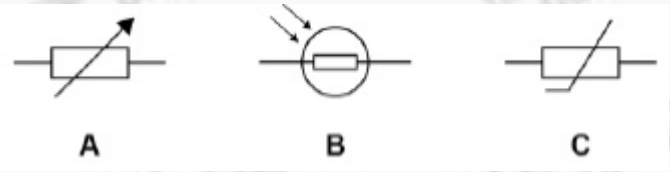
Circuits Revision Questions With Answers

Q1.

Figure 1 shows the circuit symbol for three different components.

Figure 1



(a) Which component is a variable resistor?

Tick **one** box.

A ☐ **B** ☐ **C** ☐

(1)

(b) Which component is a thermistor?

Tick **one** box.

A ☐ **B** ☐ **C** ☐

(1)

(c) In which component will the resistance decrease when the temperature increases?

Tick **one** box.

A ☐ **B** ☐ **C** ☐

(1)

(d) In which component will the resistance decrease when the light intensity increases?

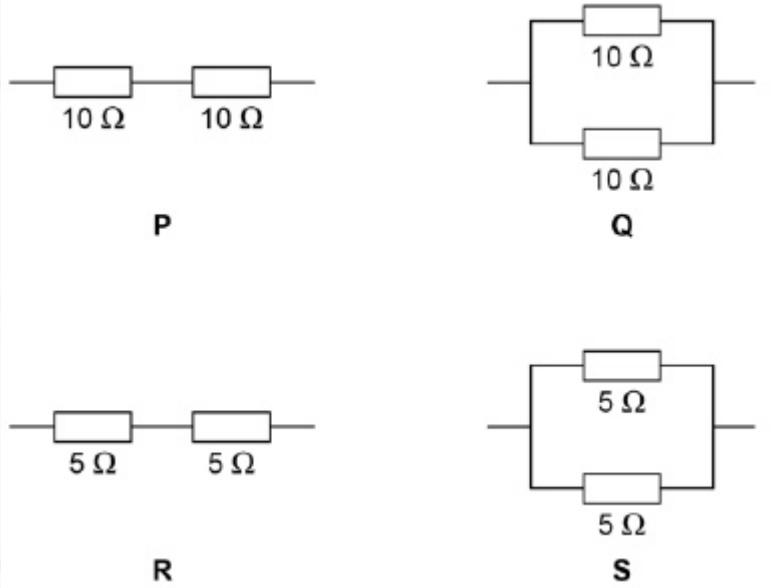
Tick **one** box.

A ☐ **B** ☐ **C** ☐

(1)

Figure 2 shows four different arrangements of resistors.

Figure 2



(e) Two of the arrangements are in series and two are in parallel.

Describe the difference between a series and a parallel arrangement.

_____

_____

_____

_____

(2)

(f) Which arrangement has a resistance of 10 Ω?

Tick **one** box.

P ☐ **Q** ☐ **R** ☐ **S** ☐

(1)

(g) Which arrangement has the highest resistance?

Tick **one** box.

P ☐ **Q** ☐ **R** ☐ **S** ☐

(1)

(h) A student connects a resistor to a cell for 60 seconds.

The current through the resistor is 0.97 A

Calculate the charge flow.

Use the equation:

charge flow = current × time

Give your answer to 2 significant figures.

_____

_____

_____

_____

_____

_____

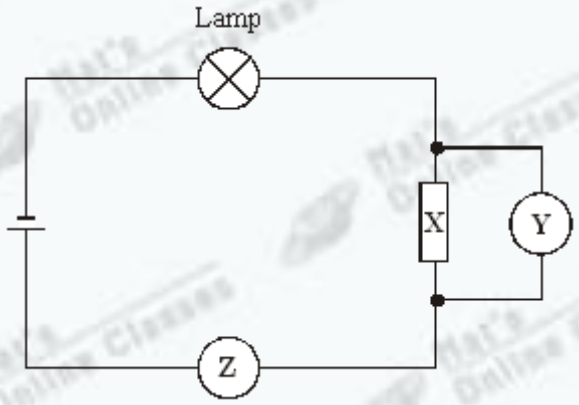
Charge flow = _____ C

(3)

(Total 11 marks)

Q2.

The diagram shows a circuit.



(a) (i) Name component **X**. _____

(ii) What does meter **Y** measure? _____

(iii) What does meter **Z** measure? _____

(3)

(b) Which of the equations shows how current, potential difference and resistance are related?

Tick the box against the correct equation.

current = potential difference × resistance ☐

potential difference = current × resistance ☐

resistance = current × potential difference ☐

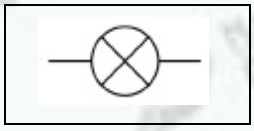
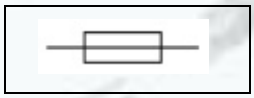
(1)

(Total 4 marks)

Q3.

Components can be connected in electrical circuits in different ways.

(a) Draw **one** line from each circuit symbol to the name of the component it represents.

Circuit symbol	**Name of component**
	cell
	diode
	fuse
	lamp
	variable resistor

(2)

(b) Complete the sentence.

Choose the answer from the box.

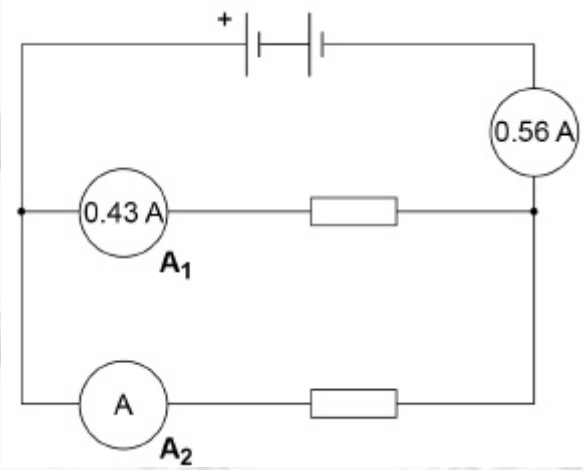
charge	**energy**	**potential difference**	**resistance**

Electric current is the rate of flow of _____.

(1)

Figure 1 shows a parallel circuit.

Figure 1



(c) Calculate the current measured by ammeter $\mathbf{A_2}$.

Current = _____ A

(1)

(d) The circuit is connected for 300 s

The total current in the circuit stays at 0.56 A

Calculate the total charge flow.

Use the equation:

charge flow = current × time

_____

_____

_____

_____

Charge flow = _____ C

(2)

(e) The potential difference supplied by the battery is 4.5 V

Calculate the total energy transferred in 300 s

Use the equation:

energy transferred = charge flow × potential difference

Use your answer to part (d).

_____

_____

_____

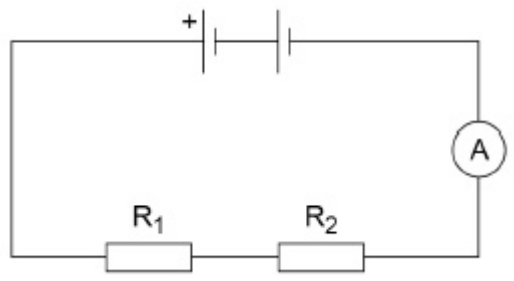
_____

Energy transferred = _____ J

(2)

(f) **Figure 2** shows a series circuit.

Figure 2



Resistor **R_2** breaks.

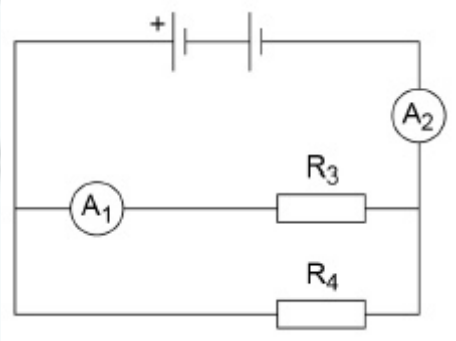
What happens to the reading on the ammeter?

_____

(1)

(g) **Figure 3** shows a parallel circuit.

Figure 3



Resistor **R_3** breaks.

What happens to the readings on the ammeter?

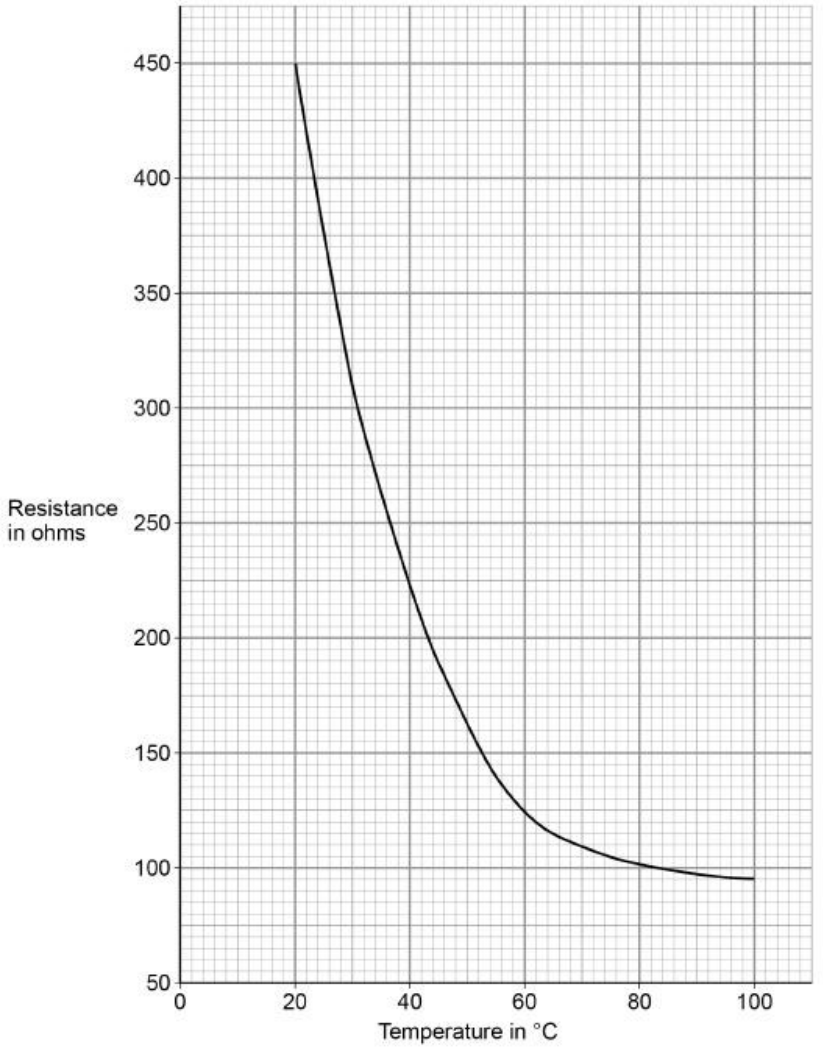
Ammeter **A_1** _____

Ammeter **A_2** _____

(2)

Figure 4 shows how the resistance of a component varies with temperature.

Figure 4



(h) What is the name of the component?

Tick **one** box.

LED ☐

LDR ☐

Resistor ☐

Thermistor ☐

(1)

(i) What is the resistance of the component at a temperature of 50 °C?

Resistance = _____ Ω

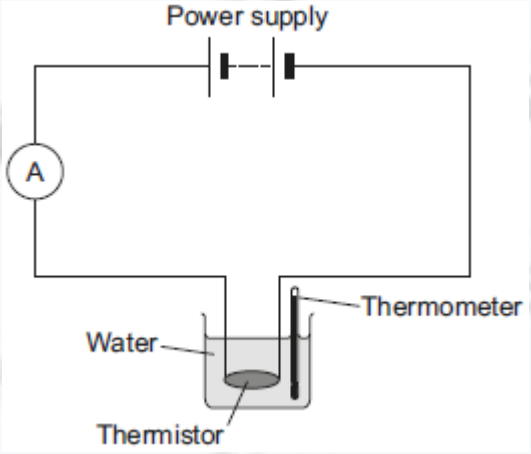
(1)

(Total 13 marks)

Q4.

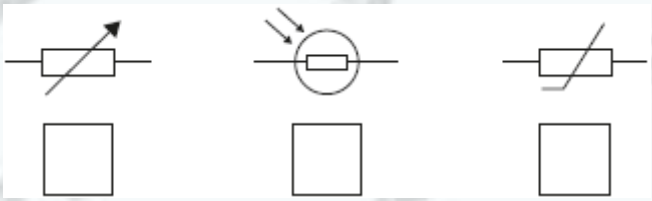
Figure 1 shows the apparatus used to investigate how the current through a thermistor depends on the temperature of the thermistor.

Figure 1



(a) Which **one** of the following is the correct circuit symbol for a thermistor?

Tick (✓) **one** box.

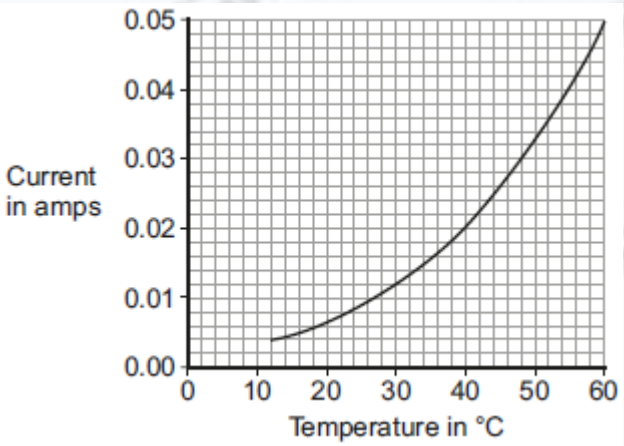


(1)

(b) To get a range of results, hot water at 60 °C was poured into the beaker. The temperature of the water and current through the thermistor were then recorded as the water cooled.

The results of the investigation are shown in **Figure 2**.

Figure 2



(i) Suggest **one** way the investigation could have been changed to give a wider range of temperatures.

_____

_____

(1)

(ii) Describe how the current through the thermistor depends on the temperature of the thermistor.

_____

_____

(1)

(iii) Use **Figure 2** to determine the current through the thermistor at 40 °C.

Current at 40 °C = _____ A

(1)

(iv) At 40 °C the thermistor has a resistance of 250 Ω.

Use your answer to part **(iii)** and the resistance of the thermistor to calculate the potential difference across the thermistor.

_____

_____

_____

_____

Potential difference = _____ V

(2)

(v) The potential difference across the thermistor stays the same all through the investigation.

What conclusion can be made from the results in **Figure 2** about the resistance of the thermistor as the temperature of the thermistor **decreases?**

Tick (✓) **one** box.

the resistance increases ☐

the resistance does not change ☐

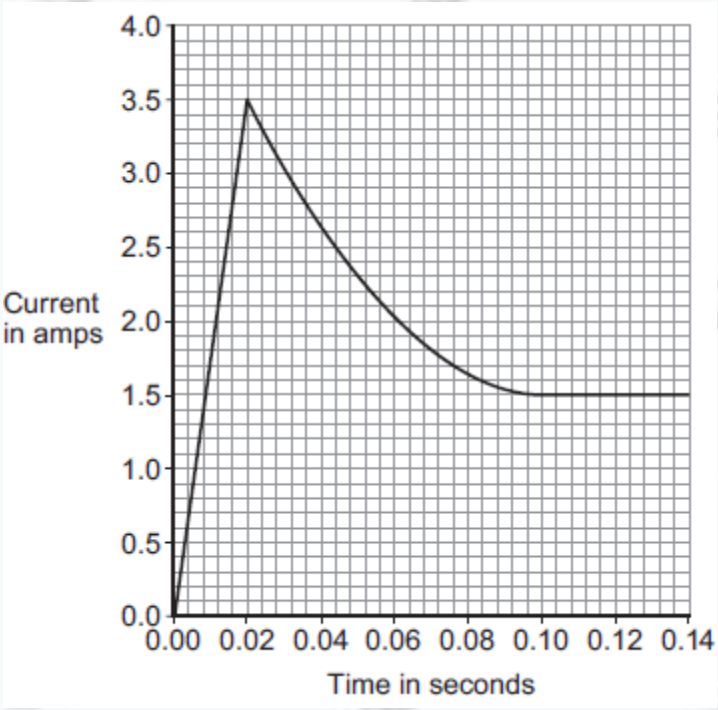
the resistance decreases ☐

(1)

(Total 7 marks)

Q5.

The graph shows how the current through a filament bulb changes after the bulb is switched on.



(a) What happens to the current through the bulb in the first 0.02 seconds after the bulb is switched on?

_____

(1)

(b) Between 0.02 seconds and 0.08 seconds the current through the bulb decreases.

(i) What, if anything, happens to the **resistance** of the bulb between 0.02 seconds and 0.08 seconds?

Draw a ring around the correct answer.

decreases **does not change** **increases**

(1)

(ii) What, if anything, happens to the **temperature** of the bulb between 0.02 seconds and 0.08 seconds?

Draw a ring around the correct answer.

decreases **does not change** **increases**

(1)

(c) The bulb is connected to a 12 V power supply.

Calculate the power of the bulb when the current through the bulb is 1.5 A.

Choose the unit from the list below.

coulomb **joule** **watt**

_____

_____

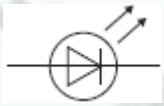
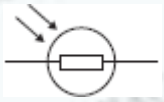
Power = _____ unit _____

(3)

(Total 6 marks)

Q6.

(a) Draw **one** line from each circuit symbol to its correct name.

Circuit symbol	Name
	Diode
	Light-dependent resistor (LDR)
	Lamp
	Light-emitting diode (LED)

(3)

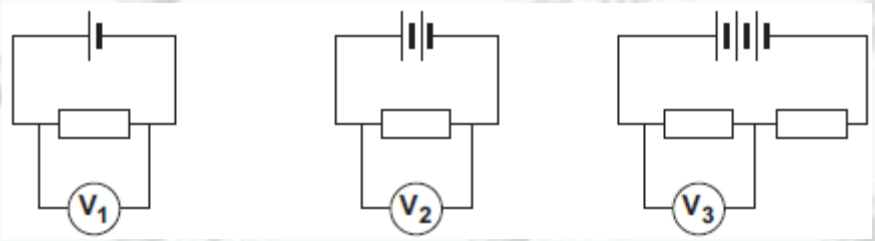
(b) **Figure 1** shows three circuits.

The resistors in the circuits are identical.

Each of the cells has a potential difference of 1.5 volts.

Figure 1

Circuit 1 **Circuit 2** **Circuit 3**



(i) Use the correct answer from the box to complete the sentence.

half	**twice**	**the same as**

The resistance of **circuit 1** is _____ the resistance of **circuit 3**.

(1)

(ii) Calculate the reading on voltmeter $\mathbf{V_2}$.

_____

Voltmeter reading $\mathbf{V_2}$ = _____ V

(1)

(iii) Which voltmeter, $\mathbf{V_1}$, $\mathbf{V_2}$ or $\mathbf{V_3}$, will give the lowest reading?

Draw a ring around the correct answer.

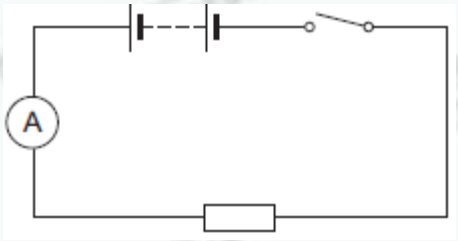
$\mathbf{V_1}$ $\mathbf{V_2}$ $\mathbf{V_3}$

(1)

(c) A student wanted to find out how the number of resistors affects the current in a series circuit.

Figure 2 shows the circuit used by the student.

Figure 2



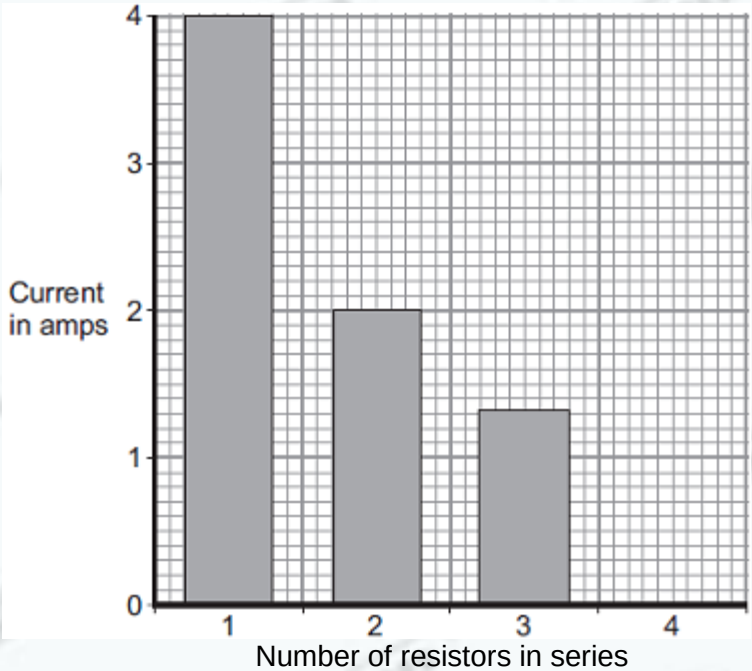
The student started with one resistor and then added more identical resistors to the circuit.

Each time a resistor was added, the student closed the switch and took the ammeter reading.

The student used a total of 4 resistors.

Figure 3 shows three of the results obtained by the student.

Figure 3



(i) To get valid results, the student kept one variable the same throughout the experiment.

Which variable did the student keep the same?

_____

(1)

(ii) The bar chart in **Figure 3** is not complete. The result using 4 resistors is not shown.

Complete the bar chart to show the current in the circuit when 4 resistors were used.

(2)

(iii) What conclusion should the student make from the bar chart?

_____

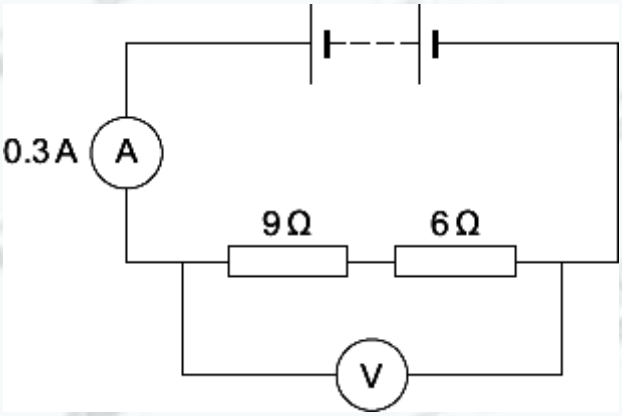
_____

(1)

(Total 10 marks)

Q7.

(a) The diagram shows a simple circuit.



(i) Calculate the total resistance of the two resistors in the circuit.

_____

Total resistance = _____ Ω

(1)

(ii) Calculate the reading on the voltmeter.

Show clearly how you work out your answer.

_____

_____

Voltmeter reading = _____ V

(2)

(iii) Draw a ring around the correct answer in the box to complete the sentence.

Replacing one of the resistors with a resistor of higher value will

decrease
not change
increase

the reading on the ammeter.

(1)

(b) The voltmeter in the circuit is replaced with an oscilloscope.

Which one of the diagrams, **X**, **Y** or **Z**, shows the trace that would be seen on the oscilloscope?

Write your answer, **X**, **Y** or **Z**, in the box.

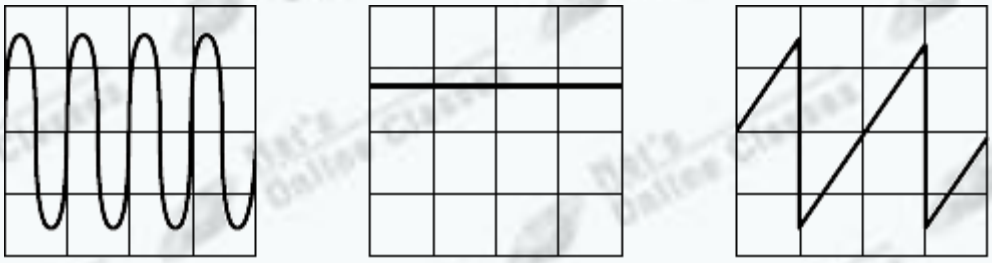


Diagram ☐

Give a reason for your answer.

_____

_____

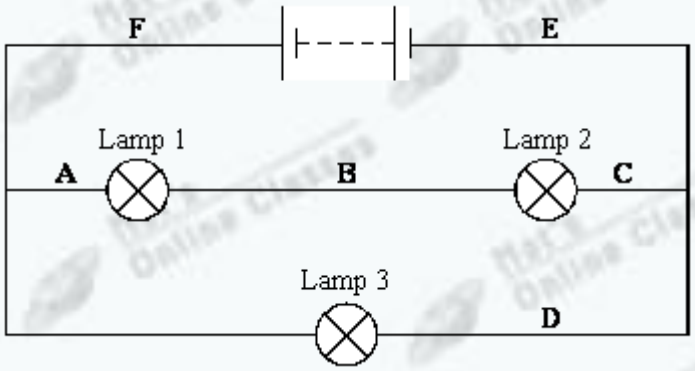
_____

(2)

(Total 6 marks)

Q8.

The circuit contains three identical lamps.



(a) Complete each of the sentences about the circuit, using one of the phrases in the box.

more than	less than	the same as

(i) The current at **A** is _____ the current at **B**.

(1)

(ii) The current at **A** is _____ the current at **D**.

(1)

(iii) The current at **F** is _____ the current at **E**.

(1)

(iv) The current at **F** is _____ the current at **D**.

(1)

(b) In the circuit, which lamp is brightest? _____

Give a reason for your answer.

_____

_____

(2)

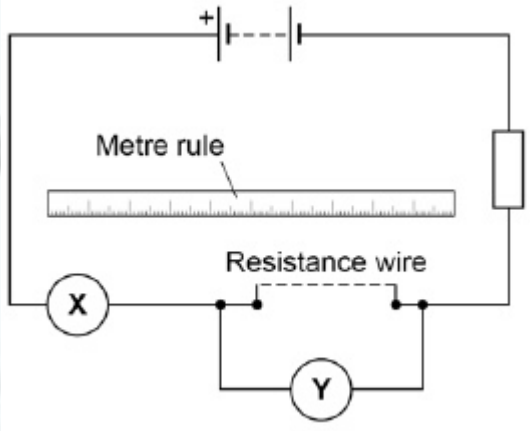
(Total 6 marks)

Q9.

A student investigated how length affects resistance of a wire.

Figure 1 shows the circuit the student used.

Figure 1



(a) The student took measurements using the meters **X** and **Y**.

Name meters **X** and **Y**.

Meter **X** _____

Meter **Y** _____

(2)

The table shows the results.

	Resistance in Ω			
Length in m	**Test 1**	**Test 2**	**Test 3**	**Mean**
0.100	0.66	0.67	0.74	0.69
0.200	1.36	1.40	1.34	1.37
0.300	2.02	2.02	2.03	2.02
0.400	2.77	2.72	2.68	2.72
0.500	3.37	3.35	3.40	3.37
0.600	4.03	4.02	3.96	4.00

(b) For which length of wire are the readings of resistance the most precise?

Give the reason for your answer.

Length = _____ m

Reason _____

_____

(2)

(c) Why did the student do three tests and calculate a mean?

_____

_____

(1)

(d) Write the equation that links current, potential difference, and resistance.

_____

(1)

(e) The potential difference across a piece of wire is 2.1 V

The current in the wire is 0.30 A

Calculate the resistance of the wire.

Write any equation that you use.

_____

_____

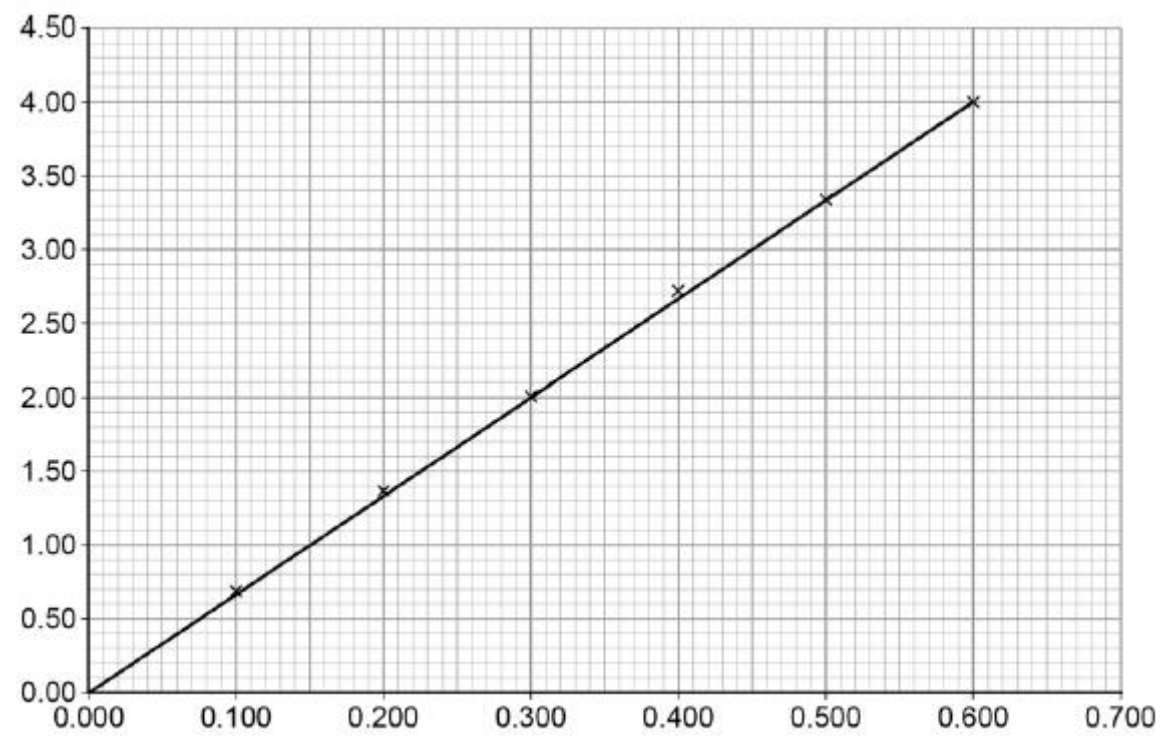
_____

Resistance = _____ Ω

(3)

Figure 2 shows a graph of the results.

Figure 2



(f) What is the label for each axis of the graph?

x-axis _____

y-axis _____

(2)

(g) What conclusion can be made from the graph in **Figure 2**?

_____

_____

(1)

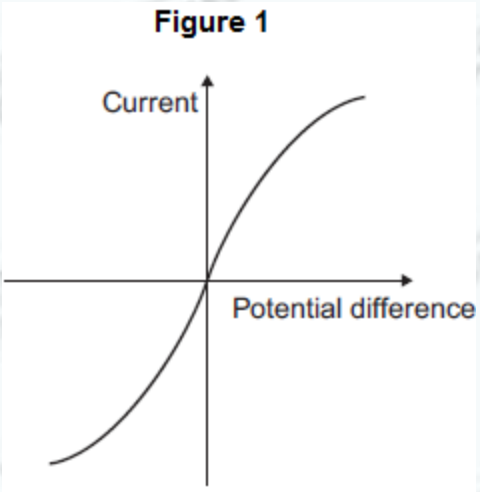
(Total 12 marks)

Q10.

The current in a circuit depends on the potential difference provided by the cells and the total resistance of the circuit.

(a) **Figure 1** shows the graph of current against potential difference for a component.

Figure 1



What is the name of the component?

Draw a ring around the correct answer.

diode **filament bulb** **thermistor**

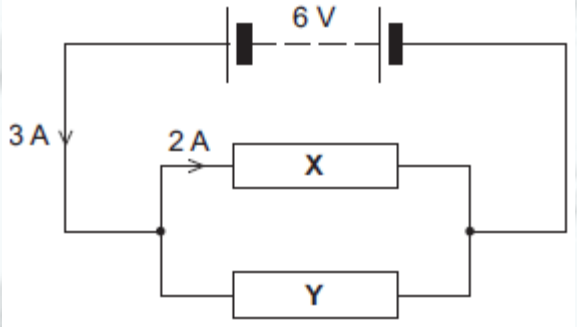
(1)

(b) **Figure 2** shows a circuit containing a 6 V battery.

Two resistors, **X** and **Y**, are connected in parallel.

The current in some parts of the circuit is shown.

Figure 2



(i) What is the potential difference across **X**?

Potential difference across **X** = _____ V

(1)

(ii) Calculate the resistance of **X**.

_____

_____

Resistance of **X** = _____ Ω

(2)

(iii) What is the current in **Y**?

Current in **Y** = _____ A

(1)

(iv) Calculate the resistance of **Y**.

_____

Resistance of **Y** = _____ Ω

(1)

(v) When the temperature of resistor **X** increases, its resistance increases.

What would happen to the:

- potential difference across **X**
- current in **X**
- total current in the circuit?

Tick (✓) **three** boxes.

	Decrease	**Stay the same**	**Increase**
Potential difference across **X**			
Current in **X**			
Total current in the circuit			

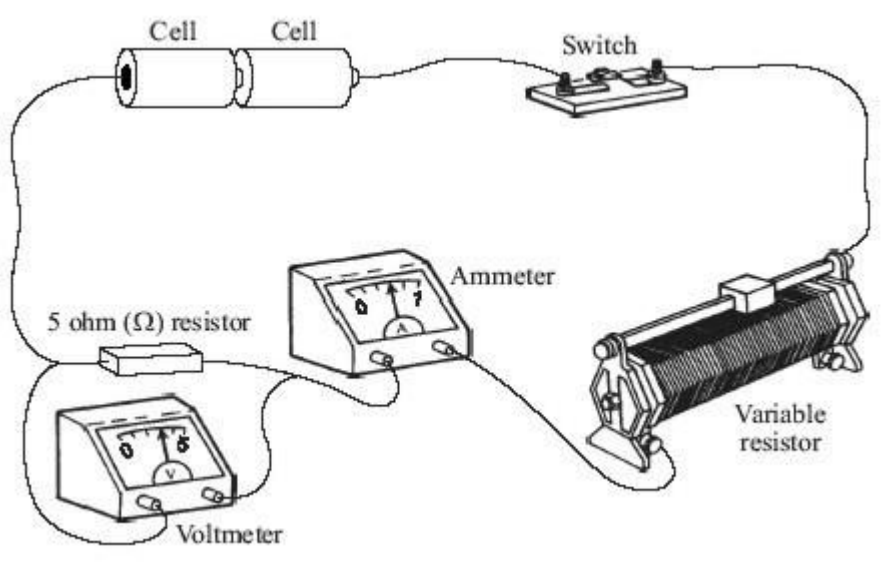
(3)

(Total 9 marks)

Q11.

The drawing shows the circuit used to investigate how the current through a 5 ohm (Ω)

resistor changes as the potential difference (voltage) across the resistor changes.



(a) Draw, in the space below, a circuit diagram of this circuit. Use the correct symbols for each part of the circuit.

(2)

(b) (i) Write down the equation that links current, potential difference and resistance.

_____

(1)

(ii) Calculate the potential difference across the 5 ohm (Ω) resistor when the current through the resistor equals 0.4 A. Show clearly how you work out your

final answer.

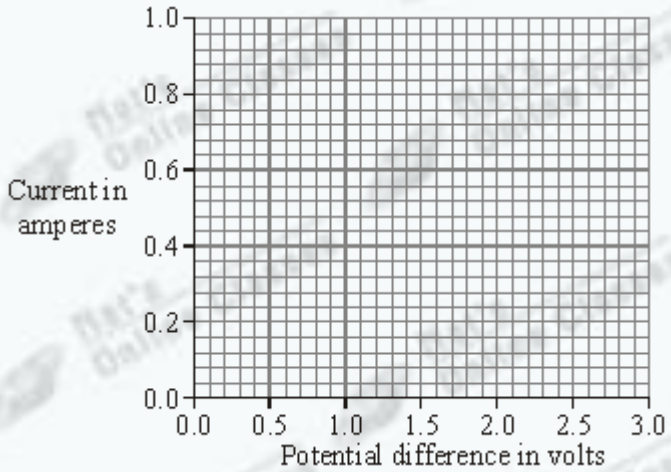
_____

_____

potential difference = _____ volts

(2)

(iii) Complete the graph to show how the current through the resistor changes as the potential difference across the resistor increases from 0 V to 3 V. Assume the resistor stays at a constant temperature.



(2)

(c) The resistor is replaced by a 3 V filament lamp. The resistance of the lamp increases as the potential difference across it increases. Why?

_____

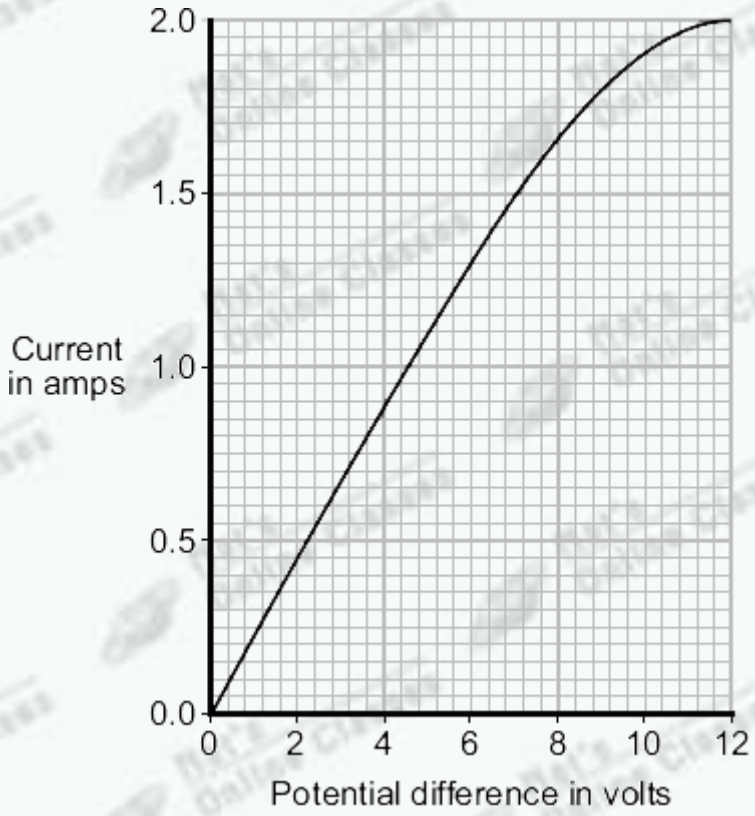
_____

(1)

(Total 8 marks)

Q12.

The graph shows how the electric current through a 12 V filament bulb varies with the potential difference across the bulb.



(a) What is the meaning of the following terms?

electric current

_____

_____

potential difference

_____

_____

(2)

(b) The resistance of the metal filament inside the bulb increases as the potential difference across the bulb increases.

Explain why.

(3)

(c) Use data from the graph to calculate the rate at which the filament bulb transfers energy, when the potential difference across the bulb is 6 V.

Show clearly how you work out your answer.

Rate of energy transfer = _____ W

(2)

(Total 7 marks)

Mark schemes

Q1.

(a) **A** **1**

(b) **C** **1**

(c) **C** **1**

(d) **B** **1**

(e) a series circuit has only one path/loop/branch **1**

a parallel circuit has a branch(es) to provide more than one path / loop **1**

allow answers that describe the difference in terms of potential difference, current or resistance

(f) **R** **1**

(g) **P** **1**

(h) Q = 0.97 × 60 **1**

Q = 58.2 (C) **1**

Q = 58 (C) **1**

*an answer of 58 (C) scores **3** marks*

[11]

Q2.

(a) (i) resistor **1**

(ii) voltage / potential difference / volts / v **1**

(iii) current / amps / A **1**

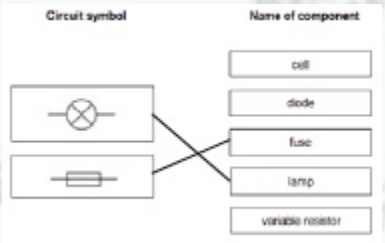
(b) potential difference = current × resistance **1**

no mark if more than one box ticked

[4]

Q3.

(a)



extra lines from circuit symbols negate the mark

1

1

(b) charge

1

(c) 0.13 (A)

1

(d) 0.56 × 300

1

168 (C)

*an answer of 168 (C) scores **2** marks*

1

(e) 168 × 4.5

1

756 (J)

an answer of 756 (J) scores 2 marks allow ecf from part (d)

1

(f) decreases to zero

allow reads zero

1

(g) (A1) decreases to zero

allow reads zero

1

(A2) decreases

*do **not** accept 'to zero' for A2*

1

(h) thermistor

1

(i) answer in range 160–165 (Ω)

1

[13]

Q4.

(a) last box ticked 

1

(b) (i) use hotter water (than 60 °C)

accept use boiling water

accept use water at any stated temperature above 60 °C

or

add ice cubes

accept add water at any stated temperature below 12 °C

use different temperatures is insufficient

1

(ii) the current increases as the temperature increases

1

(iii) 0.02 (A)

1

(iv) 5 (V)

or

their **(b)(iii)** × 250 correctly calculated

*allow **1** mark for correct substitution ie V = 0.02 × 250*

or

*V = their **(b)(iii)** × 250*

2

(v) the resistance increases

1

[7]

Q5.

(a) increases

accept reaches highest value

*do **not** accept increases and decreases*

1

(b) (i) increases

1

(ii) increases

1

(c) 18

*allow **1** mark for correct substitution i.e. 12 × 1.5 provided no subsequent step*

2

watt *accept W*

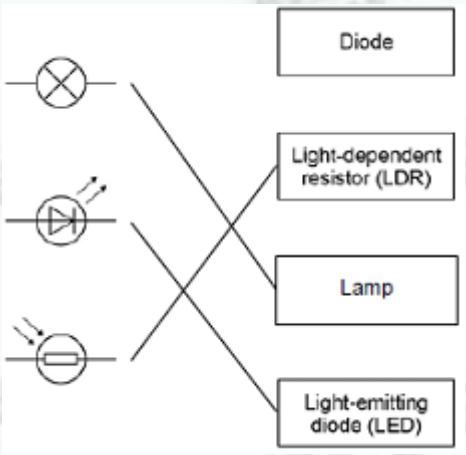
answer may be indicated in the list

1

[6]

Q6.

(a)



*allow **1** mark for each correct line if more than one line is drawn from any symbol then all of those lines are wrong*

3

(b) (i) half

1

(ii) 3(V)

1

(iii) V_1

1

(c) (i) potential difference / voltage of the power supply

accept the power supply
accept the voltage / volts
accept number of cells / batteries
accept (same) cells / batteries
do not accept same ammeter / switch / wires

1

(ii) bar drawn – height 1.(00)A

ignore width of bar
*allow **1** mark for bar shorter than 3rd bar*

2

(iii) as the number of resistors increases the current decreases

1

[10]

Q7.

(a) (i) 15

1

(ii) 4.5 or their (a)(i) x 0.3 correctly calculated

*allow **1** mark for correct substitution, ie 0.3 x 15/their (a)(i), provided no subsequent step*

2

(ii) decrease

1

(b) **Y**

accept any correct indication

*reason only scores if **Y** is chosen*
accept voltage for p.d.

1

(only one that) shows a direct current / p.d.
or
a battery / cell gives a direct current

*accept both **X** and **Z** are a.c.*

or
a battery/cell gives a constant current/p.d.

accept it's a constant current/p.d.
it is not changing is insufficient

1

[6]

Q8.

(a) (i) the same as

1

(ii) less than

1

(iii) the same as

1

(iv) more than

1

(b) 3

accept D

because there is more **or** twice the current in this part of the circuit
or the resistance is less

*accept only one lamp to go through, (not two) **or** on its own not sharing the voltage **or** energy with another*

*do not credit one lamp to go through **or** sharing current*

2

[6]

Q9.

(a) ammeter

1

voltmeter

must be in the correct order

1

(b) 0.300 (m)

1

there is the smallest spread about the mean

1

(c) to reduce the effect of random errors

1

(d) potential difference = current × resistance

allow V = I × R

1

(e) R = V / I

1

R = 2.1 / 0.30

1

R = 7.0 Ω

*an answer of 7.0 Ω scores **3** marks*

1

(f) length in m

1

resistance in Ω

must be in the correct order
allow other correct labelling eg
length / m
length (m)
allow 1 mark if units are omitted

1

(g) resistance is directly proportional to length

1

[12]

Q10.

(a) filament bulb

1

(b) (i) 6 V

1

(ii) 3 Ω or their $\frac{\text{(i)}}{2}$ correctly calculated

allow 1 mark for correct substitution ie

6 = 2 × R

or their (i) = 2 × R

2

(iii) 1 A

1

(iv) 6 Ω or their (i) / their (iii) correctly calculated

1

(v)

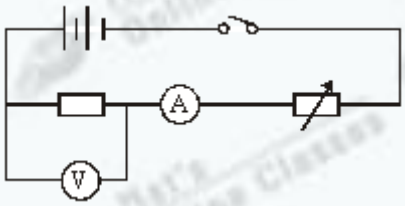
Decrease	Stay the same	Increase
	✓	
✓		
✓		

1
1
1

[9]

Q11.

(a) all symbols correct



accept push switch symbol switch may be open or closed
*any lines through symbols = **0** marks*

1

correct circuit drawn

polarity of cells not relevant provided they are joined correctly

1

voltmeter must be across resistor only

two cells are required in the diagram
ignore the order of the components
allow small gaps in circuit
*omission of any component = **0** marks*

1

(b) (i) potential difference = current × resistance

accept voltage or p.d. for potential difference
accept V= I × R

*do **not** accept C for current*

1

(ii) 2

*allow **1** mark for correct substitution*
wrong working loses both marks

2

(iii) straight line drawn <u>through the origin</u>

judge by eye

straight line passes through I = 0.4, V = their (b)(ii) / 2 **and** 0.0

this mark may be awarded if all points shown including these points are correct even if no line is drawn
*N.B. a curve scores **0** marks*

1

(c) temperature <u>increases</u>

accept filament lamp / it gets <u>hotter</u>
allow heat for temperature

1

[8]

Q12.

(a) electric current
(rate of) flow of (electric) charge / electrons

accept $I = \frac{Q}{t}$

with Q and t correctly named

1

potential difference
work done / energy transferred per coulomb of charge
(that passes between two points in a circuit)

accept $V = \frac{W}{Q}$

with W and Q correctly named

1

(b) metals contain free electrons (and ions)

accept mobile for free

1

as temperature of filament increases ions vibrate faster /
with a bigger amplitude

accept atoms for ions

accept ions/atoms gain energy

accept vibrate more for vibrate faster

do not accept start to vibrate

1

electrons collide more (frequently) with the ions
or
(drift) velocity of electrons decreases

do not accept start to collide

*accept increasing the p.d. increases the temperature (**1** mark)*

and

*(and) resistance increases with temperature (**1** mark) if no other marks scored*

1

(c) 7.8

*allow **1** mark for obtaining value 1.3 from graph*

***or** allow **1** mark for a correct calculation using an incorrect current in the range 1.2-1.6 inclusive*

2

[7]