**Question 8. The atomic masses of He and Ne are 4 and 20 amu respectively. The value of the de Broglie wavelength of He gas at -73°C is 'M' times that of the de Broglie wavelength of Ne at 727°C 'M' is.**

de Broglie's wavelength of a particle when kinetic energy (K.E) and mass (m) are given:

$\lambda = h / \sqrt{2K.E\ m}$

Given:

Mass of He atom ($m_{He}$) = 4 amu

Mass of He atom ($m_{Ne}$) = 20 amu

The temperature of He($T_{He}$) = -73°C = 200K

The temperature of Ne($T_{Ne}$) = +727°C = 1000K

We know that;

$K.E \propto T$

$K.E_{He} / K.E_{Ne} = T_{He} / T_{Ne} = 200 / 1000 = ⅕$

Now, the ratio of de Broglie's wavelengths of Ne and He ($\lambda_{He} / \lambda_{Ne}$)

$\lambda_{He} / \lambda_{Ne} = \sqrt{2K.E_{Ne}m_{Ne}} / \sqrt{2K.E_{He}m_{He}} = \sqrt{5 / 1 \times 20 / 4} = 5$

$\therefore \lambda_{He} = 5 \times \lambda_{Ne}$

The value of m is 5.