Q1 - 28 July - Shift 1

An element M crystallises in a body centred cubic unit cell with a cell edge of 300 pm. The density of the element is 6.0 g cm^{-3}. The number of atoms present in 180 g of the element is _____ $\times 10^{23}$. (Nearest integer)

Space for your notes:

Q2 - 28 July - Shift 2

Metal M crystallizes into a FCC lattice with the edge length of 4.0×10^{-8} cm. The atomic mass of the metal is _____ g/mol. (Nearest integer).
(Use : $N_A = 6.02\times10^{23}$ mol^{-1}, density of metal, M = 9.03 g cm^{-3})

Space for your notes:

Q3 - 29 July - Shift 1

Ionic radii of cation A^+ and anion B^- are 102 and 181 pm respectively. These ions are allowed to crystallize into an ionic solid. This crystal has cubic close packing for B^-. A^+ is present in all octahedral voids. The edge length of the unit cell of the crystal AB is _____ pm. (Nearest Integer)

Space for your notes:

Answer Key

Q1 (22) **Q2** (87) **Q3** (566)

Q1 (22)

M is body certred cubic , $\therefore\ Z = 2$

Let mass of 1 atom of M is A

Edge length = 300 pm

Density = 6g/cm^3

$$\therefore\ 6\text{g/cm}^3 = \frac{Z \times A}{\left(300 \times 10^{-10}\right)^3} = \frac{2 \times A}{27 \times 10^{-24}}$$

$$A = 81 \times 10^{-24}\text{g}$$

$\therefore$ Atomic mass = 48.6g

$$\therefore\ \text{Mole in 180g} = \frac{180}{48.6} = 3.7\ \text{moles}$$

$$\text{Atoms of M} = 3.7 \times 6 \times 10^{23}$$

$$= 22.22 \times 10^{23}\ \text{atoms}$$

Q2 (87)

$a = 4 \times 10^{-8}$ cm

$\mathbf{d = 9.03\text{g/ml}}$

$$d = \frac{ZM}{N_A a^3}$$

$$M = \frac{9.03 \times 6.02 \times 10^{23} \times 64 \times 10^{-24}}{4} = 86.97$$

Q3 (566)

$$a = 2(r_+ + r_-)$$

$$a = 2\,(102 + 181)$$

$$a = 2(283)$$

$$a = 566 \text{ pm}$$