

Q1: The de-Broglie wavelength of a particle having kinetic energy E is . How much extra energy must be given to this particle so that the de-Broglie wavelength reduces to 75% of the initial value?

Solution:

$$\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2mE}}$$
$$\lambda \propto \frac{1}{\sqrt{E}} \Rightarrow \frac{\lambda_1}{\lambda_2} = \sqrt{\frac{E_2}{E_1}}$$
$$\lambda_2 = \frac{75}{100} \lambda_1$$
$$\frac{\lambda_1}{\lambda_2} = \frac{4}{3} \Rightarrow \frac{4}{3} = \sqrt{\frac{E_2}{E_1}} \quad \frac{16}{9} = \frac{E_2}{E_1}$$
$$E_2 = \frac{16}{9} E_1 \quad \Delta E = \frac{7}{9} E$$