Eduqas Physics GCSE
Topic 7.1: Current, potential difference and resistance
Topic 7.2: Series and parallel circuits
Mark Schemes for Questions by topic

1.

Question			Marking details	Marks
4.	(a)	(i)	Voltmeter drawn with correct symbol in parallel with the lamp (allow a line through the voltmeter and allow other voltmeters across other components) (1) Ammeter drawn with correct symbol in series with the resistor (1) The [variable] resistor is altered / changes the resistance / resistor changes the current / resistor changes the voltage (1) Take readings <u>each time</u> (1).	4
		(ii)	Any diagonally upwards straight line from origin [as for a resistor] (1) Diagonal line of correct gradient from origin award 2 marks. Calculation of I = 3 A (at foot of page) (1) Point (12, 3) plotted (1) (Point at (12, 3) implies 2nd mark so can be awarded).	3
	(b)	(i)	$P = IV$ or $P = I^2R$ (1) or implied with correct substitution Substitution (1) Answer = 20.25 [W] (1) to be taken from their graph Expected values are: 9 V(± 0.2) , I = 2.25 A (± 0.1)	3
		(ii)	Lamp has greater resistance (1) because it has the smaller current through it / allow calculations of 5.1 Ω [and 4 Ω] (1) Accept converse argument for resistor. (Any reference to power treat as being neutral.)	2
			Question total	**[12]**

2.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	4	$I = \frac{230}{920}$ (1) = 0.25 [A] (1) P = 0.25 (**ecf**) × 230 (1) = 57.5 [W] (1) ignore a negative sign	58 [W] A calculation that arrives at 57.5 [W] and then is developed further award 3 marks only		
(b)	6	**Indicative content:** **Example 1** In a series circuit the current is the same throughout and the voltage is shared between the resistors i.e. 4.5 V across each. In a parallel circuit the voltage is the same across the resistors i.e. 9 V and the current is shared between them. The power loss in the parallel resistors is four times greater / more than the power loss in the series resistors. **Example 2** The voltage across each resistor in parallel is 9 V compared to 4.5 V when connected in series. The current through each resistor in parallel is double when connected in series. The power loss in the parallel resistors is four times greater / more than the power loss in the series resistors. **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.		
TOTAL	10				

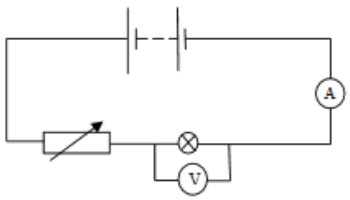
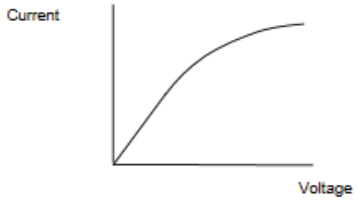
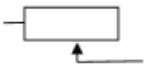
3.

Question				Marking details	Marks
5.	(a)			**Indicative content:** Diagram showing the lamp connected in series with an ammeter, a variable power supply **or** a power supply with a variable resistor. A voltmeter is connected in parallel across the lamp. A pair of readings is taken from the ammeter and voltmeter. The variable resistor is adjusted [to vary the voltage across the lamp] and another pair of readings is taken. This is repeated. Results are plotted on a graph and the variation in resistance can be determined by how the slope changes **OR** the resistance of the lamp is calculated for each set of readings by using $V=IR$. **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6
	(b)	(i)		Scales (at least ½ of each axis used) (1) plots (allow ± ½ small square division) (1) smooth curve allow ± ½ small square division (1) allow straight line between 0 and 2 and between 2 and 6 but expect a curve between 6 and 10. **Don't allow** wispy, wobbly, thick lines	3
		(ii)		Current from their graph (i.e. 1.6 A) (1), substitution (1), answer = 3.1 [Ω] (1) **ecf**	3
		(iii)		R must be increasing (1) Graph becomes less steep / as voltage increases, current increases less and less / an alternative method would be calculating another value of R (1) **To award both marks both statements must be linked.**	2
				Question total	**[14]**
				Higher tier paper total	**[60]**

4.

Question			Answer / Explanatory Notes	Marks Available
			Question total	**[10]**
5.	*(a)*	(i)	2 [A]	1
		(ii)	$R = \frac{6}{2}$ (1 –substitution) = 3 [Ω] (1) **ecf** from (i) (If found for wire in (i) R = 4.8 Ω)	2
		(iii)	6 × 2 (1 – subst) = 12 [W] (1) **ecf** from (i) (If found for wire in (i) P = 7.5 W)	2
		(iv)	11 [V]	1
		(v)	3.25 [A]	1
	(b)	(i)	**Lamp** has bigger resistance or converse argument or values given W = 4.8 Ω and L = 5.2 Ω	1
		(ii)	Smaller current through it or converse argument **or** calculations shown (allow temperature increase)	1
			Question total	**[9]**

5.

Mark	Answer	Accept	Neutral answer	Do not accept
6	**Indicative content:**  Resistance (in Ohms) is calculated each time by dividing the voltage (read from the voltmeter in volts) by the current (from the ammeter in amps). The results would show that as the voltage is increased, the resistance stays constant for low voltages and then increases as the voltage gets bigger and bigger. (The graph is initially straight and then curves showing a decreasing gradient.)  **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.	For power supply accept with or without box:  For variable resistor accept: 		Squares for ammeter, voltmeter or lamp $R = V \div C$

Mark	Answer	Accept	Neutral answer	Do not accept
	3 – 4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.			

6.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			6	**Indicative content:** Voltmeter drawn in parallel with the lamp with correct symbol and ammeter drawn in series with lamp with correct symbol. The variable resistor is set [at highest / lowest resistance] and values of the current from the ammeter and voltage from the voltmeter are taken. The variable resistor is then altered and new readings taken. Repeating in this way, a series of values of current and voltage are recorded. **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.			
(b)	(i)		1	2 [A] no tolerance			
	(ii)		2	$\frac{6}{2}$ (1) = 3 [Ω] (1) **ecf (b)(i)**			
	(iii)		2	6×2 (1) = 12 [W] (1) **ecf (b)(i)**	Use of $P = I^2R$ **ecf** on R		
	(iv)		2	Any line through (10, 2.25) (1) Straight line from origin (1) no tolerance		Ignore coordinate lines at (6,2)	More than one line e.g. a pair of coordinate lines
Total			**13**				

7.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	$\frac{1.8}{6.0}$ (1-sub) = 0.3 (1-ans)	0.3 anywhere		$\frac{6.0}{1.8}$ = 0.3
(b)			1	Current			Amps
(c)	(i)		3	Points plotted within ± ½ small square division (2) (-1 mark for each incorrect plot to a maximum of 2 marks) Straight line of best fit ± ½ small square division on each point within the range of values plotted (i.e. 10 - 75 cm) (1)			Line joined dot to dot, whispy lines, double lines
	(ii)		2	As length increases resistance increases (1) In a uniform way / steady rate (1)	Bigger wire / In a linear way / In proportion. Resistance is [directly] proportional to length **gets 2 marks.** It is proportional **gets 2 marks.** For every 10 cm resistance increases by 2 Ω **gets 2 marks.** Length is equal to 5 times the resistance **gets 2 marks.** 10 cm has 2 Ω resistance and 20 cm has 4 Ω resistance **gets 1 mark.** As length increases resistance increases equally **gets 1 mark**		Stronger resistance. Graph is proportional
(d)			2	The resistance of 100 cm would be 20 Ω / 30 Ω requires a 150 cm length (1) therefore the statement is not true (1) **ecf** it must be consistent with the first mark **The 2nd mark can only be awarded if it is linked to the 1st mark.**	10 cm has 2 Ω so 100 cm is not 30 Ω **gets 1 mark only**		
(e)			1	Yes - To check repeatability **or** No- Results all lie on a straight line / there are no anomalous results	To check if the results match.	Any reference to reliability or accuracy.	To make it more repeatable. Make sure they're right / ok
Total Mark			11				

8.

Question			Marking details	Marks
3.	(a)	(i)	$P = I^2R$ $18 = I^2 8$ (1-sub), $I^2 = \frac{18}{8}$ (1-manip), I = 1.5 [A] (1-answer) **Award 2 marks** for an answer of 2.25 [A] **Award 1 mark** if substitution precedes manipulation.	3
		(ii)	3 [A] **ecf - answer must be double the answer to (i)**	1
		(iii)	Either $V = IR$ V = 1.5 **(ecf)** × 8 (1-sub), = 12 [V] (1) **ecf must be 8 × answer to (i)** **Or** accept $P = VI$ so $V = \frac{18}{1.5}$ **(ecf)** (1-sub+manip) = 12 [V] (1) **ecf applies to 1.5 the value used must be the answer to (i)**	2
	(b)	(i)	**Either:** Supply voltage is unchanged / **current (don't accept** amps) has decreased (1) so the circuit resistance must have increased. (1) **The 2nd mark must be linked to the 1st mark.** **OR** voltage across each bulb has decreased (1) and so the **current (don't accept** amps) has decreased / but the resistance of each bulb has not changed (1) **The 2nd mark must be linked to the 1st mark.**	2
		(ii)	$P = I^2R = 0.75^2 \times 8$ (1 – sub) = 4.5 [W] (1) **Or** accept $P = VI = 6$ (**ecf** from (a)(iii)) × 0.75 (1 – sub) = 4.5 [W] (1) **Or** accept $P = V^2 / R = 6^2$ (**ecf** from (a)(iii)) / 8 (1 – sub) = 4.5 [W] (1)	2
		(iii)	Lamps are more powerful (brighter) [in parallel] / if one fails then the others will still work / they can be switched independently **Accept** they have the supply voltage across them	1
			Question total	**[11]**

9.

Resistance calculations

Evidence of 20 Ω for one arm **(1)**

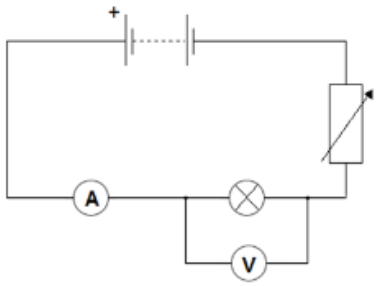
$\frac{1}{R} = \frac{1}{20} + \frac{1}{20}$ **(1)**

R = 10 Ω **(1)** 3

10.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	V = 0.10 x 45 4.5 (V)		1 1	AO2/1 4.2.2 4.2.1.3
07.2	R = 12 / 0.10 total resistance = 120 (Ω) R = 120 – 105 = 15 (Ω)		1 1 1	AO2/1 4.2.2 4.2.1.3
07.3	(total) resistance decreases (so) current increases		1 1	AO1/2 4.2.2 4.2.1.3
Total			**7**	

11.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1		battery in series with bulb and ammeter voltmeter in parallel with bulb variable resistor **or** variable power pack **or** potentiometer	1 1 1	AO1/2 4.2.1.1/3 WS2.2
08.2	A is brighter because it has a higher current (than lamp B at any p.d.) (therefore A has a) higher power output (than bulb B)	 accept higher energy output per second	1 1	AO3/1a AO1/1 4.2.4.1/3
08.3	lower current (than lamp A) for the same potential difference lower gradient (than lamp A)	accept answer in terms of R = V/I	1 1	AO1/1 AO2/2 4.2.1.3/4