

2021 Sec 4 IP Physics MYE Answers

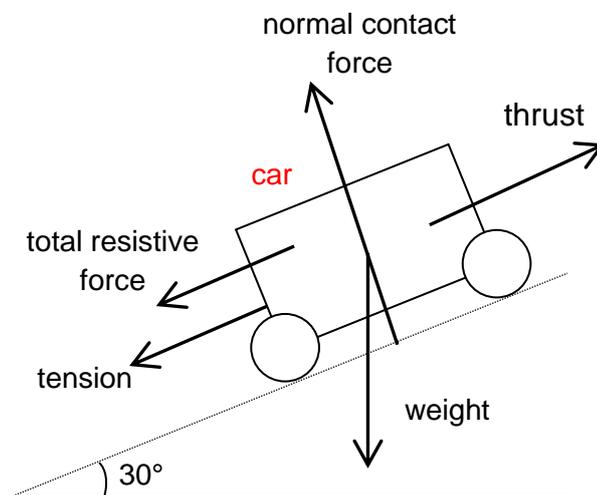
Paper 1 (30 marks)

1-----5	6-----10	11----15	16----20	21----25	26---30
CBDDD	BCABD	CDADA	CAACB	BDACA	CAAAB

Paper 2 Section A (40 marks)

1(a) Rate of change of velocity [1]

(b) Freebody diagram of car [2]



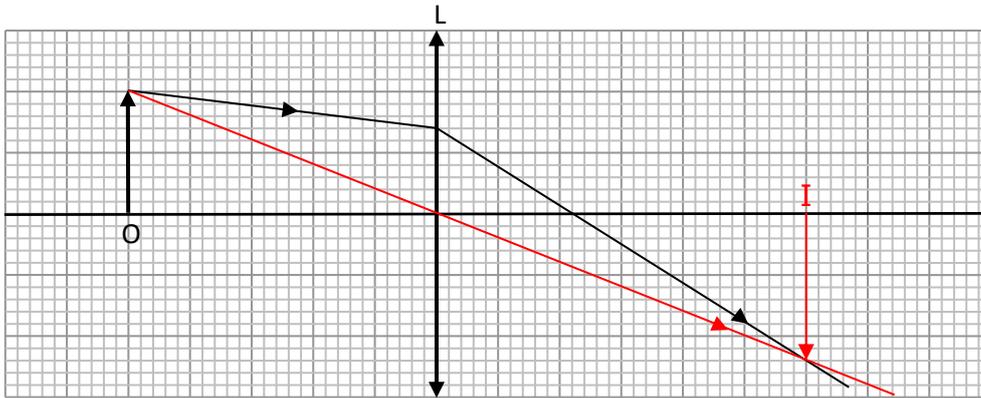
[1] mark if at least 3 forces correct (direction & label)
[2] marks if all 5 forces correct (direction & label)

(c) $W_x = 5000 \sin 30^\circ$
 $= 2500 \text{ N}$ [1]

(d) $F_{\text{net}} = \text{thrust} - \text{tension} - W_x - \text{resistive force}$
 $= 6000 - 1000 - 2500 - 500$
 $= 2000 \text{ N}$ [1]

(e) The car will now travel up the slope with a **greater acceleration**. [1]

2(a)(i)



Straight line with arrow passing through optical centre with image I drawn & labelled [1]

(ii) **Use lens formula:** $1/f = 1/u + 1/v = 1/5.0 + 1/6.0$ [1]

$$f = 2.727 = \mathbf{2.7 \text{ cm}} \text{ (2 sf)} \quad [1]$$

Accept $f = (2.7 \pm 0.1) \text{ cm}$

Or **diagram:** horizontal ray, then to image (pass through F)

(iii) The image distance will decrease. [1]

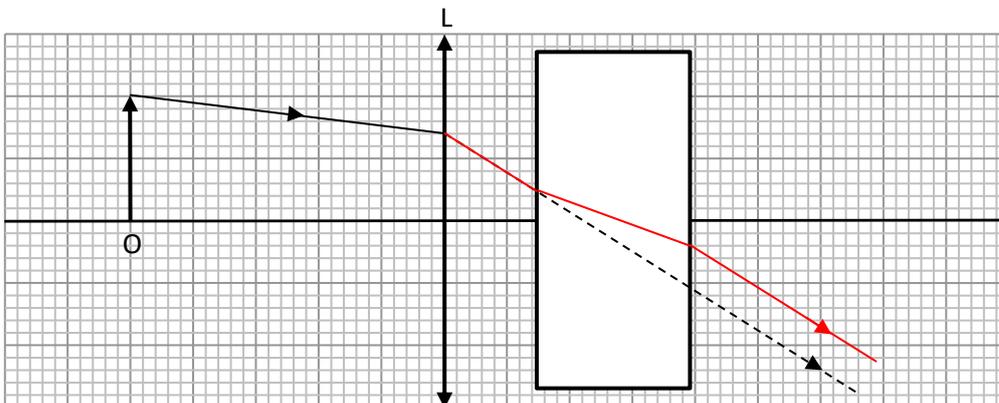
/ The image will be closer to the lens.

(b)(i) $n = c/v = (3.0 \times 10^8) / (1.97 \times 10^8) = 1.5228 = \mathbf{1.5}$ (2 sf) [1]

(ii) $n_1 \sin \theta_1 = n_2 \sin \theta_2$ □ $1.0 \sin 30^\circ = 1.522 \sin \theta_2$ [1]

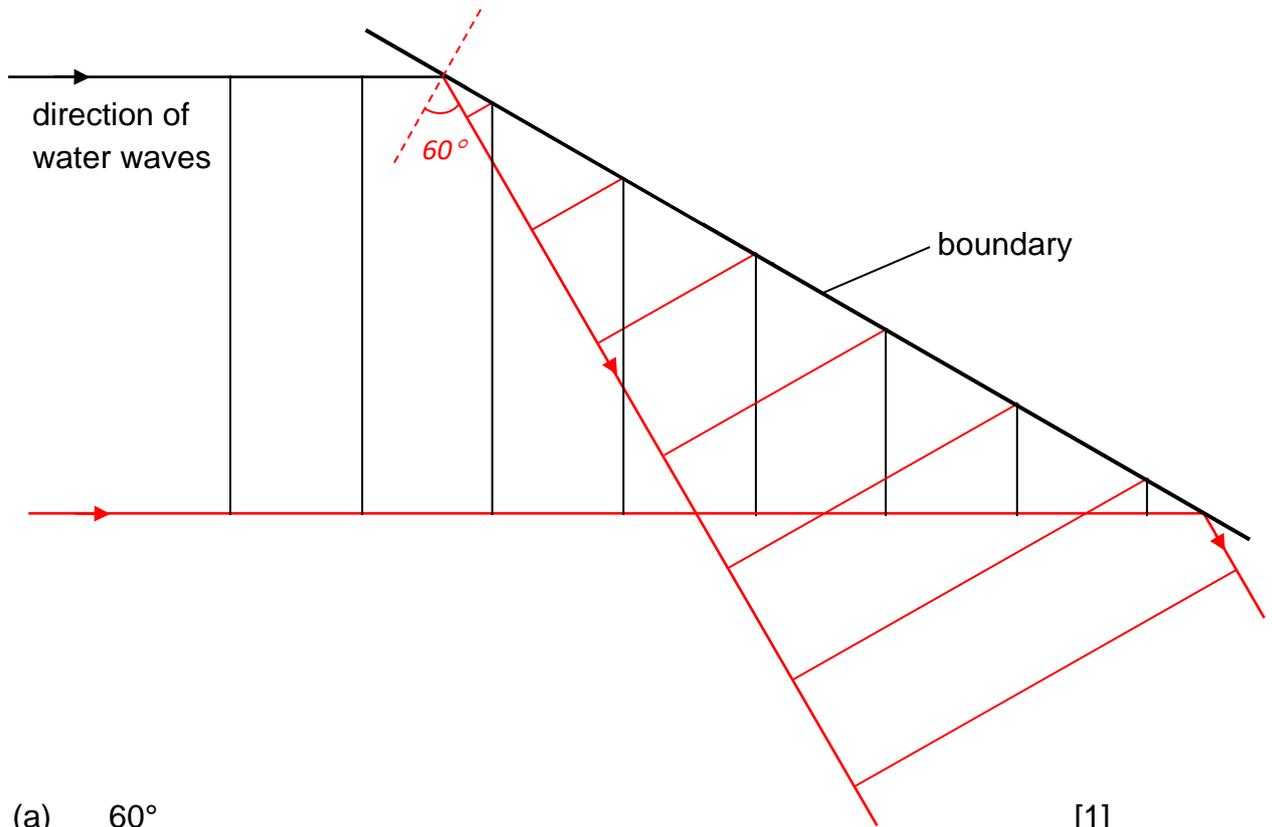
$$\theta_2 = 19.16 = \mathbf{19.2^\circ}$$
 (3 sf)

(iii)



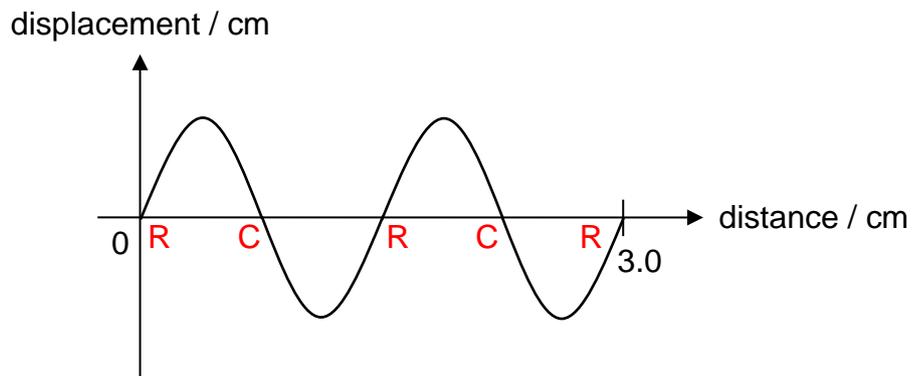
Line bending towards the normal when entering glass block and emerges bending away from normal, parallel to the incident ray. [1]

3



- (a) 60° [1]
- (b) Reflected wavefronts have same wavelength [1]
Wavefronts are connected at boundary [1]
- (c) Unchanged [1]

4(a)



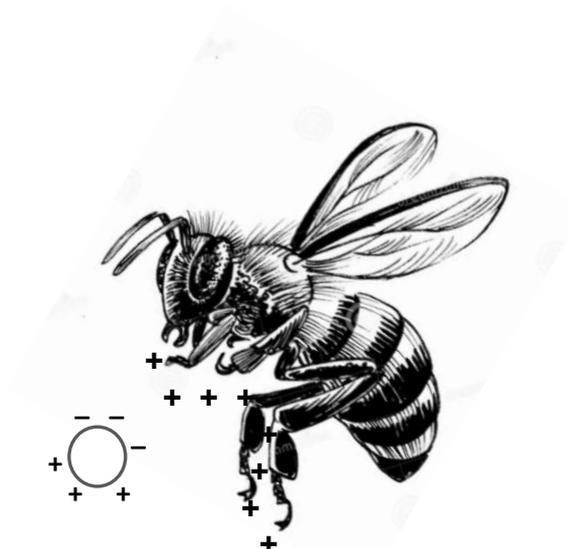
- Any one C [1]
- Any one R [1]

(b) $\lambda = (3.0 \times 10^{-2} / 2) = 1.5 \times 10^{-2} \text{ m}$ [1]

(c) $v = \lambda / T$
 $T = \lambda / v = (1.5 \times 10^{-2}) / 330$ [1]
 $= 4.54 \times 10^{-5} \approx 4.5 \times 10^{-5} \text{ s (2 sf)}$ [1]

- (d) *Any one of the following:* [1]
 Ultrasonic scanning in medicine
 SONAR
 Quality control in manufacturing

5



- Equal amount of positive & negative induced charges drawn on Fig. 5.1. [1]
- Negative charges are induced on the right side of pollen grain nearer to the bee, while positive charges are induced on the left side of the pollen grain. [1]
- The unlike charges are closer than the like charges, so the force of attraction on the pollen grain by the bee is greater than the force of repulsion. [1]
 OR there is net attractive force on the pollen grain by the bee.

6(a) $I = Q / t \quad \rightarrow \quad Q = I \times t = (2.00 \text{ A}) \times (10.0 \times 60 \text{ s})$ [1]
 $= 1200 \text{ C}$ [1]

(b) number of electrons $= Q / e = 1200 \text{ C} / 1.6 \times 10^{-19} \text{ C}$ [1]
 $= 7.5 \times 10^{21}$ [1]

Allow: e.c.f from (a) in (b).

7(a) $1/R = 1/15 + 1/22$

$\rightarrow 1/R = 0.1121 \quad \rightarrow R = 8.919 \approx 8.9 \text{ k}\Omega$ [1]

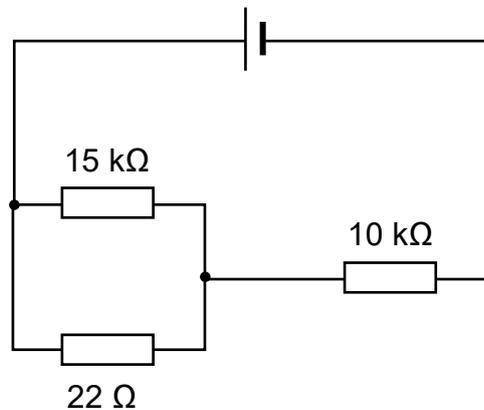
Connect resistors of resistance 15.0 k Ω and 22.0 k Ω in parallel. [1]

(b) e.m.f. = $I R_e$

$\rightarrow R_e = \text{e.m.f.} / I \quad \rightarrow R_e = 6.0 \text{ V} / (0.317 \times 10^{-3} \text{ A})$
 $= 18\,927 \Omega \approx 18.9 \text{ k}\Omega$ [1]

$R_e = R(\text{from a}) + 10 \text{ k}\Omega = 8.9 + 10.0 = 18.9 \text{ k}\Omega$ [1]
 (in series)

Neat diagram with resistors labelled. [1]



8 (a) $P = VI \rightarrow I = P / V = 2500 \text{ W} / 240 \text{ V} = 10.4 \text{ A}$ [1]

Choose 13 A fuse [1]

(b) $E = P t \rightarrow E = 2.50 \text{ kW} \times (75/60) \text{ h} \times 30 = 93.75 \text{ kW h}$ [1]

Cost = $E \times \text{unit cost} = 93.75 \text{ kW h} \times \$0.23 = \$21.56$ [1]

Paper 2 Section B (10 marks)

9(a) Ohm's states that the potential difference across a conductor is proportional to the current flowing through it, [1]

provided its temperature and other physical properties remain constant. [1]

(b) curve ① [1]

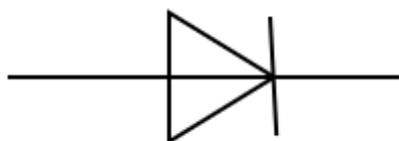
(c) resistance = $V / I = 1.0 \text{ V} / 0.40 \text{ A} = 2.5 \Omega$ [1]

(d) curve ② is not an ohmic conductor [1]

Its resistance is not constant:

$V / I = 2.0 \text{ V} / 0.10 \text{ A} = 20 \Omega$ and $V / I = 3.0 \text{ V} / 0.30 \text{ A} = 10 \Omega$ [1]

(e) [1]



(f) curve ④ [1]
The diode only allows current to flow in one direction.
/ No current flows when the potential difference is negative.

(g) curve ③ [1]

resistance of light bulb increases with increasing current/power [1]