

# Moments

## Mark Scheme 1

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Forces, Density & Pressure
Sub Topic	Moments
Paper Type	Theory
Booklet	Mark Scheme 1

Time Allowed: 53 minutes

Score: /44

Percentage: /100

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A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

- 1 (a) (i) (vertical component =  $44 \sin 30^\circ =$ ) 22 N A1 [1]
- (ii) (horizontal component =  $44 \cos 30^\circ =$ ) 38(.1) N A1 [1]
- (b)  $W \times 0.64 = 22 \times 1.60$  C1
- (W =) 55 N A1 [2]
- (c)  $F$  has a horizontal component (not balanced by  $W$ )  
 or  $F$  has 38 N acting horizontally  
 or 38 N acts on wall  
 or vertical component of  $F$  does not balance  $W$   
 or  $F$  and  $W$  do not make a closed triangle of forces B1 [1]
- (d) line from P in direction towards point on wire vertically above  $W$  and direction up B1 [1]
- 2 (a) torque of a couple = one of the forces / a force  $\times$  distance  
 multiplied by the perpendicular distance between the forces M1  
 A1 [2]
- (b) (i) weight at P (vertically) down B1  
 normal reaction OR contact force at (point of contact with the pin) P  
 (vertically) up B1 [2]
- (ii) torque =  $35 \times 0.25$  (or  $25$ )  $\times 2$  C1  
 = 18 (17.5) N m A [2]
- (iii) the two 35 N forces are equal and opposite and the weight and the upward /  
 contact / reaction force are equal and opposite B1 [1]
- (iv) not in equilibrium as the (resultant) torque is not zero B1 [1]

3	(a) torque is the product of one of the forces and the distance between forces the <u>perpendicular</u> distance between the forces	M1 A1 [2]
	(b) (i) torque = $8 \times 1.5 = 12 \text{ Nm}$	A [1]
	(ii) there is a resultant torque / sum of the moments is not zero (the rod rotates) and is not in equilibrium	M1 A1 [2]
	(c) (i) $B \times 1.2 = 2.4 \times 0.45$ $B = 0.9(0) \text{ N}$	C1 A1 [2]
	(ii) $A = 2.4 - 0.9 = 1.5 \text{ N}$ / moments calculation	A1 [1]
4	(a) point where the weight of an object / gravitational force may be considered to act	M1 A1 [2]
	(b) product of the force and the <u>perpendicular</u> distance (to the pivot)	B1 [1]
	(c) (i) 1. sum / net / resultant force is zero	B1
	2. net / resultant moment is zero sum of clockwise moments = sum of anticlockwise moments	B1 [2]
	(ii) $W \times 0.2 = 80 \times 0.5 + 70 \times 1.3$ $= 40 + 91$ $W = 655 \text{ N}$ (allow 2/3 for one error in distance but 0/3 if two errors)	C1 C1 A1 [3]
	(iii) move pivot to left gives greater clockwise moment / smaller anticlockwise moment or move W to right gives smaller anticlockwise moment	(M1) (A1) (M1) (A1) [2]

- 5 (a) product of (magnitude of one) force and distance between forces ..... M1  
 reference to *either* perpendicular distance between forces  
 or line of action of forces and perpendicular distance .... A1 [2]
- (b) (i)  $90^\circ$  ..... B1 [1]
- (ii)  $130 = F \times 0.45$  (allow e.c.f. for angle in (i)) ..... C1  
 $F = 290 \text{ N}$  ..... A1 [2]  
 (allow 1 mark only if angle stated in (i) is not used in (ii))
- 6 (a) moment: force  $\times$  perpendicular distance M1  
 of force from pivot / axis / point A1  
 couple: (magnitude of) one force  $\times$  perpendicular distance M1  
 between the two forces A1 [4]  
 (penalise the 'perpendicular' omission once only)
- (b) (i)  $W \times 4.8 = (12 \times 84) + (2.5 \times 72)$  C1  
 $W = 250 \text{ N}$  (248 N) A1 [2]
- (ii) *either* friction at the pivot or small movement of weights B1 [1]

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