



இலங்கையின் உயர்தர கணித விஞ்ஞான
பிரிவின்கான இணையதளம்

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MARKING SCHEME

PHYSICS
13 (2018)

SECTION I

①. 4	⑥ 5	⑪ 4	⑯ 1	⑳ 1
②. 3	⑦ 3	⑫ 2	⑰ 5	㉑ 4
③. 5	⑧ 3	⑬ 2	⑱ 4	㉒ 3
④. 3	⑨ 5	⑭ 5	㉙ 2	㉓ 3
⑤. 3	⑩ 4	⑮ 3	㉚ 3	㉔ 3

$$25 \times 2 = 50$$

SECTION I + SECTION II , $50 + 70 \times \frac{5}{7} = 100\%$
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STRUCTURED ESSAY

- (1). (a) A - Thimble
B - Thimble head/Ratchet knob
C - Circular scale
D - Main Scale
- * All correct — (02)
* Two correct — (01)
- (b) 0.01 mm — (01)
- (c) (i) To avoid deforming the object — (01)
(ii) When rotating the Thimble head, "click", "click" sound must be heard when the spindle touches the object — (01)
- (d) Without placing the object between anvil and spindle turn the ratchet until "click" sound is heard 2 or 3 times when the spindle touches the anvil and then take the reading — (02)
- (e) $23 \text{ mm} + 44 \times 0.01 \text{ mm} = 23.44 \text{ mm}$ — (01)
- (f) At various points along the wire take readings at right angles — (02)

TOTAL 10 MARKS

- (2) (a) The table provides frictional force to A which is equal and opposite to the tension applied in the string — (01)

- (b) The frictional force acting on block A increased to balance the increased tension in the string.
OR
The tension in the string is less than the limiting friction — (01)

(c) Limiting friction or static friction ————— (01)

(d) $F = \mu R$ ————— (01)

(e) (i)	$R(N)$	$F(N)$
	1.5	2.0
	2.5	3.0
	3.5	4.0
	4.5	5.2
	5.5	6.6
	6.5	8.0

↑ ————— All correct — (01)

↑ ————— All correct — (01)

(ii) If all 6 points are marked correctly ————— (01)

(iii) Best line ————— (01)

(iv) Slope of the graph = 1.2 ————— (01)

 $\mu = 1.2$ ————— (01)TOTAL = 10 MARKS

3) (a) $\downarrow mg - T = ma$
 $450 - 300 = 45a$

$$a = \frac{150}{45} = \frac{10}{3} \text{ m s}^{-2} \downarrow \text{ ————— (01)}$$

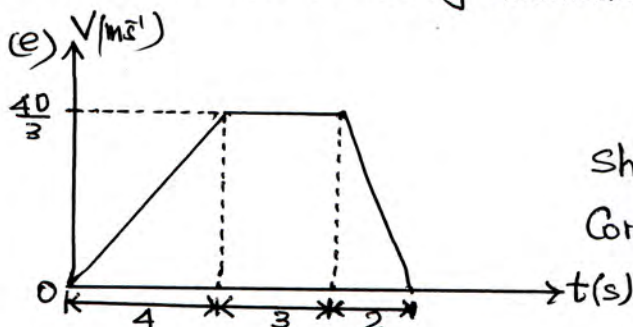
(b) Moving downwards with acceleration ————— (01)

(c) The elevator/lift is moving downwards with uniform velocity — (01)

(d) $\downarrow mg - T = ma$
 $450 - 750 = 45a$

$$a = \frac{-300}{45} = -\frac{20}{3} \text{ m s}^{-2} \downarrow \text{ ————— (01)}$$

The elevator is moving downwards with deceleration of $\frac{20}{3} \text{ m s}^{-2}$ — (01)



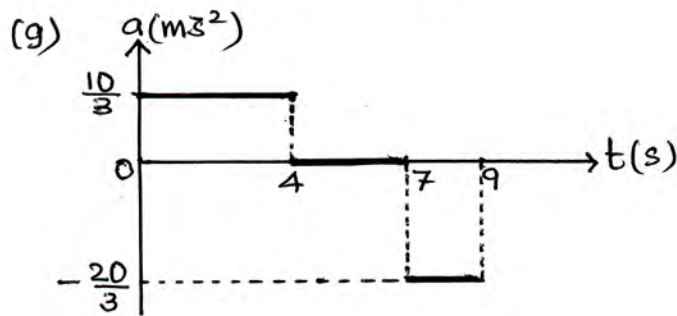
Shape of the graph ————— (01)

Correct values inserted into the graph — (01)

$$(f) \quad s = \frac{1}{2}(9+3) \times \frac{40}{3}$$

$$= 80 \text{ m}$$

(01)



(02)

TOTAL = 10 MARKS

4) (i)

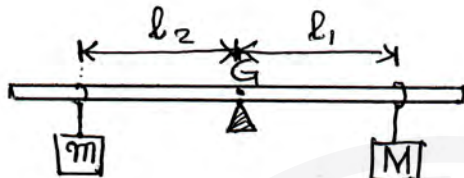


Diagram with masses suspended with thread (01)

For marking l_1 and l_2 (01)

For marking G (01)

(ii) No need to consider the mass of the meter rule (02)
 (The experiment will be independent of the mass of the metre rule)

(iii) 50 g (01)

(iv) It is possible to select larger lengths for both l_1 and l_2 as the unknown mass is roughly equal to 60 g. (01)

(v) $m l_2 = M l_1$ (01)

$$(vi) \quad l_2 = \left(\frac{M}{m}\right) l_1 \quad \text{or} \quad l_1 = \left(\frac{m}{M}\right) l_2$$

Dependent variable = l_2 } or { Dependent variable = l_1 (01)
 Independent variable = l_1 } { Independent variable = l_2 (01)

$$01) (a) (i) \tau = I \alpha \quad \text{_____} \quad (01)$$

$$5 \times 0.5 = 4 \times 0.5^2 \alpha$$

$$\alpha = \frac{5}{2} = 2.5 \text{ rad s}^{-2} \quad \text{_____} \quad (01)$$

$$(ii) \tau \cdot t = \Delta(I\omega)$$

$$5 \times 0.5 \times 3 = 4 \times 0.5^2 \times \omega$$

$$\omega = 7.5 \text{ rad s}^{-1} \quad \text{_____} \quad (01)$$

$$(iii) \theta = \left(\frac{0 + \omega}{2} \right) t$$

$$= \left(\frac{0 + 7.5}{2} \right) 3$$

$$= \frac{22.5}{2} \text{ rad} \quad \text{_____} \quad (01)$$

$$N = \frac{\theta}{2\pi} = \frac{\left(\frac{22.5}{2} \right)}{6} = \frac{15}{8} \text{ turns or revolutions} \quad \text{_____} \quad (01)$$

$$(iv) \text{Energy Gained} = \frac{1}{2} I \omega^2 \quad \text{_____} \quad (01)$$

$$= \frac{1}{2} \cdot 4 \times (0.5)^2 \cdot (7.5)^2$$

$$= \frac{225}{8} \text{ J} \quad \text{_____} \quad (01)$$

$$(v) \text{Work done} = \tau \cdot \theta = 5 \times 0.5 \times \frac{22.5}{2}$$

$$= \frac{225}{8} \text{ J} \quad \text{_____} \quad (01)$$

$$(b) (i) mg - T = ma \quad \text{_____} \quad (01)$$

$$T \cdot R = \frac{1}{2} MR^2 \alpha \quad \text{_____} \quad (01)$$

$$a = R \alpha \quad \text{_____} \quad (01)$$

$$\text{Equations } ② \times ③ \Rightarrow T = \frac{1}{2} Ma \quad \text{_____} \quad (01)$$

$$\text{Equation } ① \Rightarrow mg - \frac{1}{2} Ma = ma$$

$$a = \frac{2mg}{2m+M} \quad \text{_____} \quad (01)$$

$$(ii) \text{Equation } ④ \Rightarrow T = \frac{1}{2} M \times \frac{2mg}{2m+M}$$

$$= \frac{mMg}{2m+M} \quad \text{_____} \quad (01)$$

(iii)

$$a = \frac{2 \times 0.5 \times 10}{2 \times 0.5 + 2}$$

$$= \frac{10}{3} \text{ m s}^{-2} \quad \text{_____} \quad (01)$$

$$T = \frac{0.5 \times 2 \times 10}{2 \times 0.5 + 2}$$

$$= \frac{10}{3} \text{ N} \quad \text{_____} \quad (01)$$

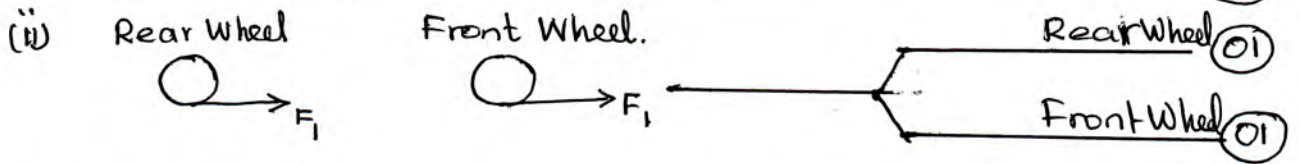
TOTAL = 15 MARKS

02) (i) $F \cdot t = \Delta mv$

$F \cdot 0.2 = 2000 \times 10 - 2000 \times 0$ _____ (01)

$F = \frac{2000 \times 10}{0.2}$

$= 10^5 \text{ N}$ _____ (01)



(iii) $s = \left(\frac{u+v}{2}\right)t$

$= \left(\frac{10+40}{2}\right)8$ _____ (01)

$= 200 \text{ m}$ _____ (01)

(iv) Work done $= \frac{1}{2}mv^2 - \frac{1}{2}mu^2$

$= \frac{1}{2} \times 2000 (40^2 - 10^2)$

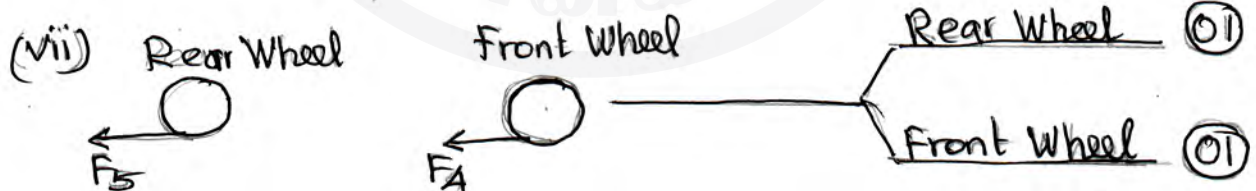
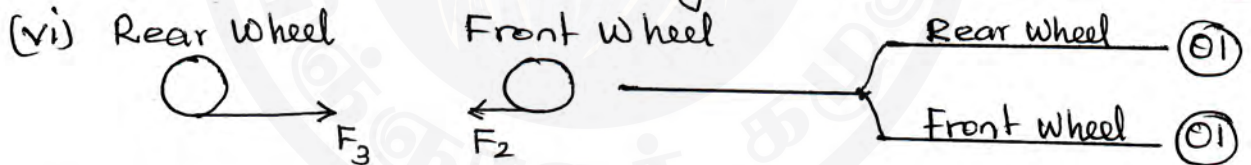
$= 1.5 \times 10^6 \text{ J}$ _____ (01)

(v) Apply $F = ma$ to the car.

$F = 2000 \left(\frac{40-10}{8}\right)$

$= 7500 \text{ N}$ _____ (01)

According to Newton's 3rd Law, equal and opposite force will be exerted on the Earth by the car, _____ (01)



(viii) Work done by friction = Loss in Kinetic energy

$8 \times 10^4 \times s = \frac{1}{2} \times 2000 \times 60^2 - 0$ _____ (01)

$s = 45 \text{ m}$ _____ (01)

TOTAL = 15 MARKS

$$03) (i) \Delta mv = 0.4 \times 30 \cos 37^\circ - 0.4 \times 20 \quad \text{--- (01)}$$

$$= 0.4 (24 + 20)$$

$$= 17.6 \text{ kg ms}^{-1} \rightarrow \quad \text{--- (01)}$$

$$(ii) F = \frac{\Delta mv}{t} = \frac{17.6}{0.1} = 176 \text{ N} \rightarrow \quad \text{--- (01)}$$

$$(iii) \uparrow \Delta mv = 0.4 \times \sin 37^\circ - 0 = 7.2 \text{ kg ms}^{-1} \quad \text{--- (01)}$$

$$(iv) \begin{array}{c} \uparrow R \\ \downarrow mg \end{array} \quad F = \frac{\Delta mv}{t}$$

$$\uparrow R - mg = \frac{7.2}{0.1} \quad \text{--- (01)}$$

$$R - 4 = 72$$

$$R = 76 \text{ N} \uparrow \quad \text{--- (01)}$$

$$(v) \begin{array}{c} \text{Resultant force } R = \sqrt{176^2 + 76^2} \quad \text{--- (01)} \\ = \sqrt{36752} \\ = 191.71 \text{ N} \quad \text{--- (01)} \end{array}$$


$$(vi) s = ut + \frac{1}{2}at^2$$

$$\uparrow 0 = 30 \sin 37^\circ \cdot T - \frac{1}{2} \times 10 T^2 \quad \text{--- (01)}$$

$$T = \frac{2 \times 30 \sin 37^\circ}{10}$$

$$= \frac{2 \times 30 \times 0.6}{10}$$

$$= 3.6 \text{ s} \quad \text{--- (01)}$$

$$(vii) \text{Horizontal Range} = 30 \cos 37^\circ \times 3.6 \quad \text{--- (01)}$$

$$= 86.4 \text{ m} \quad \text{--- (01)}$$

$$(viii) \text{Max. Horizontal Range} = u \cos 45^\circ \times \frac{2 \times u \sin 45^\circ}{g} \quad \text{--- (01)}$$

$$= \frac{u^2}{g}$$

$$= \frac{900}{10}$$

$$= 90 \text{ m} \quad \text{--- (01)}$$

$$(ix) \text{Change in momentum.} \quad \text{--- (01)}$$

TOTAL = 15 MARKS



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