

## Related Problems

### Question 16.

(i) The energy associated with first orbit in hydrogen atom is  $-2.17 \times 10^{-18} \text{ J atom}^{-1}$ . What is the energy associated with the fifth orbit ?

(ii) Calculate the radius of Bohr's fifth orbit for hydrogen atom.

### Answer:

(i) For an electron, the energies in two orbits may be compared as :

$$\frac{E_1}{E_2} = \left(\frac{n_2}{n_1}\right)^2 \quad \left[ \because E_n \propto \frac{1}{n^2} \right]$$

According to available data :  $n_1 = 1$ ,  $E_1 = -2.17 \times 10^{-18} \text{ J atom}^{-1}$ ,  $n_2 = 5$

$$\therefore \frac{(-2.17 \times 10^{-18} \text{ J atom}^{-1})}{E_2} = \left(\frac{5}{1}\right)^2 = 25$$

$$\text{or} \quad E_5 = \frac{(-2.17 \times 10^{-18} \text{ J atom}^{-1})}{25} = -8.77 \times 10^{-20} \text{ J atom}^{-1}.$$

(ii) For hydrogen atom ;  $r_n = 0.529 \times n^2 \text{ \AA}$

$$r_5 = 0.529 \times (5)^2 = 13.225 \text{ \AA} = 1.3225 \text{ nm}.$$