

## **IGCSE (EDEXCEL) Physics : Velocity and acceleration**

Q1. A driver of a car sees an obstruction in the road ahead and must stop the car.

(a) (i) State the formula linking average speed, distance travelled and time taken.

(1)

(ii) A car travels at 21m/s.

The driver's reaction time is 0.14 seconds.

Calculate the distance travelled by the car during the driver's reaction time.

(2)

distance = \_\_\_\_\_ m

(b) The car experiences a braking force of 7600 N.

The car has a mass of 1200 kg.

(i) State the formula linking force, mass and acceleration.

(1)

(ii) Calculate the acceleration of the car.

(2)

acceleration = \_\_\_\_\_  $\text{m/s}^2$

(iii) Calculate the braking distance travelled as the speed of the car is reduced from 21m/s to 0m/s.

(3)

distance = \_\_\_\_\_ m

Q2. (a) The box shows the data recorded by the data logger.

speed at A = 1.45 m/s

speed at B = 4.20 m/s

time from A to B = 0.286 s

(i) Show that the acceleration of the steel ball is approximately 9.6 m/s<sup>2</sup>.

(2)

acceleration = \_\_\_\_\_ m/s<sup>2</sup>

(ii) Explain why the student's value for the acceleration of the steel ball is lower than the accepted value for the acceleration due to gravity, g.

(2)

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(iii) Calculate the distance between the light gates.

(3)

distance = \_\_\_\_\_ m

Q3. (a) Airbags are safety devices used in cars to protect the driver if there is a crash.

(i) State the formula linking momentum, mass and velocity.

(1)

(ii) A person inside a car has a mass of 72 kg and a velocity of 13 m/s.

Show that the momentum of the person is about 900 kg m/s.

(1)

(iii) The person experiences a crash and comes to rest in 0.29 s.

Calculate the force on the person.

(2)

force = \_\_\_\_\_ N

(iv) Which statement explains how airbags protect the driver?

(1)

A increase the force acting on the driver

B increase the time taken for the driver to stop

C increase the kinetic energy store of the driver

D increase the momentum of the driver

Q4. The car is pulled to the top of a vertical shaft and then released from rest.

The car then falls freely because of the force of gravity.

(a) Calculate the speed of the car when it has fallen 18 m.

(3)

speed = \_\_\_\_\_ m/s

Q5. This question is about a parachutist.

(a) A parachutist leaves a helicopter that is hovering above the ground.

The parachutist is initially at rest and falls vertically downwards.

Calculate the speed of the parachutist after they have fallen through a distance of 1300 m.

Ignore the effect of air resistance.

(4)

speed = \_\_\_\_\_ m/s

(b) When the parachutist is much nearer to the ground, they open their parachute.

The parachutist slows down.

(i) Explain the change in speed of the parachutist.

Use ideas about forces in your answer.

(3)

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Q6. (i) The mass of the van is 1900 kg. and the resultant force 14kN.

Calculate the acceleration of the van when it brakes. Give the unit.

(3)

acceleration = \_\_\_\_\_ unit \_\_\_\_\_

(ii) The van was travelling at an initial speed of 18 m/s before braking and coming to rest.

Calculate the distance travelled by the van while it is braking.

[assume that the acceleration remains constant]

(3)

distance = \_\_\_\_\_ m

Q7. Schiaparelli is a spacecraft that was sent to Mars in 2016.

(a) Schiaparelli then opened a parachute to slow down.

Explain how the spacecraft reached a low terminal velocity after opening its parachute.

Use ideas about forces in your answer.

(4)

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(b) The parachute was disconnected when Schiaparelli was at a height of 2.0m from the surface of Mars and travelling at a speed of 0.45 m/s.

Calculate the speed of the spacecraft just before it hits the surface of Mars.

[ acceleration of free-fall on Mars = 3.4 m/s<sup>2</sup> ]

(4)

speed = \_\_\_\_\_ m/s

(c) Suggest why Mars has a lower gravitational field strength than Earth.

(1)

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Q8. A table tennis ball is a very light plastic ball filled with air.

(a) A student drops a table tennis ball from rest. The ball falls 13 m to the ground. Show that the final speed of the ball, just before it reaches the ground, should be about 16m/s. Assume that there is no air resistance.

(3)

(b) The student suggests that the ball will reach the ground with a speed that is less than 16 m/s because of air resistance.

Use ideas about forces to justify the student's suggestion.

(5)

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Q9. A car is moving along a road.

(a) The car has an initial velocity of 26 m / s.

The car then accelerates at  $1.2 \text{ m / s}^2$  until it reaches a velocity of 35 m / s.

(i) State the formula linking acceleration, change in velocity and time taken.

(1)

(ii) Calculate the time taken for the car to accelerate to 35 m/s.

(3)

time = \_\_\_\_\_ s