Name **ID No.**

A

Birla Institute of Technology and Science Pilani (Rajasthan)
CHEM F333: Chemistry of Materials

Comprehensive Exam	**Part I (Closed Book)**	**I Semester 2022-2023**
Max. Marks: 10	**Time: 45 minutes**	**Date: 27.12.2022**

Note: There are **ten** questions in all. Write the most appropriate answers in the boxes. Each correct answer will be awarded **1** mark and **0.25** mark will be deducted for each incorrect answer.

Q 1. The rate of a reaction that obeys Avrami kinetics (Given: n = 3.0, k = 5×10^{-3}) is
(A) 0.193 s (B) 1.93 s (C) 19.3 s (D) 193 s

Q. 2 The number of atoms in the critical nucleus when an FCC metal solidifies with homogeneous nucleation. (Given: melting temperature = 1085 °C**,** latent heat of fusion = 1628 *J*/cm^3, surface free energy = -177 $\times10^{-7}$ *J*/cm^2, degree of supercooling = 235 °C, lattice parameter = 0.3615 nm.)
(A) 174 (B) 348 (C) 522 (D) 696

Q. 3 A cylindrical specimen of an alloy with elastic modulus of 105 GPa and an original diameter of 4.0 mm experiences only elastic deformation when a tensile load of 2500 N is applied. The maximum length of the specimen before deformation if the maximum allowable elongation is 0.40 mm is
(A) 106 mm (B) 211 mm (C) 250 mm (D) 270 mm

Q 4. Brinell hardness measurement is made on an alloy using a 10 mm diameter sphere of tungsten carbide. A load of 3000 kg produces a 3.91 mm diameter impression on the iron surface, the HB is
(A) 77 (B) 120 (C) 240 (D) 480

Q 5. High density polyethylene may be chlorinated by inducing the random substitution of chlorine atoms for hydrogen. The concentration of Cl (in wt%) that must be added if this substitution occurs for 7% of all the original hydrogen atoms is (At. wt. in g/mol: H = 1.008, C = 12.01, Cl = 35.45)
(A) 10.16% (B) 13.16% (C) 20.33% (D) 26.33%

Q 6. From the data given below, state which metal oxide is protective in nature?

Metal	Atomic weight of metal (g/mol)	Metal density (g/cm^3)	Metal oxide	Metal oxide density (g/cm^3)
Na	22.99	0.967	Na_2O	2.27
Nb	92.91	8.57	Nb_2O_3	4.47
Ti	47.87	4.507	TiO_2	5.10
W	183.84	19.254	WO_3	7.30

(A) Na_2O (B) Nb_2O_3 (C) TiO_2 (D) WO_3

Q 7. The number average molecular weight of a polypropylene is 1,500,000 g/mol, the degree of polymerization is
(A) 3564.6 (B) 35646 (C) 356460 (D) 3564600

Q 8. A thick steel sheet of area 420 cm^2 on corrosion experiences a weight loss of 350 g in one year, to what rate of corrosion does this correspond? Density of steel is 7.9 g/cm^3.
(A) 41.48 mpy (B) 46.7 mpy (C) 4.1 mm/yr (D) 4.6 mm/yr

Q 9. The magnetization within a bar of some metal alloy is 2.4×10^5 A/m at an H field of 40 A/m, the magnetic flux density (tesla) within this material is ($\mu_0 = 1.257 \times 10^{-6}$ H/m)
(A) 0.10 (B) 0.20 (C) 0.30 (D) 0.40

Q 10. The time required by an electron to traverse a 20 mm length of a germanium crystal at room temperature if the magnitude of the electric field is 2000 V/m is (μ_e = 0.38 m^2/V s)
(A) 1.31×10^{-5} s (B) 2.63×10^{-5} s (C) 3.94×10^{-5} s (D) 5.26×10^{-5} s

Answers

1	2	3	4	5	6	7	8	9	10

****