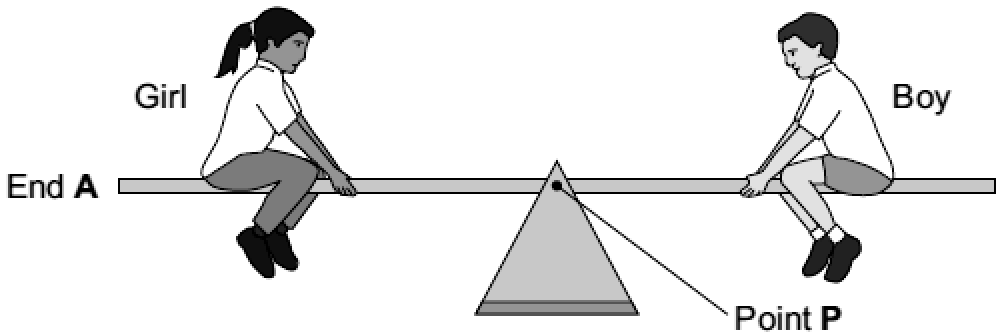
1 Two children visit a playground.

(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.

balance
rotation
turning

(1)

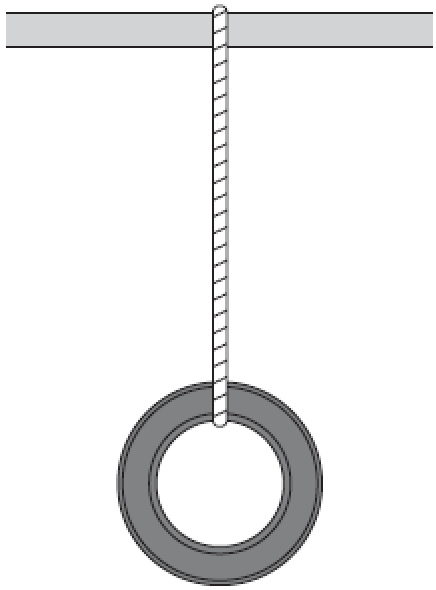
(iii) To make end **A** of the see-saw go up,

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**

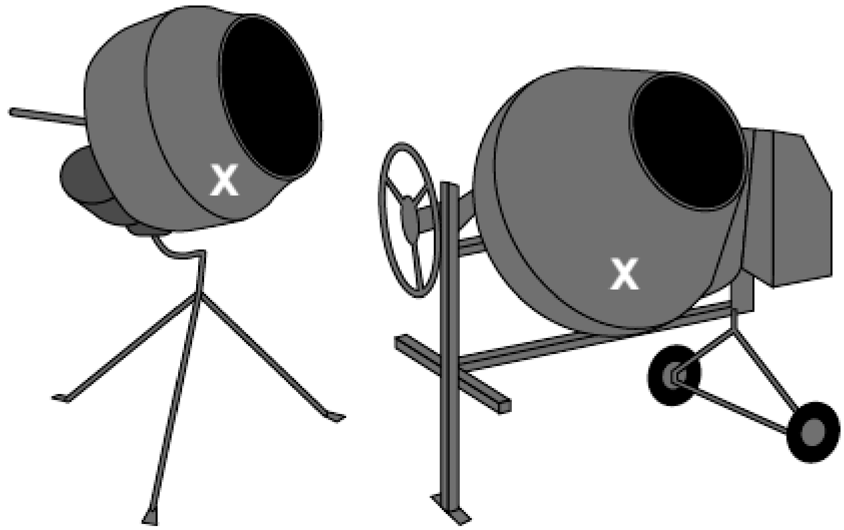
If the suspended tyre is pushed, it will come to rest with its centre of mass

directly ________________________ the point of suspension.

(1)

(Total 5 marks)

2 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.

____

____

____

____

____

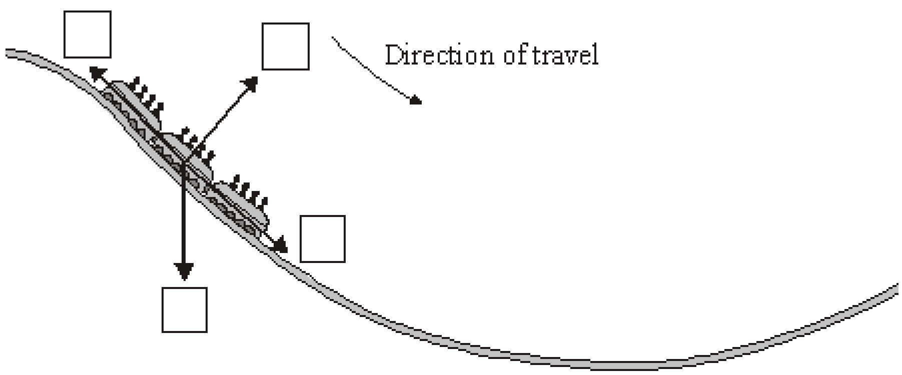
(2)

(Total 5 marks)

3 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.

____

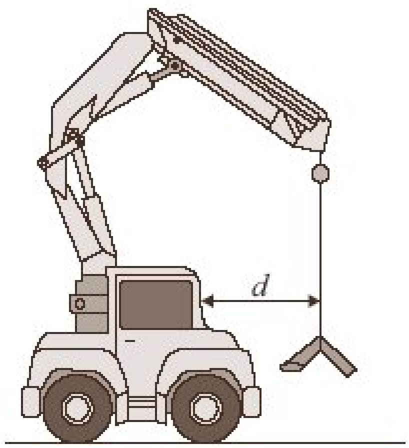
____

Maximum weight = ________________ N

(2)

(Total 5 marks)

4 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)

5 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 $\boxed{\begin{array}{l}\text{joule}\\ \text{newton}\\ \text{watt}\end{array}}$.

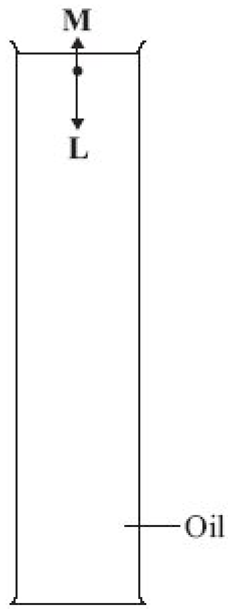
(1)

(ii) Most of the work done to push the trolley is transformed into $\boxed{\begin{array}{l}\text{heat}\\ \text{light}\\ \text{sound}\end{array}}$.

(1)

(Total 6 marks)

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

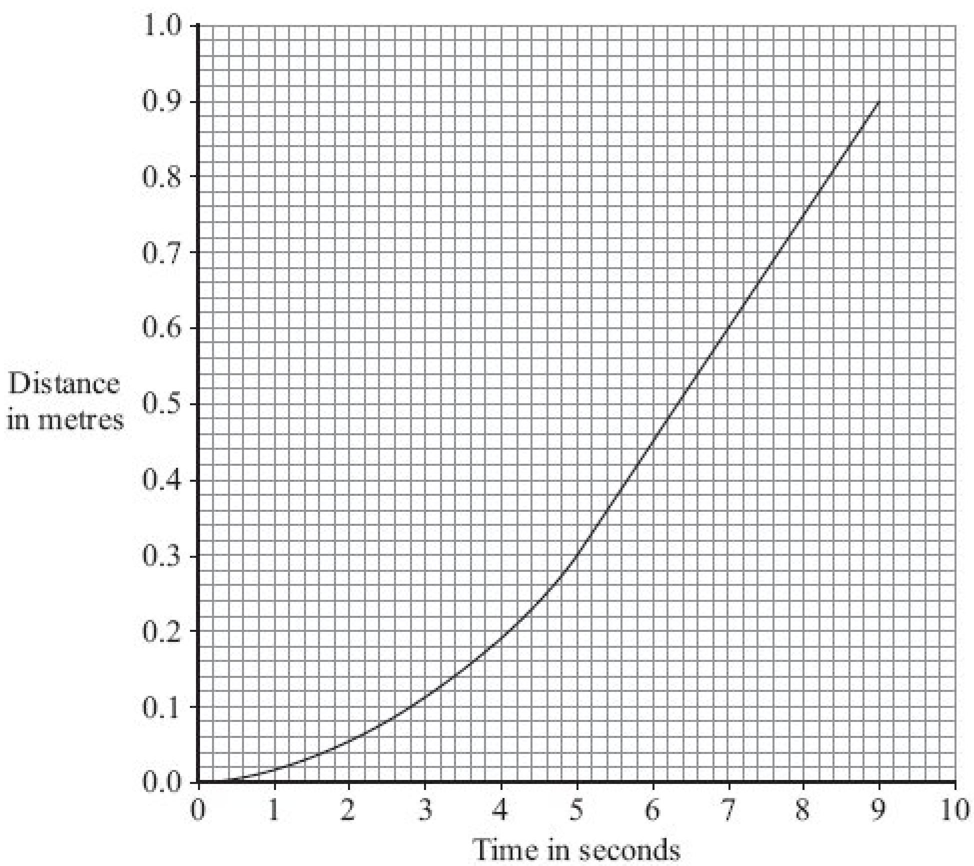


What causes force **L**?

____

(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.

____

____

____

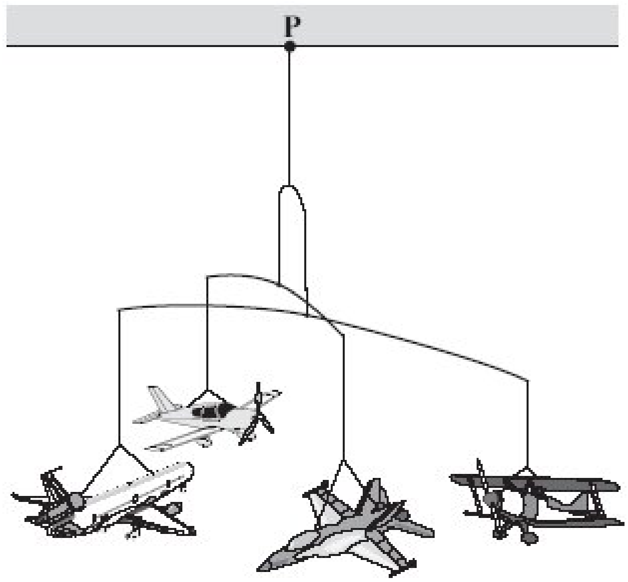
Speed = ______________________________ m/s

(2)

(Total 7 marks)

7 (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**.

____

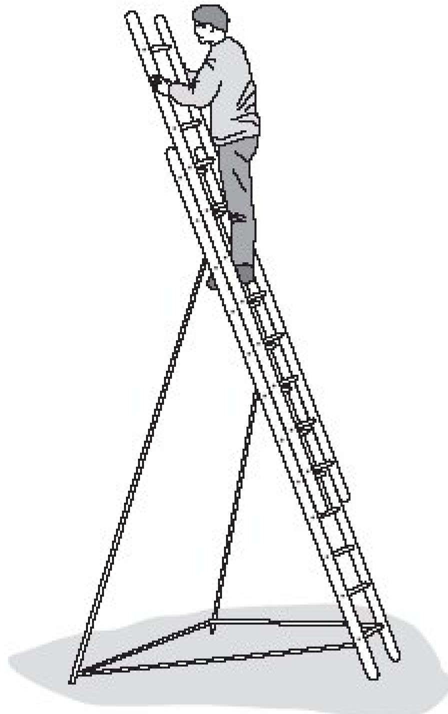
____

____

____

(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.

____

____

____

____

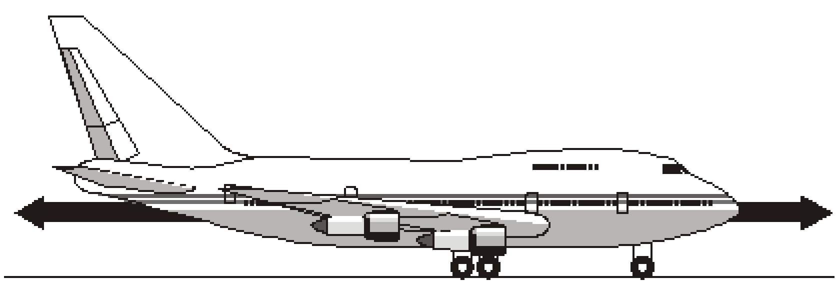
____

____

(3)

(Total 6 marks)

8 (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.

____

____

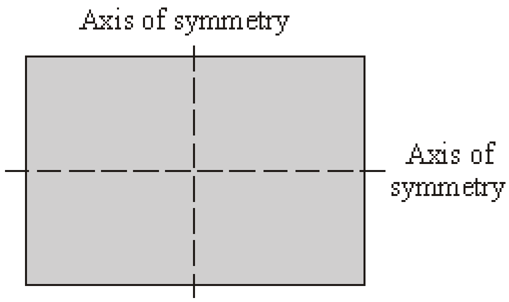
____

____

(2)

(Total 7 marks)

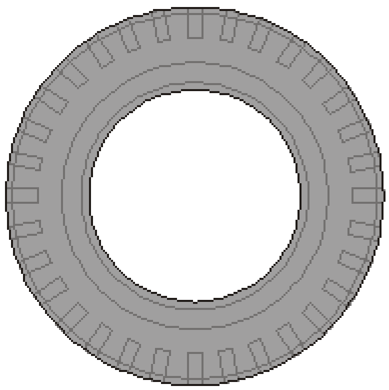
9 (a) The diagram shows a rectangle made out of a sheet of cardboard.



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).

____

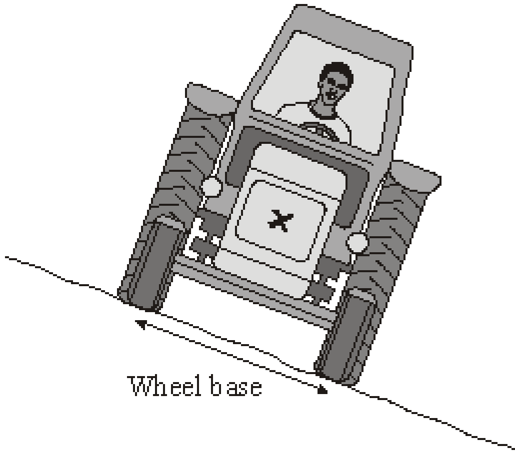
____

(1)

(Total 3 marks)

10 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 ____

____

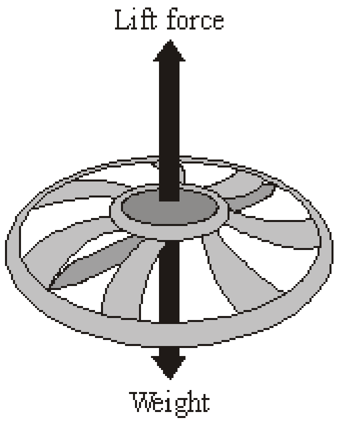
Feature 2 ____

____

(2)

(Total 5 marks)

11 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)

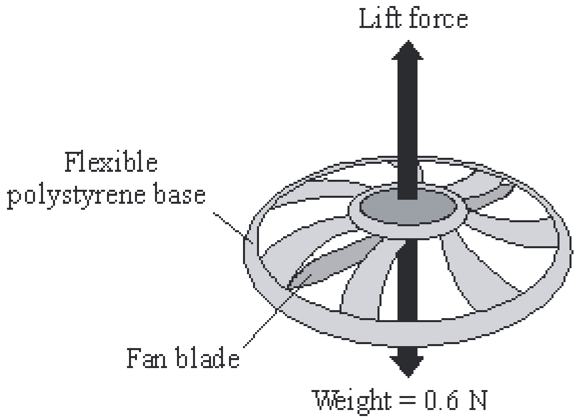
(ii) What is the direction of the resultant force on the falling toy?

____

(1)

(Total 6 marks)

12 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.

____

____

____

____

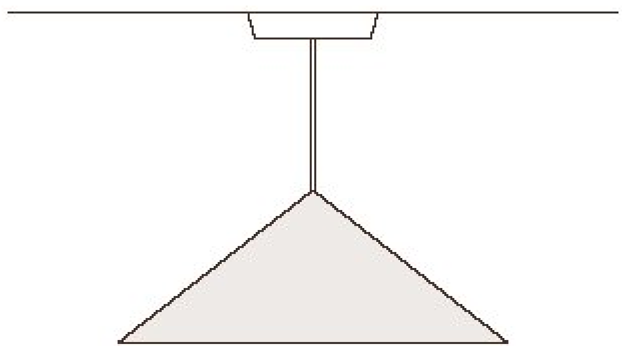
____

____

(3)

(Total 8 marks)

13 (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)

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

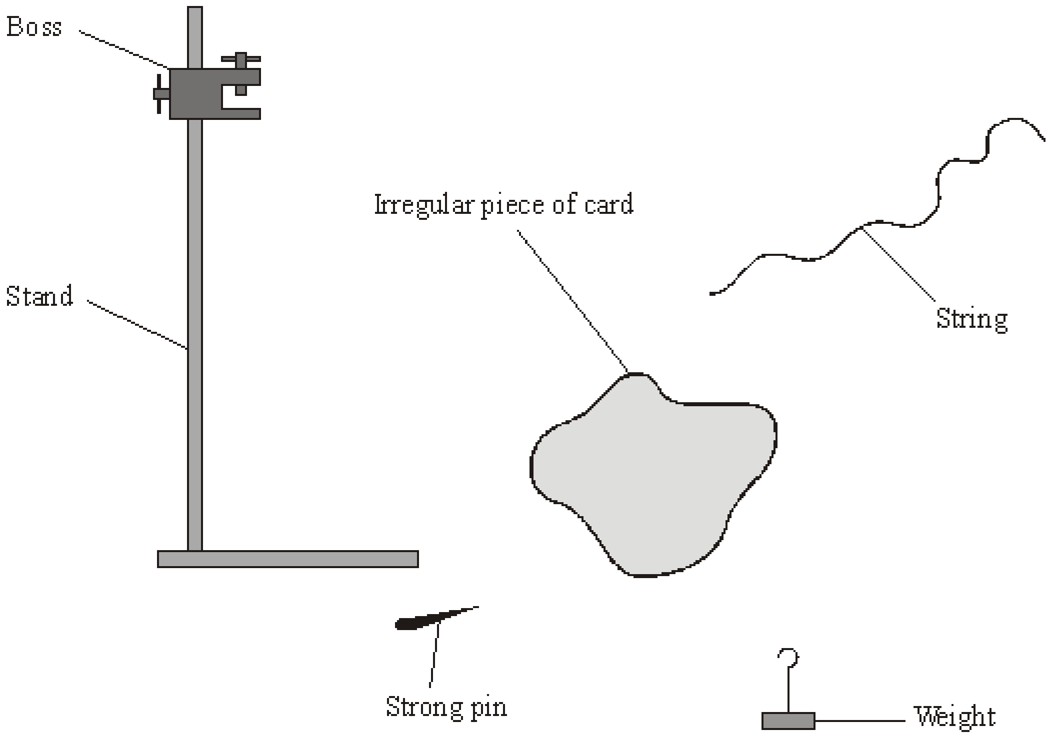
above	**below**	**to the left of**	**to the right of**

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.

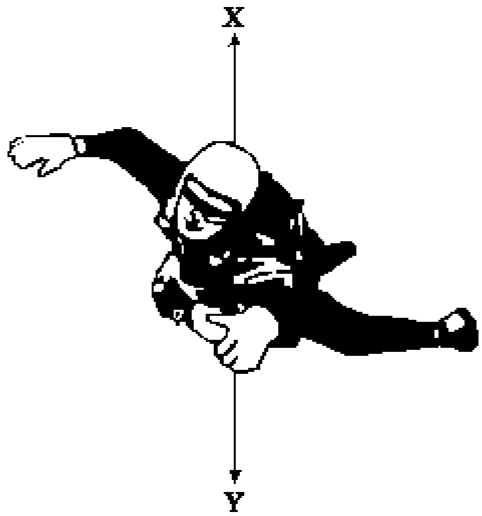
F The weight is tied to the string and then the string is hung from the pin.

D					**E**

(3)

(Total 5 marks)

14 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)

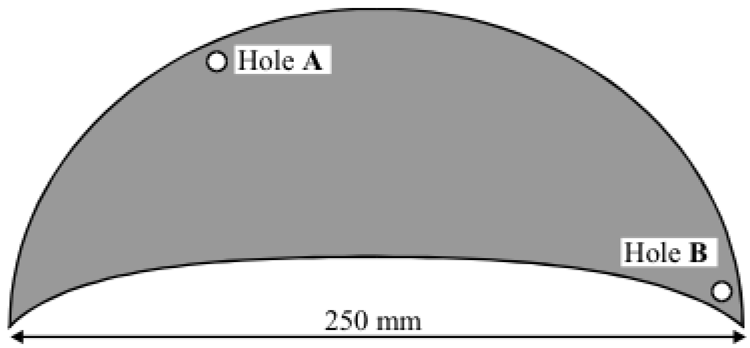
15 (a) Every object has a *centre of mass*. What is meant by the *centre of mass*?

____

____

(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 I 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.

____

____

____

____

____

____

____

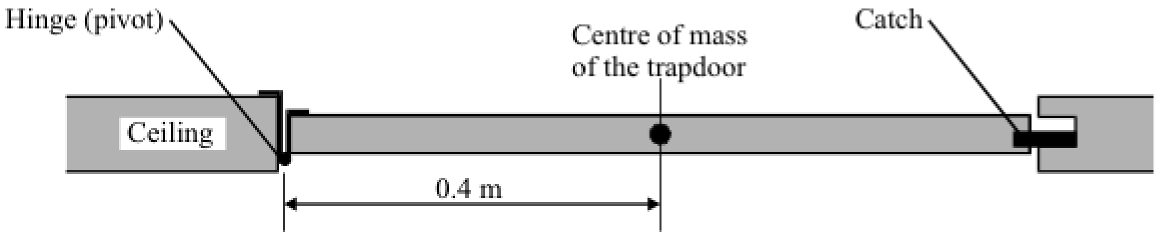
____

____

____

(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.

____

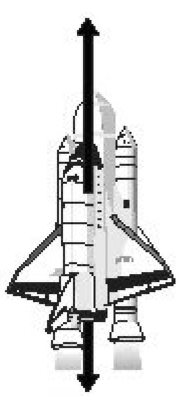
____

Turning effect = ________________________

(3)
(Total 10 marks)

16 (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?

____

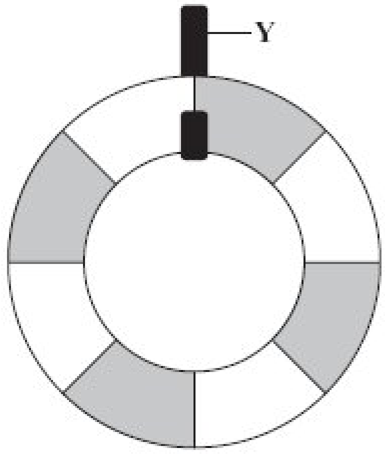
____

(1)

(Total 6 marks)

17 (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.

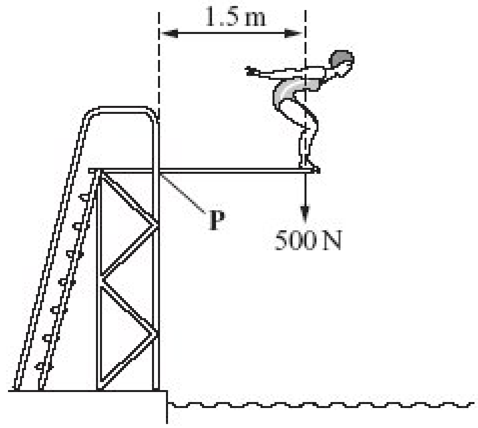
___

___

___

(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.

____

____

____

____

____

____

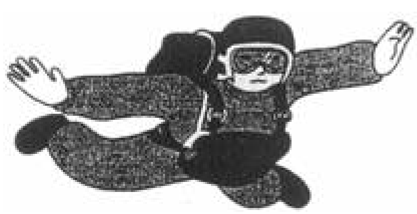
____

____

(4)

(Total 10 marks)

18 (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.

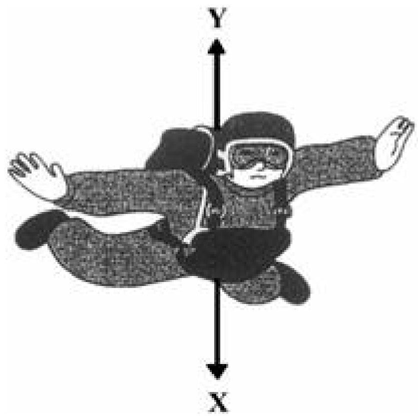
Skydiver ____________ will fall faster because ______________________________

____

____

(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**?

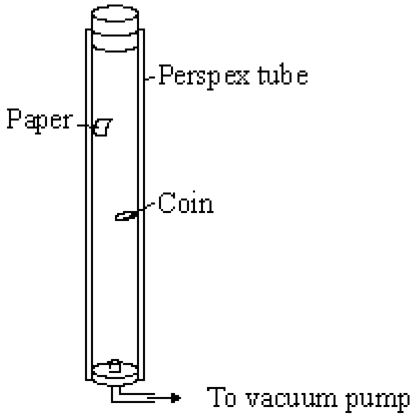
____

____

(1)

(Total 7 marks)

19 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. ____

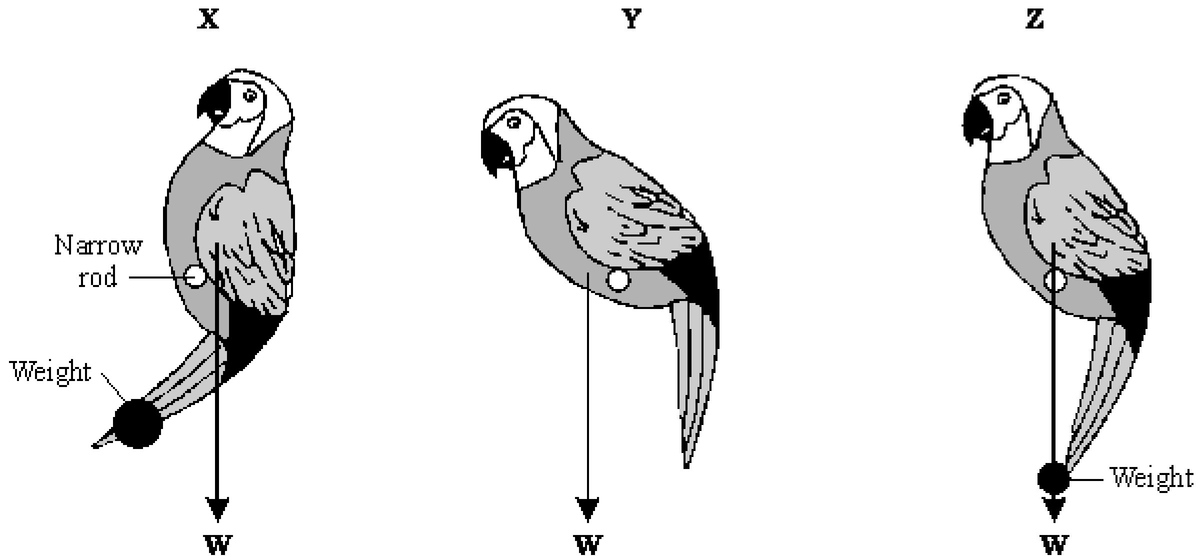
____

____

(2)

(Total 3 marks)

20 (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.

____

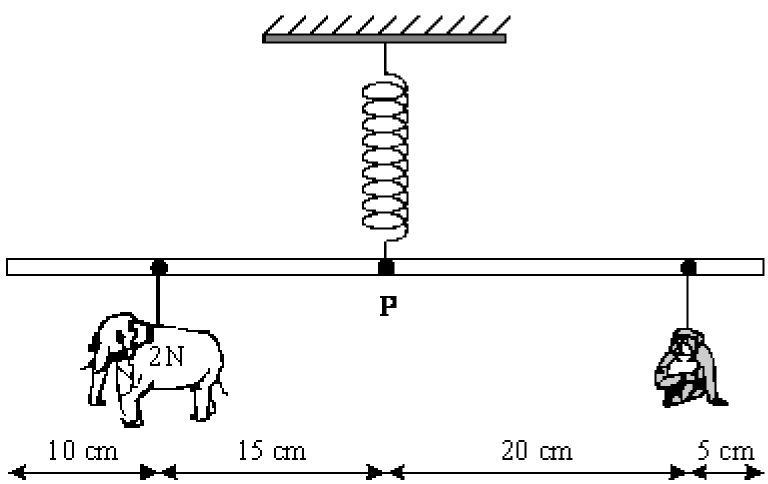
____

____

____

(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

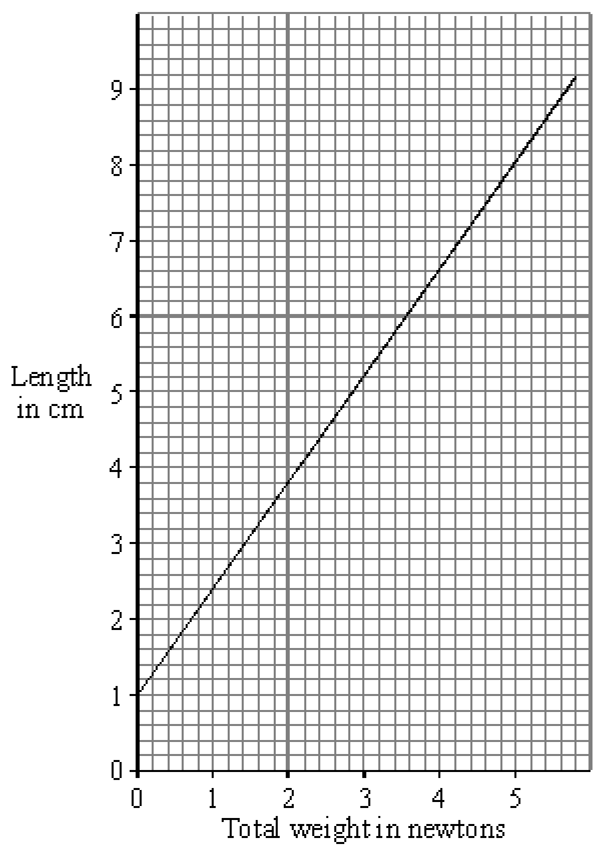
____

____

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.

____

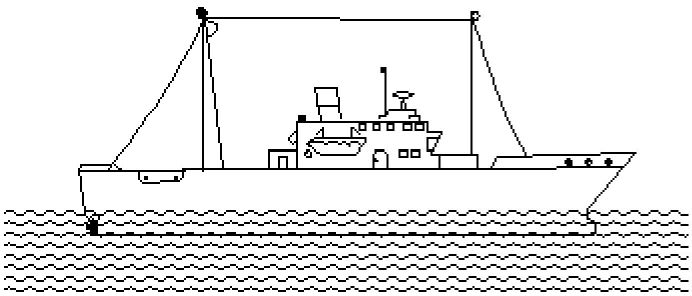
____

Extension of spring = ___________ cm

(2)

(Total 10 marks)

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

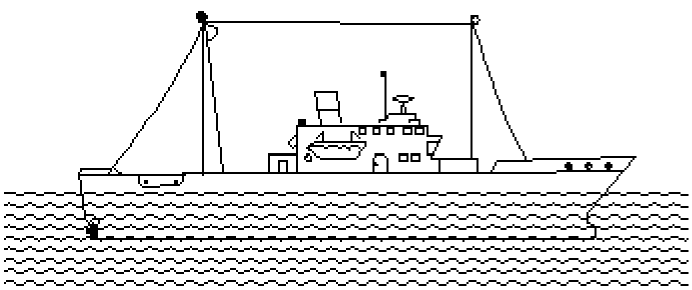


(a) The water exerts a force on the ship. In which direction does this force act?

____

(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?

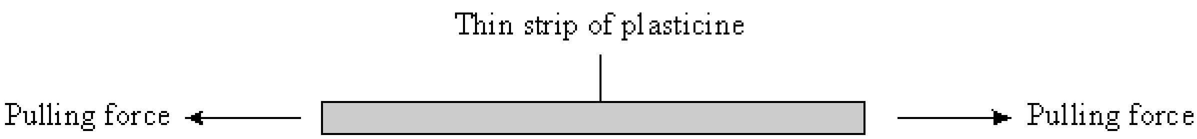
____

(1)

(Total 3 marks)

22 (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

____

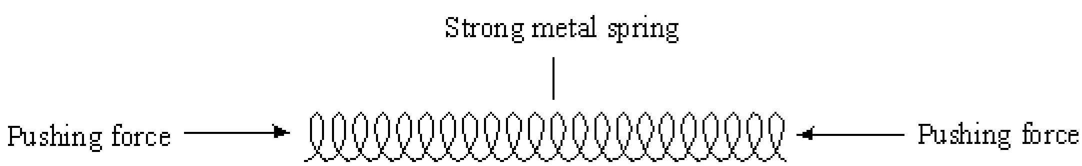
____

When the forces are removed

____

____

(ii)



When the forces are increased

____

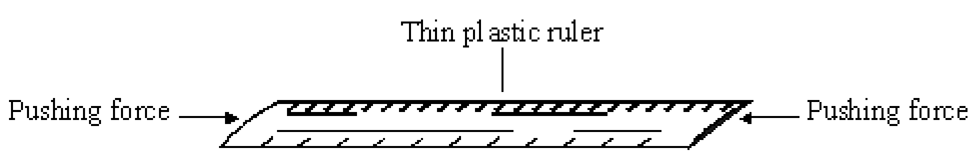
____

When the forces are removed

____

____

(iii)



When the forces are increased

___

___

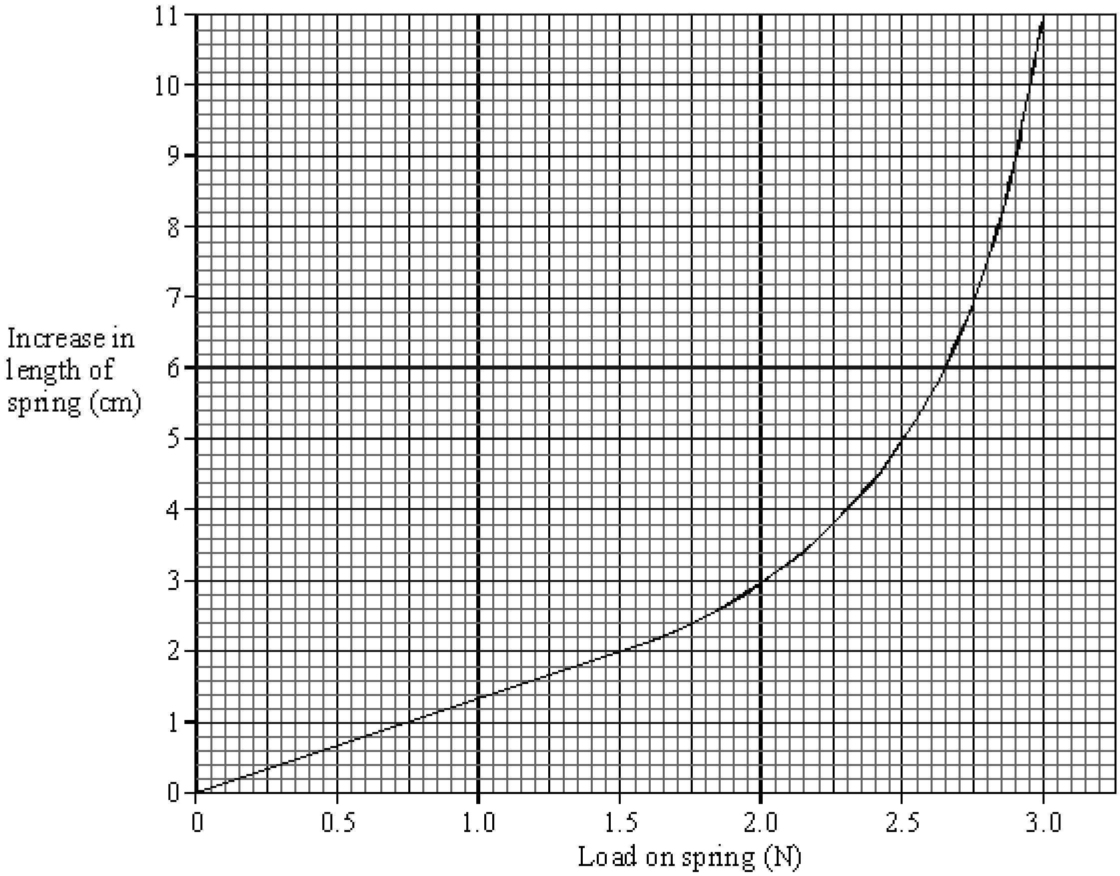
When the forces are removed

___

___

(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.

___

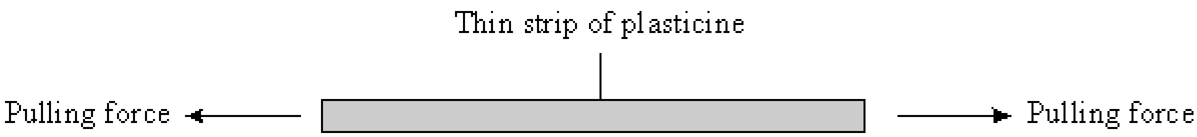
(iii) The **length** of the spring when the load was 2.3 N.

____

(3)
(Total 9 marks)

23 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 ____

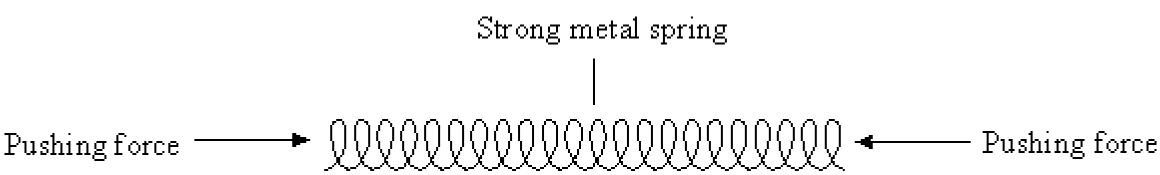
____

When the forces are removed ____

____

(2)

(b)



When the forces are increased ____

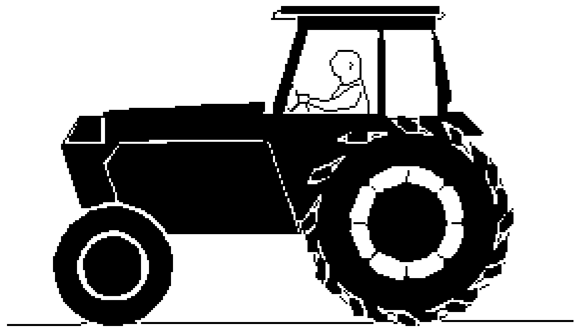
____

When the forces are removed ____

____

(2)
(Total 4 marks)

24 (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?

____

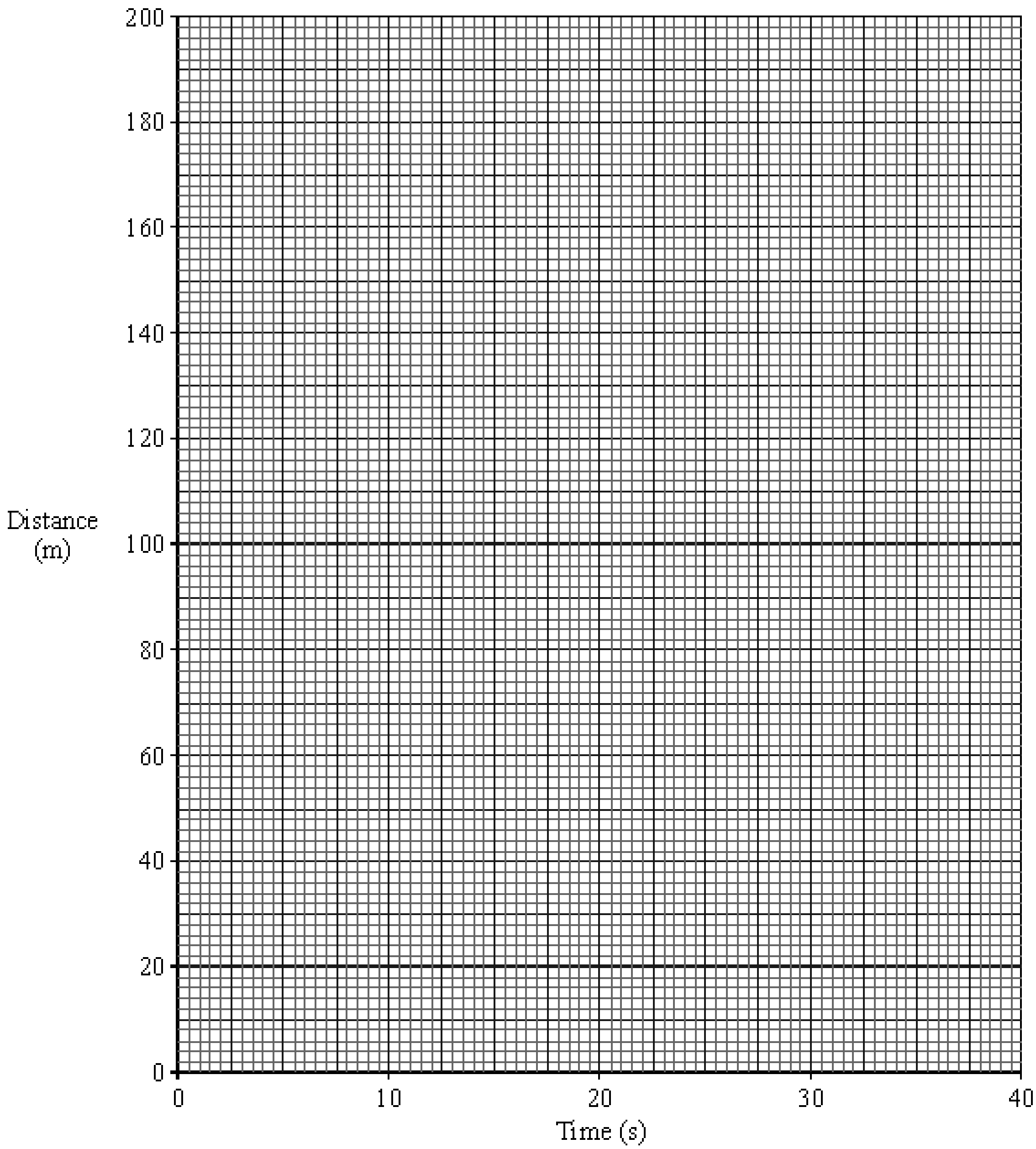
____

(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.

____

____

____

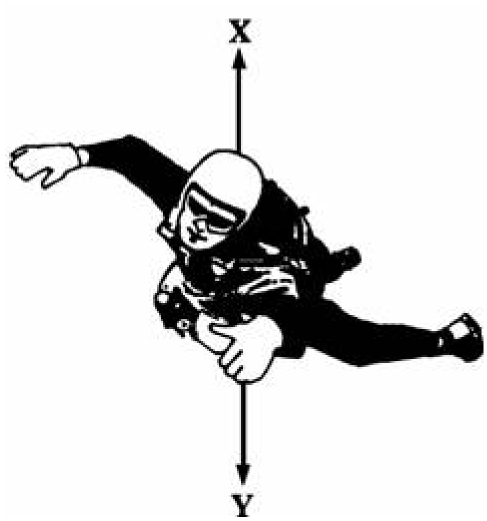
____ Acceleration = ____________ m/s^2

(3)

(Total 15 marks)

25 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?

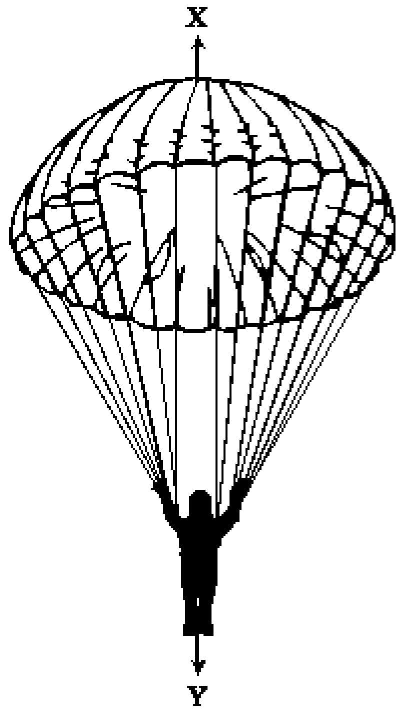
____

____

(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

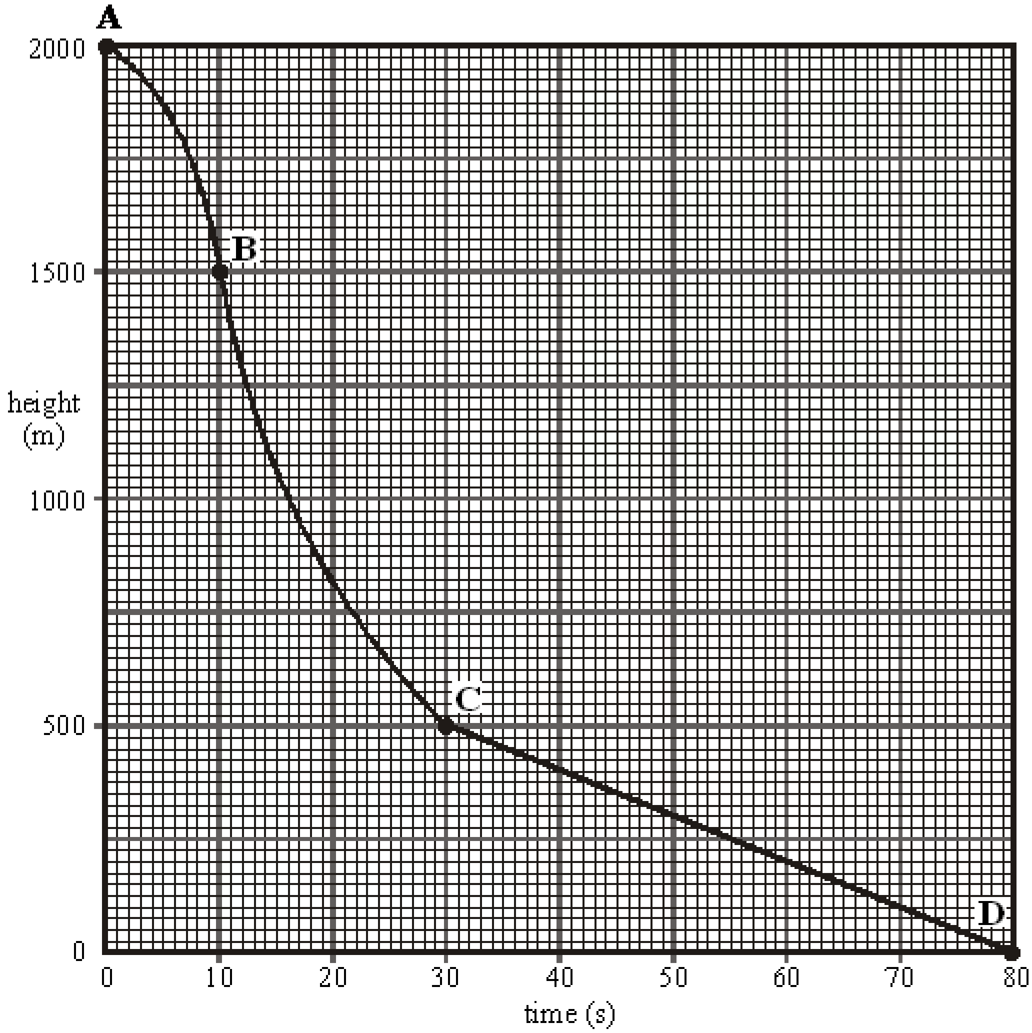
increased / stayed the same / decreased.

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.

____

____

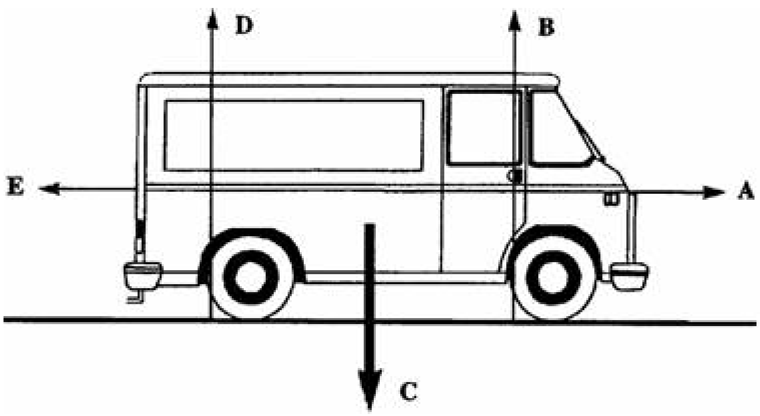
____

Speed _______________ m/s

(2)

(Total 14 marks)

26



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			

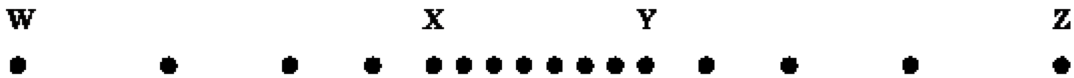
(3)

(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.

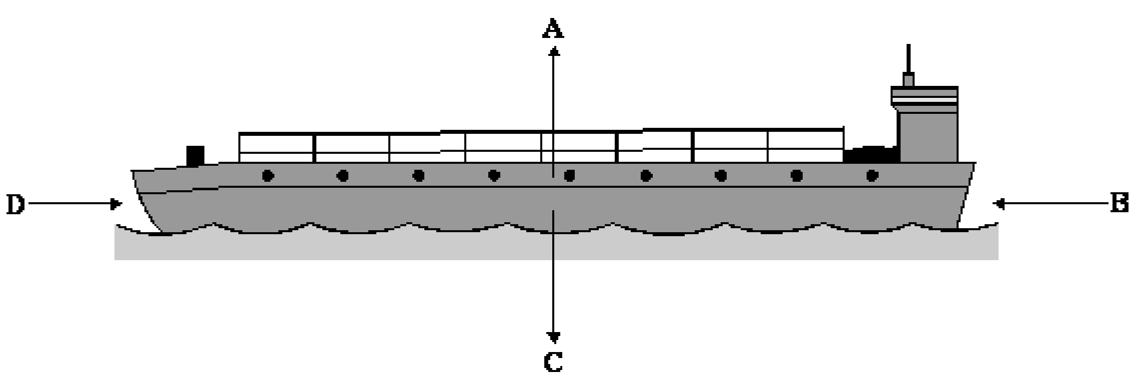
The driver and passengers would continue to move ____________________ .

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

in their seats.

(3)
(Total 11 marks)

27 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.

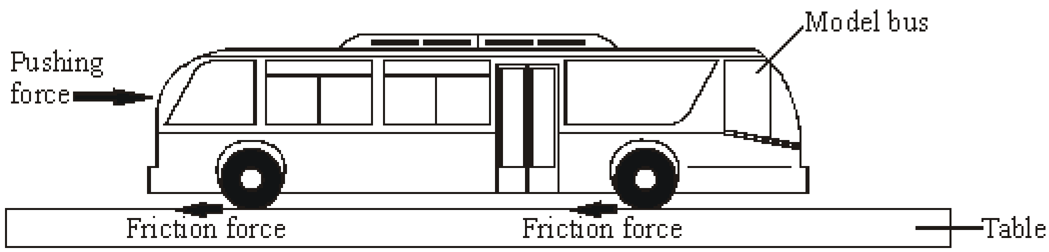
When the ship is moving at a steady speed, forces ________ and ________ are balanced.

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

force _______ .

(Total 3 marks)

28 (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)

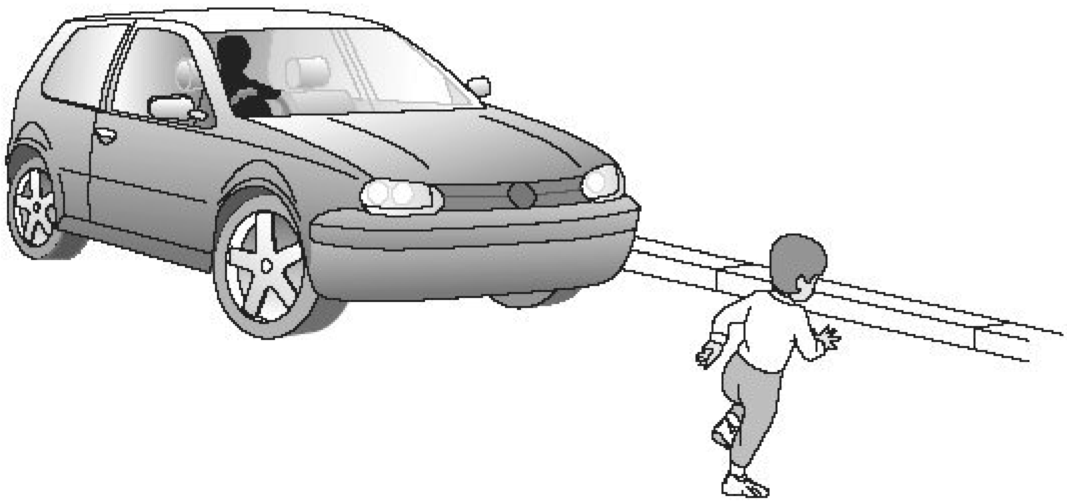
(iii) Complete the formula by choosing the correct words from the box.

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.

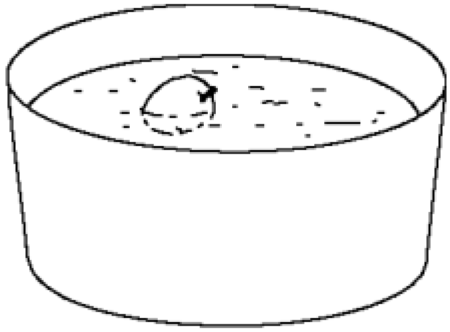
The car will skid if the braking force is too big compared with the friction

between the car's ____________________ and the ____________________ .

(1)

(Total 9 marks)

29



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.

____

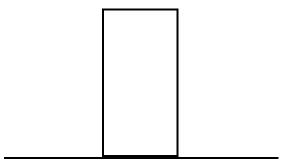
____

____

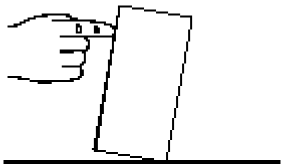
(Total 3 marks)

30

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)

31 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 ____________________________

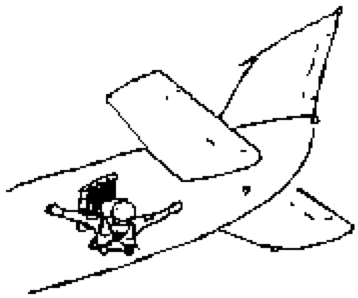
(Total 3 marks)

32

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.)

____

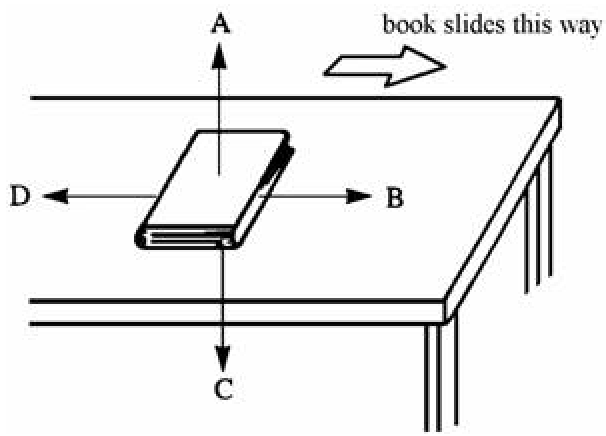
____

Answer ____________________ N

(1)

(Total 8 marks)

33 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.

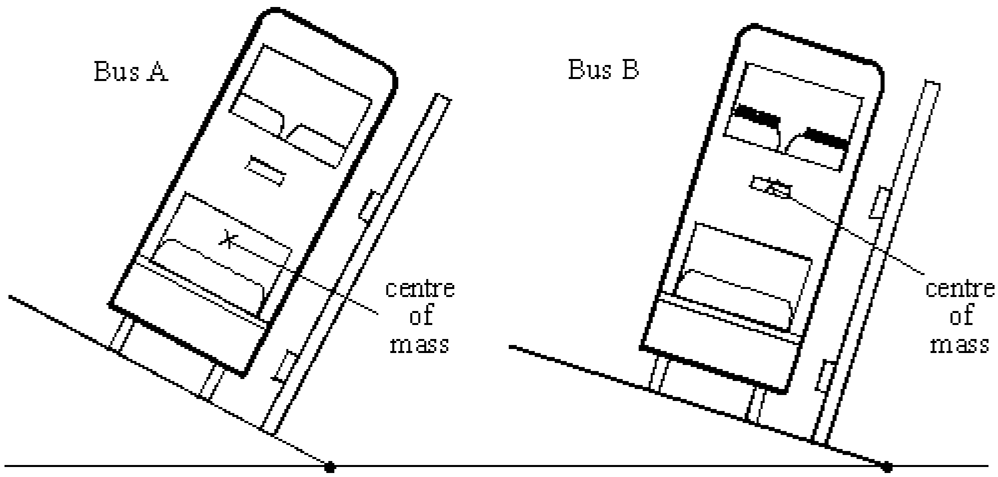
____

(1)

(Total 2 marks)

34 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?

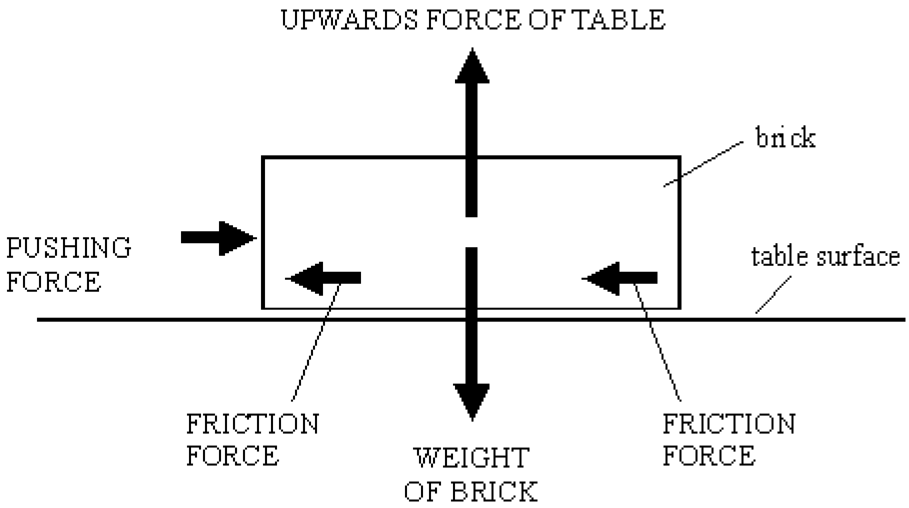
____

____

(1)

(Total 6 marks)

35 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)