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)　$W = 0.12 \times 9.81 = 1.2$ 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

(a)   for a body in equilibrium ✓

       the (sum of the) clockwise moments <u>about a point</u> ✓

       are equal to (the sum of) the anticlockwise moments ✓

       [or resultant torque <u>about a point</u> ✓

          is zero ✓]   (*3*)

Q4 Jan 2004

(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 $= 640\,\text{N}$ ✓	**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 $1600\,\text{N}$)
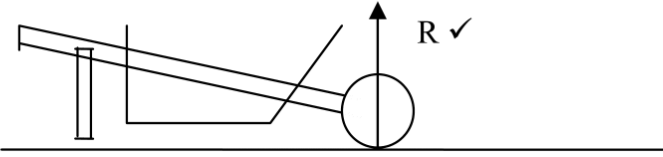(allow C.E. for incorrect value of F from (ii))   (5)

(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 *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)			**5**
	(ii)	(use of $F_1 \times d_1 = F_2 \times d_2$ gives) $0.70 \times d = 0.10 \times 0.08$ ✓ $d = 0.011$ m ✓ **Q6 Jun 2007**		
	(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**

Table for (b)(i):

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

Question 2			
(a)		the sum of clockwise and anticlockwise moments about any point ✓ is zero ✓	2
(b)	(i)	 (use of $F_1 \times d_1 = F_2 \times d_2$)	5
	(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