

Marking Scheme

This document was prepared for markers' reference. It should not be regarded as a set of model answers. Candidates and teachers who were not involved in the marking process are advised to interpret its contents with care.

Paper 1 Section A

| Question No. | Key | Question No. | Key |
|--------------|--------|--------------|--------|
| 1. | C (63) | 26. | B (58) |
| 2. | A (81) | 27. | B (69) |
| 3. | A (38) | 28. | B (42) |
| 4. | D (70) | 29. | D (45) |
| 5. | A (54) | 30. | C (53) |
| 6. | D (41) | 31. | B (47) |
| 7. | A (63) | 32. | A (47) |
| 8. | C (36) | 33. | C (40) |
| 9. | B (84) | 34. | C (37) |
| 10. | C (55) | 35. | C (65) |
| 11. | A (58) | 36. | D (51) |
| 12. | C (63) | | |
| 13. | D (67) | | |
| 14. | D (58) | | |
| 15. | B (73) | | |
| 16. | D (77) | | |
| 17. | B (78) | | |
| 18. | D (62) | | |
| 19. | A (76) | | |
| 20. | A (65) | | |
| 21. | A (40) | | |
| 22. | D (54) | | |
| 23. | C (61) | | |
| 24. | B (86) | | |
| 25. | B (49) | | |

Note: Figures in brackets indicate the percentages of candidates choosing the correct answers.

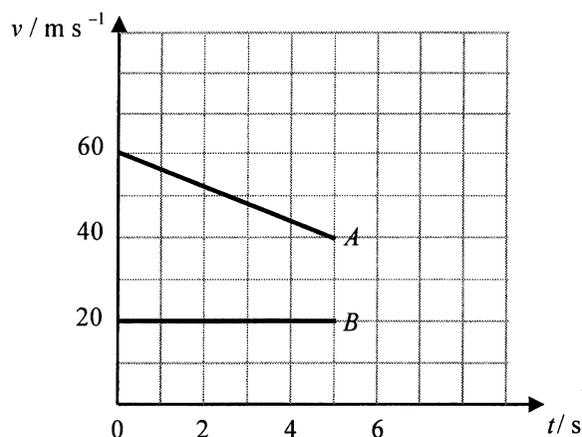
Paper 1 Section B

| | | <u>Marks</u> |
|----|--|-----------------------------|
| 1. | (a) $Q = m_s c_s \Delta T + m_s l_v$ $= 0.02 (2000)(110 - 100) + 0.02 (2260000)$ $= 400 + 45200$ $= 45600 \text{ J}$ | 1M+1M 1A <u>3</u> |
| | (b) $m_m c_m \Delta T_m = Q + m_s c_w \Delta T_w$ $0.2 (3900)(T - 15) = 45600 + 0.02 (4200)(100 - T)$ $T = 76.0 \text{ }^\circ\text{C}$ | 1M 1A <u>2</u> |
| | (c) The actual temperature of frothy milk is lower than the value calculated in (b). Because energy loss by the steam is also gained by the surroundings including the air/the metallic jug that holds the milk. | 1A 1A <u>2</u> |
| 2. | (a) $p_1 V_1 = p_2 V_2$ (Or $p \propto \frac{1}{V}$) $p_1 \left(\frac{4}{3} \pi \times (0.8)^3\right) = (1.01 \times 10^5) \left(\frac{4}{3} \pi \times (1.0)^3\right)$ $p_1 = 1.97 \times 10^5 \text{ Pa}$ | 1M 1A <u>2</u> |
| | (b) Volume increases as bubble rises but the speed / k.e. of gas molecules remains unchanged therefore frequency of collision of molecules on bubble's inner surface decreases, gas pressure decreases. | 1A 1A <u>2</u> |
| 3. | (a) (i) Friction f between the tyres and the road. $f = \frac{mv^2}{r}$ $8000 = \frac{1200 v^2}{45 \text{ m}}$ $v = 17.3 \text{ m s}^{-1}$ | 1A 1M 1A <u>3</u> |
| | (ii) Smaller For the same f , $v^2 \propto r$; when r decreases v decreases. | 1A 1A <u>2</u> |
| | (b) (Max) friction / coefficient of friction reduced, not enough to provide the centripetal force / acceleration required for circular motion. <u>Or</u> Tracking or allowed speed lowered. | 1A 1A <u>2</u> |

4. (a) (i) $v = u + at$
 $= 60 + (-4)5$
 $= 40 \text{ m s}^{-1}$

1M
 1A 2

(ii)



1A
 1

(iii) $s_A = \left(\frac{60 + 40}{2}\right)(5) = 250 \text{ m}$
 $s_B = (20)(5) = 100 \text{ m}$
 $x = 250 - 100$
 $= 150 \text{ (m)}$
 [equals to the area between the two graphs]

1M
 1A 3

(b) (i) $m u_A + m u_B = (m + m)V$
 $40 + 20 = 2V$
 $V = 30 \text{ m s}^{-1}$

1M
 1A 2

(ii) $F = \frac{mV - mu_A}{\Delta t}$
 $= \frac{(5000)(30 - 40)}{0.2}$
 $= -250000 \text{ N}$

1M
 1A

Impact force is opposite to the direction of travel of A (to the left / backwards / negative)

1A 3

5. (a) (i) Let T be the tension.

$$2T \cos 75^\circ = 60$$

$$T = 115.9 \text{ N}$$

1M

(ii) energy stored in the string = k.e. of arrow

$$= \frac{1}{2}(0.2)(45)^2$$

$$= 202.5 \text{ J}$$

1A 2

1M

1A 2

(b) (i) $d = v \cos 20^\circ t$

$$60 = 45 \cos 20^\circ t$$

$$t = 1.42 \text{ s}$$

1M

1A 2

(ii) $h = 25 - \frac{1}{2}gt^2$

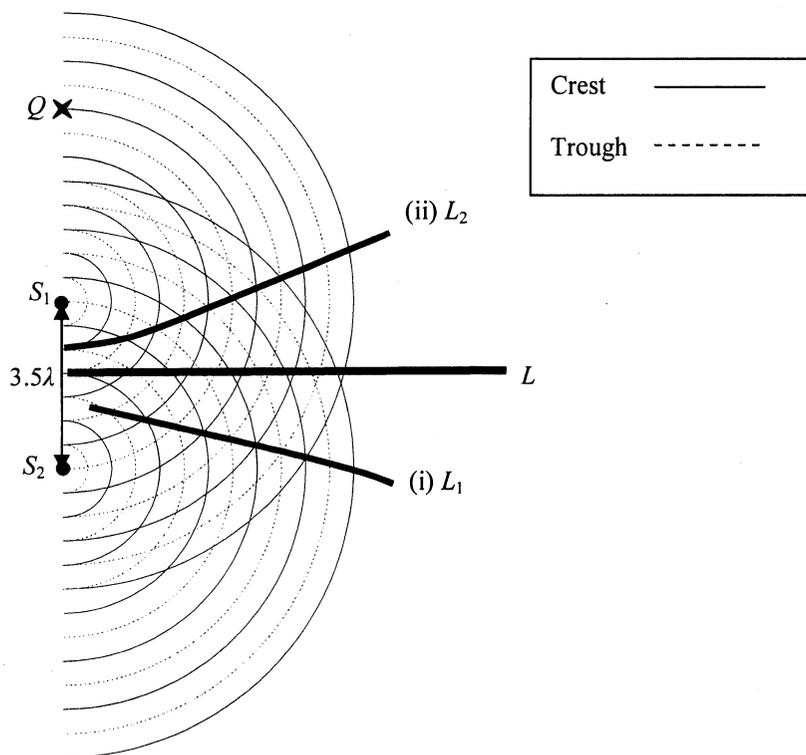
$$= 25 - \frac{1}{2}(9.81)(1.42)^2$$

$$= 15.1 \text{ m [or } h = 14.9 \text{ m]}$$

1M

1A 2

6. (a)

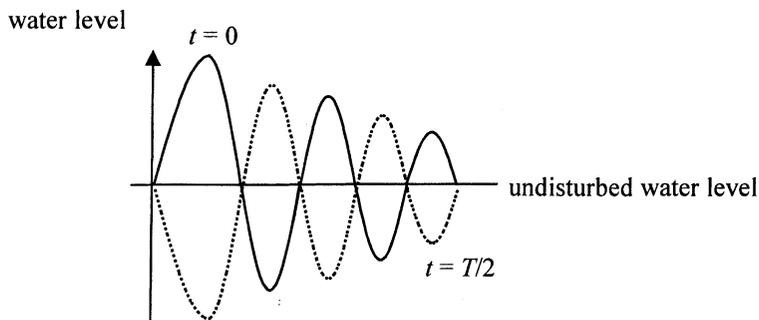


2A

L_1 / L_2 are further from L or separation of $L / L_1 / L_2$ is greater or angle between $L / L_1 / L_2$ larger.

1A 3

6. (b)



1A

1

(c) The two waves are out of phase at Q as path difference = 3.5λ ($QS_1 = 4\lambda$ and $QS_2 = 7.5\lambda$), destructive interference occurs.

1M

1A

2

(d)

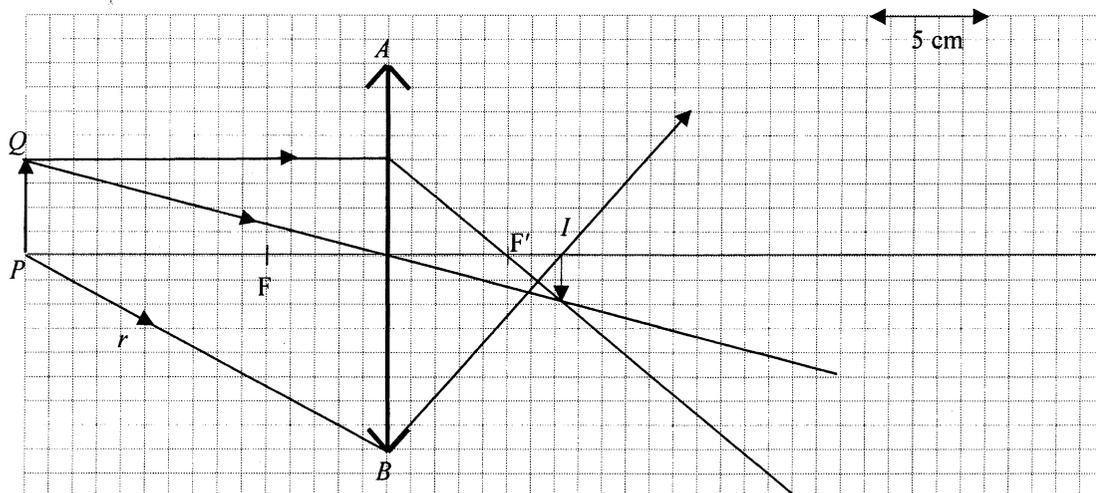
$$\Delta y = \frac{D\lambda}{a} = \frac{2.5 \times 550 \times 10^{-9}}{0.5 \times 10^{-3}} = 2.75 \times 10^{-3} \text{ m}$$

1M

1A

2

7. (a) (i)



Two correct rays to find image I .
Nature: real, inverted, diminished.

2A

2A

4

(ii) Ray r correctly completed.

1A

1

(b) (i)

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f} \quad \frac{1}{15} + \frac{1}{v} = \frac{1}{10}$$

1M

$$v = 30 \text{ cm}$$

1A

$$m = \frac{30}{15} = 2$$

1A

3

(ii) As the light energy collected by the lens is the same for both cases, for (b)(i), an enlarged image ($u < v$), same amount of light energy distributed over a larger image/intensity of light decreases as distance increases, i.e. dimmer image for (b)(i)

1A

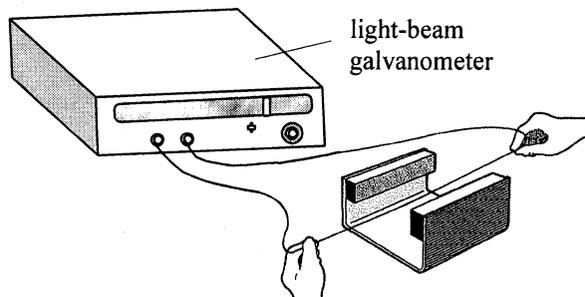
1A

Or for (a), a diminished image ($u > v$), same amount of light energy distributed over a diminished image, i.e. brighter image for (a)

2

8. (a) Keeping warm / 88 W 1A 1
- (b) $R_1 = \frac{V^2}{P} = \frac{220^2}{88}$ 1M
 $= 550 \Omega$ 1A 2
- (c) Total current $I_0 = \frac{P_0}{V} = \frac{550}{220} = 2.5 \text{ A}$ 1M
 Current in R_1 , $I_1 = \frac{220}{550} = 0.4 \text{ A}$ 1M
 Current in R_2 , $I_2 = 2.5 - 0.4 = 2.1 \text{ A}$ 1A 3
- Or Power to R_2 , $550 \text{ W} - 88 \text{ W} = 462 \text{ W}$
 Current in R_2 , $I_2 = \frac{P_2}{V} = \frac{462}{220} = 2.1 \text{ A}$
- (d) Peak current = $\sqrt{2} (2.5 \text{ A})$ 1M
 $= 3.54 \text{ A}$ 1A 2
9. (a) Humid conditions in bathrooms and water is a conductor which provides a conducting path or lowers the resistance between our hands/body and the source of electricity. 1A
1A 2
- (b) (i) The person will get electric shock because full potential drop 220 V is applied to or substantial/large current flows through the human body. 1A
1A 2
- (ii) The person will not get electric shock / Nothing happens because the current in secondary circuit has no return path/incomplete circuit. 1A
1A 2
- (c) Primary : Secondary = 2:1 for 110 V 1A 1

10. Diagram for set-up:



1A

1A
1A

Connect the long wire to the galvanometer./Connect the apparatus as shown.
Put/Place/Move the wire across the magnetic field between the pair of magnets.

Relative movement: Move the wire vertically down across the field and then up across the field, the (light-spot of the) galvanometer would deflect to one side and then to the opposite side.

Polarities of magnet: Move the wire vertically down across the field, the (light-spot of the) galvanometer would deflect to one side and then reverse the polarities of the magnet to repeat the experiment, the galvanometer would deflect to the opposite side.

Direction of movement: Move the wire vertically up/down across the field, the (light-spot of the) galvanometer would have large deflection. No deflection when the wire is moved horizontally to the left/right in the field instead.

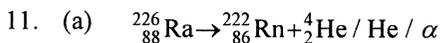
Orientation of conductor: With the wire perpendicular to the magnetic field, move it vertically up/down across the field, the (light-spot of the) galvanometer would have large deflection. No deflection when the wire is placed parallel to the field instead.

Rate of movement: Move the wire slowly across the field and then quickly across the field, the (light-spot of the) galvanometer would deflect more for a quicker movement or a faster rate.

No. of turns: Wind the wire into, say, a 10-turn coil and move it again across the field, the (light-spot of the) galvanometer would deflect more for more turns of wire.

ANY
TWO
@2A

7



2A 2

(b) $\Delta m = 226.0254 - (222.0176 + 4.0026) = 0.0052 \text{ u}$

1M

Energy released = $(0.0052)(931) = 4.84 \text{ (MeV)}$

1A 2

(c) Number of radium atoms in the source

$$N = N_A \left(\frac{1}{226} \right) \times (5 \times 10^{-6}) = (6.02 \times 10^{23}) \frac{1}{226} \times (5 \times 10^{-6}) = 1.33 \times 10^{16}$$

1A

$$\text{Activity } A = \frac{\ln 2}{t_{1/2}} \cdot N$$

1M

$$= \frac{\ln 2}{1600 \times 365 \times 24 \times 3600} \cdot 1.33 \times 10^{16}$$

$$= 1.83 \times 10^5 \text{ (disintegrations per second, Bq)}$$

1A 3