<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a</td><td></td><td>diode (1)

(diode) has a high resistance in one direction and a low resistance in the other (1)</td><td>2</td><td>allow LED (1)

allow current flows one way only (1)
allow threshold voltage / current idea (1)</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td><table><tr><th>A</th><th>B</th><th>C</th><th>output</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td></tr></table>(1)</td><td>1</td><td>all four zeros needed</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>dark / not light (1)

hot / wet (1)</td><td>2</td><td>allow night(time) / dim (1)</td></tr>
</table>

Question			Answer	Marks	Guidance
		(iii)	**any two from:** fan needs a large current / voltage to operate (1) logic gates use low current / voltage (1) logic gate would be damaged if connected (directly) to mains (1) relay switches on a high current / voltage by using a low current / voltage (1)	2	**allow** isolation idea of logic gate from fan (1) **ignore** power **ignore** changes low voltage into high voltage
			Total	**7**	

Question			Answer	Marks	Guidance
2	(a		…flows from P to S and through the resistor or to T (1) …flows from R to S and through the resistor or to T(1)	2	**ignore** current paths after T **ignore** current paths after T
	(b)		smoothed output (1)	1	**allow** suitable diagram of smoothing if it shows a comparison (to the original output) (1)
			Total	**3**	

Question			Answer	Marks	Guidance
3	(a)	(i)	24 +/- 4 scores (2) But if answer is incorrect or incomplete: correct plotting of both points (1)	2	 tolerance for points is +/- ½ a square
		(ii)	as distance increases current falls scores / AW / ORA (1) **BUT** current falls quickly at start but less quickly for greater distances / AW (2) **OR** as distance doubles current is quartered (2)	2	**ignore** stronger or weaker current **allow** inverse square law (2)
		(iii)	light diverges / spreads / becomes less intense / AW /ORA(1) **or** light intensity follows an inverse square law / AW (1)	1	(when closer) more energy /photons/ light hits solar cell / AW / ORA (1)
	(b)		Electrons knocked / released or freed (1) **BUT** electrons knocked / released or freed from silicon (2) electrons move (around the circuit) (1)	2	
			Total	**7**	

Question			Answer	Marks	Guidance
4	(a)		energy / light absorbed by photocell / silicon / crystal (1) electrons are **knocked loose** (from the silicon atoms in the crystal) (1) idea of (free) electron flow / electrons released **which** creates an electrical current (1)	3	**allow** higher level answers eg photons absorbed (1) not just light hits not merely 'electrons released' or 'electrons lost' (as alternative to electron flow) **allow** electrons move to holes (1) **allow** holes move oppositely to electrons (1) eg 'light knocks the silicon's electrons free which cause a current' (3)

Question			Answer	Marks	Guidance
	(b)		**(Level 3)** Answer shows a sensible detailed or quantitative prediction and explanation **and** a clear workable plan involving clear fair testing. Quality of written communication does not impede communication of the science at this level. (5–6 marks) **(Level 2)** Answer shows a sensible prediction or explanation **and** a clear workable plan involving clear fair testing. Quality of written communication partly impedes communication of the science at this level. (3–4 marks) **(Level 1)** Answer shows a sensible prediction **or** a basic workable plan. Quality of written communication impedes communication of the science at this level. (1–2 marks) **(Level 0)** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*** **Relevant points**(with plan as level 2) **indicative of level 3 include** • (prediction / explanation) quantitative or more detailed eg double area double output eg double diameter / length – quadruple output eg more area so more light absorbed and more output eg results in more electrons being knocked loose from the silicon atoms (in the crystal) **Relevant points indicative of level 2 include:** • (clear workable plan) eg measure the current / voltage produced eg use light of the same intensity / same distance from solar cell eg measure the diameter of each photocell to calculate the surface area of each • (sensible prediction / explanation) eg larger photocells more light falls on them eg larger photocells give more output **Relevant points indicative of level 1 include:** • (workable plan) eg shine light / Sun on photocells and measure output eg compare output of different cells **or** • (sensible prediction / explanation) eg larger photocells more light falls on them eg larger photocells give more output
			Total	**9**	

Question	Answer	Marks	Guidance
5 a **C O M M O N**	(full calculation): (720 – 240p =) 480p or £4.80 **and** Habib is correct scores [3] **if numerical answer above is incorrect or incomplete then:** cooker: 2 x 6 x 20p = 240p [1] immersion heater : 3 x 12 x 20p = 720p [1] **or** use of **2** x 6 **and** 3 x 12 [1] use of x 20p [1]	3	**answers acceptable in pence or pounds** **allow** 720 – 240p = 480p with no comment [2] **allow** 720 – 240p = 480p and Habib is correct [3] **allow** £4.80 with no comment [2] **allow** 720 – 240p = 480p [2] **allow** £4.80 and Alice is correct [2] Other acceptable full calculations: **But** £2.40 + £5.00 = £7.40 and this is near to £7.20 so Habib is correct [3] **OR** 2 x £2.40 = £4.80 which is less than £7.20 so Habib is correct [3] **Only** award 3 marks if Habib is identified along with a full calculation

b	**(at a voltage of 4.00 x 10^5)** 5(.00) x 10^3 **or** 5000 (A) [1] **(at a voltage of 2.75 x 10^5)** 7.273 x 10^3 **or** 7.273 x 10^3 **or** 7273 **or** 7272 (A) [1] (higher voltages best because) lower current / keeps wires cooler / reduces heat loss or energy waste [1]	3	for higher voltage **allow** 7270 **allow** 7.3 x 10^3 or 7300 **allow** 7200 or 7.2 x 10^3 [1] **allow** (higher voltages) - greater efficiency / less power loss [1] **ignore** cost
	Total	**6**	