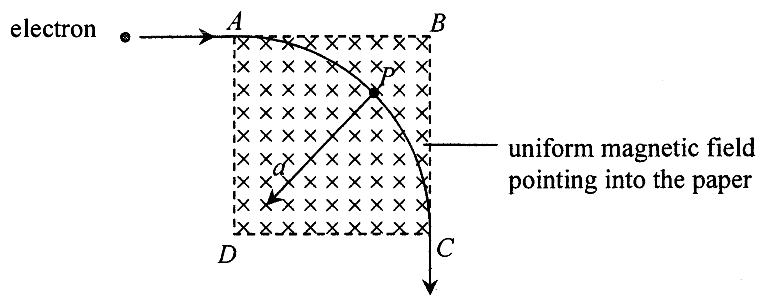
Paper 1 Section A

Question No.	Key	Question No.	Key
1.	B (54)	26.	C (42)
2.	B (49)	27.	C (59)
3.	C (53)	28.	C (42)
4.	D (48)	29.	D (42)
5.	A (44)	30.	B (40)
6.	D (56)	31.	A (43)
7.	A (25)	32.	C (46)
8.	D (41)	33.	B (49)
9.	D (64)	34.	A (76)
10.	D (61)	35.	B (56)
11.	B (48)	36.	B (63)
12.	A (52)		
13.	D (35)		
14.	A (82)		
15.	B (66)		
16.	B (71)		
17.	A (63)		
18.	D (52)		
19.	C (53)		
20.	C (64)		
21.	A (56)		
22.	C (40)		
23.	A (46)		
24.	D (53)		
25.	C (58)		

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

Paper 1 Section B

				Marks	
1.	(a)		$(1.5 \times 1000 \text{ kg}) \times 4200 \text{ J kg}^{-1} \text{°C}^{-1} \times (80 - 60) \text{°C} \times (1 - 15\%)$ $= 1.07 \times 10^8$ J	1M+1M 1A	3
	(b)		$1.07 \times 10^8 \text{ J} \div (4.5 \text{ kW}) \div 3600 \text{ s}$ = 6.61 (hours)	1M 1A	2
	(c)		Rate of heat transfer drops as the water temperature drops / the room temperature increases / temperature difference drops.	1A	1
2.	(a)		Stop heating and stir the water well.	1A 1A	2
	(b)	(i)	$\frac{L-64}{80-64} = \frac{65-20}{92-20}$ $L - 64 = 10$ $L = 74$ mm	1M 1A	2
		(ii)	Let x °C be the absolute zero. $\frac{20-x}{92-20} = \frac{64-0}{80-64}$ $20 - x = 288$ $x = -268$ °C	1M 1A	2
3.	(a)	(i)	$P = F v$ $= 8000 \text{ N} \times 2 \text{ m s}^{-1}$ = 16 kW	1M 1A	2
		(ii)	$P_{loss} = 20 \text{ kW} - 16 \text{ kW} = 4 \text{ kW}$	1A	1
	(b)	(i)	$P = 4 \text{ kW} + (8000 - 7000 \text{ N}) \times 2 \text{ m s}^{-1}$ $= 6000 \text{ W} = 6 \text{ kW}$	1M 1A	2
		(ii)	Output power required from motor is smaller. Or Force exerted by motor is smaller.	1A	1
		(iii)	No, the lift system could not work / the lift will fall as slipping would occur / the cable cannot be fixed on the drum / the drum cannot exert a force on the cable.	1A 1A	2
4.	(a)	(i)	$F = qvB = (1.60 \times 10^{-19} \text{ C})(1.2 \times 10^7 \text{ m s}^{-1})(0.01 \text{ T})$ $= 1.92 \times 10^{-14}$ N	1M 1A	2
		(ii)		1A	1

Marks

4. (b) F is perpendicular to the electron's displacement / velocity, — 1A
<u>Or</u> electron only changes direction while speed remains unchanged,
no work is done, therefore k.e. remains unchanged. — 1A — 2

(c)
$$\left.\begin{aligned} F &= qvB = \frac{mv^2}{r} \\ \frac{v}{r} &= \frac{qB}{m} = \text{constant} \end{aligned}\right\}$$ — 1M

v should be halved, i.e. 0.6×10^7 m s^{-1} — 1A — 2

5. Stick the paper strip onto the horizontal part BC of the track. — 1A
Release the toy from a certain height h from the bench surface and measure the corresponding stopping distance d. — 1A
Stopping distance should be measured from the beginning of the horizontal part BC or on the paper strip.
Release the toy from different heights and measure the corresponding stopping distances. — 1A

Plot a graph of d against h, — 1A
a straight line passing through the origin should be obtained. — 1A
<u>or</u>

since $mgh = Fd$
so $\frac{d}{h}$ = constant / $d \propto h$

5

6. (a) (i) Accelerates at g before the elastic cord stretches / at the beginning. — 1A
Acceleration decreases as the cord stretches. — 1A
Decelerates until momentarily at rest — 1A
(after the tension in the cord is greater than mg). — 3

(ii) Gravitational potential energy changed to kinetic energy and — 1A
(then) elastic potential energy in elastic cord. — 1A — 2

(b) Elastic cord lengthens the stopping time, — 1A
hence reduces the (net) force acting on the player. — 1A — 2

(c) Contact area is larger, — 1A
hence pressure is smaller during the fall and the structure is less likely to break / detach. — 1A — 2

Marks

7. (a) $c = f\lambda \Rightarrow 3 \times 10^8 \text{ m s}^{-1} = f(0.02 \text{ m})$ — 1M

$\therefore \quad f = 1.5 \times 10^{10}$ Hz or 15000 MHz — 1A — 2

(b) (i) Path difference of the diffracted waves from slits *A* and *B* to probe varies along *XY*. — 1A

Constructive and destructive interference occur alternately to give maxima and minima. — 1A — 2

(ii) $BP - AP = 1\frac{1}{2}\lambda$ — 1M

$BP - AP = 3 \text{ cm} = 0.03 \text{ m}$

$\therefore BP = 1.24 + 0.03 = 1.27 \text{ m}$ — 1A — 2

(iii) Path difference along $XY < AB$ — 1M

$AB = 3 \times 2 \text{ cm} = 3\lambda$

$\therefore$ path difference allowed = 0λ, 1λ, 2λ.

Maximum number of maxima = 3 — 1A — 2

(c) Radio waves with lower frequencies (will have longer wavelengths and hence) have greater diffraction effect. — 1A

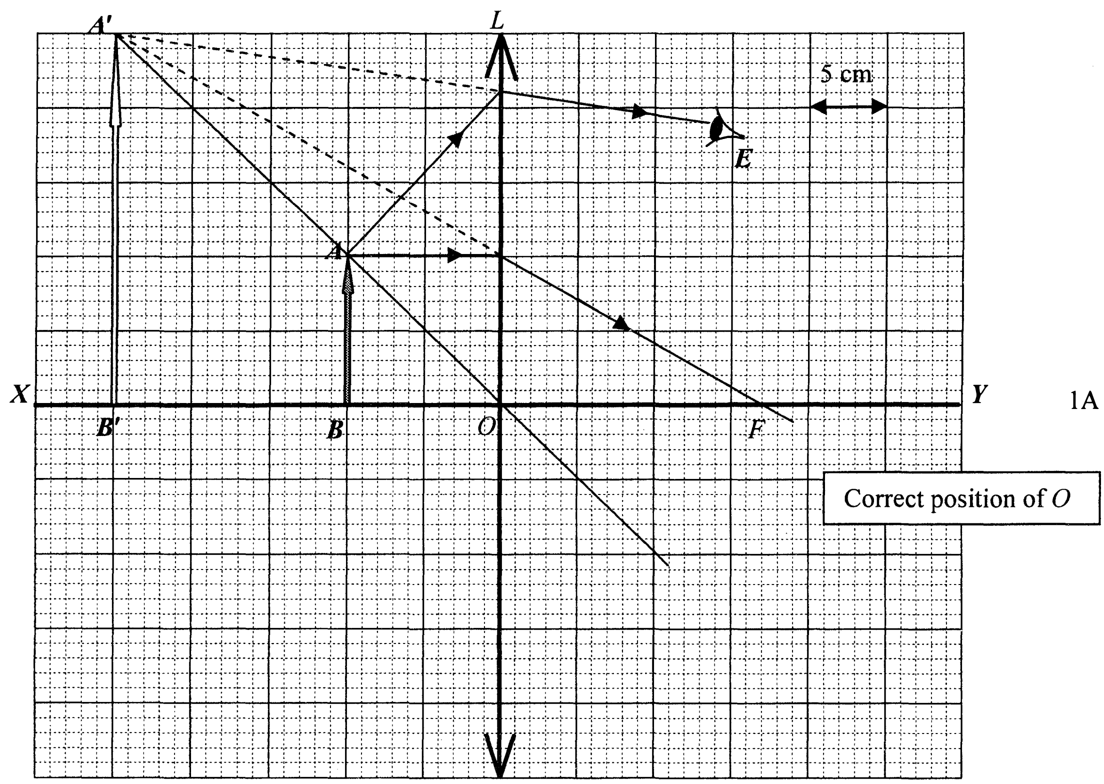
Radio waves by-pass small obstacles / not to be reflected from small obstacles. — 1A — 2

8. (a) (i) Virtual — 1A — 1

(ii) Convex. — 1A

Only convex lens can form magnified (virtual, erect) images. — 1A — 2

(b) (i)



1A — 1

(ii) Correct light ray to locate *F*. — 1M

Focal length *f* = 17 cm (16.0 to 17.5 cm) — 1A — 2

(c) Correct ray from *A'* or lens to *E*. — 1A

All correct. — 1A — 2

(d) Magnifying glass / glasses for long-sighted eyes / simple microscope — 1A — 1

Marks

9. (a) $k = \dfrac{\ln 2}{5730 \times 3.16 \times 10^7} = 3.83 \times 10^{-12}\,(\mathrm{s}^{-1})$ 1A

Activity $A = kN$

$N = \dfrac{A}{k} = \dfrac{0.2}{3.83 \times 10^{-12}}$ 1M

$= 5.22 \times 10^{10}$ 1A 3

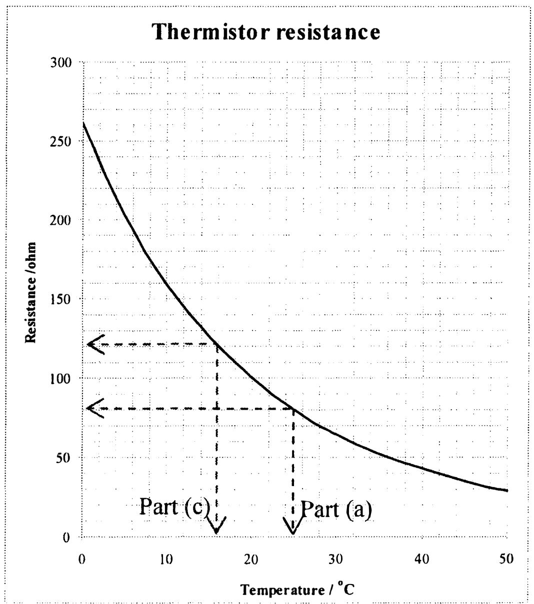
(b) No. of ^{14}C nuclei: $N_0 = 1 \times 10^{23} \times (1.3 \times 10^{-12}) = 1.3 \times 10^{11}$ 1A 1

(c) $kt = \ln \dfrac{N_0}{N}$

$(3.83 \times 10^{-12})\ t = \ln \dfrac{1.3 \times 10^{11}}{5.2 \times 10^{10}}$ 1M

$t = 2.4 \times 10^{11}$ s or 7571 (years) (accept 7500 to 7600 (years)) 1A 2

10. (a) (i) 80 Ω 1A 1



(ii) $V_{AB} = \dfrac{120}{(80+120)} 12$ 1M

$= 7.2$ V 1A 2

(b) As R_v and 120 Ω resistor are in parallel, R_{eq} across AB is smaller than 120 Ω, 1A
therefore voltage shared across AB is reduced / smaller than expected. 1A

Use a voltmeter with resistance much larger than the resistance in that part of the circuit. 1A
(e.g. 10 MΩ in some digital voltmeter) 3

(c) (i) $V_{AB} = \dfrac{120}{(R+120)} \times 12 = 6.0\,\mathrm{V}$

$R = 120\,\Omega$ 1A

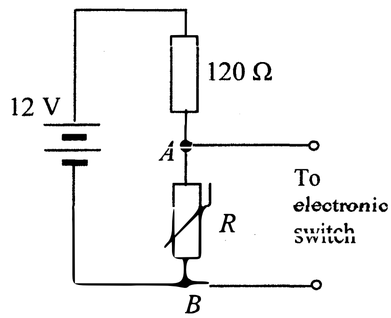
corresponds to temperature at 16°C. 1A 2

Marks

10. (c) (ii) Correct circuit (i.e. interchange thermistor R and 120 Ω resistor). 1A

As the temperature drops, the thermistor resistance increases. 1A

When the resistance increases to a value such that V_{AB} = 6.0 V or above, the electronic switch is on and it turns on the heating device. 1A 3



11. (a)

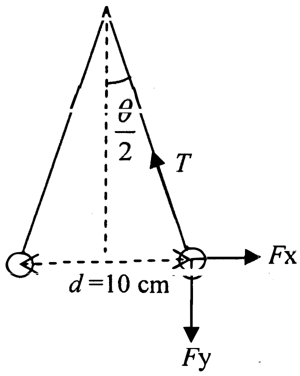
$$T\cos\frac{\theta}{2} = F_y = mg$$ 1M

$$T\sin\frac{\theta}{2} = F_x = \frac{Q^2}{4\pi\,\varepsilon_0\,d^2}$$ 1M

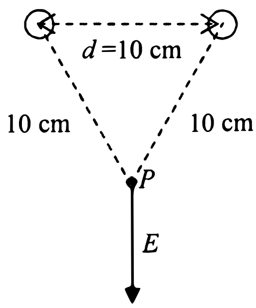
$$\tan\frac{\theta}{2} = \frac{Q^2}{4\pi\,\varepsilon_0\,d^2}\left(\frac{1}{mg}\right)$$

$$= 9\times10^9\times\frac{(3.1\times10^{-9})^2}{0.1^2}\times\frac{1}{(1.0\times10^{-5})(9.81)}$$

$$\frac{\theta}{2} = 5.0° \text{ i.e. } \theta = 10.1°$$ 1A 3



(b) (i)



1A 1

(ii) Potential at P $= \frac{Q}{4\pi\,\varepsilon_0\,d} + \frac{Q}{4\pi\,\varepsilon_0\,d} = \frac{2Q}{4\pi\,\varepsilon_0\,d}$ 1M

$$= (9\times10^9)\,\frac{2\times3.1\times10^{-9}}{0.1}$$

= 558 V 1A 2

(iii) Separation d decreases. 1A 1