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

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Moments

Time allowed: 1 hour 5 minutes

Subject code **0625**

Physics

Questions from Paper 3 and Paper 4

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

Total marks

/ 67

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 67 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 lamp is attached to a wall, as shown in Fig. 4.1.

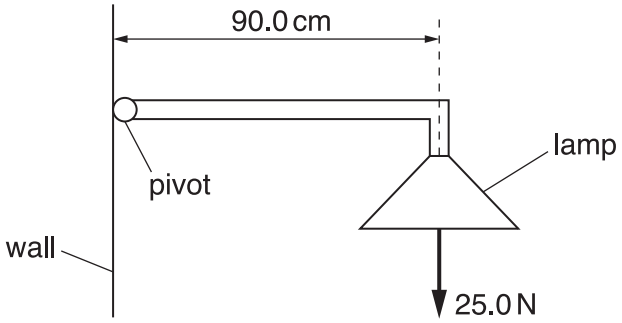


Fig. 4.1

Calculate the moment of the lamp about the pivot. Give the unit.

moment = ... [4]

[Total: 4]

Moments Click for more variations

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

1	moment = force × (perp.) distance (from pivot/bracket)	**1**
	25 × 90 or 25 × 0.9	**1**
	2250 or 22.5	**1**
	N cm or N m	**1**

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2 Fig. 2.1 shows a man pushing down on a lever to lift one end of a heavy log.

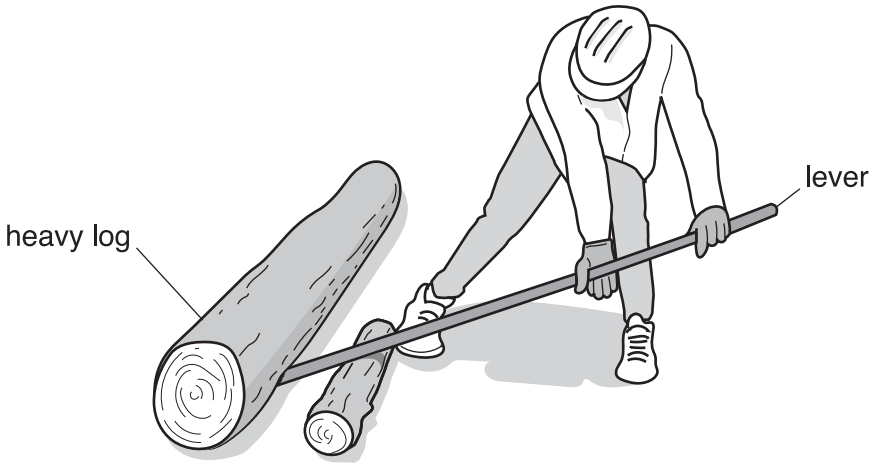


Fig. 2.1

(a) State the term used to describe the turning force exerted by the man.

.....[1]

(b) **(i)** Fig. 2.2 shows the forces acting as the man starts to lift the heavy log.

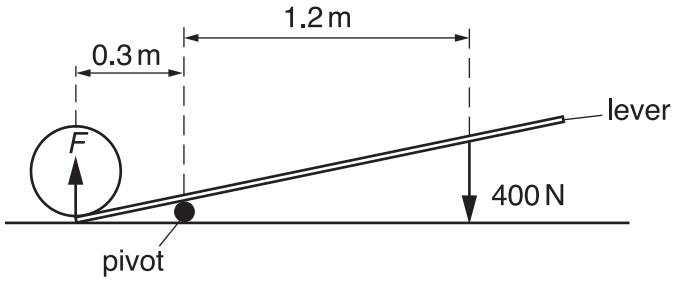


Fig. 2.2

Calculate the force *F*, exerted by the lever on the heavy log.

force *F* = ... N [3]

(ii) Describe how the man can use a smaller force to lift the heavy log.

.....

.....[1]

[Total: 5]

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2(a)	moment	B1
2(b)(i)	(sum of) clockwise moment(s) = (sum of) anticlockwise moment(s)	C1
	$1.2 \times 400 = 0.3 \times F$	C1
	1600 (N)	A1
2(b)(ii)	use a longer lever **OR** pivot closer to log / force F	B1

3 A metre rule is balanced on a pivot by three vertical forces, as shown in Fig. 5.1.

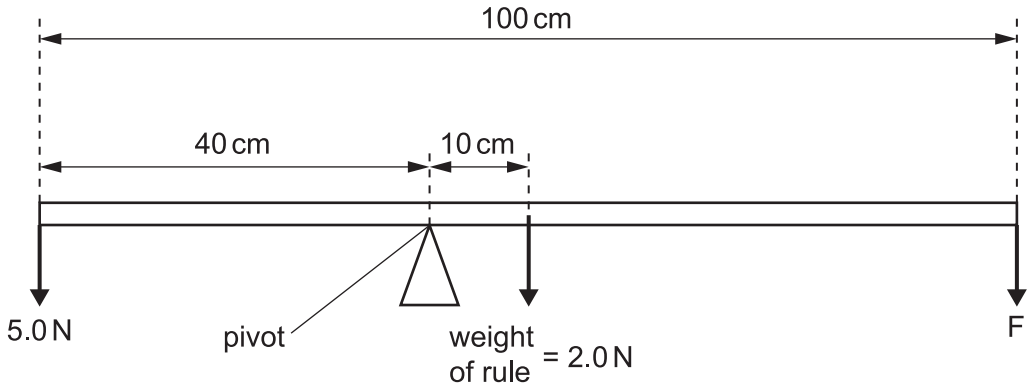


Fig. 5.1 (not to scale)

(a) Show that the moment of the 5.0 N force about the pivot is 200 N cm.

[2]

(b) Calculate the size of force F.

F = ... N [4]

[Total: 6]

Moments Click for more variations

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3(a)	(moment =) force × distance (from pivot)	**B1**
	(moment =) 5.0 × 40	**B1**
3(b)	(sum of) clockwise moments = (sum of) anticlockwise moments	**C1**
	200 = (2.0 × 10) + (F × 60)	**C1**
	F = (200 – 20) ÷ 60 OR 180 ÷ 60	**C1**
	(F =) 3.0 (N)	**A1**

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4 **(a)** Define the *moment* of a force.

..... [1]

(b) Fig. 2.1 shows an object of negligible weight. The object is in equilibrium.

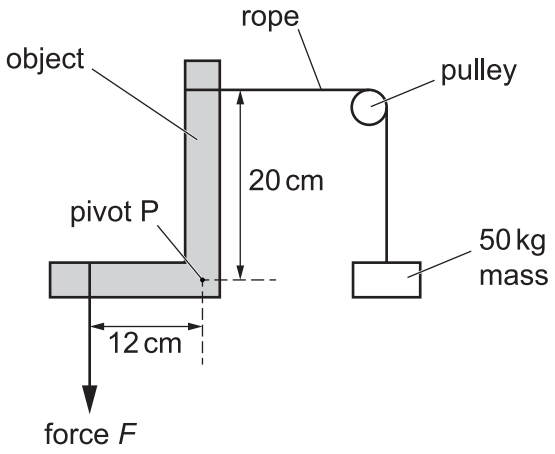


Fig. 2.1

The object is free to rotate about its pivot P.

Calculate the value of force *F*.

F = ... [2]

(c) Describe an experiment involving vertical forces to show that there is no net moment on an object in equilibrium. You may draw a diagram in the space provided.

.....

.....

.....

.....

.....

..... [3]

[Total: 6]

Moments Click for more variations

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4(a)	force × <u>perpendicular</u> distance from pivot / point	**B1**
4(b)	$(F_1d_1 = F_2d_2 =) 500 \times 20 = F \times 12$ numbers substituted in any form	**C1**
	(F = 10 000 / 12 =) 830 N	**A1**

4(c)	clear diagram or description (of object) with pivot and <u>vertical</u> forces / weights / masses / cord tension causing moments in each direction	**B1**
	indicate / measure forces and perpendicular distances	**B1**
	calculates a moment or shows / describes how to AND confirms equality of total moment (in each direction) AND statement of equilibrium / balance	**B1**

5 A 50 cm rule is balanced at its mid-point. A force of 8.0 N acts at a distance of 10 cm from one end of the rule.

Fig. 2.1 shows the arrangement.

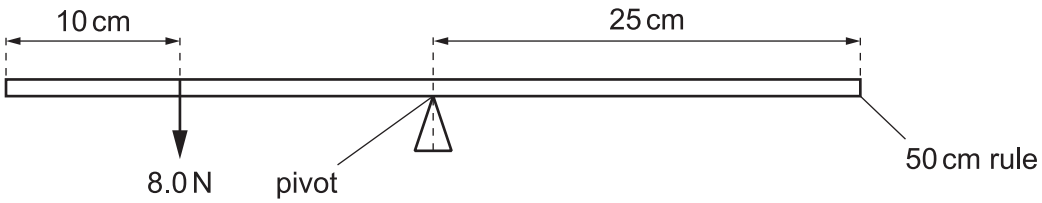


Fig. 2.1

(a) Calculate the moment of the 8.0 N force about the pivot. Give the unit.

moment = ...

unit = ...

[5]

(b) Another force acts at a point 10 cm from the pivot. It makes the rule balance.

On Fig. 2.1, draw an arrow to show the position and direction of this force. [2]

[Total: 7]

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Moments Click for more variations

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5(a)	moment = force × distance from pivot in any form	**C1**
	(distance of force from pivot = (25 – 10) =) 15 (cm)	**C1**
	8 × 15	**C1**
	120	**A1**
	N cm	**B1**
5(b)	arrow giving clockwise moment	**B1**
	arrow drawn 10 cm from pivot by eye	**B1**

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6 Fig. 3.1 shows a barrier used at a car park. The beam can be raised and lowered by a man rotating it about its pivot.

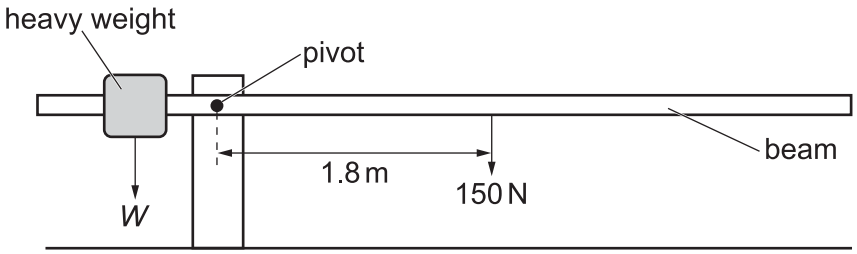


Fig. 3.1 (not to scale)

(a) The weight of the beam is 150 N. This acts at a distance of 1.8 m from the pivot as shown in Fig. 3.1.

Calculate the moment of the weight of the beam about the pivot.

Include the correct unit in your answer.

moment of weight of beam = ... unit ..... [4]

(b) When the weight *W* of the heavy weight acts at a distance of 0.6 m from the pivot, the barrier is horizontal and balanced as shown in Fig. 3.1.
The man raises the barrier and the heavy weight slips to a distance of 0.8 m from the pivot. This causes a problem for the man trying to lower the barrier.

Describe and explain the problem this causes for the man lowering the barrier.

.....

.....

.....

.....

..... [3]

[Total: 7]

Moments Click for more variations

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6(a)	(moment of weight =) weight × (perpendicular) distance (of weight from pivot)	**C1**
	(moment of weight =) 150 × 1.8	**C1**
	270	**A1**
	N m	**B1**
6(b)	barrier no longer balanced OR cannot be lowered (easily)	**B1**
	(more) force needed to lower barrier	**B1**
	(because) moment of heavy weight (has) increased	**B1**

7 **(a)** **(i)** Write down the names of **three** man-made devices in everyday use that depend, for their action, upon the moments of forces.

1. .....

2. .....

3. .....

[2]

(ii) Fig. 3.1 shows a uniform rod AB acted upon by three equal forces *F*.

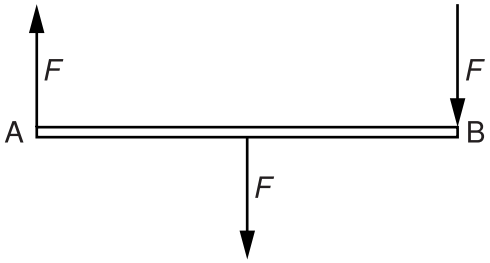


Fig. 3.1

State **two** reasons why the rod is **not** in equilibrium.

1. .....

2. .....

[2]

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(b) Fig. 3.2 shows a uniform rod PQ, supported at its centre and held in a horizontal position. The length of PQ is 1.00 m.

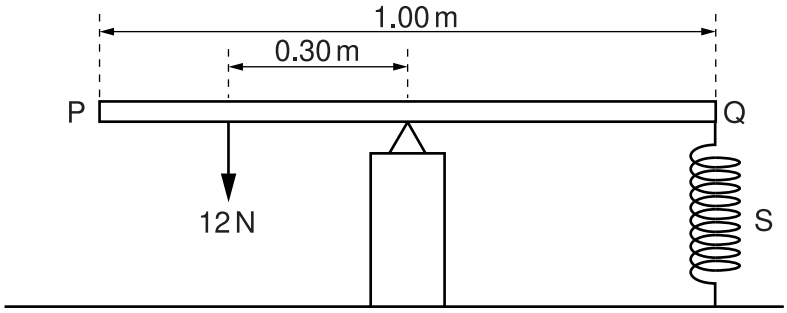


Fig. 3.2

A force of 12 N acts at a distance of 0.30 m from the support. A spring S, fixed at its lower end, is attached to the rod at Q.

(i) Calculate the force exerted on PQ by the spring.

force = ... [2]

(ii) Explain why it is not necessary to know the weight of PQ.

.....

..... [1]

[Total: 7]

Moments Click for more variations

7 **(a) (i)** 3 appropriate examples: e.g. spanner, scissors, tap etc. –1e.e.o.o. B2

(ii) there is a resultant force OR more force down than up B1
there is a resultant moment OR clockwise moment is not equal to anticlockwise moment B1

(b) (i) $F \times 0.5 = 12 \times 0.3$ C1
7.2 N A1

(ii) weight has no moment about centre of rod / has no perpendicular distance from centre of rod
OR weight acts at centre of rod / pivot / centre of mass B1

[Total: 7]

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

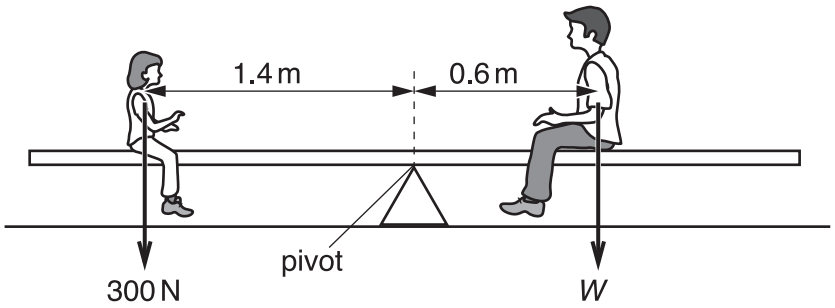


Fig. 3.1

(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

8(a)	both boxes ticked	**B1**
8(b)	moment = force × distance in any form	**C1**
	300 × 1.4	**C1**
	420 (Nm)	**A1**
8(c)	clockwise moments = anticlockwise moments	**C1**
	W x 0.6 = candidates (b) **OR** *W* = candidates (b) / 0.6	**C1**
	700 (N)	**A1**
8(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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9 **(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.

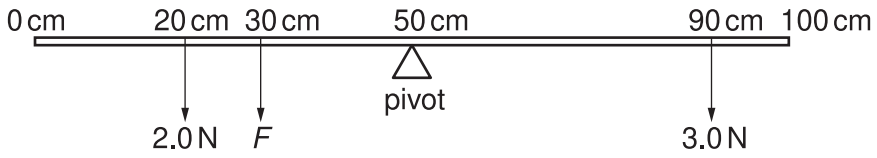


Fig. 3.1

(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.

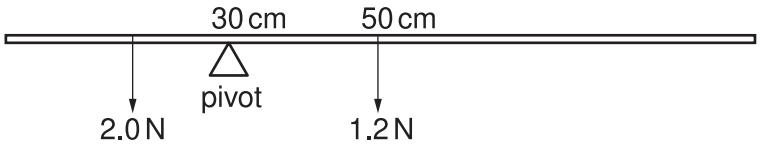


Fig. 3.2

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

9 **(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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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.

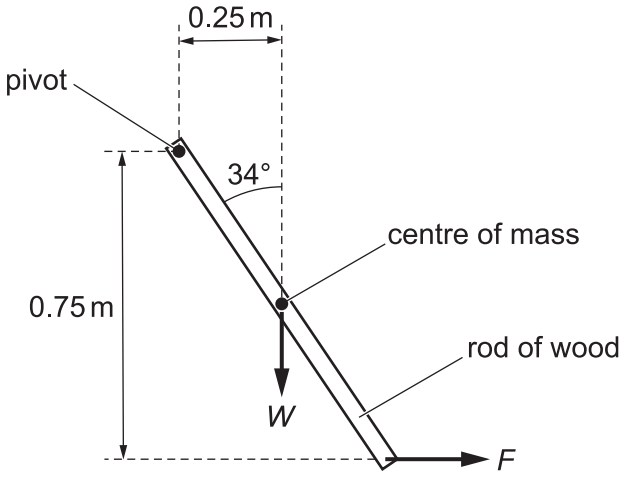


Fig. 2.1 (not to scale)

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

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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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