2009 Physics

Intermediate 2

Finalised Marking Instructions

The current in a resistor is 1·5 amperes when the potential difference across it is 7·5 volts. Calculate the resistance of the resistor.

	Answers	**Mark + Comment**	**Issue**
1.	$V = IR$ $7{\cdot}5 = 1{\cdot}5R$ $R = 5{\cdot}0\ \Omega$	(½) (½) (1)	Ideal answer
2.	$5{\cdot}0\ \Omega$	(2) Correct answer	GMI 1
3.	5·0	(1½) Unit missing	GMI 2 (a)
4.	$4{\cdot}0\ \Omega$	(0) No evidence/wrong answer	GMI 1
5.	_____ Ω	(0) No final answer	GMI 1
6.	$R = \frac{V}{I} = \frac{7{\cdot}5}{1{\cdot}5} = 4{\cdot}0\ \Omega$	(1½) Arithmetic error	GMI 7
7.	$R = \frac{V}{I} = 4{\cdot}0\ \Omega$	(½) Formula only	GMI 4 and 1
8.	$R = \frac{V}{I} =$ _____Ω	(½) Formula only	GMI 4 and 1
9.	$R = \frac{V}{I} = \frac{7{\cdot}5}{1{\cdot}5} =$ _____Ω	(1) Formula + subs/No final answer	GMI 4 and 1
10.	$R = \frac{V}{I} = \frac{7{\cdot}5}{1{\cdot}5} = 4{\cdot}0$	(1) Formula + substitution	GMI 2 (a) and 7
11.	$R = \frac{V}{I} = \frac{1{\cdot}5}{7{\cdot}5} = 5{\cdot}0\ \Omega$	(½) Formula but wrong substitution	GMI 5
12.	$R = \frac{V}{I} = \frac{75}{1{\cdot}5} = 5{\cdot}0\ \Omega$	(½) Formula but wrong substitution	GMI 5
13.	$R = \frac{I}{V} = \frac{7{\cdot}5}{1{\cdot}5} = 5{\cdot}0\ \Omega$	(0) Wrong formula	GMI 5
14.	$V = IR \quad 7{\cdot}5 = 1{\cdot}5 \times R \quad R = 0{\cdot}2\ \Omega$	(1½) Arithmetic error	GMI 7
15.	$V = IR$ $R = \frac{I}{V} = \frac{1{\cdot}5}{7{\cdot}5} = 0{\cdot}2\ \Omega$	(½) Formula only	GMI 20

2009 Physics Intermediate 2

Marking scheme

Section A

1.	C	11.	B
2.	C	12.	D
3.	E	13.	A
4.	A	14.	D
5.	B	15.	C
6.	B	16.	E
7.	D	17.	E
8.	E	18.	A
9.	B	19.	D
10.	E	20.	C

2009 Physics Intermediate 2

Sample Answer and Mark Allocation	Notes	Marks
21. (a) $E_p = mgh$ (½) $= 2000 \times 10 \times 540$ (½) $= 10800000$ J ($1{\cdot}08 \times 10^7$ J) (1)	If 9·8 used: E_p = 10584000 (accept) = $1{\cdot}06 \times 10^7$ J $E_p = E_{ptop} - E_{pbottom}$ $= 2000 \times 10 \times 540 - 2000 \times 10 \times 0$ = 10800000 – 20000 (-½ for arith) = 10780000 J [1×10^7, $1{\cdot}1 \times 10^7$ V]	2
(b) $E_k = \frac{1}{2}mv^2$ (½) $64000 = 0{\cdot}5 \times 2000 \times v^2$ (½) $v^2 = 64$ $v = 8$ m/s (1)	v = $\sqrt{2gh} = 0$ mps is incorrect unit	2
(c) (i) $P = IV$ (½) $45600 = I \times 380$ (½) $I = 120$ A (1) (Amps) (Amperes)	(-½) for incorrect power conversion	2
(ii) $E = Pt$ (½) $= 45600 \times 60 \times 60$ (½) $= 1{\cdot}64 \times 10^8$ J (1) (sig fig range $1{\cdot}6 \times 10^8$, $1{\cdot}64 \times 10^8$, $1{\cdot}642 \times 10^8$, $1{\cdot}6416 \times 10^8$)	(-½) for incorrect time conversion and/or (-½) for incorrect power conversion	2
		Total 8

Sample Answer and Mark Allocation	Notes	Marks
22. (a) $a = \frac{(v-u)}{t}$ **OR** $a = \frac{\Delta v}{t}$ (½) $a = \frac{(3-0)}{5}$ (½) $a = 0{\cdot}6\ \text{m/s}^2$ (1)	m/s^{-2} mp/s^2 m/s/s } (-½)	2
(b) $F = ma$ (½) $F = 40 \times 0{\cdot}6$ (½) $= 24$ N (1)		2
(c) There is an unbalanced force/friction, (1) this acts against the motion. (1) (must have some mention of opposing the motion) Ignore mention of component of weight		2
		Total 6

Sample Answer and Mark Allocation	Notes	Marks
23. (a) width/length of card (d) (½) time taken for <u>card to cut beam</u> (t) (½) $v = \frac{d}{t}$ or $\overline{v} = \frac{d}{t}$ (1) or with correct measurements $v = \frac{\text{length of card}}{\text{time taken card to cut beam}}$ (this equation on its own = 2)	} must <u>define 'd' and 't'</u> to get 2nd mark $v = \frac{d}{t}$ on its own = 0 marks	2
(b) (i) $p = mv$ (½) $= (5 \times 10^{-4} + 0{\cdot}3) \times 0{\cdot}35$ (½) $= 0{\cdot}105$ kg m/s	this line on its own = 1 mark must have 2nd line	1
(ii) $v = \frac{p}{m}$ $= \frac{0{\cdot}105}{5 \times 10^{-4}}$ (½) $= 210$ m/s (½)	if they use 0·105175 from mom calculation they get 210·35 = (-½) for sig figs 210·4 = ✓	1

Sample Answer and Mark Allocation	Notes	Marks
(c) (i) $a = \frac{(v-u)}{t}$ (½) $10 = \frac{(v-0)}{0\cdot2}$ (½) $v = 2$ m/s (1) (ii) $d = \bar{v}t$ (½) $= 1 \times 0\cdot2$ (½) $= 0\cdot2$ m (1)	Δ v = 2 m/s ✓ v = 1·96 if using 9·8 or 1·962 if using 9·81 if they use a graph: area under graph/or ½bh = (½) ½ (0·2 × 2) = 0·2 m (½) (1)	2 2
		Total 8

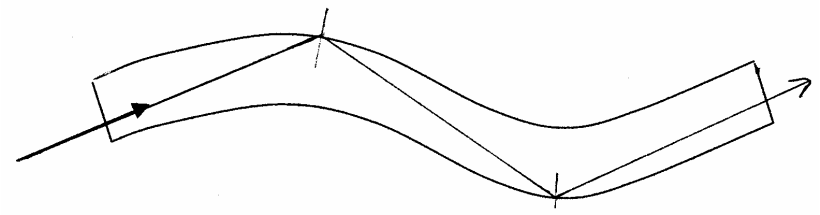
Sample Answer and Mark Allocation	Notes	Marks
24. (a) E_h = $cm\Delta T$ (½) = $4180 \times 0{\cdot}1 \times 15$ (½) = 6270 J (1)	If 4180 not used then (½) max for formula ignore negative energy	2
(b) E_h = ml (½) = $0{\cdot}1 \times 3{\cdot}34 \times 10^5$ (½) = $3{\cdot}34 \times 10^4$ J (1)	If $3{\cdot}34 \times 10^5$ not used then (½) max for formula	2
(c) (i) 33400 + 6270 = 39670 J (1)	must be consistent with (a) and (b)	
$E = Pt$ (½) $39670 = 125 \times t$ (½) t = 317·(36) s (1)	must have added (a) and (b). If not max (½) for formula (no secs)	3
(ii) Heat energy will be gained from surroundings/other food etc (1) More energy must be removed (1)		2
		Total 9

Sample Answer and Mark Allocation	Notes	Marks
25. (a) (i) I = 0·075 A (1)		
$V = IR$ (½) $4{\cdot}2 = 0{\cdot}075 \times R$ (½) $R = 56\ \Omega$ (1)		3
(ii) stays the same (1) $\frac{1{\cdot}3}{0{\cdot}023} = 56{\cdot}5 \quad \frac{3{\cdot}6}{0{\cdot}064} = 56{\cdot}25$ (1) **or** as the voltage increases the current increases by the same ratio **or** because it's a straight line <u>through the origin</u>	incorrect conclusion = 0 marks must have an attempt at justification 1 correct calculation enough for 1 mark (Not enough to say voltage increases at the current increases)	2
(b) (i) $R_t = R_1 + R_2$ (½) $= 270 + 390$ (½) $= 660\ \Omega$ (1)	must have calculation for both (i) and (ii) no calculations = 0	2
(ii) $\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2}$ (½) $= \frac{1}{33} + \frac{1}{56}$ (½) $= 0{\cdot}048$ $R_t = 20{\cdot}76\ \Omega$ (1) (sig fig range 20 Ω, 21 Ω, 20·8 Ω, 20·76 Ω)	(-½) for 0·048 = 20·76 Ω	2
		Total 9

Sample Answer and Mark Allocation	Notes	Marks
26. (a) $\frac{I_p}{I_s} = \frac{V_s}{V_p}$ (½) $\frac{I_p}{1} = \frac{5}{230}$ (½) $I_p = 0{\cdot}022$ A (1) (0·02, 0·0217 accept)		2
(b) (i) $P = \frac{V^2}{R}$ (½) $10 = \frac{9^2}{R}$ (½) $R = 8{\cdot}1\ \Omega$ (1)	9 not squared = (½) max formula P = VI V = IR both (½) 10 = 9 × I 9 = 1·11 × R sub (½) I = 1·11 A R = 8·1 Ω (1)	2
(ii) $V_g = \frac{V_o}{V_i}$ (½) $= \frac{9}{1{\cdot}5}$ (½) = 6 (1)	NB no unit!	2

Sample Answer and Mark Allocation	Notes	Marks
(c) $Eff\% = \frac{P_o}{P_i} \times 100$ (½) $= \frac{20}{25} \times 100$ (½) $= 80\%$ (1) or $Eff = \frac{P_o}{P_i}$ (½) $= \frac{20}{25}$ (½) $= 0{\cdot}08$ (% sign = (-½) (1)	if energy equation for efficiency used = 0	2
		Total 8

Sample Answer and Mark Allocation	Notes	Marks
27. (a) (i) short sight = the image is in focus before the retina or cannot see distant objects clearly (1)		1
(ii) concave or diverging (1)		1
(iii) $P = \frac{1}{f}$ (½) $= (-)\frac{1}{0 \cdot 18}$ (½) $=$ (-) 5·6 D (1) (6, 5·56, 5·556, 5·5556 acceptable)	no conversion to 'm' = (-½)	2
(b) (i) refraction = the change in the speed or wavelength of light as it passes between two media (of different densities) (or similar) or (change in direction) because of change in speed between two media (1)	not changing direction/not bending	1
(ii) $v = f\lambda$ (½) $3 \times 10^8 = f \times 7 \times 10^{-7}$ (½) $f = 4 \cdot 29 \times 10^{14}$ Hz $f = 4 \times 10^{14}$ Hz (1) (4·3, 4·29 acceptable)		2

Sample Answer and Mark Allocation	Notes	Marks
(c) (i)  Ray must obey the law of reflection (1) Appropriate number of reflections (1) (ii) (total internal) reflection (TIR) (1)	line not straight (-1) PJ	2 1
		Total 10

Sample Answer and Mark Allocation	Notes	Marks
28. (a) $v = \frac{d}{t}$ (½) $340 = \frac{d}{2\times10^{-3}}$ (½) d = 0·68 m (1) $\therefore d$ = 0·34 m one way (1)	only 340 acceptable	3
(b) $(f = \frac{1}{T})$ (½) $f = \frac{1}{0\cdot125}$ (½) f = 8 Hz (1)	non-standard symbols acceptable	2
(c) I = 200 mA (1) $P = IV$ (½) $= 200 \times 10^{-3} \times 12$ (½) = 2·4 W (1)	if use anything other than 200 then max (½) for formula if both 20 and 200 mA are used in separate calculations, the maximum power must be clearly indicated. If not – max (½) for formula	3
(d) (i) (the resistor) stops too large a current (flowing through the LED) or too large a voltage across the LED (1)	no blowing of LED protects the LED – must be qualified	1
(ii) V = 12 - 3·5 = 8·5 (V) (1) $V = IR$ (½) $8\cdot5 = 200 \times 10^{-3} \times R$ (½) R = 42·5 Ω (1)	must attempt subtraction if 12 or 3·5 used – max (½) for formula	3
		Total 12

Sample Answer and Mark Allocation	Notes	Marks
29. (a) (i) <u>equipment</u>: source, paper and suitable radiation detector and counter (geiger counter ✓) (spark counter) (1) <u>measurements</u>: count rate with paper count rate without paper (1) (no paper but range very short (few cms) acceptable) <u>explanation</u>: (conditional on previous equipment and measurements) count rate with paper decreased indicating α (1) (falls to zero = 0) (ii) Cover the front window with (3mm/few mm ✓) of aluminium to stop beta. (1)		3 1

Sample Answer and Mark Allocation	Notes	Marks
(b) Time = 112 years (1)	(½) for halving attempt at activity (½) for halving 4 times	2
(c) (i) $H = Dw_R$ (½) $= 20 \times 10^{-6} \times 20$ (½) $= 400\ \mu S_v$ (1) or 400×10^{-6} Sv (ii) increase distance (eg use tongs) shielding (lead apron/gloves) (any two (1) each) (2)	H = D × Q acceptable PJ only 1 shielding protective clothing – too vague = 0 lead suit = ✓	2 2
		Total 10

Time	Activity
0	1
28	$\frac{1}{2}$
56	$\frac{1}{4}$
84	$\frac{1}{8}$
112	$\frac{1}{16}$

[END OF MARKING INSTRUCTIONS]