Density of unit cell

i) Consider a cubic unit cell of edge length 'a' and let d be the density of the solid substance and M the molar mass.

ii) In case of cubic unit cell, volume of unit cell = a^3

iii) Mass of unit cell = number of atoms in the unit cell (z) × mass of (atom (m)

$= z \times m$

iv) Mass of an atom present in the unit cell (m)

$m = \frac{M}{N_A}$ (N_A = Avogadro number)

v) Density of unit cell (d)

$$d = \frac{\text{Mass of unit cell}}{\text{Volume of unit cell}} = \frac{z \times m}{a^3} = \frac{z \times M}{N_A a^3}$$

vi) The density of the unit cell is the same as the density of the substance. The density of the solid substance can always be determined by other methods. Out of the five parameters (z, d, M, a, N_A), if any four are known we can determine the fifth.