Mark scheme

Series and parallel circuits

Physics 0625 · Questions from Paper 3 and Paper 4

Total marks

66

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
5	5	6	6	6	7	7	8	8	8	**66**

Question 1 **[5]**

1 (a)

lamp that is lit	switches closed				
	1	2	3	4	5
lamp A only	✓	✓	✓		
lamp B only	✓	✓		✓	
lamp C only	✓				✓

B1

B2

ignore any additions for lamp A
for C allow B1 only for ✓ ✓ ✓

(b) all of them OR A, B and C B1

(c) (switch) 1 B1

[Total: 5]

STEM | Exam Builder

Question 2 [5]

2 **(a)** (lamps) stay on / have same brightness as before / nothing happens B1
(lamps) still connected to supply / have same voltage as before / are connected in parallel B1

(b) **(i)** line 1: on line 2: off line 3: off line 4: on B2
deduct one mark for e.e.o.e.

(ii) when either switch is operated, the state of the lamp changes. B1

[Total: 5]

Question 3 [6]

3 **(a)** **(i)** L1 and L2 B1

(ii) L2 and L3 B1

(b) L1 off
L2 full
L3 off
} – 1 e.e.o.o. B2

L1 partial
L2 partial
L3 partial
} – 1 e.e.o.o. B2

[6]

Question 4 [6]

4(a)(i)	the ammeters all have the same reading	**B1**
4(a)(ii)	the reading on A_1 is the biggest	**B1**
4(a)(iii)	lamps have normal brightness (in parallel) or brighter (than lamps in series)	**B1**
	If one lamp fails the other lamp is still lit	**B1**
4(b)(i)	24 (Ω)	**B1**
4(b)(ii)	(resistance of one lamp / 12 (Ω)) is more (than the combined resistance (of lamps in parallel))	**B1**

STEM | Exam Builder

Question 5 [6]

5(a)	{$R_s = R_1 + R_2 + R_3$ in any form OR (R_s)= $R_1 + R_2 + R_3$ OR (R_s) = 3 + 2 + 6 (Ω) OR (R_s) = 11 (Ω)} AND {V= IR in any form OR (I=)V / R OR (I=) 12 / 11 (A)}	**C1**
	(I=) 1.1 A	**A1**
5(b)	uses resistance of wire proportional to length OR (resistance XQ =) 6 Ω 0.6 / 2.0 (Ω) OR 1.8 (Ω)	**B1**
	$1 / R_p = 1 / R_1 + 1 / R_2$ OR (R_p=) $R_1R_2 / (R_1 + R_2)$	**C1**
	$1 / R_p = 1 / 1.5 + 1 / (6 \times 0.6 / 2)$ OR (R_p=) $1.5 \times (6 \times 0.6 / 2) / (1.5 + 6 \times 0.6 / 2)$ OR (R_p= $1.5 \times 1.8 / \{1.5 + 1.8\}$) = 0.82 (Ω)	**C1**
	(R = 3 + 2 + 0.82 =) 5.8 Ω	**A1**

Question 6 [7]

6(a)	ammeter symbol	**B1**
	ammeter in series (with power supply)	**B1**
	voltmeter symbol	**B1**
	voltmeter in parallel (with lamps/power supply)	**B1**
	two lamps in parallel	**B1**
6(b)	(brightness) stays the same	**B1**
	current (in working lamp) stays the same	**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 Ω	**C1**
	17 Ω	17 Ω	**A1**

STEM | Exam Builder

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 =) $R_1R_2/(R_1 + R_2)$	C1
	$1/R_p = 1/2 + 1/3$ OR (R_p =) $2 \times 3/(2 + 3)$	C1

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)	4.5 V	**B1**
10(b)(i)	$1/R = 1/R_1 + 1/R_2$ **OR** $R_1R_2/(R_1+R_2)$	**C1**
	(R =) 20 Ω	**A1**
10(b)(ii)	adds 55 to candidate's previous line	**B1**
10(b)(iii)	I = V / R in any form OR V / R	**C1**
	(I = 4.5 / 75 =) 0.060 A	**A1**
10(c)(i)	reference to 55 Ω resistor	**B1**
10(c)(ii)	reference to 60 Ω resistor	**B1**

STEM | Exam Builder