Marks 4

- Moseley discovered experimentally in 1913 that the atomic number, *Z*, of an element is inversely proportional to the square root of the wavelength, λ, of fluorescent X-rays emitted when an electron drops from the $n = 2$ to the $n = 1$ shell.

$$i.e. \quad \frac{1}{\sqrt{\lambda}} = kZ$$

If iron emits X-rays of 1.937 Å when a 2*s* electron drops back to the 1*s* shell, determine the identity of the elements contained in an alloy found to emit the same type of X-rays at 1.435 Å and 1.541 Å?

For iron, $Z = 26$. With $\lambda = 1.937$ Å $= 1.937 \times 10^{-10}$ m:

$$\frac{1}{\sqrt{1.937 \times 10^{-10}\ \text{m}}} = k \times (26) \quad \text{so } k = 2764\ \text{m}^{-1/2}$$

For $\lambda = 1.435$ Å $= 1.435 \times 10^{-10}$ m:

$$\frac{1}{\sqrt{1.435 \times 10^{-10}\ \text{m}}} = (2764\ \text{m}^{-1/2}) \times Z \quad \text{so } Z = 30 \text{ corresponding to Zn}$$

For $\lambda = 1.541$ Å $= 1.541 \times 10^{-10}$ m:

$$\frac{1}{\sqrt{1.541 \times 10^{-10}\ \text{m}}} = (2764\ \text{m}^{-1/2}) \times Z \quad \text{so } Z = 29 \text{ corresponding to Cu}$$

Answer: **Zn and Cu**