REV-01
MSC/01/05

2025/05

SET A

M.Sc. CHEMISTRY
FOURTH SEMESTER
ADVANCED PHYSICAL CHEMISTRY
MSC - 402C [REPEAT]

[USE OMR FOR OBJECTIVE PART]

Duration: 3 hrs. **Full Marks: 70**

(Objective)

Time: 30 min. **Marks: 20**

Choose the correct answer from the following: ***1×20=20***

1. Which phenomenon is used in magnetic storage devices?
   a. Ferromagnetism
   b. Antiferromagnetism
   c. Paramagnetism
   d. Superconductivity

2. A diamagnetic material has
   a. Positive magnetic susceptibility
   b. Negative magnetic susceptibility
   c. High coercivity
   d. Permanent magnetic moment

3. Which type of magnetic material shows hysteresis?
   a. Paramagnetic
   b. Diamagnetic
   c. Ferromagnetic
   d. Antiferromagnetic

4. Which of the following materials exhibits ferromagnetism at room temperature?
   a. Aluminum
   b. Copper
   c. Iron
   d. Silicon

5. The property of a material that determines its ability to store an electric charge is called
   a. Resistivity
   b. Conductivity
   c. Permittivity
   d. Permeability

6. In polarography, what is the purpose of the dropping mercury electrode (DME)?
   a. To measure voltage
   b. To generate electrical resistance
   c. To maintain a constant potential
   d. To generate a mercury drop for the electrode

7. The current in polarography is measured as a function of what parameter?
   a. Time
   b. Voltage
   c. Temperature
   d. Concentration

8. In polarography, the electroactive species will undergo
   a. Always oxidation
   b. Either oxidation or reduction
   c. Always reduction
   d. Adsorption

9. What is the term for the graphical representation of current versus applied voltage in polarography?
   a. Polarograph
   b. Polarocurve
   c. Polaroplot
   d. Polarogram

10. What is the primary purpose of cyclic voltammetry?
    a. To measure pH
    b. To determine molecular weight
    c. To study redox reactions
    d. To separate compounds

11. With increase in dilution, degree of dissociation for weak electrolyte-
    a. Increases
    b. Decreases
    c. First increases then decreases
    d. None of the above

12. Ag/ AgCl electrode is an example of-
    a. Polarizable electrode
    b. Semi-polarizable electrode
    c. Non-Polarizable electrode
    d. Calomel electrode

13. The glass transition temperature of polymer can be determined by
    a. Differential scanning Calorimetry
    b. Gel Permeation Chromatography
    c. X-ray Diffractometer
    d. Dynamic Mechanical Analysis

14. LOI studies provided a quantitative measure of
    a. Flammability of polymer
    b. Thermal Stability of polymer
    c. Strength properties of polymer
    d. None of the above

15. The study of flow and deformation of polymers with temperature is studied using
    a. Dynamic Mechanical Analyzer
    b. Rheometer
    c. Elemental Analyzer
    d. None of the above

16. As the crystallinity increases the strength, density and flexibility of the polymer
    a. Strength and density increases, flexibility decreases
    b. Strength and density decreases but flexibility increases
    c. Strength, density and flexibility all are increases
    d. All are decreases

17. Migration of charged particles through a solution with the influence of electric field is known as-
    a. Osmosis
    b. Electrolysis
    c. Electrophoresis
    d. Diffusion

18. Dynamical Mechanical analysis is used to study
    a. Crystallinity
    b. Flammability
    c. Viscoelastic behavior of polymers
    d. None of the above

19. Which statement is not true
    a. Polymers are never completely crystalline
    b. Polymers contains crystalline regions with amorphous regions together.
    c. Some polymers may be completely amorphous.
    d. Some polymers are 100% crystalline in nature

20. Which type of polymers cannot be recycled
    a. Thermoplasts
    b. Thermosets
    c. Elastomers
    d. All polymers

-- --- --

Descriptive

Time : 2 hrs. 30 mins. Marks : 50

[Answer question no.1 & any four (4) from the rest]

1. **a.** Write few characteristics of a p-n junction. Explain two application of p-n junction. **3+2+2+3 =10**

   b. Write two differences between indicator electrode and reference electrode used in polarography.

   c. What are the advantages of crosslinking of polymers? Explain.

   d. Why it is very much essential to study the thermal properties of a polymer? Explain the thermal resistance properties with the help of a thermogravimetric curve.

2. **a.** Describe diamagnetic, paramagnetic, ferrimagnetic and ferromagnetic materials and their properties. How do they respond to external magnetic fields? **5+3+2 =10**

   b. What is superconductivity? Discuss its characteristics and applications.

   c. What is piezoelectricity and ferroelectricity? Explain briefly.

3. **a.** What do you mean by phase transition in solids?Explain the different phase transitions shown by $BaTiO_3$. What are the coordination numbers of Ba, Ti and O - atom in $BaTiO_3$? **4+2+2+2 =10**

   b. What are the difference between photoelectric effect and photovoltaic effect?

   c. What do you mean by hysteresis and Luminescence? Explain

   d. What are type I and type II superconductors.

4. **a.** Write the principle of polarography. **2+4+2+2 =10**

   b. What are the different types of polarography? Explain any one type of polarography.

   c. Sketch the schematic representation of a cyclic voltammogram.

   d. What is the role of the deposition step in stripping voltammetry?

5. **a.** What is the role of working, reference, and counter electrodes in polarography? **3+2+3+2 =10**

b. Explain the significance of peak separation (ΔE_p) in determining reversibility in cyclic voltammetry.

c. What are the basic steps involved in an anodic stripping voltammetry experiment?

d. Define the term "residual current" in polarography.What is a polarogram?

6. a. What are the factors which effects the mechanical properties of a polymer? **1.5+1.5+3 +2+2=10**

b. Write the name of different test through which mechanical properties of a polymer can be determined?

c. With the help of stress-strain curve explain the properties of a polymer?

d. What is glass transition temperature of a polymer? Write its importance.

e. Which elements can be determined using elemental analyzer?

7. a. Write the mathematical expression for Debye –HuckelOnsagar equation? How can you verify the Onsagar Equation? **2+2+2+2 +2=10**

b. Write the postulates for Debye-Huckel theory for strong electrolytes?

c. What is Electrophoresis? Write its importance.

d. What is electrical double layer (EDL)?

e. What is perfectly polarizable and perfectly non polarizable electrodes? Give examples.

8. a. What do you understand by rheology of polymer? How can you determine the rheology of polymer? **2+2+2+2 +2=10**

b. Write a short note on photodegradation of polymer.

c. What do you understand by UV stability of a polymer? What are the techniques used to study the UV stability of a polymer?

d. What are crystalline Polymers? How crystallinity effects the properties of a polymer?

e. What are the challenges faced by the single used plastics. Explain. What are steps one can measure to prevent the use of single used plastics.

= = *** = =