**22U611** (Pages: 2) Name : .....

Reg. No : .....

**SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2025**

(CBCSS-UG)

(Regular/Supplementary/Improvement)

**CC19U PHY6 B14 / CC20U PHY6 B14 - MATERIALS SCIENCE**

(Physics - Elective Course)

(2019 Admission onwards)

Time: 2 Hours Maximum: 60 Marks

Credit: 3

**Part A** (Short answer questions)

Answer ***all*** questions. Each question carries 2 marks.

1. What is material science? Explain.
2. What is bonding energy?
3. Explain the terms grain and grain boundary.
4. What is screw dislocation?
5. What are the factors that influence the diffusion mechanism?
6. What is meant by abrasives?
7. What is the use of ceramics in modern communication systems?
8. What are the different polymorphic forms of carbon?
9. What are the stress-strain behaviour of polymers?
10. Write a short note on X-ray diffraction technique.
11. Explain the use of optical microscope.
12. Point out the features that differentiate the scanning probe microscopy from other microscopic techniques.

**(Ceiling: 20 Marks)**

**Part B** (Short essay questions - Paragraph)

Answer ***all*** questions. Each question carries 5 marks.

13. Explain why hydrogen fluoride (HF) has a higher boiling temperature than hydrogen chloride (HCl).
14. Iron has a BCC crystal structure, an atomic radius of 0.124 nm, and an atomic weight of 55.85 g/mol. Calculate theoretical density.

15. Calculate the activation energy for vacancy formation in aluminum, given that the equilibrium number of vacancies at 500 $^0$C (773 K) is 7.57 *$10^{23}$ $m^3$ .The atomic weight and density (at 500 $^0$ C) for aluminum are, respectively, 26.98 g/mol and 2.62 g/$cm^3$.

16. A plate of iron is exposed to a carburizing (carbon-rich) atmosphere on one side and a decarburizing (carbon-deficient) atmosphere on the other side at 700 $^0$C (1300 $^0$F). If a condition of steady state is achieved, calculate the diffusion flux of carbon through the plate if the concentrations of carbon at positions of 5 and 10 mm beneath the carburizing surface are 1.2 and 0.8 kg/$m^3$ , respectively. Assume a diffusion coefficient of 3* $10^{-11}$ $m^2$ /s at this temperature

17. (a) Compute the repeat unit molecular weight of polystyrene.
    (b) Compute the number-average molecular weight for a polystyrene for which the degree of polymerization is 25,000.

18. Sketch cis and trans structures for (a) butadiene, and (b) isoprene

19. Explain the rotating crystal method

**(Ceiling: 30 Marks)**

**Part C** (Essay questions)

Answer any ***one*** question. The question carries 10 marks.

20. In detail explain different crystal structures.

21. Bring out Fick's laws and explain the various applications.

**(1 × 10 = 10 Marks)**

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