

Q1. 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

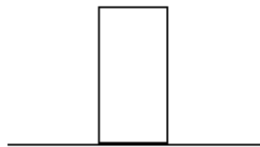
You use it to produce a bigger on the bolt.

A longer spanner works better.

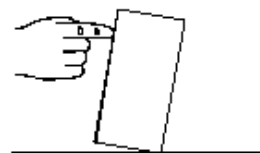
This is because there is a bigger distance between your force and the

(Total 3 marks)

Q2. 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.)

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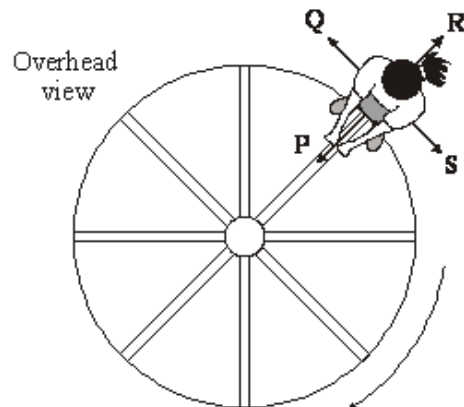
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(Total 2 marks)

Q3. A girl and her father visit a children's playground.

(a) The diagram shows the girl holding on to a roundabout which is turning.



A centripetal force must act because the girl moves in a circular path.

(i) In which direction, **P**, **Q**, **R** or **S**, does the centripetal force act?

Direction

(1)

(ii) What provides this centripetal force?

.....

.....

(1)

- (iii) Her father pushes the roundabout so that it turns faster. The girl continues to stand on the same part of the roundabout.

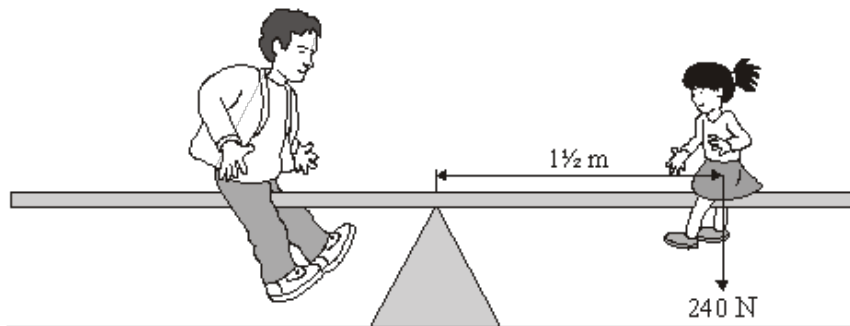
Complete the following sentence by drawing a ring around the correct line in the box.

The centripetal force on the girl

decreases
does not change
increases

(1)

- (b) The diagram shows the girl and her father on a see-saw.



- (i) Use the equation in the box to calculate the moment of the girl.

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

.....

Moment of the girl = Nm

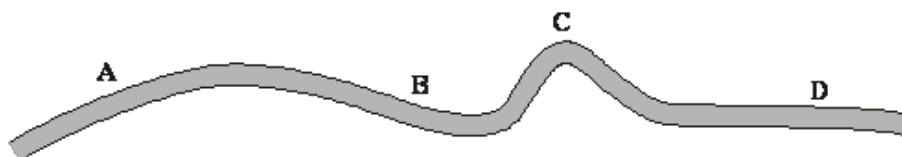
(2)

- (ii) What must her father do to increase his moment?

.....

(1)

- (c) The diagram shows part of a level road that they take when they drive home. They drive at a steady speed.



- (i) At which point, A, B, C or D, will the centripetal force on the car be greatest?

Centripetal force is greatest at

(1)

(ii) What provides the centripetal force when the car goes round a bend?

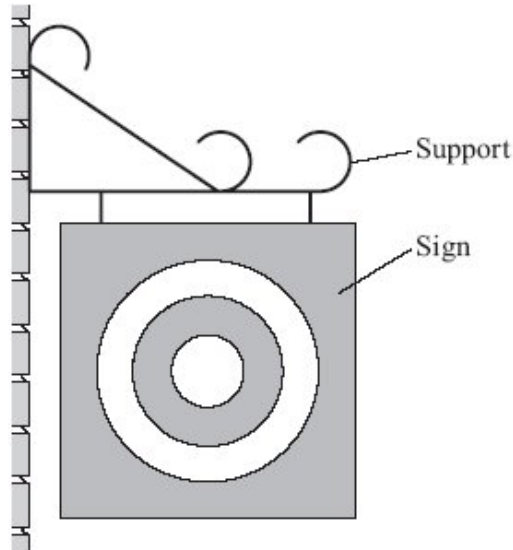
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(1)

(Total 8 marks)

Q4. 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

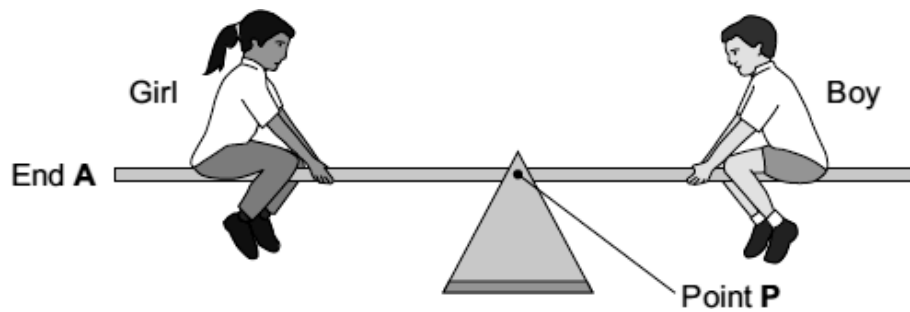
effect.

(1)

(Total 3 marks)

Q5. 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,

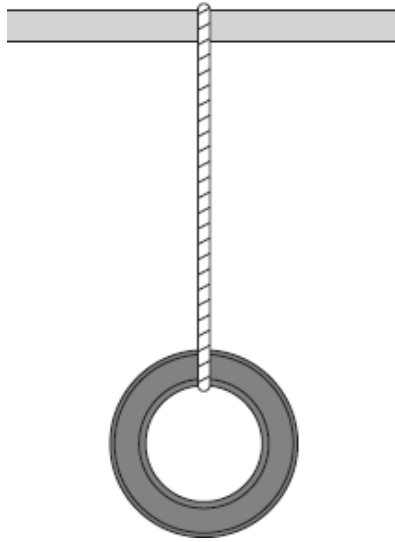
the boy moves nearer to point **P**.

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.

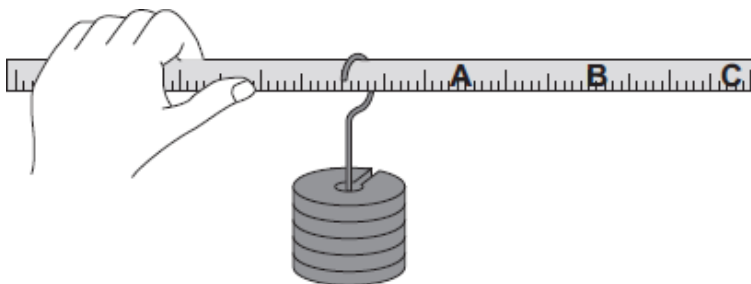
above	below	to the left of	to the right of
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If the suspended tyre is pushed, it will come to rest with its centre of mass directly the point of suspension.

(1)

(Total 5 marks)

- 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

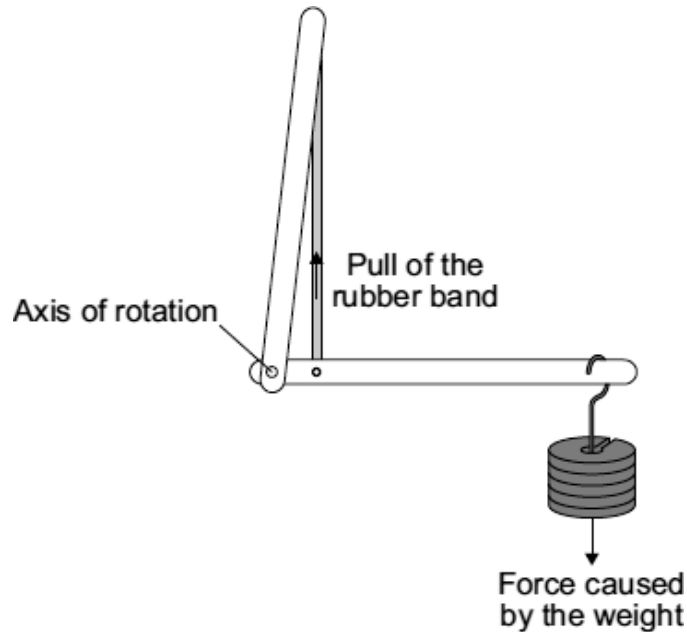
equilibrium

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

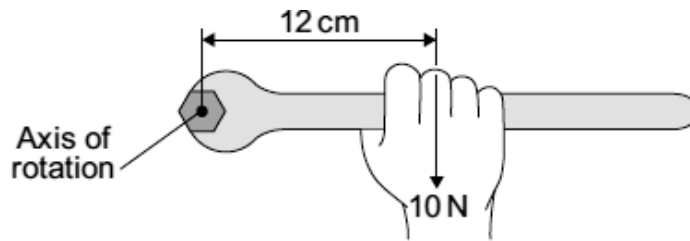
smaller than

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.

$\text{moment} = \text{force} \times \text{perpendicular distance from the line of action of the force to the axis of rotation}$
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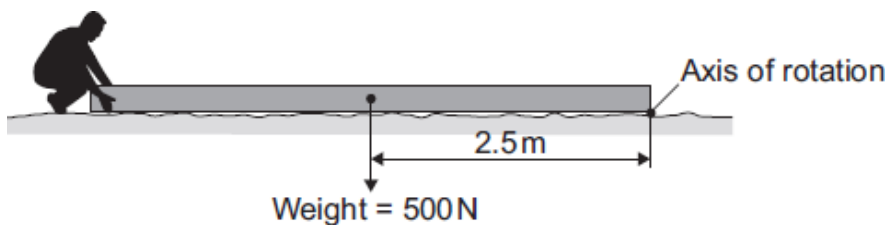
Show clearly how you work out your answer.

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Moment = N cm

(2)
 (Total 5 marks)

- Q7.** 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.

$\text{moment} = \text{force} \times \text{perpendicular distance from the line of action of the force to the axis of rotation}$
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.....

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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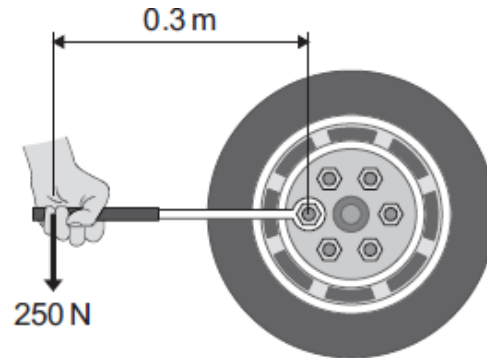
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(1)

(Total 5 marks)

- Q8.** 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.

$\text{moment} = \text{force} \times \text{perpendicular distance from the line of action of the force to the axis of rotation}$
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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

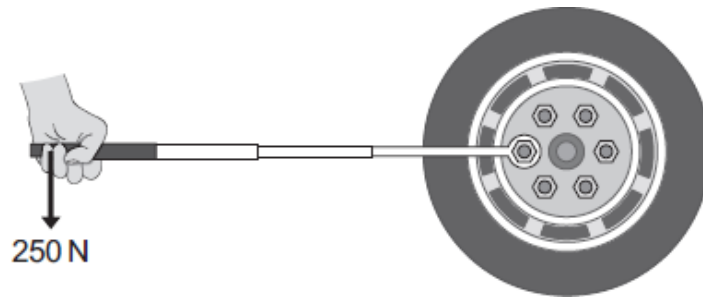
Nm

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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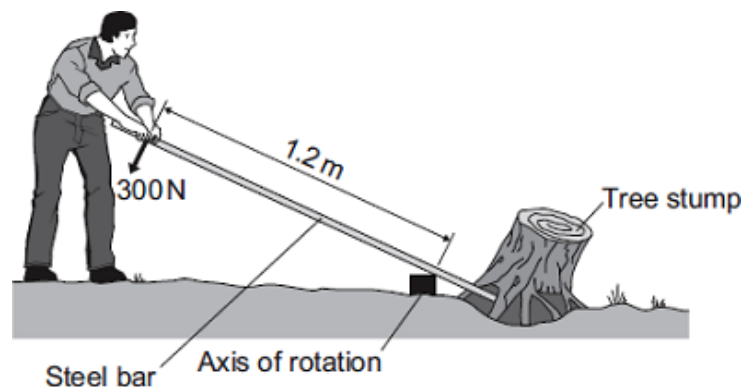
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(2)
(Total 5 marks)

- Q9.** 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 \times 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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.....

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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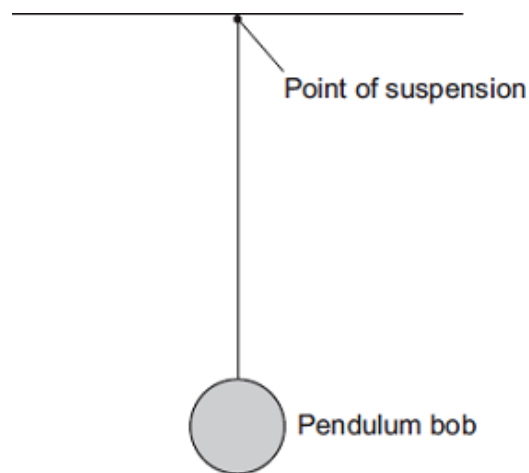
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(2)
(Total 4 marks)

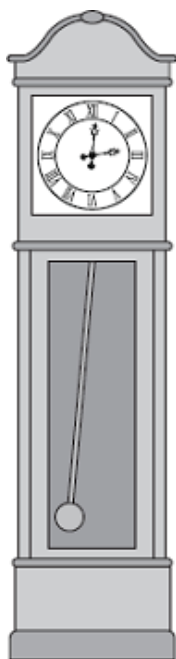
- Q10.** (a) The diagram shows a pendulum.



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.

Use the correct equation from the Physics Equations Sheet.

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Periodic time = seconds

(2)

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

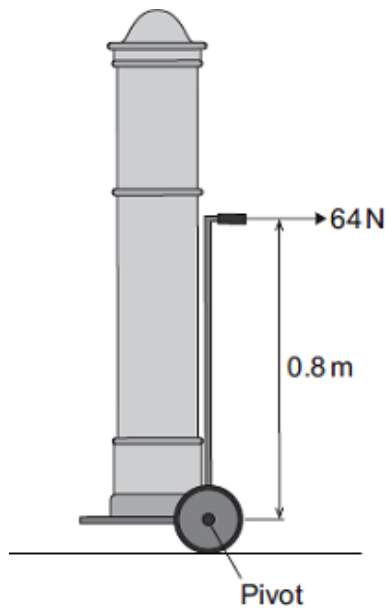
Use your answer from part (b)(i) in your calculation.

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.....
.....

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.

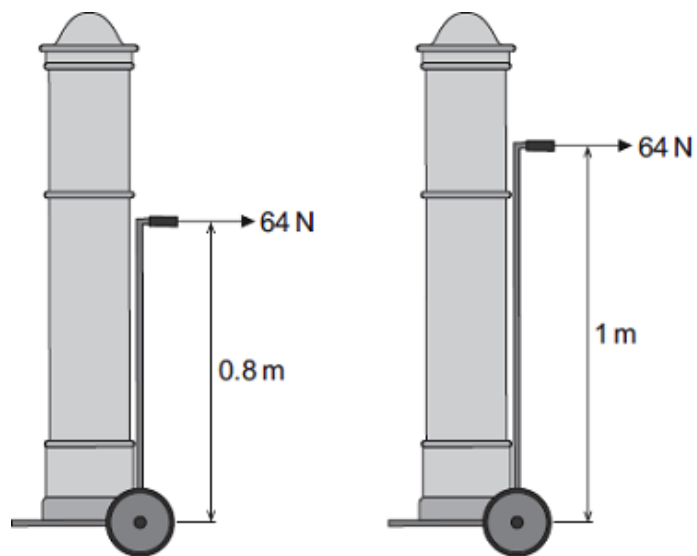
Use the correct equation from the Physics Equations Sheet.

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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?

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(1)
(Total 8 marks)

