

Chemical Engineering Department

Minor 2 CLL-111 Material & Energy Balances

Time: 1 hour

M. Marks: 20

1. A drier must remove 200 kg of water per hour from a certain material. Air at 22°C and 50 % relative humidity enters the drier and leaves at 72°C and 80 % relative humidity. What is the weight (in kg) of bone dry air used per hour. The barometer reads 103 kPa. (8)

Additional Data:

Vapor Pressure of Saturated Water

T (K)	Pressure (kPa)
273.16	0.6113
295	2.62
330	17.21
345	33.77
380	128.8

2. Two tanks containing nitrogen at the following conditions sit next to each other

	Tank A	Tank B
Volume (m^3)	1	5
Temperature ($^{\circ}\text{C}$)	25	40
Pressure (kPa)	300	?
Amount of gas (gmol)	?	?

After the two tanks are connected and reach equilibrium, the conditions in the combined tanks are 700 kPa and 35°C . What was the pressure in tank B. (6)

3. What is the number of degrees of freedom according to the Gibbs phase rule for each of the following systems:
- A mixture of liquid water and liquid octane (which is immiscible in water) both in equilibrium with their vapors.
 - Liquid water in equilibrium with moist air.
 - Solid iodine in equilibrium with its vapor.
- (2x3)