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Total Number of Pages : 02

B.Tech
PCCH4203

4th Semester Back Examination 2018-19
CHEMICAL PROCESS AND CALCULATION
BRANCH : CHEM
Time : 3 Hours
Max Marks : 70
Q.CODE : F200

Answer Question No.1 which is compulsory and any FIVE from the rest.
The figures in the right hand margin indicate marks. The psychometric chart should be provided to the students in the examination hall.

Q1 Answer the following questions : (2 x 10)

- Write the different scales of expressing the units.
- State Roult's law.
- Differentiate between concentration and composition.
- What do you mean by limiting reactant and excess reactant?
- Define normality.
- Write the advantages of multiple effect evaporators over single effect evaporator.
- Mention the necessity of purging operation in chemical process industries.
- Write the ClassiusClyperon Equation and Antonie Equation.
- 1000 kg of wet solids are to be dried from 60% to 20% moisture (by weight). The mass of moisture removed in kg is _____.
- Pure A in gas phase enters a reactor. 50% of this A is converted to B through the reaction $A \rightarrow 3B$. Mole fraction of A in the exit stream is _____.

Q2 a) Prove that the partial pressure of pure component of a mixture is the product of mole fraction and total pressure from Dalton's law of additive pressure. (5)

b) Assuming that CO₂ obeys perfect gas law, calculate the density of CO₂ (in kg/m³) at 263°C and 2 atm. (5)

Q3 a) Define humidity and classify the different types of humidity. What do you mean by wet-bulb depression? (5)

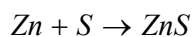
b) The wet-bulb and dry-bulb temperature of air are 313K and 333K respectively. Determine the following using the psychometric chart: (5)

- Absolute humidity
- Molal humidity
- The percent humidity

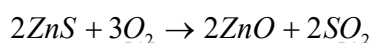
Q4 a) An aqueous solution of NaCl contains 20% NaCl. The density of the solution is 1.16 g/ml. 500 ml water of density 1g/ml is added to 1 litre of the solution. What will be the molality and molarity of the resulting solution? (5)

b) What is the specific gravity on the Baume scale for 100 °T_w solution? (5)

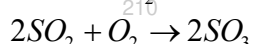
Q5 On the basis of the data and the chemical reactions given below, find the heat of formation of ZnSO₄ from the elements. (10)



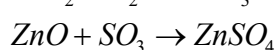
$$\Delta H = - 44 \text{ kcal / kg mol}$$



$$\Delta H = - 221.88 \text{ kcal / kg mol}$$



$$\Delta H = - 46.88 \text{ kcal / kg mol}$$



$$\Delta H = - 55.10 \text{ kcal / kg mol}$$

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Q6 Classify the different types of evaporator based on their feed arrangements. **(10)**

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Q7 After a crystallization process, a solution of CaCl_2 in water contains 62 kg of salt per 100 kg of water. Calculate the weight of solution necessary to dissolve 250 kg of $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ at 298 K. The solubility at 298 K is 7.38 kmol CaCl_2 in 100 kg of water. **(10)**

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Q8 **Write short answer on any TWO :** **(5 x 2)**

- a) Specific gravity
- b) Heat of reaction
- c) Psychometric chart

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