Unit I_Cl_7_ Question & Answers

1. **Electron diffraction at a double slit is proof of the wave nature of electrons. Justify the statement.**

   The double slit experiment is a classical experiment which conclusively proved the wave nature of radiation, and is conclusively the characteristic wave experiment.

   In the double slit experiment with electrons the electrons are diffracted and seem to reach the screen with random probabilities. But when the experiment is conducted for a larger time scale a diffraction pattern that emerges with the electrons seem to be higher probabilities of reaching selected points on the screen and certain regions with very little probability. The diffraction pattern then can be evaluated and the "wavelength" of electrons could be calculated, which is in good agreement with the de Broglie wavelength of the electrons. This shows that the particle "electron" behaves as a "wave" when it is scattered at the slits.

2. **Electrons are diffracted at a double slit. The distance between the screen and the slit is 100cm and the distance between the slits 0.20 μm. If the fringe width is 2 mm, then calculate the de Broglie wavelength of the electrons diffracted at the double slit.**

   Distance between the slit and the screen ***D*** *=100 cm =1 m*

   The distance between the slits ***d*** *= 2 mm*

   The fringe width ***w*** *= 0.2 μm*

   Hence the wavelength of the "electron waves" $\boldsymbol{\lambda} = \frac{\boldsymbol{wd}}{\boldsymbol{D}} = \frac{\mathbf{0.2\times10^{-6}\times2\times10^{-3}}}{\mathbf{1}} = 4 \times 10^{-10}\ m$