

Answer on Question#38360 – Physics – Mechanics

If kinetic energy of a body is increased by 300 percent, then the percentage change in momentum will be how much?

Solution:

p_1 – initial momentum;

p_2 – final momentum;

Kinetic energy of a body is increased by 300 percent:

$$\frac{E_2 - E_1}{E_1} \cdot 100\% = 300\%$$

$$E_2 - E_1 = 3E_1$$

$$E_2 = 4E_1 \quad (1)$$

Initial and final kinetic energy of a body:

$$E_1 = \frac{mV_1^2}{2} = \frac{m^2V_1^2}{2m} = \frac{p_1^2}{2m} \Rightarrow p_1 = \sqrt{2mE_1};$$

$$E_2 = \frac{mV_2^2}{2} = \frac{m^2V_2^2}{2m} = \frac{p_2^2}{2m} \Rightarrow p_2 = \sqrt{2mE_2}$$

Increase in momentum:

$$\begin{aligned} \frac{p_2 - p_1}{p_1} \cdot 100\% &= \frac{\sqrt{2mE_2} - \sqrt{2mE_1}}{\sqrt{2mE_1}} \cdot 100\% = \frac{\sqrt{E_2} - \sqrt{E_1}}{\sqrt{E_1}} \cdot 100\% = \\ &= \frac{\sqrt{4E_1} - \sqrt{E_1}}{\sqrt{E_1}} \cdot 100\% = \frac{\sqrt{E_1}}{\sqrt{E_1}} \cdot 100\% = 100\% \end{aligned}$$

Answer: Increase in momentum will be 100%.