

PQ 11 Questions and Answers

PQ 1

A 1000 kg car is going at 30 m/s (70 mph). How much energy will be needed to stop it?

$$E_K = \frac{1}{2} mv^2 = \frac{1}{2} 1000 (30^2) = 500 \times 900 = 450\,000 \text{ J.}$$

PQ 2

A pupil of mass 50 kg climbs stairs of vertical height 7 m in a time of 9 s.

Calculate the power used.

$$\text{Lifting force} = \text{weight: } W = mg = 50 \times 10 = 500 \text{ N}$$

$$\text{Work done: } E_w = F \times d = 500 \times 7 = 3500 \text{ J}$$

$$\text{Potential energy gained: } E_p = mgh = 50 \times 10 \times 7 = 3500 \text{ J}$$

$$\text{Power: } P = E/t = 3500/9 = 389 \text{ W}$$

PQ 3

A car of mass 800 kg, travelling at 20 m/s, is brought to rest in 40 s. What is the power of the brakes?

Work done = kinetic energy lost.

$$E_K = \frac{1}{2} mv^2 = \frac{1}{2} \times 800 \times 20^2 = 160\,000 \text{ J.}$$

$$\text{Power} = \frac{\text{work done}}{\text{time taken}} = \frac{160\,000}{40} = 4000 \text{ W or 4 kW.}$$

PQ 4

A crane lifts a load of bricks of mass 1200 kg onto a building of height 12 m.

The carrier itself has a mass of 300 kg.

What minimum power must the motor of the lift develop to lift the bricks in 15 s?

Work done = potential energy gained ($g = 10 \text{ N/kg}$)

$$E_p = mgh = 1500 \times 10 \times 12 = 180\,000 \text{ J}$$

$$\text{Power} = \frac{\text{work done}}{\text{time taken}} = \frac{180\,000}{15} = 12\,000 \text{ W or } 12 \text{ kW.}$$

PQ 5

An athlete of mass 75 kg is at a height of 2.2 m. Calculate his potential energy.

$$E_p = m g h = 75 \times 9.8 \times 2.2 = 1617 \text{ J} = 1600 \text{ J}.$$

PQ 6

A lift can carry a load of twelve passengers of average mass 85 kg through a height of 20 m in 15 s. Calculate the minimum power output of the lift's motor.

$$\text{Total mass lifted} = 12 \times 85 = 1020 \text{ kg.}$$

$$\text{Work done} = \text{potential energy gained} = m g h = 1020 \times 9.8 \times 20 = 199\,920 \text{ J}$$

$$P = E/t = 199\,920/15 = 13328 = 13 \text{ kJ s}^{-1} \text{ or } 13 \text{ kW.}$$