

# PQ 7

Questions & Answers

# Q1

*Calculate the final velocity of a car that accelerates at  $2\text{ms}^{-2}$  from an initial velocity of  $3\text{ms}^{-1}$  for 5 seconds.*

$$**v = u + at**$$

$$**v = 3 + (2 \times 5)**$$

$$**= 3 + 10**$$

$$**\text{final velocity} = 13 \text{ ms}^{-1}**$$

## Q2

*Calculate the stopping distance of a car that is decelerated at  $2.5 \text{ ms}^{-2}$  from an initial velocity of  $20 \text{ ms}^{-1}$ .*

$$v^2 = u^2 + 2as$$

$$0 = 20^2 + (2 \times -2.5 \times s)$$

$$0 = 400 + -5s$$

$$-400 = -5s$$

$$-400 / -5 = s$$

$$\text{stopping distance} = 80 \text{ m}$$

## Q3

*A stone is dropped from the edge of a cliff. If it accelerates downwards at  $9.81 \text{ ms}^{-2}$  and reaches the bottom after  $1.5\text{s}$  calculate the height of the cliff.*

$$**s = ut + \frac{1}{2} at^2**$$

$$**s = (0 \times 1.5) + \frac{1}{2} (9.81 \times (1.5)^2)**$$

$$**s = \frac{1}{2} (9.81 \times 2.25)**$$

$$**\text{cliff height} = 11.0 \text{ m}**$$

# Q4

*Calculate the time taken for a car to accelerate uniformly from  $5 \text{ ms}^{-1}$  to  $12 \text{ ms}^{-1}$  over a distance of 30m.*

$$s = \frac{1}{2} (u + v) t$$

$$30 = \frac{1}{2} (5 + 12) \times t$$

$$30 = 8.5 \times t$$

$$30 \div 8.5 = t$$

$$\text{time} = 3.53 \text{ s}$$

## Q5

*A ball is thrown upwards against gravity with an initial speed of  $8 \text{ ms}^{-1}$ . What is the maximum height reached by the ball?*

$$v^2 = u^2 + 2as$$

where:

$s$  = height upwards

$u$  =  $8 \text{ ms}^{-1}$  upwards

$v$  =  $0 \text{ ms}^{-1}$  (at maximum height)

$a$  =  $-9.81 \text{ ms}^{-2}$  (acceleration is downwards)

## Q5 continued

$$v^2 = u^2 + 2as$$

$$0 = (8)^2 + 2(-9.81 \times s)$$

$$0 = 64 - 19.62 \times s$$

$$-64 = -19.62 \times s$$

$$-64 / -19.62 = s$$

**maximum ball height = + 3.26 m**

## Q6

*Calculate the momentum of a rugby player, mass 120kg moving at 3m/s.*

$$**p = m \times v**$$

$$= 120\text{kg} \times 3\text{m/s}$$

$$**\text{momentum} = 360 \text{ kg m/s}**$$

# Q7

*Calculate the mass of a car that when moving at 25m/s has a momentum of 20 000 kg m/s.*

$$**p = m \times v**$$

$$*becomes:* **m = p \div v**$$

$$= 20000 \text{ kg m/s} \div 25 \text{ m/s}$$

$$**mass = 800 kg**$$

## Q8

*Calculate the force required to change the momentum of a car by 24000 kgm/s over a 6 second period.*

**force = momentum change  $\div$  time taken**

= 24000 kgm/s  $\div$  6 s

**force = 4000N**

## Q9

*Calculate the time taken for a force of 6000N to cause the momentum of truck to change by 42000 kgm/s.*

**force = momentum change  $\div$  time taken**

becomes:

**time taken = momentum change  $\div$  force**

= 42000 kgm/s  $\div$  6000 N

**force = 7 seconds**

# Q10

- A truck has a mass of 10 000 kg and a velocity of 3 m.s<sup>-1</sup>.  
What is its momentum?

$$\begin{aligned}\text{Momentum} &= \text{Mass} \times \text{velocity} \\ &= 10\,000 \times 3 \\ &= 30\,000 \text{ kg.m.s}^{-1}.\end{aligned}$$