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

Q1 Jan 2003

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

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

(a)(iii) (taking moments about P gives)
$Q \times 0.1 = 0.12 \times 9.81 \times 0.25$ ✓
$Q = 2.9$ N (2.94 N) ✓
$P = 2.9 - 1.2 = 1.7$ N ✓ (or $2.94 - 1.18 = 1.76$ 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 $d = 0.20$ m ✓ (*5*)
(*8*)

Question 6

(a) (moment) force × 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) $F \times 2.5 = 1800 \times 0.35$ ✓
$F = 250$ N ✓ (252 N) **Q6 Jan 2005**

(iii) $F_R = (1800 - 252)$ ✓
$= 1500$ N ✓ (1548) N
[use of $F = 250$ N gives $F_R = 1550$ 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*)

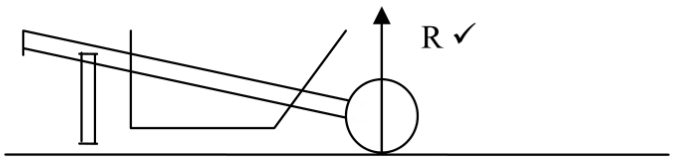
Question 3		**Q3 Jun 2006**	
(a)		resultant force zero ✓ resultant torque about any point zero ✓	**2**
(b)	(i)	force due to wire P = 5.0 − 2.0 = 3.0 N ✓	**3**
	(ii)	(moments give) $5.0 \times d = 2.0 \times 0.90$ ✓ $d = 0.36$ m ✓	
		Total	**5**

Question 5	Q5 Jan 2007		
(a)	the product of force ✓ and perpendicular distance from a point	✓✓	2
(b) (i)	(use of *moment* = *force* × *perpendicular distance* gives) 46 = *F* × 0.25 cos 40 *F* = 240 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><tr><td>weight of object A/N</td><td>weight of object B/N</td><td>weight of object C/N</td><td>weight of object D/N</td></tr><tr><td>0.40</td><td>0.40 ✓</td><td>0.70 ✓</td><td>0.10</td></tr></table>	**5**
(ii)	(use of $F_1 \times d_1 = F_2 \times d_2$ gives) 0.70 × *d* = 0.10 × 0.08 ✓ *d* = 0.011 m ✓	
(iii)	T = 0.40 + 0.40 = 0.80 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**

Q6 Jun 2007

Q2 Jan 2008

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

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