EQUILIBRIUM AND CENTRE OF GRAVITY

1. A

2. C

3. A

4.

(a)	Length	(i)	4(.0) (cm) **No UP**	1
	Force	(ii)	125 or 1250N	1
			force = 1.25 N **UP** (scores both marks)	1
(b)	Mass of L		1.25 x 40 = L x 15 or 125 (x g) x 40 = L (x g) x 15 ecf from (a) or start from scratch	1
			rearrange L = (125 x 40)/15 or L = 3.3 N no UP	1
			= 333 g (330g allow rounding to 300 g or 0.3 kg) 333⅓ 1/3 g is okay **UP**	1

(Total 6 marks)

5. (a) 1. no resultant force acts / no net force acts
OR total force up / in any direction = total force down / in opposite direction B1
allow sum of forces or resultant force for total force
2. no resultant moment / couple / torque acts
OR (sum of) clockwise moments and (sum of) anti-clockwise moments
(about any point / axis) balance B1
(b) (i) (anti-clockwise moment =) F •~ 2 C1
(total clockwise moment =) (120 •~ 33) + (20 •~ 15) = 4260 (N cm) C1
2130 N A1
(ii) 1990 N OR candidate's (b)(i) - 140 N B1
force is downwards B1 [7]

6. answers must be in terms of moments

	(a)	the moment of the weight is anticlockwise		1
			accept 'there is an anticlockwise moment'	
			*do **not** accept 'the weight acts to the left of the pivot' **or** 'the centre of gravity is to the left of the corner **or** above the base' **or** 'the weight pulls it back'*	

one mark is for showing evidence of balancing moments, one mark is for calculating the moments and one mark is for obtaining the force with its unit

| (b) | (i) | moment of force = moment of weight **or** clockwise moment = anticlockwise moment | | 1 |
| | | 10 × 5 = force × 25 | *award two marks for the equation even* | 1 |

if no other statement about balanced moments is shown

force = 2 N   *the unit is required for the mark*   1

award full marks for the correct answer even if no working is shown

answers must be in terms of moments

(ii)   the weight would act further from the corner, so the moment of the weight   1
       would be greater

*accept 'the moment of the weight would be greater' **or** 'the anticlockwise moment would be bigger' **or** 'a bigger moment would be needed to overcome the weight'*

*do **not** accept 'the weight would act further from the corner' **or** 'the vase **or** base would be heavier' **or** 'the centre of gravity would be lower' **or** 'the vase would be more stable'*

[5]

7. (a) Use of speed = distance/time or = 200/25 [1m]
        8 [1m]
        m/s [1m]
        (b) R [1m]
        Low centre of mass (equal to s) [1m]
        Wide base [1m]

[Total 6m]

8. (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 × 0.2 = 80 × 0.5 + 70 × 1.3 C1
= 40 + 91 C1
W = 655 N A1 [3]
(allow 2/3 for one error in distance but 0/3 if two errors)
(iii) move pivot to left (M1)
gives greater clockwise moment / smaller
anticlockwise moment (A1)
or move W to right (M1)
gives smaller anticlockwise moment (A1) [2]