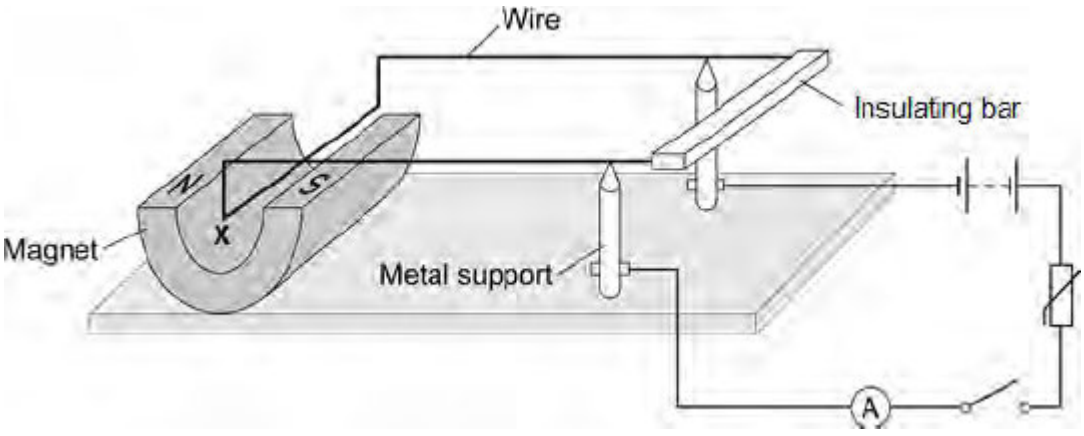
Q1.Figure 1 shows a piece of apparatus called a current balance.

Figure 1



When the switch is closed, the part of the wire labelled **X** experiences a force and moves downwards.

(a) What is the name of the effect that causes the wire **X** to move downwards?

.....

(1)

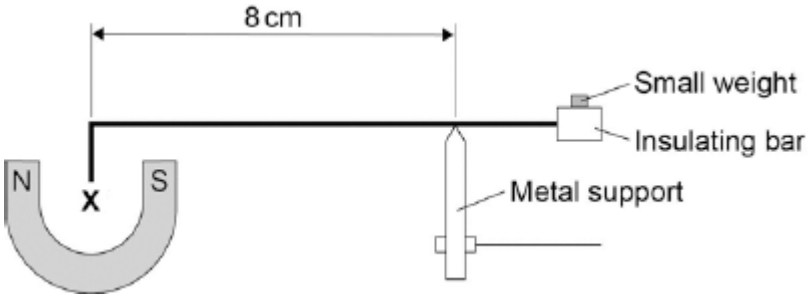
(b) Suggest one change you could make to the apparatus in **Figure 1** that would increase the size of the force that wire **X** experiences.

.....

(1)

(c) **Figure 2** shows how a small weight placed on the insulating bar makes the wire **X** go back and balance in its original position.

Figure 2



The wire **X** is 5 cm long and carries a current of 1.5 A.

The small weight causes a clockwise moment of 4.8×10^{-4} Nm.

Calculate the magnetic flux density where the wire **X** is positioned

Give the unit.

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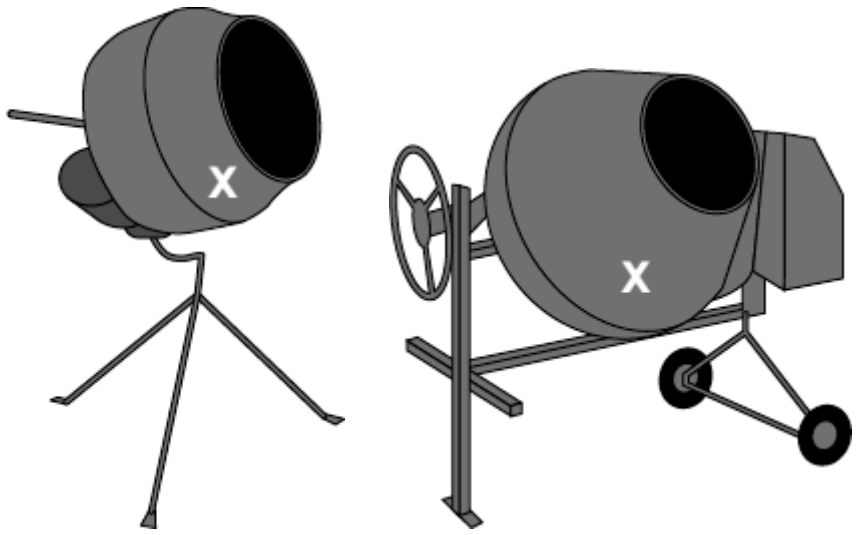
.....

Magnetic flux density = ... Unit .....

(6)

(Total 8 marks)

Q2. 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.

.....

.....

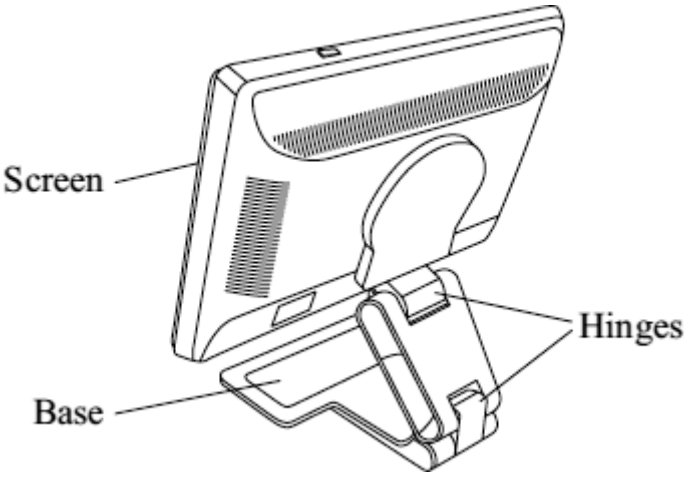
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(2)
(Total 5 marks)

Q3. 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.

.....

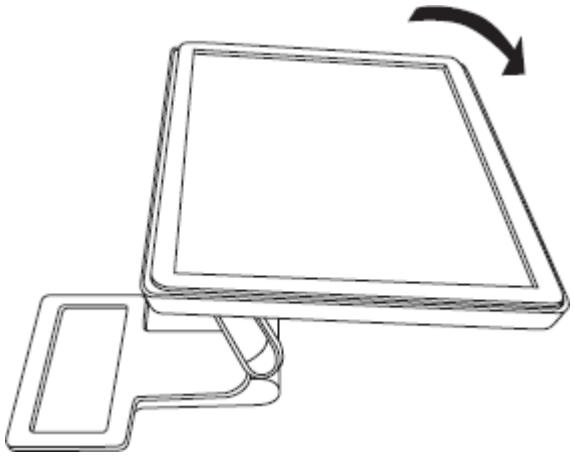
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(1)

(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.

.....

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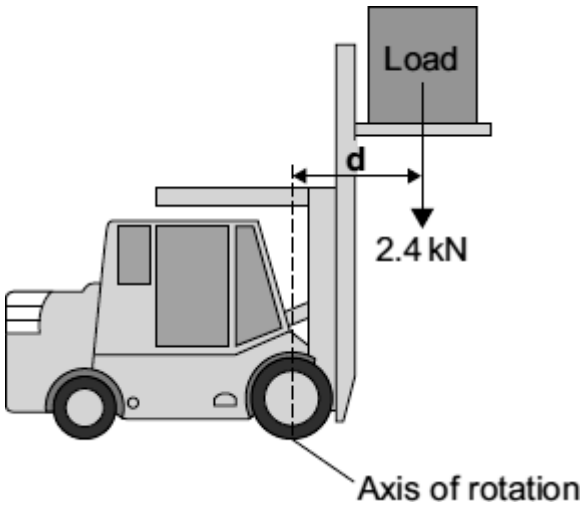
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(3)
(Total 6 marks)

Q4. **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.**

Warning

Maximum load 10.0 kN

This load must not be exceeded

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

.....

.....

.....

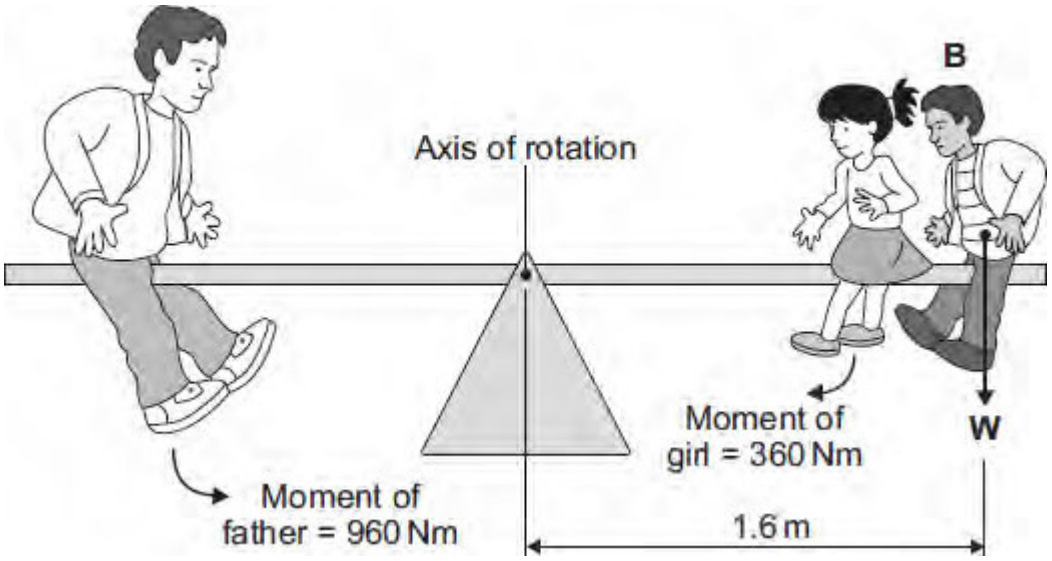
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(2)
(Total 5 marks)

Q5.The diagram shows a father and his two children sitting on a playground see-saw. The see-saw is not moving.



(a) What is the total clockwise moment of the two children about the axis of rotation?

.....

Explain the reason for your answer.

.....

.....

.....

.....

.....

.....

(3)

(b) (i) What is the clockwise moment of the boy, B, about the axis of rotation?

.....

Moment = ... Nm

(1)

(ii) Use the information in the diagram to calculate the weight, W, of the boy,

B.

Show clearly how you work out your answer.

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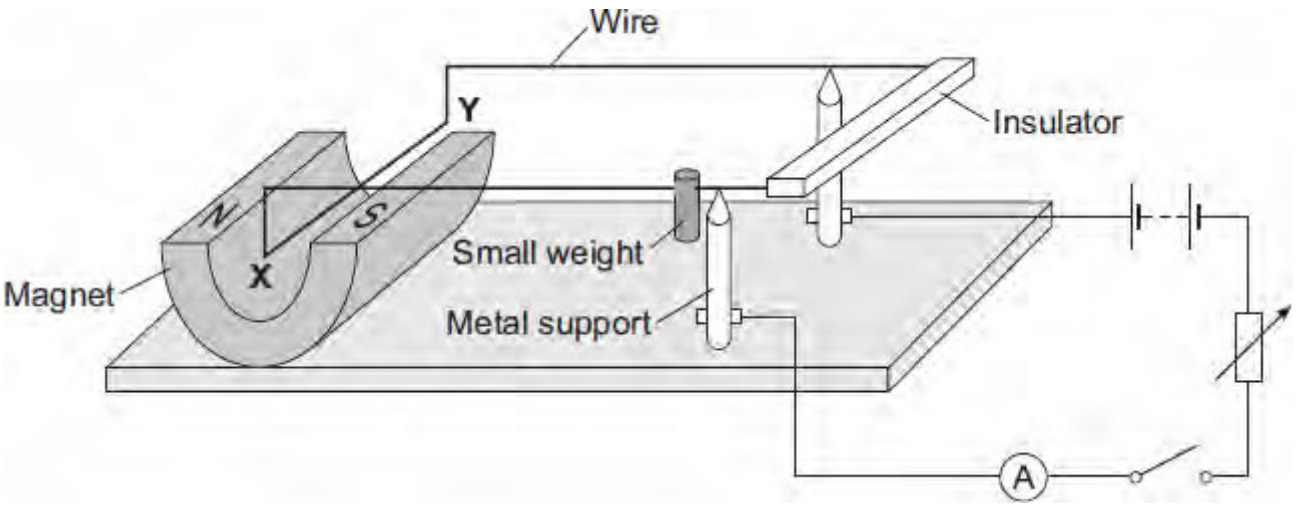
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Weight of boy B = ... N

(2)

(Total 6 marks)

Q6.The diagram shows a device called a current balance.



(a) (i) When the switch is closed, the part of the wire labelled XY moves upwards.

Explain why.

.....

.....

.....

.....

(2)

(ii) What is the name of the effect that causes the wire XY to move?

.....

(1)

(iii) An alternating current (a.c.) is a current which reverses direction. How many times the current reverses direction in one second depends on the frequency of the alternating supply.

Describe the effect on the wire XY if the battery is replaced by an a.c. supply having a frequency of 5 hertz.

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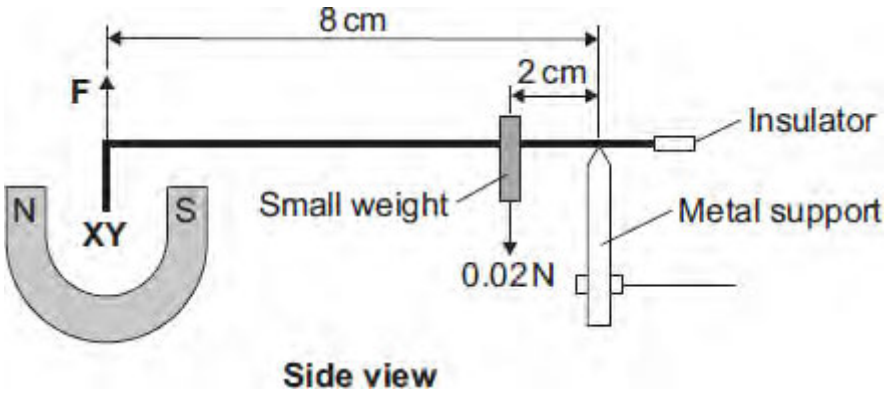
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(2)

(b) The diagram shows how a small weight can be used to make the wire XY balance horizontally.



Use the data in the diagram and the equation in the box to calculate the force, F, acting on the wire XY.

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

Show clearly how you work out your answer.

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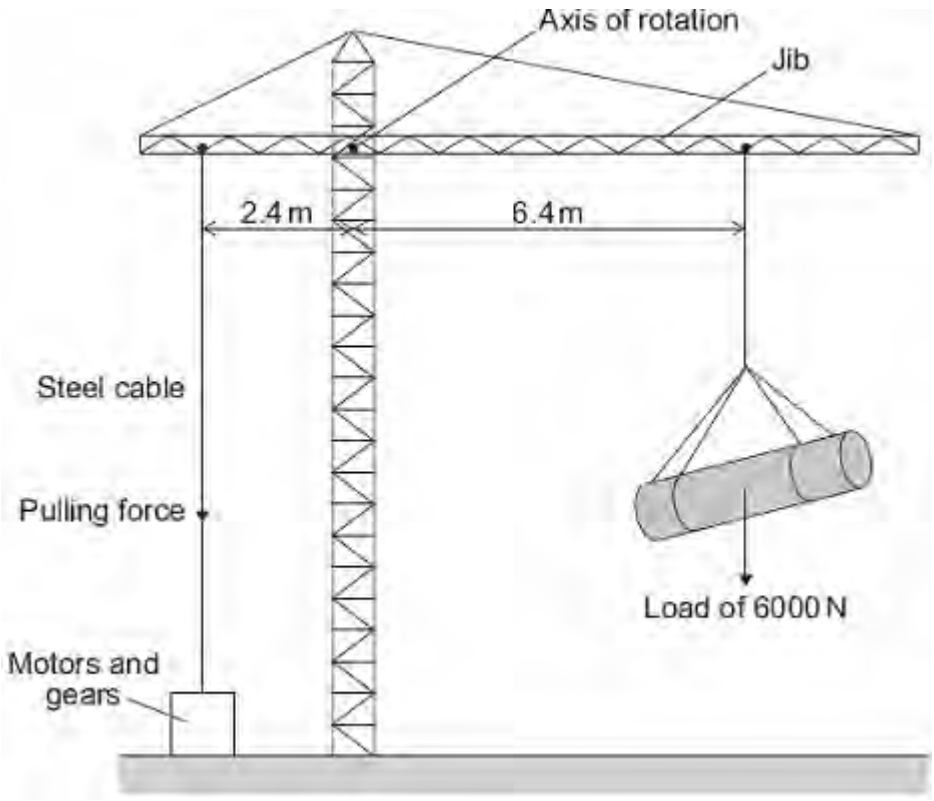
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Force = ... N

(3)

(Total 8 marks)

Q7.The diagram shows a design for a crane. The crane is controlled by a computer.



The purpose of the motors and gears is to change the pulling force in the steel cable.
This is done so that the jib stays horizontal whatever the size of the load or the position of the load.

(a) Calculate the moment caused by the load in the position shown in the diagram.

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

.....

.....

Moment = ...

(3)

(b) Calculate the pulling force that is needed in the steel cable to keep the jib horizontal.

Show clearly how you work out your answer.

.....

.....

Pulling force = ... N

(2)

(Total 5 marks)

Q8.Forces have different effects.

(a) (i) Use the correct answer from the box to complete the sentence.

slowing	stretching	turning

The moment of a force is the ..... effect of the force.

(1)

(ii) What is meant by the centre of mass of an object?

.....

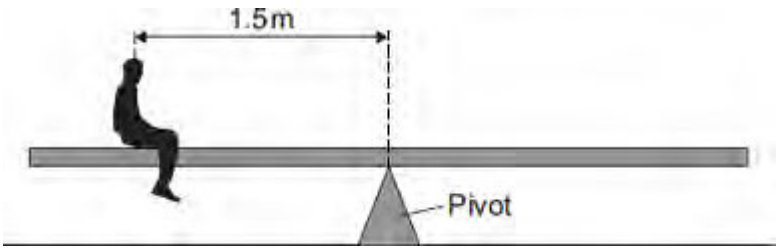
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(1)

(b) Some children build a see-saw using a plank of wood and a pivot. The centre of mass of the plank is above the pivot.

Figure 1 shows a boy sitting on the see-saw. His weight is 400 N.

Figure 1



Calculate the anticlockwise moment of the boy in Nm.

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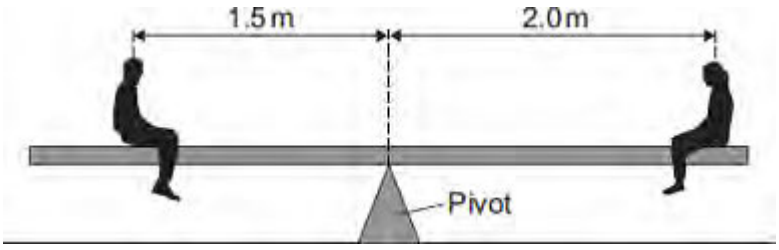
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Anticlockwise moment = ... Nm

(2)

(c) Figure 2 shows a girl sitting at the opposite end of the see-saw. Her weight is 300 N.

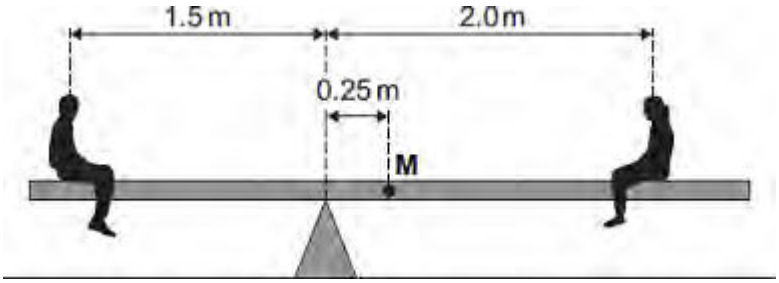
Figure 2



The see-saw is now balanced.

The children move the plank. Its centre of mass, M, is now 0.25 m from the pivot as shown in Figure 3.

Figure 3



The boy and girl sit on the see-saw as shown in Figure 3.

(i) Describe and explain the rotation of the see-saw.

.....

.....

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.....

.....

(3)

(ii) The boy gets off the see-saw and a bigger boy gets on it in the same place. The girl stays in the position shown in Figure 3. The plank is balanced. The weight of the plank is 270 N.

Calculate the weight of the bigger boy.

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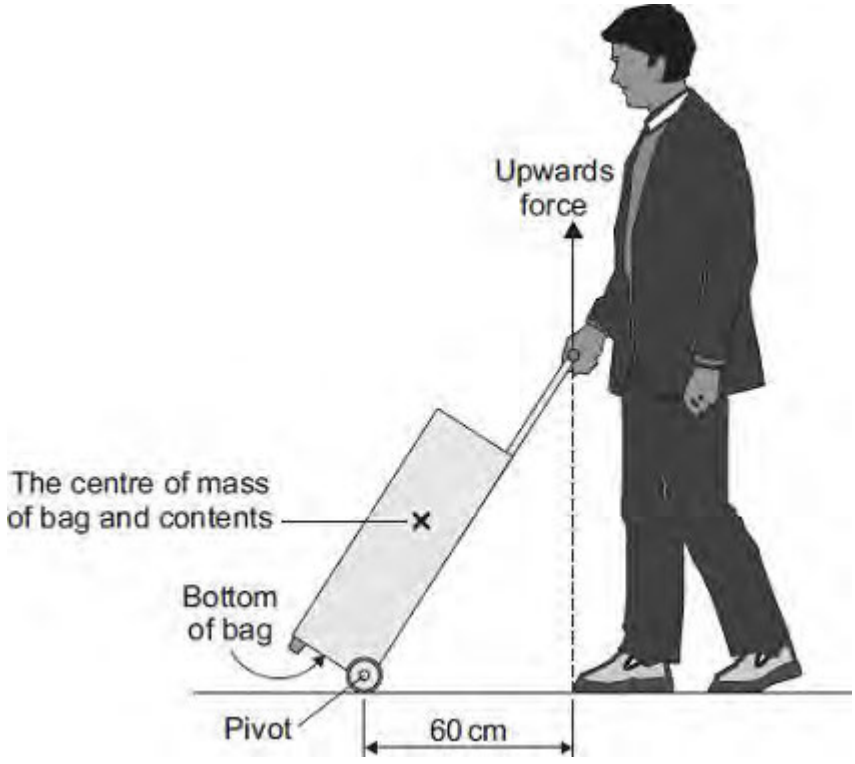
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Weight of the bigger boy = ... N

(3)
(Total 10 marks)

Q9.The diagram shows a man standing in an airport queue with his wheeled bag.



(a) The man applies an upward force to the handle of his bag to stop the bag from falling.
The moment of this force about the pivot is 36 Nm.

Calculate the upward force the man applies to the handle of his bag.

.....

.....

.....

.....

Force = ... N

(2)

(b) When the man lets go of the bag handle, the bag falls and hits the floor.

Explain why.

.....

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(2)
(Total 4 marks)