Name: _____

Motion Foundation

Questions

Date:

Time:

Total marks available:

Total marks achieved: _____

Questions

Q1.

Which of these speeds would be normal for a person walking?

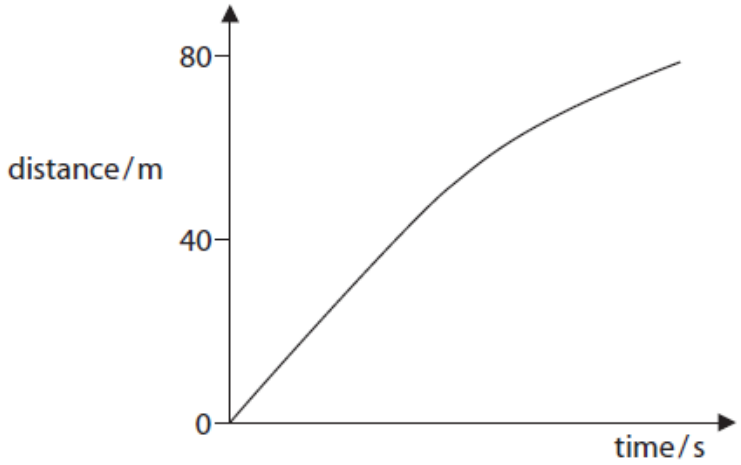
(1)

- ☒ **A** 0.1 m/s
- ☒ **B** 1.0 m/s
- ☒ **C** 10 m/s
- ☒ **D** 100 m/s

(Total for question = 1 mark)

Q2.

The distance-time graph for a car is shown below.



Describe what the graph shows about the speed of the car as it travels the 80 m.

(2)

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Q3.

Use words from the box to complete the sentences below.

direction	energy	mass	size

(2)

Vectors have size and ..... .

Scalars have only ..... .

(Total for question = 2 marks)

Q4.

An aircraft waits at the start of a runway.
The aircraft accelerates from a speed of 0 m/s to a speed of 80 m/s.
The acceleration of the aircraft is 4 m/s^2.

Calculate the distance, x, travelled by the aircraft while it is accelerating.

Use the equation

$$x = \frac{v^2 - u^2}{2a}$$

(2)

x = ... m

(Total for question = 2 marks)

Q5.

Figure 7 shows a skier going down a hill.

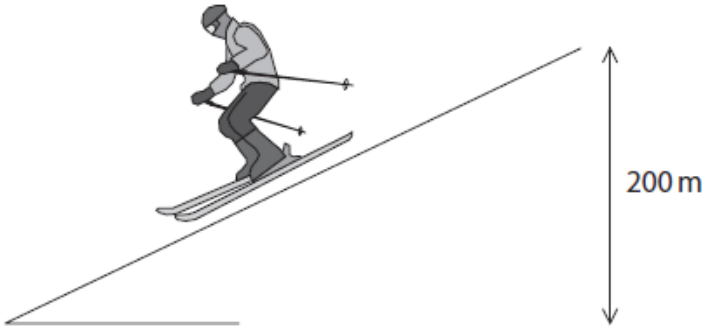

Figure 7

Describe how her speed at the bottom of the slope could be determined.

(3)

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(Total for question = 3 marks)

Q6.

The students use a telescope to view the Moon.

Light from the Moon takes 1.3 s to reach the students.

The speed of light is 300 000 km/s.

Calculate the distance to the Moon.

(2)

distance = speed × time

distance to the Moon = ...km

Q7.

This table shows data about two other cars.

car	mass	time taken to reach 30 m/s from rest
family car	1400 kg	10 s
sports car	600 kg	5 s

The owner of the family car claims that although the sports car has greater acceleration, it produces a smaller accelerating force than his family car.

Explain how these figures support his claim.

(2)

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Q8.

A car is travelling along a level road.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

When the velocity of the car is constant, the force of friction on it is

(1)

☒ **A** zero

☒ **B** greater than the driving force

☒ **C** smaller than the driving force

☒ **D** the same size as the driving force

(ii) The car now accelerates in a straight line.
Its average acceleration is 12 m/s^2.

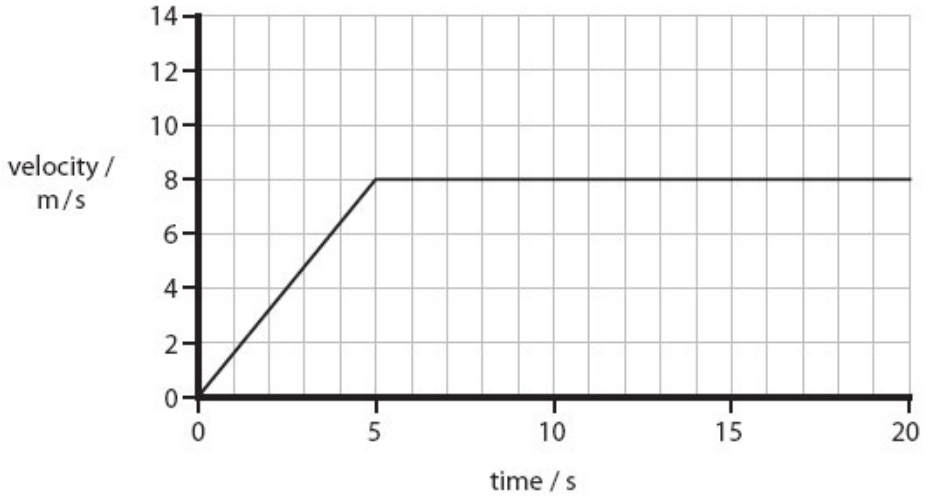
Calculate the increase in velocity of the car in 4.0 s.

(3)

speed = ...m/s

Q9.

Here is the velocity-time graph for a car for the first 20 s of a journey.



(i) Calculate the change in velocity of the car during the first 5 s.

(1)

change in velocity = ...m/s

(ii) Calculate the acceleration of the car during the first 5 s.

(2)

acceleration = ...m/s^2

(iii) State the size of the resultant force between 10 s and 15 s

(1)

resultant force = ...N

Q10.

A student needs to measure the average speed of an accelerating trolley between two marks on a bench.

Figure 5 shows the arrangement of some apparatus that the student can use.

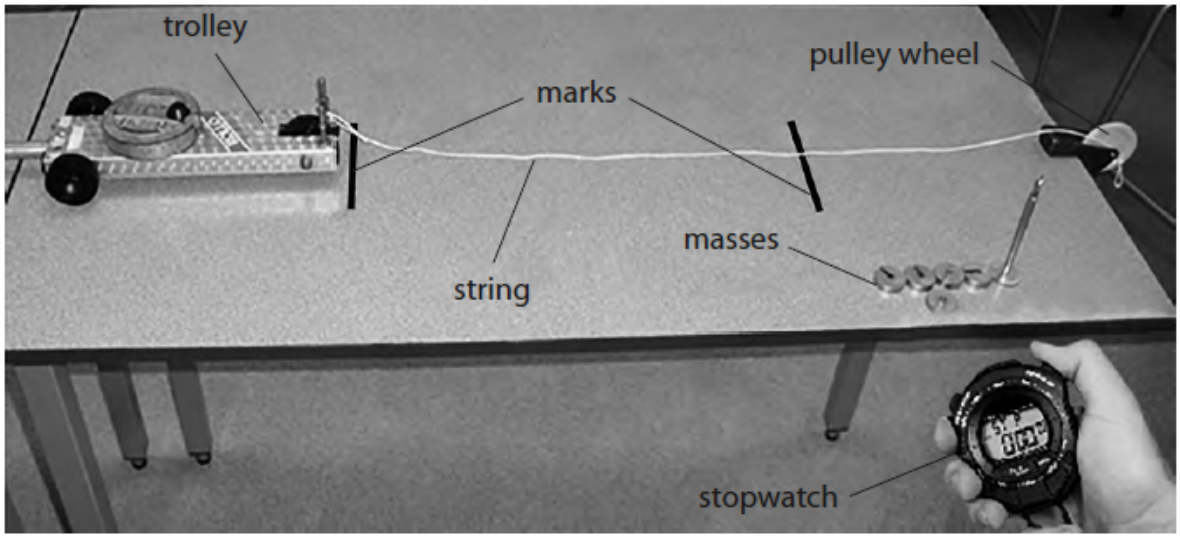


Figure 5

(i) One piece of apparatus is missing from the diagram.

This piece of apparatus is needed to determine the average speed.

State the extra piece of apparatus needed to determine the average speed.

(1)

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(ii) Describe how the student can make the trolley accelerate along the bench.

(2)

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(iii) The student wishes to develop the experiment to determine the acceleration of the trolley.

State **one other** measurement that the student must make to determine the acceleration of the trolley.

(1)

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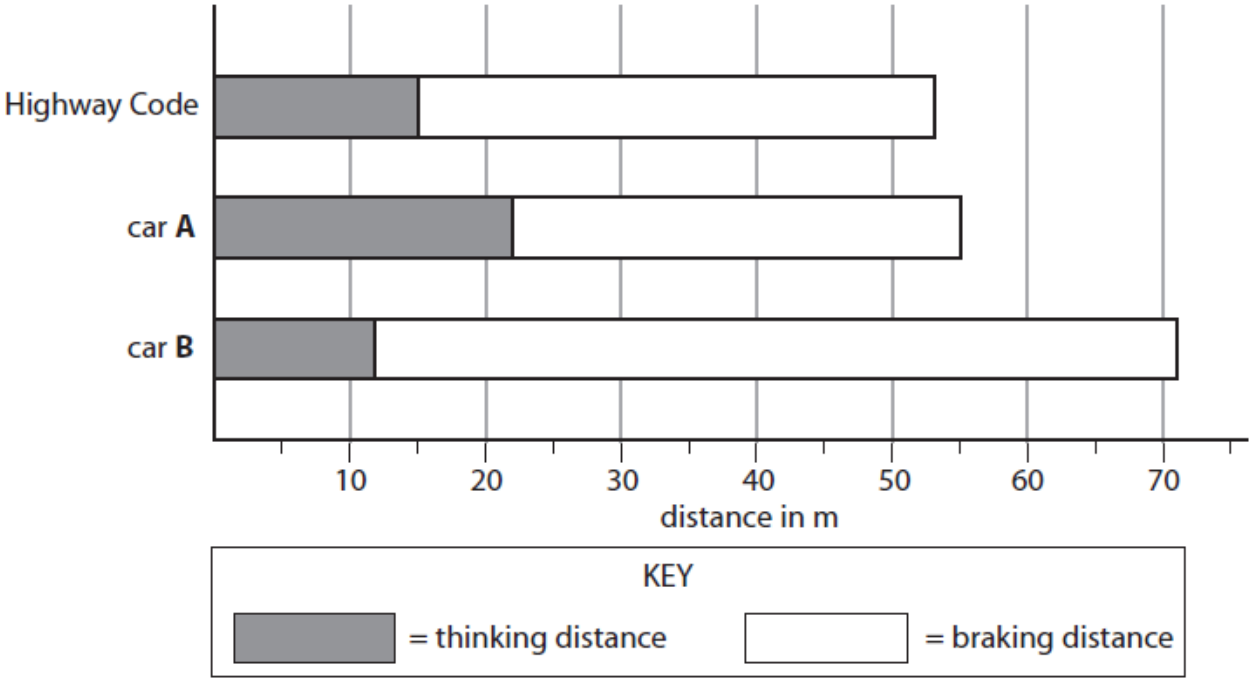
(Total for question = 4 marks)

Q11.

* The chart shows the thinking, braking and stopping distances for an average car and driver stopping from 50 miles per hour as shown in the Highway Code.

It also shows the thinking, braking and stopping distances for drivers of cars **A** and **B**, both stopping from 50 miles per hour.



A and **B** are different cars on different roads.

Use the factors that can affect thinking and braking distances to explain the differences in stopping distances for cars **A** and **B**.

(6)

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Q12.

Some students investigate the speed of cars.
They measure the time it takes each car to travel a distance of 80 m.

(a) State **two** measuring instruments the students should use.

(2)

1

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2

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(b) The table shows some of their results.

colour of car	distance travelled / m	time / s
green	80	5.0
red	80	4.0
blue	80	5.5
black	80	4.3
white	80	5.6

(i) State the colour of the slowest car.

(1)

colour of the slowest car .....

(ii) Calculate the speed of the black car.

(2)

speed of the black car = ... m/s

(iii) 20 miles per hour is approximately 9 m/s.

Estimate the speed, in miles per hour, of the black car.

(1)

speed of the black car = ... miles per hour

Q13.

Figure 1 shows a speed/time graph for a car.

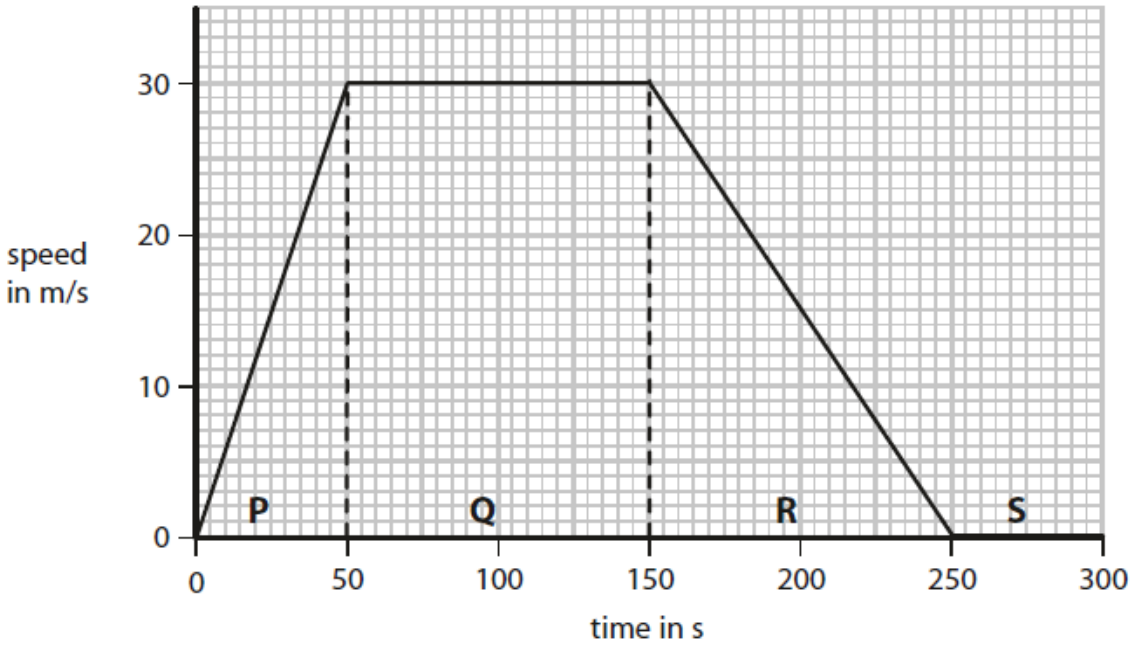


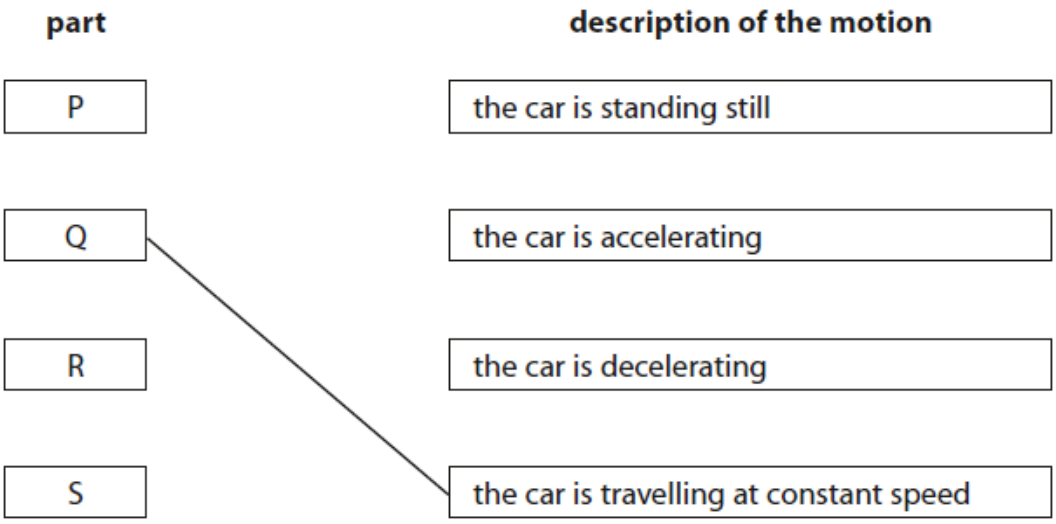
Figure 1

(i) The graph in Figure 1 is divided into four parts, **P**, **Q**, **R** and **S**.

Draw a line from the letter for each **part** to the correct **description of the motion** during that part.

One line has been drawn for you.

(2)



(ii) In two parts of the graph in Figure 1 the forces are balanced.

State the letters of the two parts of the graph where the horizontal forces acting on the car are balanced.

(2)

part ..... and part .....

(iii) Calculate the distance travelled by the car in part Q.

Use the equation

distance travelled = average speed × time

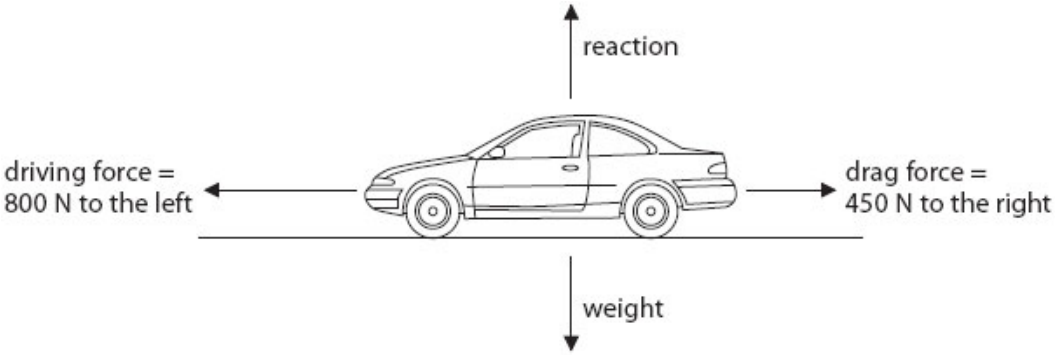
(2)

distance travelled = ... m

(Total for question = 6 marks)

Q14.

The diagram shows the forces acting on a car which is travelling along a flat straight road.



(a) (i) The size of the resultant force on the car is 350 N.

In which direction is the resultant force acting?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** down ↓

☒ **B** to the left ←

☒ **C** to the right →

☒ **D** up ↑

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The car is

(1)

☒ **A** accelerating

☒ **B** decelerating

☒ **C** moving at a constant speed

☒ **D** not moving

(2)

(iii) The mass of the car is 625 kg.

Calculate the weight of the car.

gravitational field strength = 10N/kg

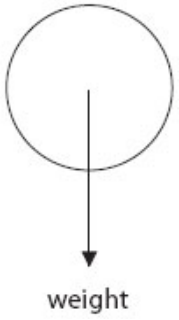
(2)

weight of car = ...N

(b) Forces also act on objects when they fall through the air.

There are two forces acting on this ball as it falls through the air.

The weight is shown on the diagram.



(i) Draw and label an arrow on the diagram to show the other force acting on the ball.

(2)

(ii) Use words from the box to complete the sentences.

(2)

balanced	changing	greater	smaller	zero

After a short time the ball falls at a steady speed.

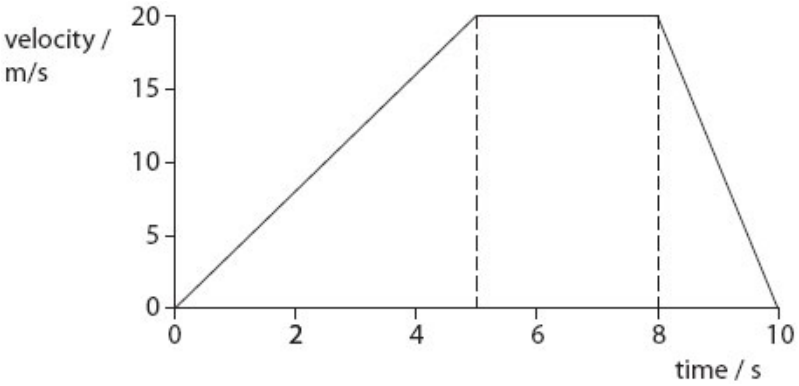
The forces acting on the ball are now .....**.**

The acceleration of the ball is now .....**.**

(Total for Question is 8 marks)

Q15.

The graph shows how the velocity of a small car changes with time.



(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The resultant force on the car will be zero when the car is

(1)

☒ **A** accelerating

☒ **B** decelerating

☒ **C** changing velocity

☒ **D** moving at a constant velocity

(b) (i) Use the graph to estimate the velocity of the car at three seconds.

(1)

velocity .....m/s

(ii) Calculate the acceleration of the car when it is speeding up.

(2)

acceleration = ...m/s^2

(iii) Explain why the units of acceleration are m/s^2.

(2)

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.....

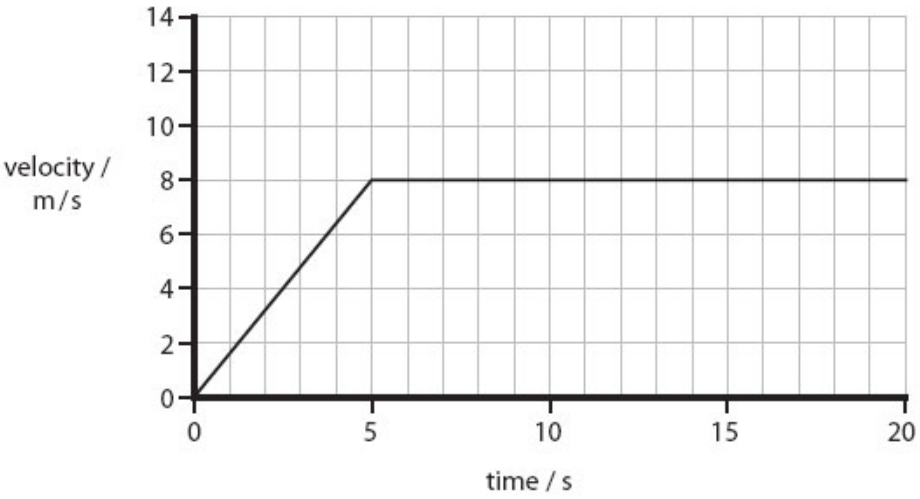
(iv) Show that the car travels further at a constant velocity than it does when it is slowing down.

(3)

(Total for Question is 9 marks)

Q16.

(a) Here is the velocity-time graph for a car for the first 20 s of a journey.



(i) Calculate the change in velocity of the car during the first 5 s.

(1)

change in velocity = ...m/s

(ii) Calculate the acceleration of the car during the first 5 s.

(2)

acceleration = ...m/s^2

(iii) State the size of the resultant force between 10 s and 15 s

(1)

resultant force = ...N

(b) The mass of a car is 1200 kg.

Calculate the resultant force on the car required to produce an acceleration of 0.8 m/s^2.

(2)

resultant force = ...N

*(c) A car, travelling at 20 m/s, with just the driver inside takes 70 m to stop in an emergency. The same car is then fully loaded with luggage and passengers as well as the driver.

Explain why it will take a different distance to stop in an emergency from the same speed.

(6)

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(Total for Question = 12 marks)