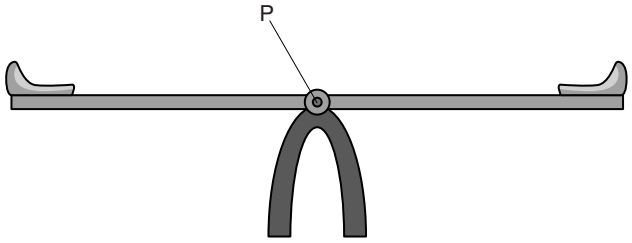
Moments 1

1) Fig. 3.1 shows a see-saw. The see-saw is horizontal when not in use.



A small child sits on one seat of the see-saw. This creates a turning effect about point P.

(a) Which of these words means the turning effect of a force? Tick one box.

- ☐ equilibrium
- ☐ moment
- ☐ resultant

[1]

(b) State the scientific name for point P.

.....[1]

(c) A much heavier boy sits on the other end of the see-saw, as shown in Fig. 3.2.

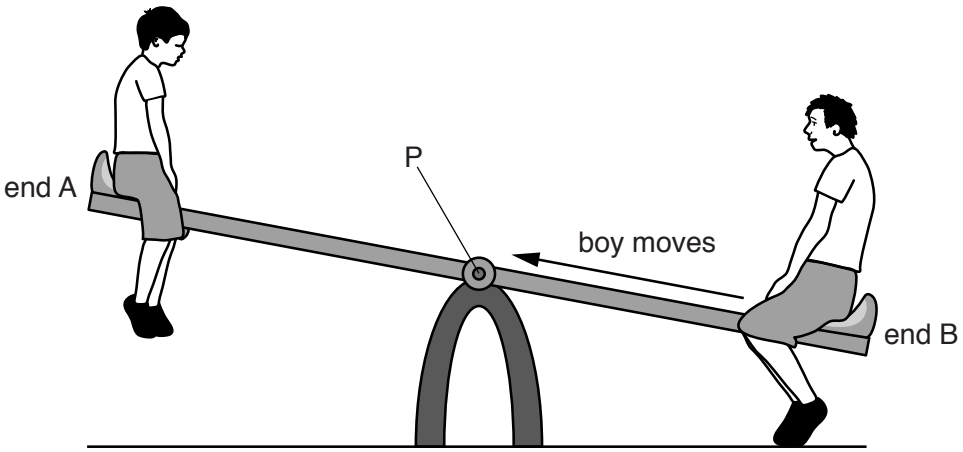


Fig. 3.2

The heavier boy moves slowly along the see-saw from end B until he reaches point P.

Describe and explain what happens to the see-saw.

.....

.....

.....

.....

.....[4]

[Total: 6]

2) Fig. 3.1 shows a girl and a boy on a see-saw.

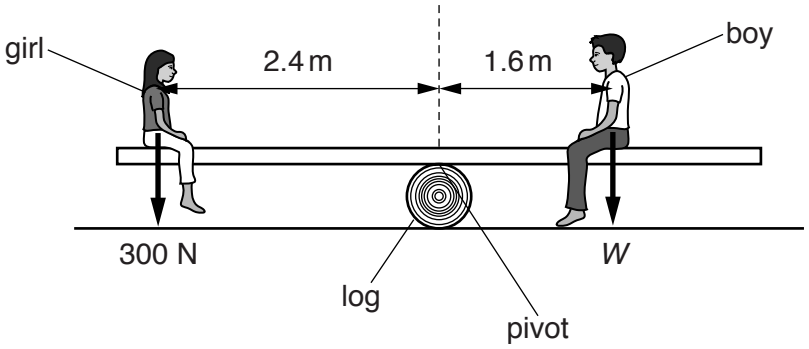


Fig. 3.1

The see-saw pivots on the log.

(a) Calculate the girl's moment about the pivot.

girl's moment = ... N m [2]

(b) The see-saw is balanced horizontally.

Calculate the weight *W* of the boy.

weight of boy = ... N [3]

[Total: 5]

3)

(a) State what is meant by the *moment* of a force.

.....

..... [1]

(b) A warehouse worker is about to close a large door, as shown in Fig. 4.1.

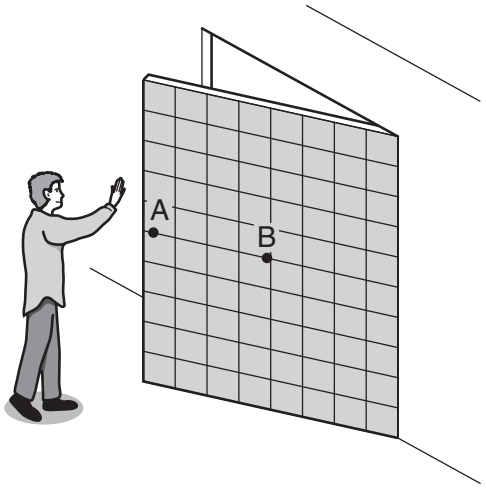


Fig. 4.1

(i) State, with a reason, which of the two positions, A or B, will enable him to close the door with least force.

.....

.....

..... [1]

(ii) On another occasion, with the door in the position shown in Fig. 4.1, two workers each push on the door with the same force at the same time. One worker pushes at A, from the side seen in Fig. 4.1. The other worker pushes at B, from the other side of the door.

Which way does the door move, if at all? Tick one box.

☐ the door closes

☐ the door opens

☐ the door remains in the same position

[1]

[Total: 3]

4) Fig. 4.2 shows another elephant pushing horizontally against a vehicle with a force of 11 kN at a distance 1.8 m above the ground. Point M is the centre of mass of the vehicle.

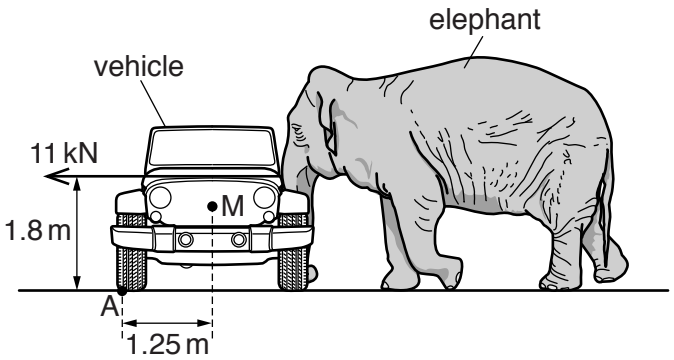


Fig. 4.2

(i) Calculate the moment about point A of the force exerted by the elephant.

moment = ...[2]

(ii) The mass of the vehicle is 1900 kg, and it does not slide when pushed by the elephant.

Determine whether the elephant tips the vehicle over. Show your working.

calculation

conclusion .....[2]

5) A metre rule balances when the 50 cm mark is directly above a pivot.

(a) State where in the rule its centre of mass is located.

.....

..... [1]

(b) Fig. 3.1 shows an apple and a 0.40 N weight placed on the rule so that the rule remains balanced at the 50 cm mark.

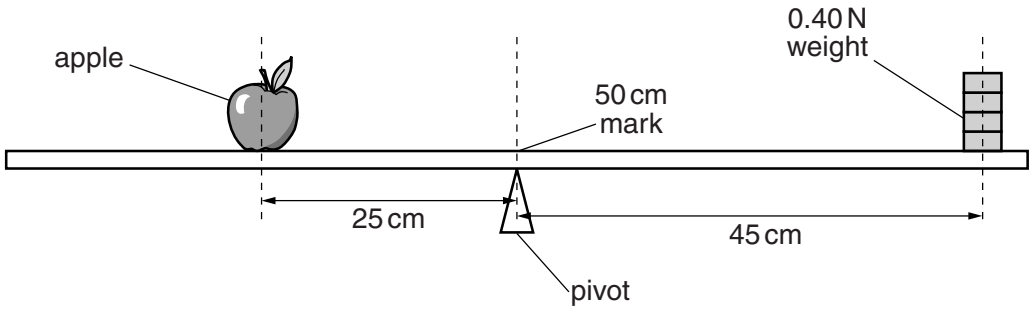


Fig. 3.1 (not to scale)

The centre of mass of the apple is 25 cm from the pivot and the centre of mass of the weight is 45 cm from the pivot.

Calculate

(i) the weight of the apple,

weight = ... [2]

(ii) the mass of the apple.

mass = ... [1]

(c) The apple is not moved. The weight is removed from the rule and the pivot is moved to the left until the rule balances as shown in Fig. 3.2.

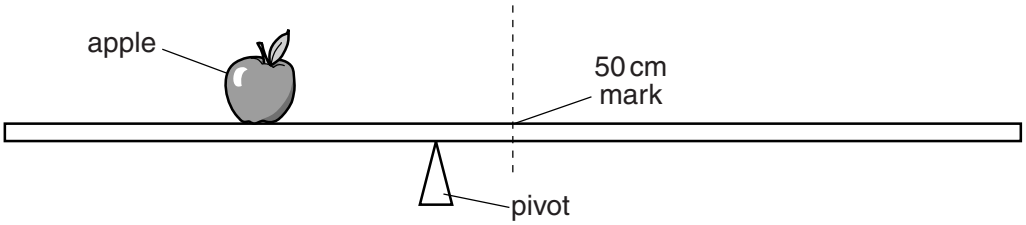


Fig. 3.2 (not to scale)

(i) Explain why the arrangement in Fig. 3.2 balances.

.....

.....

..... [2]

(ii) The pivot in Fig. 3.2 is closer to the 50 cm mark than to the centre of mass of the apple.

Compare the weight of the rule to the weight of the apple.

.....

..... [1]

[Total: 7]

6)

(a) State the two conditions necessary for a system of forces acting on a body to be in equilibrium.

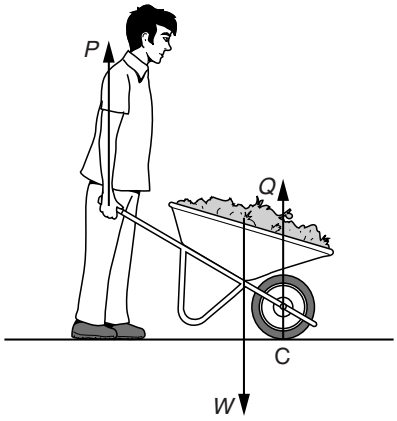
1. .....

.....

2. .....

.....
[2]

(b) Fig. 1.1 shows a loaded wheelbarrow held in equilibrium by a gardener. The wheel of the wheelbarrow is in contact with the ground at point C.



In Fig. 1.1, there are three vertical forces acting on the wheelbarrow.

P is the upward force applied by the gardener.
Q is the upward force of the ground on the wheel at point C.
W is the weight of the wheelbarrow and its contents.

Explain why the force *P* is less than the force *W*

(i) by considering the forces *P, Q* and *W*,

.....

..... [2]

(ii) by considering the moments of the forces *P* and *W* about point C.

.....

..... [2]

(c) Fig. 1.2 shows a kitchen cupboard resting on a support and attached to a wall by a screw.

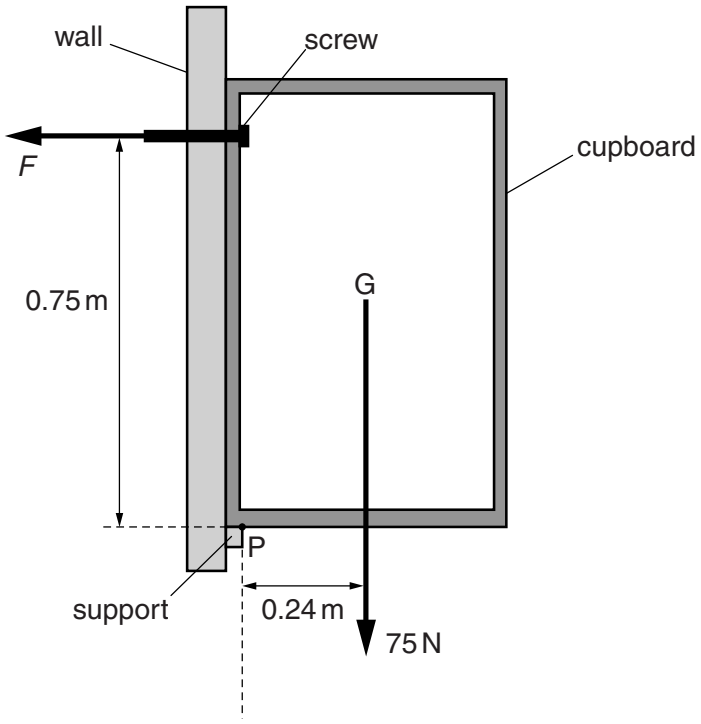


Fig. 1.2

The weight of the cupboard and its contents is 75 N. G is the position of the centre of mass of the cupboard.

The clockwise and anticlockwise moments about point P are equal.

Calculate the force *F* exerted by the screw.

F = ... [3]

[Total: 9]