

MSc DEGREE END SEMESTER EXAMINATION MARCH 2016**SEMESTER - 4, MSc CHEMISTRY**

COURSE: P4CHET15EL: ADVANCED PHYSICAL CHEMISTRY

Time: Three Hours

Max. Marks: 75

Section A*(Answer any 10 questions. Each question carries 2 marks)*

1. Lattice parameter of a face centred cubic (FCC) conventional unit cell is "a". Calculate the volume of its primitive unit cell.
2. Define screw axis and Glide planes.
3. What is oxygen starvation in fuel cells? What can happen to the fuel cell during Oxygen starvation?
4. Can $\text{Cr}_2\text{O}_7^{2-}$ be used to oxidize Fe^{2+} ? Would Cl^- oxidation be a problem with $\text{Cr}_2\text{O}_7^{2-}$?

Given $E^0_{(\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+})} = 1.38 \text{ V}$, $E^0_{(\text{Fe}^{3+}/\text{Fe}^{2+})} = 0.77 \text{ V}$, $E^0_{(\text{Cl}_2/\text{Cl}^-)} = 1.36 \text{ V}$

5. If heavier gas molecules move more slowly than lighter gas molecules, why is the average kinetic energy independent of the mass?
6. Describe the basic differences between atomic emission and atomic absorption spectroscopy.
7. Calculate the solubility product of AgI at 25.0 °C from the following data:

| Reduction reaction | half- | E^0 (V) |
|--------------------------------------------------|-------|-----------|
| $\text{AgI(s)} + \text{e}^- \rightarrow$ | | -0.15 |
| $\text{Ag(s)} + \text{I}^-$ | | |
| $\text{I}_2(\text{s}) + 2\text{e}^- \rightarrow$ | | -0.54 |
| 2I^- | | |
| $\text{Ag}^+ + \text{e}^- \rightarrow$ | | +0.80 |
| Ag(s) | | |

8. What do you mean by Debye-Falkenhagen effect?
9. Identify the two effects that lead to decrease in molar conductivity (Λ) with concentration for strong electrolytes.
10. Write down Ilkovic Equation and explain the different terms in the equation?

11. Define 'Over Potential' for a particular electrode.
 12. Write the space groups of a triclinic crystal system?
 13. Compute the Miller Indices for a plane intersecting at
 - (i) $x = \frac{1}{4}$, $y = 1$, and $z = \frac{1}{2}$,
 - (ii) $x = 2$, $y = \frac{3}{2}$, $z = 1$
- (2 × 10 = 20)
(PTO)

Section B

(Answer any 5 questions. Each question carries 5 marks)

14. Crystal of Iridium (Ir) (FCC) is analyzed by x-ray diffraction through exposure to Molybdenum K_{α} radiation, for which $\lambda_{K_{\alpha}} = 0.721 \text{ \AA} = 7.21 \times 10^{-11} \text{ m}$. Calculate the angle of reflection, θ , of the lowest-index plane present in the diffractogram. The lattice constant of Ir, a , is 3.84 \AA .
15. Write down the half cell and complete cell reactions for a Daniell cell. Why it is not rechargeable? Why the electrolytes cannot be mixed?
16. Explain the terms 'Liquid Junction Potential' and 'Concentration Cell' with suitable example.
17. (a) Compare the average speed of an oxygen molecule with that of a molecule of carbon tetrachloride at $20 \text{ }^{\circ}\text{C}$. (b) Compare their average kinetic energies.
(Atomic weight of O = 16.0, Cl = 35.5)
18. Calculate the mean free path of molecules in air using collision cross section (σ) = 0.43 nm^2
at 25°C and (a) 10 atm, (b) 1.0 atm, (c) $1.0 \text{ } \mu\text{ atm}$.
19. Distinguish between migration current and diffusion current in Polarography.
20. What is reciprocal lattice? Show that a BCC lattice in real space become FCC in reciprocal space.

21. Define (i) RMS (ii) Average and (iii) Most probable velocities. Give the formula to calculate each of them.

(5 × 5 = 25)

Section C

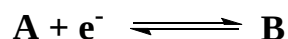
(Answer any 2 questions. Each question carries 15 marks)

22. (a) What are liquid crystals?

(b) Outline the classification of Liquid crystals.

(c) Write a short note on applications of liquid crystals and give few examples of liquid crystals?

23 Deduce the Butler-Volmer equation for the following electrochemical reaction and explain at which condition it can be reduced to Tafel Equation?



24. i) Derive Maxwell's Law of distribution of Velocities.

ii) Explain transport properties of a gas with reference to viscosity and thermal conductivity.

25. Explain the different types of mechanisms involved in energy and electron transfer.

(15 × 2 = 30)
