CPC (CH 21203) Problem Sheet by RM (Problems are mostly from Himmelblau's Book, 8th Edition)

1. **(9.2.17)** Find the value of internal energy for water (relative to the reference state) for the states indicated:

   a. Water at 0.4 MPa, 725°C

   b. Water at 3.0 MPa, 0.01 m^3/kg

   c. Water at 10.0 MPa, 100°C

   d. Water at 4.0 MPa, Sp. Volume 0.09885 m^3/Kg

2. **(9.2.18)** Steam is used to cool a polymer reaction. The steam in the steam chest of the apparatus is found to be at 250.5°C and 4000 kPa absolute and in vapor phase at the beginning of the day. At the end of the day the measurement showed that the temperature was 650°C and the pressure 10,000 kPa absolute. What was the internal energy change of 1kg of steam in the chest during the day? Obtain your data from the steam tables.

3. **(9.2.32)** A closed vessel contains steam at 1000.0 psia in a 4-to-1 vapor - volume - to – liquid volume ratio. What is the steam quality? Given 1 psi = 6.894 KPa

4. **(9.2.35)** Equal quantities by weight of water at +50°C and of ice at –40°C are mixed together. What will be the final temperature of the mixture? **Given Heat of fusion of ice at 0 °C = 334 KJ/Kg and specific heat of ice is 2.108 KJ/Kg K.**

5. **(9.2.42)** You have calculated that the specific enthalpy of 1 kg mol of an ideal gas at 300 KPa and 100°C is 6.05×10^5 J/kg mol (with reference to 0°C and 100 KPa). What is the specific internal energy of the gas at 300 KPa and 100°C?

6. **(9.3.8)** A person living in a 4 m × 5 m × 5 m room forgets to turn off a 100 W fan before leaving the room, which is at 100 kPa, 30°C. Will the room be cooler when the person comes back after 5 hr, assuming zero heat transfer? The heat capacity at constant volume for air is 30 kJ/kg mol.

7. **(9.3.25)** By use of the steam tables, compute the numerical values for Q, W, ΔH, and ΔU for the complete process in which 0.453 Kg of liquid water is initially confined in a capsule at 164.3 °C and 690 Kpa within an evacuated vessel of 0.1255 m^3 capacity; the capsule is then broken within the vessel, allowing the water to escape into the evacuated vessel; and finally the water is brought to the initial temperature (164.3 °C).

8. **(9.3.26)** 4 kilograms of superheated steam at 700 kPa and 500 K are cooled in a tank to 400 K. Calculate the heat transfer involved.

9. Extra Problem: A cylinder contains 1 Kg of steam at 600°C and 1.3 MPa pressure. It is connected to an identical cylinder by a valve (initially closed) which is evacuated. After opening the valve, the final temperature remains 400 °C. Find the condition of the steam, and also ΔU and ΔH of the process.