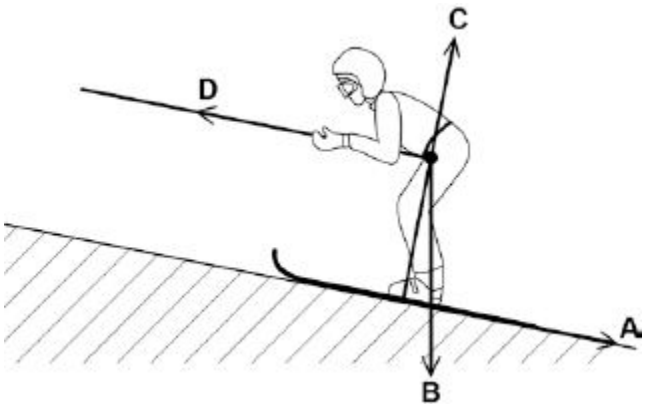
1 **Figure 1** shows a skier using a drag lift.

The drag lift pulls the skier from the bottom to the top of a ski slope.

The arrows, **A**, **B**, **C** and **D** represent the forces acting on the skier and her skis.

Figure 1



(a) Which arrow represents the force pulling the skier up the slope?

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

(1)

(b) Which arrow represents the normal contact force?

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

(1)

(c) The drag lift pulls the skier with a constant resultant force of 300N for a distance of 45 m.

Use the following equation to calculate the work done to pull the skier up the slope.

work done = force × distance

.....

.....

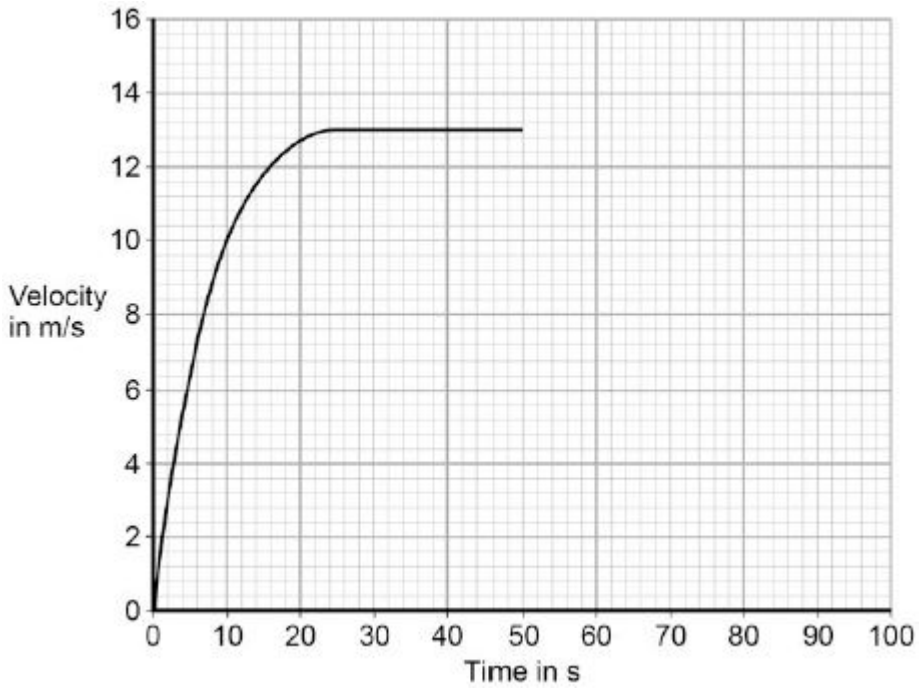
Work done = ... J

(2)

(d) At the top of the slope the skier leaves the drag lift and skis back to the bottom of the slope.

Figure 2 shows how the velocity of the skier changes with time as the skier moves down the slope.

Figure 2



After 50 seconds the skier starts to slow down.

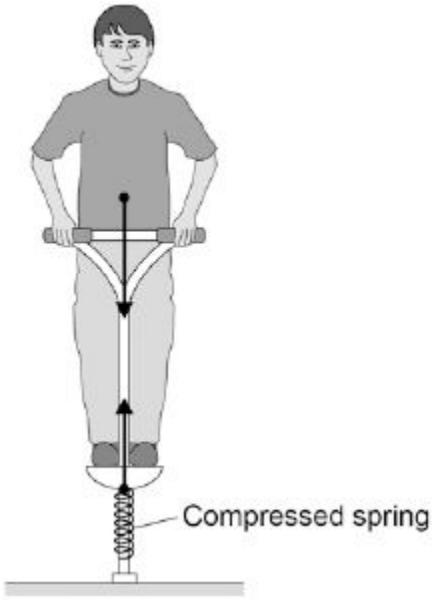
The skier decelerates at a constant rate coming to a stop in 15 seconds.

Draw a line on **Figure 2** to show the change in velocity of the skier as she slows down and comes to a stop.

(2)
(Total 6 marks)

2 The figure below shows the forces acting on a child who is balancing on a pogo stick.

The child and pogo stick are not moving.



(a) The downward force of the child on the spring is equal to the upward force of the spring on the child.

This is an example of which one of Newton's Laws of motion?

Tick **one** box.

First Law ☐

Second Law ☐

Third Law ☐

(1)

(b) Complete the sentence.

Use an answer from the box.

elastic potential	**gravitational potential**	**kinetic**

The compressed spring stores ..... energy.

(1)

(c) The child has a weight of 343 N.

Gravitational field strength = 9.8 N / kg

Write down the equation which links gravitational field strength, mass and weight.

.....

(1)

(d) Calculate the mass of the child.

.....

.....

.....

Mass = ... kg

(3)

(e) The weight of the child causes the spring to compress elastically from a length of 30cm to a new length of 23cm.

Write down the equation which links compression, force and spring constant.

.....

(1)

(f) Calculate the spring constant of the spring.

Give your answer in newtons per metre.

.....

.....

.....

Spring constant = ... N / m

(4)

(Total 11 marks)

3 The stopping distance of a car is the sum of the thinking distance and the braking distance.

The table below shows how the thinking distance and braking distance vary with speed.

Speed in m / s	Thinking distance in m	Braking distance in m
10	6	6.0
15	9	13.5
20	12	24.0
25	15	37.5
30	18	54.0

(a) What is meant by the braking distance of a vehicle?

.....

.....

(1)

(b) The data in the table above refers to a car in good mechanical condition driven by an alert driver.

Explain why the stopping distance of the car increases if the driver is very tired.

.....

.....

.....

.....

(2)

(c) A student looks at the data in the table above and writes the following:

thinking distance ∝ speed

thinking distance ∝ speed

Explain whether the student is correct.

.....

.....

.....

.....

(2)

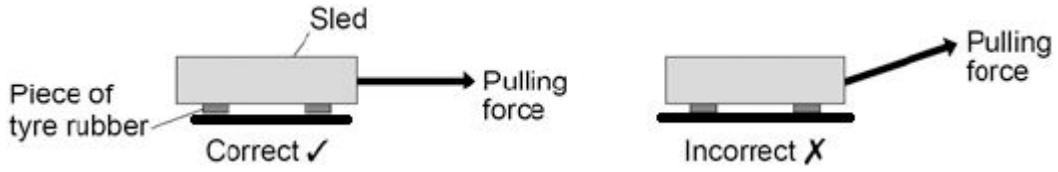
(d) Applying the brakes with too much force can cause a car to skid.

The distance a car skids before stopping depends on the friction between the road surface and the car tyres and also the speed of the car.

Friction can be investigated by pulling a device called a 'sled' across a surface at constant speed.

The figure below shows a sled being pulled correctly and incorrectly across a surface.

The constant of friction for the surface is calculated from the value of the force pulling the sled and the weight of the sled.



Why is it important that the sled is pulled at a constant speed?

Tick **one** box.

If the sled accelerates it will be difficult to control. ☐

If the sled accelerates the value for the constant of friction will be wrong. ☐

If the sled accelerates the normal contact force will change. ☐

(1)

(e) If the sled is pulled at an angle to the surface the value calculated for the constant of friction would not be appropriate.

Explain why.

.....

.....

.....

.....

(2)

(f) By measuring the length of the skid marks, an accident investigator determines that the distance a car travelled between the brakes being applied and stopping was 22 m.

The investigator used a sled to determine the friction. The investigator then calculated that the car decelerated at 7.2 m / s^2.

Calculate the speed of the car just before the brakes were applied.

Give your answer to two significant figures.

Use the correct equation from the Physics Equation Sheet.

.....

.....

.....

.....

Speed = ... m / s

(3)

(Total 11 marks)

4 When two objects interact, they exert forces on each other.

(a) Which statement about the forces is correct?

Tick (✓) **one** box.

	Tick (✓)
The forces are equal in size and act in the same direction.	
The forces are unequal in size and act in the same direction.	
The forces are equal in size and act in opposite directions.	
The forces are unequal in size and act in opposite directions.	

(1)

(b) A fisherman pulls a boat towards land.

The forces acting on the boat are shown in **Diagram 1**.

The fisherman exerts a force of 300 N on the boat.
The sea exerts a resistive force of 250 N on the boat.

Diagram 1

(i) Describe the motion of the boat.

.....

.....

.....

.....

(2)

(ii) When the boat reaches land, the resistive force increases to 300 N.
The fisherman continues to exert a force of 300 N.

Describe the motion of the boat.

Tick (✓) **one** box.

Accelerating to the right ☐

Constant velocity to the right ☐

Stationary ☐

(1)

(iii) Explain your answer to part **(b)(ii)**.

.....

.....

.....

.....

(2)

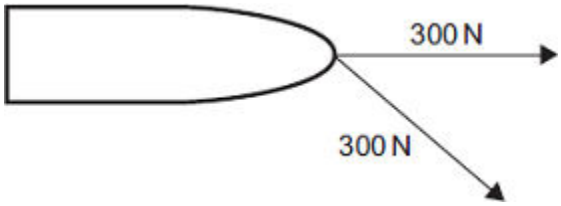
(iv) Another fisherman comes to help pull the boat. Each fisherman pulls with a force of 300 N, as shown in **Diagram 2**.

Diagram 2 is drawn to scale.

Add to **Diagram 2** to show the single force that has the same effect as the two 300 N forces.

Determine the value of this resultant force.

Diagram 2



Resultant force = ... N

(4)

(Total 10 marks)

5 On 14 October 2012, a skydiver set a world record for the highest free fall from an aircraft.

After falling from the aircraft, he reached a maximum steady velocity of 373 m / s after 632 seconds.

(a) Draw a ring around the correct answer to complete the sentence.

This maximum steady velocity is called the | frictional / initial / terminal | velocity.

(1)

(b) The skydiver wore a chest pack containing monitoring and tracking equipment. The weight of the chest pack was 54 N.

The gravitational field strength is 10 N / kg.

Calculate the mass of the chest pack.

.....

.....

Mass of chest pack = ... kg

(2)

(c) During his fall, the skydiver's acceleration was not uniform.

Immediately after leaving the aircraft, the skydiver's acceleration was 10 m / s ^{2}.

(i) Without any calculation, estimate his acceleration a few seconds after leaving the aircraft.

Explain your value of acceleration in terms of forces.

Estimate .....

Explanation .....

.....

.....

.....

.....

.....

(3)

(ii) Without any calculation, estimate his acceleration 632 seconds after leaving the aircraft.

Explain your value of acceleration in terms of forces.

Estimate .....

Explanation .....

.....

.....

.....

.....

.....

(3)
(Total 9 marks)

6 A student carries out an investigation using a metre rule as a pendulum.

(a) **Diagram 1** shows a metre rule.

Diagram 1

(i) Draw, on **Diagram 1**, an **X** to show the position of the centre of mass of the rule.

(1)

(ii) State what is meant by the 'centre of mass of an object'.

.....

.....

(1)

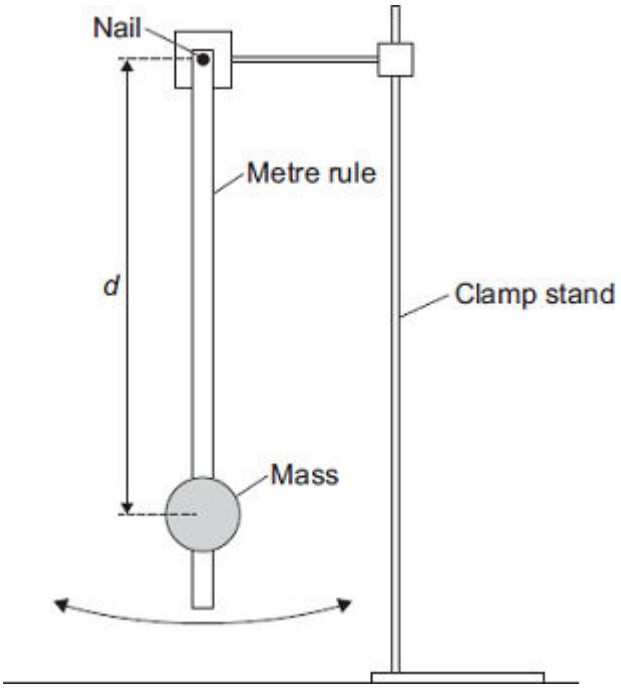
(b) The student taped a 100 g mass to a metre rule.

She set up the apparatus as shown in **Diagram 2**.

She suspended the metre rule from a nail through a hole close to one end, so she could use the metre rule as a pendulum.

The distance d is the distance between the nail and the 100 g mass.

Diagram 2



(i) Draw, on **Diagram 2**, a **Y** to show a possible position of the centre of mass of the pendulum.

(1)

(ii) The student carried out an investigation to find out how the time period of the pendulum varies with *d*.

Some of her results are shown in the table.

	Time for 10 swings in seconds				
***d* in cm**	**First test**	**Second test**	**Third test**	**Mean value**	**Mean time for 1 swing in seconds**
10.0	15.3	15.4	15.5	15.4	1.54
30.0	14.7	14.6	14.7	14.7	1.47
50.0	15.3	15.6	15.4	15.4	1.54
70.0	16.5	16.6	16.5		

Complete the table.

You may use the space below to show your working.

.....

.....

(3)

(iii) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Describe how the student would carry out the investigation to get the results in the table in part (ii).

You should include:

- any other apparatus required
- how she should use the apparatus
- how she could make it a fair test
- a risk assessment
- how she could make her results as accurate as possible.

.....

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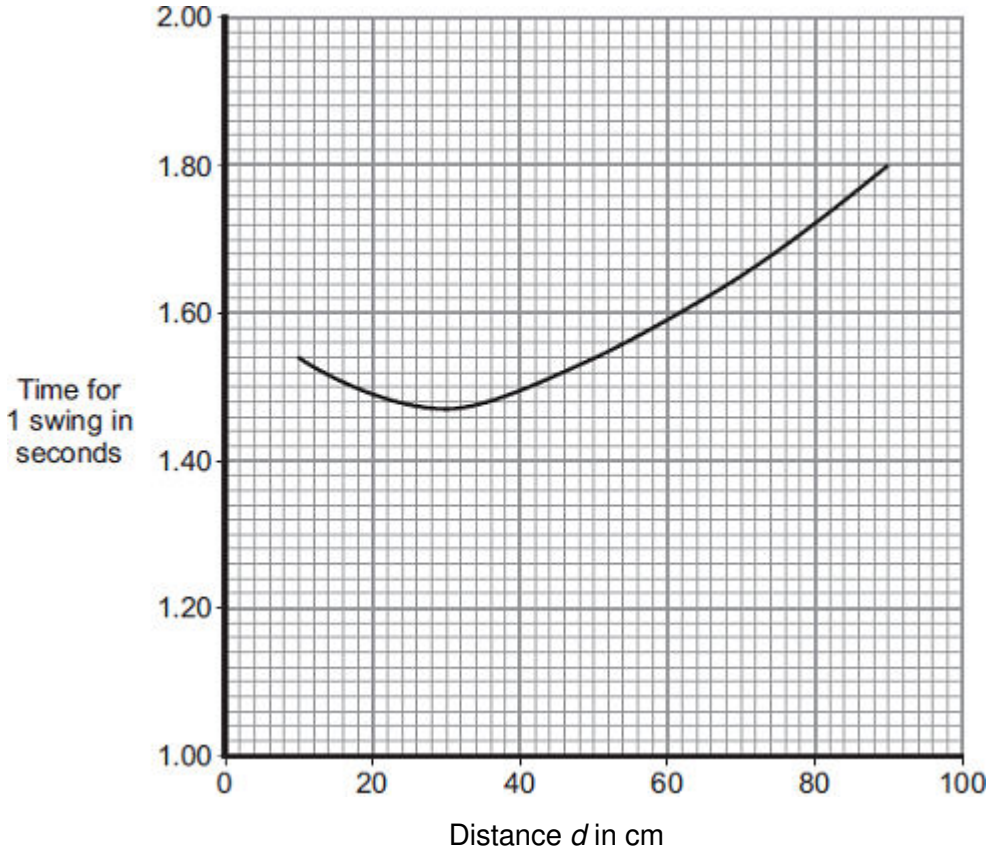
(6)

(c) A graph of the student's results is shown below.



(i) Describe the pattern shown by the graph.

.....

.....

.....

.....

(2)

(ii) The student thinks that the measurements of time for d = 10 cm might be anomalous, so she takes a fourth measurement.

Her four measurements are shown below.

15.3 s **15.4 s** **15.5 s** **15.3 s**

State whether you consider any of these measurements to be anomalous.

Justify your answer.

.....

.....

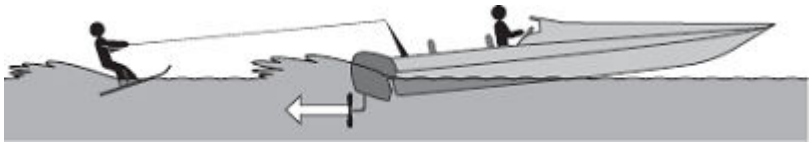
.....

.....

(2)

(Total 16 marks)

7 The diagram shows a boat pulling a water skier.



(a) The arrow represents the force on the water produced by the engine propeller. This force causes the boat to move.

Explain why.

.....

.....

.....

.....

(2)

(b) The boat accelerates at a constant rate in a straight line. This causes the velocity of the water skier to increase from 4.0 m/s to 16.0 m/s in 8.0 seconds.

(i) Calculate the acceleration of the water skier and give the unit.

.....

.....

.....

Acceleration = ...

(3)

(ii) The water skier has a mass of 68 kg.

Calculate the resultant force acting on the water skier while accelerating.

.....

.....

.....

Resultant force = ... N

(2)

(iii) Draw a ring around the correct answer to complete the sentence.

The force from the boat pulling the water skier forwards

will be | less than / the same as / greater than | the answer to part **(b)(ii)**.

Give the reason for your answer.

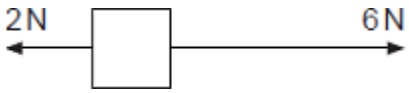
.....

.....

(2)

(Total 9 marks)

8 (a) The diagram shows two forces acting on an object.



What is the resultant force acting on the object?

Tick (✓) **one** box.

8 N to the right ☐

8 N to the left ☐

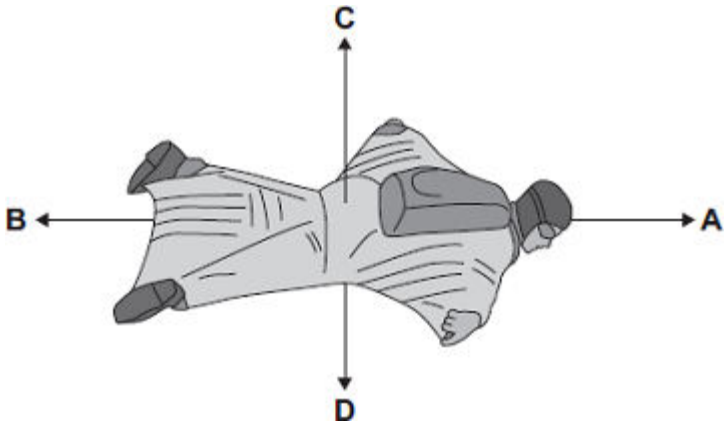
4 N to the right ☐

4 N to the left ☐

(1)

(b) BASE jumpers jump from very high buildings and mountains for sport.

The diagram shows the forces acting on a BASE jumper in flight.
The BASE jumper is wearing a wingsuit.



(i) Draw a ring around the correct answer in the box to complete each sentence.

The BASE jumper accelerates forwards when force **A** is

smaller than
equal to
bigger than

force **B**.

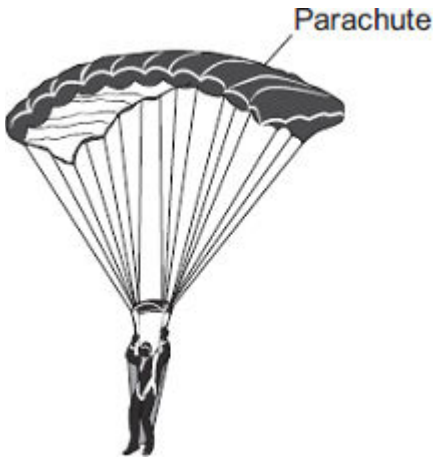
The BASE jumper falls with a constant speed when force **C** is

smaller than
equal to
bigger than

force **D**.

(2)

(ii) To land safely the BASE jumper opens a parachute.



What effect does opening the parachute have on the speed of the falling BASE jumper?

.....

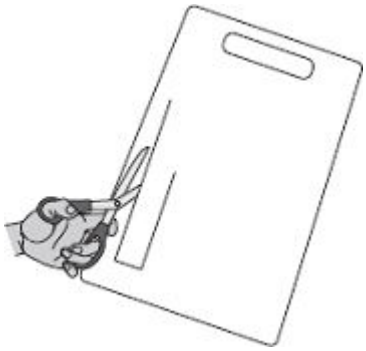
Give a reason for your answer.

.....

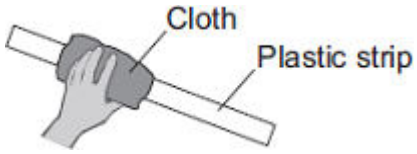
.....

(2)
(Total 5 marks)

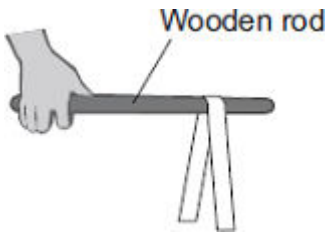
9 (a) A student uses some everyday items to investigate static electricity.



1 A strip of plastic is cut from a plastic carrier bag



2 The plastic strip is rubbed with a cloth



3 The plastic strip is hung over a wooden rod

(i) Draw a ring around the correct answer in the box to complete each sentence.

Rubbing the plastic strip with a cloth causes the strip to become negatively charged.

This happens because

electrons
neutrons
protons

move from the cloth onto the plastic strip.

The cloth is left with

a negative
a positive
zero

charge.

(2)

(ii) When the plastic strip is hung over the wooden rod, the two halves of the strip move equally away from each other.

What **two** conclusions should the student make about the forces acting on the two halves of the plastic strip?

1 .....

.....

2 .....

.....

(2)

(b) Electrical charges move more easily through some materials than through other materials.

Through which **one** of the following materials would an electrical charge move most easily?

Draw a ring around your answer.

aluminium **glass** **rubber**

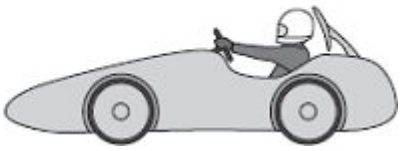
(1)

(Total 5 marks)

10 (a) Some students have designed and built an electric-powered go-kart. After testing, the students decided to make changes to the design of their go-kart.

First design **X**

Final design **Y**



The go-kart always had the same mass and used the same motor.

The change in shape from the first design (**X**) to the final design (**Y**) will affect the top speed of the go-kart.

Explain why.

.....

.....

.....

.....

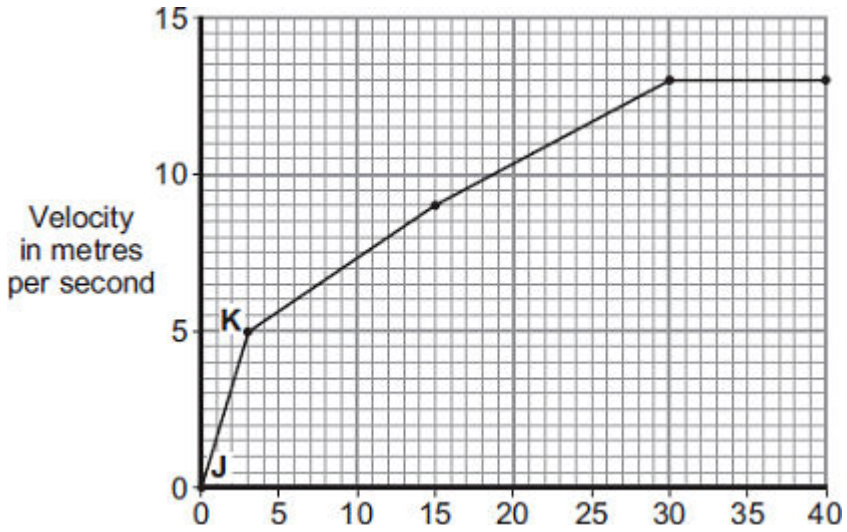
.....

.....

(3)

(b) The final design go-kart, **Y**, is entered into a race.

The graph shows how the velocity of the go-kart changes during the first 40 seconds of the race.



(i) Use the graph to calculate the acceleration of the go-kart between points **J** and **K**.

Give your answer to **two** significant figures.

.....

.....

.....

Acceleration = ... m/s^2

(2)

(ii) Use the graph to calculate the distance the go-kart travels between points **J** and **K**.

.....

.....

.....

Distance = ... m

(2)

(iii) What causes most of the resistive forces acting on the go-kart?

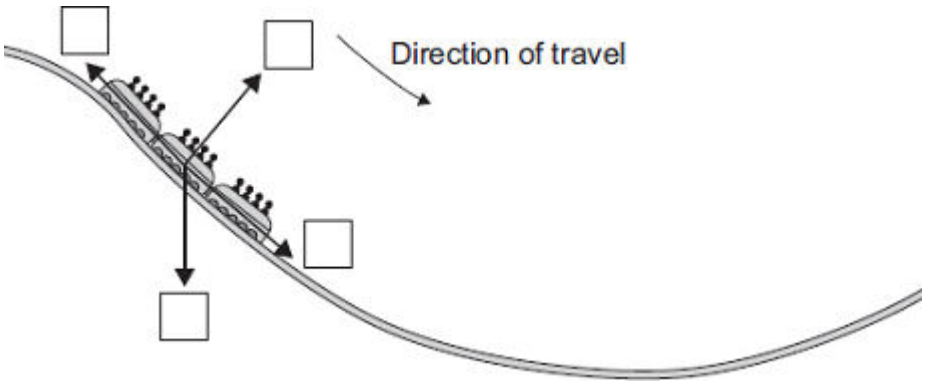
.....

(1)

(Total 8 marks)

11 The diagram shows the passenger train on part of a rollercoaster ride.

(a) Which arrow shows the direction of the resultant force acting on the passenger train?
Put a tick (✓) in the box next to your choice.



(1)

(b) For part of the ride, the maximum gravitational field strength acting on the passengers seems 3 times bigger than normal.

Normal gravitational field strength = 10 N/kg

(i) Calculate the maximum gravitational field strength that seems to act on the passengers during the ride.

.....

.....

Maximum gravitational field strength = ... N/kg

(1)

(ii) One of the passengers has a mass of 75 kg.

Calculate the maximum weight this passenger seems to have during the ride.

Show clearly how you work out your answer.

.....

.....

Maximum weight = ... N

(2)
(Total 4 marks)

12 The London Eye is one of the largest observation wheels in the world.

The passengers ride in capsules. Each capsule moves in a circular path and accelerates.

(a) Explain how the wheel can move at a steady speed and the capsules accelerate at the same time.

.....

.....

.....

(2)

(b) In which direction is the resultant force on each capsule?

.....

(1)

(c) The designers of the London Eye had to consider **three** factors which affect the resultant force described in part (b).

Two factors that increase the resultant force are:

- an increase in the speed of rotation
- an increase in the total mass of the wheel, the capsules and the passengers.

Name the other factor that affects the resultant force and state what effect it has on the resultant force.

.....

.....

(1)
(Total 4 marks)

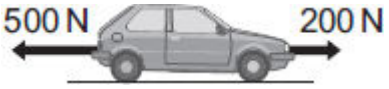
13 (a) The diagrams, **A**, **B** and **C**, show the horizontal forces acting on a **moving** car.

Draw a line to link each diagram to the description of the car's motion at the moment when the forces act.

Draw only **three** lines.

A

B

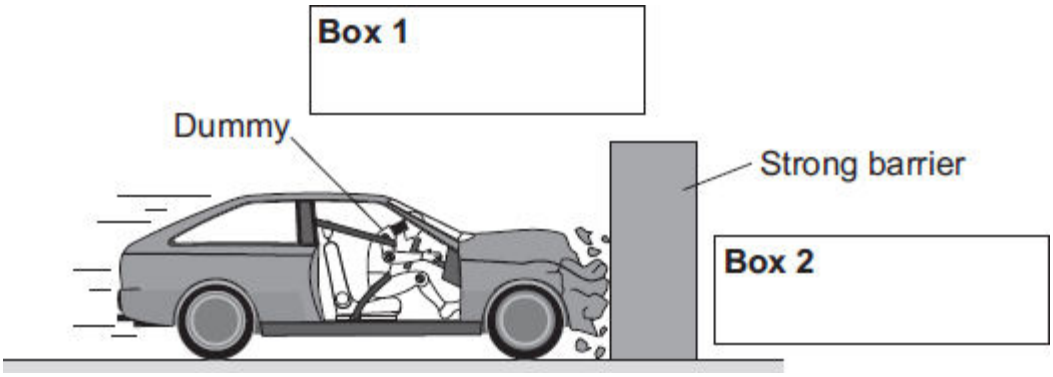


C

stationary
constant speed
slowing down
accelerating forwards

(3)

(b) The front crumple zone of a car is tested at a road traffic laboratory. This is done by using a remote control device to drive the car into a strong barrier. Electronic sensors are attached to a dummy inside the car.



(i) Draw an arrow in **Box 1** to show the direction of the force that the car exerts on the barrier.

(1)

(ii) Draw an arrow in **Box 2** to show the direction of the force that the barrier exerts on the car.

(1)

(iii) Complete the following by drawing a ring around the correct line in the box.

The car exerts a force of 5000 N on the barrier. The barrier does not move. The force

exerted by the barrier on the car will be | more than / equal to / less than | 5000 N.

(1)

(iv) Which **one** of the following gives the most likely reason for attaching electronic sensors to the dummy?

Put a tick (✓) in the box next to your answer.

To measure the speed of the car just before the impact. ☐

To measure the forces exerted on the dummy during the impact. ☐

To measure the distance the car travels during the impact. ☐

(1)
(Total 7 marks)

14 (a) A car is being driven along a straight road. The diagrams, **A**, **B** and **C**, show the horizontal forces acting on the moving car at three different points along the road.

Describe the motion of the car at each of the points, **A**, **B** and **C**.

A

.....

.....

B

.....

.....

C

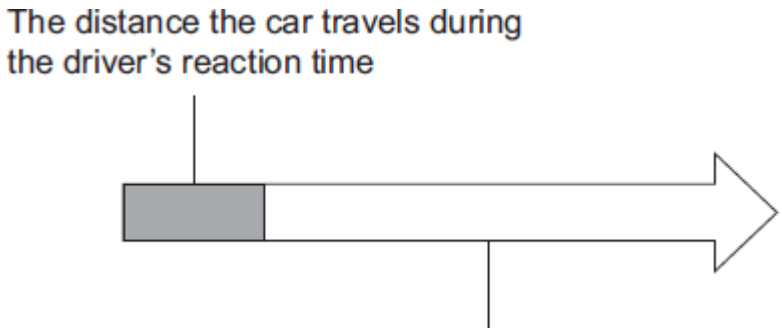
.....

.....

(3)

(b) The diagram below shows the stopping distance for a family car, in good condition, driven at 22 m/s on a dry road. The stopping distance has two parts.

(i) Complete the diagram below by adding an appropriate label to the second part of the stopping distance.



.....

.....

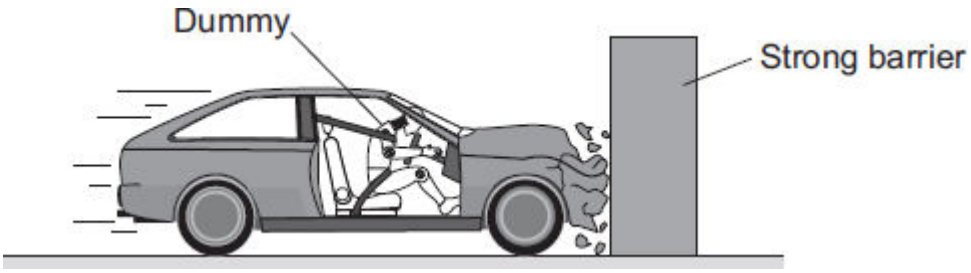
(1)

(ii) State **one** factor that changes both the first part **and** the second part of the stopping distance.

.....

(1)

(c) The front crumple zone of a car is tested at a road traffic laboratory. This is done by using a remote control device to drive the car into a strong barrier. Electronic sensors are attached to the dummy inside the car.



(i) At the point of collision, the car exerts a force of 5000 N on the barrier.

State the size and direction of the force exerted by the barrier on the car.

.....

.....

(1)

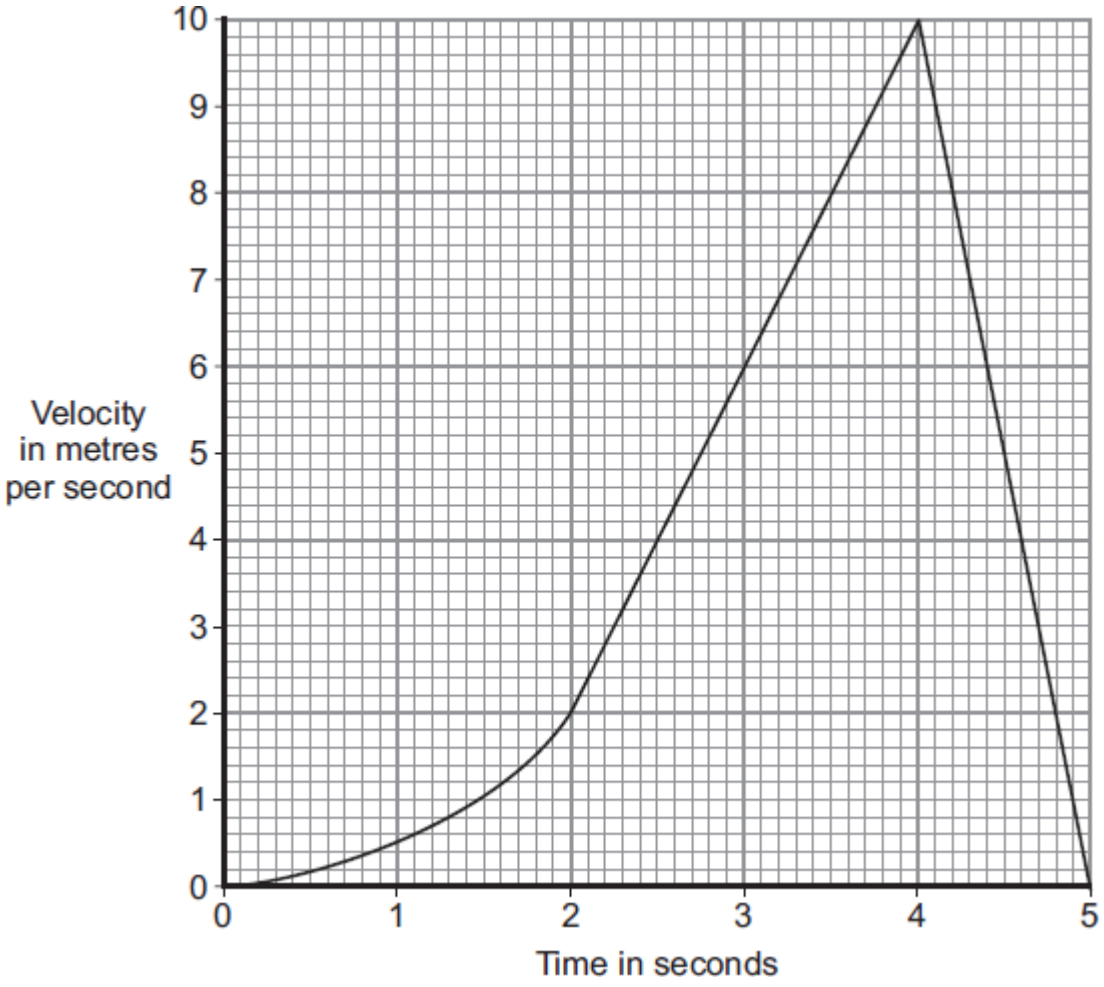
(ii) Suggest why the dummy is fitted with electronic sensors.

.....

.....

(1)

(iii) The graph shows how the velocity of the car changes during the test.



Use the graph to calculate the acceleration of the car just before the collision with the barrier.

Show clearly how you work out your answer, including how you use the graph, and give the unit.

.....

.....

.....

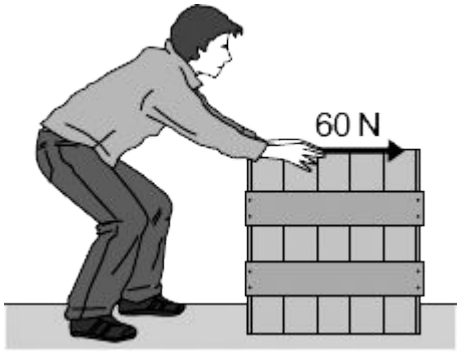
.....

Acceleration = ...

(3)

(Total 10 marks)

15 The diagram shows a worker using a constant force of 60 N to push a crate across the floor.



My Revision Notes AQA GCSE Physics for A* – C,
Steve Witney, © Philip Allan UK

(a) The crate moves at a constant speed in a straight line

(i) Draw an arrow on the diagram to show the direction of the friction force acting on the moving crate.

(1)

(ii) State the size of the friction force acting on the moving crate.

..... N

Give the reason for your answer.

.....

.....

(2)

(b) Calculate the work done by the worker to push the crate 28 metres.

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

Choose the unit from the list below.

joule **newton** **watt**

.....

.....

Work done = ...

(3)
(Total 6 marks)

16 (a) The diagram shows the forces acting on a parachutist in free fall.

The parachutist has a mass of 75 kg.

Calculate the weight of the parachutist.

gravitational field strength = 10 N/kg

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

.....

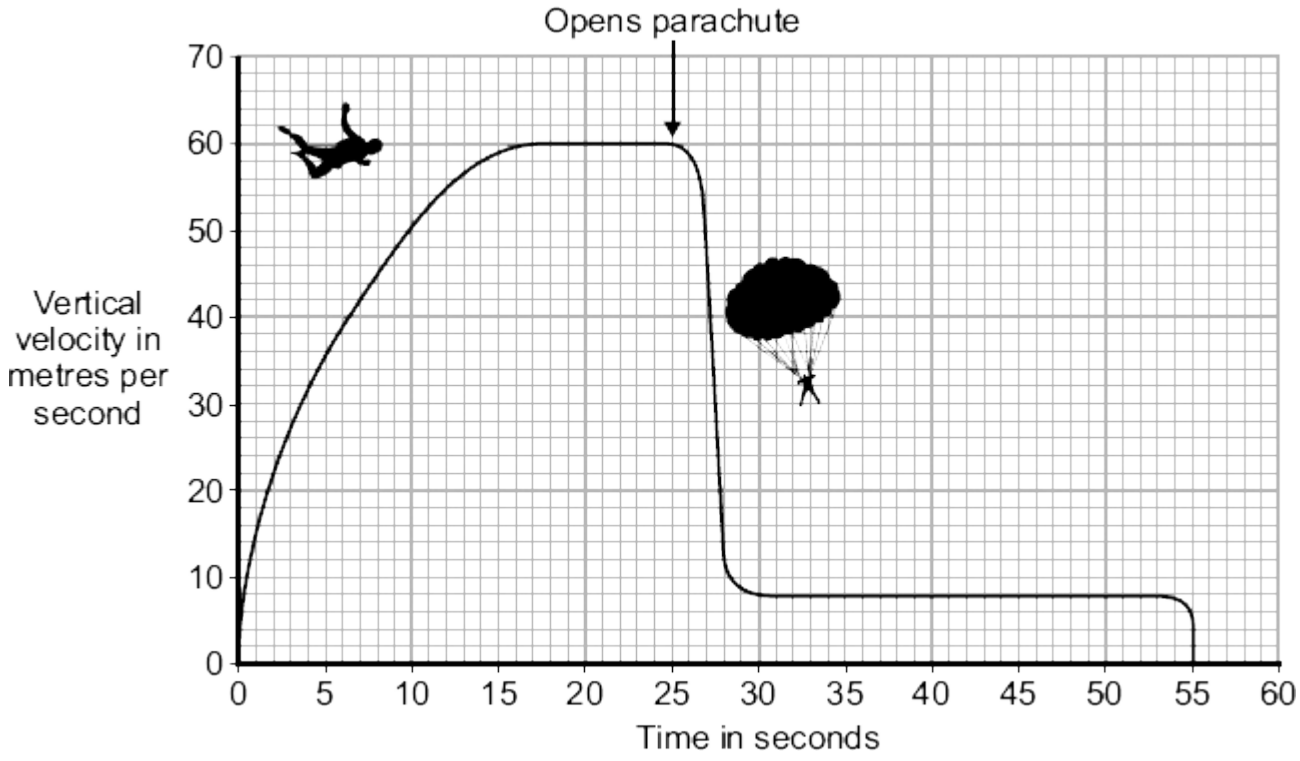
.....

Weight = ...

(3)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The graph shows how the vertical velocity of a parachutist changes from the moment the parachutist jumps from the aircraft until landing on the ground.



Using the idea of forces, explain why the parachutist reaches a terminal velocity and why opening the parachute reduces the terminal velocity.

.....

.....

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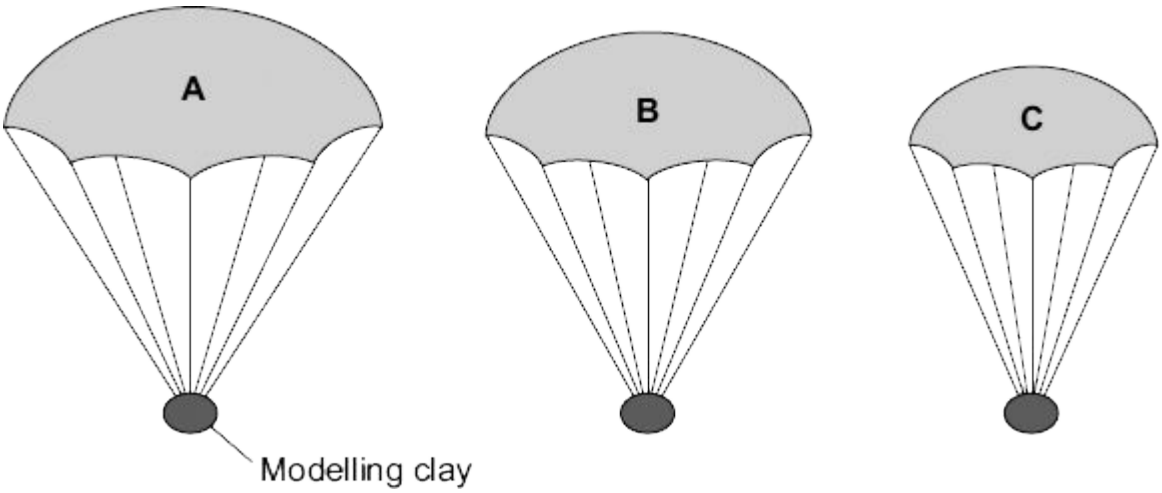
.....

(6)

(c) A student wrote the following hypothesis.

'*The larger the area of a parachute, the slower a parachutist falls.*'

To test this hypothesis the student made three model parachutes, **A**, **B** and **C**, from one large plastic bag. The student dropped each parachute from the same height and timed how long each parachute took to fall to the ground.



(i) The height that the student dropped the parachute from was a control variable.

Name **one** other control variable in this experiment.

.....

(1)

(ii) Use the student's hypothesis to predict which parachute, **A**, **B** or **C**, will hit the ground first.

Write your answer in the box. ☐

Give a reason for your answer.

.....

.....

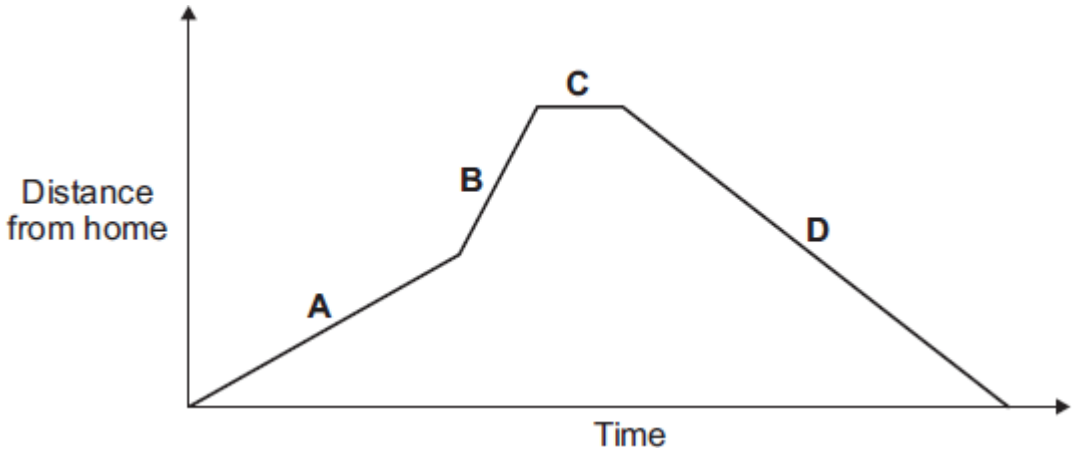
.....

(2)

(Total 12 marks)

17 (a) A person takes their dog for a walk.

The graph shows how the distance from their home changes with time.



Which part of the graph, **A**, **B**, **C** or **D**, shows them walking the fastest?

Write your answer in the box. ☐

Give the reason for your answer.

.....

.....

(2)

(b) During the walk, both the speed and the velocity of the person and the dog change.

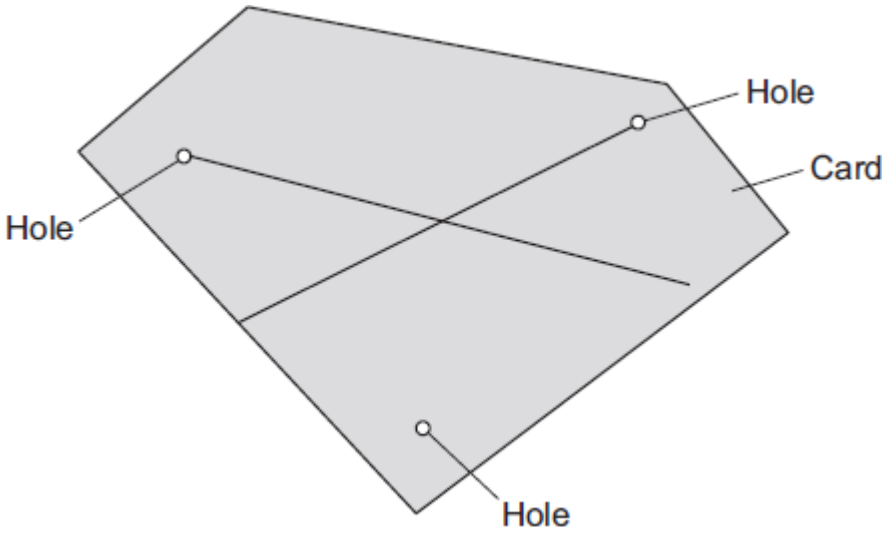
How is *velocity* different from *speed*?

.....

.....

(1)
(Total 3 marks)

18 A student was asked to find the centre of mass of a thin sheet of card. The diagram shows the result of the student's experiment. The student drew two lines onto the card. The centre of mass is where the two lines cross.



(a) Describe how the student found the correct positions to draw the **two** lines.

You may include a labelled diagram in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

(3)

(b) Explain how the student can check that the position found for the centre of mass is accurate.

.....

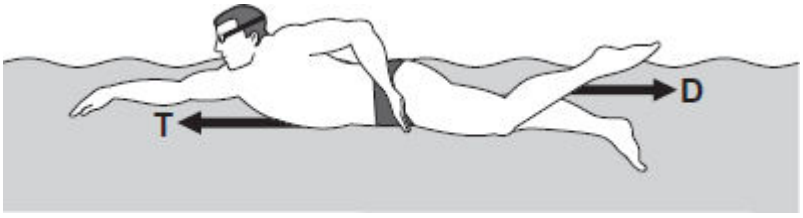
.....

.....

.....

(2)
(Total 5 marks)

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



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

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

..... N

(1)

(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.

.....

.....

Initial resultant force = ... N

(1)

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

Explain why.

.....

.....

.....

.....

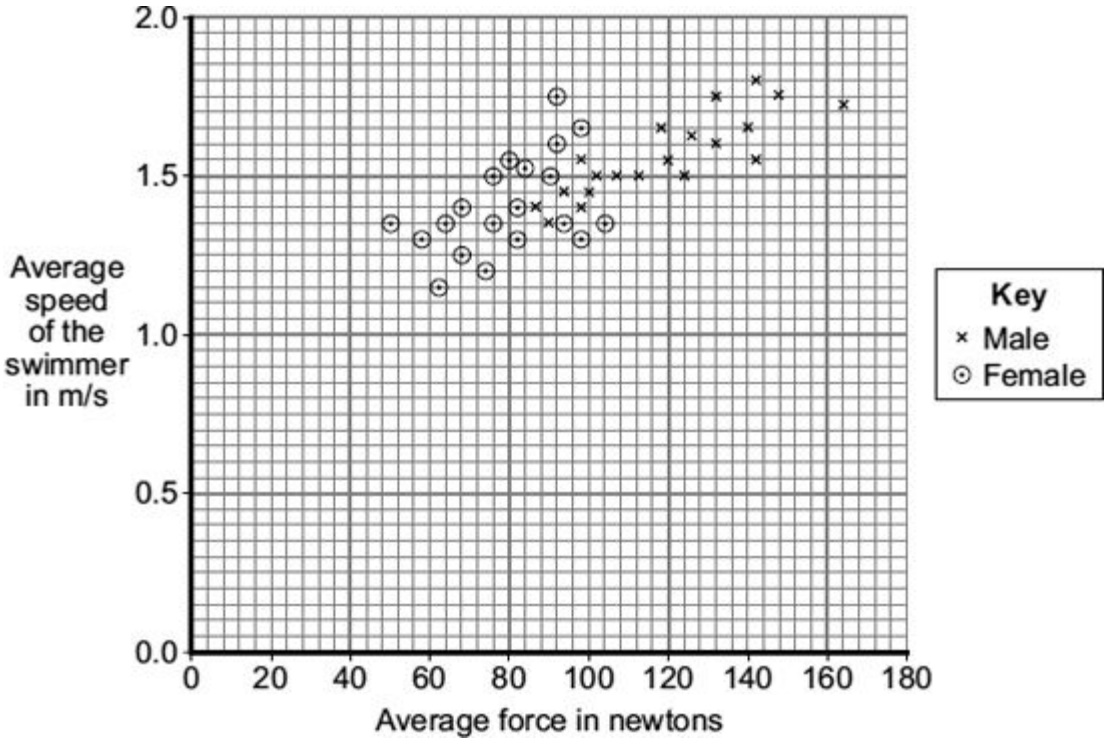
.....

.....

(3)

(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.



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

.....

(1)

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

.....

.....

.....

.....

(2)

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

.....

.....

(1)

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

.....

.....

(1)
(Total 10 marks)

20 The drawing shows a plastic toy which can stand on its feet.

(a) (i) Draw an **X** on the diagram so that the centre of the **X** marks the likely position of the centre of mass of the toy.

Photograph supplied by Hemera/Thinkstock

(1)

(ii) Explain the reason for your choice in part (a)(i).

.....

.....

(1)

(b) Suggest **two** ways in which the design of the toy could be altered to make the toy more stable.

1 .....

.....

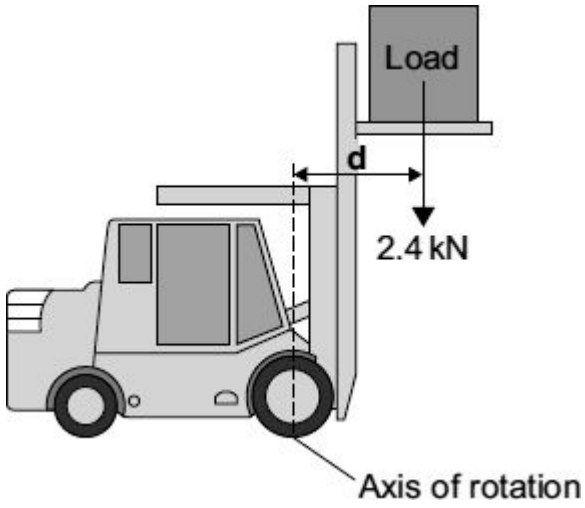
2 .....

.....

(2)

(Total 4 marks)

21 The diagram shows a fork-lift truck with a load of 2.4 kN. The clockwise moment caused by this load is 2880 Nm.



(a) Use the equation in the box to calculate the distance **d**.

moment = force × perpendicular distance from the line of action of the force to the axis of rotation

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

.....

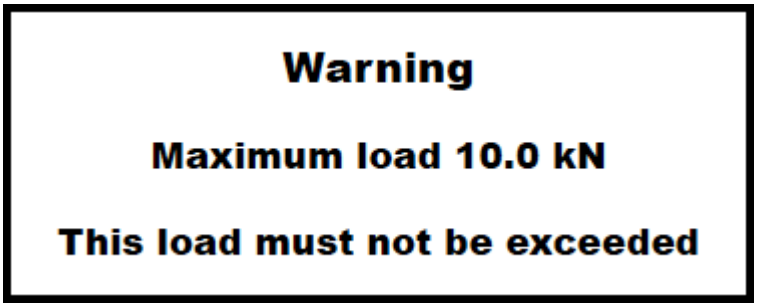
.....

.....

Distance **d** = ...

(3)

(b) This warning notice is in the driver's cab.



Explain in terms of moments why the maximum load must not be exceeded.

.....

.....

.....

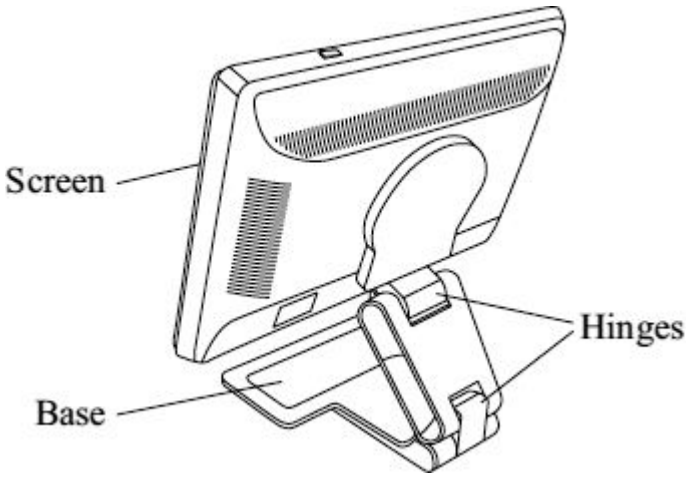
.....

.....

.....

(2)
(Total 5 marks)

22 The diagram shows a back view of a computer monitor.



(a) In normal use, the monitor is *stable.*

(i) Explain the meaning, in the above sentence, of the word *stable.*

.....

.....

.....

.....

(2)

(ii) State the relationship between the total clockwise moment and the total anticlockwise moment about any axis of the monitor when it is stable.

.....

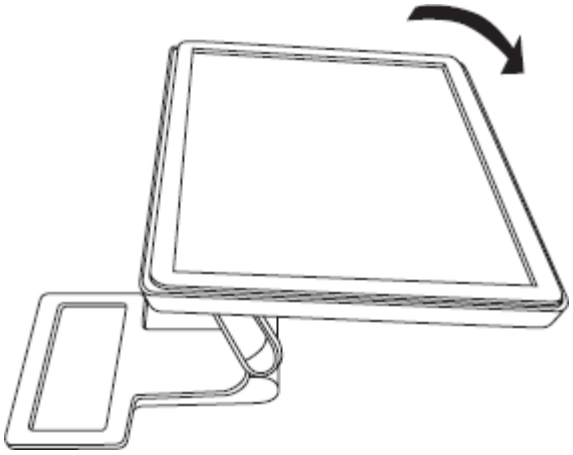
.....

(1)

(b) The instruction booklet explains that the screen can be tilted.
It also includes a warning.

Caution

The monitor can tip over if the screen is tilted too far back.



Explain why the monitor will tip over if the screen is tilted too far back.

Include the words *centre of mass, weight* and *moment* in your explanation.

.....

.....

.....

.....

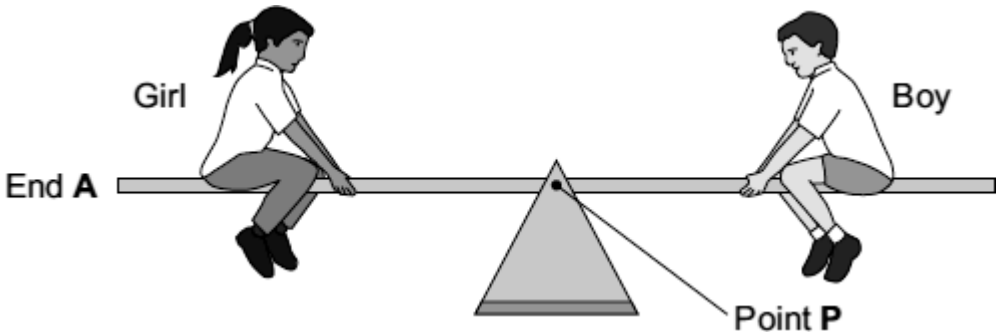
.....

.....

(3)
(Total 6 marks)

23 Two children visit a playground.

(a) The diagram shows them on a see-saw. The see-saw is balanced.



Complete the following sentences by drawing a ring around the correct word or line in the box.

(i) The turning effect of the girl's weight is called her

force.
load.
moment.

(1)

(ii) Point **P** is the axis of

balance
rotation
turning

of the see-saw.

(1)

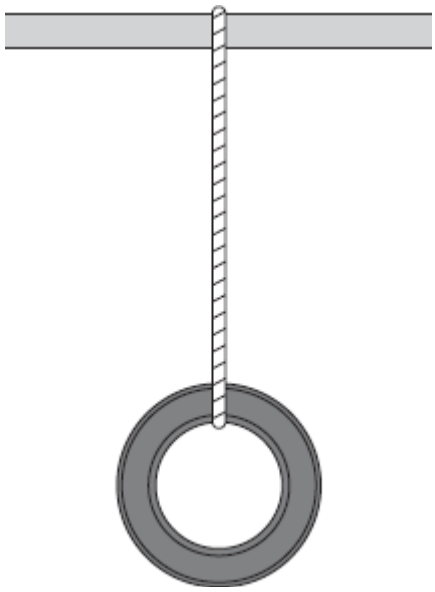
(iii) To make end **A** of the see-saw go up,

the boy moves nearer to point **P**.
the girl moves nearer to point **P**.
the girl moves nearer to end **A**.

(1)

(b) In another part of the playground, a tyre has been suspended from a bar.

(i) Draw an **X** on the diagram so that the centre of the **X** marks the centre of mass of the tyre.



(1)

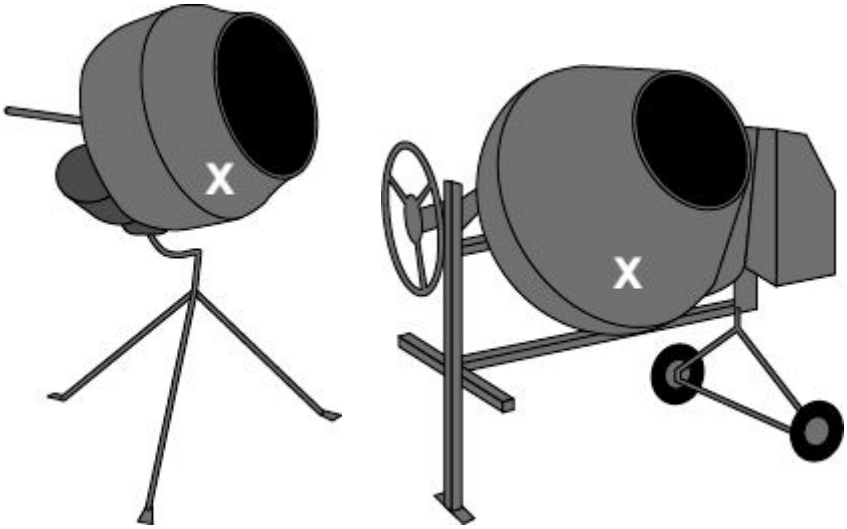
(ii) Complete the sentence by using the correct word or phrase from the box.

above	**below**	**to the left of**	**to the right of**

If the suspended tyre is pushed, it will come to rest with its centre of mass directly ..... the point of suspension.

(1)
(Total 5 marks)

24 The diagrams show two concrete mixers.



Concrete mixer **A** Concrete mixer **B**

On each diagram, the centre of the white **X** marks the centre of mass of the concrete mixer and its contents.

(a) Complete the sentence to explain what the term *centre of mass* means.

The centre of mass of a concrete mixer and its contents is .....

.....

.....

(1)

(b) Both diagrams are drawn to the same scale.

Concrete mixer **B** is more stable than concrete mixer **A**.

The two features which make concrete mixer **B** more stable are:

1 .....

.....

2 .....

.....

(2)

(c) Use the terms 'line of action of the weight' and 'resultant moment' to explain why a stable concrete mixer does not fall over when it is given a small push.

.....

.....

.....

.....

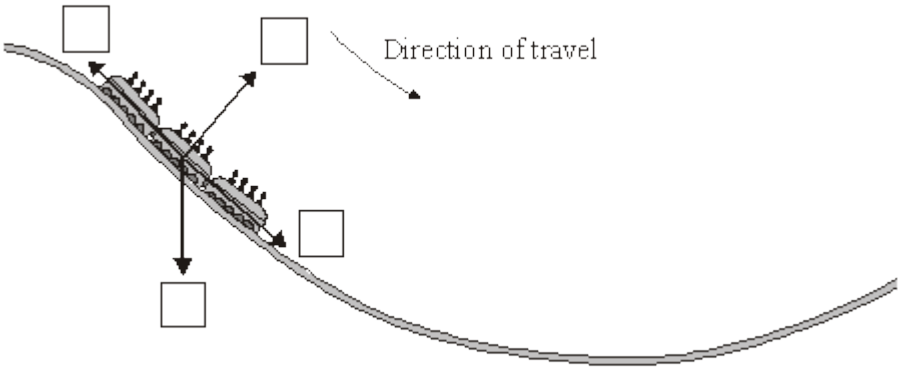
.....

(2)
(Total 5 marks)

25 The diagram shows the passenger train on part of a rollercoaster ride.

(a) Which arrow shows the direction of the resultant force acting on the passenger train?

Put a tick (✓) in the box next to your choice.



(1)

(b) At the bottom of the slope, the passengers in the train all have the same speed but they each have a different kinetic energy.

Why is the kinetic energy of each passenger different?

.....

.....

(1)

(c) For part of the ride, the maximum gravitational field strength acting on the passengers seems 3 times bigger than normal.

Normal gravitational field strength = 9.8 N/kg

(i) Calculate the maximum gravitational field strength that seems to act on the passengers during the ride.

.....

.....

Maximum gravitational field strength = ... N/kg

(1)

(ii) One of the passengers has a mass of 80 kg.

Calculate the maximum weight this passenger seems to have during the ride.

Show clearly how you work out your answer.

.....

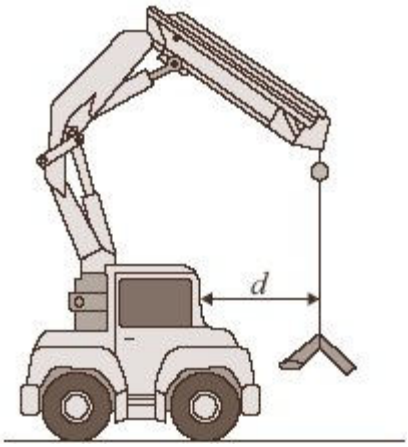
.....

Maximum weight = ... N

(2)

(Total 5 marks)

26 The diagram shows a small mobile crane. It is used on a building site.



The distance, d, is measured to the front of the cab.

The table shows information from the crane driver's handbook.

Load in kilonewtons (kN)	**Maximum safe distance, *d*, in metres (m)**
10	6.0
15	4.0
24	2.5
40	1.5
60	1.0

(a) What is the relationship between the load and the maximum safe distance?

.....

.....

.....

(2)

(b) The crane driver studies the handbook and comes to the conclusion that a load of 30 kN would be safe at a distance, *d*, of 2.0 metres.

Is the driver correct?

Explain your answer.

.....

.....

.....

.....

(2)

(c) What is the danger if the driver does not follow the safety instructions?

.....

.....

(1)

(d) How should the data in the table have been obtained?

Put a tick (✓) in the box next to your answer.

average results from an opinion poll of mobile crane drivers	☐
copied from a handbook for a similar crane	☐
results of experiments on a model mobile crane	☐
results of experiments on this mobile crane	☐

(1)
(Total 6 marks)

27 The diagram shows an adult and a child pushing a loaded shopping trolley.

(a) (i) What is the *total force* on the trolley due to the adult and child?

.....

(1)

(ii) Which **one** of the terms in the box means the same as *total force*?

Draw a ring around your answer.

answer force	**mean force**	**resultant force**

(1)

(iii) The trolley is pushed at a constant speed for 80 metres.

Calculate the work done to push the trolley 80 metres.

Show clearly how you work out your answer.

.....

.....

Work done = ...

(2)

(b) Complete the following sentences by drawing a ring around the correct word in each of the boxes.

(i) The unit of work done is the

joule
newton
watt

.

(1)

(ii) Most of the work done to push the trolley is transformed into

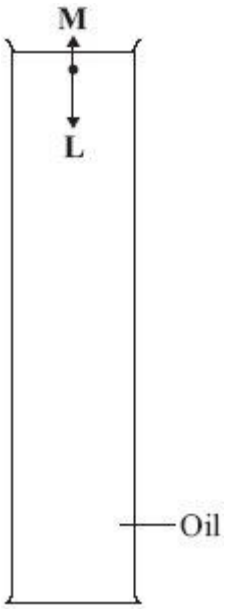
heat
light
sound

.

(1)

(Total 6 marks)

28 (a) The diagram shows a steel ball-bearing falling through a tube of oil. The forces, **L** and **M**, act on the ball-bearing.

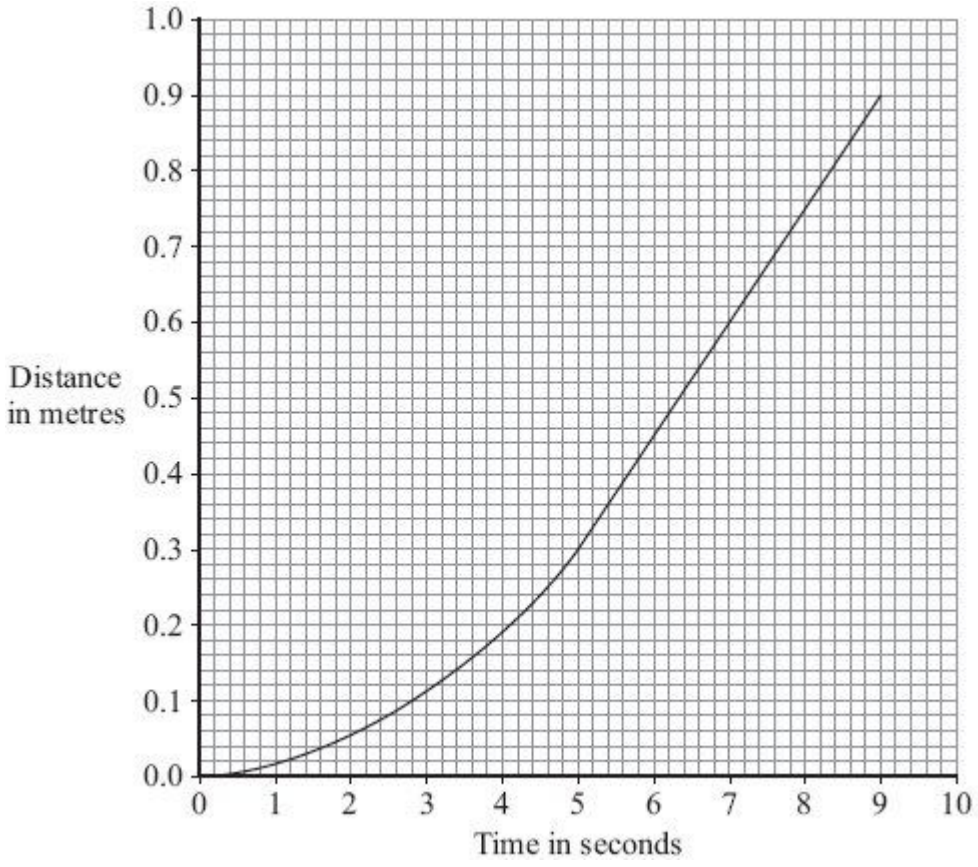


What causes force **L**?

.....

(1)

(b) The distance – time graph represents the motion of the ball-bearing as it falls through the oil.



(i) Explain, in terms of the forces, **L** and **M**, why the ball-bearing accelerates at first but then falls at constant speed.

.....

.....

.....

.....

.....

.....

(3)

(ii) What name is given to the constant speed reached by the falling ball-bearing?

.....

(1)

(iii) Calculate the constant speed reached by the ball-bearing.

Show clearly how you use the graph to work out your answer.

.....

.....

.....

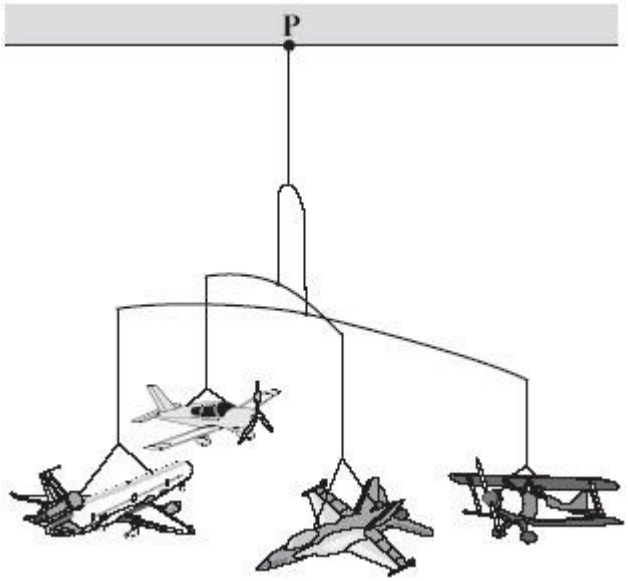
Speed = ... m/s

(2)

(Total 7 marks)

29 (a) The diagram shows a child's mobile. The mobile hangs from point **P** on the ceiling of the child's bedroom.

(i) Mark the position of the centre of mass of the mobile by drawing a letter **X** on the diagram. Do this so that the centre of the **X** marks the centre of mass of the mobile.



(1)

(ii) Explain why you have chosen this position for your letter **X**.

.....

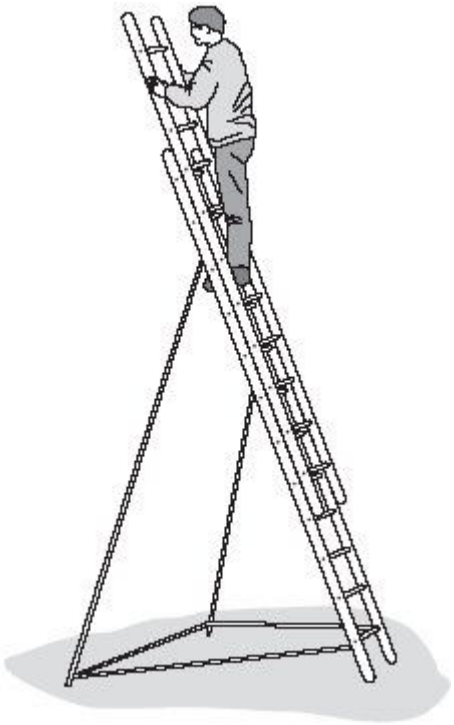
.....

.....

.....

(2)

(b) The diagram shows a device which helps to prevent a ladder from falling over.



Use the term *centre of mass* to explain why the ladder, in the situation shown, is unlikely to topple over.
You may add to the diagram to illustrate your explanation.

.....

.....

.....

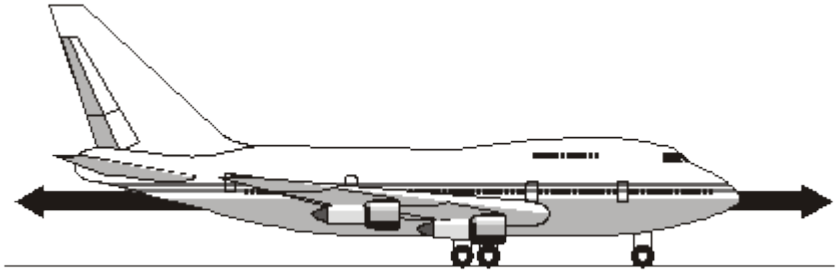
.....

.....

.....

(3)
(Total 6 marks)

30 (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*?

.....

.....

(1)

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

.....

.....

(1)

(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.

Calculate the maximum acceleration of the aircraft.

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

.....

.....

.....

Acceleration = ...

(3)

(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.

.....

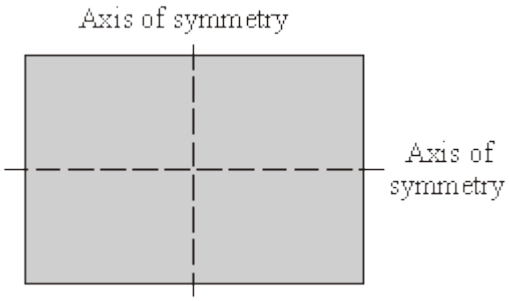
.....

.....

.....

(2)
(Total 7 marks)

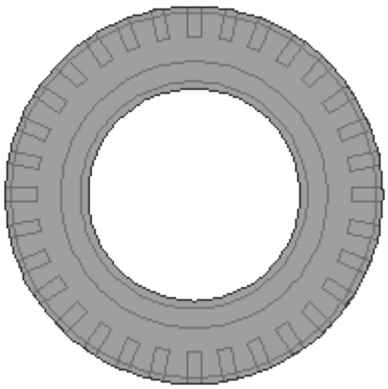
31 (a) The diagram shows a rectangle made out of a sheet of cardboard.



Draw an **X** on the diagram so that the centre of the **X** is at the centre of mass of the rectangle.

(1)

(b) The drawing shows a car tyre.



(i) Where is the centre of mass of the tyre?

.....

(1)

(ii) Explain your answer to (b)(i).

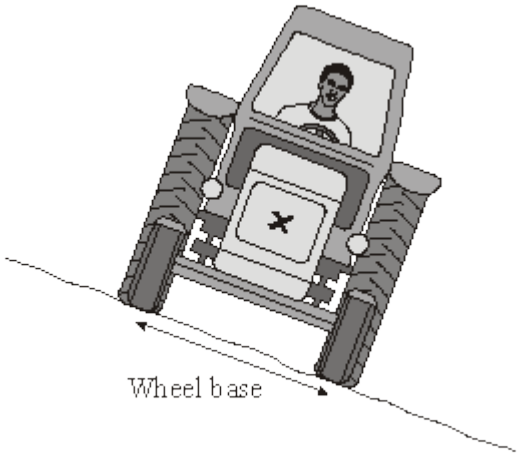
.....

.....

(1)
(Total 3 marks)

32 Tractors are often used on sloping fields, so stability is important in their design.

On the diagram, the centre of the **X** marks the centre of mass of the tractor.



(a) Explain why the tractor has **not** toppled over. You may add to the diagram to help you to explain.

.....

.....

.....

.....

.....

.....

(3)

(b) Give **two** features of the tractor which affect its stability and state how each feature could be changed to increase the tractor's stability.

Feature 1 .....

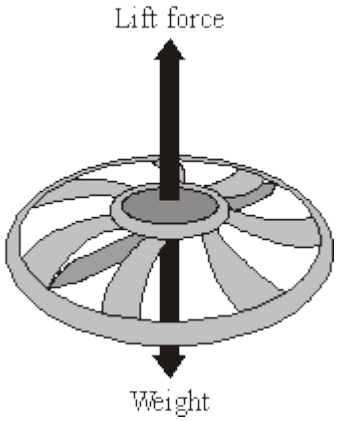
.....

Feature 2 .....

.....

(2)
(Total 5 marks)

33 The diagram shows the forces on a small, radio-controlled, flying toy.



(a) (i) The mass of the toy is 0.06 kg.
Gravitational field strength = 10 N/kg

Calculate the weight of the toy.

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

.....

.....

Weight = ...

(3)

(ii) Complete the following sentence by drawing a ring around the correct line in the box.

When the toy is hovering stationary in mid-air, the lift force is

bigger than
the same as
smaller than

the weight of the toy.

(1)

(b) When the motor inside the toy is switched off, the toy starts to *accelerate* downwards.

(i) What does the word *accelerate* mean?

.....

(1)

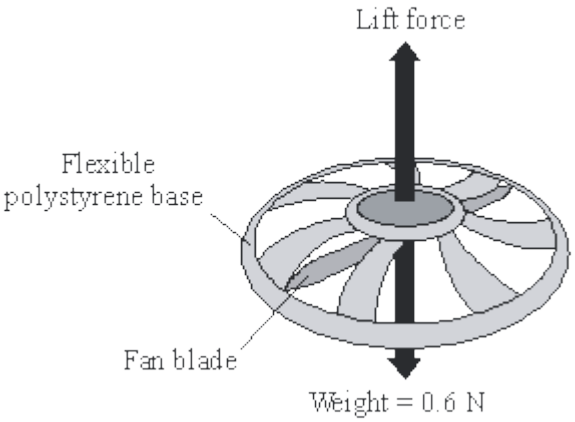
(ii) What is the direction of the resultant force on the falling toy?

.....

(1)

(Total 6 marks)

34 The diagram shows a small, radio-controlled, flying toy. A fan inside the toy pushes air downwards creating the lift force on the toy.



When the toy is hovering in mid-air, the fan is pushing 1.5 kg of air downwards every 10 seconds. Before the toy is switched on, the air is stationary.

(a) Use the equation in the box to calculate the velocity of the air when the toy is hovering.

$$\text{force} = \frac{\text{change in momentum}}{\text{time taken for the change}}$$

Show clearly how you work out your answer.

.....

.....

.....

Velocity = ... m/s

(3)

(b) Explain why the toy accelerates upwards when the fan rotates faster.

.....

.....

.....

.....

(2)

(c) The toy is not easy to control so it often falls to the ground.

Explain how the flexible polystyrene base helps to protect the toy from being damaged when it crashes into the ground.

.....

.....

.....

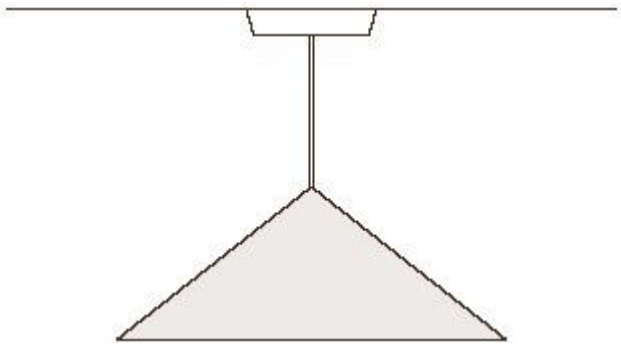
.....

.....

.....

(3)
(Total 8 marks)

35 (a) The diagram shows a lampshade hanging from the ceiling. Draw an **X** on the diagram so that the centre of the **X** marks the centre of the mass of the lampshade.



(1)

(a) Complete the sentence using the correct word or phrase from the box.

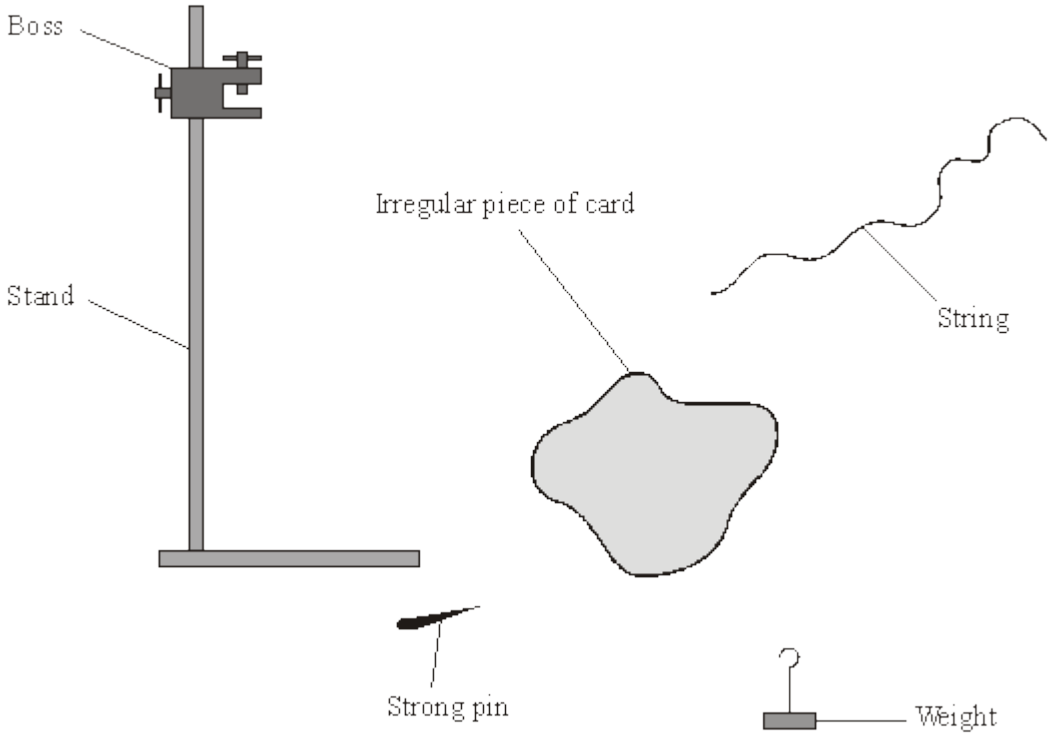
above	**below**	**to the left of**	**to the right of**

A suspended object will come to rest with its centre of mass directly

..... the point of suspension.

(1)

(c) The diagrams show equipment that a student uses to find the centre of mass of a thin sheet of card.



Arrange these sentences in the correct order to describe how the student can find the centre of mass of the card.

The sequence starts with sentence **D** and finishes with sentence **E**.

A A line is drawn on the card marking the position of the string.

B The pin is put through one of the holes in the card and held in the boss.

C This is repeated using the other hole.

D Two holes are made in the card with each hole near to the edge of the card.

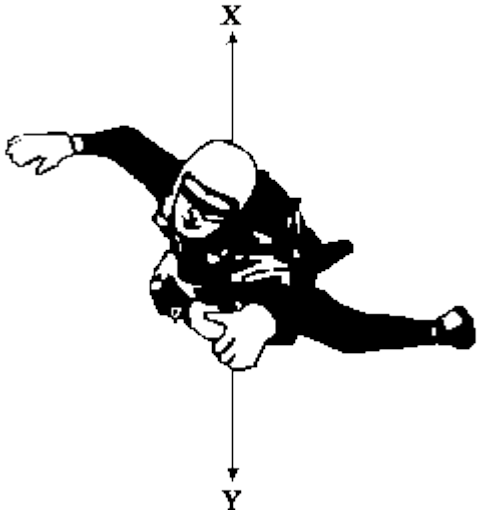
E The centre of mass is where the lines cross on the card.

F The weight is tied to the string and then the string is hung from the pin.

D					**E**

(3)
(Total 5 marks)

36 The diagram shows a sky-diver in free fall. Two forces, **X** and **Y**, act on the sky-diver.



(a) Complete these sentences by crossing out the **two** lines in each box that are wrong.

(i) Force **X** is caused by

friction
gravity
weight

. **(1)**

(ii) Force **Y** is caused by

air resistance
friction
gravity

. **(1)**

(b) The size of force **X** changes as the sky-diver falls. Describe the motion of the sky-diver when:

(i) force **X** is smaller than force **Y**,

.....

.....

(2)

(ii) force **X** is equal to force **Y**.

.....

.....

(1)

(Total 5 marks)

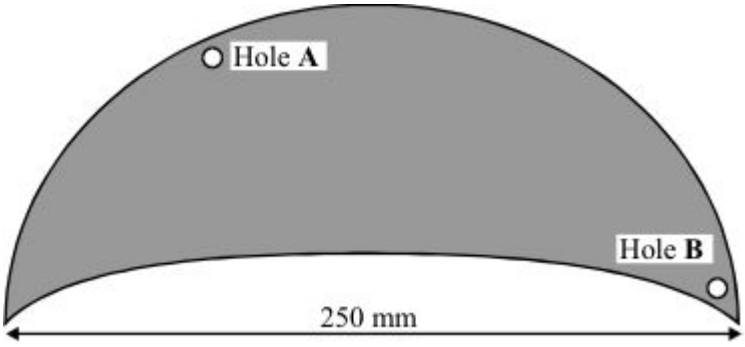
37 (a) Every object has a *centre of mass*. What is meant by the *centre of mass*?

.....

.....

(1)

(b) The drawing shows a thin sheet of plastic. The sheet is 250 mm wide. Two holes, each with a radius of 2 mm, have been drilled through the sheet.



Describe how you could use:

- a clamp and stand
- a steel rod 100 mm long and with a radius of l mm
- a weight on a thin piece of string (= a plumb line)
- a ruler
- a pen which will write on the plastic sheet

to find the centre of mass of the plastic sheet.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

.....

.....

.....

.....

.....

.....

.....

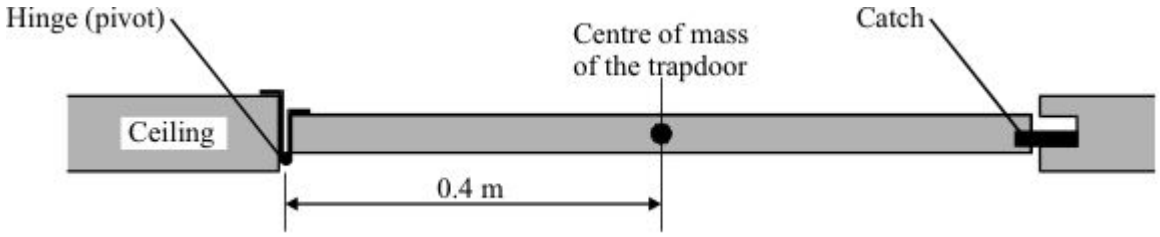
.....

.....

.....

(5)

(c) There is a trapdoor in the ceiling of a house.
The trapdoor weighs 44 N.
The drawing shows a side view of the trapdoor.



(i) Complete the **three** spaces to give the equation which is used to calculate the turning effect of a force.

..... = ... × perpendicular between .....
line of action and pivot

(1)

(ii) Calculate the turning effect, about the hinge, due to the weight of the trapdoor.

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

.....

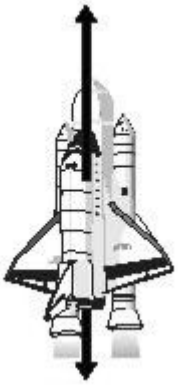
.....

Turning effect = ...

(3)
(Total 10 marks)

38 (a) The arrows in the diagram represent the size and direction of the forces on a space shuttle, fuel tank and booster rockets one second after launch. The longer the arrow the bigger the force.

Thrust force



Weight of shuttle, fuel tanks and booster rockets plus air resistance

(i) Describe the upward motion of the space shuttle one second after launch.

.....

(1)

(ii) By the time it moves out of the Earth's atmosphere, the total weight of the space shuttle, fuel tank and booster rockets has decreased and so has the air resistance.

How does this change the motion of the space shuttle? (Assume the thrust force does not change).

.....

(1)

(b) The space shuttle takes 9 minutes to reach its orbital velocity of 8100 m/s.

(i) Write down the equation that links acceleration, change in velocity and time taken.

.....

(1)

(ii) Calculate, in m/s^2, the average acceleration of the space shuttle during the first 9 minutes of its flight. Show clearly how you work out your answer.

.....

.....

average acceleration = ... m/s^2

(2)

(iii) How is the velocity of an object different from the speed of an object?

.....

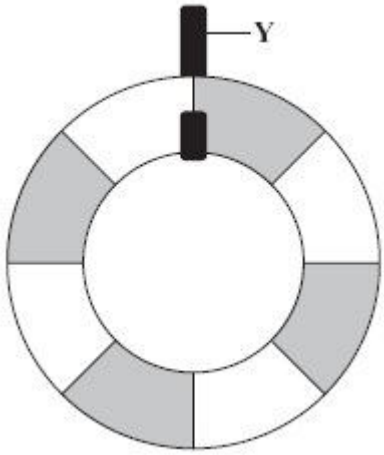
.....

(1)

(Total 6 marks)

39 (a) The diagram shows a lifebelt. It is hanging freely from hook **Y**.

(i) On the diagram, mark with an **X** the point where you think the centre of mass of the lifebelt will be.



(1)

(ii) Explain why you have chosen this point.

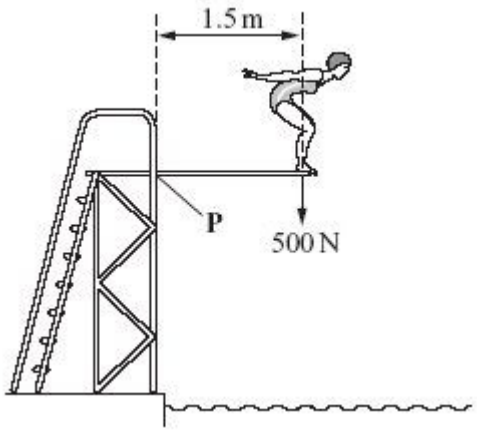
.....

.....

.....

(2)

(b) The drawing shows Susan on a diving board. She is 1.5 metres from point **P** and she weighs 500 N.



Calculate her moment (turning effect) about point **P**.
Show clearly how you work out your answer and give the unit.

.....

.....

Moment about **P** = ...

(3)

(c) Susan has a case with wheels.

When she packs this case, she puts the heaviest items at the end where the wheels are. This means that the heaviest items are less likely to crush the other contents and it helps her to find things when she opens the case.

Explain another advantage of packing her case in this way.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

.....

.....

.....

.....

.....

.....

.....

.....

(4)
(Total 10 marks)

40 (a) Two skydivers jump from a plane. Each holds a different position in the air.

A

B

Adapted from Progress with Physics by Nick England, reproduced by permission of Hodder Arnold

Complete the following sentence.

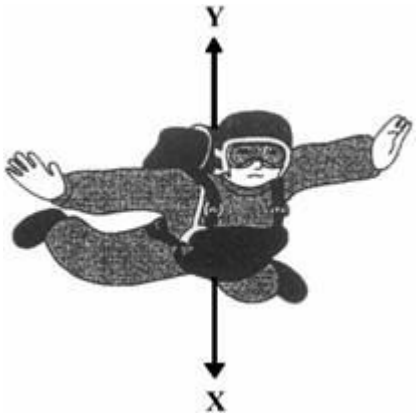
Skydiver ..... will fall faster because.....

.....

.....

(2)

The diagram shows the direction of the forces acting on one of the skydivers.



Adapted from Progress with Physics by Nick England, reproduced by permission of Hodder Arnold

(b) In the following sentences, cross out in each box the **two** lines that are wrong.

(i) Force **X** is caused by

air resistance
friction
gravity

(1)

(ii) Force **Y** is caused by

air resistance
gravity
weight

(1)

(iii) When force **X** is bigger than force **Y**, the speed of the skydiver will

go up
stay the same
go down

(1)

(iv) After the parachute opens, force **X**

goes up
stays the same
goes down

(1)

(c) How does the area of an opened parachute affect the size of force **Y**?

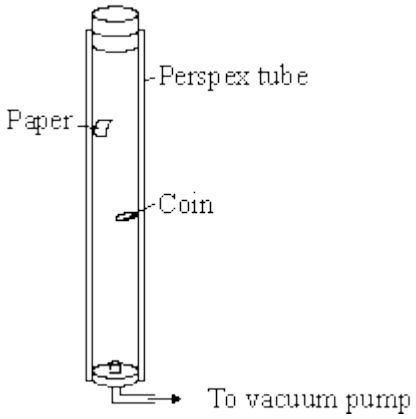
.....

.....

(1)

(Total 7 marks)

41 The apparatus shown is used to compare the motion of a coin with the motion of a piece of paper as they both fall.



(a) When the tube is filled with air the coin falls faster than the piece of paper. Why?

.....

.....

(1)

(b) The air in the tube is removed by the vacuum pump. The tube is turned upside down. State **two** ways in which the motion of the coin and piece of paper will change compared to when there was air in the tube.

1 .....

.....

.....

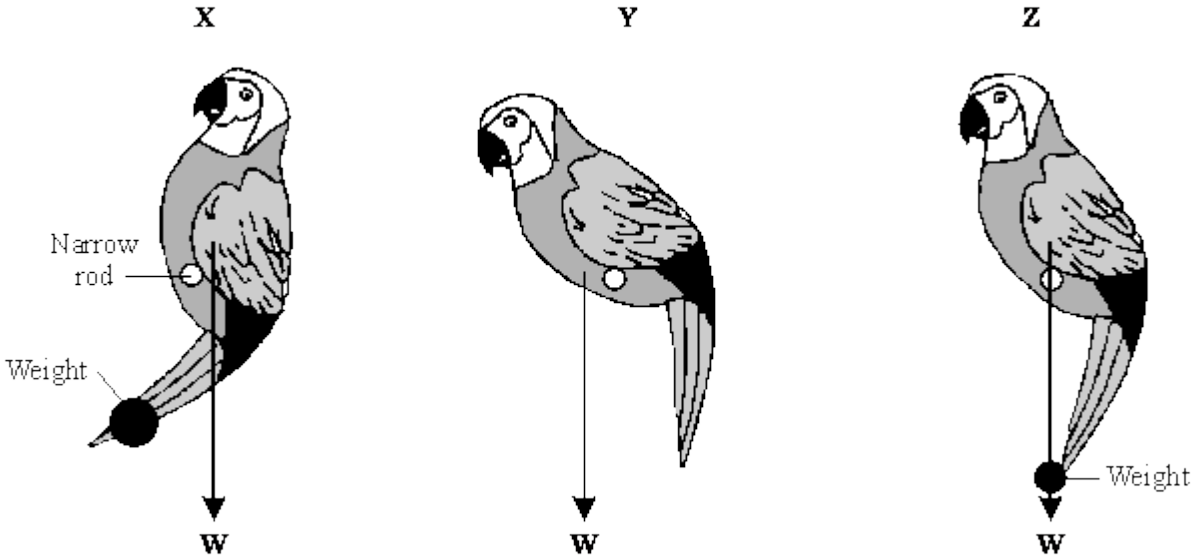
2 .....

.....

.....

(2)
(Total 3 marks)

42 (a) The diagram shows three similar toys. Each toy should be able to balance on a narrow rod. The arrows show the direction in which the weight of the toy acts.



Only one of the toys balances on the rod, the other two fall over. Which **one** of the toys is balanced? Explain the reason for your choice.

.....

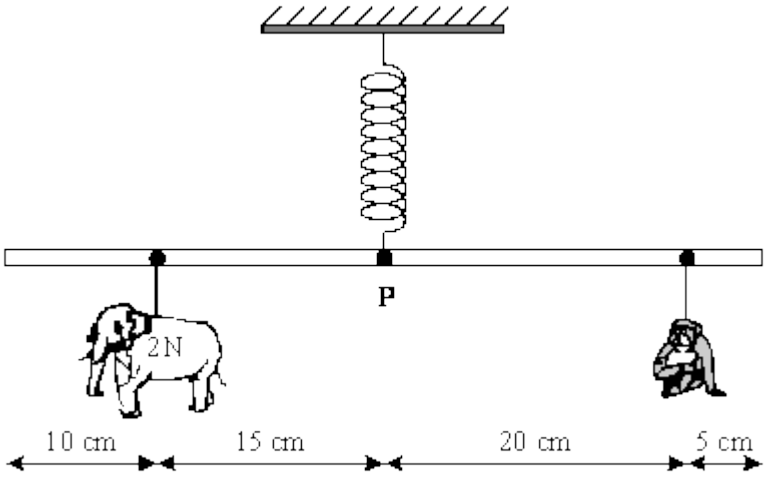
.....

.....

.....

(3)

(b) The diagram shows a simple toy. Different animal shapes can be positioned so that the 50 cm rod balances horizontally.



(i) Calculate the moment exerted by the elephant shape of weight 2N about the pivot **P**. Show clearly how you work out your answer and give the unit.

.....

.....

Moment = ...

(3)

(ii) Use the following relationship to calculate the weight of the monkey shape.

total clockwise moment = total anticlockwise moment

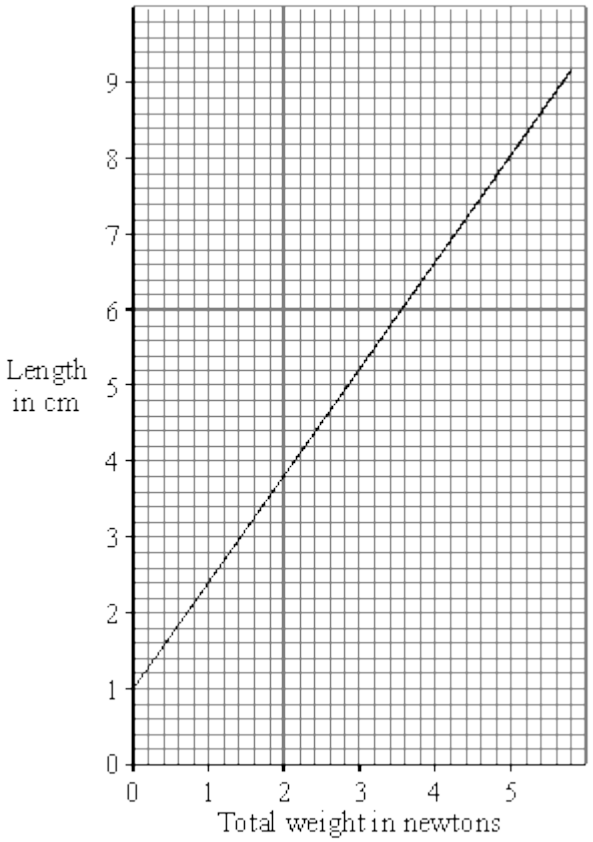
.....

.....

Weight = ... N

(2)

(c) The graph shows how the length of the spring changes as the total weight of the different animal shapes change.



Use the graph to find how much the spring extends when the elephant shape and the monkey shape are hung from the rod. Show how you get your answer.

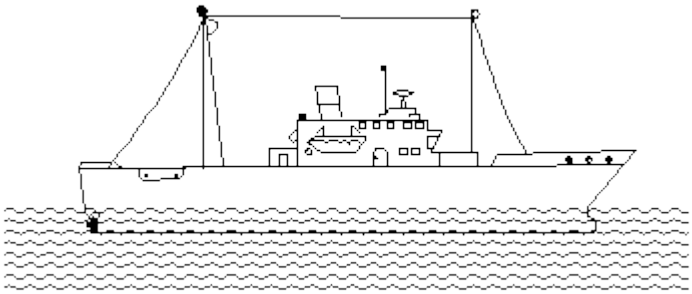
.....

.....

Extension of spring = ... cm

(2)
(Total 10 marks)

43 The diagram below shows an empty cargo ship. It is not moving.

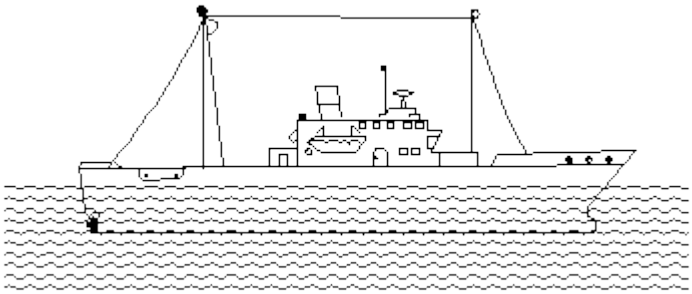


(a) The water exerts a force on the ship. In which direction does this force act?

.....

(1)

(b) The diagram below shows the same cargo ship. This time it has a full load of cargo.



(i) How does the force exerted by the water on the ship change as the ship is loaded?

.....

(1)

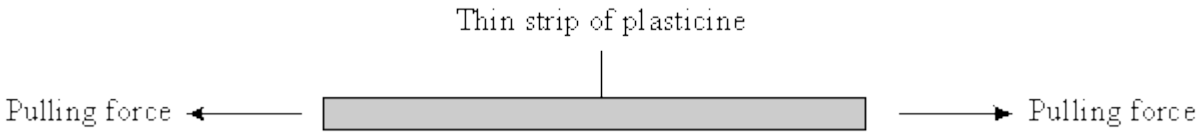
(ii) Why has the force exerted by the water changed?

.....

(1)
(Total 3 marks)

44 (a) The diagrams below show pairs of forces acting on different objects. In each case describe what happens when the forces are increased. Then describe what happens when the forces are removed.

(i)



When the forces are increased

.....

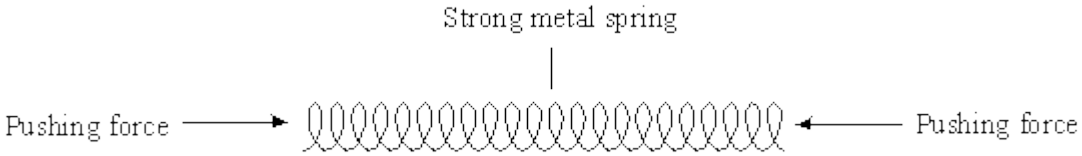
.....

When the forces are removed

.....

.....

(ii)



When the forces are increased

.....

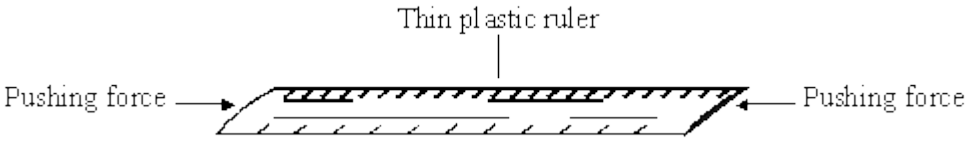
.....

When the forces are removed

.....

.....

(iii)



When the forces are increased

.....

.....

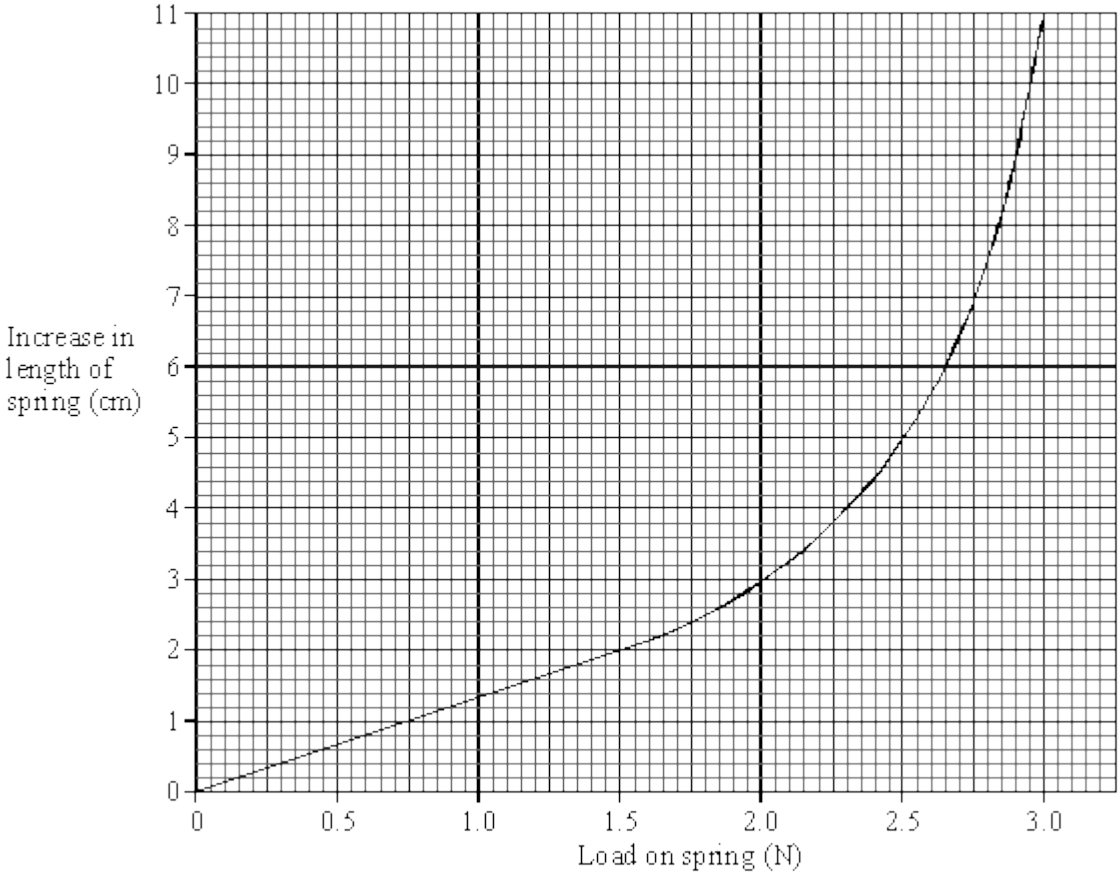
When the forces are removed

.....

.....

(6)

(b) The graph shows the increase in length of a spring against **load** (force).



The length of the spring with no load was 15 cm.

Use the graph to find:

(i) The load needed to produce an increase in length of 2 cm.

.....

(ii) The increase in length produced by a load of 2.3 N.

.....

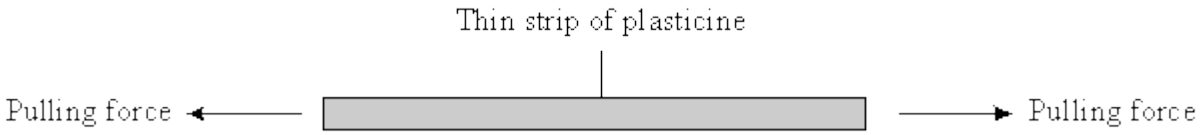
(iii) The **length** of the spring when the load was 2.3 N.

.....

(3)
(Total 9 marks)

45 The diagrams show pairs of forces acting on different objects. In each case describe what happens when the forces are increased. Then describe what happens when the forces are removed.

(a)



When the forces are increased .....

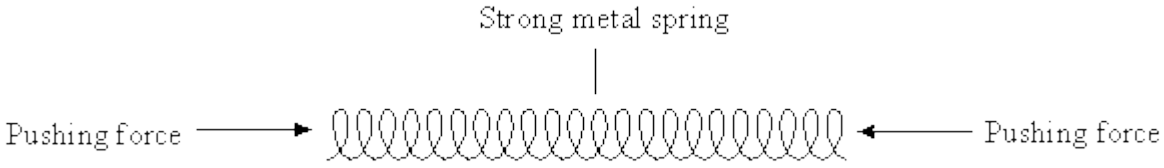
.....

When the forces are removed .....

.....

(2)

(b)



When the forces are increased .....

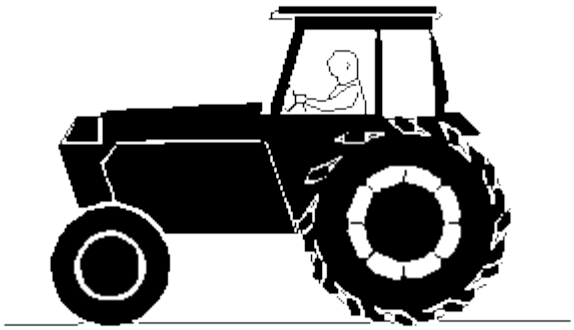
.....

When the forces are removed .....

.....

(2)
(Total 4 marks)

46 (a) The diagram below shows a moving tractor. The forward force from the engine exactly balances the resisting forces on the tractor.



(i) Describe the motion of the tractor.

.....

(ii) The tractor comes to a drier part of the field where the resisting forces are less. If the forward force from the engine is unchanged how, if at all, will the motion of the tractor be affected?

.....

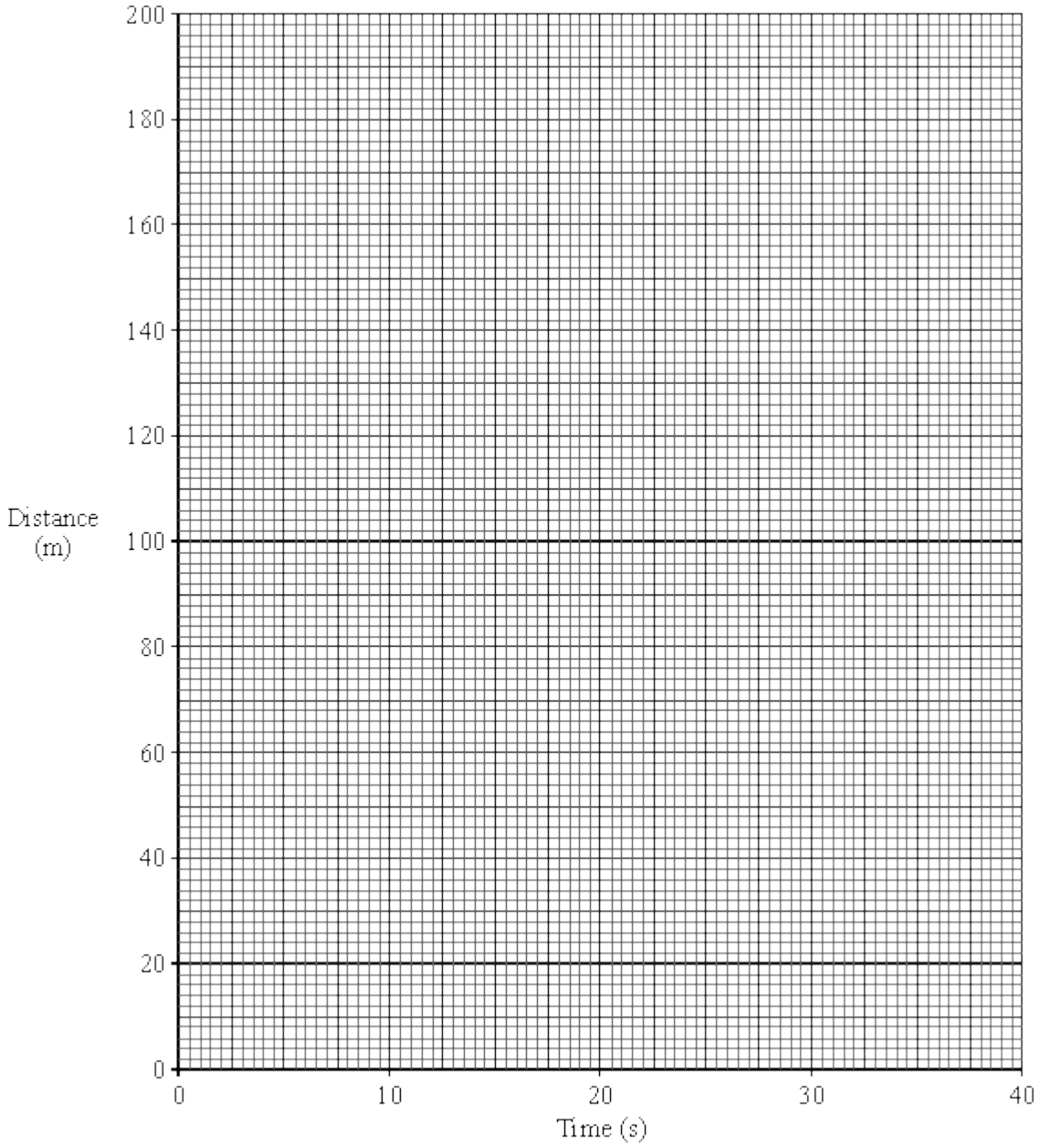
.....

(3)

(b) Two pupils are given the task of finding out how fast a tractor moves across a field. As the tractor starts a straight run across the field the pupils time how long it takes to pass a series of posts which are forty metres apart. The results obtained are shown in the table below.

Distancetravelled (m)	0	40	80	120	160	200
Timetaken (s)	0	8	16	24	32	40

(i) Draw a graph of distance travelled against time taken using the axes on the graph below. Label your graph line A.



(2)

(ii) Calculate the speed of the tractor.

.....

.....

(3)

(c) In another, wetter field there is more resistance to the movement of the tractor. It now travels at 4 m/s.

(i) Calculate the time needed to travel 200m.

.....

.....

.....

(ii) On the graph in part (b) draw a line to represent the motion of the tractor across the second field. Label this line B.

(4)

(d) On a road the tractor accelerates from rest up to a speed of 6 m/s in 15 seconds.

Calculate the acceleration of the tractor.

.....

.....

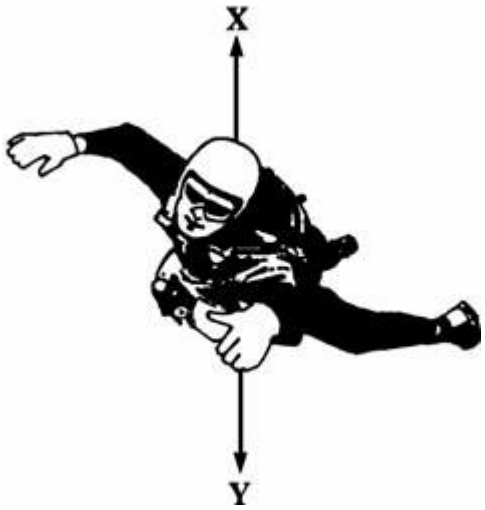
.....

.....Acceleration = ...m/s^2

(3)
(Total 15 marks)

47 A sky-diver jumps from a plane.

The sky-diver is shown in the diagram below.



(a) Arrows **X** and **Y** show two forces acting on the sky-diver as he falls.

(i) Name the forces **X** and **Y**.

X .....

Y .....

(2)

(ii) Explain why force **X** acts in an upward direction.

.....

.....

(1)

(iii) At first forces **X** and **Y** are unbalanced.

Which of the forces will be bigger? .....

(1)

(iv) How does this unbalanced force affect the sky-diver?

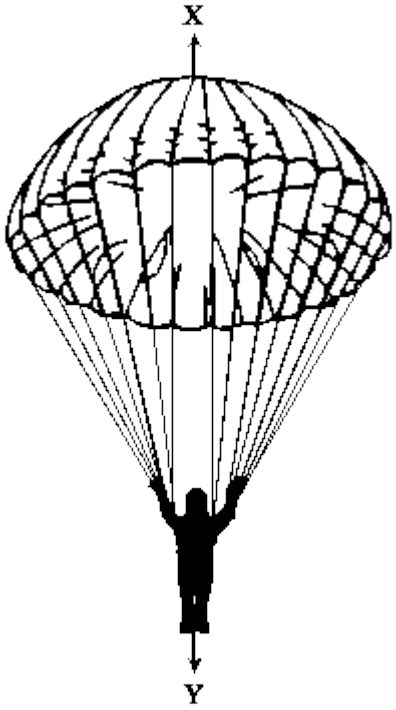
.....

.....

(2)

(b) After some time the sky-diver pulls the rip cord and the parachute opens.

The sky-diver and parachute are shown in the diagram below.



After a while forces **X** and **Y** are balanced.

Underline the correct answer in each line below.

Force **X** has

increased / stayed the same / decreased.

Force **Y** has

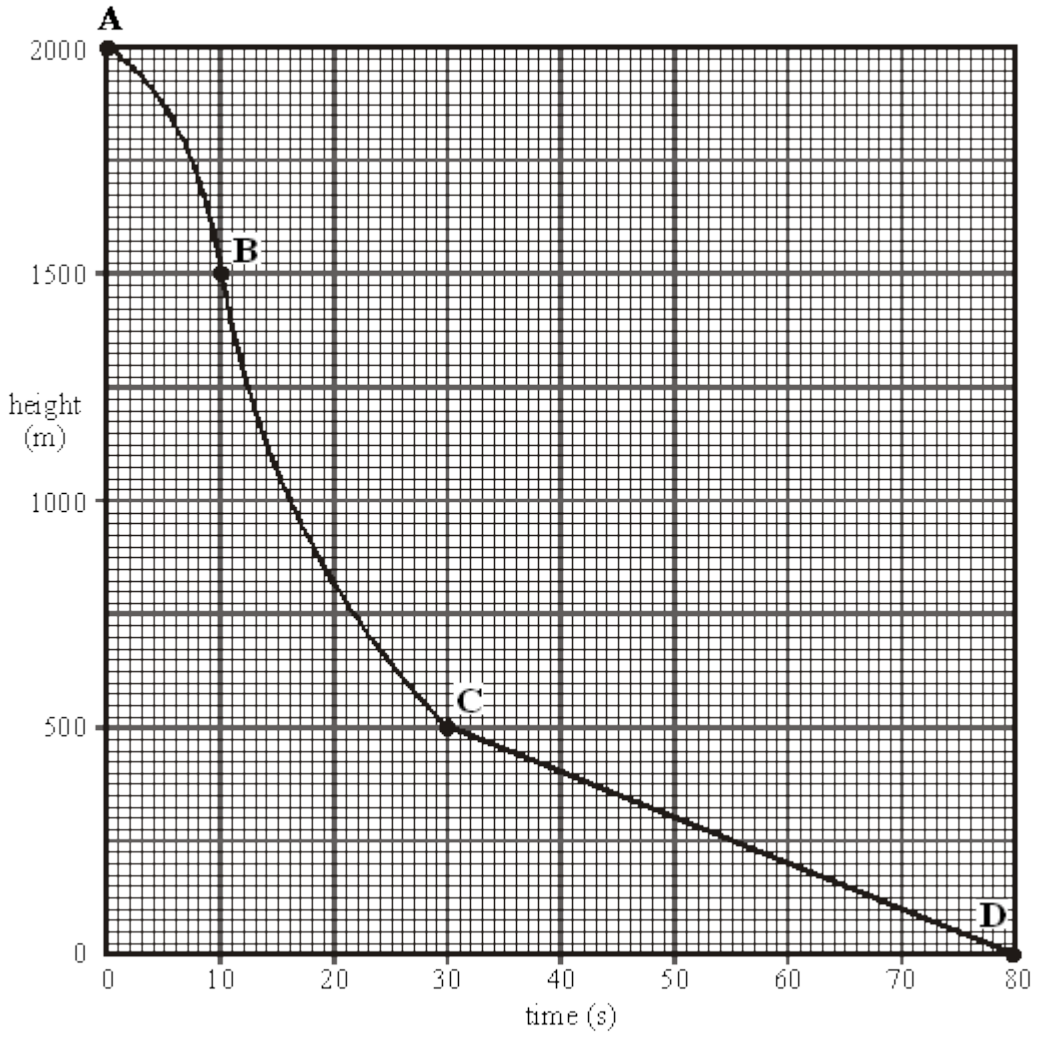
increased / stayed the same / decreased.

The speed of the sky-diver will

increase / stay the same / decrease.

(3)

(c) The graph below shows how the height of the sky-diver changes with time.



(i) Which part of the graph, **AB**, **BC** or **CD** shows the sky-diver falling at a constant speed?

.....

(1)

(ii) What distance does the sky-diver fall at a constant speed?

Distance ..... m

(1)

(iii) How long does he fall at this speed?

Time ..... s

(1)

(iv) Calculate this speed.

.....

.....

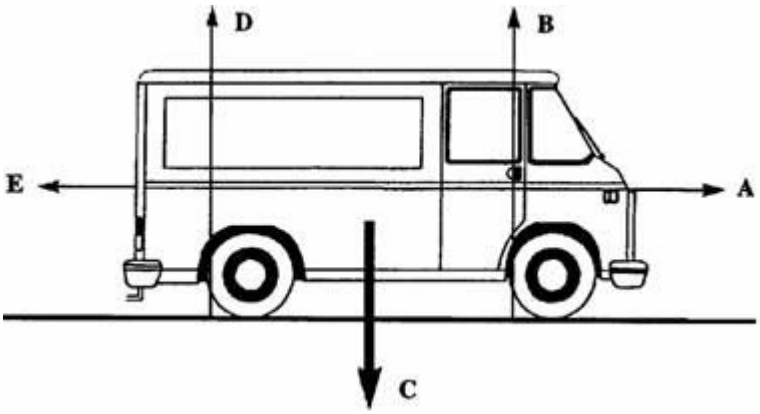
.....

Speed ..... m/s

(2)

(Total 14 marks)

48



Five forces, **A**, **B**, **C**, **D** and **E** act on the van.

(a) Complete the following sentences by choosing the correct forces from **A** to **E**.

Force ..... is the forward force from the engine.

Force ..... is the force resisting the van's motion.

(1)

(b) The size of forces **A** and **E** can change.
Complete the table to show how big force **A** is compared to force **E** for each motion of the van.
Do this by placing a tick in the correct box.
The first one has been done for you.

MOTION OF VAN	FORCE **A** SMALLER THAN FORCE **E**	FORCE **A** EQUAL TO FORCE **E**	FORCE **A** BIGGER THAN FORCE **E**
Not moving			
Speeding up			
Constant speed			
Slowing down			

(3)

(c) When is force **E** zero?

.....

(1)

(d) The van has a fault and leaks one drop of oil every second.
The diagram below shows the oil drops left on the road as the van moves from **W** to **Z**.

Describe the motion of the van as it moves from:

W to X .....

X to Y .....

Y to Z .....

(3)

(e) The driver and passengers wear seatbelts.
Seatbelts reduce the risk of injury if the van stops suddenly.

backwards **downwards** **force** **forwards** **mass** **weight**

Complete the following sentences, using words from the list above, to explain why the risk of injury is reduced if the van stops suddenly.

A large ..... is needed to stop the van suddenly.

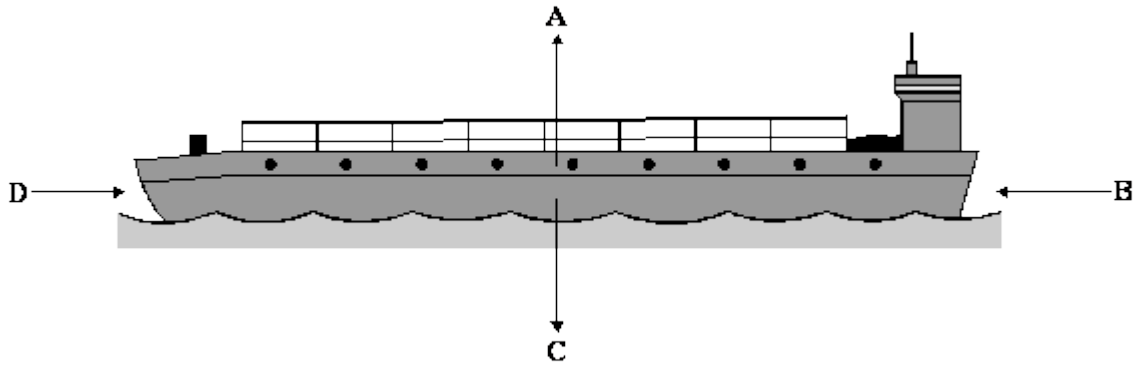
The driver and passengers would continue to move ..... .

The seatbelts supply a ..... force to keep the driver and passengers

in their seats.

(3)
(Total 11 marks)

49 Four of the forces that act on this container ship are shown in the diagram as **A, B, C** and **D**.



Complete each sentence by choosing the correct letters, **A, B, C** or **D**.

The first one has been done for you.

At the start, the ship is not moving because forces **B** and **D** are balanced.

The ship begins to move forward when forces ..... and ..... are unbalanced.

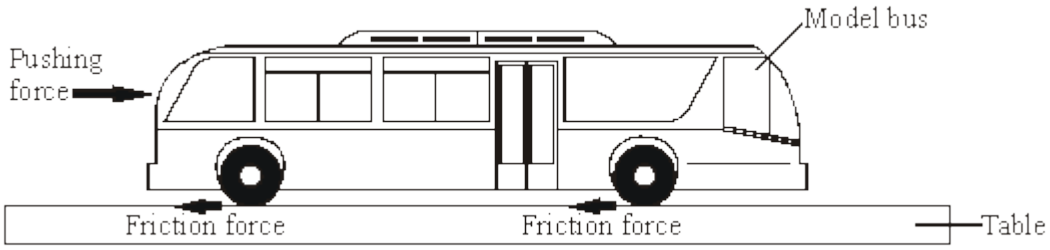
When the ship is moving at a steady speed, forces ..... and ..... are balanced.

The ship stops at a port. All of the containers are taken off and this changes

force ..... .

(Total 3 marks)

50 (a) The model bus is being pushed on a table.



(i) At first the pushing force does **not** make the model bus move. Explain why.

.....

.....

(1)

(ii) Write down **two** things that happen as the pushing force increases.

1 .....

.....

2 .....

.....

(2)

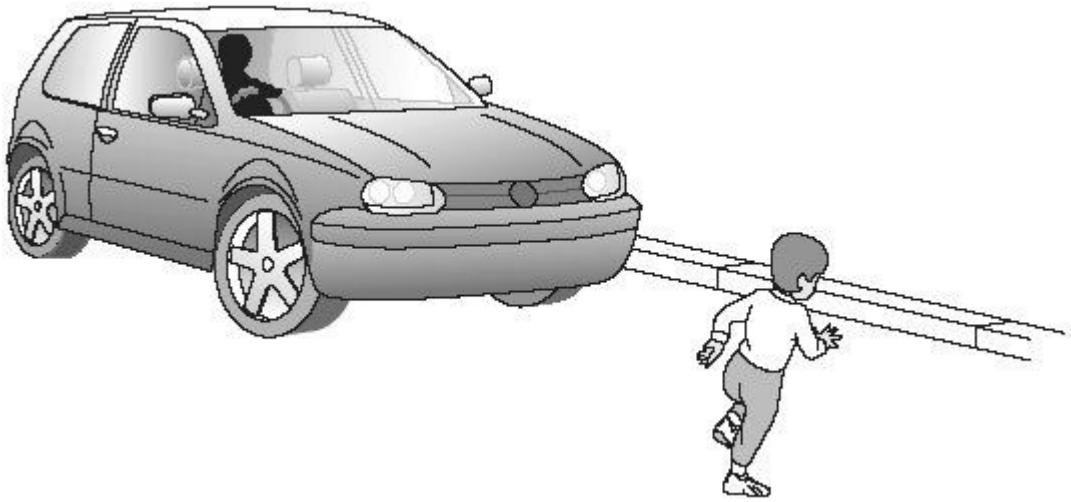
(iii) Complete the formula by choosing the correct words from the box.

acceleration	**distance moved**	**force applied**
speed	**time taken**	

Work done on the model bus = ... × .....

(2)

(b) In this situation, the car driver needs to stop the car in the shortest possible distance.



(i) Complete the table by putting ticks (✓) to show which factors would make the stopping distance greater. The first one has been done for you.

Factor	Tick (✓) makes stopping distance greater
brakes are old and worn	✓
car is travelling fast	
driver has been drinking alcohol	
four new tyres are fitted	
hot, dry, sunny weather	
ice on the road	

(3)

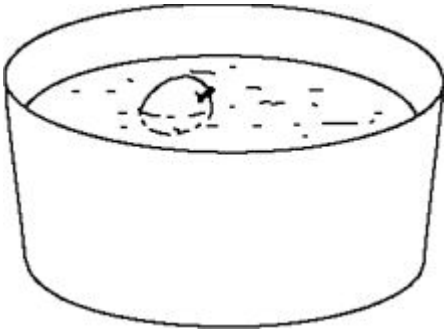
(ii) Complete the sentence by writing the correct words in the spaces.

The car will skid if the braking force is too big compared with the friction between the car's ..... and the ..... .

(1)

(Total 9 marks)

51



In a science lesson, some children float an apple on some water.

One of the children says:

"The apple is not moving. That means that there cannot be any forces acting on it."

Do you agree?
Explain your answer as fully as you can.

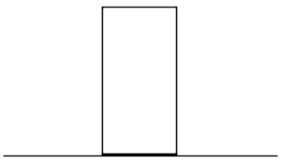
.....

.....

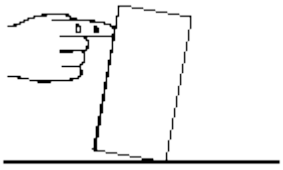
.....

(Total 3 marks)

52 A child stands a wooden brick on its end as shown in the diagram.



The child then pushes the brick to make it tilt.



How far must the brick be tilted to make it fall over?

Explain your answer.

(You may draw a labelled diagram if you wish.)

.....

.....

.....

(Total 2 marks)

53 Choose words from this list to complete the sentences below.

balanced	electricity	gravity
joules	magnetism	newtons

When you drop something it falls.

This is because it is pulled to the Earth by .....

We measure forces in units called .....

When a falling object reaches the ground, it stops moving.

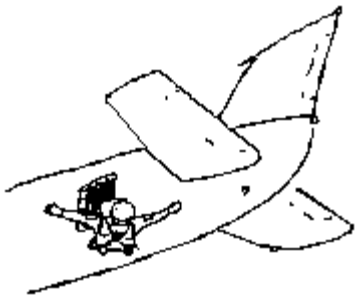
This means that the forces acting on it are now .....

(Total 3 marks)

54 A sky-diver steps out of an aeroplane.

After 10 seconds she is falling at a steady speed of 50m/s.

She then opens her parachute.



After another 5 seconds she is once again falling at a steady speed.

This speed is now only 10m/s.

(a) Calculate the sky-diver's average acceleration during the time from when she opens her parachute until she reaches her slower steady speed. (Show your working.)

.....

.....

.....

(3)

(b) Explain, as fully as you can:

(i) why the sky-diver eventually reaches a steady speed (with or without her parachute).

.....

.....

.....

.....

(3)

(ii) why the sky-diver's steady speed is lower when her parachute is open.

.....

(1)

(c) The sky-diver and her equipment have a total mass of 75kg. Calculate the gravitational force acting on this mass. (Show your working.)

.....

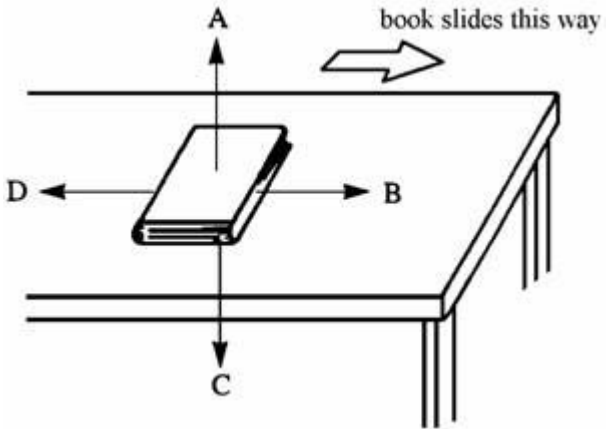
.....

Answer ..... N

(1)

(Total 8 marks)

55 When you slide a book across a table, there is a force of friction between the book and the table.



(a) Which arrow shows the force of friction that acts on the book? .....

(1)

(b) The force of friction will slow the book down.
Write down **one** other effect that the force of friction will have on the book.

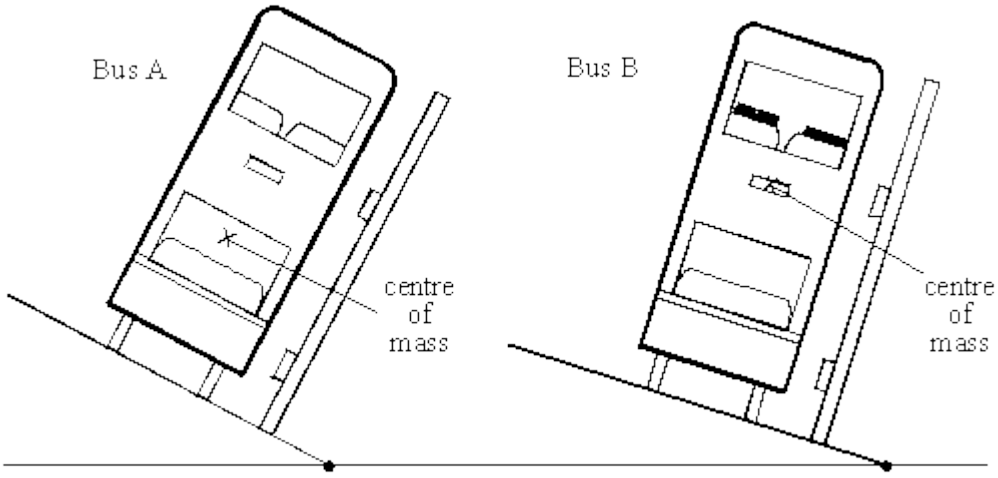
.....

(1)

(Total 2 marks)

56 The diagram shows two buses. Bus A is empty. Bus B contains bags of sand upstairs to represent passengers.

Each bus has been tilted as far as it can without falling over.



(a) Each bus will topple over if it is tilted any further.

Explain, in as much detail as you can, why this will happen.

(You can draw on one of the diagrams as part of your answer if you want to.)

.....

.....

.....

(2)

(b) What difference does it make to the stability of the bus when the upper deck is full of "passengers"? Explain your answer as fully as you can.

.....

.....

.....

(3)

(c) Why are the bags of sand in bus B only put upstairs?

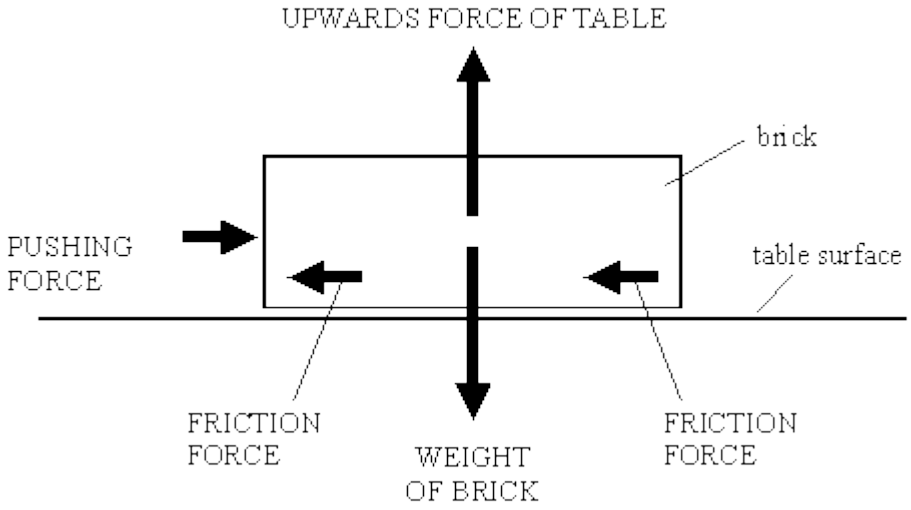
.....

.....

(1)

(Total 6 marks)

57 The brick shown in the diagram is being pushed but it is **not** moving.



(a) The pushing force does **not** make the brick move. Explain why.

.....

(1)

(b) The weight of the brick does **not** make it move downwards. Explain why.

.....

(1)

(c) A bigger pushing force **does** make the brick slide across the table.
Write down **one** thing that the sliding brick will do to the surface of the table.

.....

(1)
(Total 3 marks)