Equations of Motion Worksheet

Q1.

A car starts from rest and accelerates uniformly for 8.0 s. It reaches a final speed of 16 m s^{-1}.

a What is the acceleration of the car?

b What is the average velocity of the car?

c Calculate the distance travelled by the car.

Q2.

A new model BMW can start from rest and travel 400 m in 16 s.

a What is its average acceleration during this time?

b Calculate the final speed of the car.

c How fast is this final speed in km h^{-1}?

Q3.

A space-rocket is launched and accelerates uniformly from rest to 160 m s^{-1} in 4.5 s.

a Calculate the acceleration of the rocket.

b How far does the rocket travel in this time?

c What is the final speed of the rocket in km h^{-1}?

Q4.
A diver plunges head first into a diving pool while travelling at 28.2 m s^{-1}. Upon entering the water, the diver stops within a distance of 4.00 m from the diving board. Consider the diver to be a single point located at her centre of mass and assume her acceleration through the water to be uniform.

a Calculate the average acceleration of the diver as she travels through the water.

b How long does the diver take to come to a stop?

c What is the speed of the diver after she has dived for 2.00 m.

Q5.
When does a car have the greatest ability to accelerate and gain speed: when it is moving slowly or when it is travelling fast? Explain.

Q6.
A stone is dropped vertically into a lake. Which one of the following statements best describes the motion of the stone at the instant it enters the water?

A Its velocity and acceleration are both downwards.

B It has an upwards velocity and a downwards acceleration.

C Its velocity and acceleration are both upwards.

D It has a downwards velocity and an upwards acceleration.

Q7.
A cyclist, whilst overtaking another bike, increases his speed uniformly from 4.2 m s^{-1} to 6.3 m s^{-1} over a time interval of 5.3 s.

a Calculate the acceleration of the cyclist during this time.

b How far does the cyclist travel whilst overtaking?

c What is the average speed of the cyclist during this time?

Q8. A car is travelling along a straight road at 75 km h^{-1}. In an attempt to avoid an accident, the motorist has to brake to a sudden stop.

a What is the car's initial speed in m s^{-1}?

b If the reaction time of the motorist is 0.25 s, what distance does the car travel while the driver is reacting to apply the brakes?

c Once the brakes are applied, the car has an acceleration of –6.0 m s^{-2}. How far does the car travel while pulling up?

d What total distance does the car travel from when the driver notices the danger to when the car comes to a stop?

Q9.

A billiard ball rolls from rest down a smooth ramp that is 8.0 m long. The acceleration of the ball is constant at 2.0 m s^{-2}.

a What is the speed of the ball when it is halfway down the ramp?

b What is the final speed of the ball?

c How long does the ball take to roll the first 4.0 m?

d How long does the ball take to travel the final 4.0 m?

Q10.

A cyclist is travelling at a constant speed of 12 m s^{-1} when he passes a stationary bus. The bus starts moving just as the cyclist passes, and accelerates at 1.5 m s^{-2}.

a When does the bus reach the same speed as the cyclist?

b How long does the bus take to catch the cyclist?

c What distance has the cyclist travelled before the bus catches up?