540	9000	2.02E-02	3.57E-02	4.08104	7.22438	4.29465	7.6025	0.33385	0.59099

560	9000	1.06E-02	1.90E-02	4.06023	7.28749	4.20467	7.54674	1.843723E-	3.31E-02
580	9000	2.59E-02	9.01E-03	4.03458	7.34075	4.1227	7.50108	0.27304	0.49679
600	9000	5.06E-02	4.77E-02	4.0047	7.38499	4.04797	7.46477	0.54253	1.00048
620	9000	7.87E-02	9.46E-02	3.97211	7.42268	3.97863	7.43486	0.79286	1.48162
640	9000	0.10906	0.14893	3.93728	7.45456	3.91406	7.41059	1.02562	1.94183
660	9000	0.14176	0.20915	3.90123	7.48241	3.85305	7.38998	1.24283	2.3837
680	9000	0.17576	0.27538	3.86395	7.5061	3.79555	7.37323	1.44537	2.80778
700	9000	0.2108	0.34577	3.82636	7.52739	3.74041	7.35833	1.63507	3.21659
720	9000	0.2466	0.41989	3.78866	7.54667	3.68735	7.34487	1.81288	3.61109
740	9000	0.2831	0.49728	3.75113	7.56448	3.63603	7.33236	1.97973	3.9923
760	9000	0.31997	0.57788	3.71371	7.58073	3.58636	7.32075	2.13631	4.3608
780	9000	0.35694	0.66106	3.6767	7.59602	3.53799	7.30947	2.28345	4.71759
800	9000	0.44938	0.74626	3.64031	7.61087	3.49065	7.29798	2.42195	5.06361
850	9000	0.54119	0.96736	3.55207	7.6464	3.37626	7.26793	2.73369	5.88469
900	9000	0.63144	1.19861	3.46781	7.6804	3.26692	7.23546	3.00172	6.64812
950	9000	0.72006	1.43784	3.38775	7.71424	3.16168	7.19946	3.23228	7.36021
1000	9000	0.80649	1.6847	3.31129	7.74728	3.06058	7.16072	3.42993	8.02485
1050	9000	0.8904	1.93756	3.2385	7.78034	2.50626	6.02117	3.5991	8.64666
1100	9000	0.97105	2.19527	3.16926	7.81373	1.82203	4.49217	3.74345	9.22939
1150	9000	1.04729	2.45545	3.10397	7.84894	1.17607	2.97391	3.86665	9.77752
1200	9000	1.01541	2.71456	3.04344	7.88855	0.56489	1.46418	3.97236	10.2963
300	9500	0.93622	1.46751	2.71862	3.92906	7.48312	10.8149	8.15551	11.7867
310	9500	0.85634	1.36454	2.83137	4.12673	7.27912	10.6093	7.66246	11.1681

320	**9500**	**0.77768**	**1.25854**	**2.93894**	**4.3193**	**7.08234**	**10.4088**	**7.18939**	**10.5661**
330	**9500**	**0.70193**	**1.15234**	**3.04036**	**4.50514**	**6.89379**	**10.2151**	**6.73656**	**9.98208**
340	**9500**	**0.62961**	**1.04855**	**3.13472**	**4.6827**	**6.71439**	**10.0301**	**6.30422**	**9.41734**
350	**9500**	**0.5618**	**0.94807**	**3.22216**	**4.85193**	**6.54397**	**9.85391**	**5.89151**	**8.87143**
360	**9500**	**0.4985**	**0.85267**	**3.30214**	**5.01179**	**6.38305**	**9.68782**	**5.49836**	**8.34508**
370	**9500**	**0.44036**	**0.76253**	**3.37517**	**5.1628**	**6.23106**	**9.5313**	**5.12363**	**7.83733**
380	**9500**	**0.38752**	**0.67882**	**3.44099**	**5.30434**	**6.08816**	**9.38498**	**4.76699**	**7.34839**
390	**9500**	**0.33954**	**0.60196**	**3.4998**	**5.43646**	**5.95412**	**9.24893**	**4.42771**	**6.87784**
400	**9500**	**0.25848**	**0.53145**	**3.55231**	**5.56003**	**5.82813**	**9.12213**	**4.10451**	**6.42435**
420	**9500**	**0.1956**	**0.41066**	**3.63915**	**5.78183**	**5.59928**	**8.89607**	**3.50383**	**5.56684**
440	**9500**	**0.14918**	**0.31537**	**3.70466**	**5.97316**	**5.39787**	**8.70318**	**2.95823**	**4.76966**
460	**9500**	**0.1174**	**0.24403**	**3.75167**	**6.13718**	**5.22043**	**8.53986**	**2.46171**	**4.02698**
480	**9500**	**9.81E-02**	**0.19482**	**3.78282**	**6.27702**	**5.06385**	**8.40271**	**2.00892**	**3.3335**
500	**9500**	**0.08972**	**0.16509**	**3.80088**	**6.39625**	**4.92488**	**8.28772**	**1.59468**	**2.68356**
520	**9500**	**0.09038**	**0.1531**	**3.8079**	**6.49745**	**4.80108**	**8.19211**	**1.21488**	**2.07295**
540	**9500**	**9.85E-02**	**0.15632**	**3.80599**	**6.58353**	**4.68992**	**8.11252**	**0.86545**	**1.49704**
560	**9500**	**0.11283**	**0.1727**	**3.79692**	**6.65697**	**4.5893**	**8.04621**	**0.543**	**0.95201**
580	**9500**	**0.13259**	**0.20046**	**3.78215**	**6.71984**	**4.49753**	**7.99089**	**0.24462**	**0.43463**
600	**9500**	**0.15628**	**0.23868**	**3.76249**	**6.77331**	**4.41351**	**7.94527**	**0.03186**	**5.74E-02**
620	**9500**	**0.1834**	**0.285**	**3.73953**	**6.81979**	**4.33545**	**7.90658**	**0.28918**	**0.52737**
640	**9500**	**0.21323**	**0.33877**	**3.71381**	**6.86016**	**4.26267**	**7.87401**	**0.52892**	**0.97703**
660	**9500**	**0.24499**	**0.39889**	**3.68601**	**6.89546**	**4.19425**	**7.84623**	**0.75281**	**1.40829**
680	**9500**	**0.2785**	**0.46408**	**3.6569**	**6.92701**	**4.12931**	**7.82186**	**0.96244**	**1.82308**
700	**9500**	**0.31296**	**0.5341**	**3.62671**	**6.95516**	**4.06748**	**7.80048**	**1.15885**	**2.2224**

720	9500	0.34859	0.60756	3.59611	6.98115	4.00798	7.78074	1.34347	2.60808
740	9500	0.38461	0.68492	3.56493	7.00464	3.95092	7.76306	1.51675	2.98024
760	9500	0.42121	0.76479	3.53384	7.02691	3.89548	7.74599	1.68005	3.34072
780	9500	0.45806	0.8475	3.50273	7.04773	3.84178	7.72991	1.83373	3.68959
800	9500	0.55022	0.93248	3.47177	7.06745	3.78951	7.71428	1.97858	4.02778
850	9500	0.642	1.15265	3.39605	7.11431	3.6637	7.675	2.30613	4.83107
900	9500	0.7323	1.38304	3.32269	7.15793	3.54432	7.63536	2.58954	5.57852
950	9500	0.8211	1.62121	3.25227	7.20001	3.4301	7.5937	2.83512	6.27652
1000	9500	0.90762	1.86691	3.18443	7.24032	3.32094	7.5507	3.04737	6.92869
1050	9500	0.99145	2.11814	3.11943	7.27988	2.76391	6.45019	3.23085	7.53988
1100	9500	1.07201	2.37352	3.05747	7.31953	2.07766	4.97389	3.38932	8.11398
1150	9500	1.14823	2.63117	2.99881	7.36034	1.42879	3.50684	3.52624	8.65488
1200	9500	1.07034	2.88777	2.94432	7.40488	0.81391	2.04696	3.6452	9.16757
300	10000	1.00347	1.52145	2.30725	3.27967	7.97956	11.3426	8.64557	12.2893
310	10000	0.93384	1.4382	2.41828	3.46593	7.78014	11.1507	8.16831	11.707
320	10000	0.86366	1.3493	2.52592	3.64969	7.58583	10.9607	7.70811	11.1374
330	10000	0.79465	1.25791	2.62887	3.82892	7.39802	10.7752	7.26568	10.5824
340	10000	0.72805	1.16657	2.72616	4.00207	7.21771	10.5958	6.84138	10.0433
350	10000	0.66462	1.07715	2.8173	4.1682	7.04546	10.4238	6.43518	9.52087
360	10000	0.60475	0.9909	2.902	4.32669	6.88149	10.2598	6.04675	9.01529
370	10000	0.54937	0.90854	2.98038	4.4775	6.72562	10.1041	5.6754	8.52628
380	10000	0.4984	0.83158	3.05198	4.61973	6.57835	9.95753	5.32114	8.05452
390	10000	0.45201	0.76005	3.11717	4.75373	6.43919	9.81986	4.98305	7.59923
400	10000	0.37251	0.69444	3.17608	4.87949	6.30798	9.69111	4.66053	7.16009
420	10000	0.31034	0.58069	3.27657	5.10782	6.06758	9.45867	4.0589	6.32736
440	10000	0.26391	0.49077	3.35564	5.30661	5.85444	9.25823	3.51082	5.55201

460	**10000**	**0.23127**	**0.42329**	**3.41608**	**5.47899**	**5.66527**	**9.08642**	**3.01055**	**4.82857**
480	**10000**	**0.21116**	**0.37612**	**3.46071**	**5.62828**	**5.4967**	**8.93948**	**2.55271**	**4.15156**
500	**10000**	**0.20152**	**0.34815**	**3.49146**	**5.75666**	**5.34642**	**8.81506**	**2.13312**	**3.51705**
520	**10000**	**0.20087**	**0.33679**	**3.51086**	**5.86742**	**5.21146**	**8.70947**	**1.74724**	**2.92002**
540	**10000**	**0.20767**	**0.3402**	**3.5208**	**5.96303**	**5.08963**	**8.62005**	**1.39146**	**2.35665**
560	**10000**	**0.22117**	**0.35636**	**3.523**	**6.0458**	**4.97881**	**8.54408**	**1.06243**	**1.82321**
580	**10000**	**0.23967**	**0.38452**	**3.51842**	**6.1169**	**4.87787**	**8.48038**	**0.75784**	**1.31754**
600	**10000**	**0.26243**	**0.42206**	**3.50892**	**6.17916**	**4.78466**	**8.42573**	**0.47456**	**0.8357**
620	**10000**	**0.28849**	**0.46803**	**3.49529**	**6.23367**	**4.69816**	**8.37895**	**0.21067**	**0.37571**
640	**10000**	**0.31761**	**0.52099**	**3.47854**	**6.28198**	**4.61717**	**8.33827**	**3.59E-02**	**6.48E-02**
660	**10000**	**0.34881**	**0.58072**	**3.45904**	**6.32454**	**4.54128**	**8.30333**	**0.26627**	**0.48685**
680	**10000**	**0.38165**	**0.64562**	**3.43766**	**6.36281**	**4.46934**	**8.27237**	**0.48233**	**0.89274**
700	**10000**	**0.41583**	**0.71499**	**3.41492**	**6.39762**	**4.40075**	**8.2445**	**0.68528**	**1.28383**
720	**10000**	**0.45089**	**0.78839**	**3.39109**	**6.42939**	**4.33515**	**8.2193**	**0.8761**	**1.66105**
740	**10000**	**0.48674**	**0.86504**	**3.36662**	**6.45893**	**4.27197**	**8.19586**	**1.05589**	**2.02576**
760	**10000**	**0.52311**	**0.9448**	**3.34159**	**6.48637**	**4.21105**	**8.17405**	**1.22532**	**2.37848**
780	**10000**	**0.55969**	**1.02723**	**3.31626**	**6.51213**	**4.15208**	**8.15343**	**1.38517**	**2.72006**
800	**10000**	**0.65184**	**1.11172**	**3.2909**	**6.53678**	**4.09469**	**8.13337**	**1.53624**	**3.05147**
850	**10000**	**0.74343**	**1.33173**	**3.2275**	**6.59382**	**3.95768**	**8.08559**	**1.87857**	**3.83794**
900	**10000**	**0.83399**	**1.56112**	**3.16534**	**6.64686**	**3.828**	**8.03837**	**2.17678**	**4.57099**
950	**10000**	**0.92292**	**1.79891**	**3.10454**	**6.69647**	**3.7049**	**7.9914**	**2.43648**	**5.25545**
1000	**10000**	**1.00951**	**2.04364**	**3.04545**	**6.74357**	**3.5875**	**7.94384**	**2.66268**	**5.89601**
1050	**10000**	**1.09334**	**2.29348**	**2.98852**	**6.78952**	**3.02769**	**6.87851**	**2.85986**	**6.49722**
1100	**10000**	**1.17391**	**2.54708**	**2.9339**	**6.8349**	**2.33965**	**5.4505**	**3.03174**	**7.06283**
1150	**10000**	**1.24998**	**2.80277**	**2.88198**	**6.88089**	**1.68809**	**4.03043**	**3.18169**	**7.59648**
1200	**10000**		**3.05694**	**2.83382**	**6.93036**	**1.06966**	**2.61595**	**3.31346**	**8.10336**

Appendix C

Results for mixture of superheated vapors

T = Temperature, Kelvin

P = pressure, bar

AA%D = average absolute percentage deviations for enthalpy.

AAD = average absolute deviations for enthalpy departure, Joule/gram.

Table C-1: Mixture of 81.2 mole% &18.8 mole% cycloohexane

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
522	27.57893	0.58569	2.368907	1.563922	14.23781	1.4312	13.02955	1.65176	15.0375
527.5	27.57893	0.65501	6.097204	2.324555	21.63834	2.193587	20.41924	2.457493	22.8758
533.1	27.57893	0.952135	9.006944	2.499874	23.64829	2.369634	22.41626	2.683167	25.38218
538.6	27.57893	1.094722	10.50352	2.542512	24.39461	2.412695	23.14906	2.780425	26.67731
544.2	27.57893	1.185593	11.53258	2.546013	24.76572	2.416527	23.50616	2.84454	27.66962

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549.7	**27.57893**	**1.270631**	**12.52532**	**2.555553**	**25.19146**	**2.426388**	**23.91817**	**2.917737**	**28.76169**
555.3	**27.57893**	**1.374258**	**13.73222**	**2.590818**	**25.88858**	**2.462025**	**24.60159**	**3.020988**	**30.18704**
557	**27.57893**	**1.34482**	**13.48497**	**2.542833**	**25.49779**	**2.414076**	**24.20672**	**2.994423**	**30.02605**
558.1	**27.57893**	**1.378077**	**13.85686**	**2.563774**	**25.77934**	**2.43511**	**24.48562**	**3.029091**	**30.45826**
559.2	**27.57893**	**1.388221**	**13.99444**	**2.562137**	**25.82846**	**2.433545**	**24.53212**	**3.041371**	**30.65949**
560.8	**27.57893**	**1.425305**	**14.42463**	**2.582245**	**26.13326**	**2.453785**	**24.83315**	**3.081717**	**31.18811**
563.6	**27.57893**	**1.404406**	**14.29804**	**2.533684**	**25.79498**	**2.405338**	**24.48833**	**3.069308**	**31.24811**
566.4	**27.57893**	**1.427335**	**14.6244**	**2.529894**	**25.92118**	**2.401739**	**24.60809**	**3.101734**	**31.78031**
572	**27.57893**	**1.446974**	**15.01072**	**2.500007**	**25.93477**	**2.372216**	**24.60914**	**3.14496**	**32.62544**
577.5	**27.57893**	**1.242168**	**13.01325**	**2.252958**	**23.60256**	**2.125286**	**22.26503**	**2.971509**	**31.13023**
583.1	**27.57893**	**1.405892**	**14.93125**	**2.373366**	**25.20616**	**2.246323**	**23.85697**	**3.163823**	**33.60119**
533.1	**34.47367**	**1.727305**	**15.65286**	**1.330749**	**12.05933**	**1.149669**	**10.41833**	**0.213062**	**1.930762**
538.6	**34.47367**	**0.266268**	**2.482933**	**2.365172**	**22.05488**	**2.194694**	**20.46519**	**1.420321**	**13.24427**
544.2	**34.47367**	**0.169309**	**1.607925**	**2.515644**	**23.89105**	**2.349605**	**22.31415**	**1.659851**	**15.76358**
549.7	**34.47367**	**0.508019**	**4.906194**	**2.640333**	**25.49904**	**2.47688**	**23.92046**	**1.845839**	**17.82617**
555.3	**34.47367**	**0.702726**	**6.891188**	**2.661834**	**26.10291**	**2.500038**	**24.51628**	**1.921361**	**18.84154**
557	**34.47367**	**0.728407**	**7.173467**	**2.641589**	**26.0149**	**2.48015**	**24.4251**	**1.917136**	**18.88041**
558.1	**34.47367**	**0.753228**	**7.439033**	**2.637946**	**26.0527**	**2.476754**	**24.46073**	**1.924025**	**19.00194**
559.2	**34.47367**	**0.801322**	**7.938185**	**2.658056**	**26.33167**	**2.497127**	**24.73743**	**1.954922**	**19.36614**
560.8	**34.47367**	**0.849933**	**8.455304**	**2.667936**	**26.54123**	**2.507338**	**24.94359**	**1.980534**	**19.70284**
563.6	**34.47367**	**0.877063**	**8.784417**	**2.632232**	**26.36366**	**2.472105**	**24.7598**	**1.972678**	**19.75776**
566.4	**34.47367**	**0.881137**	**8.882581**	**2.578605**	**25.99442**	**2.418857**	**24.38409**	**1.947759**	**19.635**
572	**34.47367**	**0.934742**	**9.549037**	**2.527395**	**25.81922**	**2.368454**	**24.19551**	**1.957452**	**19.99682**
577.5	**34.47367**	**0.941518**	**9.738738**	**2.444501**	**25.28511**	**2.286239**	**23.64804**	**1.938046**	**20.0465**
583.1	**34.47367**	**0.96886**	**10.15003**	**2.390256**	**25.0409**	**2.232699**	**23.39026**	**1.951967**	**20.44931**

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555.3	**43.43682**	**1.365802**	**12.82167**	**2.905971**	**27.28033**	**2.694094**	**25.29124**	**0.723996**	**6.796629**
557	**43.43682**	**1.065448**	**10.08389**	**2.890049**	**27.35266**	**2.685098**	**25.41293**	**0.949511**	**8.986625**
558.1	**43.43682**	**0.84723**	**8.061906**	**2.943306**	**28.0073**	**2.741177**	**26.08401**	**1.114035**	**10.60068**
559.2	**43.43682**	**0.72316**	**6.911597**	**2.92705**	**27.97517**	**2.726879**	**26.06208**	**1.184305**	**11.31899**
560.8	**43.43682**	**0.539718**	**5.19094**	**2.933121**	**28.21066**	**2.735049**	**26.30552**	**1.287358**	**12.38174**
563.6	**43.43682**	**0.362123**	**3.515735**	**2.859668**	**27.76357**	**2.663792**	**25.86185**	**1.327713**	**12.89033**
566.4	**43.43682**	**0.266081**	**2.604943**	**2.753391**	**26.95585**	**2.558771**	**25.05057**	**1.292979**	**12.65834**
572	**43.43682**	**6.731967E-**	**6.69E-03**	**2.699737**	**26.8827**	**2.506806**	**24.96164**	**1.322139**	**13.16529**
558.1	**46.88419**	**0.124271**	**1.138048**	**9.084872**	**83.19385**	**8.912601**	**81.61632**	**0.786704**	**7.204194**
559.2	**46.88419**	**1.916533**	**17.7689**	**8.615265**	**79.87534**	**8.453649**	**78.37693**	**2.42E-02**	**0.223965**
560.8	**46.88419**	**1.600807**	**15.02046**	**3.684865**	**34.57519**	**3.498045**	**32.82228**	**0.574265**	**5.38833**
563.6	**46.88419**	**1.157084**	**11.01578**	**3.274057**	**31.16983**	**3.081573**	**29.33733**	**1.019315**	**9.704089**
566.4	**46.88419**	**0.982995**	**9.459001**	**2.979545**	**28.67096**	**2.784673**	**26.79584**	**1.090317**	**10.49171**
572	**46.88419**	**0.700484**	**6.869153**	**2.675807**	**26.23991**	**2.478495**	**24.305**	**1.091701**	**10.70565**
577.5	**46.88419**	**0.447582**	**4.465169**	**2.545798**	**25.39722**	**2.347308**	**23.41711**	**1.069701**	**10.67145**
583.1	**46.88419**	**0.205388**	**2.083385**	**2.495438**	**25.31277**	**2.296386**	**23.29367**	**1.064674**	**10.79969**

Table C-2: Mixture of 61.3 mole% benzene &38.7 mole% cyclohexane

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
522	27.57893	1.189069	10.85006	0.841839	7.681691	0.706071	6.442814	0.794728	7.251739
527.556	27.57893	2.72E-02	0.254338	1.829158	17.12052	1.695916	15.87334	1.827259	17.10272
533.111	27.57893	0.476473	4.543954	2.200784	20.98787	2.068811	19.72927	2.245587	21.41515
538.667	27.57893	0.699877	6.780234	2.317983	22.45595	2.186736	21.18447	2.414048	23.38659
544.222	27.57893	0.844277	8.300853	2.373049	23.33172	2.242364	22.04679	2.525453	24.83012
549.778	27.57893	0.888977	8.860257	2.342176	23.34407	2.211886	22.04556	2.555708	25.47239
555.333	27.57893	0.928869	9.383162	2.316039	23.39603	2.186163	22.08404	2.594614	26.21014
560.889	27.57893	1.00824	10.32572	2.336855	23.93243	2.207459	22.60723	2.683295	27.48044
566.445	27.57893	1.058634	10.98706	2.335512	24.23926	2.206592	22.9012	2.751969	28.56143
572	27.57893	1.0806	11.36082	2.311787	24.30485	2.18333	22.95431	2.799653	29.43397
577.556	27.57893	1.075005	11.44458	2.265511	24.11868	2.137514	22.75607	2.825543	30.08081
583.111	27.57893	1.021286	11.00329	2.175692	23.44081	2.048141	22.06656	2.808243	30.25586
538.667	34.47367	0.121672	1.168015	2.18898	20.58504	2.015753	18.95605	1.181605	11.11172
544.222	34.47367	0.184877	1.805676	2.456244	23.57833	2.28899	21.97282	1.562943	15.00327
549.778	34.47367	0.323044	3.194888	2.526922	24.67993	2.362725	23.07629	1.700281	16.6063
554.222	34.47367	0.328792	3.260931	2.516044	24.88391	2.353393	23.27522	1.730938	17.11917
555.333	34.47367	0.381087	3.792011	2.488813	24.68407	2.326434	23.07358	1.713358	16.99311
556.445	34.47367	0.38983	3.895318	2.508686	24.96281	2.346633	23.35037	1.743165	17.34549
558.111	34.47367	0.428206	4.309681	2.47251	24.70642	2.310835	23.09084	1.721363	17.20058
560.889	34.47367	0.50492	5.154565	2.440738	24.5649	2.279643	22.94358	1.713999	17.25064
566.445	34.47367	0.535297	5.539448	2.394351	24.4433	2.234285	22.80928	1.718846	17.54726
572	34.47367	0.519998	5.451265	2.320726	24.01555	2.161505	22.36794	1.700488	17.59713

Continued …

577.556	34.47367	0.524799	5.573608	2.216082	23.2317	2.057594	21.57024	1.655429	17.35424
583.111	34.47367	4.571777	43.0141	2.142572	22.75506	1.984825	21.07975	1.64576	17.47871
544.222	37.4384	0.617272	5.938283	2.143931	20.17137	1.952903	18.37406	0.736483	6.929291
549.778	37.4384	0.233731	2.283933	2.36164	22.71968	2.180912	20.98095	1.183409	11.38472
554.222	37.4384	0.143063	1.403299	2.482034	24.2531	2.305066	22.5239	1.391417	13.59614
555.333	37.4384	7.55E-02	0.743201	2.516988	24.6883	2.340721	22.95937	1.442319	14.14728
556.445	37.4384	1.43E-02	0.141196	2.532156	24.92543	2.356484	23.1962	1.471675	14.48658
558.111	37.4384	0.196376	1.960412	2.549081	25.2225	2.374191	23.49201	1.507578	14.91711
560.889	37.4384	0.308743	3.128894	2.620114	26.15692	2.446392	24.42269	1.606517	16.03806
566.445	37.4384	0.334775	3.440174	2.549684	25.83926	2.377443	24.09375	1.582167	16.0342
572	37.4384	0.341561	3.557622	2.42746	24.94508	2.256245	23.18564	1.503937	15.45479
577.556	37.4384	0.327503	3.456105	2.309864	24.05894	2.139498	22.28448	1.433498	14.93102
583.111	37.4384	1.95592	18.16591	2.189853	23.10945	2.020249	21.31962	1.36538	14.40889
549.778	41.3684	1.596507	15.21768	2.191047	20.34967	1.952449	18.13365	0.450358	4.182819
554.222	41.3684	1.417424	13.57996	2.278559	21.71895	2.08123	19.83809	0.563359	5.369881
555.333	41.3684	1.258018	12.11124	2.30944	22.12609	2.114648	20.25984	0.691953	6.629439
556.445	41.3684	1.061525	10.28867	2.339171	22.51974	2.146258	20.6626	0.798844	7.690686
558.111	41.3684	0.78695	7.707982	2.368236	22.95386	2.177381	21.104	0.916195	8.88008
560.889	41.3684	0.492354	4.90951	2.41381	23.64262	2.225217	21.79535	1.061468	10.39674
566.445	41.3684	0.3134	3.176099	2.366675	23.59932	2.180383	21.74167	1.119465	11.16275
572	41.3684	0.143957	1.481996	2.293267	23.24068	2.108195	21.36514	1.098624	11.1338
577.556	41.3684	8.77E-03	9.17E-02	2.262731	23.29436	2.078602	21.39878	1.104549	11.3711
583.111	41.3684	1.617376	15.20601	2.251699	23.53699	2.068405	21.62099	1.127837	11.78921
554.222	43.43682	1.67205	15.83282	3.674445	34.54581	3.439669	32.33848	0.328993	3.093113
555.333	43.43682	1.449287	13.8111	3.245366	30.73067	3.04074	28.79299	0.62399	5.908648

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556.445	43.43682	1.267226	12.16752	3.108117	29.619	2.910384	27.73466	0.846845	8.070065
558.111	43.43682	1.060089	10.28956	2.931773	28.14989	2.738012	26.2895	0.992539	9.530021
560.889	43.43682	1.721447	15.63581	2.736118	26.55764	2.544797	24.70068	1.093033	10.60929
555.333	45.09156	2.03E-03	0.01885	7.532381	68.41635	7.368737	66.93002	2.531897	22.99713
556.445	45.09156	1.905185	17.99161	8.505106	79.05183	8.348584	77.59709	0.644446	5.989903
558.111	45.09156	1.398001	13.42967	3.683204	34.78233	3.517159	33.21431	0.291391	2.75175
560.889	45.09156	0.914339	8.987606	3.115165	29.92529	2.932375	28.16931	0.939717	9.027261
566.445	45.09156	0.661592	6.624745	2.784044	27.36611	2.595933	25.51698	1.235093	12.1405
572	45.09156	0.506733	5.158923	2.581005	25.84452	2.39074	23.93937	1.220263	12.21891
577.556	45.09156	----------	---------	2.417063	24.60776	2.225617	22.65865	1.123629	11.43944

Table C-3: Mixture of 33.4 mole% benzene & 66.6 mole% cyclohexane

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
522	27.57893	1.166319	10.77816	0.866864	8.010813	0.727273	6.720816	0.730814	6.753554
527.556	27.57893	0.635416	5.990204	1.199584	11.30872	1.062577	10.01712	1.113728	10.49938
533.111	27.57893	0.242171	2.325201	1.436165	13.78953	1.300816	12.49005	1.396642	13.41012

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538.667	27.57893	6.65E-02	0.649585	1.616405	15.79083	1.482275	14.48052	1.625858	15.88321
544.222	27.57893	0.246778	2.449236	1.689603	16.76925	1.556343	15.4467	1.752869	17.3972
549.778	27.57893	0.372796	3.756329	1.723906	17.37039	1.591381	16.03501	1.846199	18.60256
552.556	27.57893	0.444348	4.511411	1.754002	17.80828	1.621842	16.4664	1.907586	19.36755
554.222	27.57893	0.468128	4.773566	1.754394	17.88978	1.622424	16.54401	1.9273	19.65289
555.333	27.57893	0.491202	5.023651	1.762254	18.02318	1.630414	16.67479	1.948226	19.92523
558.111	27.57893	0.49142	5.060242	1.726601	17.77901	1.595018	16.42415	1.946043	20.03866
560.889	27.57893	0.534882	5.547587	1.735834	18.0033	1.604581	16.642	1.989519	20.63439
566.445	27.57893	0.572181	6.01695	1.710636	17.9887	1.57998	16.61472	2.035062	21.4003
572	27.57893	0.581448	6.19688	1.663768	17.73187	1.533682	16.3455	2.061192	21.96754
577.556	27.57893	0.584518	6.31254	1.61607	17.45286	1.486583	16.05446	2.08794	22.54881
583.111	27.57893	0.623804	6.828195	1.608616	17.60806	1.479802	16.19804	2.155453	23.59376
538.667	34.47367	0.90029	8.700864	1.526171	14.43011	1.345198	12.71899	0.470774	4.451243
544.222	34.47367	0.505289	4.977377	1.713565	16.56067	1.542407	14.90653	0.851065	8.225068
549.778	34.47367	0.399356	3.967342	1.81439	17.87277	1.647634	16.23008	1.042132	10.26553
552.556	34.47367	0.349309	3.48715	1.803482	17.91634	1.638064	16.27295	1.061342	10.54367
554.222	34.47367	0.338652	3.391042	1.790608	17.87587	1.625848	16.23102	1.064266	10.62474
555.333	34.47367	0.276637	2.791958	1.761807	17.64164	1.597401	15.99541	1.045267	10.46667
558.111	34.47367	0.213558	2.172217	1.732264	17.4828	1.568722	15.83224	1.039309	10.4892
560.889	34.47367	8.71E-02	0.900223	1.712241	17.41612	1.549447	15.76023	1.042216	10.60089
566.445	34.47367	6.92E-03	7.26E-02	1.693583	17.49417	1.532075	15.82584	1.070563	11.05861
572	34.47367	7.08E-02	0.753189	1.651217	17.3101	1.490769	15.62802	1.079083	11.31228
577.556	34.47367	0.123014	1.327099	1.62288	17.26217	1.463414	15.56593	1.106876	11.77354
583.111	34.47367	3.274136	31.04111	1.582582	17.07275	1.424021	15.36224	1.127739	12.16594
544.222	37.23156	1.18171	11.47831	1.703329	16.14879	1.504256	14.26141	0.199665	1.893005

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549.778	**37.23156**	**0.996062**	**9.770058**	**1.812059**	**17.60114**	**1.630169**	**15.83432**	**0.711072**	**6.906904**
552.556	**37.23156**	**0.894269**	**8.821492**	**1.788139**	**17.53926**	**1.609394**	**15.78606**	**0.774846**	**7.600254**
554.222	**37.23156**	**0.872838**	**8.638507**	**1.782686**	**17.58529**	**1.6053**	**15.83552**	**0.806608**	**7.956813**
555.333	**37.23156**	**0.76627**	**7.649765**	**1.740178**	**17.22267**	**1.563472**	**15.47379**	**0.784129**	**7.760569**
558.111	**37.23156**	**0.678655**	**6.831904**	**1.701254**	**16.98383**	**1.526004**	**15.23425**	**0.785143**	**7.838177**
560.889	**37.23156**	**0.494594**	**5.061817**	**1.662955**	**16.7407**	**1.488794**	**14.98746**	**0.776666**	**7.818622**
566.445	**37.23156**	**0.395759**	**4.112907**	**1.635901**	**16.74235**	**1.463419**	**14.97709**	**0.795294**	**8.139314**
572	**37.23156**	**0.316364**	**3.337133**	**1.564558**	**16.25964**	**1.393246**	**14.4793**	**0.763733**	**7.937111**
577.556	**37.23156**	**0.215013**	**2.302006**	**1.501473**	**15.83809**	**1.331159**	**14.04155**	**0.742748**	**7.834758**
583.111	**37.23156**	**6.45E-02**	**0.59937**	**1.480349**	**15.84941**	**1.311015**	**14.03639**	**0.769201**	**8.235435**
549.778	**41.3684**	**0.546286**	**5.186809**	**9.223396**	**85.68521**	**9.039135**	**83.97347**	**1.470937**	**13.66498**
552.556	**41.3684**	**2.333504**	**22.3621**	**2.251599**	**21.37819**	**2.042811**	**19.3958**	**0.375413**	**3.564428**
554.222	**41.3684**	**2.205843**	**21.25157**	**1.886234**	**18.07588**	**1.693713**	**16.23094**	**8.47E-02**	**0.811926**
555.333	**41.3684**	**0.494951**	**4.895131**	**1.768807**	**17.04111**	**1.579441**	**15.21665**	**3.11E-02**	**0.300104**
558.111	**41.3684**	**1.774717**	**17.4819**	**3.003431**	**29.70424**	**2.819944**	**27.88948**	**1.622592**	**16.0476**
560.889	**41.3684**	**1.380819**	**13.87804**	**1.477798**	**14.55713**	**1.292812**	**12.73494**	**0.25235**	**2.485784**
566.445	**41.3684**	**1.104646**	**11.30534**	**1.449313**	**14.56643**	**1.265435**	**12.71839**	**0.387051**	**3.890045**
572	**41.3684**	**0.830951**	**8.654955**	**1.425624**	**14.59028**	**1.242278**	**12.71388**	**0.427311**	**4.37326**
577.556	**41.3684**	**0.616216**	**6.5259**	**1.466318**	**15.27279**	**1.283527**	**13.36894**	**0.500415**	**5.212189**
583.111	**41.3684**	**1.15966**	**10.8218**	**1.492798**	**15.80903**	**1.310566**	**13.87921**	**0.551697**	**5.842587**
554.222	**43.09208**	**0.839683**	**7.923687**	**6.97978**	**65.13432**	**6.831406**	**63.74968**	**1.668574**	**15.57086**
555.333	**43.09208**	**2.562317**	**24.6204**	**6.320133**	**59.64008**	**6.207864**	**58.58068**	**0.996208**	**9.400706**
558.111	**43.09208**	**2.318864**	**22.57242**	**1.820109**	**17.48879**	**1.646769**	**15.82323**	**0.282954**	**2.718802**
560.889	**43.09208**	**------**	**------**	**1.520036**	**14.79643**	**1.34056**	**13.04929**	**4.19E-02**	**0.407573**

Table C-4: Mixture of 21.1 mole% benzene & 78.9 mole% cyclohexane

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
522	27.57893	1.108598	10.30912	0.986228	9.171255	0.8446	7.854144	0.766503	7.127922
527.556	27.57893	0.627552	5.952556	1.25244	11.87985	1.113918	10.56595	1.086015	10.30123
533.111	27.57893	0.401568	3.874368	1.313611	12.67394	1.17686	11.3546	1.19208	11.50139
538.667	27.57893	0.205537	2.01605	1.375229	13.48923	1.239764	12.16047	1.299747	12.74884
544.222	27.57893	0.133487	1.329182	1.335909	13.30241	1.201324	11.96225	1.310871	13.05307
549.778	27.57893	2.01E-02	0.203045	1.353128	13.68156	1.219375	12.32915	1.383835	13.99203
552	27.57893	1.41E-02	0.143093	1.352645	13.7585	1.219186	12.40104	1.407086	14.31218
554.222	27.57893	2.44E-02	0.249876	1.330453	13.61014	1.197265	12.2476	1.409398	14.41766
555.333	27.57893	6.33E-02	0.649463	1.353216	13.88705	1.220193	12.52197	1.44465	14.82534
558.111	27.57893	0.156763	1.616413	1.098584	11.32765	0.96558	9.956226	1.222348	12.60376
560.889	27.57893	7.28E-02	0.757554	1.289991	13.42426	1.157598	12.04648	1.446495	15.05288
566.445	27.57893	0.120659	1.273583	1.272727	13.43401	1.141014	12.04372	1.49764	15.80804
572	27.57893	0.118107	1.263659	1.212152	12.96947	1.081068	11.56692	1.508102	16.13599
577.556	27.57893	0.152448	1.653806	1.193476	12.94733	1.063088	11.53282	1.562059	16.9458
583.111	27.57893	0.158355	1.741108	1.151449	12.6601	1.021744	11.234	1.593723	17.52289
538.667	34.47367	1.688456	16.29835	0.645336	6.074712	0.457399	4.305619	0.532458	5.012203
544.222	34.47367	1.14331	11.27022	1.02792	9.922299	0.853788	8.241425	0.110604	1.067641
549.778	34.47367	0.952037	9.459991	1.244933	12.27193	1.07631	10.60976	0.435657	4.294467
552	34.47367	0.808306	8.091988	1.331267	13.22825	1.164081	11.56705	0.5493	5.45815

Continued …

554.222	**34.47367**	**0.736057**	**7.396083**	**1.382069**	**13.83595**	**1.216041**	**12.17379**	**0.622638**	**6.233285**
555.333	**34.47367**	**0.648407**	**6.569616**	**1.41087**	**14.17674**	**1.245344**	**12.51352**	**0.661605**	**6.648006**
558.111	**34.47367**	**0.605742**	**6.185292**	**1.400317**	**14.18797**	**1.235787**	**12.52097**	**0.673878**	**6.827682**
560.889	**34.47367**	**0.518428**	**5.375685**	**1.355428**	**13.84036**	**1.191684**	**12.16838**	**0.650096**	**6.638155**
566.445	**34.47367**	**0.386607**	**4.071779**	**1.290858**	**13.38517**	**1.128438**	**11.70107**	**0.627881**	**6.510653**
572	**34.47367**	**0.302433**	**3.233076**	**1.293562**	**13.62385**	**1.132365**	**11.92613**	**0.676945**	**7.129624**
577.556	**34.47367**	**0.243478**	**2.640759**	**1.267449**	**13.54932**	**1.107305**	**11.83731**	**0.702268**	**7.507397**
583.111	**34.47367**	**1.888964**	**17.82521**	**1.230188**	**13.34269**	**1.071016**	**11.61632**	**0.721847**	**7.829184**
544.222	**37.09366**	**1.482036**	**14.45404**	**0.791834**	**7.472165**	**0.584064**	**5.51152**	**0.883437**	**8.336531**
549.778	**37.09366**	**1.210513**	**11.91579**	**1.581135**	**15.42062**	**1.398487**	**13.63925**	**0.44731**	**4.362542**
552	**37.09366**	**1.027617**	**10.19908**	**1.66318**	**16.37162**	**1.483775**	**14.60561**	**0.617814**	**6.081543**
554.222	**37.09366**	**0.946069**	**9.427137**	**1.688874**	**16.76204**	**1.511634**	**15.00289**	**0.703575**	**6.98299**
555.333	**37.09366**	**0.773349**	**7.779829**	**1.700589**	**16.94552**	**1.524185**	**15.18777**	**0.738317**	**7.356999**
558.111	**37.09366**	**0.664921**	**6.747748**	**1.71876**	**17.29055**	**1.544029**	**15.53275**	**0.80039**	**8.051799**
560.889	**37.09366**	**0.574874**	**5.927543**	**1.69479**	**17.1992**	**1.521237**	**15.43797**	**0.807211**	**8.191798**
566.445	**37.09366**	**0.497754**	**5.212251**	**1.567923**	**16.16704**	**1.39594**	**14.39369**	**0.722925**	**7.454143**
572	**37.09366**	**0.460388**	**4.892741**	**1.470056**	**15.39377**	**1.299241**	**13.60507**	**0.660134**	**6.912685**
577.556	**37.09366**	**0.399533**	**4.309172**	**1.361971**	**14.47425**	**1.192101**	**12.66898**	**0.588654**	**6.255915**
583.111	**37.09366**	**8.37E-02**	**0.793625**	**1.298225**	**14.00209**	**1.129281**	**12.17999**	**0.56707**	**6.116208**
552	**41.3684**	**2.278445**	**21.94049**	**8.213966**	**77.91249**	**8.035309**	**76.21787**	**0.748753**	**7.102192**
554.222	**41.3684**	**2.147384**	**20.80828**	**2.273062**	**21.88865**	**2.087312**	**20.09988**	**0.123635**	**1.190507**
555.333	**41.3684**	**1.871004**	**18.36951**	**2.052797**	**19.89169**	**1.869763**	**18.1181**	**6.92E-02**	**0.670371**
558.111	**41.3684**	**1.706225**	**16.93425**	**1.805519**	**17.72659**	**1.623967**	**15.9441**	**0.324242**	**3.1834**
560.889	**41.3684**	**1.423206**	**14.4067**	**1.634571**	**16.22305**	**1.453086**	**14.42183**	**0.387947**	**3.850326**
566.445	**41.3684**	**1.210389**	**12.47483**	**1.461699**	**14.79634**	**1.279988**	**12.95692**	**0.416498**	**4.216071**

Continued …

572	**41.3684**	**0.967711**	**10.1515**	**1.358086**	**13.99701**	**1.176221**	**12.12263**	**0.382715**	**3.944382**
577.556	**41.3684**	**0.734857**	**7.842155**	**1.357299**	**14.23829**	**1.175592**	**12.33222**	**0.410263**	**4.303768**
583.111	**41.3684**	**0.402321**	**3.831122**	**1.393639**	**14.87241**	**1.212319**	**12.93744**	**0.46432**	**4.955081**
554.222	**42.26472**	**2.140556**	**20.54795**	**6.980346**	**66.47095**	**6.842435**	**65.15766**	**0.662841**	**6.311954**
555.333	**42.26472**	**2.072892**	**20.21663**	**2.956006**	**28.37574**	**2.812786**	**27.00091**	**0.310409**	**2.97968**
558.111	**42.26472**	**1.824055**	**18.01885**	**2.020289**	**19.70362**	**1.846898**	**18.01255**	**0.176348**	**1.719923**
560.889	**42.26472**	**1.532691**	**15.45794**	**1.811727**	**17.89712**	**1.634215**	**16.14354**	**0.395079**	**3.902781**
566.445	**42.26472**	**1.243885**	**12.78816**	**1.5487**	**15.61939**	**1.367832**	**13.79527**	**0.454334**	**4.582127**
572	**42.26472**	**------**	**-------**	**1.472703**	**15.14067**	**1.290486**	**13.26732**	**0.480712**	**4.942163**

Table C-5: Mixture of 81.4 mole% benzene & 18.6 mole% hexadecane

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
577.5	6.894733	1.47873	16.3927	20.07028	1.478734	1.787373	1.810475	0.29393	3.25621
588.6	6.894733	1.50819	17.11923	20.7051	1.508193	1.800141	1.824111	0.25516	2.89627
588.6	10.3421	1.08811	12.24467	18.3388	1.088111	1.595697	1.629667	0.37133	4.1786

Table C-6 Mixture of 92 mole% benzene & 8 mole% hexadecane

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
533.1	6.894733	1.055959	10.41159	1.316149	1.897281	1.290075	12.71995	25.73379	253.7313
544.2	6.894733	1.713042	17.4004	1.963452	1.857071	1.936783	19.67299	26.60441	270.2364
555.3	6.894733	1.866117	19.42402	2.108039	1.79141	2.080787	21.65845	27.09322	282.0075
566.4	6.894733	20.20732	1.89728	2.131018	12.97705	2.103277	22.40135	27.4885	292.7714
577.5	6.894733	20.21965	1.85707	2.082813	19.94393	2.054687	22.37126	27.8289	302.9992
588.6	6.894733	19.92973	1.79141	2.00927	21.94214	1.980831	22.03713	28.14888	313.1615
555.3	10.3421	1.372452	14.14507	1.786638	22.6968	1.746563	18.00082	12.095	124.6564
566.4	10.3421	1.827384	19.36084	2.220165	22.67757	2.179387	23.09033	12.66465	134.1802
577.5	10.3421	1.811879	19.63494	2.18643	22.35349	2.144967	23.24453	12.8128	138.8493
588.6	10.3421	1.647202	18.22579	2.005099	18.41387	1.963054	21.72059	12.82657	141.9222

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555.3	13.78947	0.471139	4.787804	1.104673	23.52234	1.052529	10.69602	6.325837	64.28461
566.4	13.78947	1.198523	12.55877	1.788918	23.69386	1.735697	18.18759	7.121691	74.6251
577.5	13.78947	1.476063	15.87216	2.030241	22.1858	1.976053	21.24855	7.492162	80.56342
588.6	13.78947	1.632273	17.98472	2.154194	11.2259	2.099246	23.12992	7.74611	85.34811
577.5	20.6842	0.427108	4.503332	1.460333	18.74527	1.38407	14.59319	2.965068	31.26273
588.6	20.6842	0.633565	6.766266	0.32742	21.83126	0.248145	2.650062	2.003685	21.39857
588.6	27.57893	0.332138	3.549105	1.871609	23.73532	1.778987	19.00953	1.785528	19.07938

Table C-7: Mixture of 96.3mole% benzene & 3.7 mole% hexadecane

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
499.7	6.894733	0.572644	5.199992	7.201727	7.201727	0.766022	6.955938	30.83467	279.9987
510.8	6.894733	1.39617	13.08082	15.1047	15.1047	1.584444	14.84474	31.93492	299.2003
522	6.894733	1.739045	16.73011	18.76881	18.76881	1.922587	18.49578	32.69883	314.5717
533.1	6.894733	1.982622	19.55759	21.60407	21.60407	2.161203	21.31916	33.38381	329.3147
544.2	6.894733	2.025862	20.44592	22.49402	22.49402	2.199483	22.19818	33.9281	342.4175
555.3	6.894733	2.081556	21.49219	23.53643	23.53643	2.249918	23.23051	34.47725	355.9793

Continued …

566.4	6.894733	2.1276	22.4674	24.5029	24.5029	2.290508	24.18768	35.01649	369.7732
577.5	6.894733	2.017223	21.74757	23.77003	23.77003	2.174781	23.44621	35.44932	382.177
588.6	6.894733	1.925932	21.19786	23.20349	23.20349	2.078002	22.8717	35.89294	395.0578
510.8	10.3421	6.67E-02	0.612471	4.251441	4.251441	0.421382	3.871516	13.14562	120.7772
522	10.3421	1.248739	11.88538	15.46445	15.46445	1.582637	15.06341	14.40184	137.0757
533.1	10.3421	1.574462	15.38482	18.90664	18.90664	1.891902	18.48666	14.90817	145.6746
544.2	10.3421	1.831944	18.36096	21.82642	21.82642	2.13408	21.38921	15.35176	153.8656
555.333	10.3421	1.97553	20.28251	23.69157	23.69157	2.263443	23.23856	15.69435	161.1322
566.4	10.3421	1.989573	20.88948	24.24209	24.24209	2.264362	23.7747	15.92135	167.1662
577.5	10.3421	1.970154	21.14387	24.4392	24.4392	2.232422	23.95856	16.1179	172.9789
588.6	10.3421	1.90502	20.88351	24.12061	24.12061	2.155352	23.62775	16.27322	178.3931
522	13.78947	2.55E-02	0.23786	5.344842	5.344842	0.516427	4.824013	7.147669	66.76747
533.111	13.78947	0.812874	7.838933	13.22434	13.22434	1.314474	12.67621	8.069113	77.81474
544.2	13.78947	1.393607	13.83474	19.04546	19.04546	1.860819	18.4729	8.749585	86.85977
555.3	13.78947	1.734679	17.68065	22.73316	22.73316	2.17205	22.13852	9.20565	93.82825
566.4	13.78947	1.858209	19.3979	24.30459	24.30459	2.26936	23.6899	9.457718	98.72934
577.5	13.78947	1.865503	19.91659	24.6875	24.6875	2.253093	24.05461	9.599661	102.4886
588.6	13.78947	1.785203	19.47043	24.11323	24.11323	2.151329	23.46361	9.658105	105.3365
544.2	20.6842	0.329864	3.204859	13.22785	13.22785	1.277595	12.41267	3.384711	32.88465
555.3	20.6842	1.156687	11.60381	21.01535	21.01535	2.00971	20.16139	4.262023	42.75652
566.4	20.6842	1.447402	14.90743	23.80389	23.80389	2.224967	22.91595	4.631207	47.69892
577.5	20.6842	1.572696	16.59665	25.04931	25.04931	2.286648	24.13096	4.845956	51.13939
588.6	20.6842	1.628881	17.59493	25.65774	25.65774	2.287764	24.71209	4.995915	53.96521
555.3	27.57893	0.385452	3.765489	12.17127	12.17127	1.1384	11.12121	1.386813	13.54796
566.4	27.57893	0.506051	5.110867	19.64054	19.64054	1.834815	18.53058	2.239453	22.61719

Continued …

577.5	27.57893	0.954397	9.916312	23.33059	23.33059	2.133795	22.17049	2.701082	28.06473
588.6	27.57893	1.256978	13.41102	25.90951	25.90951	2.315615	24.70597	3.047614	32.51592
566.4	34.47367	0.49259	4.868346	18.15122	18.15122	1.715839	16.95786	1.018237	10.0633
577.5	34.47367	0.351107	3.588415	23.90491	23.90491	2.211433	22.60167	1.664703	17.01394
588.6	34.47367	0.841435	8.856209	27.1869	27.1869	2.451481	25.80207	2.055366	21.63287
577.5	41.3684	0.717292	7.160827	23.5495	23.5495	2.247205	22.43411	1.073888	10.72073
588.6	41.3684	2.54E-02	0.261891	25.97241	2.51661	2.383494	24.59855	1.371059	14.14992

Table C-8: Mixture of 19.7mole% pentane & 80.3 mole% cyclohexane

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
522	27.57893	1.663225	16.00839	0.222384	2.140452	7.55E-02	0.726991	0.143919	1.385189
524.7	27.57893	1.556817	15.111	0.247373	2.401046	0.101443	0.984635	0.096316	0.934913
533.1	27.57893	1.446348	14.37514	0.151279	1.503583	7.32E-03	7.28E-02	0.118538	1.178158
544.2	27.57893	1.479589	15.13572	8.60E-02	0.880211	0.228256	2.334981	0.24003	2.455386
555.3	27.57893	1.439069	15.15297	0.203012	2.137641	0.343544	3.617477	0.221344	2.330709

Continued …

566.4	27.57893	1.336984	14.49166	0.227662	2.467695	0.36644	3.971902	9.81E-02	1.063399
577.5	27.57893	1.266754	14.12239	0.261517	2.915471	0.398509	4.442735	2.12E-02	0.236219
588.6	27.57893	1.145719	13.13806	0.228796	2.623628	0.363863	4.172448	0.206798	2.371359
599.7	27.57893	0.940097	11.09289	9.96E-02	1.175325	0.23257	2.744215	0.484582	5.71793
610.8	27.57893	0.735485	8.926526	3.85E-02	0.46684	9.23E-02	1.120648	0.764925	9.283852
622	27.57893	0.555718	6.934789	0.159239	1.987173	3.06E-02	0.382306	1.021741	12.75026
633.1	27.57893	0.318351	4.084505	0.344295	4.417314	0.217964	2.796505	1.33281	17.10013
533.1	34.47367	3.705128	35.4375	0.744439	7.120124	0.927405	8.870152	1.779445	17.0194
535.8	34.47367	3.561788	34.38966	0.797798	7.702874	0.977997	9.442731	1.762064	17.01301
538.6	34.47367	3.389735	33.05173	0.796685	7.768103	0.974847	9.505255	1.713425	16.70679
541.4	34.47367	3.285594	32.32664	0.837154	8.236674	1.01389	9.975545	1.721953	16.9421
544.2	34.47367	3.176581	31.53491	0.854908	8.486904	1.030504	10.2301	1.715992	17.03517
555.3	34.47367	2.39852	24.73133	0.466765	4.812902	0.638539	6.584021	1.253199	12.9218
566.4	34.47367	1.791343	19.13321	0.131336	1.402782	0.300203	3.206428	0.830026	8.865462
577.5	34.47367	1.527553	16.83083	6.88E-02	0.757979	0.235387	2.593503	0.655138	7.218414
588.6	34.47367	1.334686	15.14978	3.48E-02	0.394442	0.199097	2.259896	0.487894	5.538002
599.7	34.47367	1.071218	12.528	9.78E-02	1.143926	6.41E-02	0.749275	0.209015	2.444428
610.8	34.47367	0.805775	9.704736	0.253603	3.054409	9.43E-02	1.135622	9.86E-02	1.187706
622	34.47367	0.65876	8.159345	0.307329	3.806573	0.150495	1.864025	0.305718	3.786627
633.1	34.47367	0.46602	5.934606	0.419691	5.34466	0.265452	3.380431	0.566881	7.219126

Table C-9 Mixture of 38.5 mole% pentane & 61.5 mole% cyclohexane

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
460.889	13.78947	0.694026	6.084291	7.07E-02	0.620068	1.47E-03	1.29E-02	3.697186	32.41192
466.445	13.78947	0.495958	4.420601	0.230904	2.058046	0.158083	1.40898	3.919827	34.93811
469.222	13.78947	0.416135	3.739036	0.29346	2.636793	0.220371	1.980063	4.015604	36.08135
477.556	13.78947	0.250148	2.300595	0.413104	3.799268	0.339337	3.120898	4.240951	39.00374
488.667	13.78947	8.44E-02	0.800268	0.526737	4.992583	0.452424	4.288211	4.500917	42.66144
499.778	13.78947	3.08E-02	0.300339	0.597877	5.835166	0.523322	5.107554	4.719422	46.06074
510.889	13.78947	0.168036	1.688508	0.696796	7.001573	0.6223	6.253046	4.960645	49.8458
522	13.78947	0.25746	2.661229	0.752509	7.77842	0.678266	7.010992	5.15491	53.2846
533.111	13.78947	0.280771	2.982593	0.745881	7.923277	0.672019	7.13869	5.283338	56.12368
544.222	13.78947	0.328077	3.581267	0.765843	8.359777	0.692534	7.559577	5.430702	59.28074
555.333	13.78947	0.397313	4.456185	0.809951	9.084352	0.737333	8.269903	5.59469	62.74947
566.445	13.78947	0.366072	4.213147	0.755913	8.699822	0.684018	7.872334	5.659245	65.13205
577.556	13.78947	0.379495	4.482297	0.747971	8.834544	0.676902	7.995111	5.762033	68.05739
588.667	13.78947	0.377012	4.567897	0.725601	8.791459	0.65542	7.941068	5.845951	70.82983
599.778	13.78947	0.416015	5.171065	0.745825	9.270695	0.676603	8.41024	5.965479	74.15131
610.889	13.78947	0.45726	5.82949	0.769427	9.809185	0.701203	8.939488	6.083804	77.56071
622	13.78947	0.536259	7.012517	0.831674	10.87549	0.764515	9.997288	6.234662	81.52866
633.111	13.78947	0.512481	6.864829	0.792391	10.61438	0.726251	9.728362	6.28591	84.20199
488.667	20.6842	1.003912	9.29361	0.367752	3.404415	0.253713	2.348727	1.018937	9.43269
499.778	20.6842	0.740855	7.082432	0.453966	4.339782	0.340554	3.25563	1.226077	11.72107
510.889	20.6842	0.472293	4.660038	0.587372	5.795492	0.474702	4.683829	1.500321	14.80336
522	20.6842	0.318383	3.236919	0.634632	6.45226	0.522765	5.314874	1.6996	17.27964

Continued …

533.111	**20.6842**	**0.160436**	**1.680007**	**0.704816**	**7.380523**	**0.593925**	**6.21938**	**1.924464**	**20.15216**
544.222	**20.6842**	**4.41E-02**	**0.475151**	**0.747633**	**8.056696**	**0.637854**	**6.873716**	**2.120104**	**22.84686**
555.333	**20.6842**	**5.40E-02**	**0.598432**	**0.782693**	**8.674781**	**0.674147**	**7.471736**	**2.302782**	**25.5225**
566.445	**20.6842**	**5.29E-02**	**0.602146**	**0.727236**	**8.278353**	**0.61993**	**7.056885**	**2.389367**	**27.19908**
577.556	**20.6842**	**5.92E-02**	**0.692248**	**0.68552**	**8.012446**	**0.579565**	**6.774041**	**2.481715**	**29.00648**
588.667	**20.6842**	**0.130279**	**1.563951**	**0.713277**	**8.562509**	**0.608821**	**7.308528**	**2.634107**	**31.6209**
599.778	**20.6842**	**0.16662**	**2.052837**	**0.710788**	**8.757458**	**0.607851**	**7.489152**	**2.748705**	**33.8661**
610.889	**20.6842**	**0.280975**	**3.554638**	**0.789468**	**9.987579**	**0.68817**	**8.70609**	**2.934935**	**37.12992**
622	**20.6842**	**0.377813**	**4.905366**	**0.853846**	**11.08601**	**0.754212**	**9.792377**	**3.099664**	**40.24491**
633.111	**20.6842**	**0.38913**	**5.179052**	**0.835744**	**11.12314**	**0.737707**	**9.818318**	**3.176879**	**42.28203**
505.333	**27.57893**	**1.911916**	**18.0596**	**0.290933**	**2.748062**	**0.135557**	**1.280458**	**0.250722**	**2.368238**
510.889	**27.57893**	**1.620534**	**15.59001**	**0.367971**	**3.539961**	**0.215259**	**2.070871**	**0.118478**	**1.139836**
522	**27.57893**	**1.033579**	**10.30636**	**0.639373**	**6.375461**	**0.490149**	**4.887542**	**0.259845**	**2.591033**
533.111	**27.57893**	**0.672765**	**6.932245**	**0.77684**	**8.004656**	**0.629992**	**6.491475**	**0.523028**	**5.389362**
544.222	**27.57893**	**0.372486**	**3.961163**	**0.906656**	**9.641708**	**0.761912**	**8.102444**	**0.797574**	**8.481733**
555.333	**27.57893**	**0.239695**	**2.624834**	**0.905123**	**9.911759**	**0.762255**	**8.347288**	**0.95224**	**10.42774**
566.445	**27.57893**	**7.74E-02**	**0.872639**	**0.956611**	**10.78486**	**0.81574**	**9.196651**	**1.164418**	**13.12776**
577.556	**27.57893**	**9.28E-03**	**0.107592**	**0.950608**	**11.0201**	**0.811695**	**9.40976**	**1.318399**	**15.28385**
588.667	**27.57893**	**0.102963**	**1.226898**	**0.964827**	**11.49692**	**0.827968**	**9.866061**	**1.48815**	**17.73282**
599.778	**27.57893**	**0.145156**	**1.776279**	**0.938299**	**11.48198**	**0.803481**	**9.832155**	**1.610775**	**19.71101**
610.889	**27.57893**	**0.213185**	**2.678689**	**0.945585**	**11.88129**	**0.812887**	**10.21394**	**1.759144**	**22.10361**
622	**27.57893**	**0.250539**	**3.230206**	**0.929196**	**11.98002**	**0.798616**	**10.29647**	**1.875602**	**24.18198**
633.111	**27.57893**	**0.27695**	**3.662142**	**0.907457**	**11.99956**	**0.77901**	**10.30107**	**1.978251**	**26.15886**
522	**34.47367**	**1.707235**	**16.63871**	**1.275478**	**12.43078**	**1.093473**	**10.65702**	**0.227892**	**2.221081**
533.111	**34.47367**	**1.635731**	**16.47425**	**0.726737**	**7.319312**	**0.548781**	**5.527053**	**0.181487**	**1.827878**

Continued …

544.222	34.47367	1.03837	10.84439	0.932187	9.735402	0.757045	7.906328	9.20E-02	0.96081
555.333	34.47367	0.529056	5.718497	1.164898	12.5912	0.992229	10.72483	0.414238	4.477475
566.445	34.47367	0.264675	2.951373	1.22211	13.62749	1.051609	11.72622	0.589232	6.570349
577.556	34.47367	0.130674	1.500227	1.193317	13.70052	1.024924	11.76717	0.699771	8.034151
588.667	34.47367	8.14E-02	0.961451	1.109892	13.10162	0.943631	11.13893	0.768583	9.072634
599.778	34.47367	3.69E-02	0.448057	1.043212	12.65415	0.879195	10.66466	0.859931	10.43093
610.889	34.47367	1.20E-03	1.50E-02	0.986348	12.28788	0.824686	10.27388	0.961394	11.97706
622	34.47367	0.104636	1.339131	1.006916	12.88604	0.847786	10.84959	1.136788	14.54815
633.111	34.47367	0.125834	1.652259	0.956064	12.5533	0.799402	10.49625		

Table C-10: Mixture of 61.2 mole% pentane & 38.8 mole% cyclohexane

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
444.2	13.78947	0.425731	3.708483	0.456755	3.978679	0.380894	3.317845	3.613316	31.47492
455.3	13.78947	0.421576	3.782097	0.37125	3.330562	0.293851	2.636195	3.676677	32.98463
466.4	13.78947	0.404342	3.734737	0.317019	2.928186	0.238637	2.204152	3.783423	34.94556
477.5	13.78947	0.353043	3.356951	0.309283	2.94083	0.230374	2.19051	3.938866	37.45316

Continued …

488.6	13.78947	0.295836	2.894902	0.316364	3.095789	0.237297	2.322098	4.106801	40.18676
499.7	13.78947	9.57E-02	0.964724	0.47238	4.76195	0.393531	3.967116	4.412821	44.48485
510.8	13.78947	3.22E-02	0.334234	0.561785	5.827921	0.48333	5.01402	4.648026	48.21809
522	13.78947	9.11E-02	0.972163	0.58634	6.254436	0.508401	5.423122	4.814984	51.36128
533.1	13.78947	9.07E-02	0.993642	0.555353	6.084082	0.478036	5.237082	4.920248	53.9032
544.2	13.78947	7.47E-02	0.840674	0.511611	5.753674	0.435027	4.892391	5.006419	56.30283
555.3	13.78947	0.16528	1.909519	0.576121	6.656056	0.500454	5.781824	5.189317	59.95304
566.4	13.78947	0.314671	3.735671	0.701222	8.324801	0.626575	7.438633	5.423624	64.38838
577.5	13.78947	0.308994	3.762485	0.673559	8.201569	0.599878	7.304477	5.506695	67.05245
588.6	13.78947	0.494	6.179542	0.837367	10.47476	0.764855	9.567664	5.766654	72.13587
599.7	13.78947	0.530308	6.802671	0.854338	10.95927	0.782907	10.04301	5.882209	75.45587
610.8	13.78947	0.552365	7.262943	0.858275	11.28528	0.787953	10.36063	5.981158	78.64497
622	13.78947	0.540083	7.276053	0.828919	11.16725	0.759703	10.23484	6.045539	81.44614
633.1	13.78947	0.587994	8.117143	0.860721	11.88196	0.792664	10.94251	6.163558	85.08622
472	20.6842	1.100819	10.09088	0.472463	4.330902	0.351521	3.222298	0.864704	7.926491
477.5	20.6842	1.028462	9.575923	0.426475	3.970908	0.305942	2.848608	0.878697	8.181426
485.8	20.6842	1.019512	9.706004	0.290358	2.764236	0.170253	1.620818	0.846	8.054131
488.6	20.6842	1.05264	10.0924	0.215329	2.064475	9.53E-02	0.913883	0.808944	7.755933
499.7	20.6842	0.814471	8.057101	0.307833	3.045169	0.188751	1.867147	1.059462	10.48063
510.8	20.6842	0.595507	6.073826	0.410733	4.189251	0.292722	2.985611	1.328519	13.55013
522	20.6842	0.466695	4.902222	0.444144	4.665329	0.327262	3.437574	1.531124	16.08311
533.1	20.6842	0.222887	2.412289	0.607454	6.574362	0.491992	5.324708	1.856615	20.09382
544.2	20.6842	0.163157	1.821241	0.923306	10.3063	0.809562	9.036683	2.325312	25.95608
555.3	20.6842	0.111432	1.276759	0.813493	9.320799	0.701066	8.032717	2.365796	27.10683
566.4	20.6842	0.248283	2.92451	0.897846	10.57551	0.78705	9.270506	2.588544	30.48991

Continued …

577.5	20.6842	0.366564	4.436172	0.9694	11.7318	0.860287	10.41127	2.789472	33.75848
588.6	20.6842	0.467429	5.809074	1.028321	12.7797	0.920928	11.44505	2.969042	36.89846
599.7	20.6842	0.479546	6.112535	1.002876	12.78303	0.897139	11.43526	3.057479	38.97179
610.8	20.6842	0.462634	6.04437	0.951853	12.43603	0.847777	11.07623	3.113108	40.67296
622	20.6842	0.448794	6.009633	0.906429	12.13772	0.804047	10.76678	3.167897	42.42035
633.1	20.6842	0.429923	5.897001	0.858748	11.77891	0.758063	10.39783	3.212963	44.07008
485.8	27.57893	1.854355	17.22264	0.849008	7.885303	0.682003	6.334227	6.22E-02	0.577996
488.6	27.57893	1.790117	16.7717	0.740855	6.94112	0.576506	5.401302	6.09E-03	5.71E-02
499.7	27.57893	1.527001	14.79671	0.520851	5.047083	0.36182	3.506076	8.55E-02	0.828494
502.5	27.57893	1.430053	13.97702	0.526472	5.145653	0.368263	3.599351	5.15E-02	0.502922
510.8	27.57893	1.237767	12.39418	0.494435	4.950979	0.338223	3.386725	6.75E-03	6.76E-02
522	27.57893	0.906783	9.381577	0.593629	6.141664	0.439736	4.549535	0.248506	2.571032
533.1	27.57893	0.696404	7.428513	0.6284	6.703162	0.476582	5.083661	0.442914	4.724501
544.2	27.57893	0.540677	5.939642	0.643752	7.072011	0.493968	5.426574	0.627957	6.89851
555.3	27.57893	0.417808	4.722999	0.651095	7.360218	0.503374	5.690245	0.807778	9.131371
566.4	27.57893	0.166847	1.942346	0.803212	9.350609	0.65784	7.658286	1.129489	13.14896
577.5	27.57893	1.46E-02	0.175365	0.871516	10.43362	0.728404	8.720355	1.361442	16.29895
588.6	27.57893	0.140589	1.730204	0.953624	11.736	0.812846	10.0035	1.599055	19.67923
599.7	27.57893	0.205977	2.602481	0.955347	12.0706	0.81683	10.32042	1.747802	22.08301
610.8	27.57893	0.349086	4.529965	1.04127	13.51221	0.905156	11.74594	1.970661	25.57263
622	27.57893	0.332446	4.42309	0.973984	12.95849	0.840087	11.17709	2.033559	27.05579
633.1	27.57893	0.346661	4.727509	0.942681	12.85559	0.811043	11.06042	2.122006	28.93834
502.5	34.47367	2.511208	23.83241	1.224765	11.62353	1.03519	9.824391	0.130931	1.242595
510.8	34.47367	1.225997	12.09094	1.706305	16.82778	1.522245	15.0126	0.665544	6.563652
522	34.47367	0.600838	6.156082	1.747805	17.90785	1.565904	16.04411	0.792705	8.12194

Table C-11: Mixture of 79.3 mole% pentane & 20.7 mole% cyclohexane

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
422	10.3421	0.477489	4.070484	0.118367	1.009047	6.08E-02	0.518427	6.441925	54.9157
433.1	10.3421	0.629807	5.519835	7.80E-02	0.683369	0.137357	1.203835	6.449875	56.52871
444.2	10.3421	0.272588	2.467628	0.239785	2.170691	0.179405	1.624067	6.940852	62.83366
455.3	10.3421	7.95E-02	0.742051	0.399574	3.728775	0.338521	3.159017	7.281518	67.95002
466.4	10.3421	3.66E-02	0.351153	0.413757	3.972762	0.352272	3.382384	7.481801	71.83779
444.2	13.78947	0.641778	5.742659	0.22764	2.036892	0.146469	1.31058	3.218564	28.79992
455.3	13.78947	0.410693	3.792393	0.373536	3.449241	0.291569	2.692367	3.529855	32.59528
466.4	13.78947	0.499912	4.746542	0.217125	2.06152	0.134553	1.277533	3.552068	33.72567
477.5	13.78947	0.239107	2.341427	0.419145	4.104421	0.336614	3.296242	3.918288	38.36942
488.6	13.78947	0.146325	1.47472	0.462489	4.661232	0.38015	3.831336	4.125342	41.57725
499.7	13.78947	3.90E-02	0.404572	0.603991	6.268504	0.522137	5.419036	4.419339	45.86632
510.8	13.78947	0.177467	1.895093	0.703792	7.515553	0.622592	6.648383	4.664948	49.81514
522	13.78947	0.248805	2.731592	0.740371	8.128307	0.659911	7.244945	4.842938	53.16893
533.1	13.78947	0.30431	3.432187	0.764701	8.624827	0.685083	7.726869	5.000118	56.39488
544.2	13.78947	0.38287	4.435811	0.814627	9.437991	0.735971	8.526745	5.174518	59.9506
555.3	13.78947	0.463177	5.510657	0.868543	10.33345	0.790936	9.410083	5.345972	63.60323
566.4	13.78947	0.488209	5.959423	0.86935	10.61198	0.792801	9.677539	5.460554	66.65575
577.5	13.78947	0.499256	6.249952	0.857931	10.73995	0.782477	9.795397	5.557958	69.57707
588.6	13.78947	0.515528	6.616735	0.853211	10.95075	0.778899	9.99695	5.656754	72.60323
599.7	13.78947	0.572	7.52774	0.88989	11.71128	0.816773	10.74903	5.790374	76.20379
610.8	13.78947	0.597376	8.056303	0.896825	12.09465	0.824899	11.12467	5.891592	79.45436
622	13.78947	0.539245	7.445408	0.821453	11.34179	0.750683	10.3647	5.911806	81.62457

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633.1	13.78947	0.543284	7.68061	0.809228	11.44038	0.73966	10.45685	5.987842	84.65215
454.8	20.6842	1.617183	14.49699	0.283169	2.538377	0.154983	1.389297	0.411354	3.68756
455.3	20.6842	1.574728	14.142	0.308076	2.766662	0.180041	1.616876	0.441787	3.967505
466.4	20.6842	1.514585	14.03174	6.56E-02	0.607924	6.10E-02	0.565044	0.330953	3.066059
477.5	20.6842	1.1499	11.01415	0.212823	2.038525	8.75E-02	0.837661	0.631705	6.050683
488.6	20.6842	0.877176	8.673299	0.322305	3.186826	0.198045	1.958263	0.91194	9.017048
499.7	20.6842	0.623772	6.362154	0.446608	4.555149	0.32359	3.300445	1.214467	12.38689
510.8	20.6842	0.369269	3.883152	0.595531	6.262472	0.473905	4.983526	1.54132	16.20822
522	20.6842	0.140897	1.526887	0.734996	7.964928	0.614896	6.663484	1.855225	20.10459
533.1	20.6842	2.63E-02	0.293338	0.827381	9.227899	0.708866	7.906001	2.11297	23.56618
544.2	20.6842	0.154152	1.768024	0.890521	10.21373	0.773632	8.87308	2.332423	26.75157
555.3	20.6842	0.26485	3.122121	0.944438	11.1331	0.829252	9.775275	2.532829	29.85718
566.4	20.6842	0.321047	3.886052	0.950463	11.5048	0.836982	10.13123	2.676191	32.39373
577.5	20.6842	0.364015	4.522197	0.948487	11.78309	0.836754	10.39509	2.802161	34.81149
588.6	20.6842	0.35827	4.564187	0.902332	11.49515	0.792338	10.09392	2.875826	36.63639
469.2	27.57893	3.17104	28.88963	1.355303	12.34745	1.168957	10.64972	0.160954	1.466364
472	27.57893	3.482528	32.16797	1.566871	14.47308	1.389423	12.834	0.529021	4.886576
472.5	27.57893	2.366504	21.72054	0.742879	6.818419	0.564994	5.185751	0.283398	2.601084
477.5	27.57893	1.017976	9.608469	1.678532	15.84327	1.509071	14.24375	0.79809	7.532977
488.6	27.57893	1.604273	15.53426	0.577248	5.589533	0.41204	3.989784	0.16043	1.553464
499.7	27.57893	1.258768	12.60453	0.575706	5.764736	0.413502	4.140513	3.10E-02	0.310836
510.8	27.57893	0.936927	9.6912	0.647589	6.698438	0.487782	5.045411	0.193111	1.997477
522	27.57893	0.673974	7.193995	0.717887	7.662711	0.560318	5.980804	0.435728	4.650954
533.1	27.57893	0.442709	4.870601	0.796955	8.76808	0.641629	7.059095	0.695336	7.650052
544.2	27.57893	0.288679	3.269399	0.826563	9.361	0.673433	7.626828	0.907508	10.2777

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555.3	**27.57893**	**0.127504**	**1.485858**	**0.882857**	**10.2881**	**0.732043**	**8.530672**	**1.143012**	**13.31973**
566.4	**27.57893**	**4.81E-04**	**5.74E-03**	**0.920396**	**11.02736**	**0.771928**	**9.248535**	**1.352982**	**16.21024**
577.5	**27.57893**	**0.113078**	**1.39211**	**0.956247**	**11.77273**	**0.810164**	**9.974242**	**1.552455**	**19.11292**
588.6	**27.57893**	**0.231704**	**2.930171**	**1.006579**	**12.72956**	**0.862934**	**10.91301**	**1.756484**	**22.21314**
599.7	**27.57893**	**0.211447**	**2.741917**	**0.926693**	**12.01673**	**0.785327**	**10.18361**	**1.821283**	**23.61721**
610.8	**27.57893**	**0.324063**	**4.313015**	**0.985008**	**13.10972**	**0.846134**	**11.2614**	**2.013115**	**26.79317**
622	**27.57893**	**0.316546**	**4.31832**	**0.928851**	**12.67126**	**0.792327**	**10.80886**	**2.083154**	**28.41821**
633.1	**27.57893**	**0.405815**	**5.676716**	**0.973879**	**13.62307**	**0.839825**	**11.74791**	**2.242977**	**31.3758**
488.6	**34.47367**	**3.44209**	**32.05701**	**0.976603**	**9.095376**	**0.784504**	**7.30632**	**0.778007**	**7.245746**
499.7	**34.47367**	**1.280546**	**12.6248**	**1.794699**	**17.69384**	**1.606724**	**15.84055**	**0.682731**	**6.730947**
510.8	**34.47367**	**1.406862**	**14.30099**	**1.073408**	**10.91138**	**0.884754**	**8.993752**	**3.37E-02**	**0.342277**
522	**34.47367**	**1.309705**	**13.73909**	**0.775902**	**8.139365**	**0.587854**	**6.166687**	**0.2012**	**2.110582**
533.1	**34.47367**	**0.953724**	**10.3375**	**0.843528**	**9.143061**	**0.657196**	**7.123371**	**2.89E-02**	**0.313446**
544.2	**34.47367**	**0.665196**	**7.439117**	**0.910682**	**10.18441**	**0.726399**	**8.123573**	**0.177676**	**1.986963**
555.3	**34.47367**	**0.426438**	**4.914828**	**0.972651**	**11.2101**	**0.790683**	**9.112837**	**0.401608**	**4.628605**
566.4	**34.47367**	**0.257947**	**3.05992**	**0.996414**	**11.81993**	**0.816866**	**9.690134**	**0.598697**	**7.102098**
577.5	**34.47367**	**0.194895**	**2.375846**	**0.938739**	**11.44369**	**0.761626**	**9.284637**	**0.717672**	**8.748763**
588.6	**34.47367**	**0.082174**	**1.029425**	**0.947639**	**11.87178**	**0.773189**	**9.68633**	**0.901426**	**11.29288**
599.7	**34.47367**	**2.07E-02**	**0.265856**	**0.960407**	**12.35787**	**0.788698**	**10.14848**	**1.083413**	**13.94061**
610.8	**34.47367**	**0.130798**	**1.728019**	**0.991523**	**13.09957**	**0.822641**	**10.86842**	**1.275881**	**16.85641**
622	**34.47367**	**0.139192**	**1.885862**	**0.930138**	**12.60228**	**0.763983**	**10.35115**	**1.36858**	**18.54265**
633.1	**34.47367**	**0.229836**	**3.194179**	**0.958424**	**13.31998**	**0.795153**	**11.05079**	**1.539775**	**21.39944**

Table C-12: Mixture of 27.1 mole% benzene & 72.9 mole% n-octane

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
522	13.78947	0.345813	3.584242	0.97133	10.06746	0.905287	9.382929	1.745584	18.09228
533.1	13.78947	0.050855	0.543032	1.106619	11.81714	1.03926	11.09783	2.007582	21.43815
544.2	13.78947	0.156548	1.720124	1.18815	13.05534	1.119896	12.30535	2.217607	24.36698
555.3	13.78947	0.324241	3.663018	1.253237	14.1582	1.18443	13.3809	2.409925	27.22569
560.8	13.78947	0.415791	4.762084	1.300326	14.89286	1.231371	14.10311	2.518629	28.84628
563.6	13.78947	0.456495	5.264417	1.319859	15.22093	1.250844	14.425	2.569153	29.62809
565.8	13.78947	0.472607	5.478769	1.320059	15.30302	1.250998	14.50248	2.593686	30.06787
566.4	13.78947	0.45505	5.281603	1.298434	15.07049	1.229353	14.2687	2.578953	29.93302
567	13.78947	0.477318	5.548945	1.316334	15.30276	1.247261	14.49972	2.603206	30.26303
572	13.78947	0.486313	5.719114	1.29177	15.19147	1.222623	14.37825	2.633292	30.96796
574.778	13.78947	0.523501	6.197877	1.31103	15.52164	1.241878	14.70295	2.681981	31.75266
577.5	13.78947	0.571071	6.806206	1.341569	15.9893	1.272437	15.16538	2.740835	32.66626
588.6	13.78947	0.578738	7.072569	1.286909	15.72697	1.21784	14.88289	2.800474	34.22386
544.2	20.6842	1.460822	15.61992	1.148359	12.27887	1.050104	11.2283	0.34833	3.724517
555.3	20.6842	0.778991	8.615719	1.349059	14.92067	1.249876	13.82366	0.71541	7.912473
560.8	20.6842	0.532092	5.977831	1.422557	15.98173	1.32299	14.86311	0.853905	9.593228
563.6	20.6842	0.415005	4.69905	1.46207	16.55486	1.362342	15.42563	0.925358	10.47774
565.8	20.6842	0.342686	3.903314	1.477861	16.83332	1.378021	15.6961	0.965966	11.00269
566.4	20.6842	0.34183	3.899146	1.464223	16.70184	1.364335	15.56247	0.958993	10.93887
567	20.6842	0.320683	3.663894	1.470743	16.80357	1.370828	15.66205	0.972281	11.1085

Continued …

567.8	**20.6842**	**0.265418**	**3.039847**	**1.506383**	**17.25284**	**1.406464**	**16.10845**	**1.017072**	**11.64866**
572	**20.6842**	**0.162612**	**1.88283**	**1.515496**	**17.5476**	**1.415414**	**16.38869**	**1.073452**	**12.42925**
574.7	**20.6842**	**0.073683**	**0.859355**	**1.548602**	**18.06056**	**1.448462**	**16.89265**	**1.137241**	**13.26308**
577.5	**20.6842**	**0.030357**	**0.356499**	**1.538364**	**18.06638**	**1.438141**	**16.88941**	**1.158841**	**13.6093**
588.6	**20.6842**	**0.183985**	**2.221496**	**1.568245**	**18.93531**	**1.467995**	**17.72481**	**1.317136**	**15.90334**
563.6	**27.57893**	**2.8277**	**30.89963**	**1.6536**	**18.06969**	**1.580869**	**17.27491**	**3.83E-02**	**0.418313**
565.8	**27.57893**	**2.424457**	**26.75265**	**1.686137**	**18.60562**	**1.597821**	**17.63115**	**0.292369**	**3.226147**
566.4	**27.57893**	**2.367507**	**26.17928**	**1.659997**	**18.35581**	**1.568876**	**17.34818**	**0.309315**	**3.420289**
567	**27.57893**	**2.288639**	**25.3657**	**1.66012**	**18.39961**	**1.566585**	**17.36292**	**0.347894**	**3.855813**
567.8	**27.57893**	**2.175709**	**24.18996**	**1.674475**	**18.61712**	**1.578172**	**17.54646**	**0.407205**	**4.527417**
572	**27.57893**	**1.765628**	**19.91811**	**1.666253**	**18.79702**	**1.560393**	**17.60285**	**0.554061**	**6.250345**
574.7	**27.57893**	**1.523319**	**17.34052**	**1.69637**	**19.3104**	**1.58679**	**18.06305**	**0.642501**	**7.313842**
577.5	**27.57893**	**1.348662**	**15.48405**	**1.683891**	**19.33282**	**1.571418**	**18.04156**	**0.671813**	**7.713123**
588.6	**27.57893**	**0.845838**	**10.02195**	**1.637786**	**19.40541**	**1.518789**	**17.99547**	**0.717099**	**8.496575**
566.4	**29.85419**	**4.557417**	**48.82393**	**1.999182**	**21.41736**	**2.482365**	**26.59373**	**1.350581**	**14.46889**
567	**29.85419**	**5.056075**	**53.99949**	**0.927778**	**9.908787**	**1.183341**	**12.63826**	**1.88514**	**20.13356**
567.8	**29.85419**	**5.169193**	**55.27575**	**0.315092**	**3.369387**	**0.419293**	**4.483599**	**2.053373**	**21.95733**

Table C-13: Mixture of 44.6 mole% benzene & 55.4 mole% n-octane

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
510.8	13.78947	0.180232	1.790926	13.12165	13.12165	1.258634	12.50658	2.875897	28.57664
522	13.78947	0.446866	4.573399	14.9256	14.9256	1.394612	14.27289	3.139522	32.13091
533.1	13.78947	0.605211	6.36852	15.94459	15.94459	1.450135	15.25945	3.326277	35.0016
544.2	13.78947	0.684032	7.391995	16.32669	16.32669	1.444776	15.61299	3.452767	37.31242
555.3	13.78947	0.772343	8.569122	16.96147	16.96147	1.462137	16.22232	3.598332	39.92332
560.8	13.78947	0.83595	9.397299	17.5496	17.5496	1.494364	16.79884	3.691821	41.50155
566.4	13.78947	0.828356	9.429453	17.35358	17.35358	1.457539	16.59166	3.717568	42.31847
577.5	13.78947	0.834718	9.740731	17.25385	17.25385	1.411481	16.4712	3.790646	44.23478
588.6	13.78947	0.8719	10.43017	17.57737	17.57737	1.402373	16.77594	3.893744	46.57903
533.1	20.6842	0.996169	10.19052	12.63466	12.63466	1.142462	11.68705	0.816633	8.353866
544.2	20.6842	0.662828	6.988673	12.66091	12.66091	1.105621	11.65733	0.915567	9.653432
555.3	20.6842	0.471969	5.118988	12.29803	12.29803	1.037036	11.24778	0.973912	10.56311
560.8	20.6842	0.354779	3.902406	12.62239	12.62239	1.050185	11.55157	1.051596	11.56715
562.5	20.6842	0.307572	3.398168	12.87284	12.87284	1.067666	11.79605	1.089299	12.03505
563.6	20.6842	0.289915	3.211839	12.90004	12.90004	1.06685	11.8193	1.101634	12.2046
565.3	20.6842	0.2651	2.949253	12.92368	12.92368	1.063999	11.83717	1.119192	12.45119
566.4	20.6842	0.227348	2.536706	13.18613	13.18613	1.084078	12.09589	1.152525	12.85957
568.1	20.6842	0.224639	2.516386	12.98054	12.98054	1.060945	11.88465	1.14999	12.88211
569.7	20.6842	0.158012	1.777751	13.51403	13.51403	1.103287	12.41283	1.211739	13.633
572	20.6842	0.150205	1.698977	13.30876	13.30876	1.078587	12.2002	1.21515	13.74489

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577.5	20.6842	1.75E-02	0.200155	14.17567	14.17567	1.137831	13.05031	1.341841	15.39014
588.6	20.6842	0.178728	2.105999	15.37475	15.37475	1.206635	14.21832	1.547083	18.22997
555.3	27.57893	0.400252	4.215447	12.8481	12.8481	1.118998	11.78538	5.77E-02	0.608222
560.8	27.57893	1.719844	18.45357	13.6876	13.6876	1.166469	12.51592	0.265994	2.85406
562.5	27.57893	1.618593	17.45747	13.69977	13.69977	1.159296	12.5037	0.289953	3.127293
563.6	27.57893	1.521191	16.46707	14.10027	14.10027	1.190718	12.88967	0.339151	3.671394
565.3	27.57893	1.398907	15.22471	14.48893	14.48893	1.218184	13.25785	0.390745	4.252605
566.4	27.57893	1.3456	14.69149	14.50373	14.50373	1.214518	13.26032	0.400887	4.376937
568.1	27.57893	1.245908	13.67259	14.76882	14.76882	1.230875	13.50763	0.436836	4.79385
569.7	27.57893	1.186769	13.08156	14.69768	14.69768	1.217554	13.42089	0.440101	4.851148
572	27.57893	1.106241	12.27112	14.62336	14.62336	1.201332	13.32593	0.445831	4.94544
577.5	27.57893	0.828729	9.33927	15.7057	15.7057	1.274716	14.36525	0.567827	6.399079
588.6	27.57893	1.040022	12.25504	34.37479	34.37479	2.797584	32.96518	2.196209	25.87889
560.8	31.0263	1.725221	18.11393	17.53021	17.53021	1.651383	17.33865	8.45E-02	0.887528
562.5	31.0263	1.559613	16.50212	17.02919	17.02919	1.556122	16.46515	0.105747	1.118895
563.6	31.0263	2.534485	26.95275	17.35028	17.35028	1.565028	16.64316	0.239203	2.543741
565.3	31.0263	2.346542	25.11785	17.09443	17.09443	1.516645	16.23444	0.329022	3.521945
566.4	31.0263	2.226943	23.93604	17.08317	17.08317	1.502565	16.15011	0.381404	4.099446
568.1	31.0263	2.087658	22.57005	16.7998	16.7998	1.459428	15.7781	0.416601	4.503954
569.7	31.0263	1.917511	20.851	17.14236	17.14236	1.476466	16.05505	0.488916	5.316457
572	31.0263	1.795141	19.65808	16.59001	16.59001	1.408868	15.42811	0.477986	5.234334
577.5	31.0263	1.446487	16.1126	16.75347	16.75347	1.388498	15.46664	0.535583	5.965899

Continued …

588.6	31.0263	1.144386	13.13075	14.91111	14.91111	1.174196	13.47286	0.388924	4.462541
563.6	33.30156	4.521325	46.40029	17.98669	17.98669	2.433611	24.97504	1.77912	18.25831
565.3	33.30156	3.753617	39.00237	11.71873	11.71873	1.317332	13.68788	1.168446	12.14084

Table C-14: Mixture of 67.6 mole% benzene & 32.4 mole% n-octane

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
499.7	13.78947	0.765441	7.228478	1.637849	15.46699	1.578815	14.90955	4.8361	45.66971
510.8	13.78947	1.004951	9.761403	1.795885	17.44396	1.7349	16.85166	5.12595	49.78999
522	13.78947	1.180858	11.78869	1.904462	19.01249	1.84205	18.38943	5.373331	53.64263
533.1	13.78947	1.31829	13.51324	1.985784	20.35553	1.92237	19.70552	5.59284	57.33005
544.2	13.78947	1.398594	14.70732	2.01804	21.22124	1.953934	20.54713	5.762194	60.59394
555.3	13.78947	1.425636	15.36642	2.003297	21.59275	1.938745	20.89695	5.882055	63.40038
566.4	13.78947	1.465285	16.18566	2.005719	22.1554	1.940951	21.43996	6.013355	66.42416
577.5	13.78947	1.496269	16.93163	2.003293	22.66912	1.938493	21.93581	6.134637	69.41904

Continued …

588.6	13.78947	1.538789	17.83519	2.015421	23.35952	1.950752	22.60992	6.264464	72.60755
522	20.6842	0.154695	1.504004	1.515821	14.73777	1.425104	13.85573	1.894582	18.42033
533.1	20.6842	0.216895	2.172863	1.659766	16.62754	1.56686	15.6968	2.155038	21.58924
544.2	20.6842	0.483049	4.978553	1.755207	18.08992	1.660859	17.11757	2.38044	24.53385
555.3	20.6842	0.714935	7.574622	1.852389	19.62582	1.757194	18.61722	2.616444	27.72085
566.4	20.6842	0.870587	9.470765	1.898844	20.65683	1.80319	19.61623	2.805804	30.52327
577.5	20.6842	0.996108	11.11899	1.933172	21.57885	1.837386	20.50965	2.98273	33.29445
588.6	20.6842	1.132714	12.97053	1.9919	22.80893	1.896286	21.71401	3.180462	36.41893
544.2	27.57893	0.369422	3.72756	2.116827	21.35905	2.001758	20.19798	1.434276	14.47203
555.3	27.57893	7.17E-02	0.74594	2.132664	22.19842	2.013655	20.95973	1.572343	16.36617
558.1	27.57893	0.167509	1.756809	2.145511	22.50187	2.025849	21.24686	1.612787	16.91471
560.8	27.57893	0.28531	3.01488	2.189076	23.13186	2.068902	21.862	1.683338	17.78779
562	27.57893	0.312697	3.314411	2.18579	23.16832	2.065385	21.89209	1.692085	17.93523
563.1	27.57893	0.297617	3.162252	2.144218	22.78255	2.023572	21.50068	1.661461	17.65316
564.2	27.57893	0.347824	3.707021	2.167514	23.10067	2.046714	21.81321	1.696131	18.07682
566.4	27.57893	0.382424	4.098008	2.151661	23.05675	2.030501	21.75847	1.703097	18.25003
572	27.57893	0.496032	5.390429	2.148476	23.34747	2.026625	22.02338	1.760567	19.13209
577.5	27.57893	0.605278	6.667653	2.1568	23.75901	2.034487	22.41166	1.831838	20.17928
588.6	27.57893	0.741962	8.390775	2.122973	24.0086	2.00013	22.61931	1.933252	21.86303
555.3	34.47367	1.012812	10.18411	2.332262	23.45145	2.257443	22.69915	0.827612	8.321854
558.1	34.47367	1.271875	12.9547	2.447992	24.93401	2.350525	23.94127	1.178269	12.0012
560.8	34.47367	0.930309	9.577339	2.513612	25.87716	2.404413	24.75299	1.371556	14.11989
562	34.47367	0.862157	8.909881	2.478836	25.61716	2.365839	24.44939	1.375525	14.21519
563.1	34.47367	0.742901	7.708471	2.508938	26.0333	2.39306	24.83095	1.435487	14.8949
564.2	34.47367	0.712674	7.418048	2.458854	25.59371	2.340388	24.3606	1.409528	14.67146

Continued …

566.4	34.47367	0.580593	6.085082	2.442402	25.59859	2.319722	24.3128	1.431302	15.00134
572	34.47367	0.25228	2.68986	2.458235	26.21049	2.328261	24.82461	1.506345	16.06113
577.5	34.47367	1.97E-03	2.13E-02	2.46671	26.71967	2.332181	25.26244	1.549583	16.78524
588.6	34.47367	0.452505	5.054231	2.550162	28.48375	2.410396	26.9226	1.695804	18.94108
562	39.16208	5.125856	49.16907	0.557928	5.351884	1.287651	12.35164	3.258441	31.25612
563.1	39.16208	2.063696	20.46298	2.421836	24.01416	2.801135	27.77515	0.32513	3.223915
564.2	39.16208	1.625009	16.24532	2.266128	22.65463	2.439015	24.38305	6.69E-02	0.668427
566.4	39.16208	1.474333	14.92763	2.125873	21.52448	2.147419	21.74266	0.504677	5.109898
572	39.16208	1.544997	16.07433	2.29735	23.90195	2.217808	23.07439	1.207491	12.56293
577.5	39.16208	0.95346	10.13286	2.431184	25.83724	2.320402	24.65989	1.484395	15.77532
588.6	39.16208	0.2948	3.243354	2.456771	27.02913	2.320689	25.53203	1.544572	16.99322

Table C-15: Mixture of 77.1 mole% benzene & 22.9 mole% n-octane

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
488.667	13.78947	0.985298	8.963221	1.797651	16.35311	1.740795	15.83585	5.888874	53.57063
499.778	13.78947	1.08418	10.12751	1.824503	17.04301	1.76529	16.48985	6.056127	56.57121

Continued …

510.889	**13.78947**	**1.269606**	**12.18447**	**1.950274**	**18.71685**	**1.889378**	**18.1324**	**6.325461**	**60.70558**
522	**13.78947**	**1.370323**	**13.49524**	**2.001194**	**19.70823**	**1.939041**	**19.09614**	**6.525096**	**64.26062**
533.111	**13.78947**	**1.41474**	**14.28473**	**2.002984**	**20.22435**	**1.939927**	**19.5876**	**6.676427**	**67.41256**
544.222	**13.78947**	**1.472766**	**15.24406**	**2.02356**	**20.94512**	**1.959898**	**20.28621**	**6.842234**	**70.82142**
555.333	**13.78947**	**1.499889**	**15.90511**	**2.017472**	**21.39359**	**1.953439**	**20.71461**	**6.978186**	**73.99782**
566.445	**13.78947**	**1.561334**	**16.96334**	**2.048768**	**22.25917**	**1.984597**	**21.56199**	**7.144619**	**77.624**
577.556	**13.78947**	**1.489814**	**16.55716**	**1.950382**	**21.67565**	**1.88616**	**20.96192**	**7.183107**	**79.82988**
588.667	**13.78947**	**1.394811**	**15.84844**	**1.830797**	**20.80235**	**1.766652**	**20.07344**	**7.196794**	**81.77307**
522	**20.6842**	**0.551408**	**5.317548**	**1.938005**	**18.68924**	**1.846475**	**17.80653**	**2.823613**	**27.22962**
533.111	**20.6842**	**0.726071**	**7.196107**	**1.950489**	**19.33132**	**1.857221**	**18.407**	**2.963397**	**29.37027**
544.222	**20.6842**	**0.850095**	**8.650743**	**1.947665**	**19.8198**	**1.853264**	**18.85917**	**3.100807**	**31.55436**
555.333	**20.6842**	**0.946798**	**9.88586**	**1.941598**	**20.27287**	**1.846511**	**19.28006**	**3.241233**	**33.84281**
566.445	**20.6842**	**1.038138**	**11.11727**	**1.947141**	**20.85161**	**1.851752**	**19.83009**	**3.394264**	**36.34859**
577.556	**20.6842**	**1.060262**	**11.63286**	**1.896819**	**20.8113**	**1.801366**	**19.76399**	**3.48996**	**38.29074**
588.667	**20.6842**	**1.078816**	**12.1225**	**1.852638**	**20.8178**	**1.757353**	**19.74711**	**3.587246**	**40.3093**
533.111	**27.57893**	**0.121927**	**1.181741**	**2.343529**	**22.71439**	**2.226025**	**21.57547**	**1.831282**	**17.74945**
544.222	**27.57893**	**0.273856**	**2.737126**	**2.302679**	**23.01474**	**2.182305**	**21.81164**	**1.921154**	**19.20144**
555.333	**27.57893**	**0.520134**	**5.348656**	**2.257653**	**23.21589**	**2.135484**	**21.95957**	**1.991065**	**20.47444**
558.111	**27.57893**	**0.534359**	**5.530966**	**2.213224**	**22.90827**	**2.09069**	**21.63999**	**1.977041**	**20.4636**
560.889	**27.57893**	**0.54794**	**5.708491**	**2.172131**	**22.62946**	**2.049288**	**21.34962**	**1.967305**	**20.49557**
561.445	**27.57893**	**0.555009**	**5.789844**	**2.168627**	**22.62317**	**2.045722**	**21.3411**	**1.970195**	**20.55319**
562	**27.57893**	**0.562163**	**5.872377**	**2.165245**	**22.6181**	**2.042288**	**21.33374**	**1.973242**	**20.61251**
563.111	**27.57893**	**0.57607**	**6.03372**	**2.158706**	**22.61009**	**2.035662**	**21.32135**	**1.979693**	**20.73512**

Continued …

566.445	27.57893	0.572875	6.045559	2.097914	22.13925	1.974558	20.83753	1.958618	20.66932
569.222	27.57893	0.605755	6.434767	2.085376	22.15249	1.961869	20.84047	1.980181	21.03505
572	27.57893	0.615756	6.582563	2.052895	21.94588	1.929219	20.62376	1.982525	21.19365
577.556	27.57893	0.654109	7.082375	2.012718	21.79261	1.888847	20.45142	2.013996	21.80649
588.667	27.57893	0.653663	7.25236	1.878433	20.84108	1.754402	19.46498	2.028523	22.50639
555.333	34.47367	0.22885	2.303623	2.856735	28.75645	2.726785	27.44836	1.808411	18.20382
558.111	34.47367	2.500579E-	0.254132	2.92154	29.69146	2.788431	28.33869	1.932405	19.63894
560.889	34.47367	0.210377	2.156875	2.946561	30.20939	2.811006	28.81963	1.999279	20.49744
561.445	34.47367	0.238246	2.446646	2.945235	30.24563	2.809252	28.84921	2.004905	20.58907
562	34.47367	0.266262	2.738887	2.944793	30.29094	2.8084	28.88795	2.011065	20.68638
563.111	34.47367	0.346096	3.572572	2.968946	30.64709	2.831823	29.23169	2.047769	21.13819
566.445	34.47367	0.493252	5.140568	2.966343	30.91435	2.827271	29.46502	2.076788	21.64368
569.222	34.47367	0.589893	6.194754	2.953118	31.01216	2.812726	29.5379	2.08623	21.90857
572	34.47367	0.709991	7.514332	2.972909	31.46448	2.831463	29.96745	2.127573	22.51766
577.556	34.47367	0.926271	9.953478	3.014078	32.38857	2.871028	30.85137	2.211627	23.76567
588.667	34.47367	1.043865	11.52002	2.858722	31.54875	2.713443	29.94545	2.151568	23.74466
561.445	41.3684	2.87341	27.38773	1.307159	12.45907	1.767368	16.84555	1.87232	17.84587
562	41.3684	3.127739	29.79967	0.643029	6.126501	0.90347	8.607853	2.133713	20.32903
563.111	41.3684	2.002276	19.37704	1.250684	12.10345	1.33839	12.95223	0.980476	9.488572
566.445	41.3684	2.848906	28.15593	1.40358	13.87163	1.350441	13.34645	0.111906	1.105996
569.2	41.3684	2.529321	25.31545	1.434919	14.36184	1.344271	13.45455	0.170751	1.708976

Continued …

572	41.3684	2.276037	23.02809	1.418225	14.34912	1.306902	13.22275	0.289587	2.929928
577.556	41.3684	1.883904	19.42511	1.382501	14.25508	1.249173	12.88032	0.367426	3.788572
588.6	41.3684	0.680589	7.400645	3.309036	35.98228	3.159812	34.35965	2.348122	25.53332

Table C-16: Mixture of 85.7 mole% benzene & 14.3 mole% n-octane

		Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
T	P	AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
488.6	13.78947	1.244838	11.19967	1.934549	17.405	1.877148	16.88852	7.173715	64.54122
499.7	13.78947	1.141474	10.51663	1.780493	16.40408	1.720947	15.85547	7.186304	66.20903
510.8	13.78947	1.209344	11.42611	1.804792	17.05195	1.743738	16.47511	7.372524	69.65676
522	13.78947	1.294922	12.54788	1.852406	17.94989	1.790253	17.34767	7.582551	73.4753
533.1	13.78947	1.414348	14.0538	1.938655	19.26365	1.875768	18.63881	7.825021	77.7542
544.2	13.78947	1.521987	15.50217	2.016692	20.54098	1.953343	19.89577	8.055825	82.05253
555.3	13.78947	1.640258	17.12265	2.108084	22.00634	2.044512	21.34268	8.294435	86.58582
566.4	13.78947	1.703948	18.21557	2.147389	22.95607	2.083723	22.27551	8.479293	90.64555
577.5	13.78947	1.737628	19.01215	2.158688	23.6191	2.095077	22.92314	8.633104	94.45853
588.6	13.78947	1.784159	19.97774	2.184312	24.4584	2.120907	23.74837	8.795617	98.48714

Continued …

510.8	20.6842	0.745404	6.914391	2.084946	19.34006	1.994411	18.50025	3.415669	31.6838
522	20.6842	0.756057	7.196069	1.939326	18.45842	1.846736	17.57714	3.394846	32.31187
533.1	20.6842	0.888667	8.683601	1.950509	19.05932	1.856625	18.14194	3.545279	34.64256
544.2	20.6842	1.040289	10.43372	2.003991	20.09933	1.909335	19.14995	3.746685	37.57793
555.3	20.6842	1.185062	12.19449	2.067243	21.27225	1.972202	20.29427	3.960713	40.75632
566.4	20.6842	1.3218	13.94896	2.134893	22.52949	2.039766	21.52566	4.177779	44.08806
577.5	20.6842	1.450139	15.68785	2.203535	23.83819	2.10858	22.81099	4.391834	47.51154
588.6	20.6842	1.54929	17.17129	2.250466	24.94259	2.15587	23.89416	4.579073	50.75137
533.1	27.57893	4.90E-02	0.468138	2.071059	19.80377	1.947915	18.62622	1.902628	18.19314
544.2	27.57893	0.426414	4.200429	2.147748	21.15653	2.023695	19.9345	2.095073	20.63761
555.3	27.57893	0.667321	6.758212	2.172323	21.99988	2.047659	20.73736	2.248263	22.76889
566.4	27.57893	0.952253	9.914032	2.289841	23.83975	2.165069	22.54073	2.50882	26.1196
577.5	27.57893	1.165205	12.4563	2.369171	25.32701	2.244586	23.99517	2.740478	29.29631
588.6	27.57893	1.350728	14.81657	2.444635	26.816	2.320518	25.45455	2.971979	32.60063
544.2	34.47367	0.208456	2.066042	2.003854	19.11449	1.859648	17.73893	0.893392	8.521953
555.3	34.47367	6.53E-02	0.652606	2.332422	23.11668	2.185121	21.65675	1.481427	14.68243
558.1	34.47367	0.101906	1.026586	2.351892	23.50116	2.204008	22.0234	1.533461	15.32301
560.8	34.47367	0.121015	1.221058	2.411836	24.29649	2.263536	22.80254	1.621661	16.3364
561.4	34.47367	0.163156	1.649325	2.409023	24.3073	2.260618	22.80993	1.624716	16.39359
562	34.47367	0.202113	2.049232	2.429181	24.5559	2.280707	23.05504	1.650856	16.68808
563.1	34.47367	0.264118	2.686518	2.429848	24.63618	2.281205	23.12911	1.662069	16.85171
564.2	34.47367	0.341882	3.498188	2.454275	24.9637	2.305509	23.45053	1.697098	17.26212
566.4	34.47367	0.506119	5.221015	2.46225	25.19379	2.313217	23.66884	1.725841	17.6588
569.2	34.47367	0.601613	6.252263	2.542789	26.23079	2.393565	24.69142	1.833482	18.91372
572	34.47367	0.790598	8.335827	2.562761	26.6335	2.413312	25.08035	1.880728	19.54548

Continued …

577.5	34.47367	1.045983	11.33507	2.618955	27.61344	2.469238	26.03487	1.993448	21.01834
588.6	34.47367	0.58534	5.588885	2.656804	28.79114	2.506912	27.16677	2.158286	23.38881
558.1	41.3684	1.645885	16.00612	2.000329	19.09949	1.916492	18.29902	0.027176	0.259514
560.8	41.3684	1.517816	14.80653	2.440226	23.73108	2.320194	22.5638	0.855654	8.321169
561.4	41.3684	1.410795	13.80197	2.481976	24.2121	2.357614	22.99898	0.959025	9.355463
562	41.3684	1.208367	11.88345	2.508878	24.54461	2.380825	23.29179	1.039407	10.16865
563.1	41.3684	1.047692	10.35198	2.576049	25.33351	2.44248	24.01995	1.188496	11.68798
564.2	41.3684	0.760935	7.585883	2.615722	25.8454	2.47775	24.48212	1.293178	12.77758
566.4	41.3684	0.482205	4.856504	2.691337	26.83044	2.546806	25.38954	1.463969	14.59453
569.2	41.3684	0.307129	3.121124	2.746441	27.66085	2.596086	26.14655	1.596364	16.07779
572	41.3684	2.32E-02	0.239489	2.73472	27.79086	2.58014	26.21993	1.632472	16.58958
577.5	41.3684	0.251303	2.673672	2.719831	28.10137	2.559684	26.4467	1.669801	17.25241
588.6	41.3684	3.649266	33.6045	2.561479	27.25176	2.395169	25.48229	1.566255	16.6635
561.4	44.12629	2.171568	20.34049	0.677301	6.236995	1.244709	11.46198	3.173432	29.22282
562	44.12629	1.209014	11.50731	1.49619	14.01446	1.728657	16.1919	1.668395	15.62743
563.1	44.12629	2.499792	23.99053	2.016629	19.19413	2.059061	19.59801	0.477223	4.542187
564.2	44.12629	2.229394	21.67559	2.047763	19.65243	2.021086	19.39636	0.064535	0.619369
566.4	44.12629	1.837391	18.1036	2.096202	20.38057	2.010733	19.54959	0.422666	4.109398
569.2	44.12629	1.492623	14.88022	2.138291	21.06828	2.020875	19.91141	0.753083	7.419995

Continued …

572	44.12629	0.978777	9.955628	2.193699	21.86938	2.059491	20.53142	0.962557	9.595884
577.5	44.12629	0.365654	3.847666	2.27096	23.09915	2.119279	21.55631	1.173852	11.9399
588.6	44.12629	------	-------	2.295919	24.15937	2.129135	22.40437	1.254946	13.20545

Table C-17: Mixture of 93 mole% benzene & 7 mole% n-octane

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
477.5	13.78947	1.464973	12.73048	2.11195	18.35262	2.056453	17.87035	8.376496	72.79073
488.6	13.78947	1.500955	13.3713	2.101996	18.7257	2.044142	18.21029	8.534337	76.02831
499.7	13.78947	1.532243	13.98862	2.095158	19.12774	2.03551	18.58321	8.703828	79.46148
510.8	13.78947	1.582433	14.80386	2.11254	19.76307	2.051577	19.19272	8.898791	83.24918
522	13.78947	1.580508	15.14242	2.081893	19.94606	2.019928	19.35235	9.050071	86.70626
533.1	13.78947	1.59337	15.62889	2.069206	20.29617	2.006547	19.6816	9.213818	90.37534
544.2	13.78947	1.599871	16.06104	2.052488	20.6048	1.989385	19.97132	9.370071	94.06567
555.3	13.78947	1.64484	16.90266	2.075845	21.33185	2.012521	20.6811	9.559075	98.23103
566.4	13.78947	1.638309	17.22049	2.049487	21.54239	1.986076	20.87593	9.697657	101.9333
577.5	13.78947	1.668826	17.94489	2.06124	22.16461	1.997922	21.48375	9.866929	106.0994

Continued …

588.6	13.78947	1.671504	18.37804	2.046333	22.49928	1.98321	21.80525	10.00738	110.0304
510.8	20.6842	0.820754	7.517929	1.981946	18.15405	1.889994	17.31178	3.891369	35.64386
522	20.6842	0.876694	8.238228	1.917989	18.02332	1.824502	17.14484	3.965786	37.26636
533.1	20.6842	1.027884	9.91246	1.973531	19.03179	1.879119	18.12134	4.170123	40.21474
544.2	20.6842	1.127241	11.14591	1.994545	19.72154	1.899555	18.7824	4.346848	42.98064
555.3	20.6842	1.290108	13.08332	2.090812	21.20355	1.995646	20.23847	4.597748	46.62714
566.4	20.6842	1.377975	14.31739	2.121868	22.04661	2.026725	21.05807	4.782321	49.68921
577.556	20.6842	1.470313	15.64955	2.164147	23.03452	2.06925	22.02445	4.973751	52.93912
588.6	20.6842	1.578127	17.20086	2.227898	24.28309	2.133451	23.25369	5.178548	56.44394
522	27.57893	6.36E-02	0.584375	2.122388	19.4997	1.995886	18.33744	2.180361	20.03234
533.1	27.57893	0.460459	4.359028	2.195774	20.78691	2.069533	19.59181	2.367473	22.41226
544.2	27.57893	0.743691	7.241037	2.253152	21.93795	2.126837	20.7081	2.550368	24.83183
555.3	27.57893	0.935903	9.358444	2.275736	22.75601	2.149428	21.49305	2.715921	27.15762
566.4	27.57893	1.150732	11.81447	2.355929	24.18805	2.22993	22.89447	2.950804	30.29563
577.5	27.57893	1.252077	13.1782	2.348164	24.71459	2.222586	23.39289	3.10406	32.67046
588.667	27.57893	1.338613	14.43777	2.3427	25.26744	2.217757	23.91985	3.261483	35.17702
544.2	34.47367	0.314654	2.989027	2.357042	22.39035	2.199751	20.89619	1.548058	14.70545
555.3	34.47367	0.304227	2.986157	2.492215	24.46275	2.336865	22.93791	1.834156	18.00342
558.1	34.47367	0.382703	3.784122	2.48043	24.52587	2.325261	22.99165	1.852575	18.31778
560.8	34.47367	0.507597	5.056775	2.524835	25.15294	2.369902	23.60939	1.926235	19.18955
562	34.47367	0.534419	5.340188	2.518697	25.16794	2.363816	23.62029	1.93302	19.31558
563.6	34.47367	0.608591	6.108196	2.549953	25.59295	2.395213	24.03985	1.981902	19.89159
566.4	34.47367	0.663275	6.703331	2.535347	25.62319	2.380717	24.06052	1.998308	20.19574
572	34.47367	0.771127	7.900902	2.519714	25.81689	2.365366	24.23543	2.047734	20.98102
577.5	34.47367	0.853935	8.864606	2.496973	25.92074	2.342895	24.32133	2.09301	21.72726

Continued …

588.6	34.47367	0.923367	9.828028	2.389903	25.43742	2.236426	23.80388	2.134384	22.71775
555.3	41.3684	1.708217	16.15542	2.269906	21.4675	2.100343	19.86386	0.635884	6.013872
558.1	41.3684	1.383031	13.22475	2.237065	21.39114	2.065671	19.75217	0.821128	7.851708
560.8	41.3684	1.01135	9.776551	2.343187	22.65113	2.170712	20.9838	1.054714	10.19568
562	41.3684	0.891007	8.650464	2.363327	22.94475	2.190428	21.26609	1.115545	10.83043
563.6	41.3684	0.704499	6.880691	2.427915	23.713	2.254588	22.02013	1.22475	11.96188
566.4	41.3684	0.462735	4.562488	2.484661	24.4984	2.31064	22.78254	1.339294	13.20529
572	41.3684	3.78E-02	0.379667	2.611104	26.21274	2.436155	24.45642	1.540136	15.4614
577.5	41.3684	0.120178	1.224358	2.543339	25.91105	2.367532	24.11999	1.52095	15.49512
588.6	41.3684	0.320644	3.358413	2.399298	25.13006	2.222595	23.27922	1.467224	15.36757
562	46.53945	1.161048	10.751	2.827177	26.17897	2.993769	27.72152	0.915518	8.477495
563.6	46.53945	2.265665	21.34837	2.817836	26.55125	2.74642	25.87832	0.22274	2.098829
566.4	46.53945	1.929574	18.45086	2.534952	24.23951	2.401155	22.96013	0.659672	6.307844
572	46.53945	1.628017	15.88541	2.114718	20.63437	1.949536	19.02258	0.735384	7.175491
577.5	46.53945	1.202062	11.95557	2.083776	20.7251	1.907667	18.97349	0.865282	8.606037
588.6	46.53945	0.433241	4.464205	2.246688	25.2365	2.061648	21.24348	1.118351	11.52358

Table C-18: Mixture of 48.4mole% cis-pentene & 51.6 mole% n-pentane

T	P	Lee-Kesler		Peng-Robinson		Soave-Redlick-Kwong		This Work	
		AA%D	AAD	AA%D	AAD	AA%D	AAD	AA%D	AAD
460.889	27.57893	1.427676	13.00074	1.660844	15.124	1.489403	13.56282	0.746134	6.794483
466.445	27.57893	0.909701	8.455394	1.828278	16.99318	1.660471	15.43347	1.011069	9.397533
472	27.57893	0.530064	5.020437	1.937378	18.34969	1.771794	16.78141	1.201357	11.37852
474.778	27.57893	0.320285	3.062609	2.031202	19.42263	1.866557	17.84829	1.33526	12.7679
477.556	27.57893	0.114551	1.105728	2.131627	20.57627	1.967834	18.99519	1.476433	14.25173
483.111	27.57893	9.56E-02	0.938609	2.160718	21.20891	1.998154	19.61318	1.589293	15.59992
488.667	27.57893	0.319474	3.188599	2.229547	22.25271	2.068131	20.64164	1.747381	17.44029
494.222	27.57893	0.486678	4.935509	2.263207	22.9518	2.102819	21.32528	1.874916	19.01411
499.778	27.57893	0.666393	6.866548	2.325439	23.96155	2.166104	22.31977	2.034902	20.96785
466.45	31.0263	2.947288	26.63304	0.991174	8.956699	0.797397	7.205616	0.323035	2.919106
472	31.0263	1.565896	14.57267	1.802067	16.7705	1.615779	15.03687	0.661793	6.15885
474.78	31.0263	1.121078	10.56079	2.03325	19.15373	1.849064	17.41862	0.944204	8.894652
477.56	31.0263	0.855293	8.14062	2.118203	20.1609	1.935423	18.42123	1.069431	10.17877
483.11	31.0263	0.37827	3.672538	2.294475	22.27629	2.11386	20.52275	1.31522	12.76906
488.67	31.0263	0.224103	2.211669	2.211649	21.82712	2.032269	20.05674	1.298317	12.81328
472	34.47367	4.195107	37.69734	0.719394	6.464488	0.51404	4.61916	0.964593	8.667863
474.78	34.47367	3.531713	32.21811	0.897724	8.189517	0.696377	6.352682	0.557375	5.084635
477.56	34.47367	2.61837	24.30031	1.42833	13.25586	1.229893	11.41427	0.103556	0.961097
483.11	34.47367	1.69931	16.16997	1.803011	17.15678	1.607234	15.29378	0.600908	5.718042
488.67	34.47367	1.111967	10.80865	1.99562	19.39804	1.801309	17.50928	0.85236	8.285131
494.22	34.47367	0.816147	8.077508	1.988655	19.68184	1.795185	17.76707	0.888647	8.795025
499.78	34.47367	0.503549	5.073885	2.052057	20.67688	1.859529	18.7369	0.999793	10.07408

Continued …

474.78	**35.50788**	**3.229306**	**29.44773**	**1.698896**	**15.49207**	**1.498343**	**13.66325**	**5.86E-02**	**0.534043**
477.56	**35.50788**	**3.492472**	**32.04696**	**0.997971**	**9.15736**	**0.797216**	**7.315279**	**0.436608**	**4.006298**
483.11	**35.50788**	**2.258849**	**21.3262**	**1.555702**	**14.68762**	**1.357008**	**12.8117**	**0.310891**	**2.935151**
488.67	**35.50788**	**1.60719**	**15.51399**	**1.745241**	**16.84653**	**1.547399**	**14.93675**	**0.569081**	**5.493299**
494.222	**35.50788**	**1.102416**	**10.85942**	**1.898663**	**18.70287**	**1.70157**	**16.76137**	**0.760998**	**7.496212**
499.778	**35.50788**	**0.794296**	**7.96654**	**1.928119**	**19.33839**	**1.73161**	**17.36743**	**0.826244**	**8.286988**

الخلاصة

ان التنبؤ بالقيمة الصحيحة للمحتوى الحرارري والمحتوى الحراري المتبقي للسوائل له اهمية كبيرة في الحسابات التصميمية وبعض التطبيقات الصناعية الاخرى. وبما انه ليس من السهولة الحصول على قيم المحتوى الحراري للابخرة المحمصة مختبريا فقد تحول الاهتمام الى حسابها باستخدام معادلات الحالة.

في هذه الدراسة تم استخدام المعادلات التكعيبية للحالة بهدف احتساب المحتوى الحراري والمحتوى الحراري المتبقي للابخرة النقية المحمصة، والمعادلات هي .بالاضافة الى هذه المعادلات استعملت ايضا ،وعلاقة . وقد جربت هذه الطرائق على ٢١٧٧نقطة مختبرية للابخرة المحمصة وقد وجد ان معادلة هي الافضل مقارنة مع المعادلات الاخرى. مع الملاحظة ان معادلة الحالة تم تطويرها اساسا للتوازن بين حالتي البخار والسائل ، ولذلك وجد ان هنالك مجال لتطويرها لغرض التنبؤ بالمحتوى الحراري المتبقي في المركبات النقية ولتطوير علاقة جديدة للخلائط . وقد اجرى تعديل على معادلة لتحسين دقتها وذلك من خلال ادخال علاقة جديدة لاحتساب قيمة m في المعادلة بدلالة درجة الحرارة والضغط المنقوصين بالاضافة الى معامل اللامركزية كما يلي :

$$m = a_f + b_f \omega + c_f \omega^2$$

حيث :

$$a_f = 3.192426$$

$$b_f = -14.6167 \times T_r - 5.7701 \times T_r^2 - 10.3125 \times P_r + 6.91052 \times T_r \times P_r + 0.97196 \times P_r^2$$

$$c_f = 95.60639 \times T_r + 57.877 \times T_r^2 - 4.94924 \times P_r + 21.14243 \times T_r \times P_r - 4.58519 \times P_r^2$$

النتائج المستحصلة من استعمال هذه الطريقة تطابقت مع النتائج المختبرية فقد كان المعدل المطلق للانحراف لثمانية مركبات نقية مع ١٠٣٢نقطة كان ٦,٤٣٥٠٣ جول/غرام للمحتوى الحراري المتبقي و٠,٧٣١٢١٤ للمحتوى الحراري ،بالمقارنة مع علاقة حيث ان المعدل المطلق للانحراف ١٠,٦٤١٢٥ جول/غرام للمحتوى الحراري المتبقي والمعدل المطلق لنسبة الانحراف ١,٢٠٥٠٦٥ للمحتوى الحراري لنفي عدد النقاط . هذه العلاقة طبقت على المركبات النقية عند ضغط اقل من ١٣٨ بار.للضغوط العالية للنايتروجين الى ١٠٠٠٠ بار والامونيا الى ٥٠٠٠ بار كذلك تم تطوير معادلة بنفس الطريقة وقد تم الحصول على تعديل اخر لقيمة m للمركبات النقية كما يلي :

$$m = a_f + b_f\omega + c_f\omega^2$$

حيث:

$$a_f = 1.08047$$

$$b_f = -8.3078 - 2.06477 \times T_r - 0.1202866 \times P_r$$

$$c_f = -2.2745 + 37.73731 \times T_r + 1.034199 \times P_r$$

ان معدل المطلق للانحراف الذي حصلنا عليه من استخدام هذه العلاقة مع ١١٤٥ نقطة مختبرية للنايترجين والامونيا كان ٢,٤٨٧٣٩ للمحتوى الحراري المتبقي و ٤,٦١١٠٤ للمحتوى الحراري.

لتوسيع التطبيقات الى الخلائط ، لقد طورت علاقة جديدة للتنبؤ بالمحتوى الحراري والمحتوى الحراري المتبقي للخلائط. وهذه العلاقة مبنية على اسس الحالات المتناظرة (درجة الحرارة المنقوصة ،الضغط المنقوص ،معامل اللامركزية والتركيب).

$$\frac{H^R}{RT_{CM}} = -0.12579 - 0.78614 \times T_r - \frac{0.34704}{P_r} + 0.6758\frac{T_r}{P_r} - 0.168728\frac{T_r^2}{P_r^2} - 1.109548\frac{P_r^{(4.36269)}}{T_r^{(14.1992)}}$$

بالنسبة الى الخلائط المزدوجة غير القطبية تم استعمال المعادلة اعلاه مع انظمة الخلط المناسبة لها والتي اظهرت ان انظمة الخلط هي الافضل دائما .انظمة الخلط هذه مع العلاقة الجديدة المشتقة ونتيجة هذا العمل كان المعدل المطلق لانحراف المحتوى الحراري المتبقي هو٥,٣٣٤١٤٨ جول/غرام والمعدل المطلق لنسبة الانحراف للمحتوى الحراري هو ٠,٥٢٤٠٥٤٥لـ٧٥٤ نقطة مختبرية تعودالى خمس خلائط مزدوجة غير مستقطبة ،وبالمقارنة مع طريقةLee-Kesler كان المعدل المطلق لانحراف المحتوى الحراري المتبقي ١٠,٦٤٦٨٥ جول/غرام والمعدل المطلق لنسبة الانحراف المحتوى الحراري ١,٠٥٦١٣٢ تحت نفس الظروف ولنفس المواد.

شكر وتقدير

أود أن اعبر عن خالص شكري وتقديري وامتناني العميق للمشرف الدكتور محمود عمر عبد الله لما قدمه لي من توجيهات قيمة ونصائح سديدة طوال فترة إنجاز البحث.

أود أيضـاً أن اشـكر الدكـتور فائق وجميع أساتذة وموظفي قسم الهندسة الكيماوية في جامعة النهرين لإبدائهم المساعدة اللازمة أثناء هذا العمل.

ولا أنسـى أن أتقدم بالشكر والامتنان إلى من لازمني طوال فترة البحث وخلال اصعب الظروف إلى أعز من في الوجود إلى أبى وأمي وأخواتي فلهم جزيل الشكر والتقدير.

لبنى غالب عبد الخالق اللامي

التحري عن علاقات عامة والتنبؤ للمحتوى الحراري المتبقي للبخار المحمص للمركّبات النقية والخلائط

رسالة مقدمة الى كلية الهندسة

جامعة النهرين

كجزء من متطلبات نيل درجة ماجستير علوم في

الهندسة الكيمياوية

من قبل

لبنى غالب عبد الخالق اللامي

بكلوريوس في الهندسة الكيمياوية ٢٠٠١

رمضان ١٤٢٥

تشرين الثاني ٢٠٠٤