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Mathematics 9709/42

Paper 4 Mechanics May/June 2023

Question No (1)

- 1 A particle of mass 1.6 kg is dropped from a height of 9 m above horizontal ground. The speed of the particle at the instant before hitting the ground is 12 m s^{-1} .

Find the work done against air resistance.

Solution:

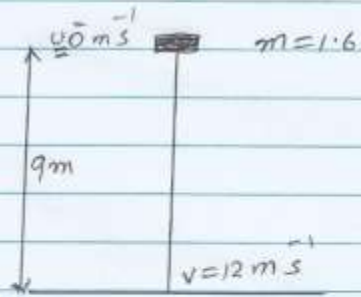
Given data of particle

$u = 0\text{ m s}^{-1}$ (due to rest)

$s = 9\text{ m}$

$v = 12\text{ m s}^{-1}$

$m = 1.6$



using the equation of motion

$$v^2 - u^2 = 2as$$

$$(12)^2 - (0)^2 = 2(a)(9)$$

$$144 = 18a$$

$$a = 8\text{ m s}^{-2}$$

According to Newton's second law of motion

$$W - R = ma$$

$$1.6g - R = 1.6a$$

$$1.6 \times 10 - R = 1.6(8)$$

$$16 - R = 12.8$$

$F = ma$
(As the particle is moving down $W > R$)
 $W = mg$

HERO NOTES

$$R = 16 - 12.8$$

$$R = 3.2$$

work done against air resistance = force \times distance

$$W.D = R \times d$$

$$= 3.2 \times 9$$

$$WD = 28.8 \text{ J}$$