GCSE Physics

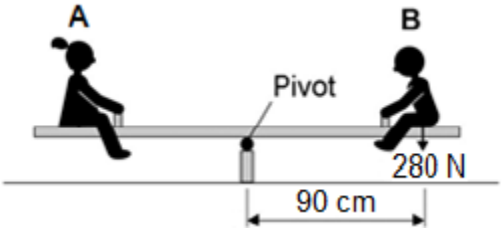
Moments

Question Paper

Time available: 56 minutes
Marks available: 49 marks

1. Two children, **A** and **B**, are sitting on a see-saw, as shown in the figure below.

The see-saw is balanced.



(a) Use the following equation to calculate the moment of child **B** about the pivot of the see-saw.

moment of a force = force × distance

Give your answer in newton-metres

Moment = _____ Nm

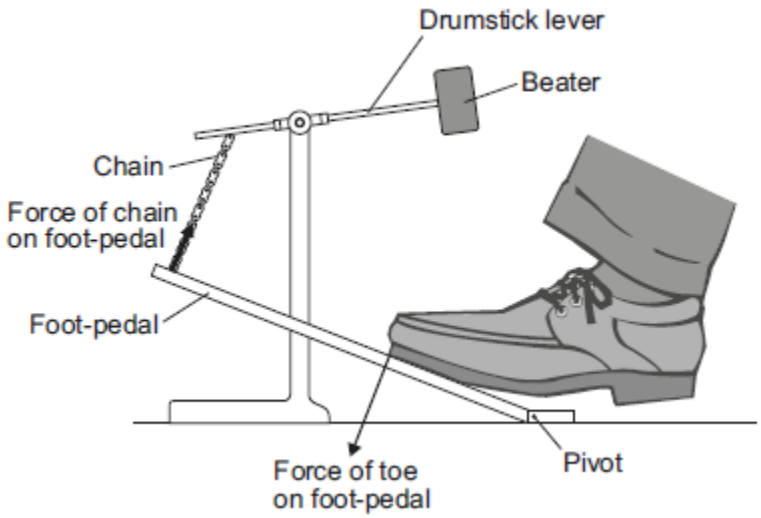
(2)

(b) Use the idea of moments to explain what happens when child **B** moves closer to the pivot.

(3)

(Total 5 marks)

2. A drum is hit by a beater attached to a drumstick lever. The drumstick lever is attached to a foot-pedal by a chain, as shown below.



(a) State how the size of the force of the chain on the foot-pedal compares with the size of the force of the toe on the foot-pedal.

_____

_____

(1)

(b) The foot-pedal is pushed halfway down and held stationary.

The force of the toe and the force of the chain each create a moment which acts on the foot-pedal.

Compare the size and direction of the moments of the toe and the chain.

Tick (✓) **one** box.

Size	**Direction**	**Tick (✓)**
The moments are equal	same	
The moments are equal	opposite	
The moment of the force of the toe is greater	same	

(1)

(c) How can the drummer create a greater moment about the pivot without increasing the force he applies?

_____

_____

(1)

(Total 3 marks)

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

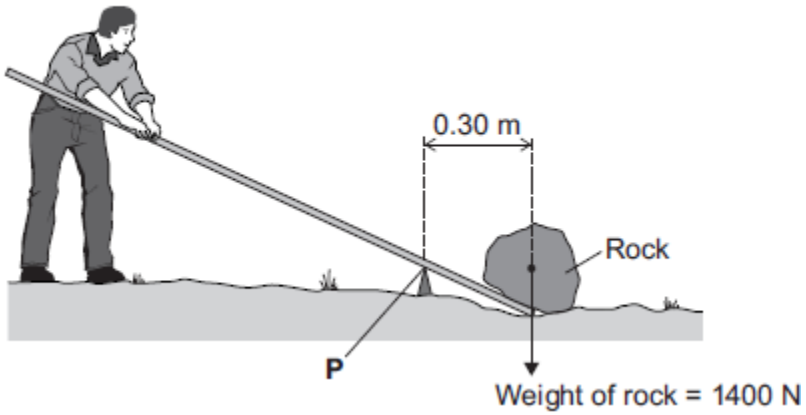
balancing	stretching	turning

A moment is the _____ effect of a force.

(1)

(b) **Figure 1** shows how a lever can be used to lift a heavy rock.

Figure 1



Calculate the moment of the weight of the rock about point **P**.

_____

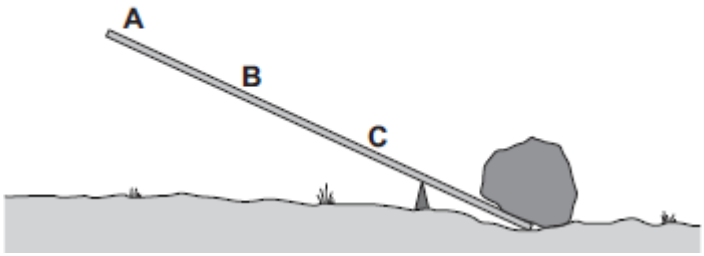
_____

Moment = _____ newton metres

(2)

(c) **Figure 2** shows three positions on the lever, **A**, **B** and **C**, where the person could have applied a force to lift the rock.

Figure 2



Which position, **A**, **B** or **C**, needs the smallest force to lift the rock?

Draw a ring around the correct answer.

A **B** **C**

Give the reason for your answer.

_____

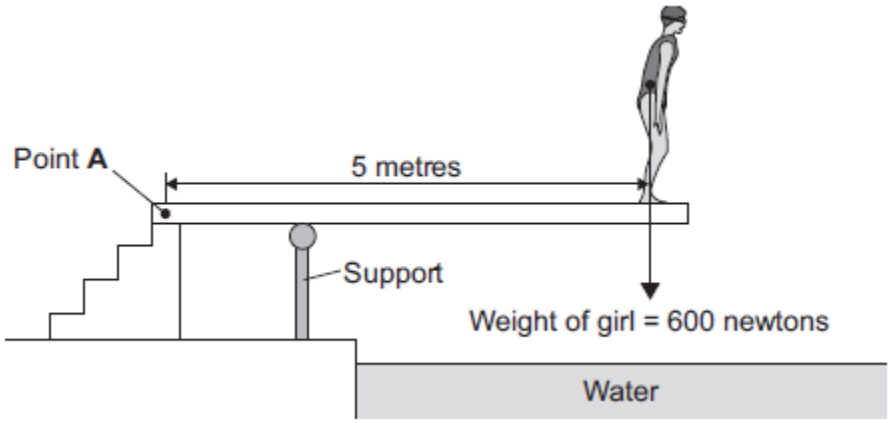
_____

(2)

(Total 5 marks)

4. **Figure 1** shows a girl standing on a diving board.

Figure 1



(a) Calculate the moment of the girl's weight about Point **A**.

_____

_____

_____

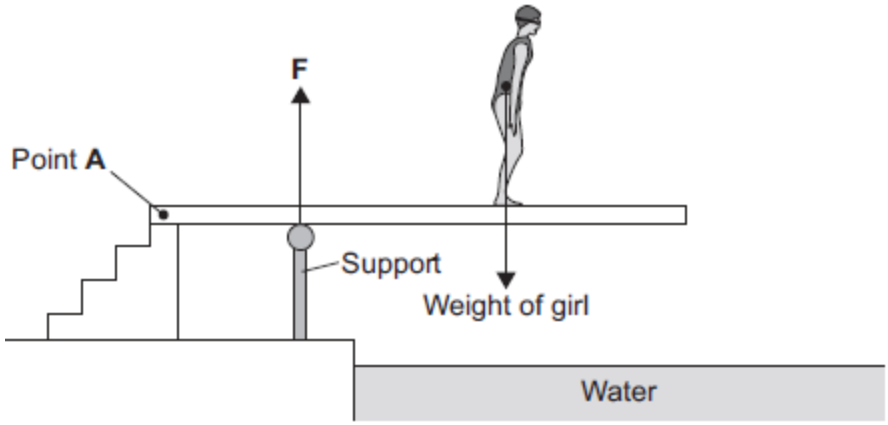
Moment = _____ newton metres

(2)

(b) **Figure 2** shows the girl standing at a different place on the diving board.

The support provides an upward force **F** to keep the diving board balanced.

Figure 2



Complete the following sentence.

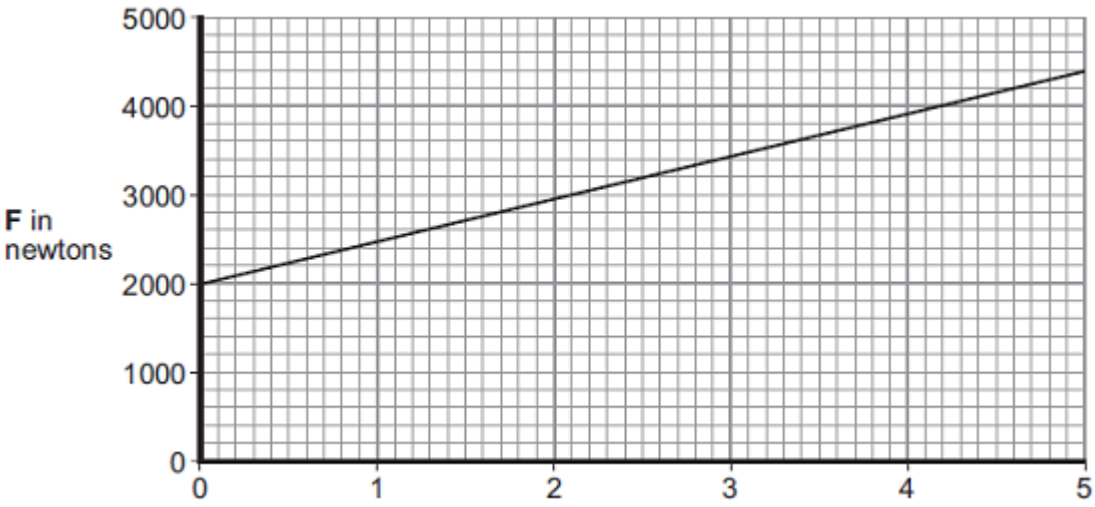
The diving board is not turning. The total clockwise moment is balanced

by the total _____ .

(1)

(c) **Figure 3** shows how the upward force **F** varies with the distance of the girl from Point **A**.

Figure 3



(i) Use **Figure 3** to determine the upward force **F** when the girl is standing at a distance of 3 metres from point **A**.

Upward force **F** = _____ newtons

(1)

(ii) What conclusion should be made from **Figure 3**?

_____

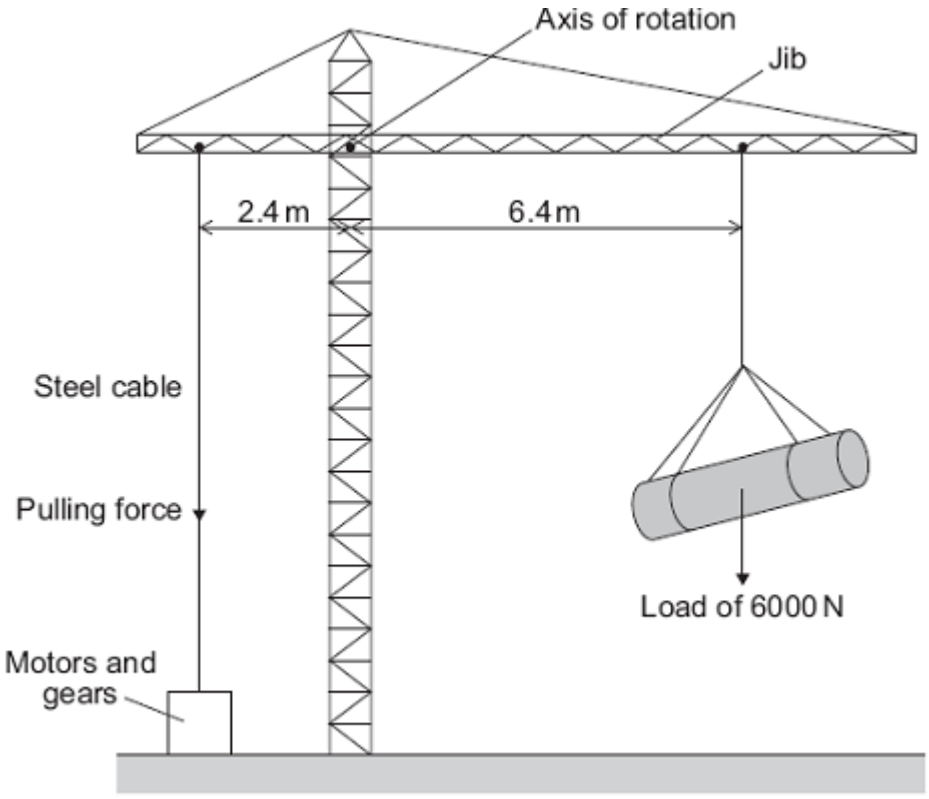
_____

_____

(1)

(Total 5 marks)

5. 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.

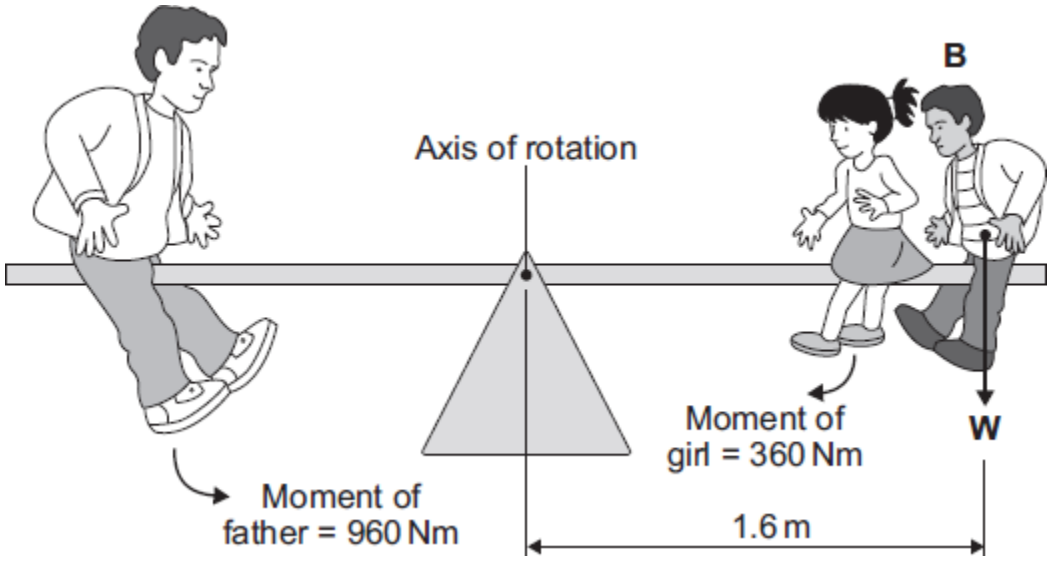
Show clearly how you work out your answer.

Pulling force = _____ N

(2)

(Total 5 marks)

6. 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.

_____

_____

_____

_____

Weight of boy **B** = _____ N

(2)

(Total 6 marks)

7. (a) A student investigates the moment of a force.

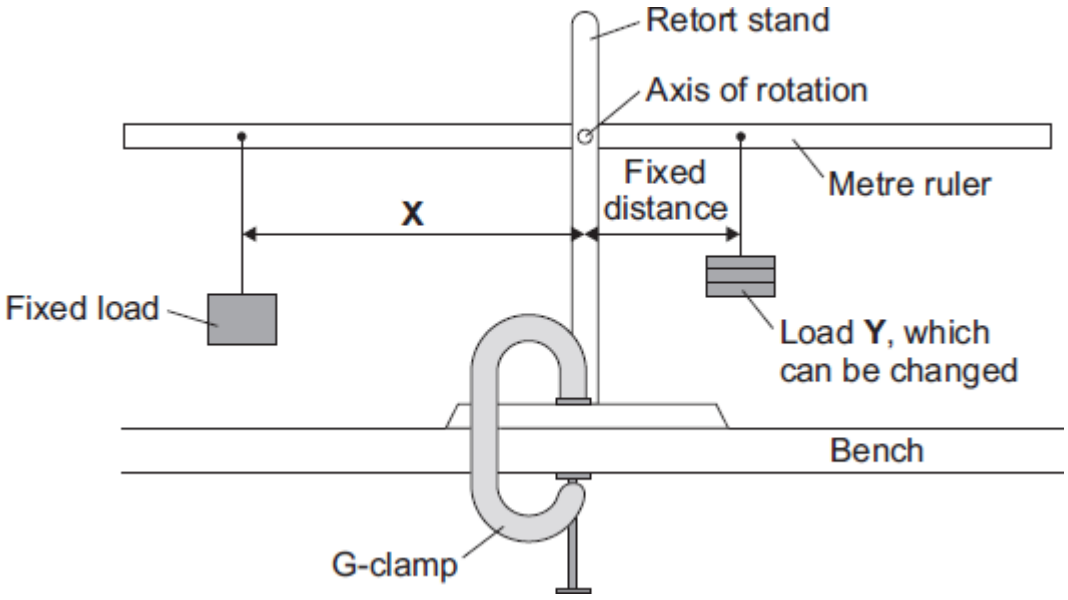
(i) What does the word *moment* mean in this sentence?

_____

_____

(1)

(ii) The diagram shows how she sets up her apparatus.



Suggest the purpose of the G-clamp.

_____

_____

(1)

(iii) A horizontal rod fits into a hole at the centre of the metre ruler. This is the axis of rotation. The student changes the load **Y** and adjusts the distance **X** until the metre ruler is horizontal. She takes six pairs of measurements which are shown in the table.

Load Y in newtons	**Distance X in centimetres**
1	7
2	14
3	21
4	28
5	35
6	42

Explain fully how distance **X** varies with load **Y**.

_____

_____

_____

_____

_____

(2)

(iv) The weight of the ruler can be ignored in this experiment.

Which statement gives the reason why?

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

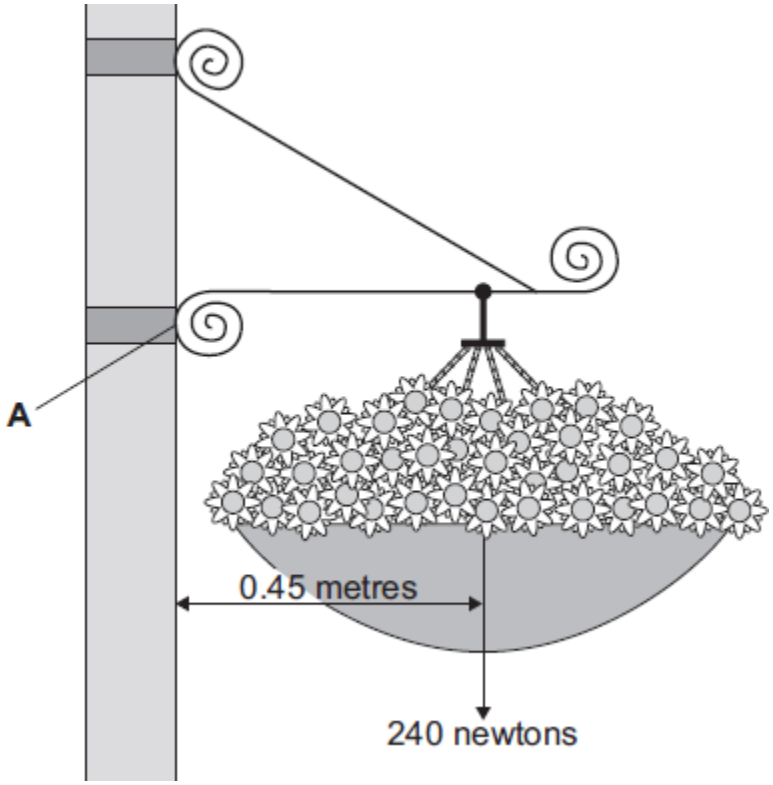
The weight of the ruler is so small it is negligible. ☐

The centre of mass of the ruler is at the axis of rotation. ☐

The ruler is a symmetrical object. ☐

(1)

(b) In the summer, a town council fits hanging baskets to some of its lamp posts.



Use the information in the diagram and the equation in the box to calculate the moment produced by the weight of the hanging basket about an axis through point **A**.

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

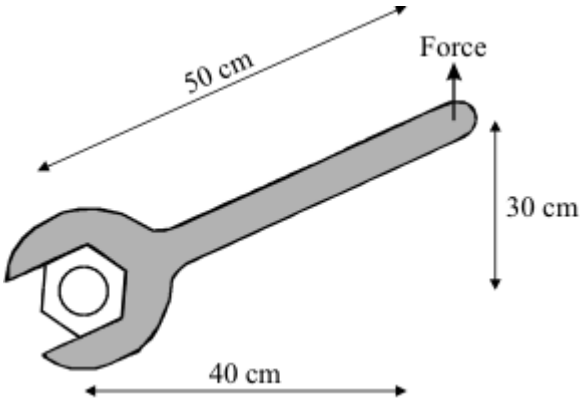
Show clearly how you work out your answer **and** give the unit.

Moment = _____

(3)

(Total 8 marks)

8. The diagram shows a spanner being used to undo a tight nut.



The nut was tightened using a moment of 120 newton metres.

Calculate the force needed to undo the nut. Show clearly how you work out your answer.

_____

_____

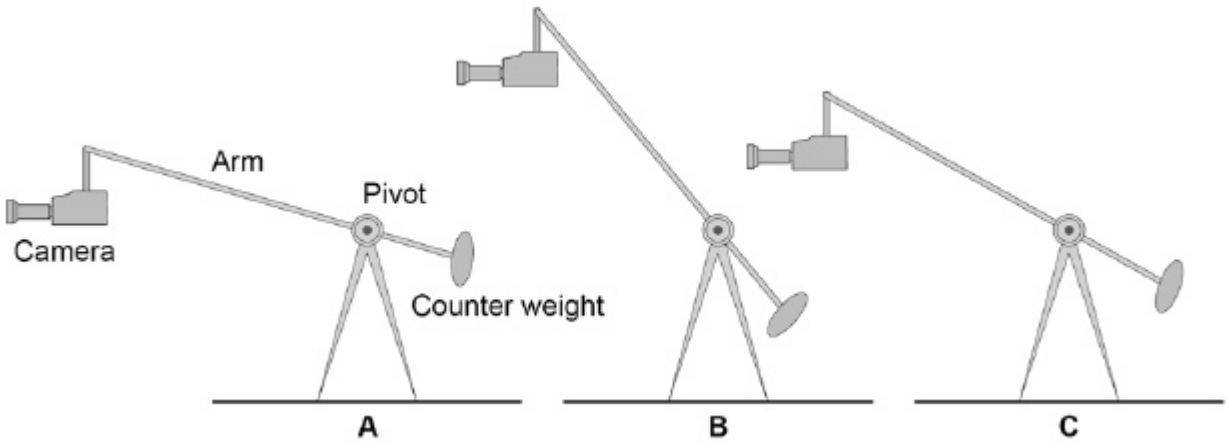
Force = _____ N

(Total 2 marks)

9. A camera boom is used at a television studio to allow filming from different positions.

Figure 1 shows the arm of the boom in three different positions.

Figure 1



(a) In which position will the weight of the camera cause the largest moment about the pivot?

Tick **one** box.

A ☐ **B** ☐ **C** ☐

Give the reason for your answer.

_____

_____

(2)

(b) Complete the sentence.

Choose the answer from the box.

decreases	**does not change**	**increase**

When the moment caused by the weight of the camera increases, the moment caused by the counterweight _____ .

(1)

(c) The camera has a mass of 5.0 kg

gravitational field strength = 9.8 N/kg

Calculate the weight of the camera.

Use the equation:

weight = mass × gravitational field strength

Give the unit.

Choose the answer from the box.

joule	**kilogram**	**newton**

_____

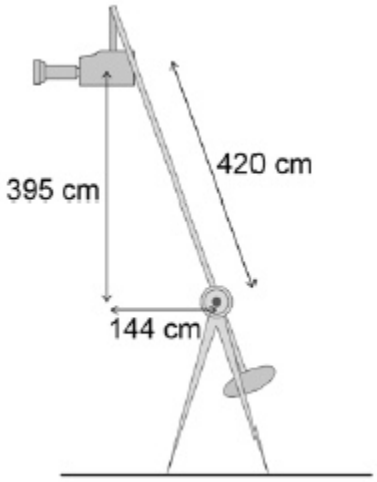
_____

Weight = _____ Unit _____

(3)

Figure 2 shows the camera boom in a new position, **D**.

Figure 2



(d) Write the equation which links distance, force and moment of a force.

_____

(1)

(e) Calculate the moment about the pivot caused by the weight of the camera when the arm of the boom is in position **D**.

_____

_____

_____

_____

_____

Moment = _____ Nm

(3)

(Total 10 marks)