Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Turning effects

Time allowed: 1 hour 15 minutes

Subject code **0625**

Physics

Questions from Paper 3, Paper 4 and Paper 6

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 72

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 72 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 **(a)** Fig. 4.1 shows a metal triangle suspended from a thread.

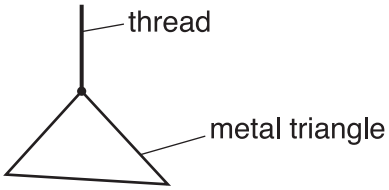


Fig. 4.1

Complete the sentence. Choose the correct word or phrase from the box.

above	below	to the left of	to the right of

The metal triangle will come to rest with its centre of mass directly ..... the point of suspension. [1]

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(b) A student finds the centre of mass of a shape made of thin card. Fig. 4.2 shows the equipment.

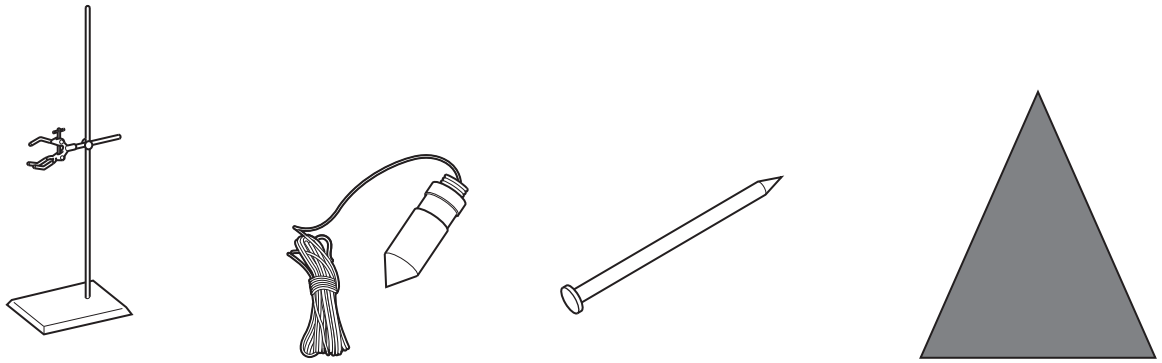


Fig. 4.2 (NOT to scale)

Describe how the student finds the centre of mass of the card. Choose from these sentences.

A A line is drawn on the card showing the position of the string.

B A pin held in a clamp is put through the hole in the card.

C The centre of mass is where the lines cross on the card.

D The process is repeated using holes near the other two edges.

Complete the flow chart. Write the letter for the correct sentence in each box.

A small hole is made near one edge of the card

↓ [ ]

↓

The plumbline is attached to the pin

↓ [ ]

↓ [ ]

↓ [ ]

[3]

[Total: 4]

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Centre of gravity and stability Click for more variations

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1(a)	below	**B1**
1(b)	B A D C	**B3**

2 The IGCSE class is carrying out a moments experiment by balancing a metre rule on a small pivot.

(a) A student has a small pivot and a metre rule.

Explain briefly how the student finds the position of the centre of mass of the metre rule.

.....

.....

.....[1]

(b) The student finds that the centre of mass is not in the middle of the rule but at the 50.2 cm mark.

Explain what the student could do to prevent this from affecting her results.

.....

.....[1]

(c) The student places the metre rule on a pivot so that it balances.

She places a load **P** on one side of the metre rule at a distance *x* from the pivot. She places another load **Q** on the metre rule and adjusts the position of the load **Q** so that the rule balances, as shown in Fig. 1.1.

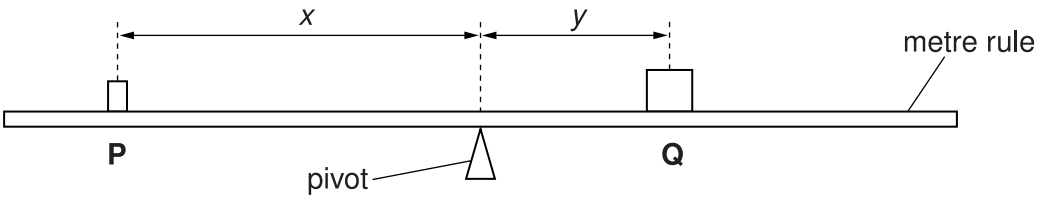


Fig. 1.1

The load **Q** is a distance *y* from the pivot.

The readings are shown in Table 1.1.

Table 1.1

weight of **P**/N	weight of **Q**/N	*x*/	*y*/
2.0	5.0	39.0	15.5

(i) Complete the column headings in the table. [1]

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(ii) Calculate the clockwise moment and the anticlockwise moment using the equation

moment of a force = force × perpendicular distance to the pivot.

clockwise moment = ...

anticlockwise moment = ...
[1]

(d) In practice, it is difficult to adjust the loads to make the rule balance exactly.

Explain briefly how you would reduce the uncertainty in the position of **Q** required for exact balance.

.....

.....[1]

[Total: 5]

Moments Click for more variations

2 **(a)** rule balanced and pivot at centre of mass [1]

(b) EITHER take readings from 50.2 cm mark
OR add mass/weight/load
OR place pivot at 50.2 cm mark [1]

(c) **(i)** cm, cm [1]

(ii) clockwise 77.5 (or 78) (N cm)
anticlockwise 78 (N cm) [1]

(d) EITHER repeats
OR estimate between two best positions that almost balance but tip opposite sides o.w.t.t.e
OR suitable method to locate centre of mass **Q** [1]

[Total: 5]

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3 **(a)** A student determines the centre of mass of a piece of card. Fig. 3.1 shows the equipment the student uses.

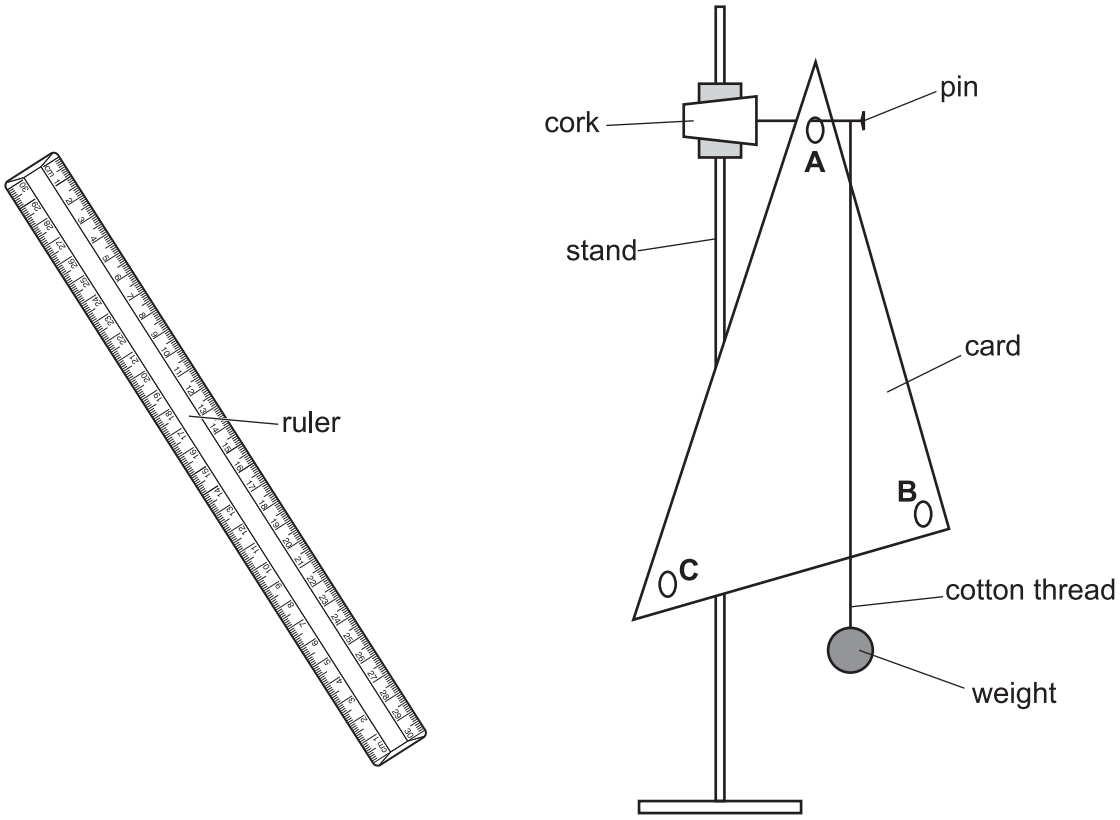


Fig. 3.1

Describe how the student determines the centre of mass of the card using the equipment in Fig. 3.1.

.....

.....

.....

.....

.....

..... [3]

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(b) Another card is pivoted at point P. The weight of the card is 1.4 N and acts through a point 20 cm from P.

Fig. 3.2 shows the arrangement.

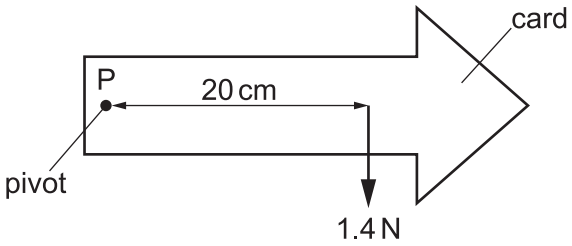


Fig. 3.2

Calculate the moment of the weight of the card about point P.

moment of weight = ... N cm [3]

[Total: 6]

Centre of gravity and stability Click for more variations

Reduced to 77% to fit the page (wider than A4).

3(a)	any **three** from: line drawn alongside cotton thread / string hang triangle from a different corner (B or C) repeat marking of string (position on the card) centre of mass is where lines intersect	**B3**
3(b)	(moment of weight =) weight × distance (of direction of force from pivot)	**C1**
	(moment =) 1.4 × 20	**C1**
	28 (N cm)	**A1**

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4 Fig. 3.1 shows a child and an adult on a see-saw.

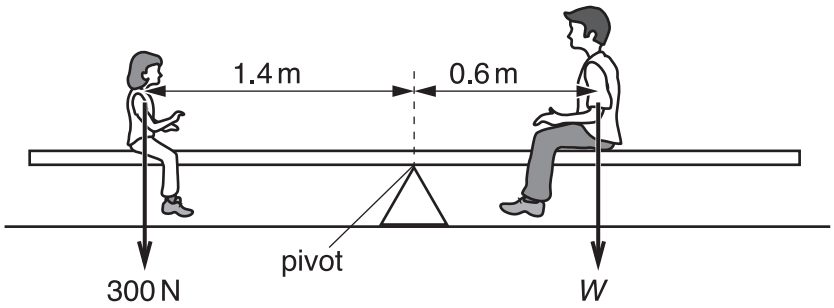


Fig. 3.1

(a) The see-saw shown in Fig. 3.1 is in equilibrium.

Tick the box alongside any correct statement.

☐ The resultant force on the see-saw is zero.

☐ The resultant turning effect on the see-saw is zero.

[1]

(b) Calculate the moment of the child about the pivot.

moment = ... N m [3]

(c) Calculate the weight *W* of the adult.

weight = ... N [3]

(d) State what would happen if the child moved further away from the pivot.

.....

.....[1]

[Total: 8]

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Moments Click for more variations

4(a)	both boxes ticked	**B1**
4(b)	moment = force × distance in any form	**C1**
	300 × 1.4	**C1**
	420 (Nm)	**A1**
4(c)	clockwise moments = anticlockwise moments	**C1**
	W x 0.6 = candidates (b) **OR** *W* = candidates (b) / 0.6	**C1**
	700 (N)	**A1**
4(d)	child 's OR left side goes down **OR** adult side goes up **OR** right side goes up **OR** child's moment is larger **OR** child's turning force larger	**B1**
	Total:	**8**

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5 Fig. 4.1 shows a tractor fitted with a device for breaking up soil in a field.



Fig. 4.1

(a) (i) The tractor has a heavy weight at the front. Explain why the heavy weight is needed.

.....

..... [1]

(ii) Fig. 4.2 represents the weight of the device and its distance from the pivot.

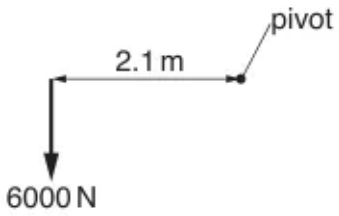


Fig. 4.2

Calculate the moment of the weight of the device about the pivot. State the unit.

moment = ... [4]

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(b) Fig. 4.3 shows a tractor fitted with narrow tyres and the same tractor fitted with wide tyres.

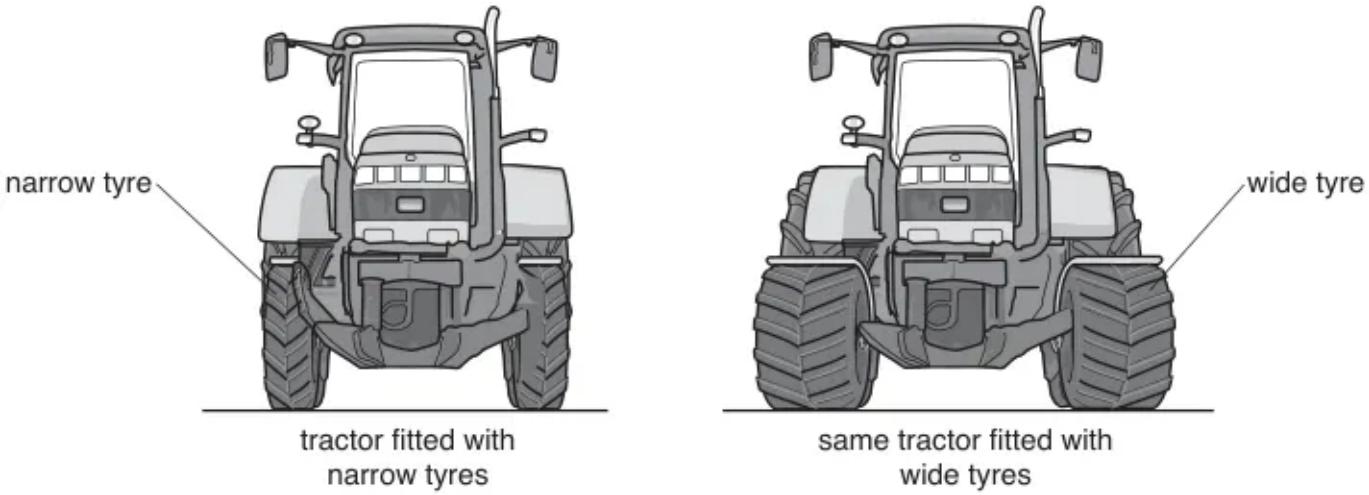


Fig. 4.3 (view from the front)

Explain why wide tyres are more suitable for the tractor on soft soil.

.....

.....

.....

..... [3]

[Total: 8]

Moments Click for more variations

Reduced to 78% to fit the page (wider than A4).

5(a)(i)	stop the tractor tipping up/keep tractor level owtte	**B1**
5(a)(ii)	moment = force × (perp.) distance from pivot in any form	**C1**
	6000 × 2.1	**C1**
	12 600	**A1**
	Nm	**B1**
5(b)	Any **three** from: (wide tyres have) greater area (in contact with ground) pressure = force ÷ area in any form the bigger the area the smaller the pressure so tractor less likely to sink/become stuck (in soft ground)	**B3**

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6 A student balances a beam on a pivot. They then balance block A and block B on the beam, as shown in Fig. 3.1.

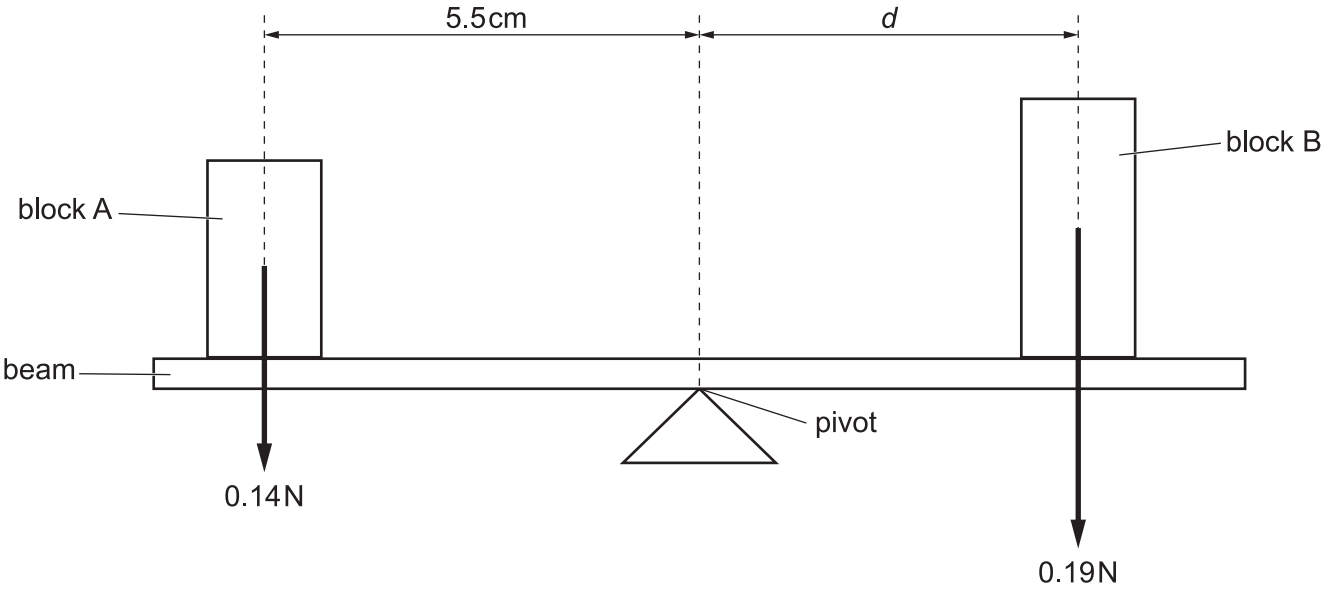


Fig. 3.1 (not to scale)

(a) (i) The weight of block A is 0.14 N.

Show that the moment of block A about the pivot is approximately 0.8 N cm.

[3]

(ii) The weight of block B is 0.19 N.

Calculate the distance *d* between the pivot and the centre of block B.

distance *d* = ... cm [3]

(b) The weight of block B is 0.19 N.

Calculate the mass of block B.

mass of block B = ... kg [3]

[Total: 9]

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Moments Click for more variations

6(a)(i)	(moment =) force × (perpendicular) distance in any form	**C1**
	0.14 × 5.5	**C1**
	0.77 (N cm)	**A1**
6(a)(ii)	(sum of) ACM = (sum of) CM	**C1**
	0.19 × *X* = 0.77 **OR** 0.19 × *X* = 0.8 **OR** 0.19 × *X* = 0.14 × 5.5	**C1**
	4.1 (cm) **OR** 4.2 (cm)	**A1**
6(b)	*(m =) W* ÷ *g* **OR** *W* ÷ 9.8 in any form	**C1**
	0.19 ÷ 9.8	**C1**
	0.019 (kg)	**A1**

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7 **(a)** A stationary body is acted upon by a number of forces. State the two conditions which must apply for the body to remain at rest.

1. .....

2. .....

[2]

(b) Fig. 3.1 shows a device used for compressing crushed material.

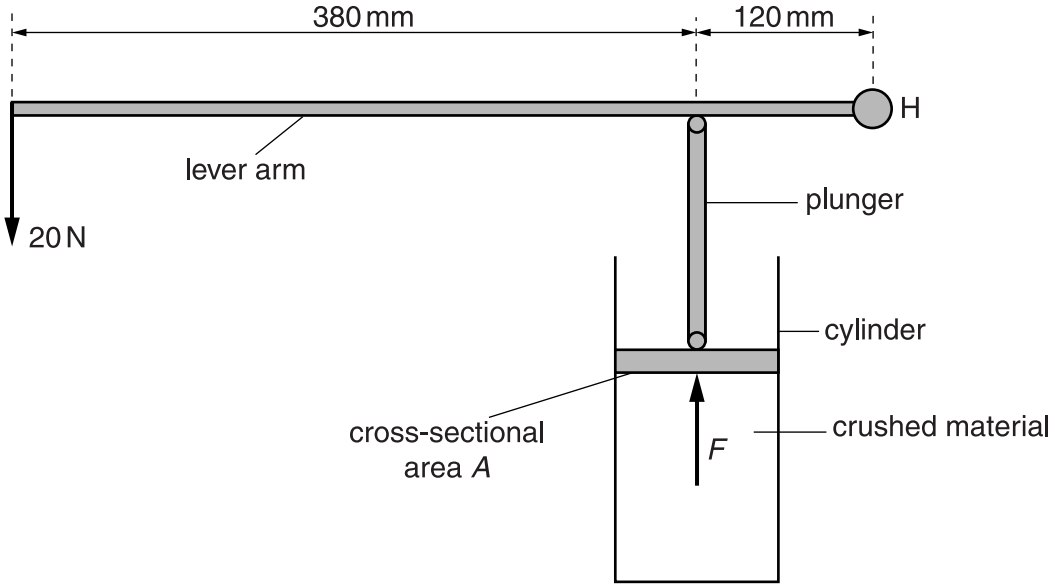


Fig. 3.1

The lever arm rotates about the hinge H at its right-hand end. A force of 20 N acts downwards on the left-hand end of the lever arm. The force *F* of the crushed material on the plunger acts upwards. Ignore the weight of the lever arm.

(i) Use the clockwise and anticlockwise moments about H to calculate the upward force *F* which the crushed material exerts on the plunger. The distances are shown on Fig. 3.1.

force *F* = ... [3]

(ii) The cross-sectional area *A* of the plunger in contact with the crushed material is 0.0036 m^2. Calculate the pressure exerted on the crushed material by the plunger.

pressure = ... [2]

[Total: 7]

Moments Click for more variations

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7 **(a)** No resultant/net force OR no resultant force in any direction
OR no resultant force in any two perpendicular directions B1

No resultant/net moment/turning effect/couple/torque
OR (total) clockwise moment = (total) anticlockwise moment B1

Either order

(b) **(i)** F × 120 / F × 0.12 C1
= 20 × 500 OR 20 × 0.5 C1
F = 83.3 N at least 2 significant figures. Allow $83^1/_3$ *Unit penalty applies A1

(ii) F/A or in words OR 83.3/0.0036 ecf from **(b)(i)** C1
= 23100 Pa / N/m^2 OR 2.31 N/cm^2 OR 23.1 kPa *Unit penalty applies A1 **[7]**

*Apply unit penalty once only

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8 **(a)** A uniform metre rule is pivoted at its centre, which is also the position of its centre of mass.

Three loads, 2.0 N, *F* and 3.0 N are positioned on the rule at the 20 cm, 30 cm and 90 cm marks respectively, as shown in Fig. 3.1.

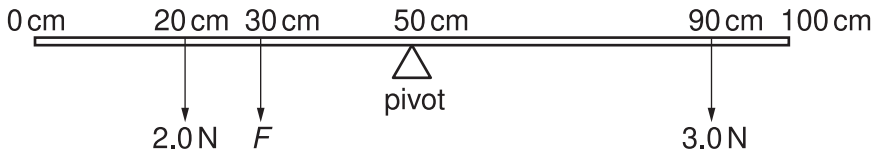


Fig. 3.1

(i) Calculate the moment of the 3.0 N load about the pivot.

moment = ... [1]

(ii) Calculate the moment of the 2.0 N load about the pivot.

moment = ... [1]

(iii) The force *F* maintains the metre rule in equilibrium on the pivot.

Calculate the value of *F*.

F = ... [3]

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(b) The weight of the metre rule is 1.2 N and can be considered to act at the 50 cm mark.

All the weights in **(a)** are removed. The pivot is positioned under the 30 cm mark and the 2.0 N load is placed on the rule as shown in Fig. 3.2.

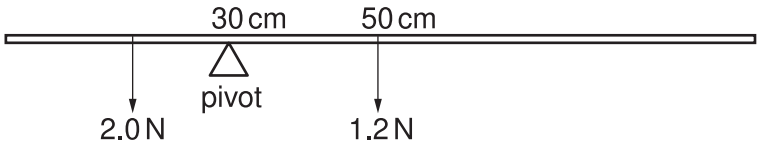


Fig. 3.2

The position of the 2.0 N load is adjusted until the metre rule is again in equilibrium.

Determine the position of the 2.0 N load.

2.0 N load is at the ..... cm mark [3]

[Total: 8]

Moments Click for more variations

8 **(a)** **(i)** 120 Ncm OR 1.2 Nm B1

(ii) 60 Ncm OR 0.6 Nm B1

(iii) idea of CW moments = ACW moments C1
$60 + 20F = 120$ OR $0.6 + 0.2F = 1.2$ e.c.f. C1
3.0 N OR 3 N e.c.f. A1

(b) $1.2 \times 20 = 2.0 \times d$ OR $1.2 \times 0.2 = 2.0 \times d$ C1
(d =) 12 OR 0.12 C1
18 c.a.o. OR special case (30 – his 12) correctly evaluated B1 A1

[Total: 8]

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9 **(a)** Define the moment of a force and describe the effect that it measures.

.....

.....

.....

..... [3]

(b) A large rectangular block of stone has a square base of side 3.4 m. Fig. 3.1 shows the block at rest on a horizontal surface.

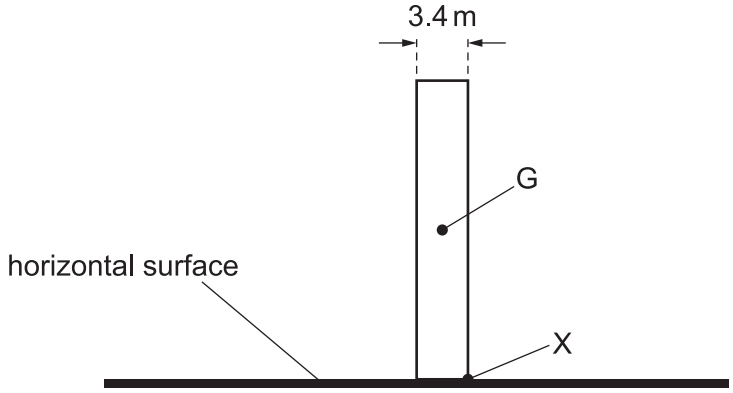


Fig. 3.1

The block is of uniform density and the centre of gravity G is at its centre.

(i) Explain what is meant by centre of gravity.

.....

..... [1]

(ii) The weight of the block is 1.3×10^7 N.

Calculate the moment of the weight of the block about corner X.

moment of weight = ... [2]

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(c) The block shown in Fig. 3.1 is in equilibrium.

State the **two** different conditions that apply when an object is in equilibrium.

1 .....

2 .....
[2]

[Total: 8]

Moments Click for more variations

Reduced to 78% to fit the page (wider than A4).

9(a)	force × perpendicular distance (from pivot)	**A2**
	Any one from: • force × distance from pivot • reference to perpendicular distance (from pivot) • reference to perpendicular force	C1
	(it measures the) turning effect (of a force)	**B1**
9(b)(i)	point where (all) the weight (of an object) seems to act	**B1**
9(b)(ii)	2.2×10^7 N m	**A2**
	1.7 (m) **OR** 3.4 / 2 **seen**	C1
9(c)	resultant force = 0 **OR** (all) forces cancel out owtte	**B1**
	resultant moment = 0 **OR** moments balance owtte	**B1**

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10 **(a)** Define the moment of a force about a point.

.....

..... [1]

(b) Fig. 2.1 shows a uniform rod of wood suspended from a pivot.

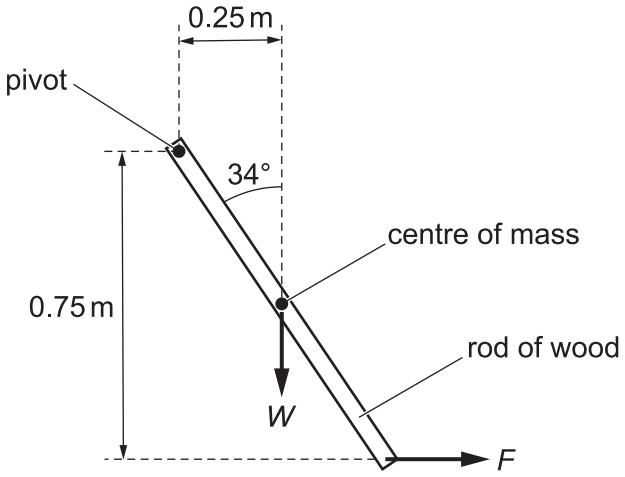


Fig. 2.1 (not to scale)

The rod is held stationary by a horizontal force *F* acting as shown.
The mass of the rod is 0.080 kg.

Calculate:

(i) the weight *W* of the rod

weight = ... [1]

(ii) the moment of *W* about the pivot

moment = ... [2]

(iii) the moment of *F* about the pivot

moment = ... [1]

(iv) the force *F*.

force = ... [2]

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(c) The angle between the rod and the vertical is increased.

State whether the force *F* needed to hold the rod stationary must be increased, decreased or stay the same.
Explain your answer.

.....

.....

.....

..... [2]

[Total: 9]

Moments Click for more variations

Reduced to 78% to fit the page (wider than A4).

10(a)	force × perpendicular distance (from point)	**B1**
10(b)(i)	0.80 N	**B1**
10(b)(ii)	(moment = force × distance =) 0.8 × 0.25	**C1**
	(moment =) 0.20 N m	**A1**
10(b)(iii)	same value as (ii) with correct unit	**B1**
10(b)(iv)	*F* × 0.75 = 0.20 in any form OR (*F* =) 0.2 / 0.75	**C1**
	(*F* = 0.2 / 0.75 =) 0.27 N	**A1**
10(c)	(perpendicular) distance (from pivot) of F decreases / is less (than 0.75 m) OR (perpendicular) distance (from pivot) of W increases / is more (than 0.75 m)	**M1**
	(so) increased / greater (force *F*) (needed for greater moment)	**A1**

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