Answer on Question#38258 – Physics – Mechanics

A particle of mass2kg is released from rest and slides down a plane inclined at 30 degree to the horizontal. There is a constant resistance force of 4N. Find the speed of the particle after it has travelled 8 meter

Solution:

First, we can write the Newton's second law along the plane ($\mathrm{F_{resist}} = 4N$):

$$\mathrm{F_{net}} = \mathrm{ma} \qquad (1)$$

$$\mathrm{F_{net}} = (\mathrm{mg})_{\mathrm{slope}} - \mathrm{F_{resist}} = \mathrm{mg} \cdot \sin\alpha - \mathrm{F_{resist}} \qquad (2)$$

$(2)\mathrm{in}(1)$:

$$\mathrm{mg} \cdot \sin\alpha - \mathrm{F_{resist}} = \mathrm{ma}$$

Acceleration of the car:

$$\mathrm{a} = \frac{\mathrm{mg} \cdot \sin\alpha - \mathrm{F_{resist}}}{\mathrm{m}} = \mathrm{g} \cdot \sin\alpha - \frac{\mathrm{F_{resist}}}{\mathrm{m}} =$$

$$= 9.81\frac{\mathrm{m}}{\mathrm{s^2}} \cdot \sin 18.4° - \frac{4\mathrm{N}}{2\ \mathrm{kg}} = 1.1\frac{\mathrm{m}}{\mathrm{s^2}}$$

Equation of motion for the car:

$$\mathrm{d} = \frac{\mathrm{at^2}}{2}$$

$$\mathrm{t} = \sqrt{\frac{2\mathrm{d}}{\mathrm{a}}} \qquad (3)$$

Rate equation for the car

$$\mathrm{V_1} = \mathrm{at} = \mathrm{a} \cdot \sqrt{\frac{2\mathrm{d}}{\mathrm{a}}} = \sqrt{2\mathrm{da}} = \sqrt{2 \cdot 8\mathrm{m} \cdot 1.1\frac{\mathrm{m}}{\mathrm{s^2}}} = 4.2\frac{\mathrm{m}}{\mathrm{s}}$$

Answer: the speed of the particle after it has travelled 8 meter is equal to $4.2\frac{\mathrm{m}}{\mathrm{s}}$.