Mark scheme

Electric circuits and electrical safety

Physics 0625 · Questions from Paper 3 and Paper 4

Total marks

79

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
5	10	9	10	10	4	7	8	8	8	**79**

Question 1 [5]

1(a)	fault: insulation damaged owtte	**B1**
	hazard: electrocution **OR** electric shock	**B1**
1(b)(i)	earth (wire)	**B1**
1(b)(ii)	(switch is connected in) live (wire)	**M1**
	(so appliance is) disconnected from main / supply **OR** disconnected from high voltage (when switch is open / off)	**A1**

Question 2 [10]

2 **(a)** **(i)** parallel B1

(ii) 4.2 (V) B1

(iii) V=IR in any form OR V/R C1
4.2 / 3 e.c.f. **(ii)** C1
1.4 e.c.f. **(ii)** A1
A OR amp(s) OR ampere(s) B1

(iv) 1. bigger OR the sum of the two currents OR 2 (A) B1
2. same/equal B1

(b) clear series connection of all 3 across battery in one circuit B1
clear parallel connection of all 3 across battery in other circuit, and must not be shorted out B1
allow B1 max in (b) if correct series/parallel circuits both shown, but with more or less than 3 resistors in either/both [10]

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Question 3 [9]

3(a)(i)	(electric) current	B1
3(a)(ii)	tick in third box A_1 is equal to A_3	B1
3(b)(i)	resistors in parallel	B1
	connected to battery AND correct circuit symbol for battery	B1
3(b)(ii)	same brightness / if one fails the rest are still lit / lamps can be switched off independently / same p.d. across owtte	B1
3(c)(i)	potential divider / potentiometer	B1
3(c)(ii)	dimmer / change light output / intensity	B1
3(c)(iii)	move the slider	B1
	varies p.d. (across lamp)	B1

Question 4 [10]

4(a)(i)	Thermistor correctly identified	B1
4(a)(ii)	correct symbol for voltmeter	B1
	Voltmeter in parallel with thermistor	B1
4(b)(i)	V= IR	C1
	(R) = 6.0 ÷ 0.010	C1
	600 (ohms or Ω)	A1
4(b)(ii)	Resistance is decreasing	B1
	So current will increase	B1
4(b)(iii)	Current greater than 0.04 (A)	B1
4(c)	700 (ohms or Ω)	B1

Question 5 [10]

5(a)(i)	**any three** from: damaged insulation owtte coiled cables damp / wet conditions 5 A / thin cable connected to (10 A) kettle owtte	B3
5(a)(ii)	overheating / fire	B1
	electric shock	B1
5(b)(i)	a. c. (power) supply	B1
5(b)(ii)		B1
5(b)(iii)	to protect a circuit / prevents excess currents owtte	B1
5(b)(iv)	easy to reset / quick to reset OR reusable	B1
5(c)	13 A	B1

Question 6 [4]

6(a)	conditions (outdoors) may be damp / wet	**C1**
	water conducts (electricity) OR clear statement of need for waterproof / outdoor specification (components)	**A1**
6(b)	protects components / appliances / circuit / wires / user / mains supply prevents electrical supply overheating / fires / electrocution / shocks	**B1**
	excess current / power in circuit / wires OR fuse melts / blows OR circuit breaker opens	**B1**

Question 7 [7]

7(a)(i)	voltmeter shown connected across LED		**B1**
7(a)(ii)	ammeter shown connected in series with LED		**B1**
7(b)	p.d. across two resistors in parallel = (3.7 – 2.1 =) 1.6 V	resistance of circuit = (3.7 / 0.19) = 19.5 Ω AND resistance of LED (= 2.1 / 0.19) = 11.1 Ω	**B1**
	combined resistances of two resistors in parallel = R / 2 OR $1 / R = 1 / R_1 + 1 / R_2$ OR $R = R_1 R_2 / R_1 + R_2$ OR current in either R = I / 2	resistance across parallel combination of resistors = (19.5 – 11.1) = 8.4 Ω	**B1**
	$R = V / I$ in any form	$R = V / I$ in any form	**C1**
	$R / 2 = 1.6 / 0.19$	$R / 2 = 8.4\ \Omega$	**C1**
	17 Ω	17 Ω	**A1**

Question 8 [8]

8(a)(i)	0 (A)	**B1**
8(a)(ii)	(I = 12 / 2 =) 6.0 A	**A2**
	(I =) V / R in any form	C1
8(a)(iii)	(I = 12 / 5 =) 2.4 A	**A2**
	($R_s = R_1 + R_2$ = 2 + 3 =) 5 (Ω)	C1
8(b)	(R_p = 6 / 5 =) 1.2 Ω	**A3**
	$1 / R_p = 1 / R_1 + 1 / R_2$ OR (R_p =) $R_1 R_2 / (R_1 + R_2)$	C1
	$1 / R_p = 1 / 2 + 1 / 3$ OR (R_p =) $2 \times 3 / (2 + 3)$	C1

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Question 9 [8]

9(a)(i)		**B2**
	four components joined in series	B1
	all circuit symbols correct for resistor, thermistor, a filament lamp and a power supply	B1
9(a)(ii)	voltmeter connected in parallel to the resistor	**B1**
9(a)(iii)	(p.d. across terminals of power supply) = 18 V	**A4**
	(current through resistor when p.d. across it is 6.0 V =) 0.4 A	C1
	current same through all components in series circuit OR horizontal line through 0.4 A on graph through all three curves OR p.d. across filament lamp = 3.0 V OR p.d. across thermistor = 9.0 V	C1
	p.d. across filament lamp = 3.0 V AND p.d, across thermistor = 9.0 V	C1
9(b)	any sensible use requiring temperature control or depending on temperature, e.g. fire alarms, to keep computers cool (by operating fan), in incubators, electronic thermometer, electronic thermostat in kettle / car engine	**B1**

Question 10 [8]

10(a)	any **two** from: • (potential divider) splits / shares / divides the e.m.f. / voltage / potential difference / p.d. (of a power source / in a circuit) • (e.m.f. is) split between (two) resistors / components (connected in series to power source) • (potential divider shares e.m.f.) in proportion to the resistances (of the resistors / components)	**B2**
10(b)(i)	(e.m.f. =) 15 V	**B1**
10(b)(ii)	(resistance =) 60 Ω	**A3**
	(R_{I} =) R_2R_3 / (R_2 + R_3) **OR** (R_{II} =) 40 × 40 / (40 + 40) **OR** (R_{II} =) 1600 / 80 **OR** 1 / R_{II} = 1 / R_2 + 1 / R_3 **OR** 1 / R_{II} = 1 / 40 + 1 / 40 **OR** (R_{II} =) (1 / 40 + 1 / 40)$^{-1}$ **OR** (R_{II} =) 20 (Ω)	C1
	(resistance =) 40 + (candidate's value for combined resistance of R_2 and R_3)	C1

10(c)	(reading =) 10 V	**A2**
	emf shared in same proportion as resistance **OR** e.g. R_1 / R_{II} = V_1 / V_{II} **OR** (reading =) 15 × 40 / 60 **OR** (reading =) 0.25 × 40	C1

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