

**UNIVERSITY OF TECHNOLOGY, JAMAICA**

**COLLEGE/ FACULTY:** Engineering and Computing

**SCHOOL/ DEPARTMENT:** ChemicalEngineering

**Mid-semester Examination 2, Semester 3**

**Module Name:** Chemical Engineering Thermodynamics 1

**Module Code:** CHE3003

**Date:** July 24, 2012

**Theory/ Practical:** Theory

**Groups:** B.ENG.3C

**Duration:** 3 hours

**Instructions**

1. **ANSWER ALL QUESTIONS**
2. **EACH QUESTION MUST BEGIN ON A NEW PAGE**
3. **LEAVE TWO LINES BETWEEN PARTS OF A QUESTION**
4. **READ EACH QUESTION CAREFULLY BEFORE ANSWERING**
5. **SHOW CLEARLY ALL EQUATIONS USED FOR CALCULATIONS**
6. **THE INTENDED MARK IS INDICATED AT THE BEGINNING OF EACH QUESTION**
7. **ANSWER MUST BE NUMBERED IDENTICAL TO THE QUESTION BEING ANSWERED**
8. **A FORMULA SHEET AND UNIT CONVERSION CHART ARE ATTACHED.**

**\*\*\* DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO \*\*\***

**Question #1 [35 marks]**

A vessel with a volume of 0.35 m3 is used to store liquid propane at its vapor pressure. Safety considerations dictate that at a temperature of 320 K the liquid must occupy no more than 80% of the total volume of the vessel. For these conditions, determine the mass of vapor and the mass of liquid in the vessel using the Peng/Robinson (PR) equation. At 320 K the vapor pressure of propane is 16.0 bar.

**Question #2 [35 marks]**

An equimolar mixture of nitrogen and acetylene enters a steady-flow reactor at 298.15 K (25°C) and atmospheric pressure. The only reaction occurring is:

N2(g) + C2H2(g) 2HCN(g)

The product gases leave the reactor at 873.15 K (600°C) and contain 24.2 mole-% HCN. How much heat is supplied to the reactor per mole of product gas?

**Question #3 [30 marks]**

A binary mixture of Ethanol (l) and l-propanol (2) with a mole fraction of = 0.25 is flashed to conditions of T = 360 K and P = 0.8 atm. Assuming that Raoult's law applies, determine:

1. the equilibrium mole fractions and of the liquid and vapor phases formed,
2. the molar fraction V of the vapor formed, and
3. the fractional recovery R of species 1 in the vapor phase (defined as the ratio of the moles of species 1 in the vapor to moles in the feed).

**Total Marks = 100**

**\*\*\*\*\* END OF PAPER \*\*\*\*\***

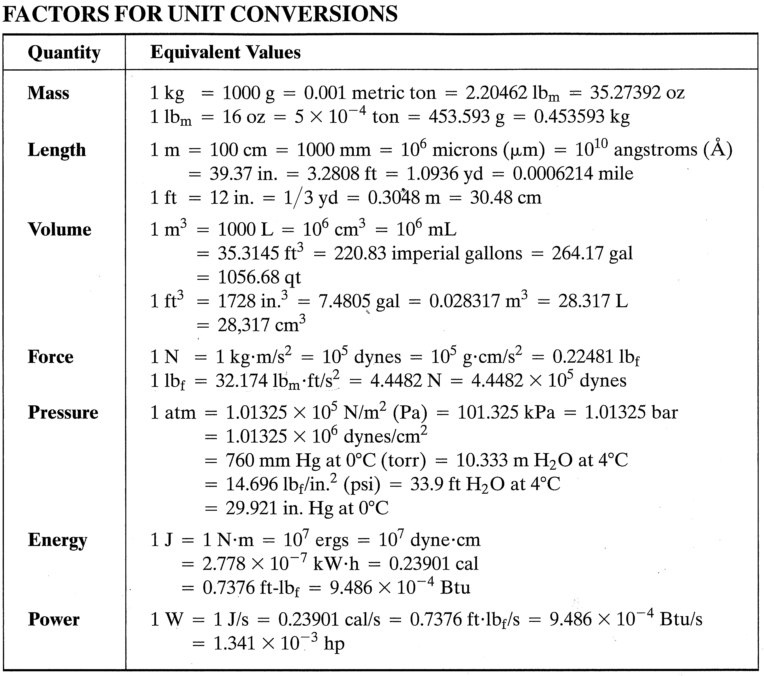
**Formula Sheet**

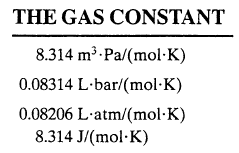
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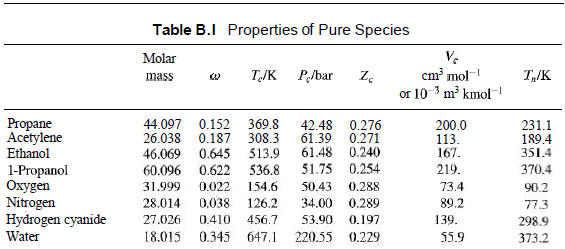
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*For Liquid and Liquid-like Roots*

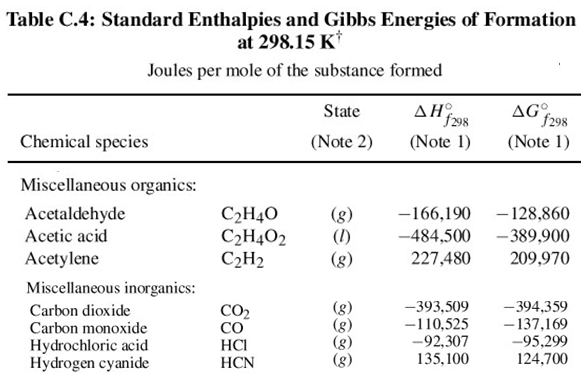
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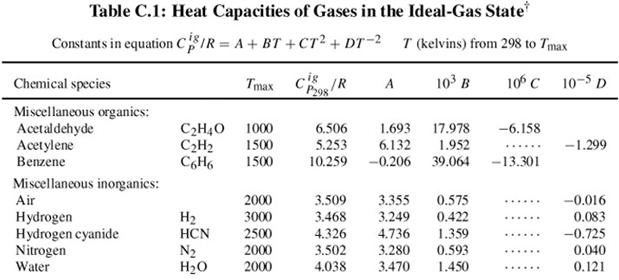


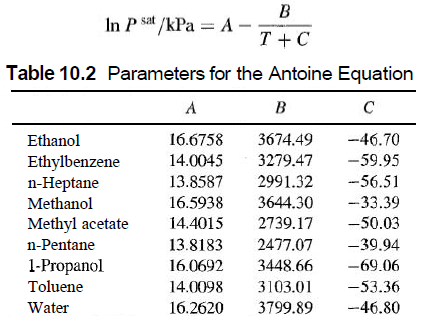


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