

## The Plasma frequency of Caesium

Caesium is a body centred cubic metal.

Each atom donates one electron to the conduction band.

The cube spacing of caesium is  $6.05 \times 10^{-10}$  m.

From this information determine the plasma wavelength of caesium.

### Solution:

Bcc, therefore 2 atoms per unit cell.

Each atom contributes one electron to the conduction band.

Therefore the electron density  $N$  is given as:

$$N = 2 / (6.05 \times 10^{-10})^3 = 9.031 \times 10^{27} \text{ m}^{-3}$$

Therefore the plasma frequency  $\omega_p$  is given by:

$$\begin{aligned} \omega_p &= (Ne^2/m\epsilon_0)^{1/2} \\ &= [9.031 \times 10^{27} \times (1.6 \times 10^{-19})^2] / [9.1 \times 10^{-31} \times 8.8 \times 10^{-12}] \text{ s}^{-1} \end{aligned}$$

$$\omega_p = 5.37 \times 10^{15} \text{ s}^{-1}$$

$$\lambda = 2\pi c / \omega_p = 351 \text{ nm}$$