

M.Sc. CHEMISTRY
FOURTH SEMESTER
PHYSICAL CHEMISTRY-V
(SOLID STATE & POLYMER CHEMISTRY)
MSC-403 C

(Use separate answer scripts for Objective & Descriptive)

Duration: 3 hrs.

Full Marks: 70

(**PART-A: Objective**)

Time: 20 min.

Marks: 20

Choose the correct answer from the following:

1x20=20

1. Which of the following is/are the property/properties of superconductors?
 - a. Diamagnetic in nature
 - b. Zero resistivity
 - c. Infinite conductivity
 - d. All of these
2. Basic source of magnetism:
 - a. Charged particles alone
 - b. Movement of charged particles
 - c. Magnetic dipoles
 - d. Magnetic domains
3. The electrons in a cooper pair behaves as a:
 - a. Phonons
 - b. Bosons
 - c. Fermions
 - d. All of these
4. A material which is slightly repelled by a magnetic field is:
 - a. Ferromagnetic material
 - b. Diamagnetic material
 - c. Paramagnetic material
 - d. Conducting material
5. Fermi energy level for p-type extrinsic semiconductors lies:
 - a. At middle of the band gap
 - b. Close to conduction band
 - c. Close to valence band
 - d. None
6. The zone in a semiconductor-semiconductor junction where free charge carrier exists is:
 - a. Anode region
 - b. Cathode region
 - c. Depletion region
 - d. Inversion region
7. Magnetic permeability greater than unity for which one of the following material?
 - a. Diamagnetic
 - b. Paramagnetic
 - c. Antiferromagnetic
 - d. Both (b) & (c)
8. Diffusion less phase transformations in solids are referred to as:
 - a. Spinodal decomposition
 - b. Martensitic transformations
 - c. 1st order nucleation
 - d. None of the above
9. In a p type semiconductor, the Fermi level:
 - a. Lies at the center of forbidden energy gap.
 - b. Is near the conduction band.
 - c. Is near the valence band.
 - d. May be anywhere in the forbidden energy gap.
10. Percentage of free space in a bcc unit cell is:
 - a. 32 %
 - b. 34 %
 - c. 28 %
 - d. 20 %

11. Which of the following is true for T_g and T_m relationship?
 a. $1/2 < T_m / T_g < 2/3$ b. $1/2 > T_m / T_g > 2/3$
 c. $1/2 < T_g / T_m < 2/3$ d. $1/2 > T_g / T_m > 2/3$
12. According to Newton's model which one of the following is not correct?
 a. Stress is independent of strain b. Stress is time independent
 c. Stress is time dependent d. Stress is proportional to rate of strain
13. Rubbery state of a polymer is:
 a. Below T_f b. Above T_g
 c. In between T_g and T_f d. All of these
14. The excluded volume of a polymer chain is _____ times greater than that of a single monomer sphere.
 a. 4 b. 8 c. 16 d. 32
15. Destruction of waste polymer by burning is known as:
 a. Recycling b. Incineration
 c. Bio-degradation d. None of the above
16. Deformation behavior of a polymer is generalized by:
 a. Newton Model b. Voigt Model
 c. Maxwell Model d. Burger Model
17. Amorphous polymer has/have:
 a. Only T_g b. Only T_m
 c. Only T_f d. Both T_g and T_f
18. Chemical potential is:
 a. Change in free energy with one mole of a substance at constant T & P.
 b. Change in enthalpy with one mole of a substance at constant T & P.
 c. Change in entropy with one mole of a substance at constant T & P.
 d. Change in volume with one mole of a substance at constant T & P.
19. The point beyond lower yield stress point in stress-strain curve is known as:
 a. Proportional limit b. Elastic limit
 c. Ultimate stress point d. Breaking point
20. Which of the following polymer has the highest T_g value?
 a. Polyethylene b. Methylpolyacrylates
 c. Ethylpolyacrylates d. Butylpolyacrylates

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(**PART-B :Descriptive**)

Time: 2 hrs. 40min.

Marks: 50

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

1. a. Sketch stress-strain curve for elastomeric compound and discuss it. 5+5=10
 b. What are Cooper pairs? Discuss the mechanism of superconductivity.
2. a. What is meant by the term density of states? Derive an expression for the density of states for electrons in metals. 5+5=10
 b. What are intrinsic semiconductors? Derive an expression for electrical conductivity of intrinsic semiconductors.
3. What do you mean by glass transition temperature? Discuss the different factors influencing glass transition temperature. 2+8=10
4. a. Explain the phenomenon of hysteresis in ferromagnets. 5+5=10
 b. Explain Type I and Type II superconductors with examples.
5. a. Explain how the Internal Brownian Movement and External Brownian Movement affects the behavior of polymer a molecule. 5+5=10
 b. What do you mean by chemical potential of a polymer molecule? Derive an expression for Gibbs-Duhem equation.
6. a. What do you mean by rheology of plastic? Write the mechanism of plastic deformation for both relaxation and retardation process. 6+4=10
 b. Discuss how Hooks' method and Newtons' method for plastic deformation differ from one another.
7. a. What is polymer degradation? Explain oxidative degradation with mechanism of rubber oxidation. 6+4=10
 b. Explain in brief different types of phase transitions in solids.
8. a. With the help of a suitable diagram, explain the formation of depletion region in a p-n junction. How does its width change when the junction is
 i. forward bias
 ii. reversed bias 6+4=10
 b. What is photoconductivity? Explain the mechanism of photoconduction in semiconductor.

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