2022/07

M.Sc. CHEMISTRY
FOURTH SEMESTER
SOLID STATE & POLYMER CHEMISTRY
MSC - 402C

(Use Separate Answer Scripts for Objective & Descriptive)

Duration: 3 hrs. Full Marks: 70

[PART-A: Objective]

Time: 30 min. Marks: 20

Choose the correct answer from the following: ***1X20=20***

1. Below the critical temperature (T_C) a super conductor behave as a
   a. Diamagnetic b. Paramagnetic
   c. Ferromagnetic d. Ferroelectric
2. Which of the following is antiferromagnetic?
   a. Co b. MnO
   c. Ni d. Gd
3. When heated from room temperature to 100^{0}C the resistance of copper and germanium respectively
   a. Decreases and increases b. Increases for both
   c. Increases and decreases d. Decreases for both
4. Which of the following material is photo sensitive to ultra-violet radiation only?
   a. Sodium b. Rubidium
   c. Caesium d. Zinc
5. Synthetic polyvinyl difluride used to monitor blood pressure and respiration work on the principle of
   a. Piezoelectric effect b. Photoelectricity
   c. Thermoelectricity d. Conversion of solar energy
6. A mixture is formed by 5 mole of A and 6 mole of B. A small change in composition results into chemical potential of A changing by -48 J/mol. How much will be the change in chemical potential of B.
   a. 40 J/mol b. -40 J/mol
   c. 25 J/mol d. -25 J/mol
7. Which of the following is wrong definition of chemical potential?
   a. $(\delta G/\delta nj)$ constant = p, T, n' b. $(\delta U/\delta nj)$ constant = S, T, n'
   c. $(\delta A/\delta nj)$ constant = V, T, n' d. $(\delta H/\delta nj)$ constant = S, p, n'
8. Which of the following is true?
   a. In good solvents coils are relatively extended b. In poor solvents coils are relatively contracted
   c. Both a & b d. None of them
9. Experimental results of which polymer solutions obeys Flory-Huggins theory?
   a. poly(dimethyl siloxane) in benzene b. Ploystyrene in benzene
   c. Polystyrene in toluene d. Rubber in benzene

10. Which step of polymer desolution can be speed up by mechanical agitation?
    a. First b. Second
    c. Third d Fourth

11. The molecular weight of polymer can be determined by
    a. Thermogravimetric Analysis(TGA) b. Gel Permeation Chromatography
    c. Elemental Analyzer d. NMR spectroscopy

12. The surface morphology of polymer can be studied by
    a. Thermogravimetric Analysis b. Gel Permeation Chromatography
    c. Scanning electron microscope d. Universal testing machine

13. 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

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. As the crystallinity increases the strength and flexibility of the polymer
    a. Strength increases, flexibility decreases b. Both are increases
    c. Strength and flexibility both are increases d. Both are decreases

16. The major strengthening due to martensite transformation is caused by _____
    a. Solid solution strengthening b. Lattice distortion
    c. Dislocation hardening d. Precipitation hardening

17. Identify which one is first order phase transition?
    a. A metal to superconductor transition in the absence of a magnetic field
    b. A paramagnetic to ferromagnetic transition in the absence of a magnetic field
    c. A liquid to gas transition close to its triple point
    d. A liquid to gas transition at its critical temperature

18. Across a first order phase transition, the free energy is
    a. Proportional to the temperature
    b. A continuous function of the temperature but its derivatives is discontinuous
    c. Such that the first derivative with respect to temperature is continuous
    d. A discontinuous function of the temperature

19. For a second order phase transition which one is correct?
    a. Entropy changes discontinuously b. Volume changes discontinuously
    c. Gibbs free energy changes discontinuously d. None of the above

20. Polymeric molecules _____ a definite crystalline structure.
    a. Have b. Do not have
    c. Completely having d. Partially having

-- --- --

PART-B: Descriptive

Time : 2 hrs. 40 min. Marks : 50

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

1. a. With the help of stress-strain curve explain the properties of a polymer? **3+3+4 =10**

   b. Explain the temperature dependence of resistivity of a metal.

   c. Explain four different factors that affect on Glass transition temperature.

2. a. Define resistivity and conductivity of a metal. **2+5+3 =10**

   b. Discuss the contribution of phonons and impurity in a metal towards the net resistivity of it.

   c. Discuss three differences between first order and second order phase transition.

3. a. Explain what do you mean by Meissner effect. Mention the difference between type I and type Ii super conductors. **4+3+3 =10**

   b. State Curie law. Explain why a ferromagnetic substance does not behave as a magnet in absence of magnetic field.

   c. What do you mean by the phenomenon of hysterisis? Compare the significance of hysterisis loop of steel with that of soft iron.

4. a. Derive Gibbs-Duhem equation. Describe it's significance. **4+3+3 =10**

   b. What are the three types of deviation of solution from Rault's law. Describe briefly.

   c. Describe effect of Long range interactions on polymer conformations.

5. a. Describe briefly Flory-Huggins theory. What are it's limitations. How Flory-Krigbaum theory improved upon it? **5+2+3 =10**

   b. Describe how crystaline melting point of polymer is related to its solubility.

   c. Discuss freely joint chain model in terms of polymer conformation.

6. a. Why it is very much essential to study the thermal properties of a polymer? **2+3+2+2+1=10**

   b. Explain the thermal resistance properties with the help of a thermogravimetric curve.

   c. How crystallinity changes affect the properties of a polymer? Explain.

   d. How morphology of the polymer can be determined. Explain.

   e. How impact resistance of the polymer can be determined.

7. a. What is chemical resistance test for a polymer? **4+3+3=10**

   b. What do you understand by UV stability of the polymer.

   c. What are the importances of Glass transition temperature?

8. a. What is spinodal decomposition? Explain with suitable diagram. **5+5=10**

   b. Write short note on (i) Martensitic transformation and (ii) order-disorder transition in solid.

= = *** = =