

# Test Review Questions Motion 5

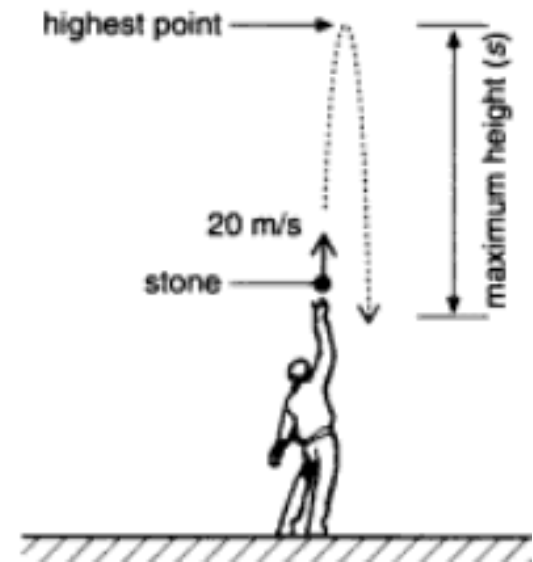
Questions

# Q1

A car travelling with uniform acceleration on a straight road passes two points, A and B, which are 100 m apart. Find the car's acceleration if it has a speed of  $10 \text{ m s}^{-1}$  when passing point A and a speed of  $20 \text{ m s}^{-1}$  when passing point B.

## Q2

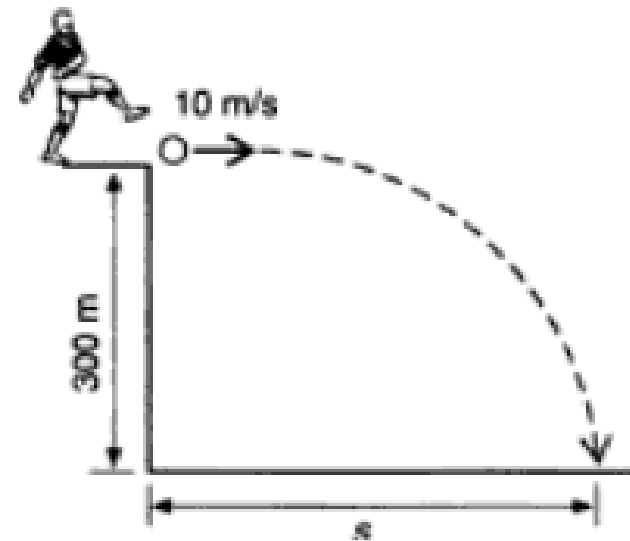
*A stone is thrown upwards with an initial velocity of 20 m/s. What is the maximum height risen, and how long does it take to reach this height? (Take acceleration due to gravity as  $9.8 \text{ m/s}^2$ .)*



# Q3

*A ball is kicked horizontally off the edge of a cliff, 300 m high, at 10 m/s. Find the time taken for it to fall to the ground, and the horizontal distance travelled from the cliff base. ( $g = 9.8 \text{ m/s}^2$ .)*

Start by drawing a diagram (see right). List the information in the vertical and horizontal directions, and then pick the appropriate equations.



## Q4

A pellet of mass  $0.001 \text{ kg}$  is fired from an air rifle at a speed of  $110 \text{ m s}^{-1}$  into a wood block. The pellet penetrates the block to a depth of  $0.050 \text{ m}$ . Calculate the impact force.

## Q5

A railway engine of mass 20 000 kg moving at  $3 \text{ m s}^{-1}$  collides with and couples to an initially stationary train of wagons of total mass 10 000 kg. Calculate,

- (a) the speed of the engine and wagons just after impact.
- (b) the loss of K.E. as a result of the impact.

## Q6

A driver of a vehicle travelling at a speed of  $30 \text{ m s}^{-1}$  on a motorway brakes sharply to a standstill in a distance of 100 m. Calculate the deceleration of the vehicle.

## Q7

A vehicle of mass 600 kg accelerates uniformly from rest to a speed of  $8.0 \text{ m s}^{-2}$  in 20 s. Calculate the force needed to produce this acceleration.

## Q8

A vehicle of mass 900 kg on a level road, travelling at a speed of  $15 \text{ m s}^{-1}$  can be brought to a standstill, without skidding, by a braking force equal to  $0.5 \times$  its weight. Calculate:

- a** the deceleration of the vehicle,
- b** the braking distance.

## Q9

On a fairground ride, the track descends by a vertical drop of 55 m over a distance of 120 m along the track. A train of mass 2500 kg on the track reaches a speed of  $30 \text{ m s}^{-1}$  at the bottom of the descent after being at rest at the top.

Calculate

- a** the loss of potential energy of the train,
- b** its gain of kinetic energy,
- c** the average frictional force during the descent.

# Q10

An aircraft powered by engines that exert a force of 40 kN is in level flight at a constant velocity of  $80 \text{ m s}^{-1}$ . Calculate the output power of the engine at this speed.

# Q11

A rail wagon of mass 4500 kg moving along a level track at a speed of  $3.0 \text{ m s}^{-1}$  collides with and couples to a second rail wagon of mass 3000 kg which is initially stationary. Calculate the speed of the two wagons immediately after the collision.

# Q12

A mass has an initial velocity of  $10.0 \text{ m s}^{-1}$ . It moves with acceleration  $-2.00 \text{ m s}^{-2}$ . When will it have zero velocity?

# Q13

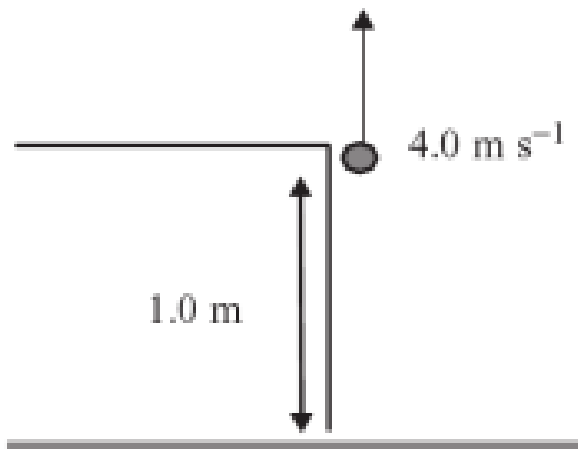
A ball of mass  $0.250 \text{ kg}$  moves on a frictionless horizontal floor and hits a vertical wall with speed  $5.0 \text{ m s}^{-1}$ . The ball rebounds with speed  $4.0 \text{ m s}^{-1}$ . If the ball was in contact with the wall for  $0.150 \text{ s}$ , find the average force that acted on the ball.

## Q14

A mass of 5.00 kg moving with an initial velocity of  $12.0 \text{ m s}^{-1}$  is brought to rest by a horizontal force over a distance of 12.0 m. What is the force?

# Q15

A ball is thrown vertically upward with a speed of  $4.0 \text{ m s}^{-1}$  from a height of  $1.0 \text{ m}$  from the floor, as shown



## Q16

What is the minimum power required to lift a mass of 50.0 kg up a vertical distance of 12 m in 5.0 s?