

MANIPAL ACADEMY OF HIGHER EDUCATION

Manipal Institute of Technology

Engineering Chemistry [CHM 1051]

Ist Sessional

09-09-2019

SCHEME OF VALUATION

Marks: 15

Duration: 60 mins.

PART – A

Answer all the questions.

Q1. Which of the following factors will **not** affect appreciably the emf of the cell? (0.5)

1. Nature of the electrode
2. Concentration of the electrolyte
3. Temperature
4. ****Liquid junction potential**

Q2. The EMF of the following cell is found to be 0.20 V at 298 K, (0.5)



What is the molar concentration of Cd^{2+} ions in solution?

1. 4.00 M
2. ****0.040 M**
3. 0.400 M
4. 0.004 M

Q3. Calomel electrode is an example of (0.5)

1. Redox electrode
2. ****Metal insoluble salt electrode**
3. Ion selective electrode
4. Gas electrode

Q4. Calculate the free energy of Cu electrode with Cu^{2+} concentration 0.015 M. (0.5)

1. -44816 J
2. **** -55217 J**
3. -65620 J
4. -65260 J

Q5. Nickel-Cadmium batteries are preferred to lead-acid batteries in military (0.5)
application because.....

1. ****it delivers large amount of power**
2. has low environmental impact
3. it is a low cost battery
4. of ease in servicing

Q6. The Charge carrier in polymer electrolyte membrane fuel cell is (0.5)

1. SO_4^{2-}
2. **** H^+**
3. OH^-
4. CO_3^{2-}

Q7. Density of ice is less than that of water due to (0.5)

1. Instantaneous-induced dipole
2. Ion-dipole
3. Dipole-induced dipole
4. ****Hydrogen bonding**

Q8. The minimum functionality of a monomer to undergo polymerization is (0.5)

1. Four
2. Three
3. ****Two**
4. One

Q9. A polymer sample contains: (0.5)

No. of Molecules	10	20	20	25	20	5
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Molecular mass	5000	7500	10000	15000	20000	25000
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Calculate its number-average molecular weight

1. 51480
2. 15480
3. 31000
4. ****13000**

Q10. Which among the following is true for ionic compounds? (0.5)

1. Low melting and boiling point
2. Soluble in organic solvents
3. ****Do not exhibit isomerism**
4. Soft and brittle

PART B

Q11.

(i) **Discuss the origin of electrode potential for Ni/NiSO₄.**

Helmoholtz double layer diagram

½ M

Explanation with respect to Nickel

½ M

(ii) **Consider the cell**

Cd/CdCl₂.2H₂O // AgCl_(s) /Ag.

The EMF of the cell is 1.018 V at 293 K and the temperature coefficient is -4.00 x 10⁻⁵ VK⁻¹.

Calculate enthalpy and entropy changes at 293 K.

$$(ii) \Delta H = nF \left(T \left(\frac{\partial E}{\partial T} \right)_p - E \right)$$

$$= 2 \times 96500 [(293 \times -4 \times 10^{-5}) - 1.018]$$

$$= -198.735 \text{ KJ}$$

½ M

$$\Delta S = nF \left(\frac{\partial E}{\partial T} \right)_p$$

$$= -7.72 \text{ JK}^{-1}$$

½ M

Q12. (i) **At 25° C, the EMF of the cell Pt, H₂ (1 atm) / H⁺ // KCl (satd)/ Hg₂Cl₂ (s),Hg**

is 0.445 V. Calculate the pH of the solution.

$$E_{\text{cell}} = E_{\text{cal}} (\text{Sat.}) - (-0.0591 \text{pH}) \quad \frac{1}{2} \text{ M}$$

$$0.445 = 0.2444 + 0.0591 \text{ pH}$$

$$0.2006 = 0.0591 \text{ pH}$$

$$\text{pH} = \frac{0.2006}{0.0591} = 3.3942 \quad \frac{1}{2} \text{ M}$$

(ii) What are the consequences of overcharging a lead acid battery?

(i) Excessive charging may reduce the acid level and may damage the exposed electrode grids ½ M

(ii) In extreme cases, there will be dangerous high-pressure build-up that can lead to a serious risk of explosion. ½ M

Q13. (i) Give reason: Optimal water concentration is crucial for the efficient functioning of polymer electrolyte membrane fuel cell.

Dehydration of the membrane reduces the proton conductivity, excess of water can lead to the flooding of the electrolyte and reduced the efficiency 1 M

(Note:- Any 2 of the above 3 points)

(ii) Discuss the experimental method to determine decomposition potential of an Electrolyte.

Diagram / explanation ½ M

Graphical determination ½ M

Q14. (i) With an appropriate example explain London dispersion forces and its significance.

Explanation of London forces with example (Ar) ½ M

Liquefaction and in some cases, the solidification of the inert gases ½ M

(ii) Discuss how the polymer structure affects its strength.

higher the forces of attraction higher the strength ½ M

lower slipping power higher the strength ½ M

Q15 (i) Distinguish between number-average and weight-average molecular weight of a polymer.

Number – average molecular weight: Number average molecular mass of a polymer can be defined as the total mass of all the molecules in a polymer sample divided by the total number of molecules present.

Weight – average molecular weight: The sum of the fractional masses that each molecule contributes to the average according to the ratio of its mass to that of the whole sample and

½ M

No. of average molecular weight is lower value and weight average molecular weight of the polymer higher value

½ M

(Note:- One difference ½ Mark)

(ii) Write the correct sequence of increasing order of Tg for the following polymers with suitable explanation.

Polyethylene, Polypropylene, Polystyrene

Due to the presence of bulky groups

½ M

PE < Polypropylene < Polystyrene

½ M