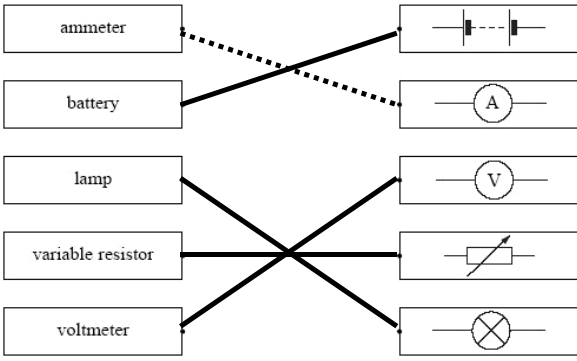


Question number	Answer	Notes	Marks
1 (a)	 <p>all 4 lines;;; any 2 lines;;; any one line;</p>	(dotted line is given)	3
(b) (i)	light dependent resistor / LDR;	allow <ul style="list-style-type: none"> • photo sensitive resistor • light sensitive resistor allow recognisable spellings	1
(ii)	thermistor;	allow recognisable spellings total marks = 5	1

Question number	Answer	Notes	Marks
2	<p>Max of three electrical hazards identified;;;</p> <p>Max of three amplifying details relevant to the hazard(s) identified;;;</p> <p>MP1. Idea of water in contact with something electrical e.g. plugs/sockets/switches;</p> <p>MP2. Idea that an electrical device with a heating element reaches a high temperature;</p> <p>MP3. Idea that damaged equipment poses a hazard; e.g. microwave oven</p> <p>MP4. Idea overloaded cables or sockets;</p> <p>MP5. Idea of trip hazard from trailing cables;</p>	<p>Max of 2 amplifications for any one hazard. A repeated amplification can only be credited once e.g. shock, fire, provide plenty of sockets e. Idea that water conducts electricity;</p> <p>Idea that this can cause shock;</p> <p>(risk of) burns;</p> <p>idea that insulation can melt and cause a fire;</p> <p>Live parts should not be exposed; Idea that this can cause shock; leaky microwave radiation can cause cancer;</p> <p>circuits should have correct fuses; can cause a fire;</p> <p>don't use multiway socket extensions; provide sufficient sockets;</p> <p>Do not use extension cables; Provide sufficient sockets; Use short mains leads; NOTE</p>	6

	MP6. Idea of misusing equipment e.g. sticking metal objects into a socket or exposed heating element;	Appropriate training/safety regime, e.g. use of 'blanks' to cover sockets that children can reach; Idea that this can cause shock; Use proper (insulated) tools;	
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Total 6 marks

Question number	Answer	Notes	Marks
3	<p>Any four of -</p> <p>MP1. either transfer between the two is by conduction; or same SA either way up.</p> <p>MP2. Infrared (radiation) mentioned;</p> <p>MP3. Idea of emission of thermal energy;</p> <p>MP4. a correct effect of (surface) colour on emission;</p> <p>MP5. Comparative of surfaces;</p> <p>MP6. correct statement about thermal energy flow at equilibrium temperature;</p>	<p>- ignore other comments about conduction, convection, absorption and reflection</p> <p>for thermal energy accept heat or radiation e. black emits heat e.</p> <ul style="list-style-type: none"> • black is a good emitter • white is a poor emitter <p>e.g. the black loses more heat than the white</p>	4

Total 4 marks

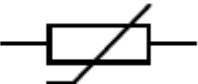





Question number	Answer	Notes	Marks
4 a i	Power = current x voltage;	Accept <ul style="list-style-type: none"> rearranged equation equation in recognised symbols 	1
ii	Substitution and rearrangement; Evaluation; eg $I = 2000 / 230$ 8.7 (A)	Accept <ul style="list-style-type: none"> 9 (A) 8.695.....(A) ETC NOT <ul style="list-style-type: none"> 8.6 incorrect truncation 9.0 incorrect rounding 	1 1
iii	D 13 A		1
b	Series – single switch to control both; Parallel – independent control;	Allow idea of one element failing (and the other continuing) ignore comments about voltages or currents there is no mark for getting the 2 answers reversed	1

c	<p>i</p> <p>ANY FOUR FROM –</p> <p>MP1. earth connected to (metal) casing;</p> <p>MP2. If casing becomes live/ live wire touches case;</p> <p>MP3. Provides low resistance path (to earth);</p> <p>MP4. (So) large/surge current <u>in earth wire</u>;</p> <p>MP5. (hence) fuse breaks/melts/blows;</p> <p>MP6. (so) circuit switches off or current stops or supply cuts off;</p>	<p>Allow circuit breaker(RCCB)</p> <p>DO NOT CREDIT: the electricity goes to the ground/eq for MP3</p>	4
	<p>ii</p> <p>any two from</p> <p>MP1. It has a metal case;</p> <p>MP2. Metals/the case conducts (electricity);</p> <p>MP3. to prevent (user getting) a shock;</p>		1 1

(Total for question 4 = 12 marks)

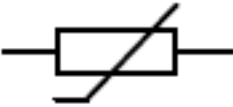
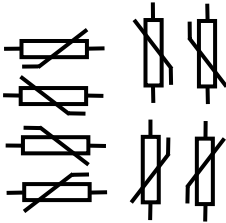
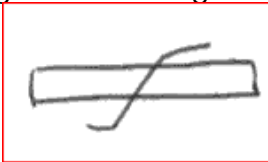
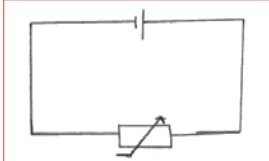

Question number	Answer	Notes	Marks
5 a	Any FOUR from: MP1. Current in <u>coil</u> ; MP2. (Creates) magnetic field (around the wires of the coil); MP3. Interaction of (this) field with that of (permanent) magnets; MP4. There is a force on the wire(of coil); MP5. Reference to left hand rule; MP6. force up on one side and down on other side;	current in circuit is not enough coil becomes an electromagnet allow field cutting as the interaction idea of catapult field reference to moment/turning effect on the coil	4
b i	one of <ul style="list-style-type: none"> • Reverse supply polarity (however described); • reverse current direction (however described); • swap magnets over(however described); 		1
ii	any one from: <ul style="list-style-type: none"> • Reduce current (however described); • Reduce voltage (however described); • increase resistance of circuit (however described); • weaker magnetic field (however described); 	Allow : less turns on coil Condone: fewer coils	1

(Total for Question 5= 6 marks)

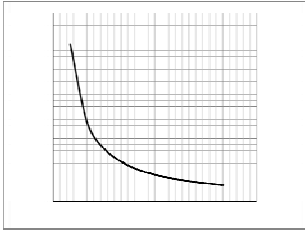
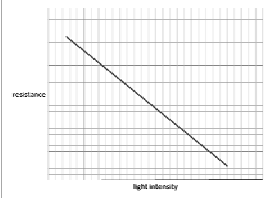

Question number	Answer	Notes	Marks
6 (a) (i)	<p>symbols for circuit components;</p> <ul style="list-style-type: none"> • cell, battery, 'box' labelled power supply, a.c. symbol, component ends for battery • ammeter or milliammeter • thermistor  <p>a series circuit;</p> <p>(ii) voltmeter in parallel with thermistor;</p>	<p>Acceptable power supply symbols</p>   <p>   (DC) or  (AC) </p> <p>ignore all other symbols</p> <p>ecf from 'thermistor' in ai</p>	<p>2</p> <p>1</p>

(iii)	<p>any FIVE from:</p> <p>MP1. measure current at any known/fixed temperature;</p> <p>MP2. measure voltage at any known/fixed temperature;</p> <p>MP3. measure temperature;</p> <p>MP4. vary temp and take new readings ;</p> <p>MP5. idea of allowing temp to equalise between readings;</p> <p>MP6. either change temp by heating water OR start at 100°C and allow to cool;</p> <p>MP7. either start from ice OR use ice cubes to take temp down below room temp;</p> <p>MP8. calculate V/I;</p> <p>MP9. repetition/averaging (at any stage);</p> <p>MP10. use of stirrer/digital thermometer;</p>		5
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Question number	Answer	Notes	Marks
6 (b) (i)	<p>no mark for the choice any valid explanation (dependant on choice of line or curve); e.g. A/curve it fits more points/all the points are closer to the line / eq;</p> <p>OR B /straight line it has 4 points above the line, 4 points below the line/eq;</p>	<p>accept theory says it should be a curve the resistance will not be zero at 100 °C</p>	1
(ii)	<p>One of the following ideas: -</p> <ul style="list-style-type: none"> • the new point could be nearer to one line than the other; • the lines are furthest apart at 10°C; 	<p>accept this measurement would give more data</p>	1
(c)	<p>Any one correct ; All three correct;; L metal wire at constant temperature K diode J filament lamp</p>		1

Question number	Answer	Notes	Marks
7 (a)	 <p>Symbol can be in any orientation, e.g.</p> 	<p>the line through the rectangle must be correct</p>  =0 <p>Ignore the size Ignore the rest of the circuit</p>  <p>e.g. =0 as the line through is incorrect</p> <p>Allow without the connection leads</p>  =1	1
(b)	<p>(i) Voltage = current x resistance;</p> <p>(ii) Convert milliamps to amps OR kilo-ohms to ohms; Substitution into <i>correct</i> equation & rearrangement; Calculation to greater than 1SF;</p> <p>2.6 mA = 0.0026 A</p> $(R) = \frac{13.2}{0.0026}$ $= 5077 (\Omega)$	<p>Allow $V = IR$ Allow rearrangements ignore a bald 'triangle'</p> <p>'show that' question, working must be shown for full mark</p> <p>Allow 5080, 5076 (truncation) 5.080 with working is worth 2 marks 5.08 with no working is worth 1 mark</p>	1 3

Question number	Answer	Notes	Marks
7 (c)	<p>Any five of <i>ABOUT A</i></p> <ol style="list-style-type: none"> 1. Resistance of A decreases with temperature; 2. For A, {largest slope / rate of change} is at lower temperature ORA {smallest slope /rate of change} is at higher temperature; 3. A is a thermistor (ntc); <i>ABOUT B</i> 4. Resistance of B increases with temperature; 5. For B, {largest slope / rate of change} is at higher temperature(s) ORA {smallest slope /rate of change} is at lower temperature; 6. For B, resistance is constant below 50 °C; <p><i>ABOUT BOTH</i></p> <ol style="list-style-type: none"> 7. More results for B/ fewer results for A; 8. stated both relationships are non-linear; 9. Range of (temperature/resistance) values for both is similar; 10. data comparison e.g. both have the same resistance at 80 °C; 	<p>Accept</p> <ul style="list-style-type: none"> • (MP1) for A, when the temperature is low, the resistance is high, ORA • (MP4) for B, when the temperature is low, the resistance is low, ORA <p>Allow component B is a ptc thermistor ORA Up to 60 °C</p> <p>Ignore: inversely proportional positive/negative correlation</p> <p>Do not take implication of MP8 when MP 1,2,4,5 is given</p>	5
		Total	10

Question number	Answer	Notes	Marks
8	<p>Bright light low resistance/Dim light high resistance;</p> <p>Idea of an inverse relationship between R and intensity; e.g. 'bright at lower resistance' ORA =2 marks</p> <p>Idea of non-linear relationship;</p>	<p>ACCEPT Correct answers shown on a <u>labelled</u> sketch graph (light / intensity / light intensity acceptable for one axis, resistance for the other)</p> <div style="display: flex; align-items: center; margin-bottom: 10px;">  = 0 (axis/axes not labelled) </div> <div style="display: flex; align-items: center; margin-bottom: 10px;">  = 2 (first two marking points) </div> <div style="display: flex; align-items: center;">  = 3 marks </div> <p>If diagram and text contradict, use list principle</p> <p>REJECT Negative values of resistance or light intensity in sketch graph for 1 mark</p>	3

Total 3 Marks

Question number	Answer	Notes	Marks
9 (a)	Any two of braking force; air resistance / drag; (road or tyre) friction;	ACCEPT Headwind/wind resistance in this case	2
(b) (i)	force = mass x acceleration;	ACCEPT mass = force ÷ acceleration ACCEPT acceleration = force ÷ mass ACCEPT standard symbols, $F = m \times a$	1
(ii)	Substitution in correct equation; Calculation; e.g. $1400 \times 5.5 = 7700 \text{ (N)}$ or 7.7 k(N)	correct answer = 2 marks	2
(c)	Attempt at area under the graph (e.g. $\frac{1}{2} \times \text{base} \times \text{height}$); $\frac{1}{2} \times 4 \times 22$; Correct answer 44 (m); OR distance = (average) speed x time; 11×4 ; correct answer 44 (m)	correct answer = 3 marks first mark implied in correct substitution first mark implied in correct substitution	3
(d) (i)	(graph is a) curve(d line) /gradient changes / slope changes / (graph is) not a straight line / graph levels off;		1
(ii)	Any two of <u>Increase</u> in air resistance / drag / wind resistance; <u>Increase</u> in road resistance / (tyre) friction; <u>Decrease</u> in resultant force; Road becomes <u>steeper</u> / goes uphill;	IGNORE references to terminal velocity IGNORE 'more weight in the car' IGNORE 'driver changed gear' IGNORE 'driver turned corner'	2

Total 11 Marks

Question number	Answer	Notes	Marks
10 (a)	A carbon;		(1)
(b)	A negatively charged electrons;		(1)
(c)	D steel;		(1)
(d)	C 2 N poles facing;		(1)

Total for Question 10 = 4 marks