Cambridge International AS & A Level

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Mathematics   9709/42

Paper 4 Mechanics   May/June 2021

Question No (1)

1   A particle of mass 0.6 kg is projected with a speed of $4\,\mathrm{m\,s}^{-1}$ down a line of greatest slope of a smooth plane inclined at $10°$ to the horizontal.
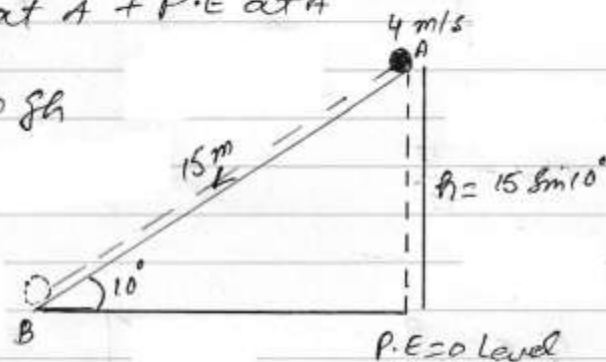
Use an energy method to find the speed of the particle after it has moved 15 m down the plane.

<u>Solution:</u>

$$m = 0.6 \text{ kg}$$

$$K.E \text{ at } B = K.E \text{ at } A + P.E \text{ at } A$$

$$\frac{1}{2} m (V_B)^2 = \frac{1}{2} m u^2 + m gh$$

4 m/s

A

15 m

$h = 15 \sin 10°$

10°

B

P.E = 0 level

$$\frac{1}{2} (0.6)(V_B)^2 = \frac{1}{2} (0.6)(4)^2 + (0.6)(10)(5 \sin 10°)$$

$$0.3 (V_B)^2 = \frac{1}{2} (0.6)(16) + 6 \times 15 \sin 10°$$

$$0.3 (V_B)^2 = 4.8 + 15.628$$

$$(V_B)^2 = \frac{4.8 + 15.628}{0.3}$$

$$= 68.0944$$

$$V_B = 8.25 \text{ m s}^{-1}$$