Marking Scheme

1.

Question			Marking details	Marks
3.	(a)	(i)	$P = I^2R$ $18 = I^2 8$ (1-sub), $I^2 = \dfrac{18}{8}$ (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)** $\times$ 8 (1-sub), = 12 [V] (1) **ecf must be 8 × answer to (i)** **Or** accept $P = VI$ so $V = \dfrac{18}{1.5}$ **(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:** <u>Supply</u> 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 <u>across each bulb</u> 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 <u>supply</u> voltage across them	1
			Question total	**[11]**

2.

Question			Marking details	Mark
5.	(a)		Subs+manip 40/230 (1) $I = 0.17[4]$ [A] (1) [Do not accept 0.173 but accept 0.2]	2
	(b)	(i)	Subs+manip $I^2 = \dfrac{118}{82}$ (1) = 1.44 (1), $I = 1.2$ [A] (1) If 1.44 on the answer line then award 2 marks. If 1.43 used, no penalty for rounding I will = 1.19 [A] N.B. $\sqrt{1.4} = 1.18$	3
		(ii)	current through each lamp = $\dfrac{1.2(ecf)}{12} = 0.1$ [A] (1) **Either** pd across dimmer = 1.2 x 82 = 98[.4] (1) pd across lamps = 230 – 98.4 **ecf** = 131.6 (accept 132) power = 131.6 **ecf** x 0.1**ecf** = 13.16 [W] (accept 13.2) (1) **OR** resistance of each lamp = $\dfrac{230}{0.174} = 1\,322$ (1) **ecf** for 0.174 Power = 0.1^2 **ecf** x 1 322 **ecf** = 13.22 [W] (1)	3
			Question total	[8]

3.

Question			Answer / Explanatory Notes	Marks Available
1.	*(a)*	(i)	2 [A]	1
		(ii)	$R = \dfrac{6}{2}$ (1 –substitution) = 3 [Ω] (1) **ecf** from (i) (If found for wire in (i) $R = 4.8\ \Omega$)	2
		(iii)	3.25 [A]	1
	(b)	(i)	<u>Lamp</u> 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
	(c)		Beyond about 11 V, W has the bigger current (1) hence W has the bigger power (1) **Or** <u>power calculations</u> at 12 V (1) this is because the current in W is now bigger than in L (1) **Or** at 11 V the powers are equal (1) because the currents are equal (1)	2
			Question total	[8]

4.

	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($\pm$ 0.2) , I = 2.25 A ($\pm$ 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]**

5.

	Question		Marking details	Marks Available
1	(a)	(i)	Horizontal velocity = $\dfrac{1.20}{0.60}$ = 2[.0 m s^{-1}]	1
		(ii)	$0 = u^2 - 2 \times 9.81 \times 0.44$ [correct substitution into $v^2 = u^2 + 2ax$] (1) $u = 2.94$ [m s^{-1}] (1) **or** $0 = u - 9.81 \times 0.30$ [correct substitution into $v = u + at$] (1) $u = 2.94$ [m s^{-1}] (1) **[Other solutions possible]**	2
	(b)	(i)	$R = (4 + 8.64)^{1/2}$ (1) [**ecf** from (a)(i) and/or (a)(ii)] $R = 3.56$ [m s^{-1}] (1)	2
		(ii)	$\theta = 55.8°$ **ecf**	1
	(c)	(i)	<u>Force of gravity on earth due to grasshopper</u>	1
		(ii)	$F = 3 \times 10^{-5} \times 9.81 = 2.9 \times 10^{-4}$ [N] Accept 0.3 m[N]	1
	(d)		←	1
			Question 1 Total	**[9]**