. *A particular hydrogen-like ion emits radiation of frequency* $2{\cdot}467 \times 10^{15}$ Hz *when it makes transition from* $n = 2$ *to* $n = 1$. *What will be the frequency of the radiation emitted in a transition from* $n = 3$ *to* $n = 1$?

Solution : The frequency of radiation emitted is given by

$$\nu = \frac{c}{\lambda} = K\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right).$$

Thus, $2{\cdot}467 \times 10^{15}\ \text{Hz} = K\left(\frac{1}{1^2} - \frac{1}{2^2}\right)$

or, $$K = \frac{4}{3} \times 2{\cdot}467 \times 10^{15}\ \text{Hz}.$$

The frequency of the radiation emitted in the transition $n = 3$ to $n = 1$ is

$$\nu' = K\left[\frac{1}{1^2} - \frac{1}{3^2}\right]$$

$$= \frac{8}{9}K = \frac{8}{9} \times \frac{4}{3} \times 2{\cdot}467 \times 10^{15}\ \text{Hz}$$

$$= 2{\cdot}92 \times 10^{15}\ \text{Hz}.$$