

Chapter 7 Exercise 7A

$$\begin{aligned} \text{Q. 1. (i) } \frac{\text{NEW}}{\text{OLD}} &= -e \\ \Rightarrow \frac{p}{-10} &= \frac{-3}{5} \\ \Rightarrow p &= 6 \text{ m/s} \end{aligned}$$

The new velocity = $6\vec{j}$ m/s

$$\begin{aligned} \text{(ii) } \vec{I} &= M\vec{v} - M\vec{u} \\ &= 2(6\vec{j}) - 2(-10\vec{j}) \\ &= 32\vec{j} \text{ Ns} \end{aligned}$$

$$\begin{aligned} \text{(iii) K.E.}_{\text{before}} &= \frac{1}{2}(2)(-10)^2 \\ &= 100 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{K.E.}_{\text{after}} &= \frac{1}{2}(2)(6)^2 \\ &= 36 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Loss} &= 100 - 36 \\ &= 64 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Q. 2. (i) } \frac{\text{NEW}}{\text{OLD}} &= -e \\ \Rightarrow \frac{v}{-20} &= -0.5 \\ \Rightarrow v &= 10 \text{ m/s} \end{aligned}$$

$$\begin{aligned} \text{(ii) } \vec{I} &= M\vec{v} - M\vec{u} \\ &= (0.2)(10) - (0.2)(-20) \\ &= 2 + 4 = 6 \text{ Ns} \end{aligned}$$

$$\begin{aligned} \text{(iii) K.E.}_{\text{before}} &= \frac{1}{2}(0.2)(-20)^2 \\ &= 40 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{K.E.}_{\text{after}} &= \frac{1}{2}(0.2)(10)^2 \\ &= 10 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Loss} &= 40 - 10 \\ &= 30 \text{ J} \end{aligned}$$

Q. 3. (i) To find speed at impact:

$$\begin{aligned} v^2 &= u^2 + 2as \\ \Rightarrow v^2 &= 0^2 + 2(9.8)(2.5) \\ \Rightarrow v &= 7 \text{ m/s} \end{aligned}$$

$$\begin{aligned} \text{(ii) } \frac{\text{NEW}}{\text{OLD}} &= -e \\ \Rightarrow \frac{p}{-7} &= -\frac{4}{7} \\ \Rightarrow p &= 4 \\ &= 4 \text{ m/s} \end{aligned}$$

$$\begin{aligned} \text{(iii) } \vec{I} &= M\vec{v} - M\vec{u} \\ &= (1)(4\vec{j}) - (1)(-7\vec{j}) \\ &= 11\vec{j} \text{ Ns} \end{aligned}$$

$$\begin{aligned} \text{(iv) Loss} &= \frac{1}{2}Mu^2 - \frac{1}{2}Mv^2 \\ &= \frac{1}{2}(1)(49) - \frac{1}{2}(1)(16) \\ &= 16\frac{1}{2} \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Q. 4. (i) } v^2 &= u^2 + 2as \\ \Rightarrow v^2 &= 0^2 + 2(9.8)(10) \\ \Rightarrow v &= 14 \text{ m/s} \end{aligned}$$

$$\begin{aligned} \text{(ii) } \vec{I} &= M\vec{v} - M\vec{u} \\ &= (6)(0) - (6)(-14\vec{j}) \\ &= 84\vec{j} \text{ Ns} \end{aligned}$$

$$\begin{aligned} \text{(iii) Loss} &= \frac{1}{2}Mu^2 - \frac{1}{2}Mv^2 \\ &= \frac{1}{2}(6)(14)^2 - \frac{1}{2}(6)(0)^2 \\ &= 588 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Q. 5. (i) } u &= 0, \quad a = 9.8, \quad s = 22.5 \\ v &= \sqrt{u^2 + 2as} \\ &= \sqrt{0 + 2(9.8)(22.5)} \\ &= 21 \text{ m/s} \end{aligned}$$

$$\begin{aligned} \text{(ii) } \frac{\text{NEW}}{\text{OLD}} &= -e \\ \Rightarrow \frac{v_1}{-21} &= -\frac{5}{7} \\ \Rightarrow v_1 &= 15 \text{ m/s} \end{aligned}$$

$$\begin{aligned} \text{(iii) } \vec{I} &= M\vec{v}_1 - M\vec{v} \\ &= (0.1)(15) - (0.1)(-21) \\ &= 3.6 \text{ Ns} \end{aligned}$$

$$\begin{aligned} \text{(iv) K.E.}_{\text{before}} &= \frac{1}{2}(0.1)(21)^2 \\ &= 22.05 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{K.E.}_{\text{after}} &= \frac{1}{2}(0.1)(15)^2 \\ &= 11.25 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Loss} &= 22.05 - 11.25 \\ &= 10.8 \text{ J} \end{aligned}$$