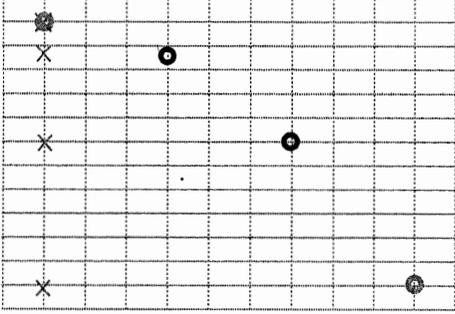


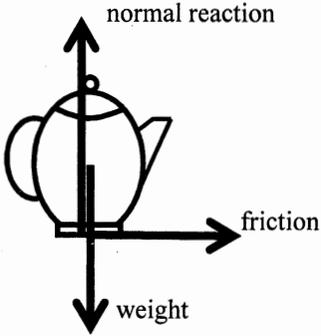
**Paper 1 Section A**

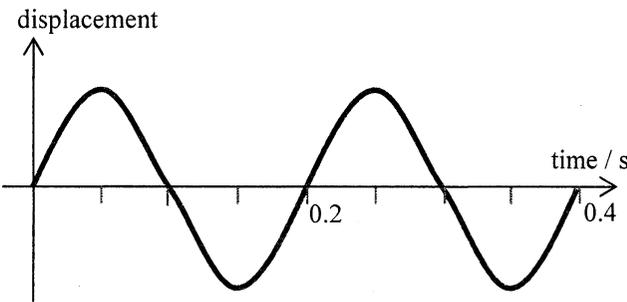
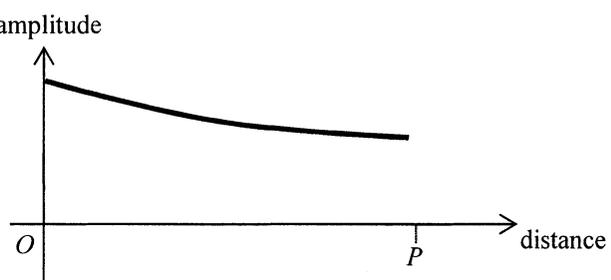
<b>Question No.</b>	<b>Key</b>	<b>Question No.</b>	<b>Key</b>
1.	D (86)	26.	A (46)
2.	C (88)	27.	B (73)
3.	A (68)	28.	C (46)
4.	D (72)	29.	A (68)
5.	A (70)	30.	D (54)
6.	A (67)	31.	A (57)
7.	C (93)	32.	C (64)
8.	B (75)	33.	B (69)
9.	B (68)		
10.	A (40)		
11.	B (57)		
12.	C (89)		
13.	C (59)		
14.	A (54)		
15.	D (61)		
16.	C (77)		
17.	B (42)		
18.	D (73)		
19.	D (51)		
20.	B (63)		
21.	C (66)		
22.	B (63)		
23.	D (55)		
24.	B (62)		
25.	D (70)		

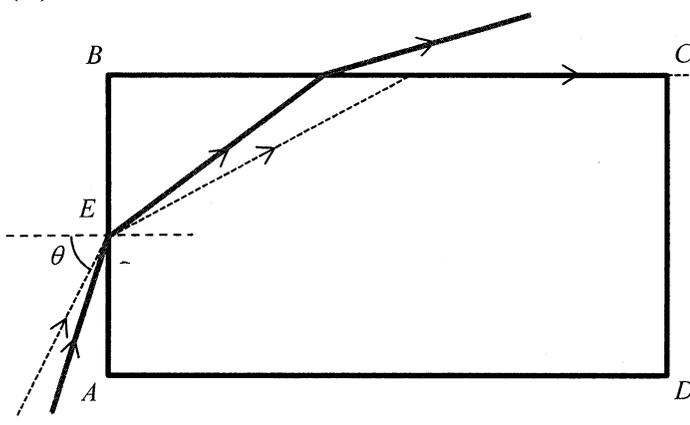
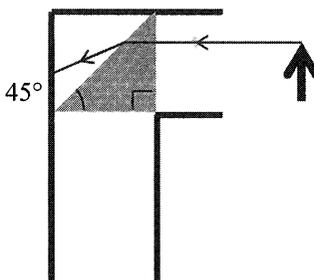
*Note: Figures in brackets indicate the percentages of candidates choosing the correct answers.*

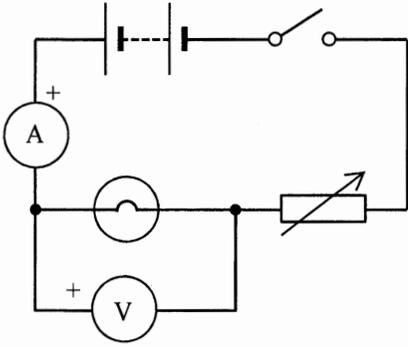
Solution	Marks	Remarks
1. (a) A larger bulb improves the sensitivity of the thermometer. <b>Or</b> A larger bulb minimizes the effect on the temperature reading due to the other parts of the thermometer stem that are exposed to different temperatures.	1A    1A	
	1	
(b) (i) $E = mc\Delta T$ $= 0.015 \times (2.9 \times 10^3) \times (20 - 15)$ $= 217.5 \text{ J}$	1M 1A  2	
(ii) Time taken to reach air temperature = $\frac{217.5}{0.5}$ $= 435 \text{ s}$	1M 1A  2	
(iii) The thermometer would be in direct contact with the cooler air and would cool down quickly. The temperature reading would be less than the actual soil temperature.	1A 1A  2	
2. Measure the mass of a bullet $m$ and the mass of the trolley with plasticine $M$ . Fire the bullet towards the plasticine. Read the speed of the trolley $v$ immediately after the bullet hit the plasticine.  The speed of the bullet $u$ is given by $u = \frac{M + m}{m} v$ .  Precaution: - The bullet should be fired close to the plasticine. - The bullet should be fired along the direction of travel of the trolley. - The track must be horizontal / friction compensated.	1A 1A 1A  1A  1A 1A 1A  5	

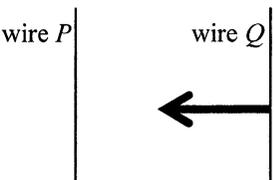
Solution	Marks	Remarks
3. (a) $\frac{(c_{rms})_f}{c_{rms}} = \sqrt{\frac{T_f}{T}}$ $\frac{c_{r.m.s. \text{ at } 350\text{K}}}{c_{r.m.s. \text{ at } 300\text{K}}} = \sqrt{\frac{350}{300}}$ $= 1.08$  (b) The speed of the gas molecules increases. They collide more frequently and violently with the wall of the container. Thus, the pressure increases.	1M  1A  2  1A+1A  2	
4. (a) (i) By $s = ut + \frac{1}{2}gt^2$ $0.11 = \frac{1}{2}g(0.05 \times 3)^2$ $g = 9.78 \text{ m s}^{-2}$	1M 1A 2	
(ii) (1) 	1A 1A 2	Correct horizontal positions Correct vertical positions
(2) $v_x = 1 \text{ m s}^{-1}$ $v_y = u_y + gt$ $= 0 + 9.78 \times (0.05 \times 3)$ $= 1.47 \text{ m s}^{-1}$ $v = \sqrt{v_x^2 + v_y^2}$ $= \sqrt{1^2 + 1.47^2}$ $= 1.78 \text{ m s}^{-1}$	1M  1M 1A 3	
(b) The air resistance acting on the ball increases as its speed increases. When the air resistance equals to the weight of the ball, net force acting on the ball becomes zero, by Newton's first law of motion, the ball travels with constant speed.	1A 1A 1A	
<div style="border: 1px solid black; padding: 5px;"> <b>Or</b>            net force acting on the ball becomes zero, by Newton's second law of motion, the ball will not accelerate further and travels with constant speed.         </div>	1A 3	

Solution	Marks	Remarks
5. (a) <div style="text-align: center;">  </div>	1A+1A	
	2	
(b) $\omega = \pi \text{ s}^{-1}$ $F = mr\omega^2$ $= (1)(0.3)(\pi)^2$ $= 2.96 \text{ N (towards the centre of the turntable)}$ <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <i>Alternative method:</i>  <math display="block">v = 0.3\pi \text{ m s}^{-1}</math> <math display="block">F = m \frac{v^2}{r}</math> <math display="block">= 2.96 \text{ N}</math> </div>	1A 1M 1A 1A 1M 1A	
	3	
(c) The initial linear speed of the teapot $= r\omega = 0.3\pi \text{ m s}^{-1}$ Deceleration of the teapot $a = \frac{f}{m} = \frac{10}{1} = 10 \text{ m s}^{-2}$ Distance travelled $s$ is given by $v^2 - u^2 = 2as$ $s = \frac{u^2}{2a} = \frac{(0.3\pi)^2}{2(10)}$ $= 0.044 \text{ m (or 4.4 cm)}$	1M 1M 1A	
<div style="border: 1px solid black; padding: 5px;"> <i>Alternative method:</i>            The initial linear speed of the teapot <math>= r\omega = 0.3\pi \text{ m s}^{-1}</math>            K.E. of the teapot is dissipated as work done against friction  <math display="block">\frac{1}{2} mu^2 = fd</math> <math display="block">d = \frac{mu^2}{2f} = \frac{(1)(0.3\pi)^2}{2(10)}</math> <math display="block">= 0.044 \text{ m}</math> </div>	1M 1M 1A	
	3	

Solution		Marks	Remarks
6. (a)	(i) $v = f\lambda$ $= 5 \times 4$ $= 20 \text{ cm s}^{-1}$	1M 1A	
		2	
	(ii) $Y$ is moving upwards at $t = 0$ .	1A	
		1	
	(iii)		
		1A 1M	
		2	
	(b) (i) The water waves from $A$ and $B$ are in anti-phase at $Q$ .	1M	
	<b>Or</b> The path difference at $Q = (n + 1/2)\lambda$ .	1M	
	Destructive interference occurs to form a minimum.	1A	
	2		
(ii) Path difference at $Q = 1.5\lambda = 3 \text{ cm}$ $\lambda = 2 \text{ cm}$	1M 1A		
	2		
(iii)			
	1A		
	1		

Solution	Marks	Remarks
7. (a) (i) At the critical angle $c$ , $\frac{\sin 90^\circ}{\sin c} = n$ $\frac{1}{\sin c} = 1.36$ $c = 47.3^\circ$	1M 1A 2	
(ii) Angle of refraction at $E = 90^\circ - 47.33^\circ = 42.67^\circ$ By Snell's law $\frac{\sin \theta}{\sin 42.67^\circ} = 1.36$ $\theta = 67.2^\circ$	1M 1M 1A 3	
(iii) 	2A 2	
(b) (i)   The angle of incidence of the light ray from the object is $(45^\circ, \text{ which is less than the critical angle of the plastic prism. Total internal reflection will not occur and the image may not be clear enough for observation.}$	1A 1A 1A 3	
(ii) Glass prism (with critical angle less than $45^\circ$ ) <b>Or</b> Plane mirror	1A 1A 1	

Solution	Marks	Remarks
8. (a) 	1A 1A 1A 3	Correct symbols of light bulb, variable resistor and voltmeter Correct positions Correct positive terminal connection for the voltmeter
(b) As the voltage across the light bulb increases, the temperature of the light bulb increases, thus its resistance increases.	1A 1A 2	
(c) $R = \frac{V}{I}$ is the definition of resistance. It is applicable to all conductors.	1A 1	
(d) At $V = 0.1 \text{ V}$ $R = \frac{V}{I} = \frac{0.1}{76 \times 10^{-3}} = 1.32 \Omega$  At $V = 2.5 \text{ V}$ $R = \frac{V}{I} = \frac{2.5}{250 \times 10^{-3}} = 10 \Omega$	1A 1A 3	for reading correct values (ignore the order of magnitude) from the graph
(e) $R = \rho \frac{l}{A}$ $l = \frac{RA}{\rho} = \frac{1.32 \times (1.66 \times 10^{-9})}{5.6 \times 10^{-8}} = 0.039 \text{ m}$	1M+1M 1A 3	

Solution		Marks	Remarks	
9.	(a) (i)	The magnetic field at $Q$ due to $P$ points out of the paper.	1A	
			1	
	(ii)		1A	
			1	
	(iii)	The magnetic field at $Q$ due to $P$ is	1M	
		$B_Q = \frac{\mu_0 I_P}{2\pi r}$		
		For a certain length segment $l$ of wire, the magnetic force is	1M	
		$F = B_Q I_Q l \sin \theta$ $= \frac{\mu_0 I_P}{2\pi r} I_Q l$		
		The magnetic force per unit length is	1M	
		$F_l = \frac{F}{l} = \frac{\mu_0 I_P I_Q}{2\pi r}$		
		3		
(iv)	The two forces form an action and reaction pair, thus they are equal in magnitude.	1A 1A		
		2		
(b) (i)	As current passes in the same direction between neighbouring wire segments, the wire segments attract each other, and the solenoid is compressed.	1A 1A		
		2		
(ii)	Current keeps on flowing in the same direction between neighbouring wire segments at each instant, thus the solenoid will be compressed due to magnetic force.	1A		
		1		

Solution	Marks	Remarks
10. (a) ${}_{84}^{210}\text{Po} \rightarrow {}_{82}^{206}\text{Pb} + {}_2^4\text{He}$	2A 2	
(b) The $\alpha$ -particles ionize the air particles. The ions neutralize the charges on the dust/photo or film surface.	1A 1A 2	
(c) This is because $\alpha$ -particles have a range of only a few centimeters in air.	1A 1	
(d) Activity after 1 year = $\left(\frac{1}{2}\right)^{\frac{365}{138}}$ = 0.160 unit	1M 1A	
<div style="border: 1px solid black; padding: 5px;"> <p><i>Alternative method:</i></p> <math display="block">A = A_0 e^{-\frac{\ln 2}{t_{1/2}} t}</math> <math display="block">= 1 \times e^{-\frac{\ln 2}{138}(365)}</math> <math display="block">= 0.160 \text{ unit}</math> </div>	1M 1A	
	2	