

Q1.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Figure 19 shows four forces, P, Q, R and S, acting on a rod.

The rod can rotate around an axle.

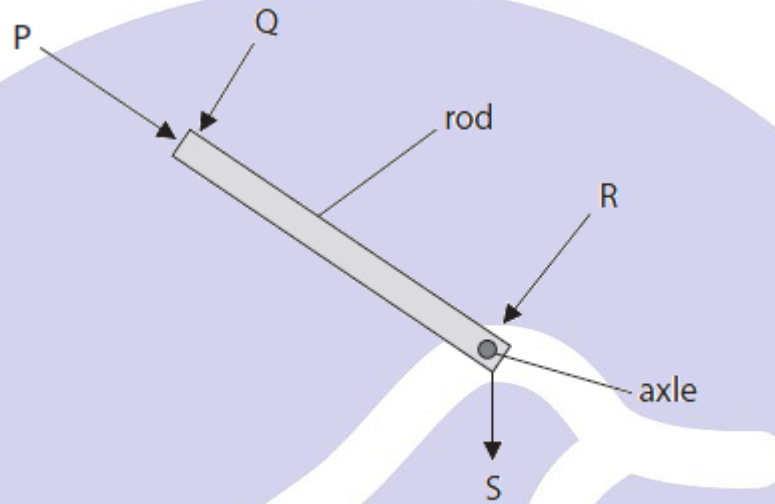


Figure 19

Which force will make the rod rotate about the axle?

(1)

- | | | |
|-------------------------------------|----------|---|
| <input checked="" type="checkbox"/> | A | P |
| <input checked="" type="checkbox"/> | B | Q |
| <input checked="" type="checkbox"/> | C | R |
| <input checked="" type="checkbox"/> | D | S |

(Total for question = 1 mark)

Q2.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 11 shows a person doing a push-up exercise.

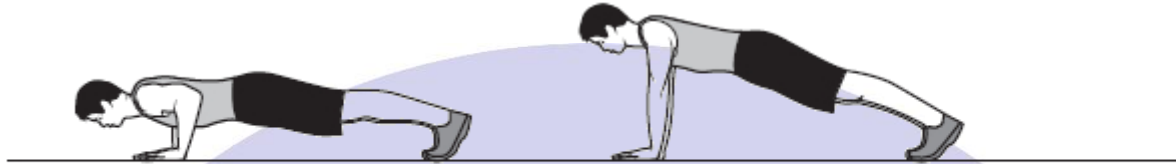


Figure 11

An upward force is used to cause rotation about a pivot.

Which row of the table is correct for this rotation?

(1)

- A
- B
- C
- D

	provide the upward force	act as a pivot
A	arms	hands
B	arms	feet
C	legs	hands
D	legs	feet

(Total for question = 1 mark)

Q3.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Figure 1 shows some forces acting on a seesaw.

The forces shown have the same magnitude but act in different directions.

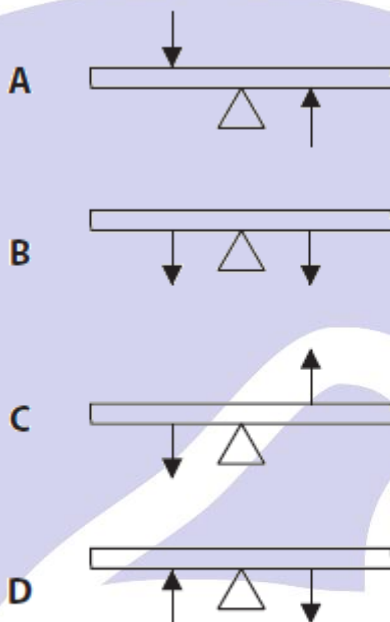


Figure 1

In which of these could the forces acting on a seesaw be in equilibrium?

(1)

- A
- B
- C
- D

(Total for question = 1 mark)

Q4.

A student investigates moments of forces.

Figure 14 shows the apparatus used.

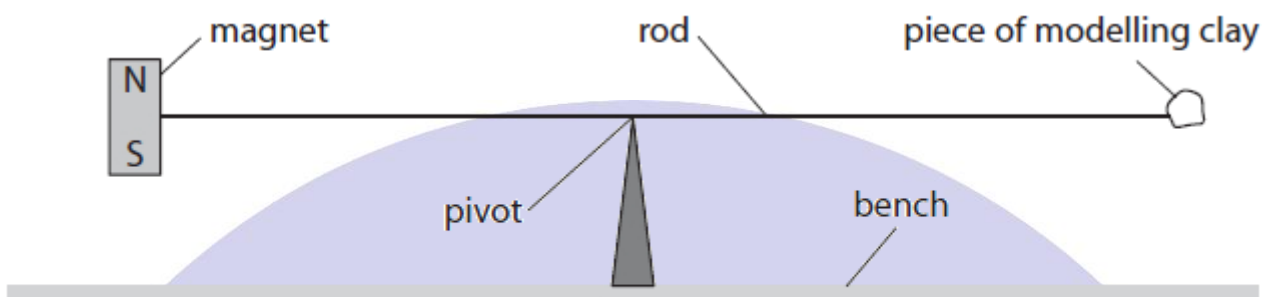


Figure 14

The pivot is under the centre of the rod.

A magnet is fixed to one end of the rod.

A piece of modelling clay is fixed to the other end of the rod.

The system is in equilibrium.

State the relationship between the moment of the weight of the magnet and the moment of the weight of the piece of modelling clay about the pivot.

(1)

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(Total for question = 1 mark)

Q5.

Figure 3 shows a force, F , acting on a ruler.

The ruler has a pivot at one end.

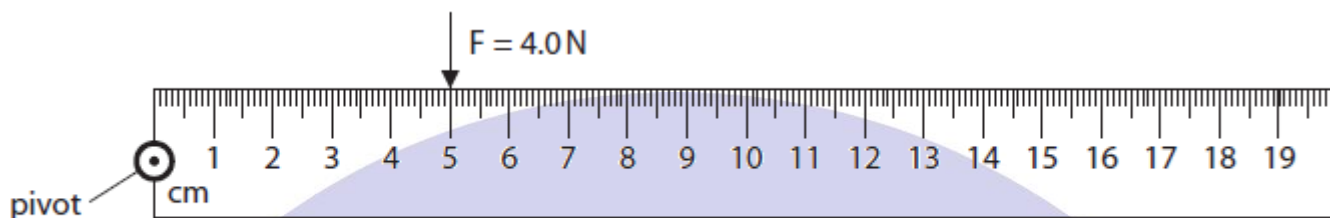


Figure 3

Calculate the moment of the force, F , around the pivot.

Give your answer in units of Nm.

Use the equation

$$\text{moment of a force} = \text{force} \times \text{distance from pivot}$$

(2)

moment = Nm

(Total for question = 2 marks)

Q6.

Figure 3 shows a force of 200 N acting at the end of a plank of wood.

The force acts at right angles to the plank and at 3.0 m away from a pivot.

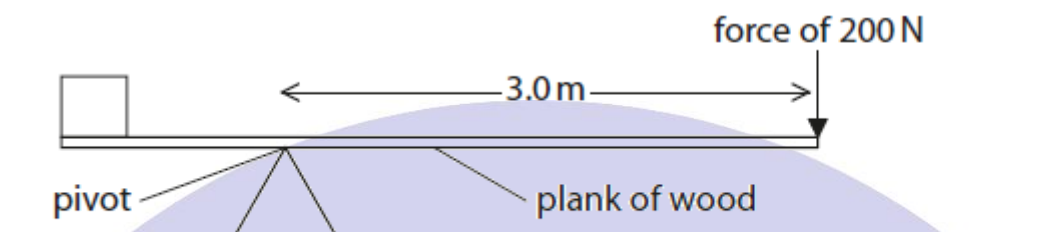


Figure 3

Calculate the moment of the 200 N force about the pivot.

State the unit of the moment of the force.

Use the equation

$$\text{moment of a force} = \text{force} \times \text{distance at right angles to the direction of the force}$$

(3)

moment of the force about the pivot = unit

(Total for question = 3 marks)

Q7.

(i) Figure 8 shows a force of 70 N turning a lever about point P.

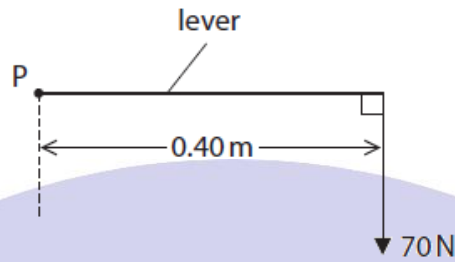


Figure 8

Calculate the moment of the 70 N force about point P.
State the unit.
Use the equation

$$\text{moment} = \text{force} \times \text{distance normal to the direction of the force}$$

(3)

moment =unit

(ii) Figure 9 shows a worker using a wheelbarrow to move some sand.

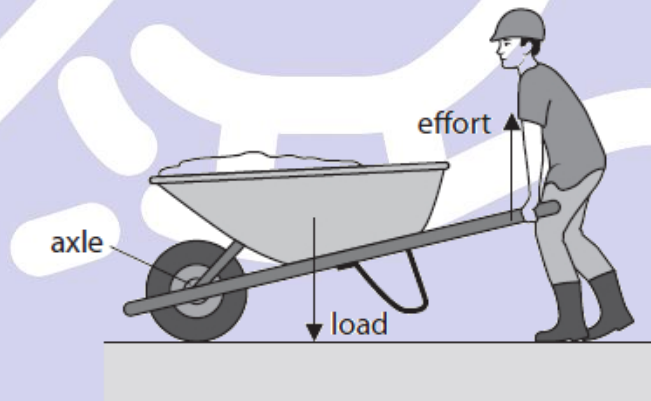


Figure 9

The load is equal to the total weight of the sand and the wheelbarrow.
The effort is the force that the worker applies to the wheelbarrow handles.
The worker applies just enough effort to lift the load.
Explain why the effort is smaller than the load.

(2)

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(iii) Some sand falls down and sticks between the wheel and the axle.

State why it might be harder to push the wheelbarrow along when there is some sand between the wheel and the axle.

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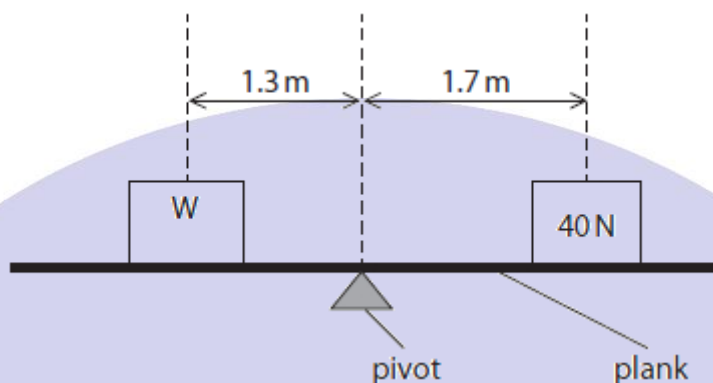
(Total for question = 5 marks)



Q8.

Figure 7 shows two boxes on a plank.

The plank is balanced on a pivot.



One box has a weight of 40 N.

- (i) Calculate the moment of the 40 N weight about the pivot.

State the unit.

Use the equation

moment = force \times perpendicular distance

(3)

moment =

unit

- (ii) Calculate the weight, W , needed to balance the plank in Figure 7.

(3)

$W = \dots\dots\dots$ N

(Total for question = 6 marks)

Q9.

Figure 17 shows a balanced seesaw with two children on it.

The pivot is at the centre of the seesaw.

The seesaw is balanced with no children sitting on it.

Child P has a weight of 150 N.

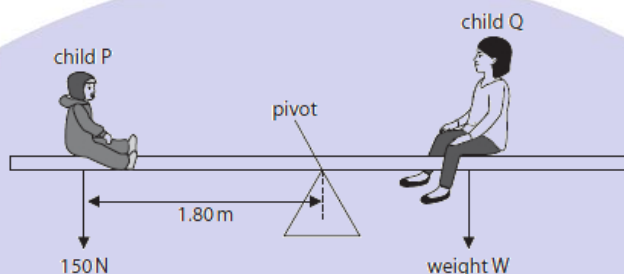


Figure 17

(i) Calculate the moment of the weight of child P about the pivot in N m.

Use the equation

$$\text{moment of a force} = \text{force} \times \text{distance to pivot}$$

(2)

moment = N m

(ii) Figure 18 shows the same balanced seesaw, with the distance of child Q to the pivot labelled as well.

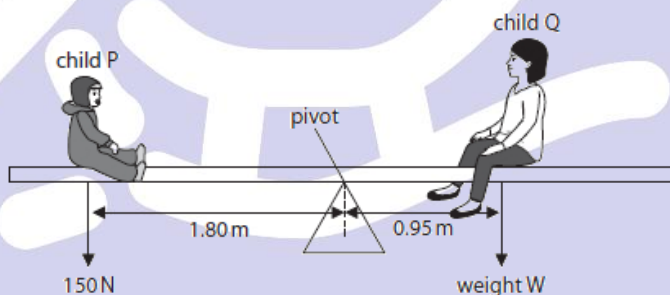


Figure 18

Calculate the value of W, the weight of child Q.

Use the idea of moments and the equation

$$\text{the moment of } W = \text{the moment of the weight of child P}$$

Give your answer to 2 significant figures.

(3)

W = N

(Total for question = 5 marks)

Q10.

Figure 3 is a diagram of the forces acting on a swing.

The swing is not moving.

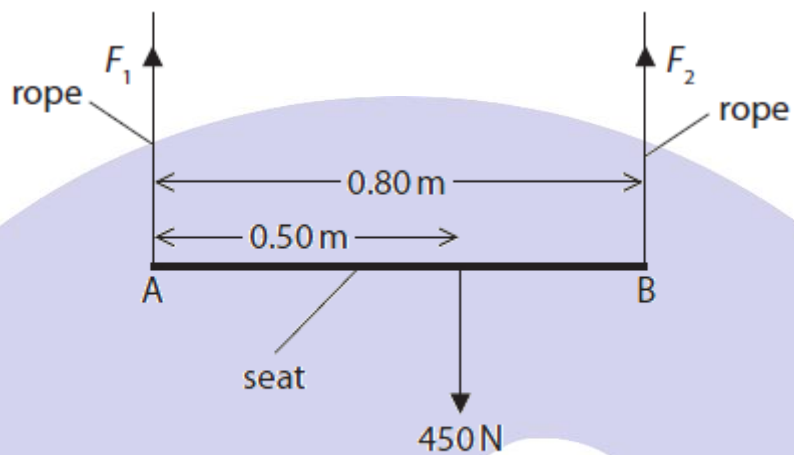


Figure 3

The seat of the swing, AB, is 0.80 m long.

A person of weight 450 N sits on the seat.

The person's weight acts at a distance of 0.50 m from A as shown in Figure 3.

Ignore the weight of the seat.

The upward forces exerted by the ropes on the seat are F_1 and F_2 .

Calculate the force F_2 by taking moments about A.

(3)

force $F_2 = \dots\dots\dots$ N

(Total for question = 3 marks)

Q11.

A scuba diver goes for a diver. When underwater, the diver tries to move a large stone block.

The diver uses a long iron bar and a pivot, as shown in Figure 26.

When pushing down with a force of 120 N, the block is balanced.

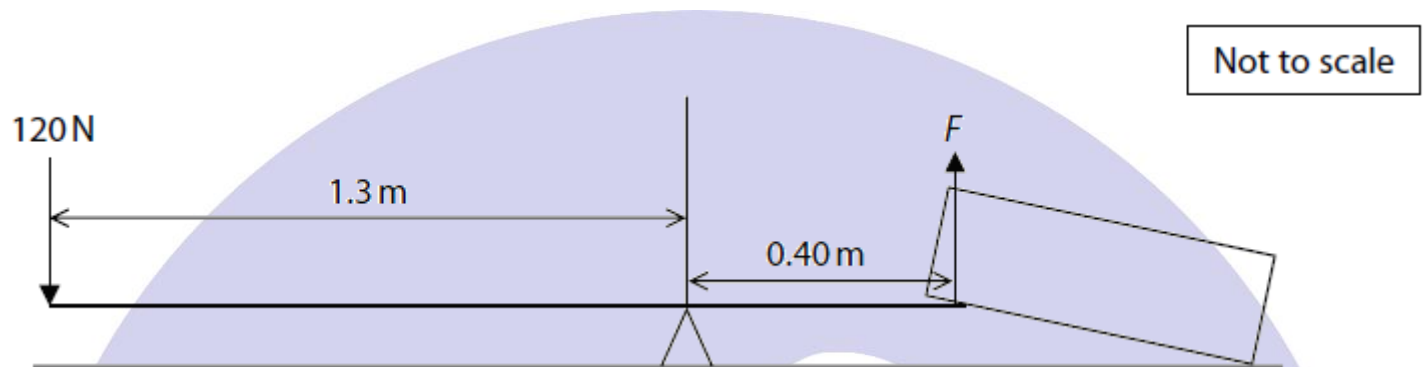


Figure 26

Calculate the size of the force, F , of the bar on the block.

(3)

force = N

(Total for question = 3 marks)

Q12.

Figure 13 shows a toy that a student makes for a nursery school.

for a nursery school. The rod hangs by a string from the ceiling.

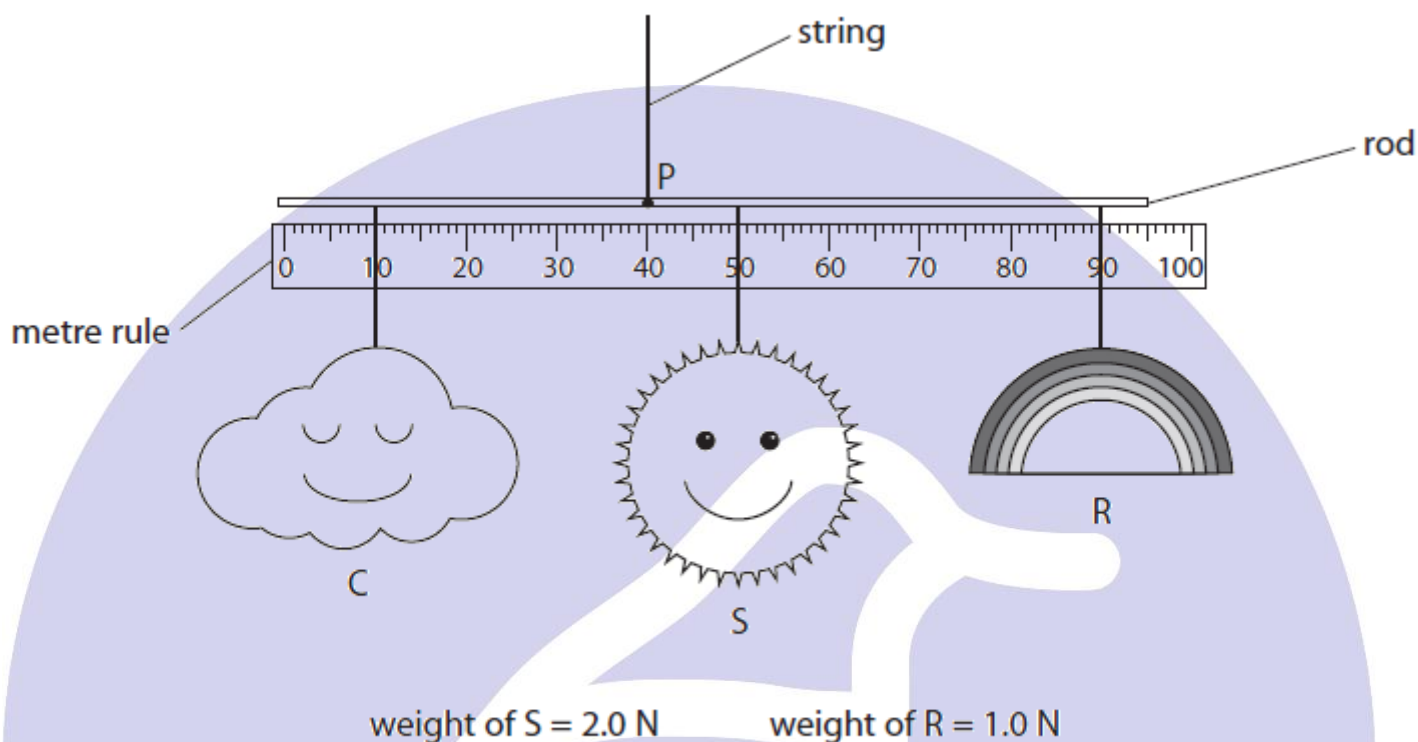


Figure 13

(i) The moment of C about point P is 0.60 Nm.

Calculate the weight of C.

Use the equation

$$\text{moment} = F \times d$$

(2)

weight of C N

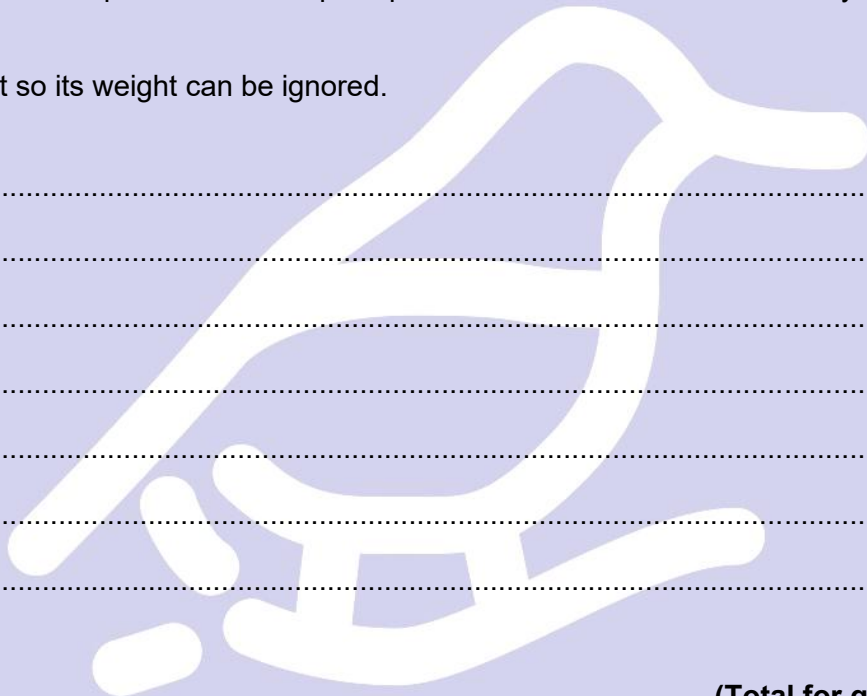
(ii) Show that the total moment of S and R about P is 0.70 N m.

(2)

(iii) Using the data in the question and the principle of moments, determine if the toy shown in Figure 13 is in equilibrium.

The rod is very light so its weight can be ignored.

(3)



(Total for question = 7 marks)

Q13.

Figure 12 shows three toy animals hanging from a rod.

The rod hangs from the ceiling by a string tied to the centre of the rod.

The system is in equilibrium.

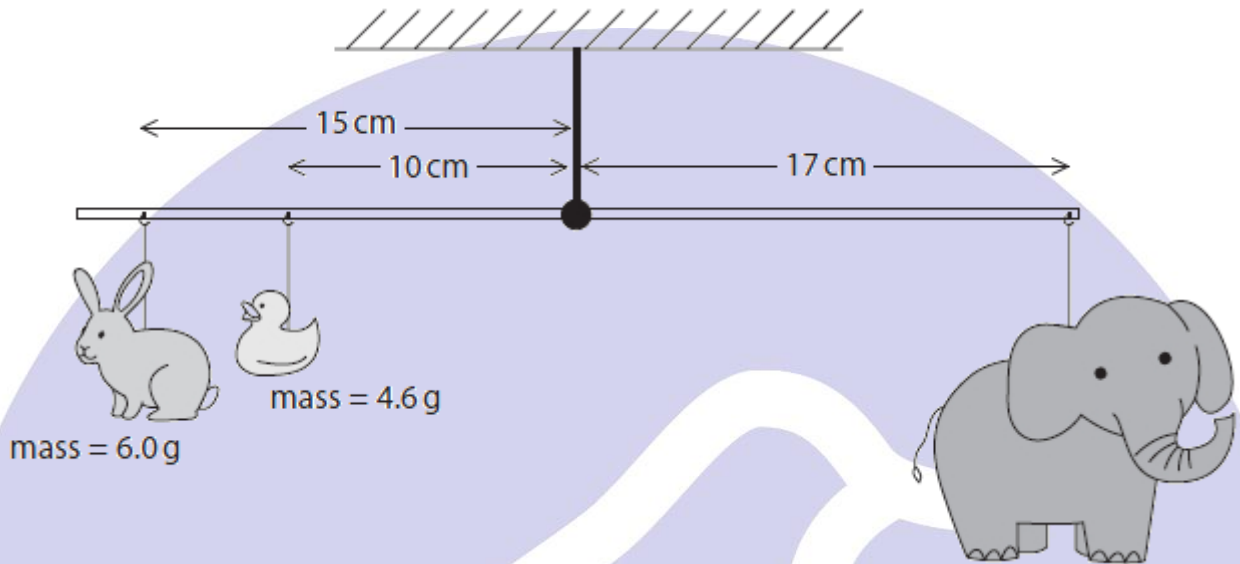


Figure 12

Use the principle of moments to calculate the mass of the toy elephant.

(4)

mass = g

(Total for question = 4 marks)

Q14.

Figure 12 shows some of the bones and muscles in an arm.

The arrows show the forces on the forearm when the arm is bent.

The hand is empty.

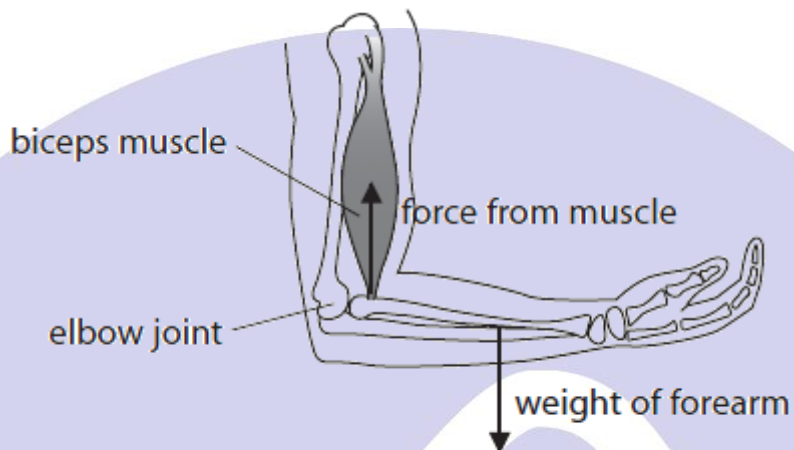


Figure 12

The biceps muscle provides a force to balance the weight of the forearm.

The weight of the forearm can be represented as a single force.

Figure 13 shows a diagram representing the forces and distances involved.

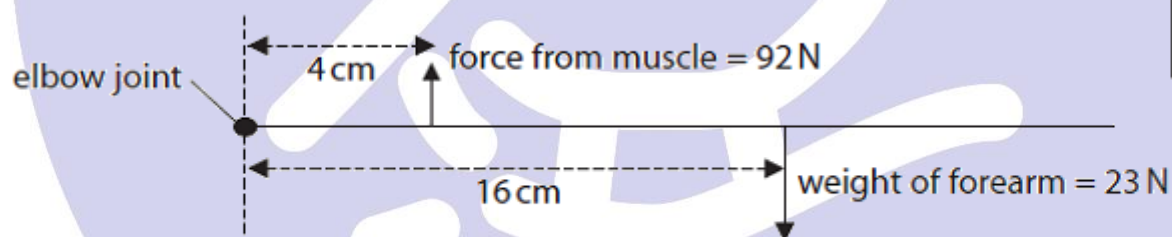


Figure 13

(i) Use the principle of moments to show that the system shown in Figure 13 is in equilibrium.

(2)

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(ii) The person then holds a ball weighing 15 N in their hand.

Figure 14 shows the forces on the forearm and their distances from the elbow joint.

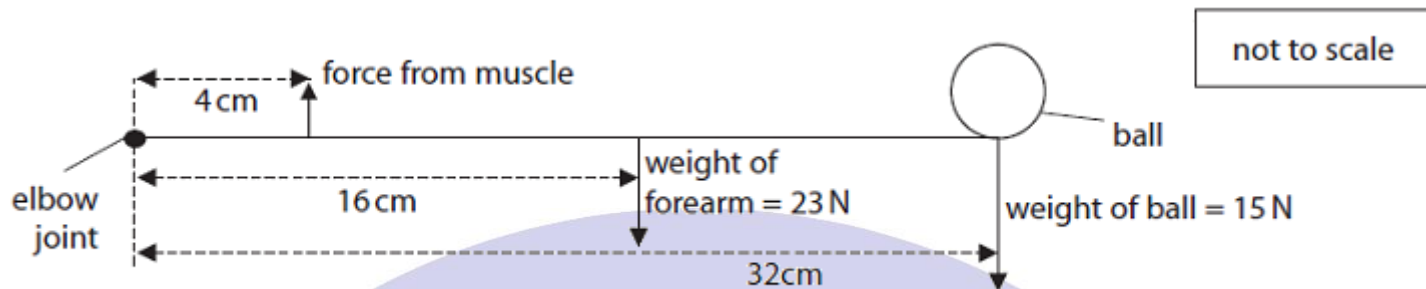


Figure 14

Calculate the force from the muscle that is needed to keep the system in Figure 14 in equilibrium.

(3)

force = N

(Total for question = 5 marks)

Q15.

Figure 20 shows a person trying to lift a large rock using a metal bar.

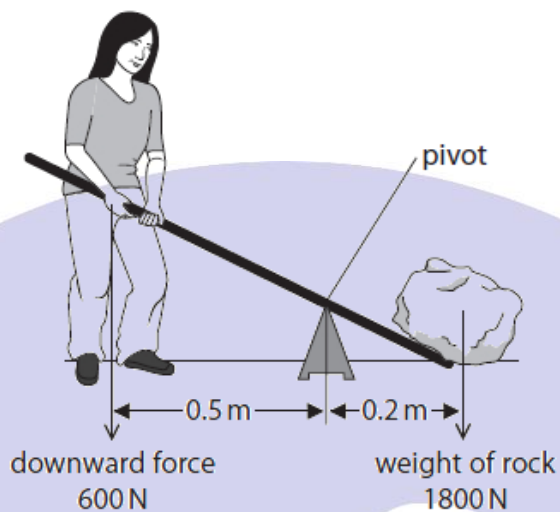


Figure 20

The rock weighs 1800 N.

The person can only produce a downwards force of 600 N.

The person cannot lift the rock.

(i) Explain, using calculations, why the person cannot lift the rock.

(3)

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(ii) Explain **one** change to the arrangement that will make it possible for this person to lift the rock.

(2)

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(Total for question = 5 marks)

Q16.

Figure 11 shows a lever used to lift a heavy load.

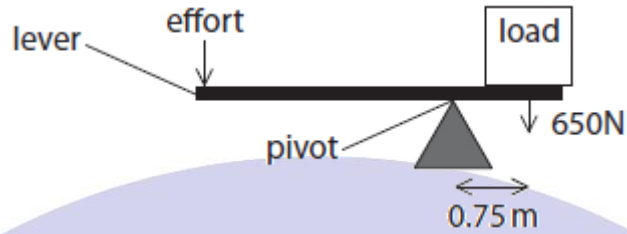


Figure 11

- (i) The weight of the load is 650 N.

The centre of the load is 0.75 m from the pivot.
Calculate the moment of the load about the pivot.
State the unit.
Use the equation
moment = force \times distance from the pivot

(3)

moment = unit

- (ii) State the principle of moments.

(1)

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- (iii) An effort of 160 N is applied to the end of the lever to balance the load in Figure 11.
Calculate the distance between the effort and the pivot.

(3)

distance = m

(Total for question = 7 marks)

Q17.

A 20 cm ruler has a pivot at its centre.

The ruler is balanced when no forces act on the ruler.

Figure 4 shows two forces, Y and Z, acting on the ruler.

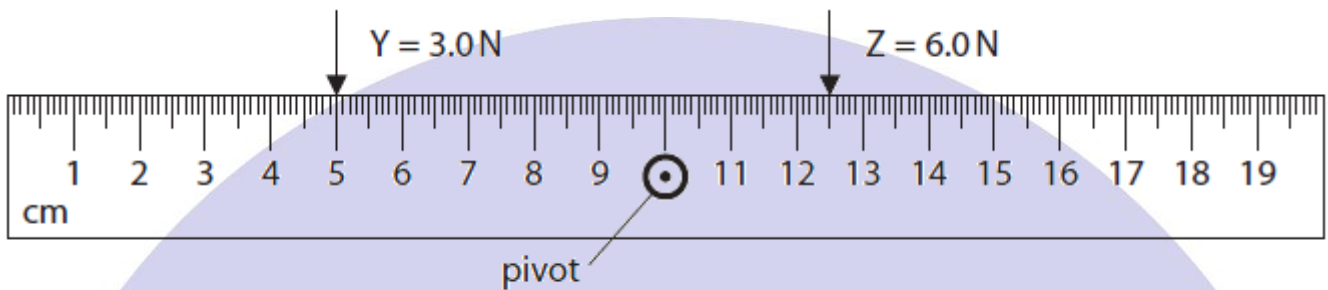


Figure 4

Use the principle of moments to show that the ruler in Figure 4 is balanced.

(2)

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(Total for question = 2 marks)

Q18.

Figure 2 shows an open door.

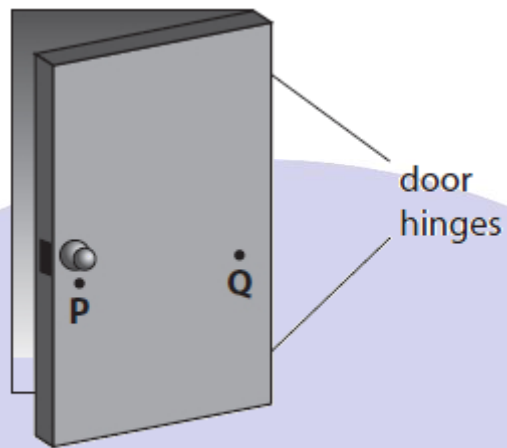


Figure 2

Explain why it is easier to close the door by pushing at point **P** rather than pushing at point **Q**.

(2)

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(Total for question = 2 marks)

Q19.

* Figure 19 shows a crowbar being used to lift a heavy weight.

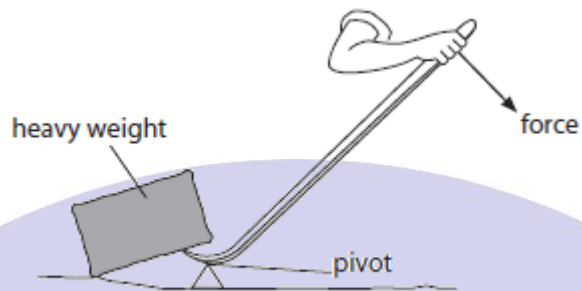


Figure 19

Explain how the crowbar enables a person to lift a heavy weight.

You should include the idea of moments in your answer.

It may help to label some distances in Figure 19 and use those distances in your explanation.

(6)

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(Total for question = 6 marks)