*Calculate the two highest wavelengths of the radiation emitted when hydrogen atoms make transitions from higher states to $n = 2$ states.*

***olution*** : The highest wavelength corresponds to the lowest energy of transition. This will be the case for the transition $n = 3$ to $n = 2$. The second highest wavelength corresponds to the transition $n = 4$ to $n = 2$.

The energy of the state $n$ is $E_n = \frac{E_1}{n^2}$.

Thus, $$E_2 = -\frac{13{\cdot}6 \text{ eV}}{4} = -3{\cdot}4 \text{ eV}$$

$$E_3 = -\frac{13{\cdot}6 \text{ eV}}{9} = -1{\cdot}5 \text{ eV}$$

and $$E_4 = -\frac{13{\cdot}6 \text{ eV}}{16} = -0{\cdot}85 \text{ eV}.$$

The highest wavelength is $\lambda_1 = \frac{hc}{\Delta E}$

$$= \frac{1242 \text{ eVnm}}{(3{\cdot}4 \text{ eV} - 1{\cdot}5 \text{ eV})} = 654 \text{ nm}.$$

The second highest wavelength is

$$\lambda_2 = \frac{1242 \text{ eVnm}}{(3{\cdot}4 \text{ eV} - 0{\cdot}85 \text{ eV})} = 487 \text{ nm}.$$