Section A

1. How much is the contribution in a unit cell of a particle at the corner of a simple cube?
(a) 1 (b) 1/2
(c) 1/4 (d) 1/8

2. An atom at the face centre of a face-centered cubic cell is shared by
(a) 4 unit cells (b) 2 unit cells
(c) 1 unit cell (d) 6 unit cells

3. In a body-centered cubic cell, an atom at the body centre is shared by
(a) 1 unit cell (b) 2 unit cells
(c) 3 unit cells (d) 4 unit cells

4. Which of the following cubic lattices has the maximum number of atoms per unit cell?
(a) simple cubic (b) body-centered cubic
(c) face-centered cubic (d) all have the same number of atoms

5. How many atoms are provided by the edge atom of a cube to the unit cell?
(a) 1/2 (b) 1/4
(c) 1/8 (d) 1

6. In a bcc unit cell, a metal atom at the centre of the cell is surrounded by how many other metal atoms?
(a) 8 (b) 6
(c) 12 (d) 4

7. How many number of atoms are there in a cubic unit cell having one atom on each corner and two atoms on each body diagonal of the cube?
(a) 8 (b) 6
(c) 4 (d) 9

8. The coordination number in a hexagonal closed packed structure (hcp) is
(a) 12 (b) 10
(c) 8 (d) 6

9. The ABAB.... packing and ABC ABC.... packing are respectively called
(a) hexagonal close packing (hcp) and cubic close packing (ccp)
(b) ccp and hcp
(c) body-centered cubic close packing (bcc) and hexagonal close packing (hcp)
(d) hcp and bcc

10. Which of the following statements is not correct?
(a) the coordination number of each ion in CsCl crystal is 8
(b) a metal in bcc structure has a coordination number equal to 12
(c) a unit cell of an ionic crystal shares some of its ions with other unit cell
(d) the length of the unit cell in NaCl is 552 pm ($r_{Na^+} = 95\,\text{pm}$; $r_{Cl^-} = 181\,\text{pm}$)

11. Lithium selenide can be described as a closest packed array of selenide with lithium ions in all the tetrahedral holes. The formula of lithium selenide is
(a) Li_2Se (b) $LiSe$
(c) $LiSe_2$ (d) Li_3Se

12. The mass of a unit cell of NaCl corresponds to
(a) 1 Na^+ and 6Cl^- (b) 1 Cl^- and 6 Na^+
(c) 1 Na^+ and 1 Cl^- (d) 4 Cl^- and 4 Na^+

13. 6 : 6 of NaCl coordination changes to 8 : 8 coordination on
(a) applying high pressure
(b) increasing temperature
(c) both
(d) no effect of changing pressure and temperature on coordination

14. The density of a crystal is

(a) $\frac{a^3 \times No}{Z \times M}$ (b) $\frac{Z \times M}{a^3 \times No}$

(c) $\frac{Z \times M}{a^3}$ (d) $\frac{M}{a^3 No}$

15. A metallic element crystallises into a lattice containing a sequence of layers of AB ABAB.... Any packing of spheres leaves out voids in the lattice. The empty space in percentage by volume in this lattice is
(a) 26 % (b) 32 %
(c) 20 % (d) 30 %

16. The point defect which lowers the density of a material is
(a) Schottky (b) Frenkel
(c) both (d) none of the above

17. LiBr, NaBr, KBr, and RbBr have the same crystal structure (cubic). Which of the following is a simple cubic, whereas all others are fcc?

(a) Li Br (b) Na Br

(c) KBr (d) Rb Br

18. Cs Cl has a body-centered cubic lattice. How many Cs^+ and Cl^- are there in the unit cell?

(a) 2 Cs^+ ions and 2Cl^- ions (b) 1 Cs^+ and 8 Cl^- ions

(c) 1 Cs^+ and 1 Cl^- ion (d) 1 Cl^- and 8 Cs^+ ions

19. Noble gases crystallise in

(a) bcc (b) ccp

(c) hcp (d) none of the above

20. The fraction of total volume occupied by atoms in a simple cube is

(a) $\pi/6$ (b) $\sqrt{3}\pi/8$

(c) $\sqrt{2}\pi/6$ (d) $\pi/3$

Section B

1. How many spheres surround an octahedral void?

(a) 6 (b) 4

(c) 8 (d) 12

2. How many Cl^- ions are there around the Na^+ ion in an NaCl crystal?

(a) 3 (b) 4

(c) 6 (d) 8

3. A pure crystalline substance on being heated gradually first forms a turbid liquid at a constant temperature, and later at a higher temperature the turbidity disappears. This is the characteristic of

(a) allotropic crystals (b) liquid crystals

(c) isomeric crystals (d) isomorphous crystals

4. When electrons are trapped into the crystal in anion vacancy, the defect is known as

(a) Schottky defect (b) Frenkel defect

(c) Stoichiometric defect (d) F-centres

5. A solid has a structure in which W atoms are located at the corners of a cubic lattice, *O* atoms at the centre of edges and Na atom at the centre of the cube. The formula of the compound is

(a) Na WO_2 (b) Na WO_3

(c) Na_2 WO_3 (d) Na WO_4

6. Potassium crystallises with a

(a) face-centered cubic lattice
(b) body-centered cubic lattice
(c) simple cubic lattice
(d) orthorhombic lattice

7. A compound formed by elements '*A*' and '*B*' crystallises in the cubic structure where '*A*' atoms are at the corners of the cube and '*B*' atoms are at the face centres. The formula of the compound is

(a) AB_3
(b) AB
(c) A_3B
(d) A_2B_2

8. The second-order Bragg diffraction of X-rays with $\lambda = 1.00$ A° from a set of parallel planes in a metal occurs at an angle of 60°. The distance between the scattering planes in the crystal is

(a) 0.575 A°
(b) 1.00 A°
(c) 2.00 A°
(d) 1.15 A°

9. Potassium has a bcc structure with the nearest neighbour distance of 4.52 A°. Its atomic weight is 39. Its density will be

(a) 910 kg m^{-3}
(b) 804 kg m^{-3}
(c) 852 kg m^{-3}
(d) 968 kg m^{-3}

10. Which of the following expressions is correct in case of a CsCl unit cell (edge length = *a*)?

(a) $r_{Cs^+} + r_{Cl^-} = a$
(b) $r_{Cs^+} + r_{Cl^-} = \frac{a}{\sqrt{2}}$
(c) $r_{Cs^+} + r_{Cl^-} = \frac{\sqrt{3}a}{2}$
(d) $r_{Cs^+} + r_{Cl^-} = \frac{a}{2}$

Answer Key

Section A

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	D	B	A	C	B	A	D	A	A	B
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	A	D	A	B	A	A	D	C	B	A

Section B

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	A	C	B	D	B	B	A	D	A	C