SCOTTISH QUALIFICATIONS AUTHORITY

2006 Physics

Intermediate 2

Finalised Marking Instructions

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Physics – Marking Issues

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

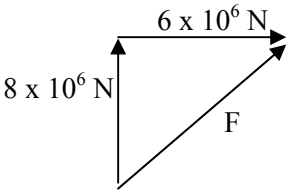
2006 Physics Intermediate 2

Marking scheme

Section A

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

2006 Physics Intermediate 2		
Sample Answer and Mark Allocation	**Notes**	**Marks**
21. (a) $E_P = m\ g\ h$ (½) $= 90 \times 10 \times 3$ (½) $= 2\,700$ J (1)		2
(b) $E_K = ½\ m\ v^2$ (½) $= ½ \times 90 \times 8^2$ (½) $= 2\,880$ J (1)		2
(c) Extra energy has been supplied (1) by (the work done) pedalling (1)		2
(d) (i) decreases (1)		1
(ii) friction <u>increases</u> OR fatigue OR less force by cyclist (1)		1
		Total 8

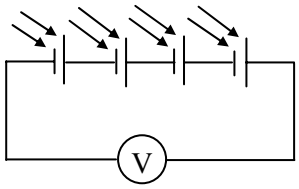
Sample Answer and Mark Allocation	Notes	Marks
22. (a) $F^2 = (8\times10^6)^2 + (6\times10^6)^2$ (½) $F = \sqrt{(1\cdot0\times10^{14})}$ (½) $= 1\cdot0 \times 10^7$ N (1) OR by scale diagram diagram (1) all vectors accurate to the same scale (½) evidence of measurement of resultant and scaling to answer (½)  		2
(b) $F = m\,a$ (½) $1\cdot0 \times 10^7 = 7\cdot5 \times 10^8 \times a$ (½) $a = 0\cdot013$ m/s^2 (1) (*range of significant figures is from* 0·01 *to* 0·01333)		2
(c) (i) $f = \frac{1}{16} = 0\cdot0625$ Hz (1) - (ii) $v = f\lambda$ (½) $12\cdot5 = 0\cdot0625 \times \lambda$ (½) $\lambda = 200$ m (1)	½ unit deduction	1 2
		Total 7

Sample Answer and Mark Allocation	Notes	Marks
23. (a) momentum = m v (½) = 110 × 4·8 (½) = 528 kg m/s (1)		2
(b) momentum before = momentum after (½) 60 x v = 528 (½) v = 8·8 m/s (1)		2
(c) (i) d = v t (½) = 4·8 × 0·65 (½) = 3·12 m (1)		2
(ii) $a = \frac{v - u}{t}$ (½) $10 = \frac{v - 0}{0 \cdot 65}$ (½) v = 6·5 m/s (1)		2
		Total 8

Sample Answer and Mark Allocation	Notes	Marks
24. (a) E_H = c m ΔT (½) = 4180 × 15 × 6 (½) = 376200 J (1)		2
(b) E_H = c m ΔT (½) 376200 = 480 × 0·75 × ΔT (½) ΔT = 1045 (ºC) (½) - initial temperature of iron: = 1045 + 23 (½) = 1068 ºC (1)		3
(c) all heat energy retained within system OR no heat lost to surroundings (1) OR no steam created		1
(d) greater (1) value of c less (½) Less heat required per degree temperature rise OR greater temperature rise for same energy input (½) Note: first mark only available if explanation attempted		2
		Total 8

Sample Answer and Mark Allocation	Notes	Marks
25. (a) $\frac{N_P}{N_S} = \frac{V_P}{V_S}$ (½) $\frac{N_P}{400} = \frac{25000}{2000}$ (½) $N_P = 5000$ (1)		2
(b) $P = I\,V$ (½) $7{\cdot}0 \times 10^6 = I \times 2000$ (½) $I = 3500$ A (1)		2
(c) $E_W = P\,t$ (½) $= 7{\cdot}0 \times 10^6 \times 15$ (½) $= 1{\cdot}05 \times 10^8$ (J) - $E_W = F\,d$ (½) $1{\cdot}05 \times 10^8 = F \times 540$ (½) $F = 1{\cdot}94 \times 10^5$ N (1) OR $d = v\,t$ (½) $540 = v \times 15$ (½) $v = 36$ (m/s) $P = F\,v$ (½) $7 \times 10^6 = F \times 36$ (½) $F = 1{\cdot}94 \times 10^5$ N (1) (*range of significant figures for either method is from* 2 *to* $1{\cdot}944 \times 10^5$)		3
		Total 7

Sample Answer and Mark Allocation			Notes	Marks
26.	(a)	in d.c. electrons/charges move in one direction only (1) in a.c. direction of movement of electrons/ charges continually (½) reverses (½)		2
	(b)	(i) 10 V (1) (ii) 6 V (1) (iii) 4 V (1) Note: ½ unit deduction in each case		1 1 1
	(c)	less (1)		1
	(d)	Q (only) (1)		1
	(e)	P and Q (only) (1)		1
				Total 8

Sample Answer and Mark Allocation	Notes	Marks
27. (a) 225 (units) (1) accept range 220-230		1
(b) so that meter measures the same brightness as the solar cell receives (1)		1
(c)  four cells in series voltmeter across them (1)		1
(d) (i) (NPN) transistor (1) (ii) (increasing brightness), solar cell voltage increases (1) when voltage reaches 0·7 V OR when light meter reading reaches 225 (units) (1) transistor switches on (1)		1 3
		Total 7

Sample Answer and Mark Allocation				Notes	Marks
28.	(a)	(i)	600 mm (½ unit deduction) (1) (ii) doubled OR larger OR magnified (1) (iii) inverted OR upside down OR opposite way up (1)		1 1 1
	(b)		brought closer to <u>lens</u> OR moved leftwards (1)		1
	(c)		$P = \frac{1}{f}$ (½) $= \frac{1}{0 \cdot 2}$ (½) $= (+)5$ D (1)		2
	(d)		(lens-film distance) increased (1) OR lens moved away from film		1
					Total 7

Sample Answer and Mark Allocation					Notes	Marks
29.	(a)	(i)	35º (½ unit deduction)	(1)		1
		(ii)	same as candidate's answer to (i) provided angle is less than 90° (½ unit deduction)	(1)		1
	(b)	(i)	total internal reflection	(1)		1
		(ii)	any angle <u>less than</u> 45º	(1)		
			angle of incidence must be more than critical	(1)		2
	Note:		first mark only available if explanation attempted			**Total 5**

Sample Answer and Mark Allocation				Notes	Marks
30.	(a)	(i)	2 protons + 2 neutrons OR helium <u>nucleus</u> (1)		1
		(ii)	(1) electron (1)		1
	(b)	(i)	removal or addition of electron(s) from atom/molecule (1)		1
		(ii)	alpha (1) increased distance (½) fewer alphas reach grid OR more alphas absorbed (½)		2
	(c)		$Q = I\,t$ (½) $= 2{\cdot}9 \times 10^{-7} \times 60$ (½) $= 1{\cdot}74 \times 10^{-5}$ (C) (½) - for one spark: $Q = \frac{1{\cdot}74 \times 10^{-5}}{87}$ (½) $= 2{\cdot}0 \times 10^{-7}$ C (1)		3
					Total 8

<table>
<tr><th colspan="3">Sample Answer and Mark Allocation</th><th>Notes</th><th>Marks</th></tr>
<tr><td>31.</td><td>(a)</td><td>The time taken for the <u>activity</u> to halve (1)</td><td></td><td>1</td></tr>
<tr><td></td><td>(b)</td><td><table><tr><th>Time (days)</th><th>Activity (MBq)</th></tr><tr><td>0</td><td>56·0</td></tr><tr><td>8·1</td><td>28·0</td></tr><tr><td>16·2</td><td>14·0</td></tr><tr><td>24·3</td><td>7·0</td></tr><tr><td>32·4</td><td>3·5</td></tr><tr><td>40·5</td><td>1·75</td></tr></table>working (1)
answer: 40·5 days (1)</td><td></td><td>2</td></tr>
<tr><td></td><td>(c)</td><td>Iodine 135 (1)
activity remains high for hours (½)
returns to safer level by next day (½)</td><td></td><td>2</td></tr>
<tr><td></td><td>(d)</td><td>Iodine 127 (1)
not radioactive (1)</td><td></td><td>2</td></tr>
<tr><td colspan="3"></td><td></td><td>Total 7</td></tr>
</table>

[END OF MARKING INSTRUCTIONS]