SCOTTISH QUALIFICATIONS AUTHORITY

2005 Physics

Intermediate 2

Finalised Marking Instructions

These Marking Instructions have been prepared by Examination Teams for use by SQA Appointed Markers when marking External Course Assessments.

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

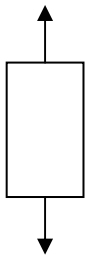
2005 Physics Intermediate 2

Marking scheme

Section A

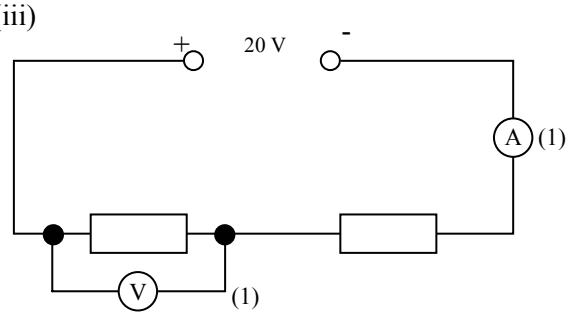
1.	E	11.	A
2.	D	12.	A
3.	C	13.	B
4.	C	14.	B
5.	E	15.	B
6.	B	16.	B
7.	D	17.	D
8.	A	18.	C
9.	C	19.	E
10.	C	20.	D

2005 Physics Intermediate 2		
Sample Answer and Mark Allocation	**Notes**	**Marks**
21. (a) $E_K = ½ m v^2$ (½) $= ½ \times 1{\cdot}5 \times 10^2$ (½) $= 75$ J (1)		2
(b) $E_W = Fd$ (½) $75 = F \times 1{\cdot}5$ (½) $F = 50$ N (1) Note: alternative answer for (b) $v^2 = u^2 + 2as$ $10^2 = 0 + 3a$ $a = 33{\cdot}3$ m/s^2 (1) $F = ma$ $F = 1{\cdot}5$ x $33{\cdot}3$ $F = 50$ N (1)		2
(c) momentum before collision = $1{\cdot}5 \times 2 = 3$ (½) momentum after collision = $(1{\cdot}5 \times 1{\cdot}2) + (0{\cdot}25v)$ (½) $3 = 1{\cdot}8 + 0{\cdot}25v$ $v = 4{\cdot}8$ m/s (1)		2
(d) measure <u>distance</u> (½) (from release to jack) with tape (½) measure <u>time</u> (½) (from release to jack) with stopwatch (½) calculate average speed using speed = distance/time (1)		3
		Total 9

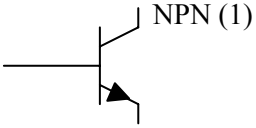
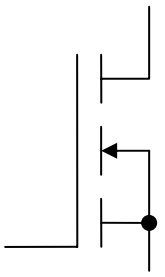
Sample Answer and Mark Allocation				Notes	Marks
22.	(a)	(i)	C or 60 s (1)		1
		(ii)	E or 110 s (1)		1
	(b)		air resistance OR air friction (1) weight OR gravity <u>force</u> (1)	<u>not</u> gravity	2
	(c)	W	= m g (½) = 90 × 10 (½) = 900 N (1)		
			force of friction = 900 N (1)		3
					Total 7

Sample Answer and Mark Allocation			Notes	Marks
23. (a)	(i)	$E_P = m\ g\ h$ (½) $= 8000 \times 10 \times 500$ (½) $= 40\ 000\ 000$ J (½) $= 40$ MJ (½)		2
	(ii)	40 MW (1) (Note: ½ unit deduction)		1
	(iii)	% eff. $= \frac{P_{out}}{P_{in}} \times 100$ (½) $80 = \frac{P_{out}}{40 \times 10^6} \times 100$ (½) $P_{out} = 32$ MW (1)		2
(b)		$I_p V_p = I_s V_s$ (½) $1280 \times 25\ 000 = I_s \times 400\ 000$ (½) $I_s = 80$ A (1)		2
				Total 7

Sample Answer and Mark Allocation	Notes	Marks
24. (a) E_H = c m ΔT (½) = 2100 × 0·6 × 36 (½) = 45360 J (1)		2
(b) E_H = 1 m (½) = 2·34 × 10^5 × 0·6 (½) = 140 400 J (1)		2
(c) (i) total E_H = 45 360 + 140 400 = 185 760 J (1) E = P t (½) 185 760 = 120 t (½) t = 1548 s (1) (ii) No heat (energy) enters the ice cream (1)		3 1
		Total 8

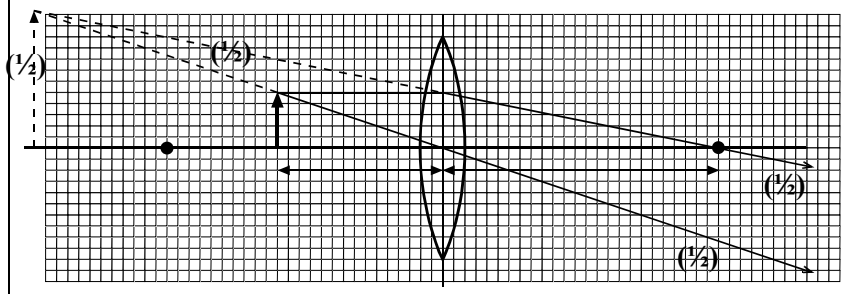
Sample Answer and Mark Allocation	Notes	Marks
25. (a) (i) $R_{tot} = 15 + 25 = 40\ \Omega$ (1) $V = I R$ (½) $20 = I \times 40$ (½) $I = 0{\cdot}5$ A (1)		3
(ii) $V = I R$ (½) $= 0{\cdot}5 \times 15$ (½) $= 7{\cdot}5$ V (1)		2
(iii) 		2
(b) voltage across $R_2 = 8$ V (1) $P = \frac{V^2}{R}$ (½) $= \frac{8^2}{25}$ (½) $= 2{\cdot}56$ W (1)		3
Note: alternative answer to (b) voltage across $R_2 = 8$V (1) $V = IR$ $8 = I$ x 25 $I = 0{\cdot}32$ (A) (1) $P = IV$ $P = 0{\cdot}32$ x 8 $P = 2{\cdot}56$W (1)		
		Total 10

Sample Answer and Mark Allocation				Notes	Marks
26.	(a)	moving OR changing <u>magnetic field</u> induces voltage in the <u>coil</u>	(1) (1)		2
	(b)	increases	(1)		1
	(c)	stronger magnet OR more turns OR larger or more cups	Any Two (1) (1)		2
	(d)	electrons move alternately in opposite directions in the circuit	(½) (½)		1
					Total 6

Sample Answer and Mark Allocation	Notes	Marks
27. (a) NPN (1)  MOSFET (1) 		2
(b) (electronic) <u>switch</u> (1)		1
(c) voltage across 5·5 kΩ resistor = 9 - 2·4 = 6·6 V (1) $\frac{V_1}{V_2} = \frac{R_1}{R_2}$ (½) (½) $\frac{2.4}{6.6} = \frac{R_1}{5500}$ R_1 = 2 000 Ω (1) Note: alternative answer to (c) voltage across 5·5 kΩ resistor = 6·6V (1) V = IR 6·6 = I x 5500 I = 0·0012 (A) (1) V = IR 2·4 = 0·0012 x R R = 2000 Ω (1)		3
		Total 6

Sample Answer and Mark Allocation	Notes	Marks
28. (a) $v = f\lambda$ (½) $340 = 400 \times \lambda$ (½) $\lambda = 0{\cdot}85$ m (1)		2
(b) $V = IR = 0{\cdot}025 \times 16$ (½) $= 0{\cdot}4$ (V) (½) $V_{gain} = \frac{V_{out}}{V_{in}}$ (½) $= \frac{0{\cdot}4}{0{\cdot}002}$ (½) $= 200$ (1) Note: ½ unit deduction if any unit given		3
		Total 5

Sample Answer and Mark Allocation	Notes	Marks
29. (a) energy (1)		1
(b) $d = v\,t$ (½) $1{\cdot}5 \times 10^{11} = 3 \times 10^{8} \times t$ (½) $t = 500$ s (1)		2
(c) (i) microwaves (1)		1
(ii) X-rays OR gamma rays (1)		1
(iii) electrons removed from or added to atom or molecule (1)		1
		Total 6

Sample Answer and Mark Allocation	Notes	Marks
30. (a) (i) 40 º (1) (Note: ½ unit deduction)		1
(ii) 59 º (1) (Note: ½ unit deduction)		1
(b) (i)  		2
(ii) P = $\frac{1}{f}$ (½) = $\frac{1}{0{\cdot}05}$ (½) = (+) 20 D (1)		2
		Total 6

Sample Answer and Mark Allocation					Notes	Marks
31.	(a)	(i)	slows neutrons	(1)		1
		(ii)	absorbs neutrons	(1)		1
	(b)	(i)	number of decays per second	(1)		1
		(ii)	time taken for activity (to fall) to half (its original value)	(1)		1
		(iii)	<table><tr><th>Time (years)</th><th>Activity (Bq)</th></tr><tr><td>0</td><td>16×10^{12}</td></tr><tr><td>30</td><td>8×10^{12}</td></tr><tr><td>60</td><td>4×10^{12}</td></tr><tr><td>90</td><td>2×10^{12}</td></tr><tr><td>120</td><td>1×10^{12}</td></tr><tr><td>150</td><td>$0{\cdot}5 \times 10^{12}$</td></tr></table>	(1)		
			Activity = 5×10^{11} Bq	(1)		2
	(c)	(i)	a measure of the radiation's **biological** effect	(1)		1
		(ii)	$H = D\,Q \quad 276 \times 10^{-6} = D \times 2{\cdot}3$ $D = 120 \times 10^{-6}$ (Gy) $E = D\,m$ $= 120 \times 10^{-6} \times 90$ $= 0{\cdot}0108$ J	(½) (½) (½) (½) (1)		3
						Total 10

[END OF MARKING INSTRUCTIONS]