

# Forces - Moments/Centre of Mass

## Mark Scheme 1

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	General Physics
Sub-Topic	Forces moments/centre of mass
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 1

**Time Allowed:** 65 minutes

**Score:** /54

**Percentage:** /100

- 1 (a) 2 vectors correct direction AND relative length by eye B1  
 correct triangle OR rectangle with resultant on correct diagonal B1  
 7.2 kN tolerance 7.0 – 7.4 kN B1
- (b) (i) (moment =) force  $\times$  distance C1  
 (moment = 11 000  $\times$  1.8 =) 20 kNm A1
- (ii) (moment of weight = 19 000  $\times$  1.25 =) 24 (kNm) B1  
 correct statement based on two moments seen B1
- [Total: 7]**

- 2 (a) Note: answers in either order  
 Resultant/net/total force B1  
 Resultant/net/ total turning effect/moment/torque/couple B1
- (b) (i) 1. (240  $\times$  1.2 =) 290 (Nm)  
 2.  $F \times 3.2$  B1
- (ii)  $F \times 3.2 = 288$  C1  
 90 N A1
- (iii) To balance the weight B1  
 OR to make resultant (vertical) force zero  
 OR to make resultant moment zero  
 OR to keep the ladder in (vertical) equilibrium  
 OR because there is a downward force  
 OR because the ladder is pressing on the ground  
 OR otherwise the ladder would fall / sink (into the ground)

**[Total: 7]**

- 3 (a) (immediately below/above the/at) 50 cm mark **OR** at pivot B1
- (b) (i) anticlockwise moment = clockwise moment **OR**  $45 \times 0.40 = 25 \times W$  C1  
 $0.72 \text{ N}$  A1
- (ii)  $0.072 \text{ kg}$  **OR**  $72 \text{ g}$  e.c.f from (b)(i) B1
- (c) (i) no net moment **OR** two moments cancel C1  
 moment due to weight of rule cancels moment due to weight of apple A1
- (ii) weight of the rule / it is bigger B1

**[Total: 7]**

- 4 (a) no resultant/net force (acting) B1  
 no resultant/net moment (acting)  
**OR** clockwise moment = anticlockwise moment B1
- (b) (i)  $W = P + Q$  in any form B1  
**OR** (total) upward force = (total) downward force B1  
 $P = W - Q$  so  $P$  must be less than  $W$   
**OR**  $P$  is not the only upward force B1
- (ii)  $P \times$  its distance (from C) =  $W \times$  its distance (from C) B1  
**OR**  $P$  and  $W$  have equal moments (about C)  
**OR** clockwise moment = anticlockwise moment B1  
 $P$  is farther from C/pivot (than  $W$  so  $P$  must be less than  $W$ ) B1
- (c) clockwise moment =  $75 \times 0.24$  C1  
 anticlockwise moment =  $F \times 0.75$  C1  
 (moments equated gives  $F =$ )  $24 \text{ N}$  A1

**[Total: 9]**

- 5 (a) (i) 180 N B1
- (ii)  $(P =) F \div A$  OR  $180 \div (0.30 \times 0.04)$  C1  
15 000 Pa A1
- (b) (i) arrow (labelled  $W$ ) from/to correct centre of mass B1
- (ii) 1. force  $\times$  (perpendicular) distance OR  $40 \times 0.60$  OR  $180 \times 0.15$  in 2. C1  
24 N m A1
2. 27 N m e.c.f. from (a)(i) A1
- (iii) slab topples / rotates (about point D) OR corner C lifts from ground B1  
OR falls over
- moment of force at B becomes bigger than moment of weight /  $W$   
OR anticlockwise moment becomes bigger than clockwise moment  
OR weight/centre of mass outside base B1

[Total: 9]

- 6 (a) 85 000 N (accept 83 300 N)
- (b) (  $(P =) F/A$  OR  $85\,000/3.4$  OR  $85\,000/3.4 \times 2$  OR  $85\,000/6.8$  (e.c.f. from (a)(i)) C  
 $1.2/1.25/1.3 \times 10^4$  Pa (e.c.f. from (a)(i)) A
- (ii) larger area M1  
smaller pressure A1
- (c) (i) (measure of) turning effect OR  $F \times x$  B1
- (ii) no resultant/net force B1  
no resultant/net turning effect/moment B1 [8]

- 7 (a) (i) 3 appropriate examples: e.g. spanner, scissors, tap etc. –1e.e.o.o. B2
- (ii) there is a resultant force OR more force down than up B1  
there is a resultant moment OR clockwise moment is not equal to  
anticlockwise moment B1
- (b) (i)  $F \times 0.5 = 12 \times 0.3$  C1  
7.2N A1
- (ii) weight has no moment about centre of rod/has no perpendicular distance  
from centre of rod  
OR weight acts at centre of rod/pivot/centre of mass B1

**[Total: 7]**