<u>**XII**</u>
<u>**Chemistry**</u>
<u>**Ch. 1: The Solid state**</u>
<u>**Important formulae & Concepts**</u>

1. Number of atoms in different unit cells:
   a. Primitive unit cell: 1 atom
   b. Face centred unit cell: 4 atoms
   c. Body centred unit cell: 2 atoms

2. Let the number of close packed spheres = N
   Number of octahedral voids generated = N
   Number of tetrahedral voids generated = 2N

3. Packing efficiency is the percentage of total space occupied by constituent particles (atoms, molecules or ions).

$$\text{Packing efficiency} = \frac{\text{Volume occupied by spheres in the unit cell}}{\text{Total volume of unit cell}} \times 100\%$$

   a. Packing efficiency for face centred cubic unit cell $= 74\%$
   b. Packing efficiency for body centred cubic unit cell $= 68\%$
   c. Packing efficiency for simple cubic unit cell $= 52.4\%$

4. Relationship between radius of constituent particle (r) and edge length(a):
   a. Simple cubic unit cell: a= 2r
   b. Face centred unit cell: $a = 2\sqrt{2}\,r$
   c. Body centred unit cell: $a = \dfrac{4r}{\sqrt{3}}$

5. Volume of a unit cell = (edge length)^3 = a^3
   a. Simple cubic unit cell: Volume= (2r)^3
   b. Face centred unit cell: Volume $= (2\sqrt{2}\,r)^3$
   c. Body centred unit cell: Volume $= (\dfrac{4r}{\sqrt{3}})^3$

6. Number of atoms in a unit cell (z):
   a. Simple cubic unit cell: z = 1
   b. Face centred unit cell: z = 4
   c. Body centred unit cell: z = 2

7. Density of unit cell:

$$\text{Density of unit cell} = \frac{zM}{a^3 \cdot N_A}$$