2010 Physics

Intermediate 2

Finalised Marking Instructions

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.	$V = IR$ $7{\cdot}5 = 1{\cdot}5R$ $R = 5{\cdot}0\ \Omega$	(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.	$V = IR$ $7{\cdot}5 = 1{\cdot}5 \times R$ $R = 0{\cdot}2\ \Omega$	(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

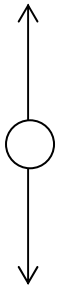
2010 Physics Intermediate 2

Marking scheme

Section A

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

2010 Physics Intermediate 2			
Sample Answer and Mark Allocation		**Notes**	**Marks**
21. (a) a $= \frac{v-u}{t}$	(½)		
$= \frac{6-0}{60}$	(½)		
$= 0{\cdot}1\ m/s^2$	(1)		**2**
(b) s = area under graph	(½)		
= $(0{\cdot}5 \times 60 \times 6) + (40 \times 6)$	(½)		
= 420 m	(1)		**2**
(c) v $= \frac{s}{t}$	(½)		
$= \frac{420}{100}$	(½)		
= 4·2 m/s	(1)		**2**
(d) W = mg	(½)	accept 9·8 and 9·81 for 'g' which give 3920 N and 3924 N	
= 400 × 10	(½)		
= 4000 N	(1)		**2**
(e) F = ma	(½)	must be consistent with (a) and (d)	
= 400 × 0·1	(½)		
= 40 (N)	(½)		
Upward force = 4000 + 40	(½)		
= 4040 N	(1)		**3**
			Total 11

Sample Answer and Mark Allocation	Notes	Marks
22. (a) p before = p after (½) $(2{\cdot}0 \times 10^{-3} \times 4) = 3{\cdot}2 \times 10^{-3}$ v (½) v = 2·5 m/s (1)		**2**
(b)  Direction (½) Air resistance (½) Weight (not gravity) (½) Direction (½)	unacceptable: wind resistance friction must be qualified	**2**
(c) $Q = It$ (½) $I = \frac{1650}{0{\cdot}15}$ (½) $= 1{\cdot}1 \times 10^{4}$ A (1)		**2**
(d) Light travels faster than sound (1)		**1**
		Total 7

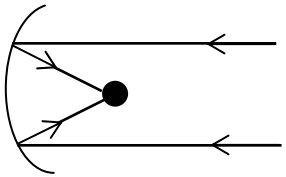
Sample Answer and Mark Allocation	Notes	Marks
23. (a) $E_h = cm\Delta T$ (½) $c = \frac{2 \cdot 59 \times 10^7}{60 \times [\ (307 - (-173)\ ]}$ (½) $= 899$ J/kg°C (1)		**2**
(b) $P = \frac{E}{t}$ (½) $t = \frac{2 \cdot 59 \times 10^7}{1440}$ (½) $= 18000$ s (1)		**2**
(c) $\frac{288000}{1440}$ (1) = 200 (rocks) (1)		**2**
(d) It would be easier (1) Gravitational field strength at the surface of Mercury is less than that at the surface of Earth OR Weight of rocks on Mercury is smaller than their weight on Earth OR Gravity is less on Mercury (1)		**2**
		Total 8

Sample Answer and Mark Allocation	Notes	Marks
24. (a) $R_T = R_1 + R_2 = 8 + 24 = 32\ \Omega$ (1) $V = IR$ (½) $I = \frac{6}{32}$ (½) $I = 0{\cdot}19$ A (1)		**3**
(b) $V_2 = \left(\frac{R_2}{R_1 + R_2}\right) V_S$ (½) $V_2 = \left(\frac{8}{8+24}\right) 6$ (½) $V_2 = 1{\cdot}5$ V (1) OR $V = IR$ (½) $= 0{\cdot}19 \times 8$ (½) $= 1{\cdot}5$ V (1)		**2**
(c) Voltage across $8\ \Omega$ resistor would decrease (1) The $8\ \Omega$ resistor now has a smaller proportion of the total resistance or less current in the circuit (1)		**2**
		Total 7

Sample Answer and Mark Allocation	Notes	Marks
25. (a) a.c. (source) (1) changing magnetic field/current is necessary (to induce voltage) (1)	unacceptable: transformers do not work with dc	**2**
(b) P = IV (½) = 0·5 × 12 (½) = 6 W (1)		**2**
(c) P = IV = 0·23 × 23 (½) = 5·3 W (½)		**1**
(d) percentage efficiency = $\frac{\text{useful } P_o}{Pi} \times 100$ (½) = $\frac{5 \cdot 3}{6} \times 100$ (½) = 88(%) (1)		**2**
(e) $\frac{N_S}{N_P} = \frac{V_S}{V_P}$ (½) $V_S = \frac{3000 \times 12}{1500}$ (½) = 24 V (1)		**2**
		Total 9

Sample Answer and Mark Allocation			Notes	Marks
26.	(a)	Y (n-channel enhancement) MOSFET (1) Z Lamp (1)	unacceptable: transistor	**2**
	(b)	(Resistance) decreases (1)		**1**
	(c)	(As resistance of thermistor decreases) voltage across thermistor decreases. (½) V across X increases (½) When it reaches 1·8V MOSFET $V_{(transistor)}$ switches on (½) Bulb lights and buzzer sounds (½)		**2**
	(d)	To allow switch on temperatures to be varied (1)		**1**
				Total 6

Sample Answer and Mark Allocation	Notes	Marks
27. (a) $s = vt$ (½) $t = \frac{51}{340}$ (½) $= 0{\cdot}15$ s (1)		**2**
(b) (i) Longitudinal (1)		**1**
(ii) A transverse wave is one in which the particles vibrate at right angles to the direction of the wave. (1) A longitudinal wave is one in which the particles vibrate parallel to the direction of the wave. (1)		**2**
(iii) Energy (1)		**1**
(c) (i) $P = \frac{V^2}{R}$ (½) $R = \frac{315^2}{2400}$ (½) $= 41{\cdot}3\,\Omega$ (1)		**2**
(ii) Any 2 of: • independent switching or one off/others stay on (1) • to ensure that 315 V is across each bulb (1) • if they were in series the necessary voltage would be too high (1)		**2**
		Total 10

Sample Answer and Mark Allocation	Notes	Marks
28 (a) (i) $v = f\lambda$ (½) $f = \frac{3\times10^{8}}{0\cdot06}$ (½) $= 5 \times 10^{9}$ Hz (1)		**2**
(ii) $T = \frac{1}{f}$ (½) $T = \frac{1}{5\times10^{9}}$ (½) $= 2 \times 10^{-10}$ s (1)		**2**
(b) Signals received at same time (1) Radio waves and microwaves have same speed (1)		**2**
(c) If there are no arrows = 0 for diagram  Diagram must have minimum of two rays. All rays drawn must come to a distinct focus or incoming waves are focussed towards one point (1) Curved reflector gives <u>point where energy is maximised</u> (or equivalent) (1)	Where there is no diagram: Incoming waves are reflected to a point or focus (1) This maximises the signal at the focus (1)	**2**
		Total 8

Sample Answer and Mark Allocation	Notes	Marks
29. (a) A particle containing two protons and two neutrons OR A helium nucleus (1)		**1**
(b) The gain/loss of electrons by an atom (1)		**1**
(c) $4800 \xrightarrow{1} 2400 \xrightarrow{2} 1200 \xrightarrow{3} 600 \xrightarrow{4} 300$ or equivalent (1) $4 \times 2{\cdot}5 = 10$ hours (1)		**2**
(d) $A = \frac{N}{t}$ (½) $N = 1200 \times 2 \times 60$ (½) $= 144{,}000$ (decays) (1)		**2**
(e) Source may also emit β and/or γ radiation (accept other valid non-standard answer eg neutrons, positrons) (1)		**1**
		Total 7

Sample Answer and Mark Allocation	Notes	Marks
30. (a) (i) Slows neutrons (1)		**1**
(ii) Absorbs neutrons (1)		**1**
(b) $P = \frac{E}{t}$ (½) $E = 1{\cdot}4 \times 10^{9} \times 60 \times 60$ (½) $= 5{\cdot}0 \times 10^{12}$ (J) (½) Numbers of fissions = $\frac{5{\cdot}0 \times 10^{12}}{2{\cdot}9 \times 10^{-11}}$ (1) $= 1{\cdot}7 \times 10^{23}$ (½)		**3**
(c) Any valid advantage eg much greater energy per kg of fuel compared to other sources OR No greenhouse gases emitted or equivalent (1) Any valid disadvantage eg radioactive waste requires special storage (1)	These must be relevant to nuclear power and any statements eg 'dangerous' must be qualified	**2**
		Total 7

[END OF MARKING INSTRUCTIONS]