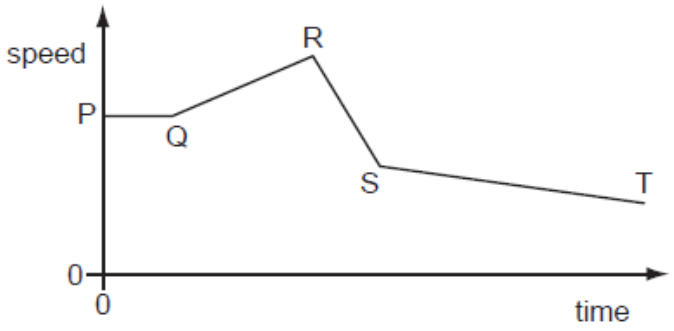
Revision – Forces and Motion 1

1.

The diagram shows the speed/time graph for a train as it travels along a track.



For which part of the graph is the train's speed changing at the greatest rate?

A PQ **B** QR **C** RS **D** ST

2.

A small steel ball is dropped from a low balcony.

Ignoring air resistance, which statement describes its motion?

A It falls with constant acceleration.

B It falls with constant speed.

C It falls with decreasing speed.

D It falls with increasing acceleration.

3.

Which is the unit for force and which is the unit for weight?

	force	weight
A	kg	kg
B	kg	N
C	N	kg
D	N	N

4.

A cup contains hot liquid.

Some of the liquid evaporates.

What happens to the mass and to the weight of the liquid in the cup?

	mass	weight
A	decreases	decreases
B	decreases	stays the same
C	stays the same	decreases
D	stays the same	stays the same

5.

A force acting on an object causes some properties of the object to change.

Which list contains **only** properties that can be changed by the action of the force?

A mass, motion and shape

B mass, motion and size

C mass, shape and size

D motion, shape and size

6.

A box is being moved by a fork-lift truck. The total weight of the box is 3000 N.

The force exerted by the fork-lift truck on the box is 3500 N upwards.

What is the resultant force on the box?

A 500 N downwards

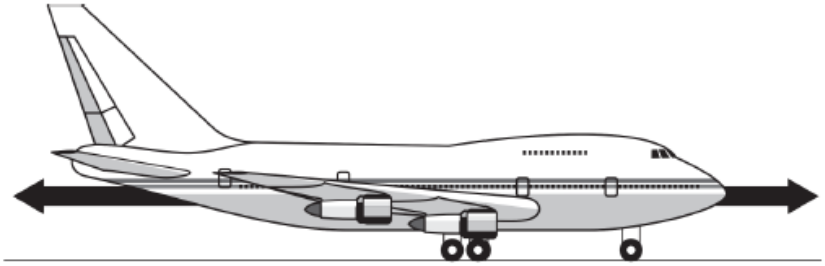
B 500 N upwards

C 6500 N downwards

D 6500 N upwards

7.

(a) The diagram shows an aircraft and the horizontal forces acting on it as it moves along a runway. The *resultant force* on the aircraft is zero.



(i) What is meant by the term *resultant force*?

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(1 mark)

(ii) Describe the movement of the aircraft when the resultant force is zero.

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(1 mark)

(b) The aircraft has a take-off mass of 320 000 kg. Each of the 4 engines can produce a maximum force of 240 kN.

Use the equation in the box to calculate the maximum acceleration of the aircraft.

resultant force = mass × acceleration

Show clearly how you work out your answer and give the unit.

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Acceleration = ...

(3 marks)

(c) As the aircraft moves along the runway to take off, its acceleration decreases even though the force from the engines is constant.

Explain why.

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(2 marks)

8.

A cyclist travelling along a straight level road accelerates at 1.2 m/s^2 for 5 seconds.
The mass of the cyclist and the bicycle is 80 kg.

(a) Use the equation in the box to calculate the resultant force needed to produce this acceleration.

resultant force = mass × acceleration

Show clearly how you work out your answer and give the unit.

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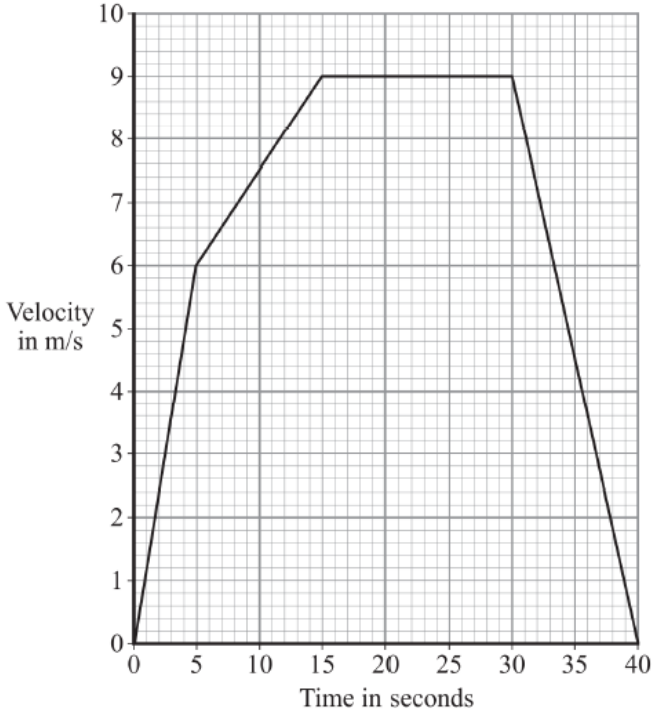
Resultant force = ...

(3 marks)

(b) The graph shows how the velocity of the cyclist changes with time.



(b) (i) Complete the following sentence.

The velocity includes both the speed and the ..... of the cyclist.

(1 mark)

(b) (ii) Why has the data for the cyclist been shown as a line graph instead of a bar chart?

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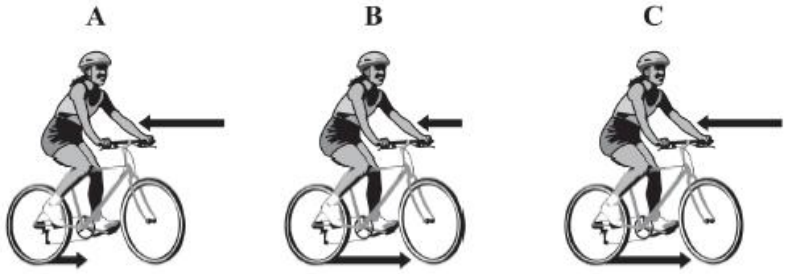
(1 mark)

(b) (iii) The diagrams show the horizontal forces acting on the cyclist at three different speeds. The length of an arrow represents the size of the force.



Which **one** of the diagrams, **A**, **B** or **C**, represents the forces acting when the cyclist is travelling at a constant 9 m/s?

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Explain the reason for your choice.

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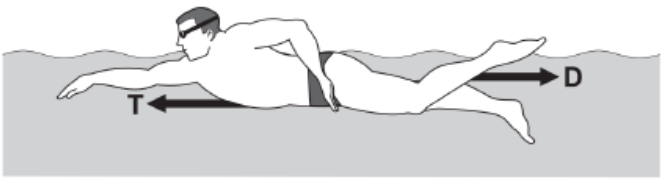
(3 marks)

9.

(a) The diagram shows the horizontal forces acting on a swimmer.



(a) (i) The swimmer is moving at constant speed.
Force **T** is 120 N.

What is the size of force **D**?

..... N
(1 mark)

(a) (ii) By increasing force **T** to 140 N, the swimmer accelerates to a higher speed.

Calculate the size of the initial resultant force acting on the swimmer.

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Initial resultant force = ... N
(1 mark)

(a) (iii) Even though the swimmer keeps the force **T** constant at 140 N, the resultant force on the swimmer decreases to zero.

Explain why.

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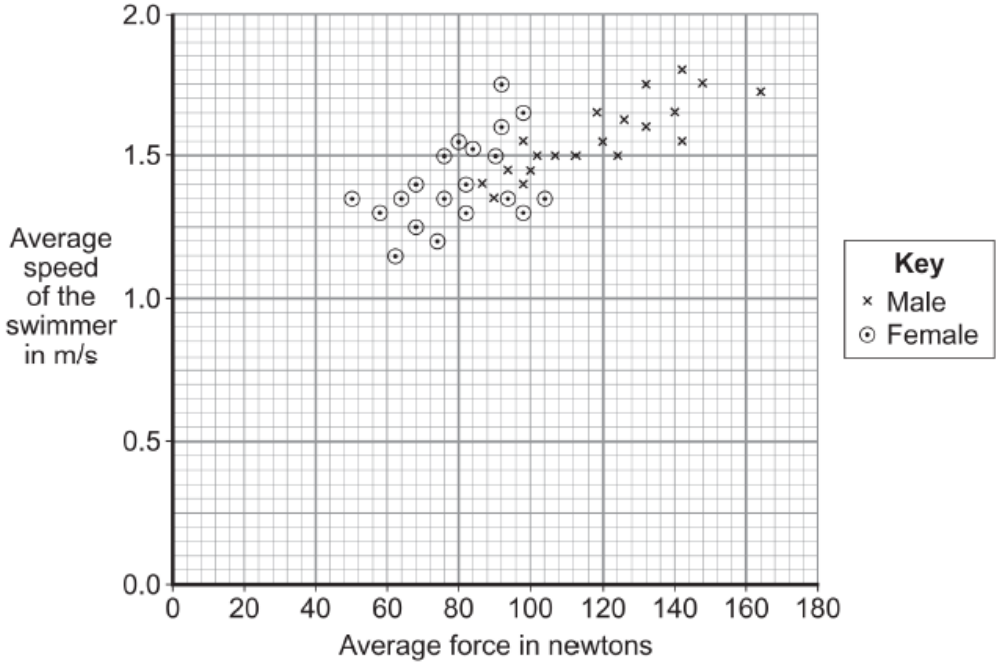
(3 marks)

(b) A sports scientist investigated how the force exerted by a swimmer's hands against the water affects the swimmer's speed.
The investigation involved 20 males and 20 females swimming a fixed distance.
Sensors placed on each swimmer's hands measured the force 85 times every second over the last 10 metres of the swim.
The measurements were used to calculate an average force.
The average speed of each swimmer over the last 10 metres of the swim was also measured.

The data from the investigation is displayed in the graph.



(b) (i) What was the dependent variable in this investigation?

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(1 mark)

(b) (ii) Explain **one** advantage of measuring the force 85 times every second rather than just once or twice every second.

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(2 marks)

(b) (iii) Give **one** way in which the data for the male swimmers is different from the data for the female swimmers.

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(1 mark)

(b) (iv) Considering only the data from this investigation, what advice should a swimming coach give to swimmers who want to increase their average speed?

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(1 mark)