

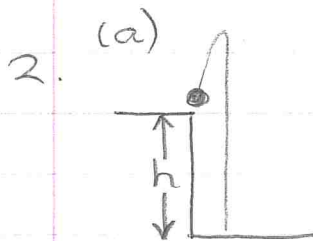
Mechanics 03 - Centre of Mass and Tilting SOLUTIONS

Section 1.

1. $u = 0$
 $a = 2$
 $v = 8$
 $t = ?$
 $s = ?$

(a) $v = u + at$
 $8 = 0 + 2t \quad t = 4$
time = 4s

(b) $v^2 = u^2 + 2as$ (doesn't use t)
 $64 = 0 + 2(2)s$
 $s = 64 \div 4 = 16$
distance = 16m



$s = -h$
 $u = 16$
 $a = -9.8$
 $t = 4$
 $v = ?$

$s = ut + \frac{1}{2}at^2$
 $-h = 16(4) - \frac{1}{2}(9.8)16$
 $-h = 64 - 78.4$
 $h = 14.4$

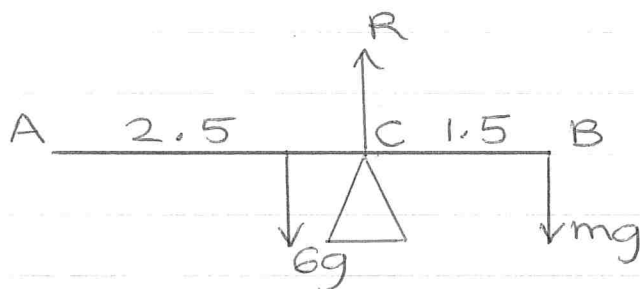
(b) $v = u + at$

$v = 16 - 9.8(4)$

$= 16 - 39.2 = -23.2 \quad \therefore$ speed = 23.2 ms⁻¹

(-ve sign indicates moving ↓)

3.



$R = mg + 6g$

↶ c): $mg \times 1.5 = 6g \times 0.5$

$1.5mg = 3g$

$m = 2$

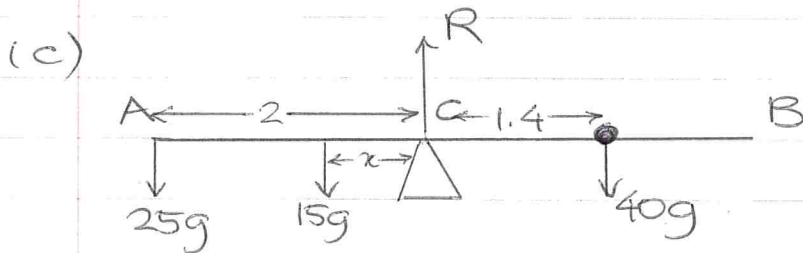
mass = 2kg

$R = 8g = 78.4 \text{ N}$

reaction = 78.4 N

4. (a) $25g \times 2 = 40g \times x$ \curvearrowright
 $50 = 40x$
 $x = 1.25 \text{ m}$

(b) That its weight acts at its centre.



(c) $25g \times 2 + 15g \times x = 40g \times 1.4$
 $50g + 15g x = 56g$
 $15x = 6$
 $x = \frac{6}{15} = 0.4$

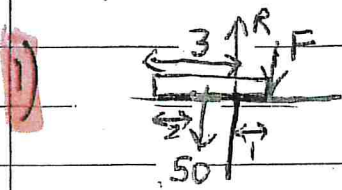
distance = 0.4 m

Section 2 \longrightarrow

MECHANICS 3 - CoG and Tilting - SOLUTIONS

Section 2:

TOTAL: 30

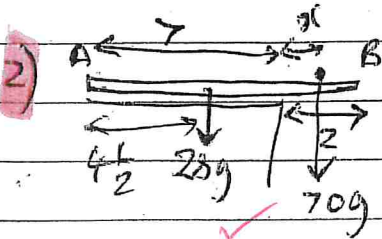


a) At edge of table (1)

b) $F \times 1 = 50 \times 1$ (2)

$F = 50\text{N}$

c) $R = 100\text{N}$ (1)



a) $70g \times x = 28g \times 2\frac{1}{2}$ (3)

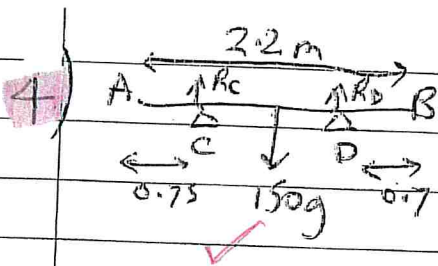
$x = 70/70 = 1\text{m from edge}$

b) $m \times 7 + 28g \times 2\frac{1}{2} = 70g \times 2$ (4)

$m = (140 - 70)/7 = 10\text{kg}$

3) a) $W \times 1.25 = 0.75 \times 200 + 2.75 \times 500$ (Tipping about D) (3)
 $W = 1525 / 1.25 = 1220\text{N}$

b) $500 \times 0.8 = 1.2 \times 200 + 3.2 \times W$ (Tipping about C) (4)
 $400 = 240 + 3.2W$
 $W = 50\text{N}$



4
(6)

a) $R_c + R_d = 150g$ $\uparrow = \downarrow$ ①
 $R_c \times 0.75 + R_d \times 1.5 = 150g \times 1.1$ \checkmark (A_d)
 $R_c + 2R_d = 220g$ \checkmark ② $\times \frac{4}{3}$
 ② - ① $R_d = 70g \Rightarrow R_c = 80g$

(3)

b) i) $Mg \times 0.75 = 150g \times 0.35$ \checkmark (Tilting about C)
 $M = 52.5 / 0.75 = 70 \text{ kg}$ \checkmark

(3)

ii) $Mg \times 0.7 = 150g \times 0.4$ \checkmark (Tilting about D)
 $M = 60 / 0.7 = 85.7 \text{ kg}$ \checkmark