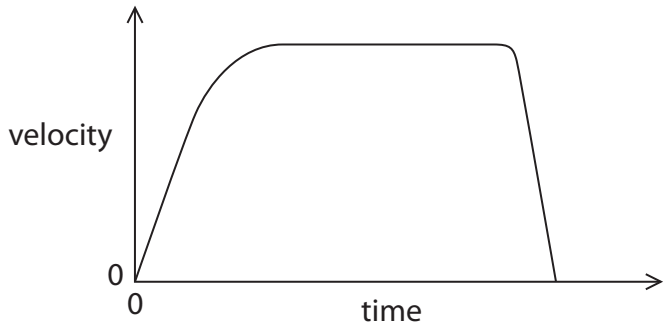
All questions are for both separate science and combined science students

1 A toy car rolls down a ramp and hits a cushion.

The graph shows how its velocity changes with time.



(a) Constant velocity on the graph is shown by

(1)

- ☒ **A** the area under the line
- ☒ **B** the horizontal part of the line
- ☒ **C** the sloping line at the end
- ☒ **D** the sloping line at the start

(b) The distance travelled is shown by

(1)

- ☒ **A** the area under the line
- ☒ **B** the horizontal part of the line
- ☒ **C** the sloping line at the end
- ☒ **D** the sloping line at the start

(c) The average velocity of the toy car is given by

(1)

- ☒ **A** the change in velocity divided by the time taken
- ☒ **B** the distance moved divided by the time taken
- ☒ **C** the time taken divided by the change in velocity
- ☒ **D** the time taken divided by the distance moved

(Total for Question 1 = 3 marks)

2 A racing cyclist practises by riding around a track.

A student wants to find the average speed of the cyclist.

Describe a method that the student could use to find the average speed.

(5)

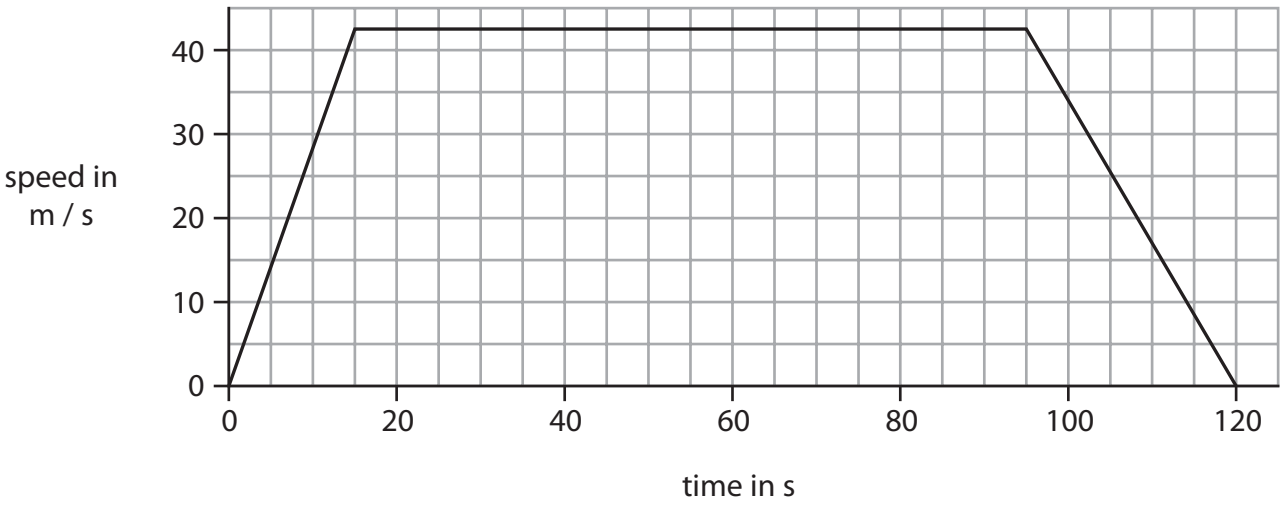
(Total for Question 2 = 5 marks)

3 An aeroplane takes two minutes to travel the short distance between airports on two islands.

The graph shows how the speed of the aeroplane changes as it

- takes off
- flies across the sea
- lands on the other island

When it is flying across the sea, the aeroplane travels at a constant speed.



(a) Use the graph to answer the following questions.

(i) State the value of the constant speed.

(1)

speed ..... m/s

(ii) Calculate the acceleration of the aeroplane at the start of the journey and give the unit.

(3)

acceleration = ... unit .....

(iii) Calculate the total distance that the aeroplane travels.

(3)

distance = ... m

(b) Each airport has a runway that is about 500 m long.

When it lands, the speed of the aeroplane is 40 m/s.

Explain why the airline should not use an aeroplane that has more mass and needs a higher speed for landing.

(3)

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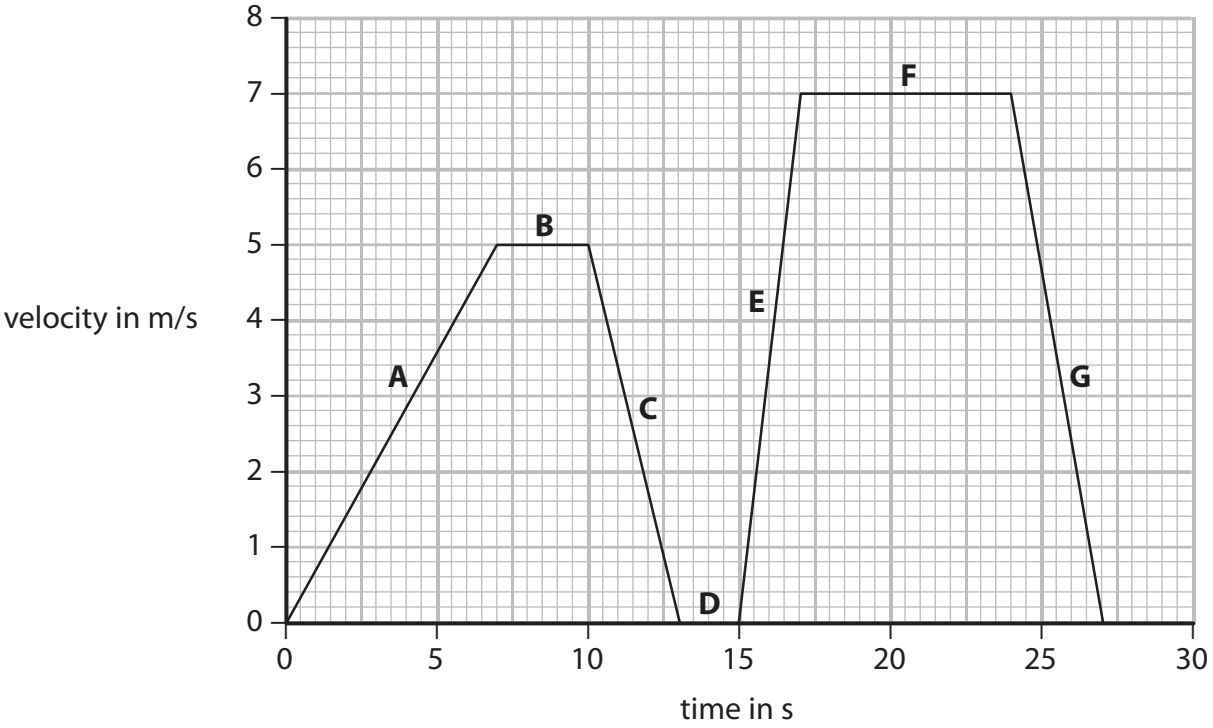
(Total for Question 3 = 10 marks)

4 A student cycles to school.

The graph shows the stages A to G of the journey.



(a) Describe the motion of the student during stages B and D.

(2)

Stage	Description
B	
D	

(b) State how the graph shows that the acceleration for stage E is greater than the acceleration for stage A.

(1)

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(c) Calculate the distance that the student travels in the last 10 s of the journey.

(4)

distance = ... m

(d) The total distance travelled is 106.5 m.

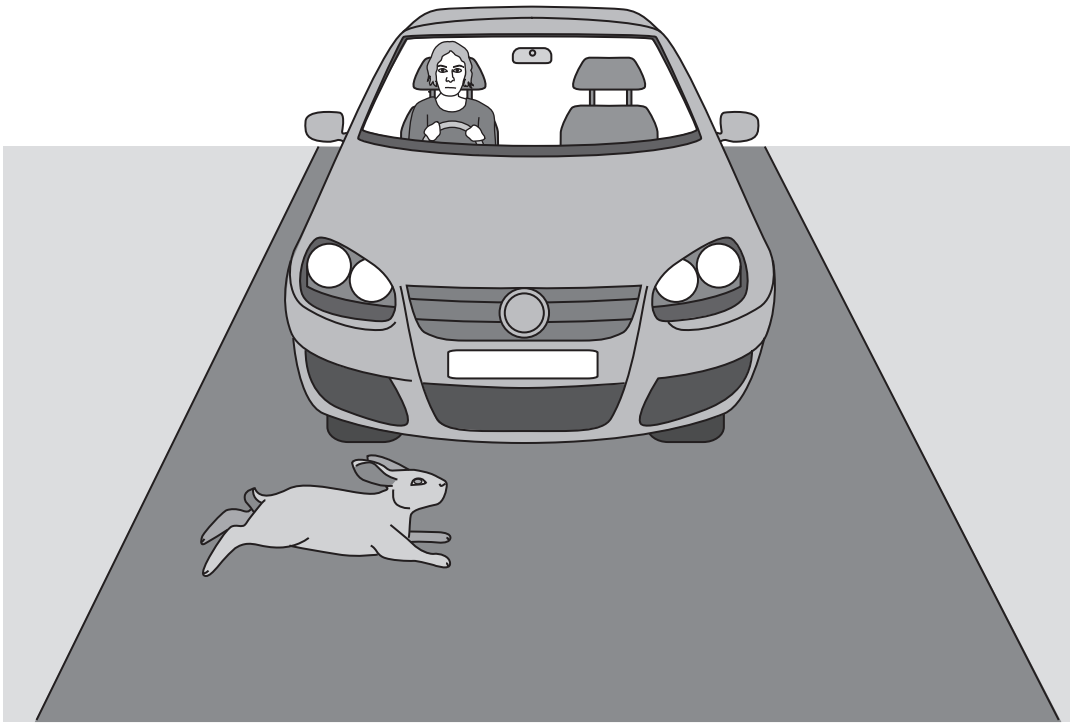
Show that the average speed of the journey is about 4 m/s.

(3)

(Total for Question 4 = 10 marks)

5 A rabbit runs across the road in front of a car.

The driver applies the brakes.



State **four** factors that affect the chance of the rabbit escaping without being hit.

(4)

1 .....

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2 .....

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3 .....

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4 .....

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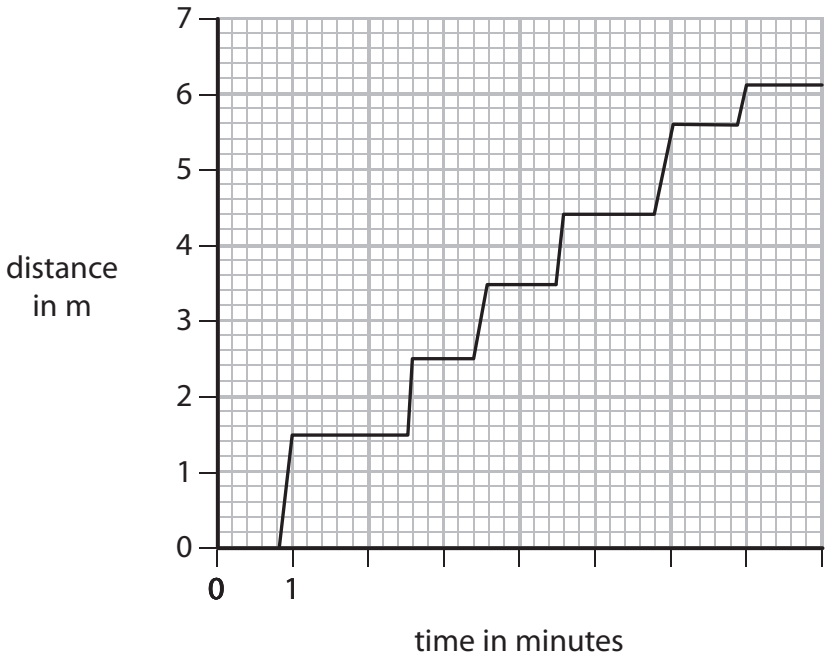
(Total for Question 5 = 4 marks)

6 The diagram shows some people waiting in a queue at a supermarket.

The queue moves forward each time a person leaves the checkout.

Person X spends seven minutes in the queue before reaching the checkout.

The graph shows how distance changes with time for person X.



(a) (i) What is the initial length of the queue?

(1)

initial length = ... m

(ii) Explain how you could use the graph to work out the number of times person X is stationary.

(2)

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(b) (i) State the equation linking average speed, distance moved and time taken.

(1)

(ii) Calculate the average speed of person X in the queue.

Give the unit.

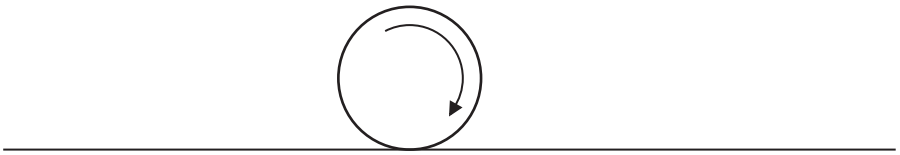
(3)

average speed = ... unit .....

(Total for Question 6 = 7 marks)

7 A golfer practises hitting balls on a golf course.

(a) Ball X rolls along level ground, as shown in the diagram.



(i) Add labelled arrows to the diagram to show the directions of two of the forces acting on ball X.

(2)

(ii) Explain why ball X slows down and stops.

(3)

(b) The golfer hits ball Y at an angle into the air.

He gives it the same initial kinetic energy as ball X.

Suggest why ball Y travels much further than ball X before it stops.

(1)

(c) The mass of ball Y is 45 g.

The golfer gives the ball 36 J of kinetic energy when he hits it.

(i) State the equation linking kinetic energy, mass and speed.

(1)

(ii) Calculate the initial speed of ball Y.

(4)

initial speed = ... m/s

(iii) Ball Y reaches a maximum height of 30 m.

Suggest how the golfer should hit ball Y so it can reach a greater height.

(1)

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(Total for Question 7 = 12 marks)