

REV-01
MSC/15/20

2023/06

M.Sc. CHEMISTRY
FOURTH SEMESTER
SOLID STATE & POLYMER CHEMISTRY
MSC – 402C
[USE OMR FOR OBJECTIVE PART]

**SET
A**

Duration: 3 hrs.

Full Marks: 70

Time: 30 min.

(Objective)

Marks: 20

Choose the correct answer from the following:

1X20=20

- What is the definition of a lower critical solution temperature?
 - The minimum temperature at which equilibrium is achieved
 - The lowest temperature at which two components will attain vapor state
 - The lowest temperature at which two components sublimate
 - None of these
- Introducing stiffening group in the polymer chain ____ glass transition temperature, T_g
 - Increases
 - Decreases
 - Not effected
 - None of these
- Phase transitions in solids are associated with which of the following change?
 - Structure only
 - Composition only
 - Both (a) and (b)
 - No Change
- Displacive phase transition in solids is associated with
 - Bond breaking
 - Distortion of bonds
 - New Bond formation
 - No change in structure
- Martensite is _____
 - Diffusion transformation
 - Diffusion less transformation
 - No transformation
 - None of these
- Identify which one is first order phase transition?
 - A metal to superconductor transition in the absence of a magnetic field
 - A paramagnetic to ferromagnetic transition in the absence of a magnetic field
 - A liquid to gas transition close to its triple point
 - None of these
- Second-order phase transitions are characterized by discontinuities in
 - First derivatives of the free energy with respect to temperature
 - Both (a) and (b)
 - First derivatives of the free energy with respect to pressure
 - Second derivatives of the free energy

8. Which of the following materials exhibits ferromagnetism at room temperature?
- | | |
|-------------|------------|
| a. Aluminum | b. Copper |
| c. Iron | d. Silicon |
9. The phenomenon in which a material becomes magnetic when an external magnetic field is applied and loses its magnetism when the field is removed is called
- | | |
|-------------------|-----------------------|
| a. Diamagnetism | b. Paramagnetism |
| c. Ferromagnetism | d. Antiferromagnetism |
10. Superconductors are characterized by
- | | |
|-----------------------------------|-------------------------------|
| a. Zero electrical resistance | b. High electrical resistance |
| c. Strong paramagnetic properties | d. Low thermal conductivity |
11. Which of the following is not a property of a diamagnetic material
- | | |
|---|--|
| a. It gets weakly magnetized in the direction opposite to an applied magnetic field | b. It does not retain magnetism when the external field is removed |
| c. It exhibits a repulsive effect when placed in a magnetic field | d. It shows strong attraction to magnets |
12. The property of a material that determines its ability to store an electric charge is called
- | | |
|-----------------|-----------------|
| a. Resistivity | b. Conductivity |
| c. Permittivity | d. Permeability |
13. Excitation of electrons by electric current in p-n junctions is called
- | | |
|----------------------|------------------------|
| a. Luminescence | b. Electroluminescence |
| c. Photoluminescence | d. Cathodoluminescence |
14. Polarized Optical Microscopy is used to characterize
- | | |
|---|---|
| a. To determine the crystallinity of polymer | b. To study the surface morphology of polymer |
| c. To study the rheological properties of polymer | d. To determine the Limiting Oxygen Index value |
15. Bakelite is an example of
- | | |
|---|---|
| a. Thermosetting plastic which is prepared from styrene and butadiene. | b. Thermoplastic which is prepared from phenol and formaldehyde |
| c. Thermosetting plastic which is prepared from phenol and formaldehyde | d. Thermoplastic which is prepared from styrene and butadiene |
16. 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 |

17. In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

Assertion: Network polymers are thermosetting.

Reason: Network polymers have high molecular mass.

- a. Assertion and reason both are correct statement but reason does not explain assertion. b. Assertion and reason both are correct statements and reason explains the assertion.
- c. Both assertion and reason are wrong statement d. Assertion is correct statement and reason is wrong statement.
18. Which of the following statements is not true about low density polythene?
- a. Hard b. Poor conductor of electricity
- c. Highly branched structure d. None of the above
19. Which of the following are characteristics of thermosetting polymers?
- (i) Heavily branched cross linked polymers.
- (ii) Linear slightly branched long chain molecules.
- (iii) Become infusible on moulding so cannot be reused.
- (iv) Soften on heating and harden on cooling, can be reused.
- a. (i) and (ii) are correct option b. (i) and (iii) are correct option
- c. (ii) and (iii) are correct option d. All are correct
20. Match the polymer of column I with correct monomer of column II.

Column I	Column II
(i) High density polythene	(a) Isoprene
(ii) Neoprene	(b) Tetrafluoroethene
(iii) Natural rubber	(c) Chloroprene
(iv) Teflon	(d) Acrylonitrile
(v) Acrilan	(e) Ethene

- a. (i)- (e)
 (ii)- (a)
 (iii)- (c)
 (iv)- (d)
 (v) - (b)
- b. (i)- (e)
 (ii)- (c)
 (iii)- (a)
 (iv)- (b)
 (v) - (d)
- c. (i)- (e)
 (ii)- (d)
 (iii)- (a)
 (iv)- (b)
 (v) - (c)
- d. (i)- (d)
 (ii)- (c)
 (iii)- (b)
 (iv)- (a)
 (v) - (e)

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(Descriptive)

Time : 2 hrs. 30 mins.

Marks : 50

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

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|----|--|--------------|
| 1. | a. What is plasticizer? What do you mean by degree of crystallinity?
b. Explain how a p-n junction can form with diagram showing all the regions?
c. With the help of stress-strain curve explain the properties of a polymer? | 3+3+4
=10 |
| 2. | a. What is martensitic transformation? Explain using suitable diagram to depict the transformation.
b. What do you mean by spinodal decomposition? Explain using a phase diagram.
c. Explain three different factors that effects on glass transition temperature. | 4+3+3=
10 |
| 3. | a. What do you mean by lower and upper critical solution temperature? Explain with a phase diagram of polystyrene in toluene.
b. Discuss the variation of specific volume with temperature for semicrystalline polymer with proper graph.
c. Write three differences between first order and second order phase transitions. | 4+3+3=
10 |
| 4. | a. What do you mean by phase transition in solids? What is the Buerger's classification of phase transitions? Briefly explain with suitable example of each.
b. What is superconductivity? Discuss its characteristics and applications.
c. What is piezoelectricity and ferroelectricity? Explain briefly. | 4+3+3=
10 |

5. a. Describe diamagnetic, paramagnetic, ferrimagnetic and ferromagnetic materials and their properties. How do they respond to external magnetic fields? 5+3+2=
10
- b. Describe the phenomenon of Anti-ferromagnetism. Discuss the key properties of Anti-ferromagnetic materials by drawing a graph.
- c. What do you mean by hysteresis? Explain?
6. a. What are the difference between photoelectric effect and photovoltaic effect? 2+4+1+
3=10
- b. Explain the different phase transitions shown by BaTiO₃. What are the coordination numbers of Ba, Ti and O - atom in BaTiO₃?
- c. What do you mean by Luminescence?
- d. Describe briefly Flory-Huggins theory. What are its limitations?
7. a. Write the importance of cross-linking of polymers? 2+2+2+
2+2=10
- b. Explain the thermal resistance properties with the help of a thermogravimetric curve.
- c. How surface morphology of the polymer can be determined. Explain.
- d. What do you understand by biodegradation of polymers? Give some examples of biodegradable polymers.
- e. How crystallinity changes affect the properties of a polymer? Explain.
8. a. What do you understand by UV stability of polymer? Explain the methodologies to determine the UV stability of a polymer? 3+2+3+
2=10
- b. Explain the procedure to determine the chemical resistance properties of a polymer?
- c. What is photodegradation and Ultrasonic degradation of polymers? Explain.
- d. Write the applications of HDPE, LDPE, PV and Bakelite.

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