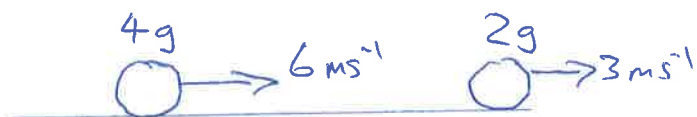


Worked Example

Conservation of Momentum

①

Before



After



Conservation of Momentum

$$24 + 6 = 4v_1 + 2v_2$$

$$30 = 4v_1 + 2v_2$$

$$15 = 2v_1 + v_2 \quad \text{--- (1)}$$

Conservation of Energy:

$$\frac{1}{2} 4(6)^2 + \frac{1}{2} 2(3)^2 = \frac{1}{2} 4v_1^2 + \frac{1}{2} 2v_2^2$$

$$2 \times 36 + 9 = 2v_1^2 + v_2^2$$

$$81 = 2v_1^2 + v_2^2 \quad \text{--- (2)}$$

From (1): $v_2 = 15 - 2v_1$

Substitute for v_2 into (2):

$$81 = 2v_1^2 + (15 - 2v_1)^2$$

$$81 = 2v_1^2 + 225 - 60v_1 + 4v_1^2$$

Collect similar terms:

$$0 = 6v_1^2 - 60v_1 + 144$$

i.e. $6v_1^2 - 60v_1 + 144 = 0$

$$6v_1^2 - 60v_1 + 144 = 0$$

②

$$v_1 = \frac{60 \pm \sqrt{60^2 - 4 \times 6 \times 144}}{12} = \frac{60 \pm \sqrt{144}}{12} = \frac{60 \pm 12}{12}$$

Either $v_1 = \frac{72}{12} = 6 \text{ ms}^{-1}$

or $v_1 = \frac{48}{12} = 4 \text{ ms}^{-1}$

then from ① the corresponding value for v_2 are:

$v_2 = 3 \text{ ms}^{-1}$

or $v_2 = 7 \text{ ms}^{-1}$

More plausible.