

Registration Number:

Date & Session



ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU -27

B.Sc.-V SEMESTER

SEMESTER EXAMINATION: OCTOBER 2023

(Examination conducted in November /December 2023)

CH 5223- Physical Chemistry

(For current batch students only)

Time: 2 Hours

Max Marks: 60

This paper contains 3 printed pages and 3 parts.

PART-A

Answer any SEVEN of the following

(7 x 2 =14)

1. Explain asymmetric effect.
2. What is meant by the term 'phase'?
3. The resistance of 0.01 M solution of an electrolyte was found to be 210 ohm at 25°C. Calculate the cell constant, if specific conductance of the solution at 25°C is 0.419 Sm⁻¹.
4. Mention any two differences between thermoplastics and thermosetting plastics.
5. What is meant by single electrode potential?
6. Give one application of radioisotopes, ⁹⁹Tc and ³²P, in the field of medicine and agriculture, respectively.
7. What are conducting polymers? Give two examples.
8. Draw a neat labelled diagram of standard hydrogen electrode.
9. What is liquid junction potential? How do you eliminate it?

PART-B

Answer any SIX of the following.

(6 x 6 =36)

10. a) State Kohlrausch's law of independent migration of ions. Calculate λ_m^0 for CaCl₂, if molar ionic conductance of Ca²⁺ and Cl⁻ are $\lambda_{Ca^{2+}}^0 = 119.0 \times 10^{-4} \text{ Sm}^2\text{mol}^{-1}$ and $\lambda_{Cl^-}^0 = 76.3 \times 10^{-4} \text{ Sm}^2\text{mol}^{-1}$, respectively.
b) Arrange the following alkali metal ions in the increasing order of ionic mobility in water. Explain the order of ionic mobility with proper reasoning.
K⁺, Li⁺, Na⁺ (3+3)
11. a) Draw a neat labelled phase diagram of water, indicating the areas, curves and triple point.
b) Name the four radioactive series. How does the mass number vary across the nuclides in each of these series? (3+3)
12. a) Explain the principle of neutron activation analysis.
b) In an isotope dilution experiment, penicillin was determined by adding 0.981 mg of the ¹⁴C-labeled compound (having a specific activity of 5.42 x 10³ cpm/mg), to the sample. After equilibration, 0.406 mg of pure crystalline penicillin was isolated and this material had a net activity of 343 cpm. Calculate the mass in milligrams of penicillin in the original sample. (3+3)
13. What are fuel cells? Explain the construction and working of hydrogen-oxygen fuel cells.

14. a) Write the monomers used for the synthesis of the polymers given below. Mention any two uses of these polymers.
 i) Dacron ii) Nylon-6,6
- b) A polymer sample contains 1, 2, 3 and 4 molecules having molecular weights 1×10^5 , 2×10^5 , 3×10^5 and 4×10^5 , respectively. Calculate the number average and weight average molecular weight of the polymer. (3+3)
15. Explain the steps involved in the addition polymerization of ethene, with suitable free radical reactions, using benzoyl peroxide as initiator.
16. a) Derive Nernst equation for the following half-cell reaction.

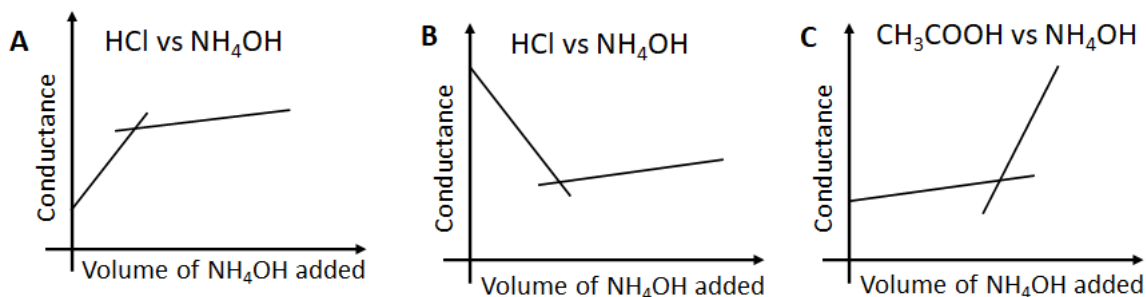
$$M^{n+} + ne^{-} \rightleftharpoons M$$
- b) Consider the cell: $Zn | Zn^{2+} || Ag^{+} | Ag$. [Given $E^{\circ}_{Zn^{2+}/Zn} = -0.76 V$ and $E^{\circ}_{Ag^{+}/Ag} = 0.80 V$]
 i) Write the half-cell reactions.
 ii) Calculate the standard EMF of the cell and predict whether the reaction is spontaneous or not. (3+3)
17. Explain the construction and working of saturated calomel electrode with a neat labelled diagram. Derive an expression to determine the pH of the solution when saturated calomel electrode is combined with standard hydrogen electrode.

PART-C

Answer any TWO of the following.

(2 x 5 = 10)

18. a) Identify, whether the given conductometric titration plots (A, B, C) are correct/incorrect.

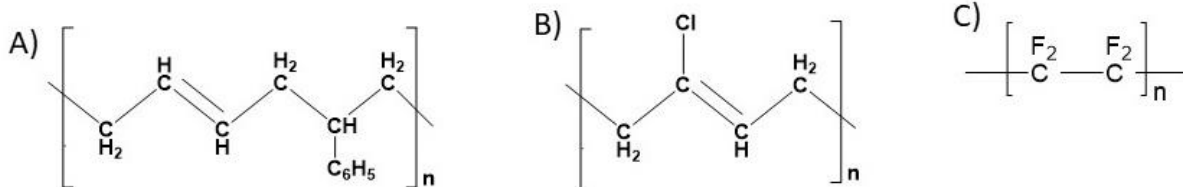


- b) Which among the following have higher molar conductance? Give reason.

- i) 1 mole of KCl dissolved in 500 cm^3 of water.
 ii) 1 mole of KCl dissolved in 200 cm^3 of water.

(3+2)

19. a) Identify the copolymer among the following. Write the structures of its monomer units



- b) Identify X in each of the following nuclear reactions.

- i) ${}^{68}_{30}\text{Zn} + {}^1_0\text{n} \rightarrow {}^{65}_{28}\text{Ni} + X$
 ii) ${}^{130}_{52}\text{Te} + {}^2_1\text{H} \rightarrow {}^{131}_{53}\text{I} + X$

20. The standard reduction potentials of various electrode systems are given in the table. Answer the following questions based on this table.

Electrode	E° (Volts)
Mg^{2+}/Mg	-2.38
Zn^{2+}/Zn	-0.76
Ni^{2+}/Ni	-0.23
H^+/H_2	0.00
Cu^{2+}/Cu	0.34

- i) If Mg and Cu are combined together to form a cell, which metal is likely to undergo corrosion?
- ii) Which electrode can act as the strongest reducing agent?
- iii) Can Ni displace H_2 from dilute acid solution?
- iv) Which two electrodes can be combined to form a cell with $\text{EMF} = 0.57 \text{ V}$?
(1+1+1+2)
