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H-6346

M.Sc. (Semester-IV) Examination, July, 2022

CHEMISTRY

(Material Science)

Time Allowed : Three Hours

Maximum Marks : 70

Minimum Passing Marks : 25

Note : Question paper is divided into **four** sections. Attempt questions of all four sections as per direction. Distribution of marks is given in each section.

SECTION-A

(Objective Type Questions)

Note : Attempt **any ten** questions. Each question carries **1** mark. [1x10=10]

1. Choose the correct option :

(i) A crystal having lattice parameters $a = b \neq c$, $\alpha = \beta = \gamma = 90^{\circ}$ belongs to the crystal system :

(a) Monoclinic

(b) Orthorhombic

(c) Rhombohedral

(d) Tetragonal

(ii) In the CsCl structure, the number of ions in a unit cell is :

(a) 2

(b) 4

(c) 6

(d) 8

(iii) The arrangement of sulphur in zinc blende and wurtzite structures, respectively, are :

(a) Hexagonal close packing and cubic close packing

(b) Cubic close packing and hexagonal close packing

(c) Simple cubic packing in both the structure

(d) None of the above

(iv) The electrical conductivity of a metal :

(a) increases with increasing temperature

(b) decreases with increasing temperature

(c) is independent of temperature

(d) shows oscillatory behaviour with temperature

(v) The defect that results when electrons are trapped in an ionic crystal lattice in place of an anion vacancy is known as :

(a) Frenkel defect

(b) Schottky defect

(c) F-center

(d) Dislocations

(vi) The electrical conductivity of a crystalline solid increases with temperature. The solid is a :

(a) Superconductor

(b) Metal

(c) Semiconductor

(d) Semimetal

(vii) On doping Ge metal with a little of In or Ga, one gets :

(a) p-type semiconductor

(b) n-type semiconductor

(c) insulator

(d) rectifier

(viii) In graphite electrons are :

(a) localised on each carbon atom

(b) spread out between the sheets

(c) localised on every third carbon atom

(d) present in antibonding orbital

(ix) Anisotropic substances have different properties in different _____ .

(x) The number of carbon atoms per unit cell of diamond unit cell is _____.

(xi) Which of the following anions is present in the chain structure of silicates?

(a) $(Si_2O_5^{2-})_n$

(b) $(SiO_3^{2-})_n$

(c) SiO_4^{4-}

(d) $Si_2O_7^{6-}$

(xii) In normal spinel, metal in +2 oxidation state occupies _____ void.

SECTION-B

(Very Short Answer Type Questions)

Note : Attempt **any five** questions. Each question carries **2** marks. (Maximum word limit **25-30** words) [5x2=10]

2. (i) What is the structure of rock salt?

(ii) What do you mean by crystal lattice?

(iii) Define the law of constancy of Interfacial Angles.

(iv) What is F-centre?

(v) What are excitons and polarons?

(vi) What is binary smart metal?

(vii) What do you mean by thermotropic liquid crystal?

SECTION-C

(Short Answer Type Questions)

Note : Attempt **any five** questions. Each question carries **4** marks. (Maximum word limit **250** words) [5x4=20]

3. (i) Explain the structure of fluorite, antifluorite and zinc blende.

(ii) Describe Free electron theory.

(iii) Describe the principle and application of superconductors.

(iv) Explain the ionic conductors of alumina and copper ion.

(v) What are spinels? Describe the structure of normal and inverse spinel.

(vi) Write the preparation and application of polyacetylenes and polyvinylidenes.

(vii) Describe the characteristic and electrical properties of charge transfer complexes.

SECTION-D

(Essay Type Questions)

Note : Attempt **any three** questions. Each question carries **10** marks. (more than **500** words) [3x10=30]

4. (i) What is Bragg's equation? Describe principle, instrumentation and application of X-ray diffraction technique for structure determination of solid.

(ii) What is Crystal defect? Explain types of crystal defect and its effect on electrical, optical, magnetic, thermal and mechanical properties of crystal.

(iii) Write short notes on the following :

(a) Photoconducting material alongwith its principle, example and applications.

(b) Thermotropic and lyotropic liquid crystals.

(iv) Write short notes on the following :

(a) Carbon Nano particles

(b) Models of Ionic motion - simple hopping motion and cooperative motion models.

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