

Mark Scheme Moments Past Paper Questions

Jan 2002 to Jan 2009

3

Q3 Jun 2004

- (a) product of the force and the **perpendicular distance** ✓
reference to a point/pivot ✓ (2)
- (b)(i) since W is at a greater distance from A ✓
then W must be less than P if moments are to be equal ✓
- (ii) P must increase ✓
since moment of girl's weight increases as she moves from A to B ✓
correct statement about how P changes
(e.g. P minimum at A, maximum at B, or P increases in a linear fashion) ✓ max (4)
(6)

1

- (a)(i) resultant force acting on tray is zero [or $P + W = Q$] ✓ **Q1 Jan 2003**
resultant torque is zero
[or correct moments equation
or anticlockwise moments = clockwise moments] ✓

(a)(ii) $W = 0.12 \times 9.81 = 1.2 \text{ N}$ ✓ (1.18 N)

- (a)(iii) (taking moments about P gives)
 $Q \times 0.1 = 0.12 \times 9.81 \times 0.25$ ✓
 $Q = 2.9 \text{ N}$ (2.94 N) ✓
 $P = 2.9 - 1.2 = 1.7 \text{ N}$ ✓ (or $2.94 - 1.18 = 1.76 \text{ N}$)
(allow C.E. for values of W and Q) (6)

- (b) placed at Q ✓
no additional turning moment about Q ✓ (2)
(8)

- 4** **Q4 Jan 2004**
- (a) for a body in equilibrium ✓
 the (sum of the) clockwise moments about a point ✓
 are equal to (the sum of) the anticlockwise moments ✓
 [or resultant torque about a point ✓
 is zero ✓] (3)
- (b)(i) diagram to show: pivot/fulcrum/balance point ✓
 masses or appropriate objects ✓
- (ii) known masses on either side of pivot ✓
 move this mass until ruler is in equilibrium/balanced ✓
 measure distances ✓
 repeat with other masses ✓
- (iii) (calculate) weights of masses (on left and right of pivot) ✓
 product of weight and distance to pivot on either side of pivot ✓
 hence should be equal ✓ max(7)
(10)

Question 3	Q3 Jan 2006	
(a)	the point (in a body) ✓ where the weight (or gravity) of the object appears to act [or resultant torque zero] ✓	2
(b) (i)	$P \times 0.90 = 160 \times 0.50$ ✓ $P = 89 \text{ N}$ ✓ (88.9 N)	3
(ii)	$Q = (160 - 89) = 71 \text{ N}$ ✓ (allow C.E. for value of P from (i))	
(c)	(minimum) force $\times 0.10 = 160 \times 0.40$ ✓ force = 640 N ✓	2
(d)	force is less ✓ because distance to pivot is larger ✓ smaller force gives large enough moment ✓	3
	Total	10

- 4(a) sum of clockwise moments equals sum of anticlockwise moments ✓
 for a body in equilibrium ✓ **Q4 Jan 2002** (2)
- (b) point in the body through which the weight/mass (appears to) acts
 [or point where resultant torque/moment is zero]
 [or point where body would balance] ✓ (1)
- (c)(i) towards A ✓
 so that weight of ruler ✓
 provides balancing moment ✓
- (ii) (moments about pivot give) $1.0 \times (0.30 - d) = 0.50 \times d$ ✓
 $1.5 d = 0.30$ and $d = 0.20 \text{ m}$ ✓ (5)
 (8)

Question 6

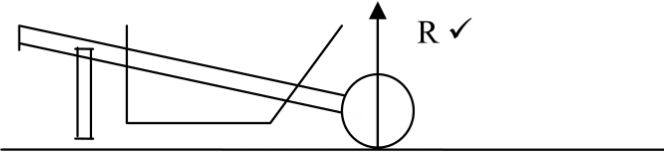
- (a) (moment) force \times perpendicular ✓ distance (from the point) ✓ (2)
- (b)(i) the point in a body where the resultant torque is zero
 [or where the (resultant) force of gravity acts or where the weight acts through] ✓
- (ii) $F \times 2.5 = 1800 \times 0.35$ ✓
 $F = 250 \text{ N}$ ✓ (252 N) **Q6 Jan 2005**
- (iii) $F_R = (1800 - 252)$ ✓
 $= 1500 \text{ N}$ ✓ (1548) N
 [use of $F = 250 \text{ N}$ gives $F_R = 1550 \text{ N}$ or 1600 N]
 (allow C.E. for incorrect value of F from (ii)) (5)
- (c) force must have a horizontal component ✓
 F (therefore) increases in magnitude ✓
 and act at an angle (to the vertical) towards the car ✓ (3)
 (10)

Question 3		Q3 Jun 2006	
(a)	resultant force zero ✓ resultant torque about any point zero ✓		2
(b)	(i) force due to wire P = $5.0 - 2.0 = 3.0 \text{ N}$ ✓ (ii) (moments give) $5.0 \times d = 2.0 \times 0.90$ ✓ $d = 0.36 \text{ m}$ ✓		3
Total			5

Question 5		Q5 Jan 2007	
(a)	the product of force ✓ and perpendicular distance from a point	✓✓	2
(b) (i)	(use of <i>moment = force × perpendicular distance</i> gives) $46 = F \times 0.25 \cos 40$ $F = 240 \text{ N}$	✓✓	4
(ii)	increases to a maximum (when shaft is horizontal) and then decreases because the perpendicular distance changes	✓✓	
Total			6

Question 6														
(a)	for a body in equilibrium (or for a stationary body) ✓ the sum of the clockwise moments about any point is equal to the sum of the anti-clockwise moments ✓ (about the same point)					2								
(b) (i)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>weight of object A/N</th> <th>weight of object B/N</th> <th>weight of object C/N</th> <th>weight of object D/N</th> </tr> </thead> <tbody> <tr> <td>0.40</td> <td>0.40 ✓</td> <td>0.70 ✓</td> <td>0.10</td> </tr> </tbody> </table>	weight of object A/N	weight of object B/N	weight of object C/N	weight of object D/N	0.40	0.40 ✓	0.70 ✓	0.10					5
weight of object A/N	weight of object B/N	weight of object C/N	weight of object D/N											
0.40	0.40 ✓	0.70 ✓	0.10											
(ii)	(use of $F_1 \times d_1 = F_2 \times d_2$ gives) $0.70 \times d = 0.10 \times 0.08$ ✓ $d = 0.011 \text{ m}$ ✓	Q6 Jun 2007												
(iii)	$T = 0.40 + 0.40 = 0.80 \text{ N}$ ✓													
(c) (i)	beam (holding B) turns clockwise ✓ or beam tips right or moves up					3								
(ii)	beams falls ✓													
(iii)	(main) beam rotates clockwise ✓ or beam tips right all due to because of unbalanced moment ✓ (explanation can be attached to any answer) (all three rotations correct 2 max, two rotations correct 1 mark)													
Total					10									

Q2 Jan 2008

Question 2		
(a)	the sum of clockwise and anticlockwise moments about any point ✓ is zero ✓	2
(b) (i)	 <p>(use of $F_1 \times d_1 = F_2 \times d_2$)</p>	5
(ii)	$F \times 1.5 = 500 \times 0.7$ ✓ $F = 23(3) \text{ N}$ ✓	
(iii)	$R + 233 = 500$ ✓ $R = 270 \text{ N}$ ✓ (267 N) (c.e. from (i))	
Total		7

Question 1	Q1 Jun 2008	
(a)	<p>resultant force must be zero ✓ (or forces balance)</p> <p>resultant torque must be zero ✓ (or acm = cm or no turning effect)</p> <p>otherwise object will accelerate ✓ (or change direction)</p> <p>otherwise object would rotate/turn (with angular acceleration) ✓</p>	4
(b) (i)	<p>(use of $w_1 \times d_1 = w_2 \times d_2$)</p> <p>$U \times 1.1 = 200 \times 1.85$ ✓</p> <p>$U = 340 \text{ N}$ ✓</p>	3
(ii)	<p>CE from (i)</p> <p>$D = 340 - 200 = 140 \text{ N}$ ✓ (or by moments)</p>	
(c)	<p>U must decrease ✓</p> <p>because greater distance ✓</p> <p>(means for same moment force can be less)</p> <p>change in D consistent with U ✓ (if U wrong max 1 mark)</p> <p>as U has decreased but weight of pole remained the same ✓</p> <p>(or $U = D + 200$)</p>	max 3
Total		10