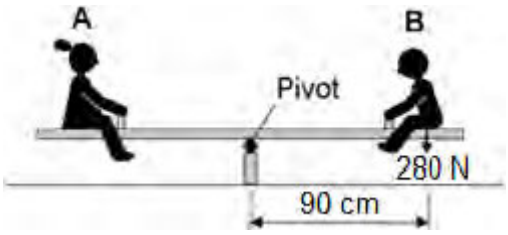
Q1. Two children, **A** and **B**, are sitting on a see-saw, as shown in the figure below.

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.

.....

.....

.....

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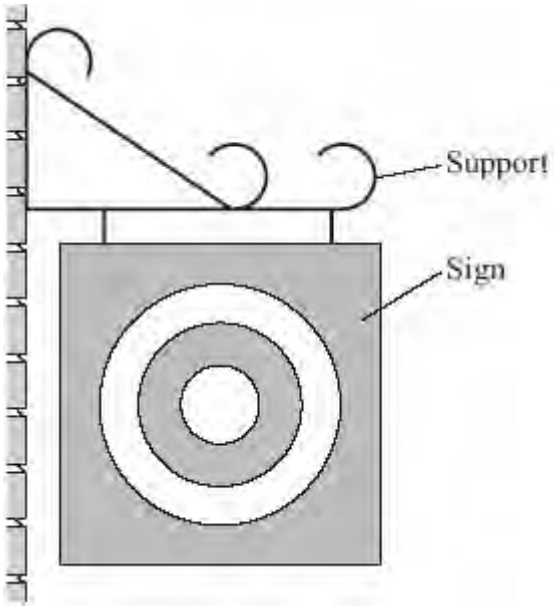
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(3)

(Total 5 marks)

Q2. The drawing shows a sign which hangs outside a shop.



(a) Draw an **X** on the sign so that the centre of your **X** is at the centre of mass of the sign.

(1)

(b) Use a ruler to draw **one** axis of symmetry on the sign.

(1)

(c) One force which acts on the sign is its weight.

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

The moment of the weight produces	an accelerating a balancing a turning	effect.

(1)
(Total 3 marks)

Q3. A spanner makes it a lot easier to loosen a bolt.



You cannot usually loosen a bolt with your fingers.

It is easier with a spanner.

Choose words from this list to complete the sentences below.

lever **piston** **pivot** **pulley** **turning effect**

The spanner is a simple .....

You use it to produce a bigger ..... on the bolt.

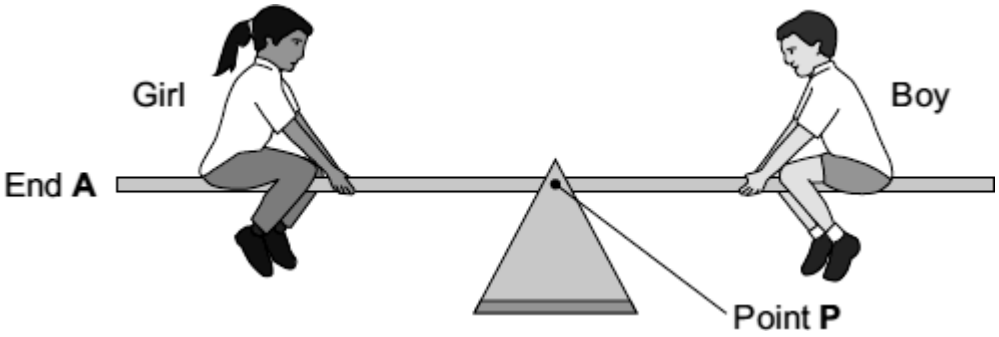
A longer spanner works better.

This is because there is a bigger distance between your force and the .....

(Total 3 marks)

Q4. 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.
oad.
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,

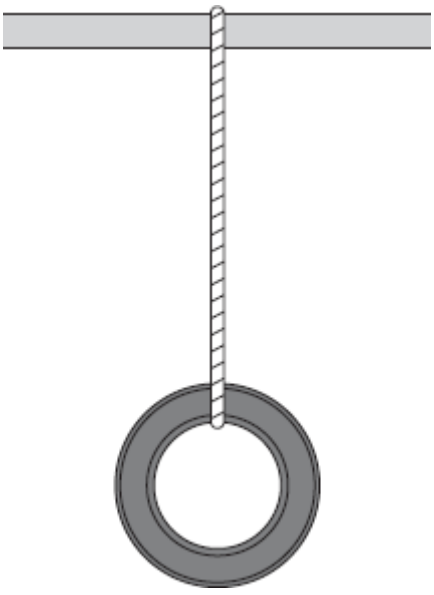
the boy moves nearer to point **P**.
the girl moves nearer to point **P**.
the girl moves nearer to end **A**.

(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.

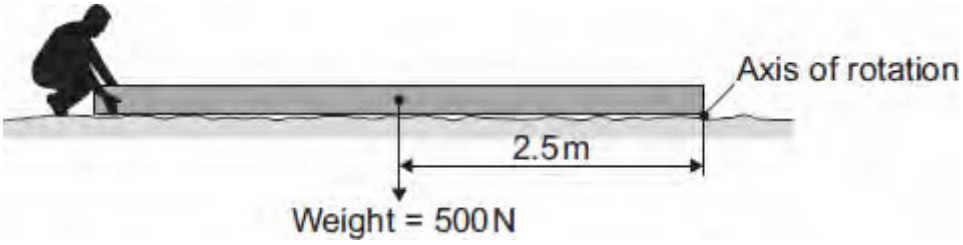
above	**below**	**to the left of**	**to the right of**

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)

Q5. The diagram shows someone starting to lift the end of a heavy wooden pole.



(a) Use the equation in the box to calculate the moment produced by the weight of the pole.

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

.....

.....

Moment = ... Nm

(2)

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

The smallest force needed to lift the end of the pole will be

bigger than
the same as
smaller than

the weight of the pole.

(1)

(ii) Give a reason for your answer to part (b)(i).

.....

.....

(1)

(c) How could the person lifting the end of the pole increase the moment?

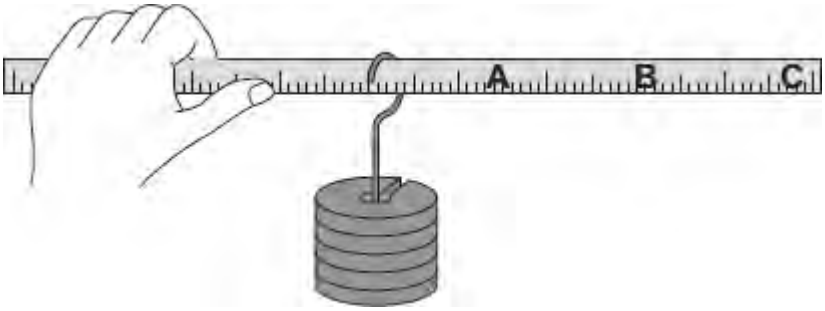
.....

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(1)

(Total 5 marks)

Q6. (a) A student holds a ruler at one end and slides a weight along the ruler.



At which point, **A**, **B** or **C**, will the turning effect of the weight feel greatest?

Write your answer, **A**, **B** or **C**, in the box. Point ☐

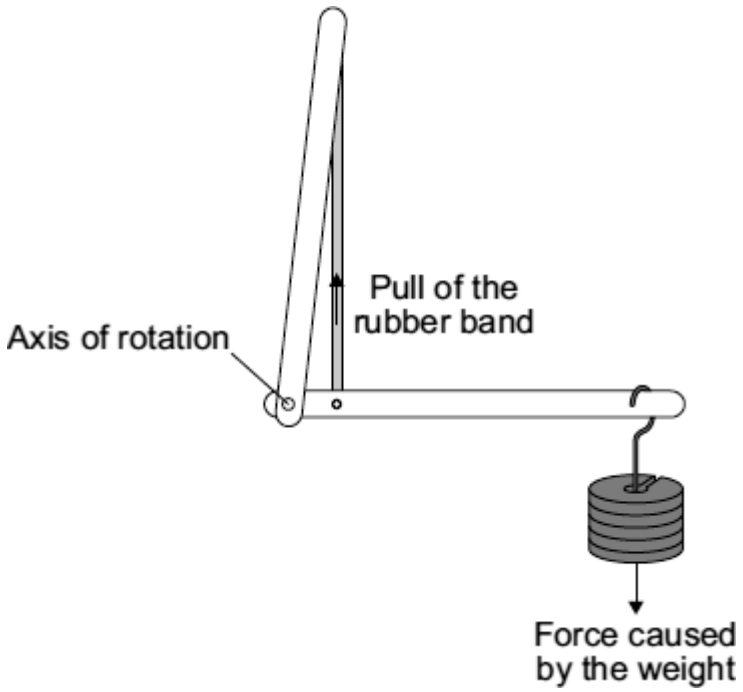
(1)

(b) Complete the following sentence by drawing a ring around the correct word in the box.

The turning effect of a force is called the | axis / equilibrium / moment | of the force.

(1)

(c) In a human arm, the biceps muscle provides the force needed to hold the arm horizontal.
A student uses a model in which a rubber band represents the biceps muscle.



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

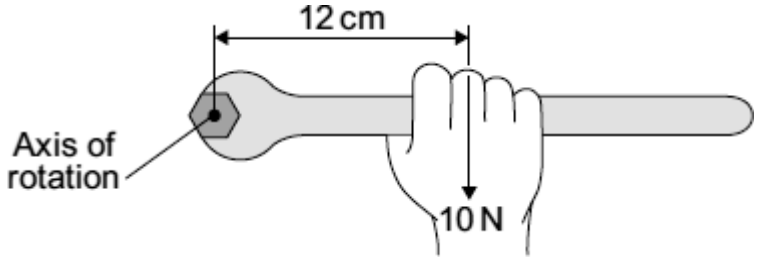
To hold the model arm horizontal, the pull from the rubber band will be

bigger than
smaller than
the same as

the force caused by the weight.

(1)

(d) The diagram shows a long spanner.



Use the equation in the box to calculate the moment, in N cm, being produced.

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.

.....

.....

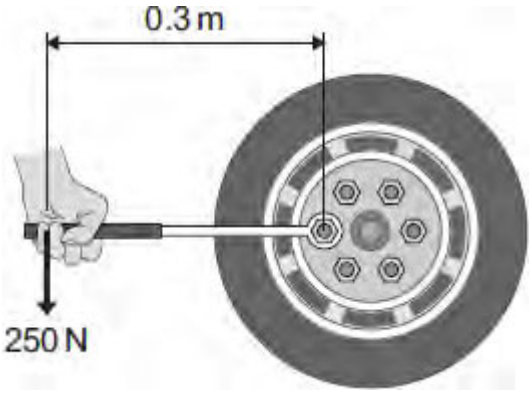
Moment = ... N cm

(2)

(Total 5 marks)

Q7. A company makes a wheel wrench with an extending handle. The company claims that the extending handle makes it easier to loosen the wheel nuts on a car.

The diagram shows the wheel wrench being used without the handle extended.



(a) (i) Use the equation in the box to calculate the moment produced by the force on the wrench.

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.

.....

.....

Moment = ... newton metres

(2)

(ii) Units can be written in words or symbols.

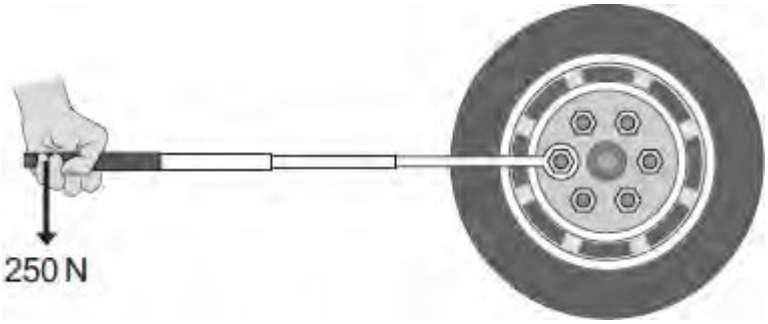
Which of the following is the unit for a moment written using symbols?

Draw a ring around your answer.

nm **Nm** **nM** **NM**

(1)

(b) The wheel nut will not move and so the handle of the wrench is extended.



It is now easy to loosen the wheel nut using the same force as before.

Explain why.

.....

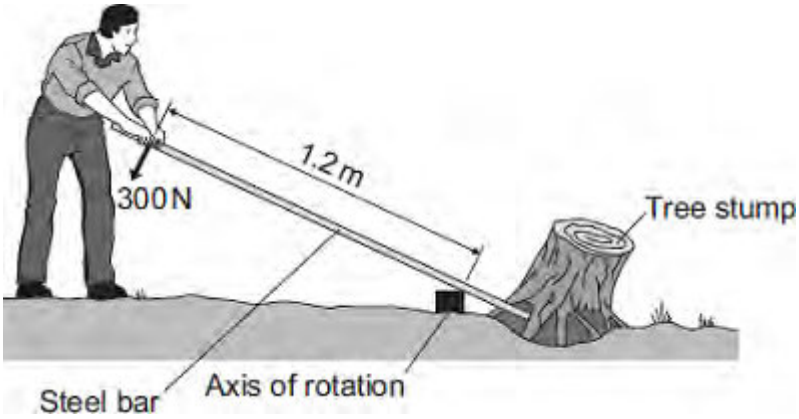
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(2)
(Total 5 marks)

Q8. The diagram shows a gardener using a steel bar to lift a tree stump out of the ground.



When the gardener pushes with a force of 300 **N**, the tree stump just begins to move.

(a) Use the equation in the box to calculate the moment produced by the 300 N force.

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

Show clearly how you work out your answer.

.....

.....

Moment = ... newton metres

(2)

(b) Using a longer steel bar would have made it easier for the gardener to lift the tree stump out of the ground.

Explain why.

.....

.....

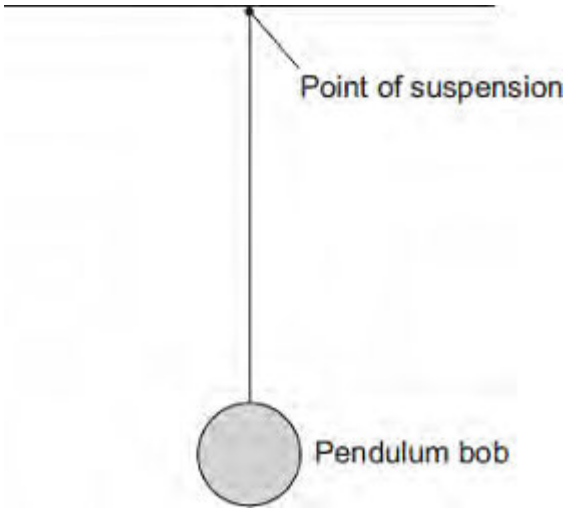
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(2)

(Total 4 marks)

Q9.(a) The diagram shows a pendulum.



Draw an X on the diagram above, so that the centre of the **X** marks the centre of mass of the pendulum bob.

(1)

(b) A large clock keeps time using the swing of a pendulum.



(i) The frequency of the swinging pendulum is 0.5 hertz.

Calculate the periodic time of the pendulum.

.....

.....

.....

Periodic time = ... seconds

(2)

(ii) Calculate the number of complete swings the pendulum would make in 60 seconds.

Use your answer from part (b)(i) in your calculation.

.....

.....

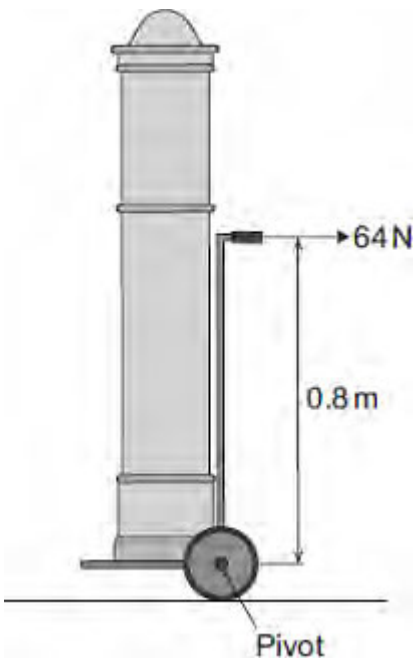
.....

Number of swings in 60 seconds = ...

(2)

(c) The diagram shows a clock on a trolley.

The trolley is being used to move the clock.



Calculate the moment of the 64 N force about the pivot.

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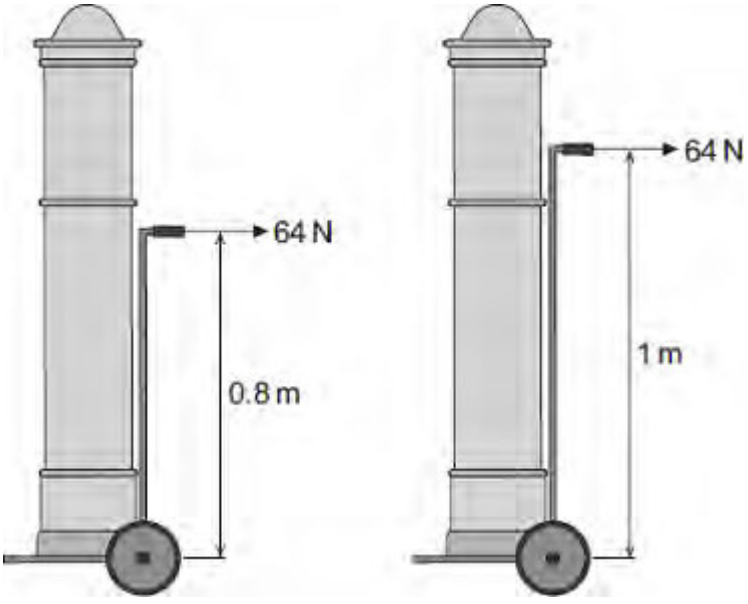
.....

.....

Moment of the force = ... Nm

(2)

(d) The design of the trolley is now changed to make it taller.



How does making the trolley taller affect the moment produced by the 64 N force about the pivot?

.....

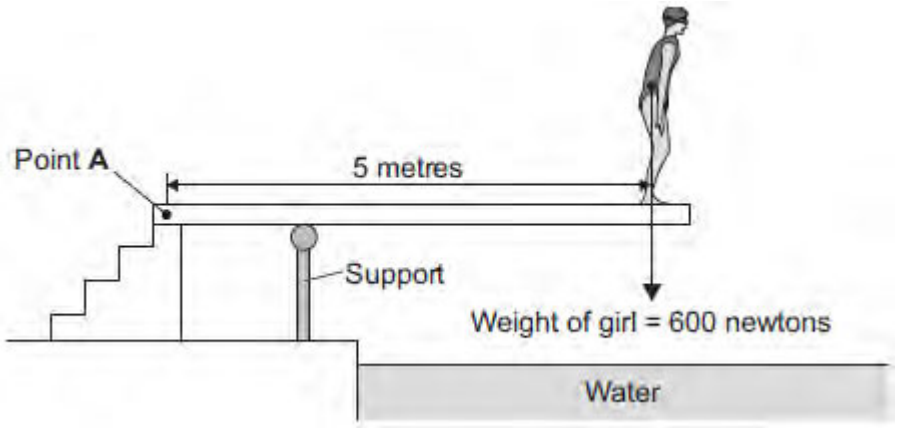
.....

(1)

(Total 8 marks)

Q10.Figure 1 shows a girl standing on a diving board.

Figure 1



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

.....

.....

.....

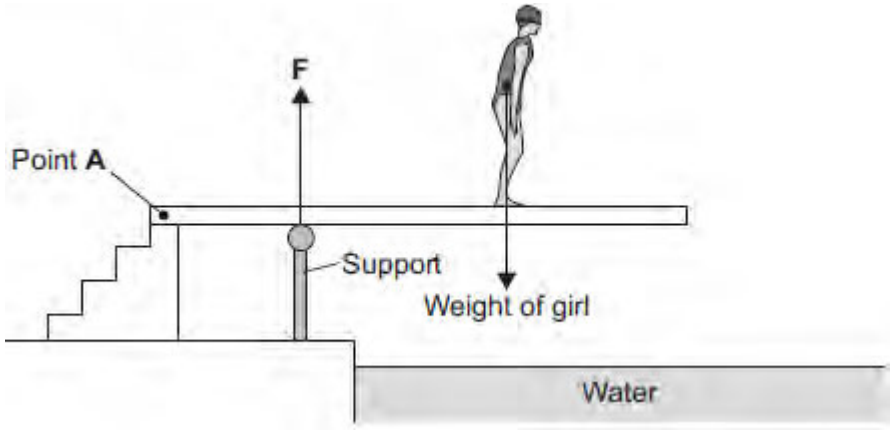
Moment = ... newton metres

(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.

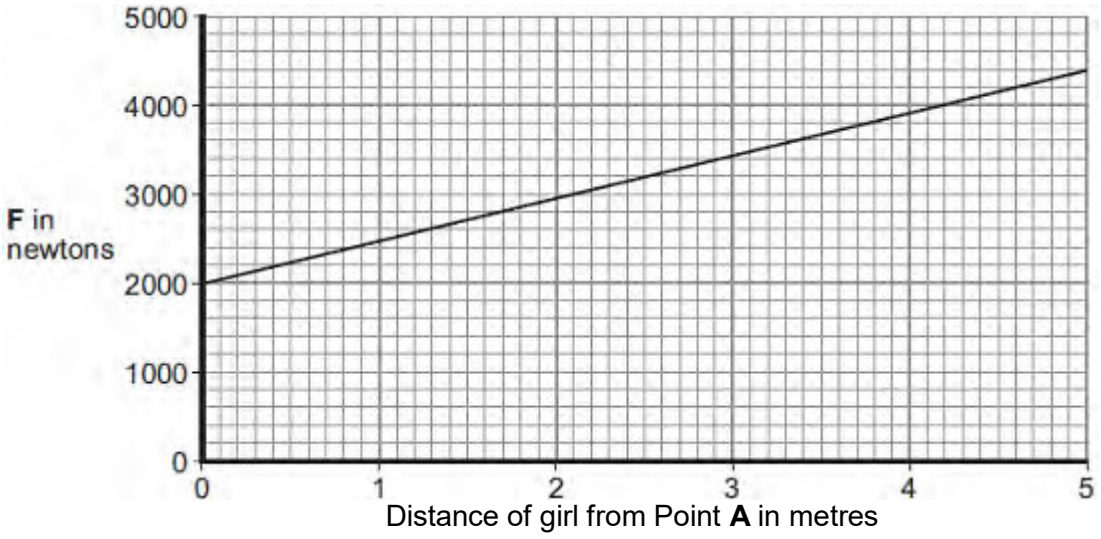
The diving board is not turning. The total clockwise moment is balanced

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**?

.....

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.....

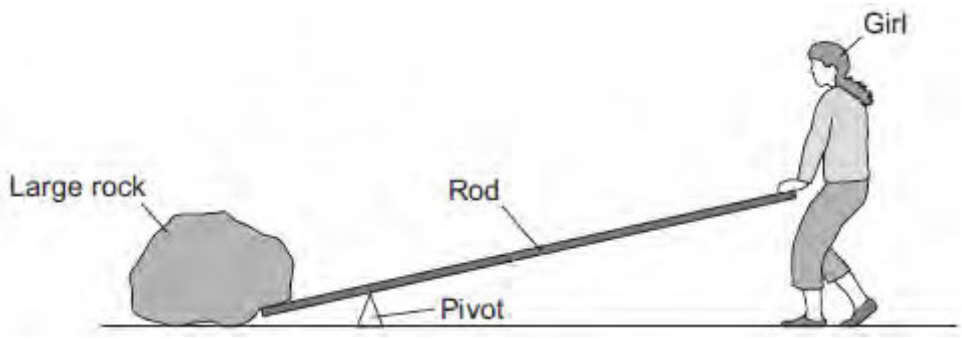
(1)

(Total 5 marks)

Q11. Levers and hydraulic systems can act as force multipliers.

(a) **Figure 1** shows a girl trying to lift a large rock using a long rod as a lever.

Figure 1



The girl is pushing down on the rod but is just unable to lift the rock.

Which of the following changes would allow her to lift the rock?

Tick (✓) **two** boxes.

Change	**Tick (✓)**
Move the pivot away from the rock	
Make the rod longer	
Push the rod upwards	
Push down on the rod with a greater force	

(2)

(b) Liquids are used in hydraulic systems because they are virtually incompressible.

Explain how the spacing of particles in a liquid cause it to be virtually incompressible.

.....

.....

.....

.....

(2)

(c) **Figure 2** shows a man using a car jack to lift his car.

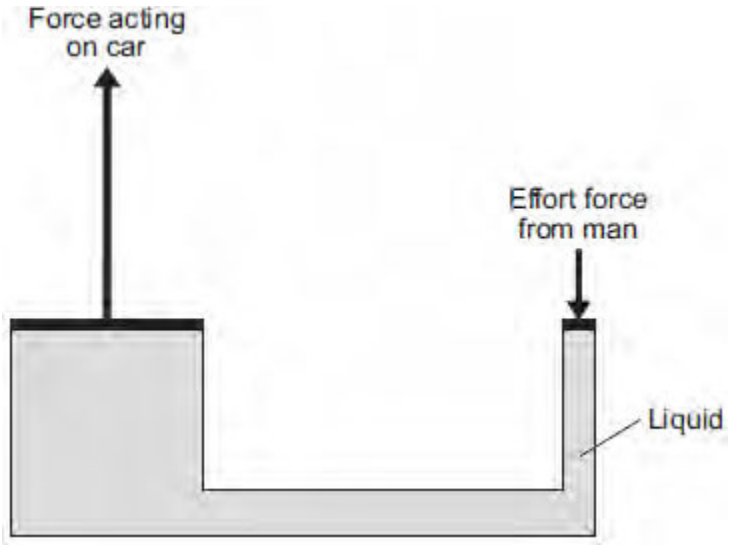
Figure 2



© lisafx/iStock/Thinkstock

Figure 3 shows a simple diagram of a car jack.

Figure 3



(i) The man pushes down with an effort force. This results in a much larger force acting upwards on the car.

Use information from **Figure 3** to explain how.

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(ii) Which of the following statements about the forces in **Figure 3** is correct?

Tick (✓) **one** box.

	Tick (✓)
The force acting on the car moves a greater distance than the effort force.	
The force acting on the car moves less distance than the effort force.	
The force acting on the car moves the same distance as the effort force.	

(1)
(Total 9 marks)