ME40 – QUIZ 1
Fall 2010

Last Name: ______________

First Name: ______________

Circle the section you attend:
M 4-5
T 10-11
T 1-2

Student ID #:____________

ABSOLUTELY NO QUESTIONS WILL BE ANSWERED DURING THE TEST. IF YOU ARE UNSURE ABOUT SOMETHING, MAKE AND STATE AN ASSUMPTION AND COMPLETE THE PROBLEM.

Complete as many problems as you can.

Problems 1-4 are multiple-choice, only the circled answer will be graded.

For Problems 4-8:

Show all work on the pages provided and cite assumptions made.

Box all answers. Answers without proper units will be considered incomplete.

Partial credit will be given.

Property tables/charts are attached to the back of the test.

1) A water jet that leaves a nozzle at 50m/s at a flow rate of 1.1kg/s is to be used to generate power by striking the buckets located on a the perimeter of a wheel. Determine the power generation potential of this water jet.

A. 15. 75 kW

B. 1.375 kW

C. 25 kW

D. It cannot be determined with the given values

2) Given the following table, find the corresponding saturation pressure of water for a saturation temperature of 28.6 deg. C. Use of exponential interpolation will yield the correct result.

Temp., T °C	Sat. press., P_{sat} kPa
0.01	0.6117
5	0.8725
10	1.2281
15	1.7057
20	2.3392
25	3.1698
30	4.2469

A. 3.894 kPa

B.3.945 kPa

C. 3.917 kPa

D. 3.708 kPa

3) Find the state and quality of R-134a at T = -34 deg. C and h = 200 kJ/kg.

A. Sub-cooled liquid, x = 0.547

B. Super-heated vapor, x = 0

C. 2 phase mixture, x = 0.562

D. Saturated vapor, x = 1.02

E. 2 phase mixture, x = 0.87

F. Saturated liquid, x = 0.754

4) Using the generalized compressibility chart. Determine the compressibility factor of R-134a at the following condition: P=6,000kPa, T=412K.

Important Values:

$R = 0.0815 kPa.m^3 / kg.K$

$P_{cr} = 4.059 MPa$

$T_{cr} = 374.2K$

A. z = 0.65

B. z = 0.25

C. z = 0.39

D. z = 0.49

5) For working fluid X of mass m = 2 kg, we know that Cp is a function of T, as of:

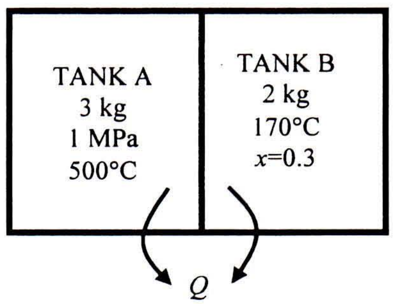
$$C_p = a + bT^{1/2}$$

Where a = 2 kJ/kg.K , b = 3 kJ/kg.K$^{3/2}$

As precisely as possible, evaluate the change in enthalpy of this working fluid (ΔH), between 20 and 25°C.

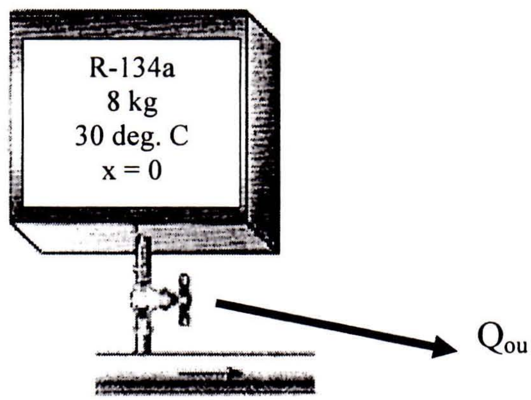
6) Two tanks (Tank A and Tank B) are separated by a partition. Initially Tank A contains 3-kg steam at 1MPa and 500°C while Tank B contains 2-kg saturated liquid-vapor mixture at 170°C with a vapor mass fraction of 30%. The partition is now removed and the two sides are allowed to mix until the mechanical and thermal equilibrium are established. If the pressure at the final state is 300kPa determine:

a) The temperature and the quality of steam (if mixture) at the final state
b) The amount of heat lost from the tanks



7) An air-conditioning system is to be filled from a rigid container that initially contains 8 kg of saturated liquid R-134a at 30 degrees C. The valve connecting this container to the air-conditioning system is now opened until the mass in the container is 0.34 kg, at which time the valve is closed. During this time, only liquid R-134a flows from the container. Presuming the process is isothermal while the valve is open, determine:

a. the final quality of the R-134a in the container
b. the total heat transfer.



8) Refrigerant-134a enters a diffuser steadily as saturated vapor at 700 kPa with a velocity of 20 m/s, and it leaves at 1000 kPa and 60 deg. C. The exit area of the diffuser is 72.5 percent greater than the inlet area. The working fluid then passes through a throttling valve that drops the pressure to 400 kPa. Determine:

a) the velocity of the flow as it exits the diffuser
b) the specific enthalpy, h, of the R-134a as it exits the throttling valve