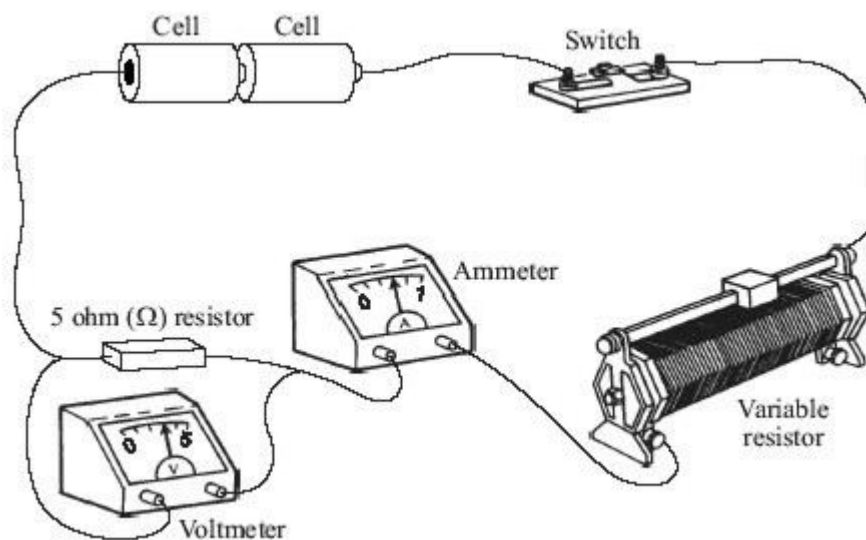


- 1 The drawing shows the circuit used to investigate how the current through a 5 ohm (Ω) resistor changes as the potential difference (voltage) across the resistor changes.



- (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.

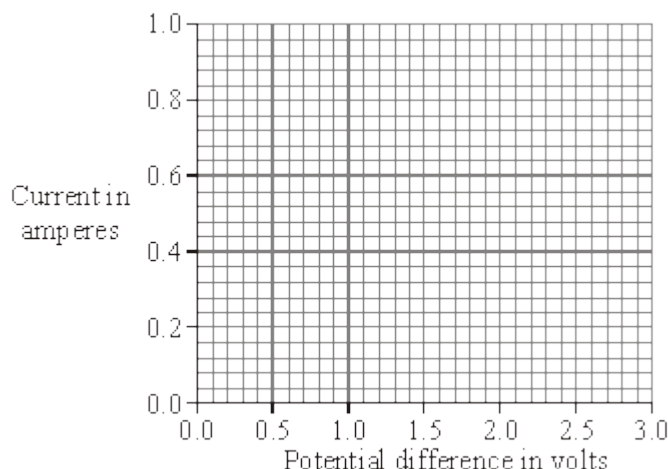
.....

.....

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?

.....

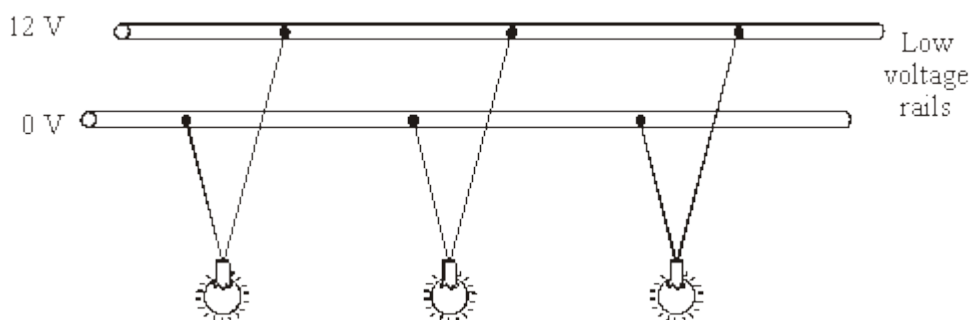
.....

(1)

(Total 8 marks)

2

The diagram shows a 12 volt lighting system. Each lamp has a power of 32 watts.



- (i) Write down the equation that links current, potential difference and power.

.....

(1)

- (ii) Calculate the input current to the lighting system. Show clearly how you work out your answer.

.....

.....

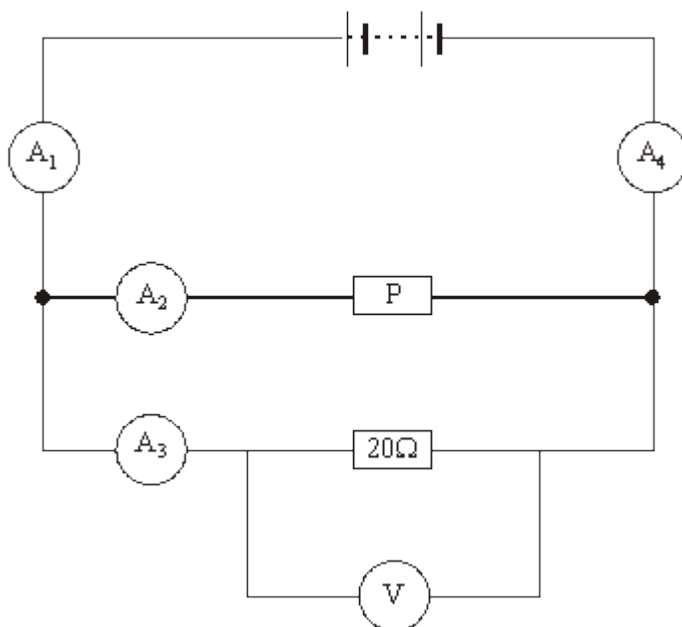
current = A

(2)

(Total 3 marks)

3

The circuit shown has four identical ammeters.



(a) The table gives the current through two of the ammeters.

(i) Complete the table to show the current through the other two ammeters.

Ammeter	Reading on ammeter in amps
A_1	
A_2	0.2
A_3	0.3
A_4	

(2)

(ii) Which **one** of the following statements is correct. Tick (✓) the box next to your choice.

The resistance of **P** is more than $20\ \Omega$.

☐

The resistance of **P** is equal to $20\ \Omega$.

☐

The resistance of **P** is less than $20\ \Omega$.

☐

Give a reason for your choice.

.....

.....

.....

(2)

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

.....

(1)

(ii) Calculate the reading on the voltmeter. Show clearly how you work out your answer.

.....

.....

Voltmeter reading =

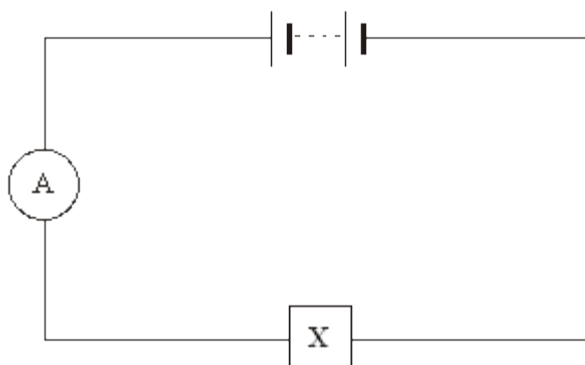
(2)

(iii) State the potential difference of the power supply.

.....

(1)

(c) A second circuit contains an unknown component labelled **X**.



As component **X** is heated, the reading on the ammeter goes up.

What is component **X**?

.....

Give a reason for your answer.

.....

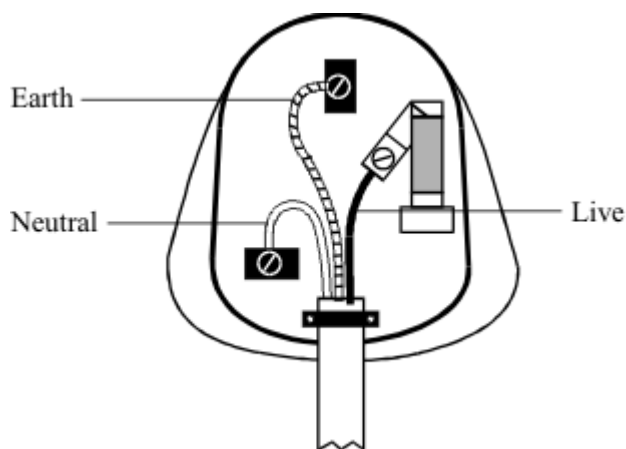
.....

(2)

(Total 10 marks)

4

The diagram shows the inside of a mains plug.

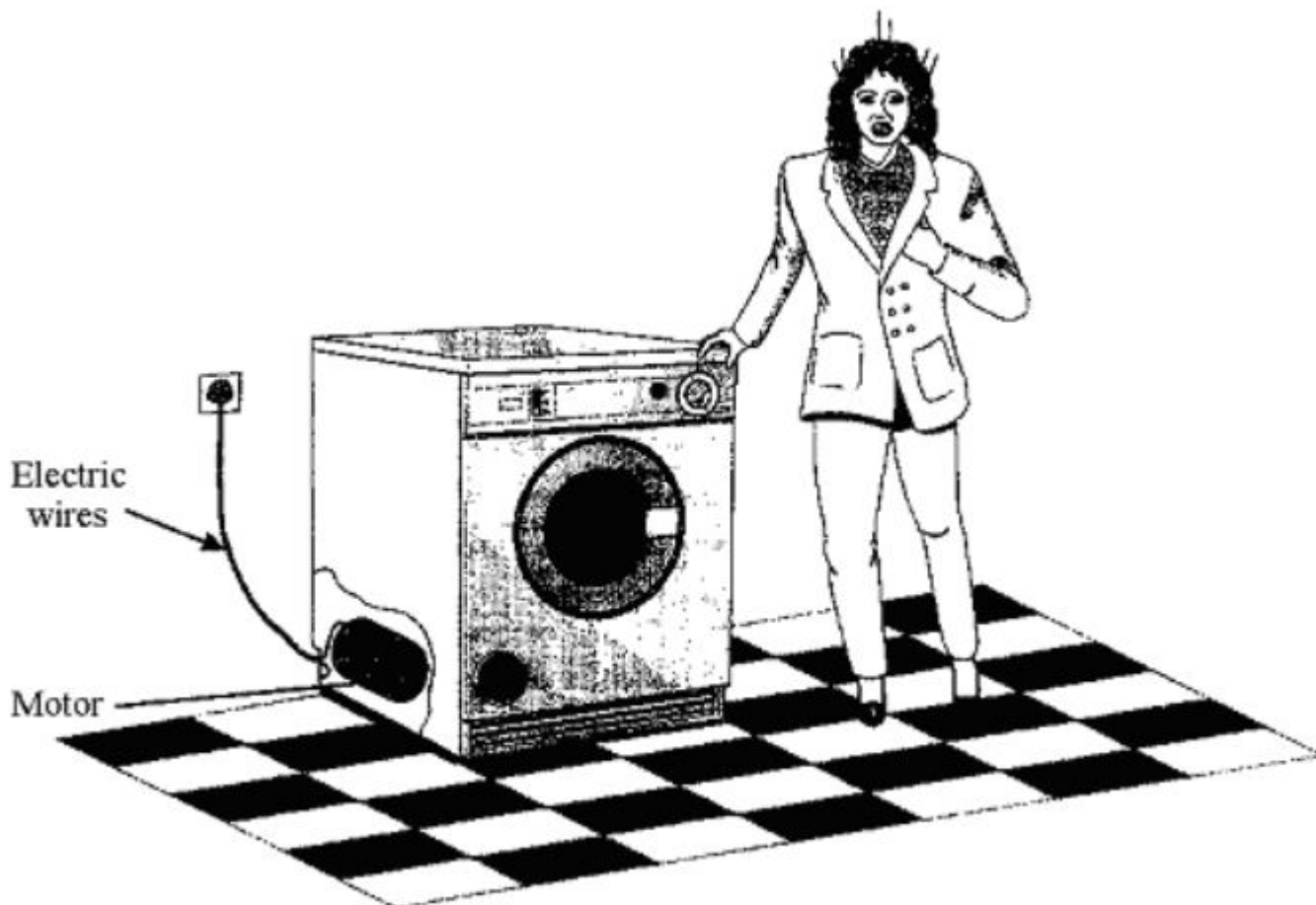


(a) Complete the table.

Wire	Colour of insulation
Earth	
Live	
Neutral	

(3)

(b) The diagram shows a washing machine without an earth connection. The live wire has become loose and is touching the metal case of the washing machine.



(i) Draw on the diagram the path taken by the electricity when the person touches the metal case of the machine.

(1)

- (ii) Describe how the path of the electricity would change if the washing machine had an earth connection.

.....

.....

.....

(2)

- (c) Some electrical appliances use a cable which does not have an earth wire. Which **one** of the following appliances can safely use this type of cable?

hairdrier

iron

refrigerator

.....

Give a reason for your answer.

.....

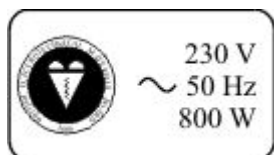
.....

(2)

(Total 8 marks)

5

The information plate on a hairdrier is shown.



- (a) What is the power rating of the hairdrier?

.....

(1)

- (b) (i) Write down the equation which links current, power and voltage.

.....

(1)

- (ii) Calculate the current in amperes, when the hairdrier is being used. Show clearly how you work out your answer.

.....

.....

.....

.....

Current = amperes

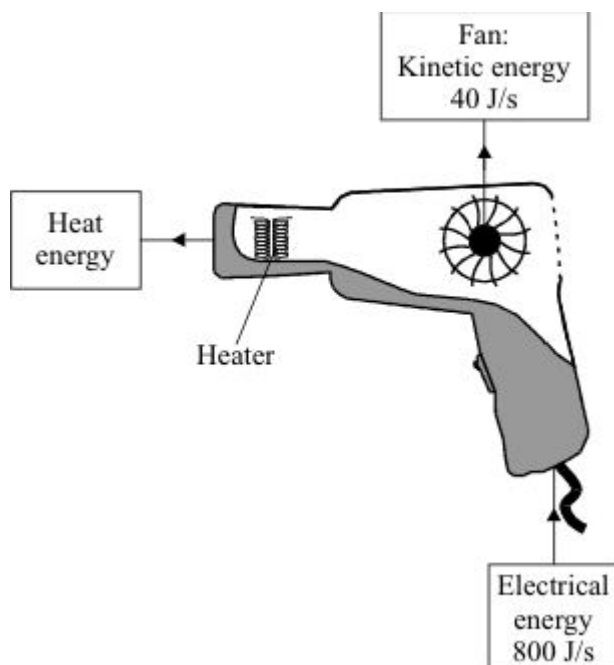
(2)

- (iii) Which **one** of the following fuses, 3A, 5A or 13A, should you use with this hairdrier?

.....

(1)

- (c) The hairdrier transfers electrical energy to heat energy and kinetic energy.



Calculate the efficiency of the hairdrier in transferring electrical energy into heat energy.

.....

.....

.....





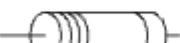



Efficiency =

(2)

(Total 7 marks)

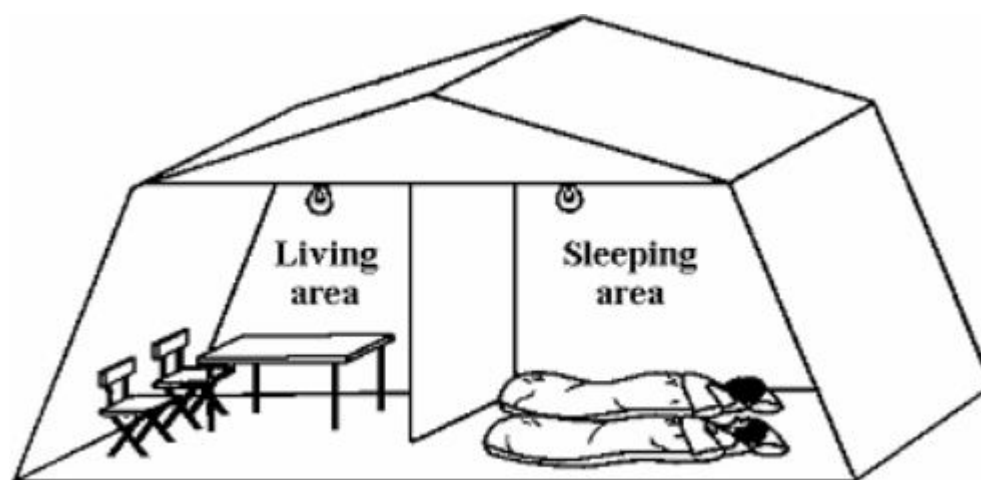
6

- (a) Draw lines to join the picture to the correct circuit symbol. The lamp has been done for you.

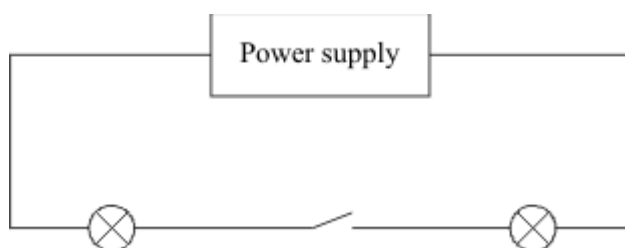
Variable resistor		
Diode		
Resistor		
Lamp		

(2)

- (b) A family tent is to be fitted with a simple lighting circuit.



The diagram shows the first circuit used.



- (i) Are the lamps connected in series or in parallel?

.....

(1)

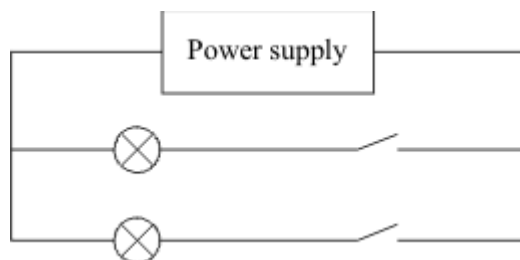
- (ii) This is not a good circuit for using in the tent. Why?

.....

.....

(1)

The diagram shows the second circuit used.



- (iii) Give **two** reasons why this circuit is better than the first circuit.

1.

.....

2.

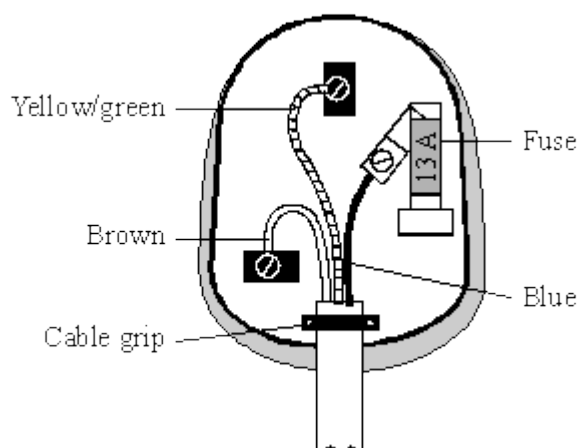
.....

(2)

(Total 6 marks)

7

- (a) The diagram shows a 13 amp plug.



- (i) What is wrong with the way this plug has been wired?

.....

.....

(1)

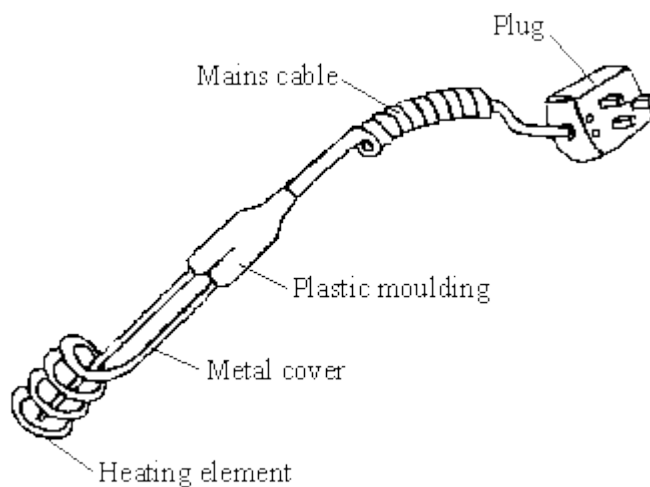
- (ii) Why do plugs have a fuse?

.....

.....

(1)

- (b) The diagram shows an immersion heater which can be used to boil water in a mug.



- (i) Which part of the immersion heater should be connected to the earth pin of the plug?

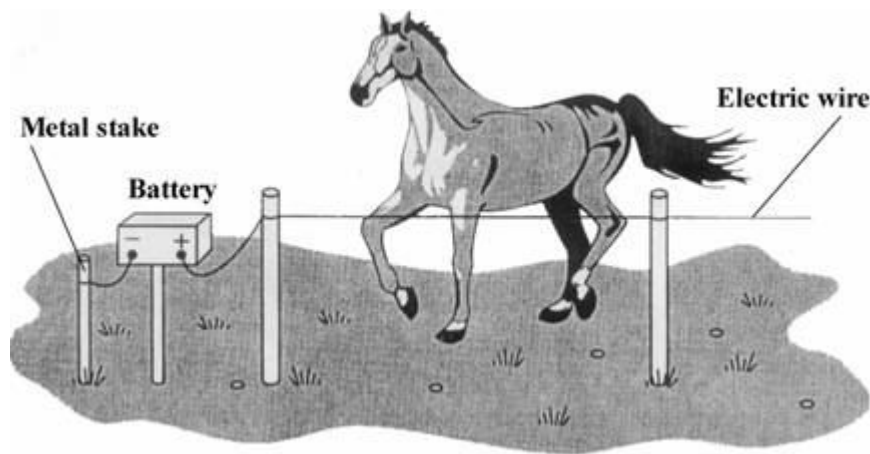
.....

(1)

(Total 3 marks)

8

- (a) The diagram shows an electric fence, designed to keep horses in a field.



When a horse touches the wire the horse receives a mild electric shock. Explain how.

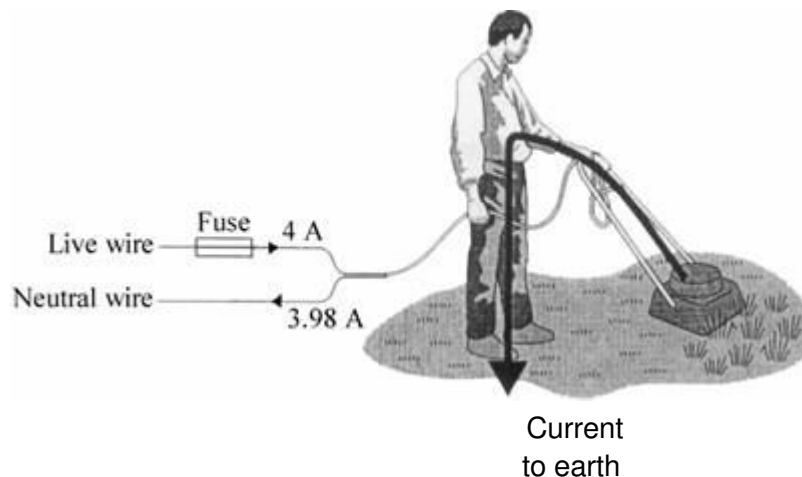
.....

.....

.....

(2)

- (b) The diagram shows how a person could receive an electric shock from a faulty electrical appliance. Using a residual circuit breaker (RCB) can help to protect the person against receiving a serious shock.



- (i) Compare the action of an RCB to that of a fuse.

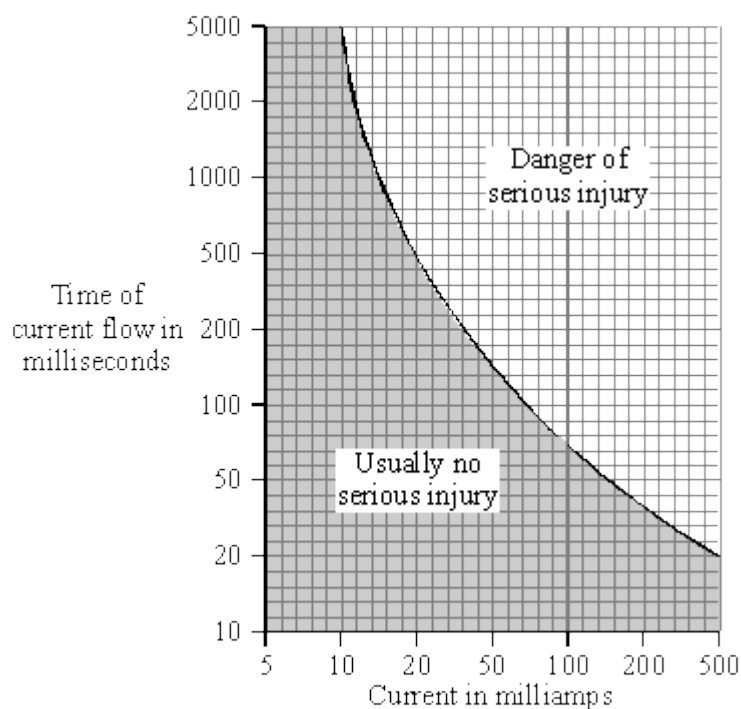
.....

.....

.....

(2)

- (ii) The graph illustrates how the severity of an electric shock depends upon both the size of the current and the time for which the current flows through the body.



Within how long must the RCB cut off the current if the person using the lawnmower is to be in no danger of serious injury?

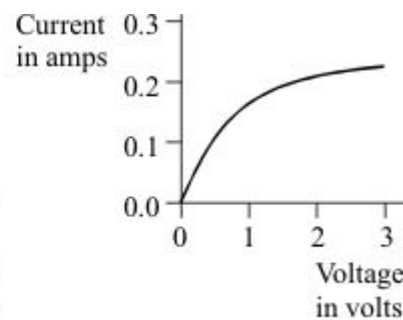
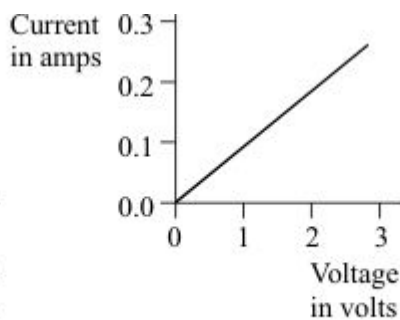
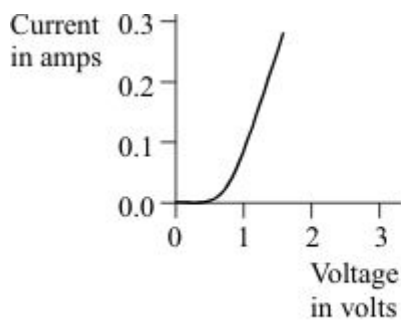
.....

Time = milliseconds

(2)
 (Total 6 marks)

9

- (a) The diagram shows the voltage-current graphs for three different electrical components.



Which **one** of the components **A**, **B** or **C** could be a 3 volt filament lamp? Explain the reason for your choice.

.....

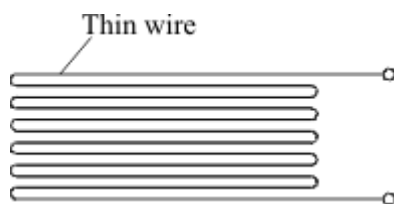
.....

.....

.....

(3)

- (b) Using the correct symbols draw a circuit diagram to show how a battery, ammeter and voltmeter can be used to find the resistance of the wire shown.



(3)

- (c) When correctly connected to a 9 volt battery the wire has a current of 0.30 amperes flowing through it.

- (i) Give the equation that links current, resistance and voltage.

.....

(1)

- (ii) Calculate the resistance of the wire. Show clearly how you work out your answer and give the unit.

.....

.....

Resistance =

(3)

- (iii) When the wire is heated, the current goes down to 0.26 amperes. State how the resistance of the wire has changed.

.....

.....

(1)

(Total 11 marks)

10

- (a) (i) Complete the sentence by choosing the correct word from the box.

electrons	neutrons	protons
-----------	----------	---------

An electric current is a flow of

(1)

- (ii) What is the name and circuit symbol for the instrument used to measure electric current?

Name:

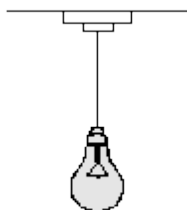
Symbol:

(2)

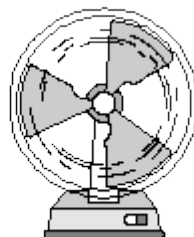
- (b) When an electric current flows through a wire, the wire will get hot. **Two** of the following make use of this heating effect. Which **two**?



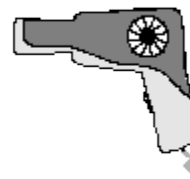
Microwave oven



Light bulb



Fan



Hairdryer

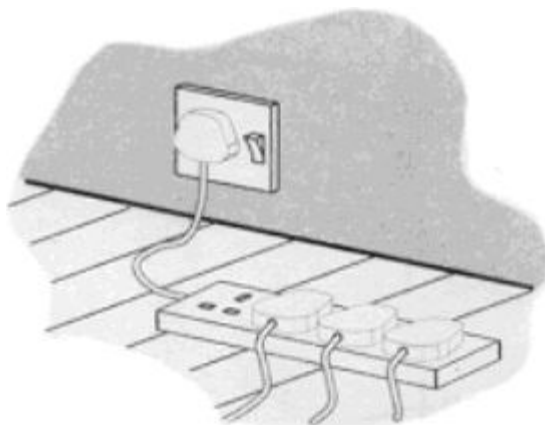
1.

2.

(2)**(Total 5 marks)**

11

- (a) An adaptor can be used to connect up to four appliances in parallel to one 230 V mains socket. The adaptor is fitted with a 13 A fuse. The table gives a list of appliances and the current they draw from a mains socket.



Appliance	Current
computer	1 A
hairdryer	4 A
heater	8 A
iron	6 A
television	2 A

- (i) What current will flow to the adaptor when the television, computer and hairdryer are plugged into the adaptor?

.....

Current = A

(1)

- (ii) Write down the equation which links current, electrical power and voltage.

.....

(1)

- (iii) Calculate the electrical power used when the television, computer and hairdryer are plugged into the adaptor. Show clearly how you work out your answer and give the unit.

.....

.....

.....

Electrical power =

(2)

- (iv) What would happen to the fuse if the heater is also plugged into the adaptor?

Give a reason for your answer.

.....

.....

(2)

- (b) The diagram shows **two** of the appliances.



Iron



Hairdryer

- (i) For safety reasons, it is important that the iron has an earth wire connected to its outer metal case. Explain why.

.....

.....

.....

.....

(2)

- (ii) The hairdryer does not have an earth wire. It is safe to use because it is *double insulated*. Explain what the term *double insulated* means.

.....

.....

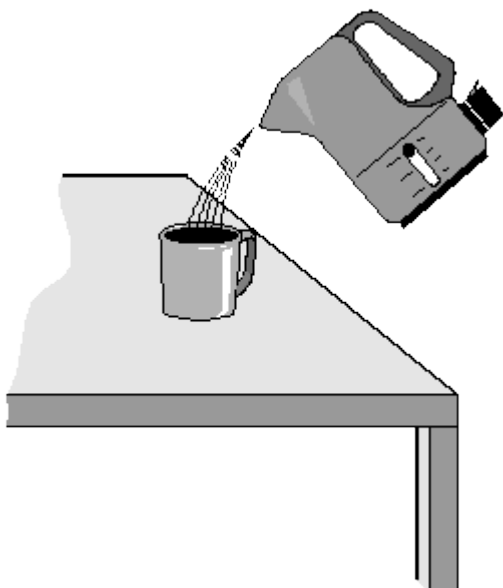
.....

.....

(2)
(Total 10 marks)

12

- (a) The diagram shows hot water being poured into a mug.



- (i) Complete the sentence by choosing the correct words from the box. Each word may be used once or not at all.

air	mug	table	water
-----	-----	-------	-------

Heat energy is being transferred from the to
the

(1)

- (ii) When will this transfer of heat energy stop?

.....

.....

(1)

- (b) In the box are the names of four types of fuel used to heat homes.

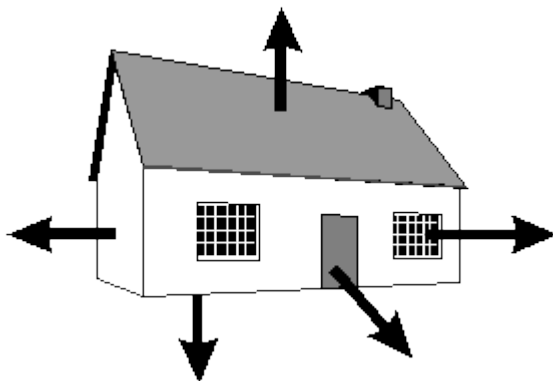
coal	gas	oil	wood
------	-----	-----	------

Which **one** of these types of fuel is renewable?

.....

(1)

- (c) The diagram shows where heat energy is lost from a house.



- (i) Complete the sentences by choosing the correct words from the box. Each word may be used once or not at all.

conduction	conductor	convection	electric	evaporation	insulator
------------	-----------	------------	----------	-------------	-----------

The amount of heat energy lost through the windows by

..... can be reduced by using thick

curtains. The curtains trap a layer of air and air is a good

..... . The curtains will also stop

..... currents pulling cold air

into the room through small gaps in the window.

(3)

- (ii) Write down **one** other way of reducing heat loss from a house.

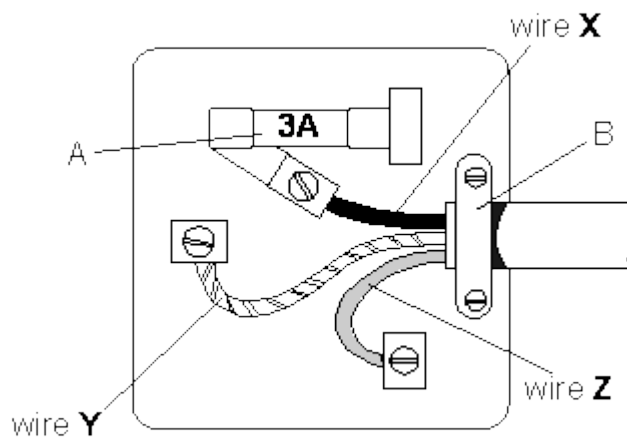
.....

.....

(1)
(Total 7 marks)

13

The diagram below shows an electric mains plug.



- (a) Name the parts of the plug labelled **A** and **B**.

A

B

(2)

- (b) Name the colour of each of the wires **X**, **Y** and **Z**.

X

Y

Z

(3)

- (c) Name a suitable material for the case of the plug.

.....

(1)

- (d) Electric fires have three wires connected in the plug. One is the live wire to feed electric current in, another is the neutral (return) wire.

(i) What is the third wire called?

.....

(1)

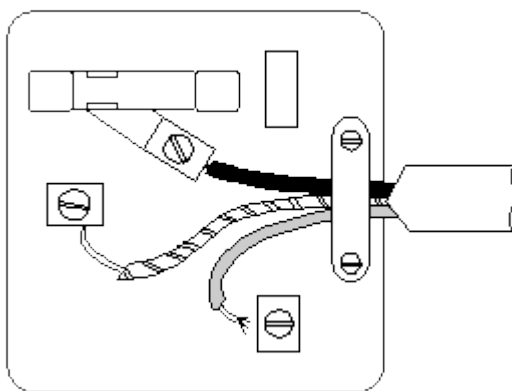
(ii) Why is it important that the third wire is also connected?

.....

.....

(1)

- (e) The diagram below shows a badly wired mains plug.



Look at the plug carefully. What **four** changes should be made to make the plug safe?

1.

.....

2.

.....

3.

.....

4.

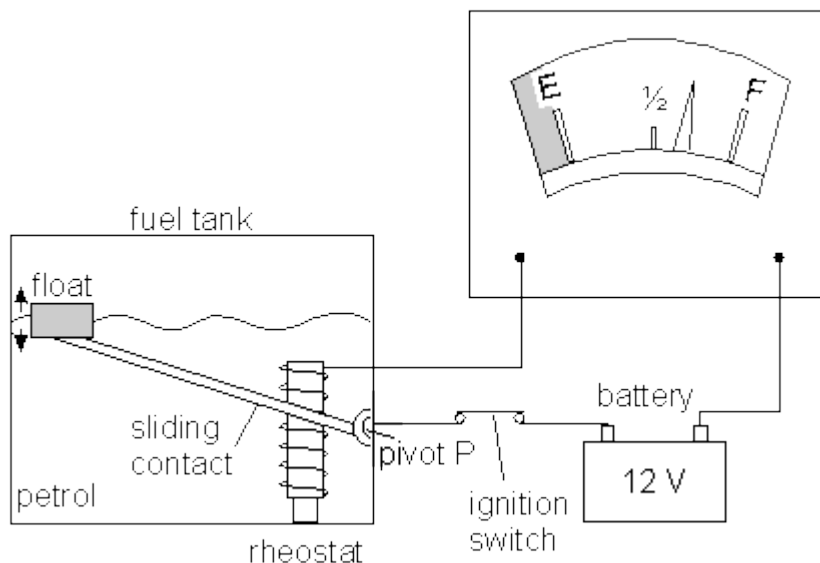
.....

(4)

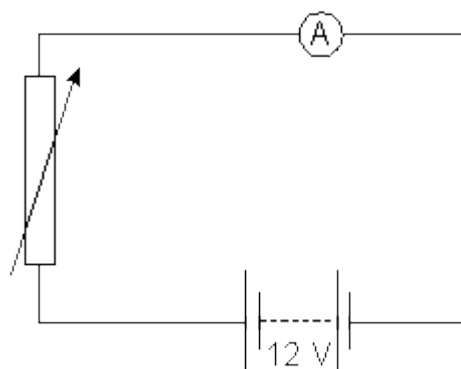
(Total 12 marks)

14

The diagram below shows how one type of fuel gauge in a car works. A sliding contact makes contact with a resistance wire wound in a coil (rheostat). It is connected to a float via a pivot P. When the petrol level changes the circuit resistance changes. This causes the pointer in the fuel gauge to move and show how much petrol is in the petrol tank.



The circuit diagram is shown below.



The petrol gauge is an ammeter. Explain why the reading on the ammeter falls as the petrol is used.

.....

.....

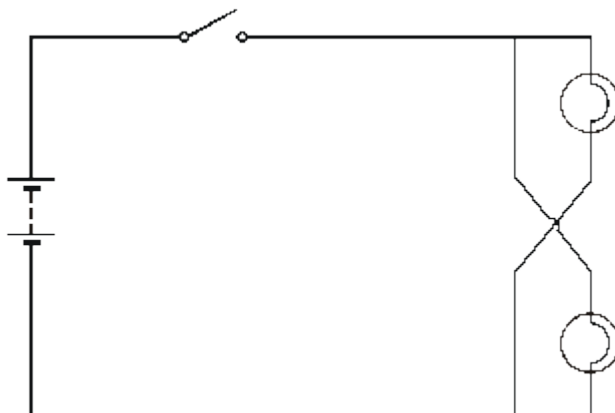
.....

.....

(Total 3 marks)

15

The circuit diagram below shows a circuit used to supply electrical energy to the two headlights of a car.



The current through the filament of one car headlight is 3.0 A. The potential difference across each of the two headlights is 12 V.

- (a) Suggest a suitable fuse for the circuit.

(1)

- (b) Calculate the resistance of the headlight filament when in use.

.....

Answer W

(2)

- (c) Calculate the power supplied to the two headlights of the car.

.....

Answer W

(2)

- (d) The fully charged car battery can deliver 72 kJ of energy at 12 V. How long can the battery keep the headlights fully on?

.....

.....

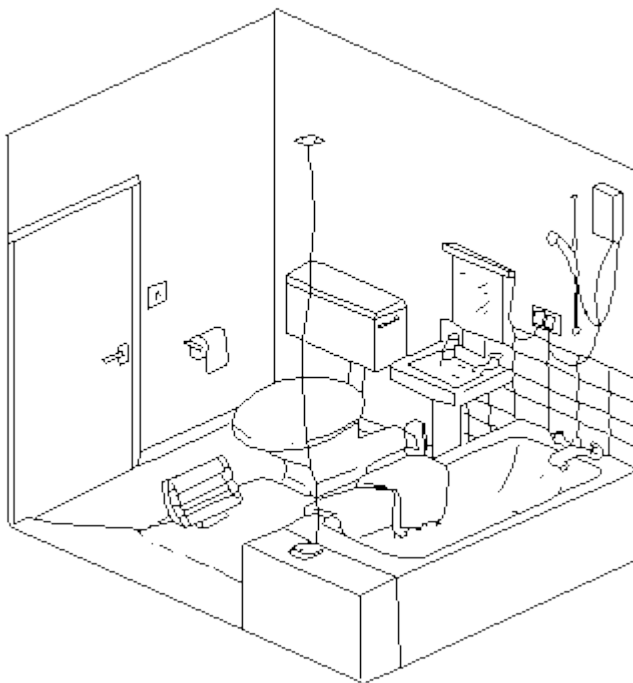
.....

Answer s

(2)
(Total 7 marks)

16

- (a) The picture below shows the bathroom in a house.



Describe **three** examples of dangerous practice in the use of mains electricity in this bathroom.

1.
-
2.
-
3.
-

(3)

- (b) In the table below three electrical appliances are listed with their power ratings and the number of hours they are used each week.

ELECTRICAL APPLIANCE	POWER RATINGS (W)	TIME USED EACH WEEK (h)	k Wh USED EACH WEEK
TV	200	35	
Kettle	2000	2	
Toaster	1000	1	
Cooker	11 500	7	

- (i) Complete the table by inserting the number of kWh used by each appliance each week.
- (ii) Which appliance would cost the least to run per week?
-
- (iii) The cost of running a toaster is 8p per week. How much does it cost to run the kettle each week?
-
-
-

(6)
(Total 9 marks)

17

There are many forms of energy. Some of these forms of energy can be “stored” ready to be used when the energy is needed. The chemical energy in fuels is one example of stored energy.

- (a) Complete the following sentences by adding the missing words.

The chemical energy in fuels such as coal came originally from the

Energy from fuels can be used to

(2)

- (b) An electric milk float has its batteries charged up overnight. Early in the morning the milkman sets off on his round. Describe the energy transfers which take place in the milk float as the milkman does his rounds.

.....

.....

.....

.....

.....

.....

(4)

- (c) Give another example of energy other than fuels which can be classed as “stored” energy. Give a use of the “stored” energy.

Type of “stored” energy

Use

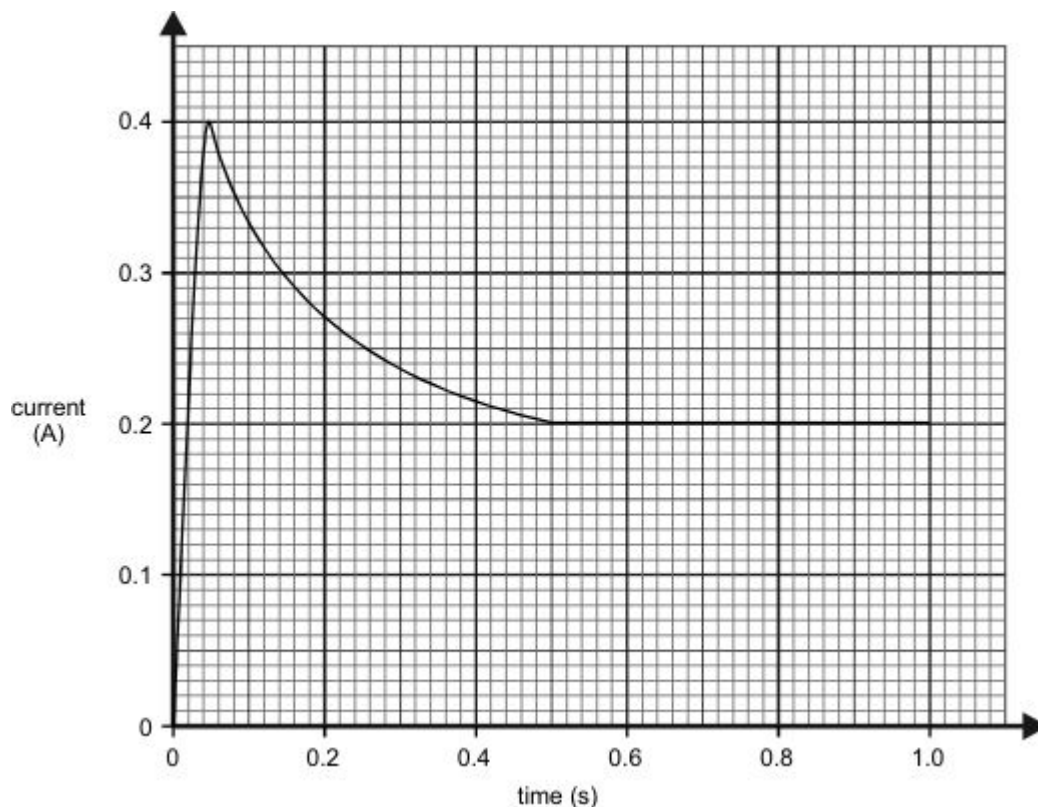
.....

(2)

(Total 8 marks)

18

When a mains lamp is switched on it takes 0.5 seconds for the filament to reach its normal operating temperature. The way in which the current changes during the first second after switching on is shown in the sketch graph below. Mains voltage is 240 V.



- (a) Calculate the resistance of the filament whilst the lamp is drawing the **maximum** current.

.....

.....

.....

(3)

- (b) Describe how the resistance of the lamp changes after the current has reached its maximum value.

.....

.....

(2)

- (c) Calculate the **maximum** power taken by the lamp.

.....

.....

.....

(2)

- (d) Calculate the power of the lamp in normal use.

.....

.....

.....

(2)

- (e) Calculate the energy used by the lamp in six hours of normal use.

.....

.....

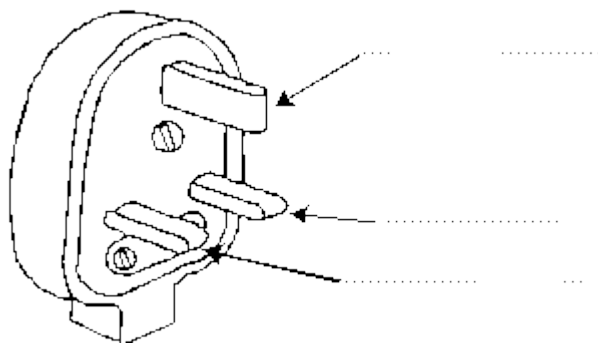
.....

(3)

(Total 12 marks)

19

- (a) The diagram below shows the three pins in a mains plug. The pins connect with the live, neutral and earth terminals in a socket.



On the diagram, label each pin to show which is:

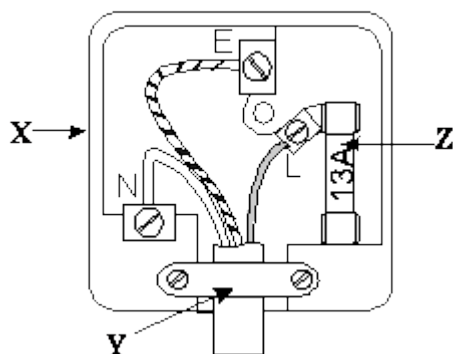
the live pin,

the neutral pin,

the earth pin.

(3)

- (b) The diagram below shows the inside of a mains plug.



- (i) Name **one** material which could be used for the part labelled **X**.

.....

- (ii) Complete the sentences below.

The part labelled **Y** is called the

This is used to hold the firmly in place.

The component labelled **Z** is the

- (iii) The plug is used with an electric fire.
Which part of the electric fire is connected to the earth pin?

.....

(5)

(Total 8 marks)

20

You wash and dry your hair, then comb it with a plastic comb. As you move the comb away from your head some hairs are attracted to the comb.

- (a) What has happened to the comb to make it attract the hairs?

.....

.....

(1)

- (b) If the comb is now held above some small pieces of dry tissue paper what is likely to happen?

.....

.....

(1)

- (c) If you rub your hands all over the comb it will no longer attract your hair.
Explain why.

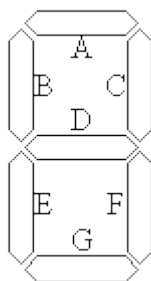
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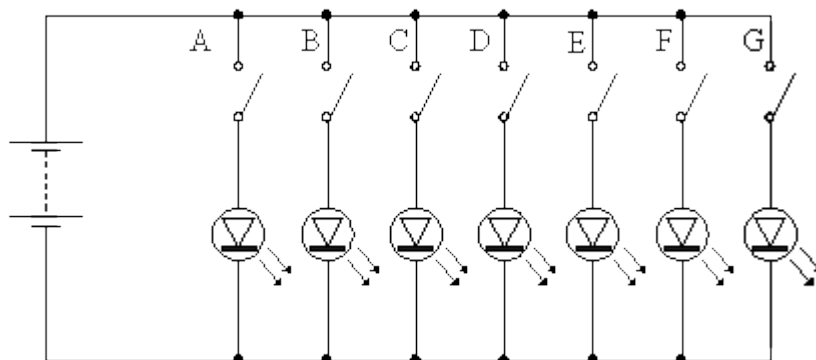
(2)
(Total 4 marks)

21

Some electronic calculators use light emitting diodes (LEDs) to display numbers. Each number in a display consists of up to seven LEDs. The LEDs are arranged as shown in the diagram below. The different numbers are formed by switching different LEDs on at the same time. The LEDs are labelled A to G.



A simplified circuit to provide power to the LEDs is shown below.



- (a) Explain why each LED has its own switch.

.....

.....

(2)

- (b) What number is displayed when all switches except E are closed?

.....

(1)

- (c) Which switches would be open if the number 3 is to be displayed?

.....

(1)

- (d) Which of the numbers 0 to 9 draws least current from the battery? Explain your answer.

Number

Explanation

.....

.....

(2)

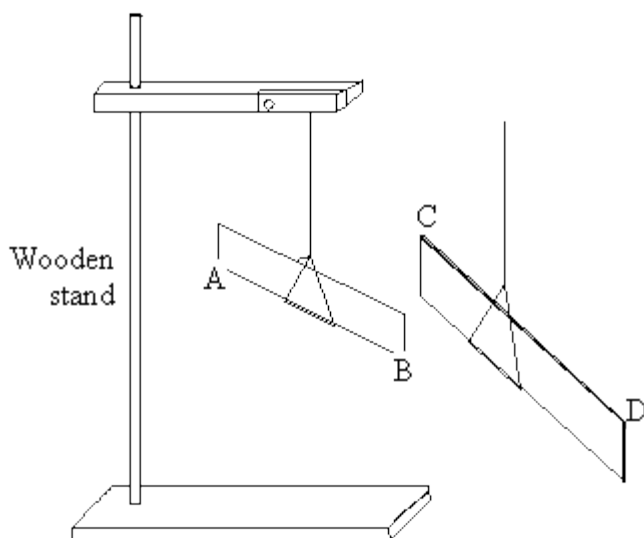
(Total 6 marks)

22

A pupil did an experiment following the instructions below.

1. Take a polythene rod (AB), hold it at its centre and rub both ends with a cloth.
2. Suspend the rod, without touching the ends, from a stand using a stirrup and nylon thread.
3. Take a perspex rod (CD) and rub it with another cloth.
4. Without touching the ends of the perspex rod bring each end of the perspex rod up to, but without touching, each end of the polythene rod.
5. Make notes on what is observed.

The diagram below shows how the apparatus is to be set up.



(a) When end C was brought near to end B they attracted each other.

(i) Explain why they attracted each other.

.....

.....

(ii) What would happen if end C were brought near end A?

.....

(3)

(b) The experiment was repeated with two polythene rods.

(i) Describe what you would expect the pupil to observe as the end of one rod was brought near to the end of the other.

.....

.....

(ii) Explain your answer.

.....

.....

(2)

(c) Explain, in terms of electron movement, what happened as the rods were rubbed with the cloths.

.....

.....

.....

.....

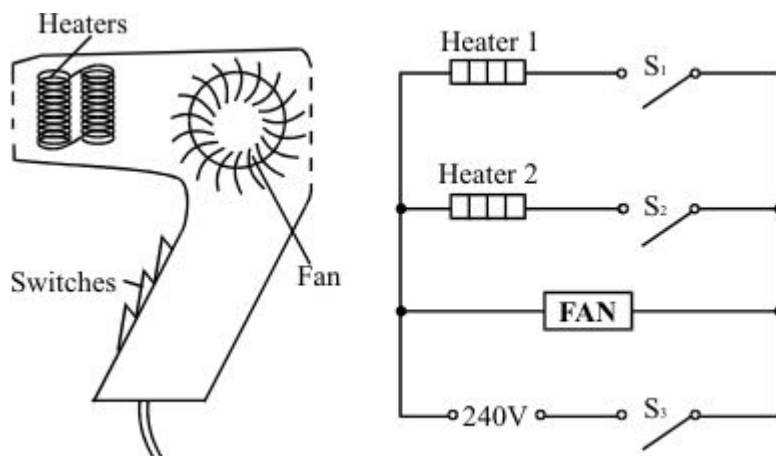
.....

(3)

(Total 8 marks)

23

The diagrams show a hair-dryer and the circuit inside the hair-dryer.



- (a) Switches S_1 , S_2 and S_3 are all shown in the **OFF** position.

Which switch or switches have to be **ON** to make:

- (i) only the fan work?
- (ii) both heaters work?

(2)

- (b) (i) What happens to the current in the circuit when the heaters are switched on?

.....

- (ii) Suggest why it is important to have the fan working when the heaters are switched on.

.....

.....

.....

(3)

- (c) This hair-dryer has a plastic case. It is connected to a mains socket by a 3-pin plug. The cable connecting the hair-dryer to the plug contains only two wires.

- (i) Write down the colour of the insulation on the wires.

Wire 1

Wire 2

- (ii) Which of the usual three wires is **not** needed?

.....

- (iii) This hair-dryer is safe to use without the third wire. Explain why.

.....

.....

.....

(5)

- (d) The following information is stamped on the hair-dryer.



- (i) Which number tells us how fast the hair-dryer uses energy?

.....

- (ii) On what else does the energy used by the hair-dryer depend?

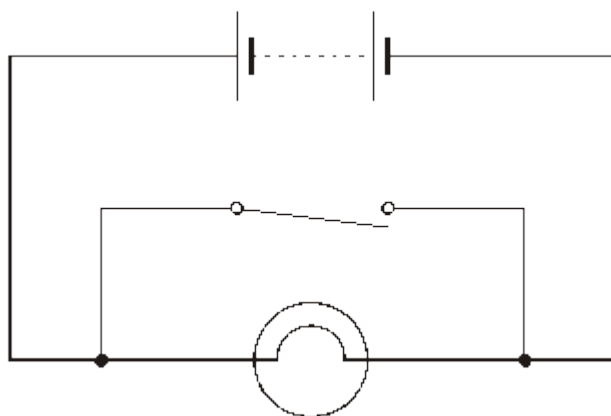
.....

(2)

(Total 12 marks)

24

The circuit diagram below shows a battery connected to a lamp and a switch.



- (a) State what happens to the lamp when:

- (i) the switch is open (OFF);

.....

- (ii) the switch is closed (ON).

.....

(2)

- (b) When the switch is closed what problem is caused in the circuit?

.....

.....

.....

(1)

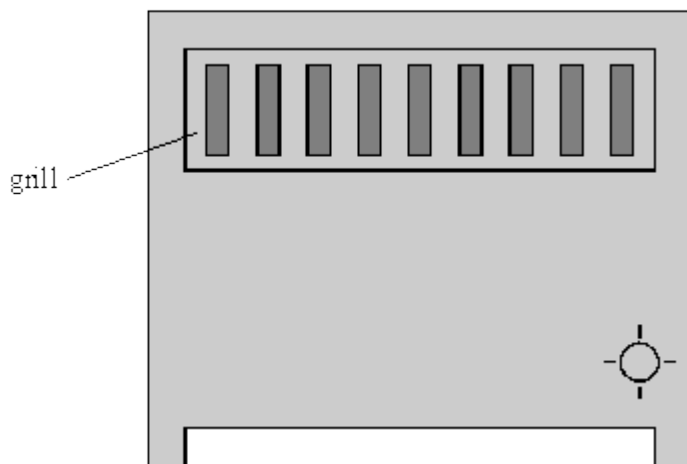
- (c) In the space below draw a circuit diagram to show how the switch should be correctly connected to the lamp and battery.

(1)

(Total 4 marks)

25

The diagram shows a fan heater.



- (a) Complete this sentence.

The fan heater is designed to transfer electrical energy as
energy and energy.

(2)

(b) The fan heater is connected to the mains by a three core cable.

(i) Why are the wires in the cable made out of copper?

.....

(ii) Why are the wires in the cable covered by plastic?

.....

(2)

(c)

You may find this equation useful when answering this part of the question

$$\text{energy transferred (kWh)} = \text{power (kilowatt, kW)} \times \text{time (hour, h)}$$

(i) The power of the fan heater is 2.75 kW.

Calculate how many kilowatt hours (kWh) of energy are transferred when the fan heater is used for 6 hours.

.....

.....

Number of kilowatt hours

(2)

(ii) How much will it cost to use the fan heater for 6 hours if one Unit of electricity costs 7p?

.....

.....

Cost p

(2)

(d) A fault caused a much higher than normal current to flow in the heater.
Describe what happened to the wire in the fuse.

.....

.....

.....

(2)

(Total 10 marks)

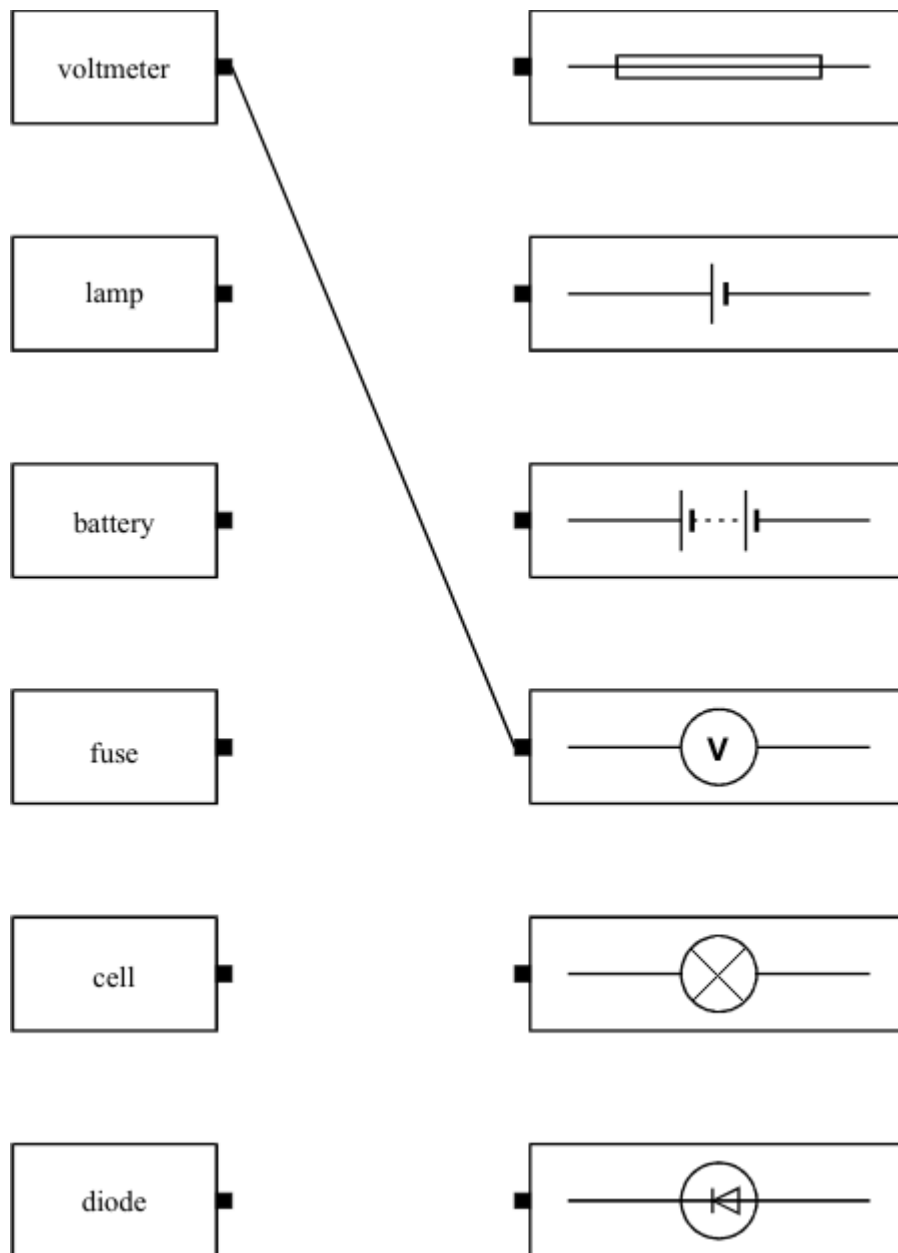
26

- (a) Complete the sentence below to name the instrument used to measure electrical current.

The instrument used to measure electrical current is called

(1)

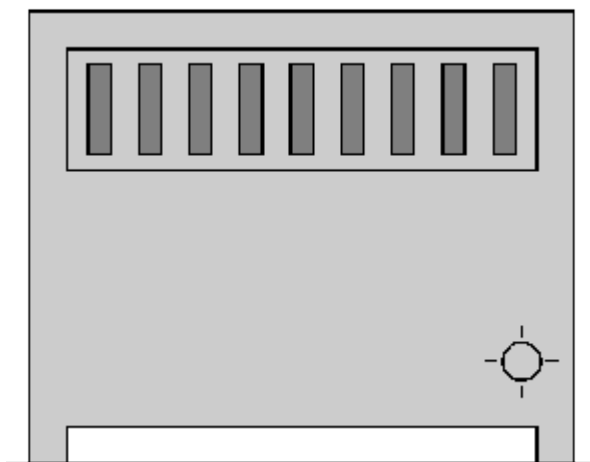
- (b) In the diagram below each box contains an electrical component or a circuit symbol. Draw straight lines to link each electrical component to its circuit symbol. The first one has been done for you.



(4)
(Total 5 marks)

27

- (a) The diagram shows a fan heater.



- (i) A current of 11A flows when the fan heater is working normally. Fuses of value 3A, 5A, 10A and 13A are available. Which one should be used in the plug of the fan heater?

.....

(1)

- (ii) A fault caused a much higher than normal current to flow in the heater. Describe what happened to the wire in the fuse.

.....

.....

.....

.....

(2)

- (b)

You may find this equation useful when answering this part of the question

$$\text{energy transferred (kWh)} = \text{power (kilowatt, kW)} \times \text{time (hour, h)}$$

- (i) The power of the fan heater is 2.75 kW. Calculate how many kilowatt hours of energy are transferred when the fan heater is used for 6 hours.

.....

.....

.....

Number of kilowatt hours

(2)

- (ii) How much will it cost to use the fan heater for 6 hours if one Unit of electricity costs 7p?

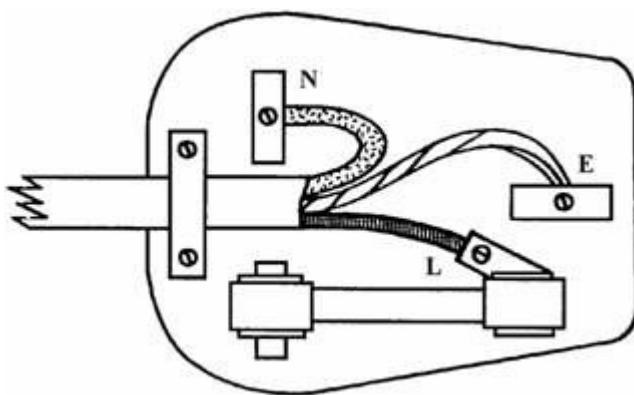
.....

Cost p

(2)
 (Total 7 marks)

28

The diagram shows the inside of a 3-pin plug.



- (a) What colour wire should be connected to each terminal?

Terminal **E**

Terminal **N**

Terminal **L**

(3)

- (b) Name **two** parts inside the 3-pin plug which help to make it safe.

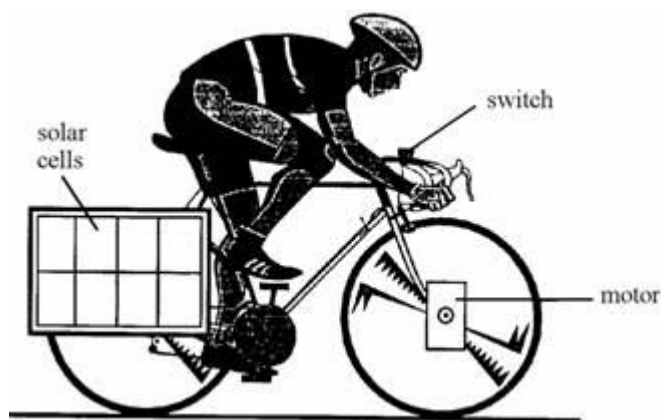
1

.....

2

.....

(2)
 (Total 5 marks)



A battery is connected to the solar cells.

The solar cells charge up the battery.

There is a switch on the handlebars.

When the switch is closed, the battery drives a motor attached to the front wheel.

- (a) Use words from the list to complete the following sentences. Words may be used once, more than once, or not at all.

chemical electrical heat (thermal) kinetic
light potential sound

- (i) The solar cells transfer energy to energy.
- (ii) When the battery is being charged up, energy is transferred to energy.
- (iii) The motor is designed to transfer energy to energy.

(6)

- (b) (i) The cyclist stops pedalling for 10 seconds. During this time the motor transfers 1500 joules of energy. Calculate the power of the motor.

.....

Power W

(2)

- (ii) Name **one** form of wasted energy which is produced when the motor is running.

.....

(1)

(Total 9 marks)

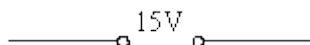
30

A student investigates how the current flowing through a filament lamp changes with the voltage across it.

She is given a filament lamp and connecting wires.

She decides to use a 15V power supply, a variable resistor, an ammeter, a voltmeter and a switch.

- (a) Complete the circuit diagram to show how she should set up the circuit.

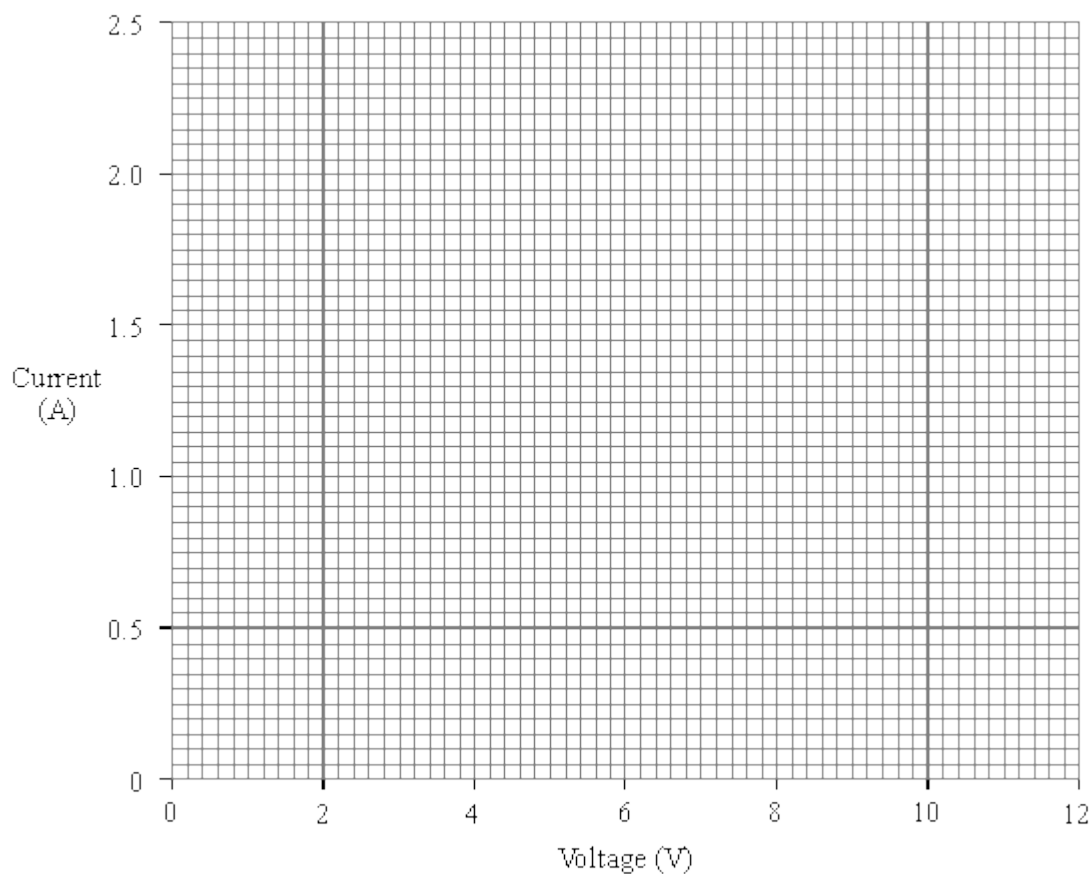


(4)

- (b) The student obtains the following results.

VOLTAGE (V)	0.0	3.0	5.0	7.0	9.0	11.0
CURRENT (A)	0.0	1.0	1.4	1.7	1.9	2.1

- (i) Plot a graph of current against voltage.



(3)

- (ii) Use your graph to find the current when the voltage is 10V.

Current A

(1)

- (iii) Use your answer to (ii) to calculate the resistance of the lamp when the voltage is 10V.

.....

Resistance Ω

(2)

- (c) (i) What happens to the resistance of the lamp as the current through it increases?

.....

(ii) Explain your answer.

.....

.....

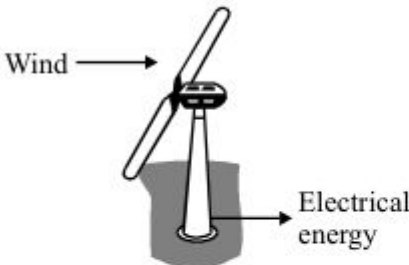
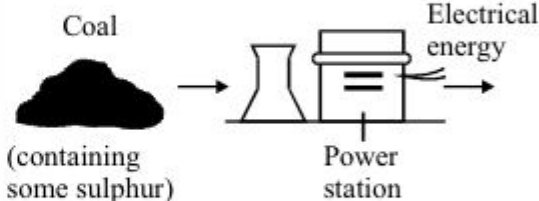
.....

(2)
(Total 12 marks)

31

Electricity is a useful form of energy.

(a) Different energy sources can be used to generate electricity.

Wind is an energy source	Coal, a fossil fuel, is an energy source
	
This wind turbine generates 1 MW. (1 MW = 1000 kW)	This coal-fired power station generates 1000 MW.
Electricity demand in the UK can be 48 000 MW.	

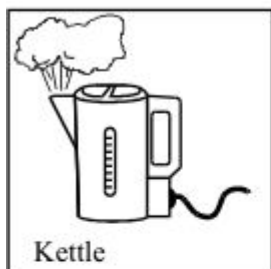
Give **one** advantage and **one** disadvantage (other than cost) of using each energy source to generate electricity in the UK.

Advantage	Disadvantage
Using wind	Using wind
Using coal	Using coal

(4)

- (b) List **A** shows three electrical devices.
List **B** gives the type of useful energy transferred.

Draw a straight line from each electrical device in List **A** to the useful energy it transfers in List **B**.

List A**Electrical device****List B****Useful energy transferred**

heat

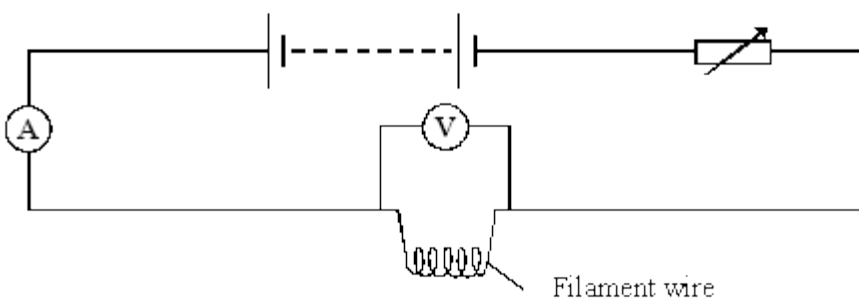
light

sound

(2)
(Total 6 marks)

32

A bulb heats up when an electric current passes through the filament wire. The current was measured when different voltages were applied across the filament wire shown in the diagram below.



- (a) (i) Look at the circuit diagram. How was the voltage changed?

.....

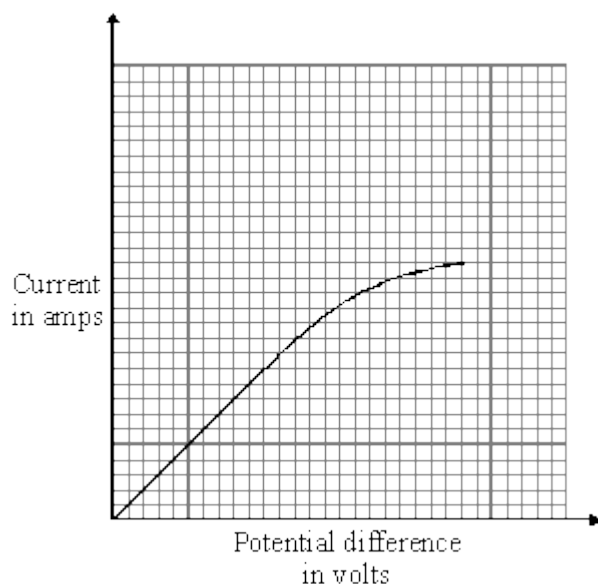
(1)

- (ii) Write an equation that shows the relationship between *current*, *potential difference* and *resistance*.

.....

(1)

- (b) The graph shows how the current through the filament wire changed as the potential difference across it changed.



- (i) Describe the effect of increasing the potential difference on the current flowing through the filament wire.

.....

.....

.....

(2)

- (ii) Explain this effect in terms of the resistance of the filament wire.

.....

.....

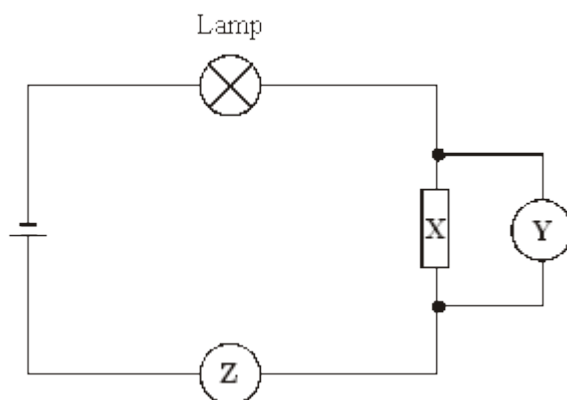
.....

(2)

(Total 6 marks)

33

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 \times resistance ☐

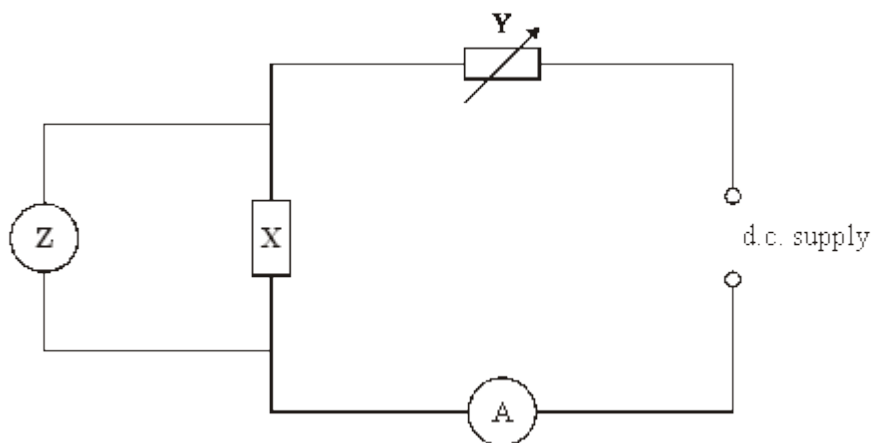
potential difference = current \times resistance ☐

resistance = current \times potential difference ☐

(1)
(Total 4 marks)

34

The current through component **X** is measured when different voltages are applied across it.



- (a) Name the component labelled **Y** in the circuit.

.....

(1)

- (b) What type of meter is **Z**?

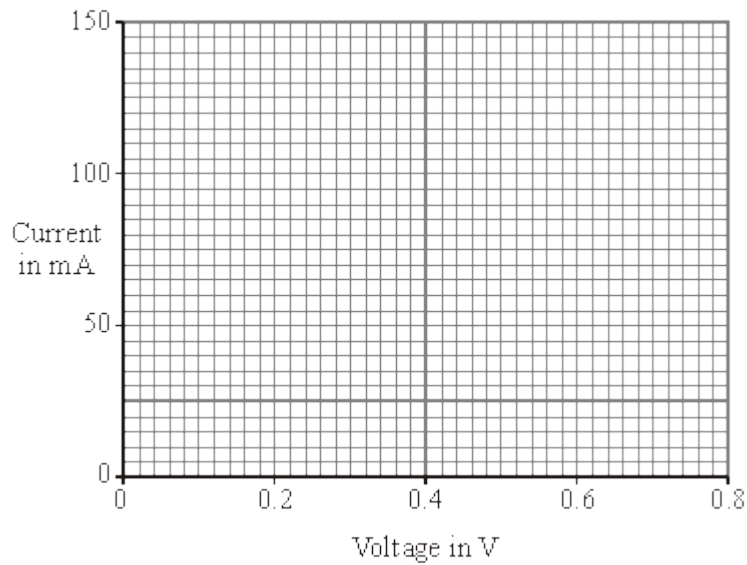
.....

(1)

- (c) The table shows the measurements obtained in this experiment.

Voltage in V	0	0.2	0.4	0.6	0.8
Current in mA	0	0	50	100	150

Draw a graph of the measurements.



(2)

- (d) Use the shape of the graph to name component **X**.

.....

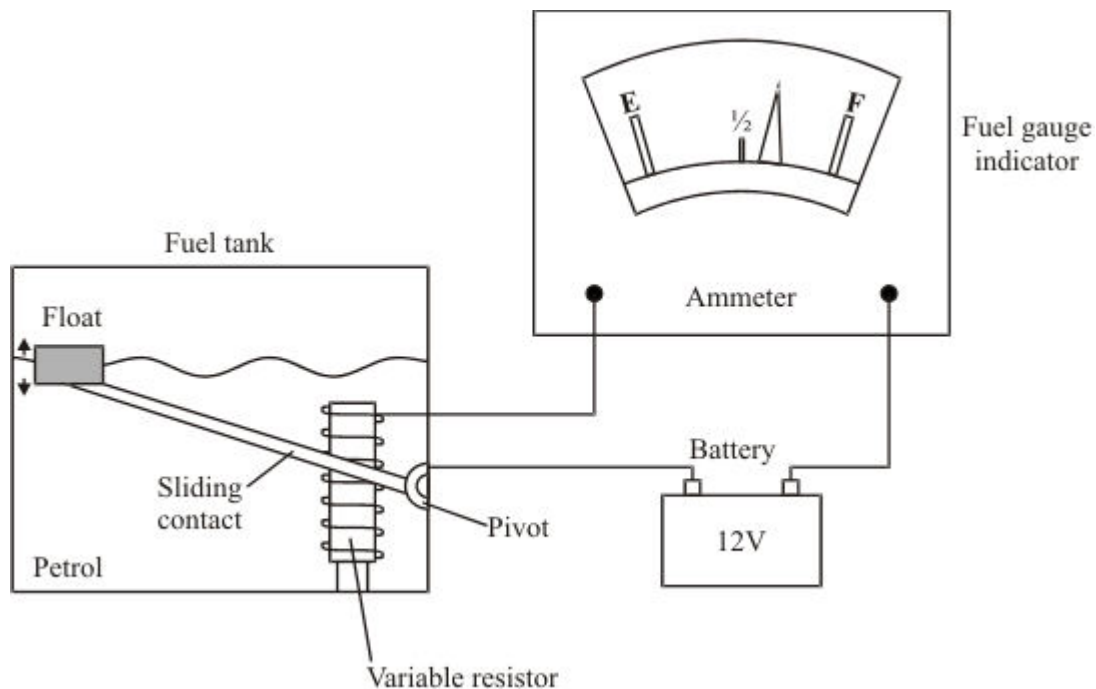
(1)

(Total 5 marks)

35

The diagram shows the fuel gauge assembly in a car.

- The sliding contact touches a coil of wire and moves over it.
- The sliding contact and the coil form a variable resistor.
- The sliding contact is connected to a float via a pivot.
- The fuel gauge indicator is an ammeter.
- When the petrol level changes, the resistance of the circuit changes.
- This causes the pointer in the fuel gauge indicator to move.



- (a) Use standard symbols to draw a circuit diagram for the fuel gauge assembly.

(3)

- (b) How will the current in the circuit change as the level of petrol in the tank falls?

.....

Explain the reason for your answer.

.....

.....

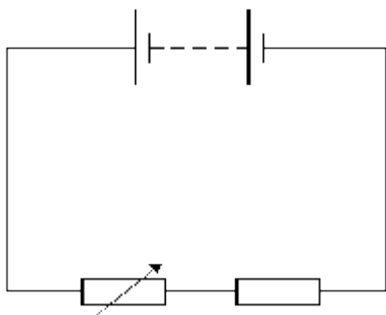
.....

(2)

(Total 5 marks)

36

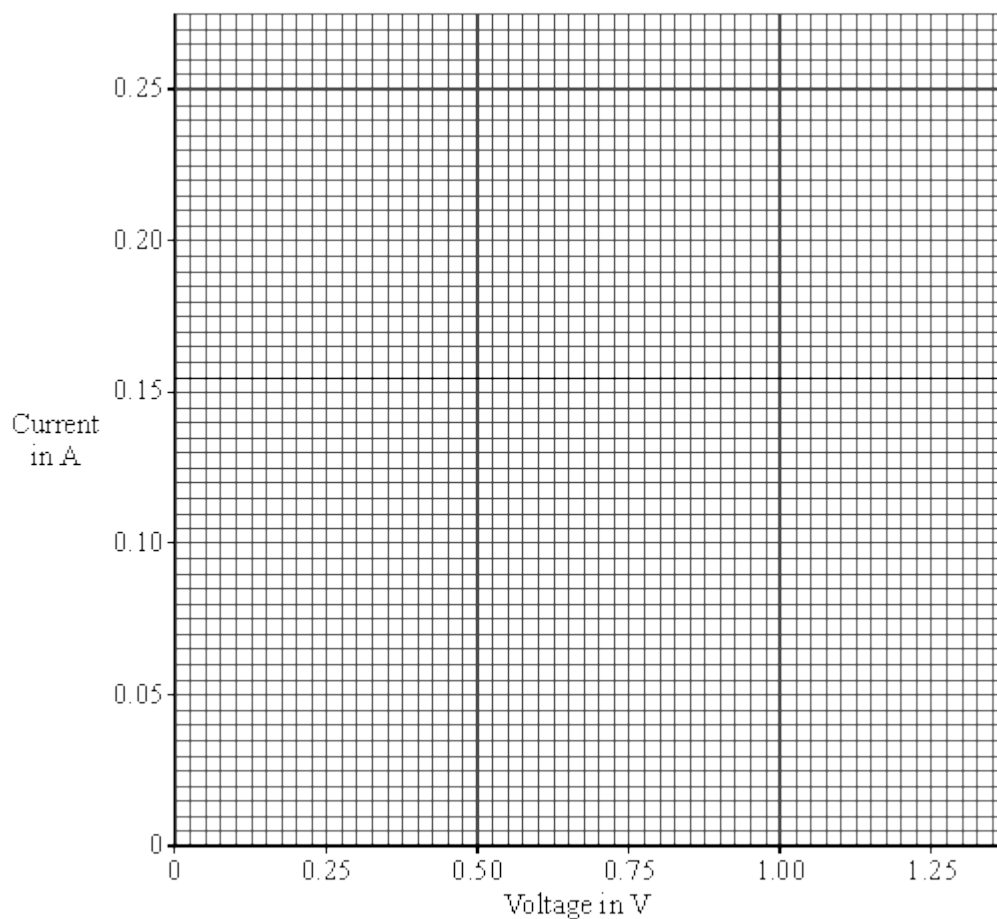
- (a) The diagram shows a simple circuit. Add an ammeter and a voltmeter to the circuit to show how to measure the current through the fixed resistor and the voltage across it.

**(2)**

- (b) An experiment using a circuit like the one above was set up. The following results were obtained when the resistance of the variable resistor was decreased.

- (i) Draw a graph of the results below.

Voltage across fixed resistor in volts	Current in amps
0.50	0.10
0.75	0.15
1.00	0.20
1.25	0.25



(2)

- (ii) Use the graph to find the voltage when the current is 0.05 A.

Voltage = V

(1)

(Total 5 marks)

37

- (i) Write the equation which shows the relationship between the electric *current*, the *power* and the *voltage*.

.....

(1)

- (ii) Calculate the power if the current is 5 A and the voltage is 400 000 V. Show clearly how you work out your answer and give the unit.

.....

Power =

(2)**(Total 3 marks)****38**

The following specification is taken from the instruction booklet of a combination microwave oven.

AC voltage	240 V 50 Hz
Power required	
Microwave	1.5 kW
Dual (Roast/Bake)	2.8 kW
Dual (Grill)	2.5 kW
Convection	1.35 kW
Grill	2.3 kW
Output power	
Microwave	850 W
Convection heater	1350 W
Grill heater	1000 W
Microwave frequency	2450 MHz

- (a) (i) What is the current when the oven is being used to cook in the dual (roast/bake) mode? Show clearly how you work out your answer.

.....
.....

Current = A

(2)

- (ii) Calculate the resistance of this combination microwave oven when it is being used in the dual (roast/bake) mode. Show clearly how you work out your answer and give the units.

.....
.....
.....

Resistance =

(3)

- (b) What is the percentage efficiency of the oven when it is working in the microwave mode?

.....
.....
.....

Percentage efficiency = %

(2)

(Total 7 marks)

39

- (a) The student is using a microphone connected to a cathode ray oscilloscope (CRO).



The CRO displays the sound waves as waves on its screen. What does the microphone do?

.....

.....

.....

(2)

- (b) The amplitude, the frequency and the wavelength of a sound wave can each be either increased or decreased.

- (i) What change, or changes, would make the sound quieter?

.....

(1)

- (ii) What change, or changes, would make the sound higher in pitch?

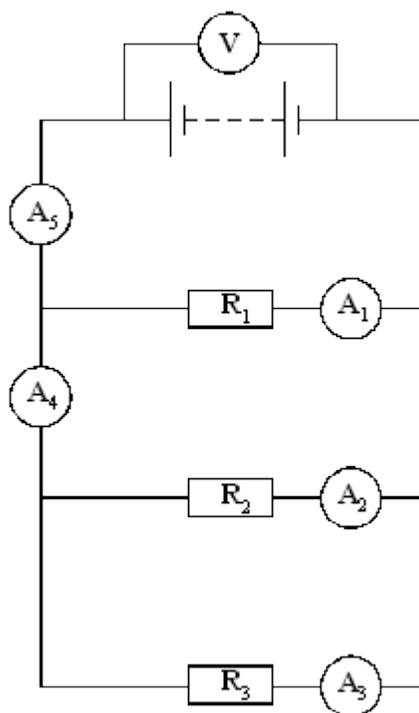
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(1)

(Total 4 marks)

40

A circuit was set up as shown in the diagram.



- (a) The table gives the current through three of the ammeters. Complete the table to show the current through the other two ammeters.

Ammeter	Reading on ammeter in amps
A_1	0.2
A_2	0.6
A_3	0.3
A_4	
A_5	

(2)

- (b) The reading on the voltmeter is 12 V.

What is the resistance of R_2 ?

Show your working and include the correct unit.

.....

.....

.....

Resistance =

(3)

- (c) In the circuit above, the resistor R_2 burned out and current stopped flowing in it. There was no other change to the circuit.

Complete the table below to show the readings on the ammeters after this took place.

Ammeter	Reading on ammeter in amps
A_1	0.2
A_2	0.0
A_3	
A_4	
A_5	

(3)
(Total 8 marks)

41

A student did an experiment with two strips of polythene. She held the strips together at one end. She rubbed down one strip with a dry cloth. Then she rubbed down the other strip with the dry cloth. Still holding the top ends together, she held up the strips.



- (a) (i) What movement would you expect to see?

.....
.....

(1)

- (ii) Why do the strips move in this way?

.....

(2)

- (b) Complete the **four** spaces in the passage.

Each strip has a negative charge. The cloth is left with a.....

charge. This is because particles called have been transferred from the to the

(4)

- (c) The student tried the experiment using two strips of aluminium. The strips did not move.

Complete **each** of the sentences.

- (i) Materials, such as aluminium, which electricity will pass through easily, are called

(1)

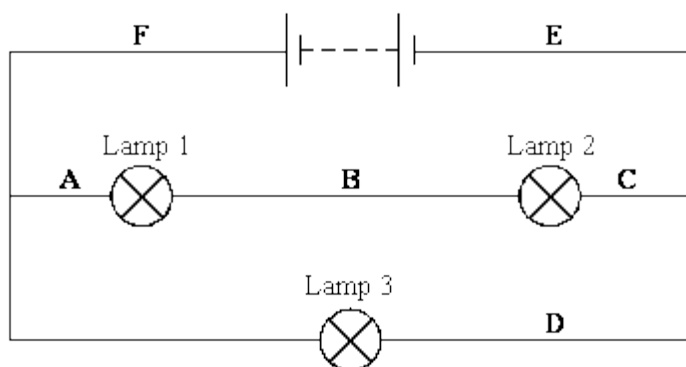
- (ii) Materials, such as polythene which electricity will **not** pass through easily, are called

(1)

(Total 9 marks)

42

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** isthe current at **E**.

(1)

(iv) The current at **F** isthe current at **D**.

(1)

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

Give a reason for your answer.

.....

.....

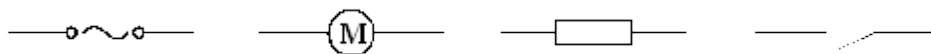
(2)

(Total 6 marks)

43

In a hairdryer circuit there is a heater and a motor. It is important that the motor is always running when the heater is switched on.

(a) Using the symbols shown below only **once** each, draw a circuit for a hairdryer.



(2)

(b) Modern hairdryers are described as *double insulated*.

Explain what this term means.

.....

.....

.....

(2)

(c) On a modern hairdryer handle it states:

1600 W

230 V

50 Hz

- (i) [A] Write an equation which shows the relationship between current, power and voltage.

.....

(1)

- [B] Calculate the current in the hairdryer when it is on full power.
Show clearly how you get your answer.

.....

.....

Current = A

(2)

- (ii) [A] Write an equation which shows the relationship between current, resistance and voltage.

.....

(1)

- [B] The resistance of the heater is 20 ohms. Calculate the resistance of the motor.
Show clearly how you get your answer.

.....

.....

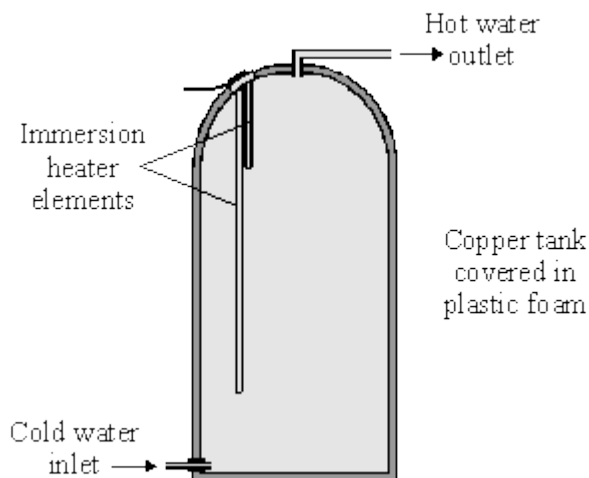
Resistance = ohms

(2)

(Total 10 marks)

44

The diagram shows a type of electric immersion heater in a hot water tank. These hot water tanks are normally found in airing cupboards.



Information on the immersion heater states:

230 V

10 A

- (a) (i) What is the equation which shows the relationship between power, current and voltage?
-
- (1)
- (ii) Calculate the power of the heater. Show clearly how you get to your answer and give the units.
-
- Power = (2)
- (b) (i) What rating of fuse should be in the immersion heater circuit?
-
- (1)
- (ii) There are three wires in the cable to the immersion heater. Two of the wires are connected to the immersion heater. The third wire is connected to the copper tank.

Explain the function of this third wire and the fuse in the circuit.

.....

.....

.....

.....

(3)

- (c) (i) What is the equation which shows the relationship between resistance, current and voltage?

.....

(1)

- (ii) Calculate the resistance of the heater. Show clearly how you get to your answer and give the units.

.....

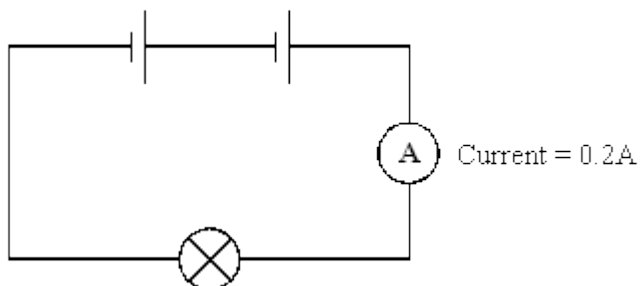
Resistance =

(2)

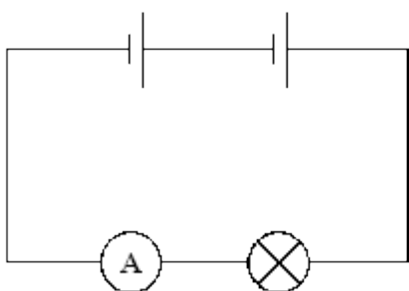
(Total 10 marks)

45

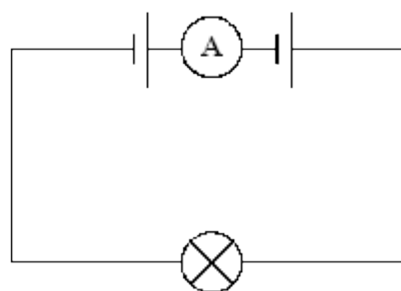
The circuit contains two cells, an ammeter and a lamp. The reading on the ammeter is 0.2 A.



- (a) What will be the reading on the ammeters in each of the circuits below?



(i) Current is A



(ii) Current is A

(2)

- (b) An ammeter was in a series circuit with two cells and a variable resistor.

The ammeter showed a reading of 0.3 A.

- (i) Draw a circuit diagram for the circuit.

(2)

- (ii) What will happen to the reading on the ammeter if the resistance of the variable resistor is **increased**?

.....

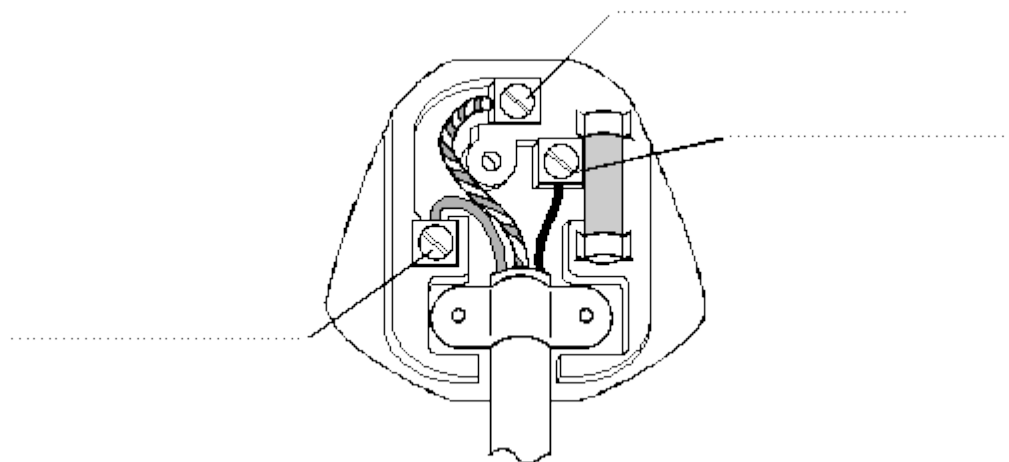
(1)

(Total 5 marks)

46

The diagram shows the inside of a mains plug.

- (a) Label the earth, live and neutral pins.



(3)

- (b) (i) Explain how the earth wire and the fuse protect a person from an electric shock when there is a short circuit to the metal case of an appliance.

.....

.....

.....

.....

.....

.....

(4)

- (ii) What is the most appropriate size fuse rating for a fuse in a television?

Circle the correct answer.

3 A

5 A

13 A

(1)

(Total 8 marks)

47 A combination oven can cook food by using three methods; a microwave generator, a grill and a heating element.

voltage	230 V
microwave power (max)	900 W
grill power	1300 W
convection heater power	1200 W

- (a) What is the current when the oven is operating using full microwave power? Give the equation and show your working.

.....

.....

.....

Current = A

(3)

- (b) It is possible to cook using infrared radiation, from the grill, and microwaves. What is the maximum current in the oven when using both together?

.....

.....

.....

Current = A

(2)

- (c) For baking and roasting, the microwave is used at 450 W and the convection heating element is on fully at 1200 W. A thawed or fresh medium-sized chicken takes 30 minutes to cook.

Calculate the energy transferred in kilowatt-hours.

Use:

units (kWh) = power (kW) × time (h)

.....

.....

.....

Energy = kWh

(2)

- (d) Why is a combination oven of this sort more economical than a convection-only oven?

.....

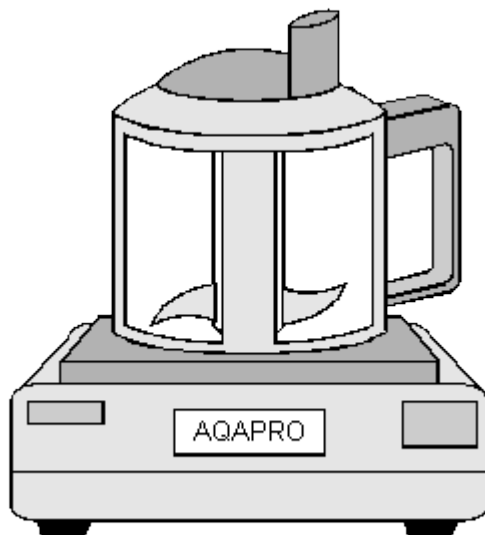
.....

(1)

(Total 8 marks)

48

The drawing shows a food processor. It has an electric motor. Inside is a blade which spins round and cuts up the food.



The food processor is designed to transfer electrical energy to kinetic energy. However some of the energy is wasted as heat and sound.

The power input to the food processor is 1150 W. The power of the spinning blade is 900 W.

- (i) Calculate how much energy is wasted when the food processor is used for two minutes.

Show clearly how you get to your answer and give the unit.

.....

Energy =

(3)

- (ii) Why does the food processor produce sound when it is switched on?

.....

(1)

(Total 4 marks)

49

Carefully read the following extract from a safety leaflet. Then answer the questions.

An RCD adaptor is an automatic safety switch. It should be used when there is a particular risk of electric shock. For example, it is recommended that it is used with an electric lawnmower.

Inside one make of RCD is an electromagnet that holds the switch closed so that the RCD is switched on. An electronic circuit in the RCD monitors the difference between the current in the live wire and the current in the neutral wire.

If something goes wrong and this difference is greater than 30 milliamps then the RCD will trip (= switch off) within 40 milliseconds.

- (a) Suggest **two** reasons why there is a particular risk of an electric shock when using an electric lawnmower.

1.

.....

2.

.....

(2)

- (b) Why will there be a difference between the current in the live wire and the current in the neutral wire if something goes wrong?

.....

.....

(1)

- (c) (i) Use the words charge, current and time to write an equation which shows the relationship between them.

.....

(1)

- (ii) Calculate how much charge flows when a current of 30 milliamps passes for 40 milliseconds.

Clearly show how you get to your answer and give the unit.

.....

.....

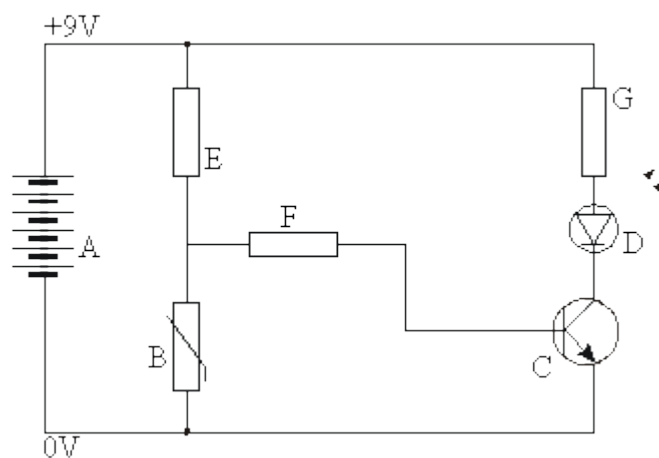
Charge =

(3)

(Total 7 marks)

50

The diagram shows an electronic circuit.



(a) Write down the names of the components in the list below.

A =

B =

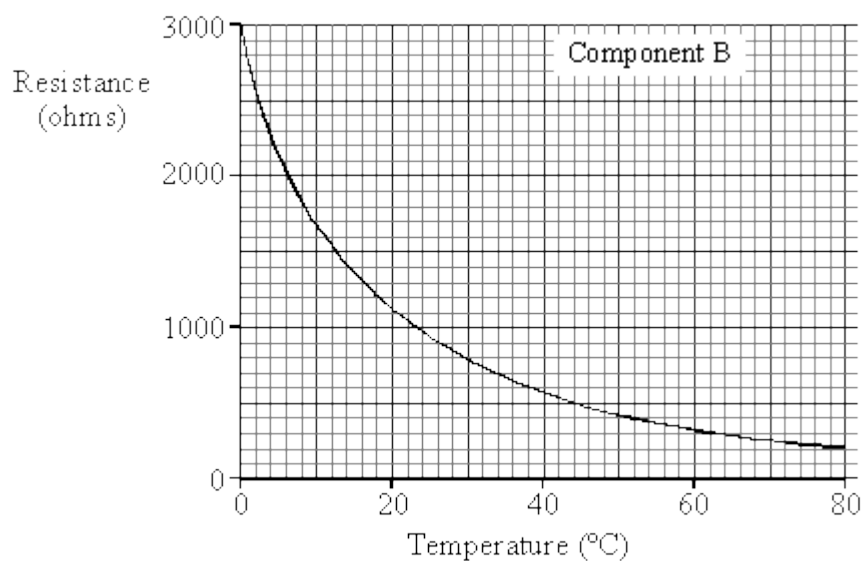
C =

D =

E, F and G =

(5)

- (b) The graph shows how the resistance of component B depends on its temperature.



Describe, in as much detail as you can, how the resistance of component B changes as its temperature rises from 0°C to 80°C.

.....

.....

.....

.....

.....

(4)

- (c) At what temperature does component B have a resistance of 1000 ohms?

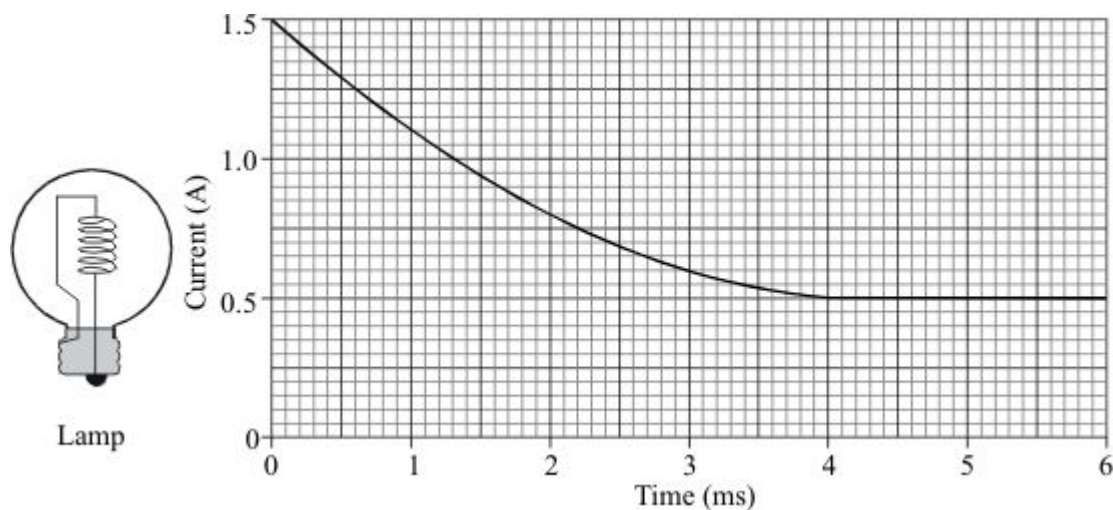
Answer °C .

(2)

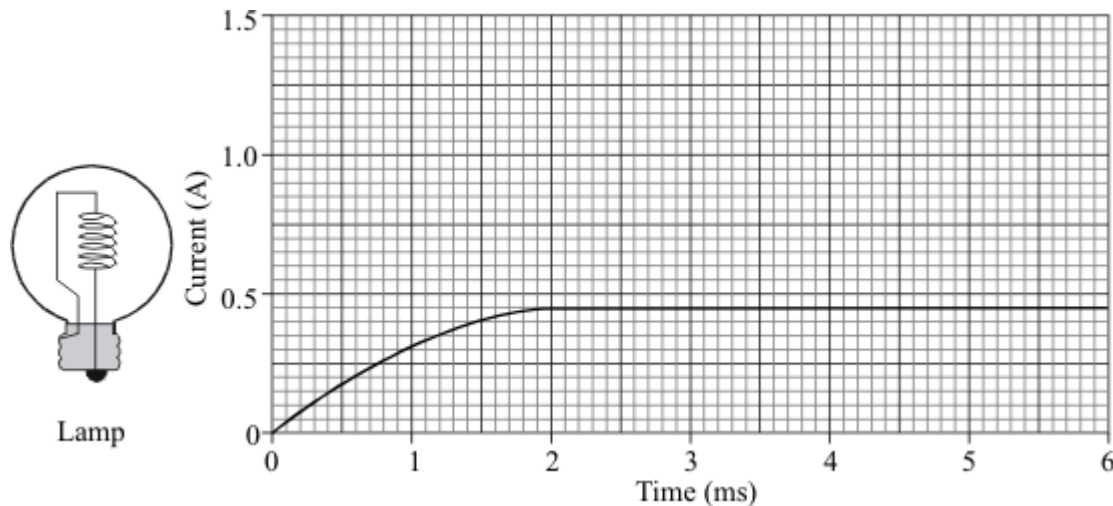
(Total 11 marks)

51

A computer is set up to produce a graph of the current through an electric lamp during the first few milliseconds after it is switched on.



The lamp is modified then tested in the same way.



(a) Describe **three** differences in the way the lamp behaves after it has been modified.

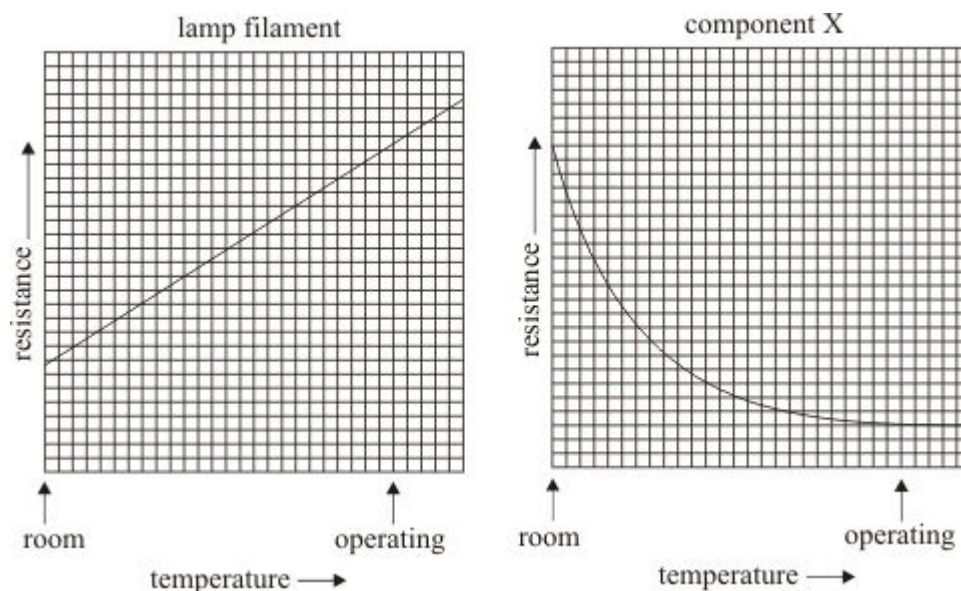
1.
2.
3.

(3)

- (b) The current through the modified lamp depends on the total resistance of the filament and component X.

The smaller this total resistance is, the greater the current.

The following graphs show how the resistance of the lamp filament and component X change as the lamp heats up to its operating temperature.



Use the information shown on the graphs to explain the behaviour of the modified lamp.

.....

.....

.....

.....

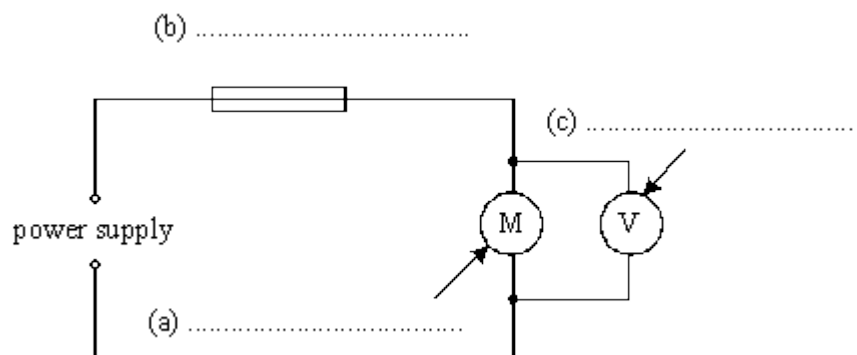
.....

.....

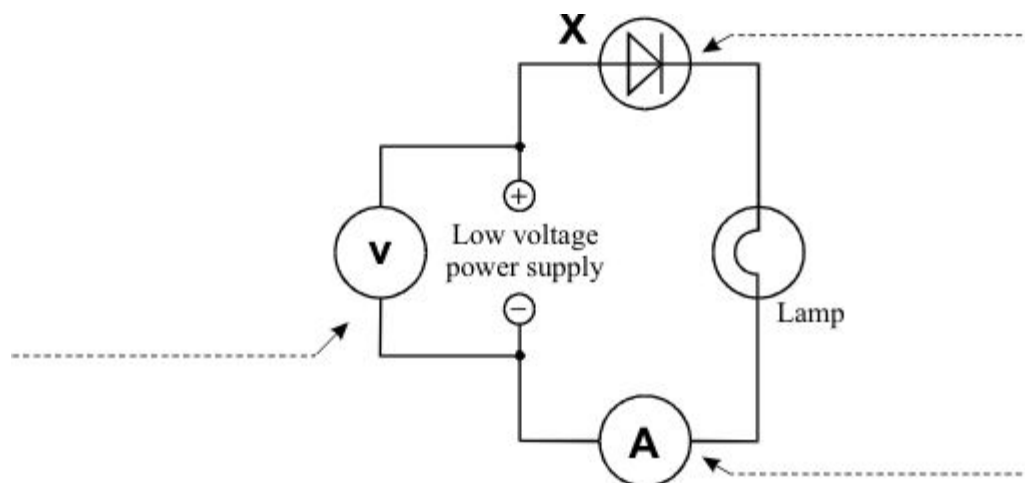
(4)
(Total 7 marks)

52

Label the parts of the electric circuit below.

**(Total 3 marks)****53**

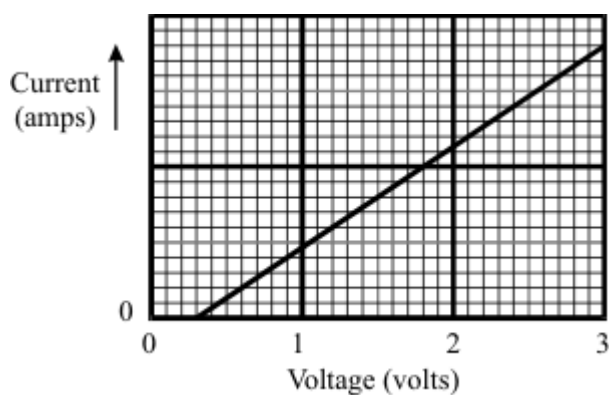
(a) Add the missing labels to the diagram.

**(3)**

- (b) Some students use the circuit shown above.

They want to find out how the current through component X changes as they change the voltage.

The graph shows their results.



Describe, as fully as you can, what happens to the current through component X as the students increase the voltage.

.....

.....

.....

.....

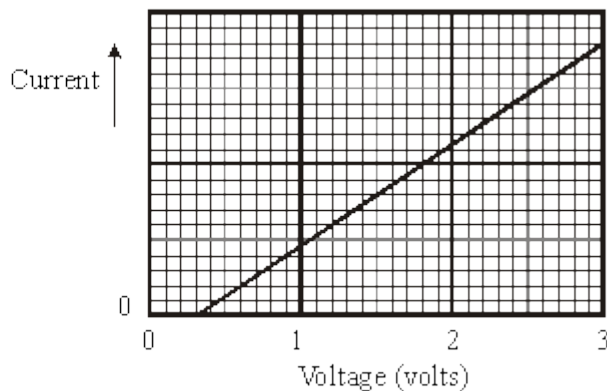
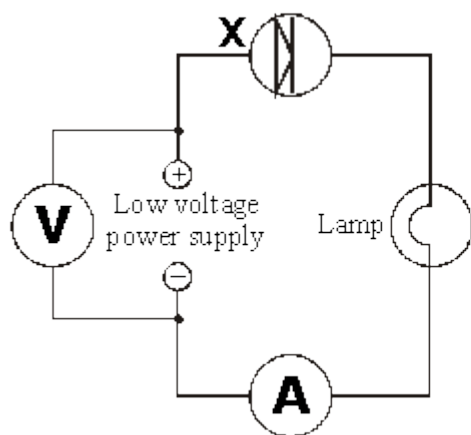
.....

(4)
(Total 7 marks)

54

Some students want to find out how the current through component X changes with the voltage they use.

The diagram shows their circuit. The graph shows their results.



- (a) Describe, as fully as you can, what happens to the current through component X as the students increase the voltage.

.....

.....

.....

(4)

- (b) The students want to find out whether component X allows the same current to flow through it in the opposite direction.

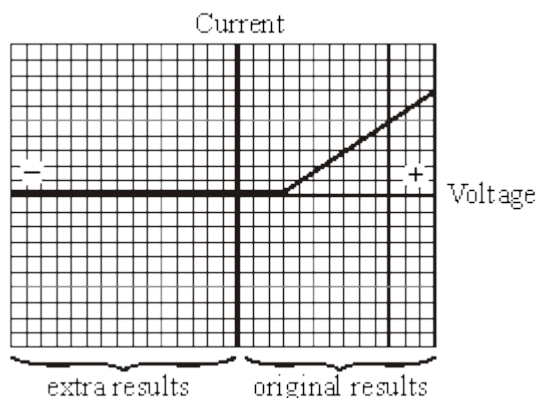
- (i) How should they change the circuit to test this?

.....

(1)

- (ii) The graph shows the students' extra results.

What do the extra results tell you?



.....

.....

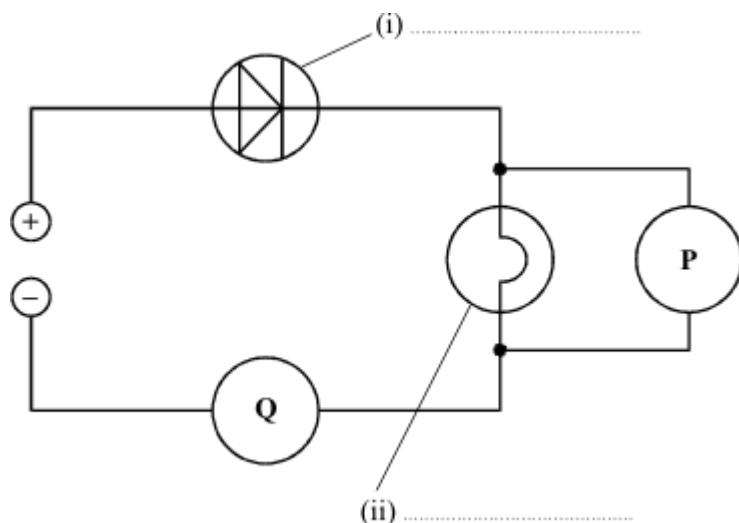
.....

(1)

(Total 6 marks)

55

The diagram shows an electrical circuit.



(a) Complete the two labels on the diagram.

(2)

(b) **P** and **Q** are meters.

What is meter **P** measuring?

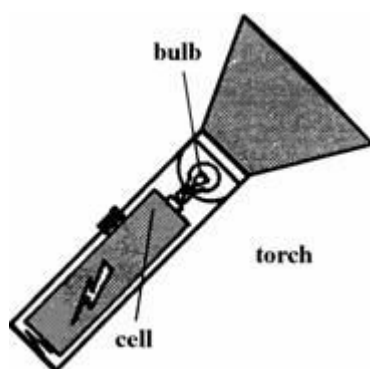
What is meter **Q** measuring?

(2)

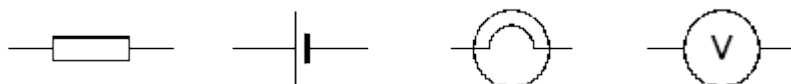
(Total 4 marks)

56

A small torch uses a single cell to make the bulb light up.

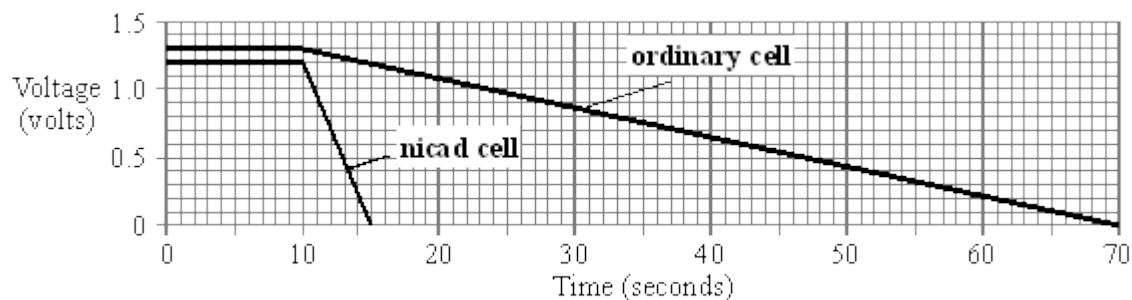


(a) Label the symbol for a cell and the symbol for a bulb (lamp)



(2)

- (b) The graphs show the voltage across two different types of cell as they transfer the last bit of their stored energy through the torch bulb.



Describe the differences that the graphs show between the two types of cell.

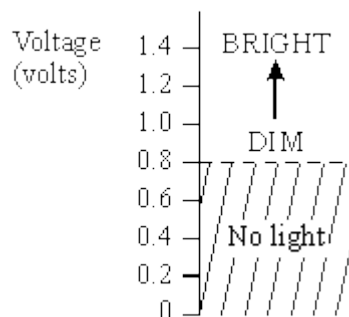
.....

.....

.....

(3)

- (c) The diagram shows how bright the torch bulb is for different voltages.



From the point when the voltage of each cell starts to fall, how long will the bulb stay lit:

- (i) with the ordinary cell?

.....

- (ii) with the nicad cell?

.....

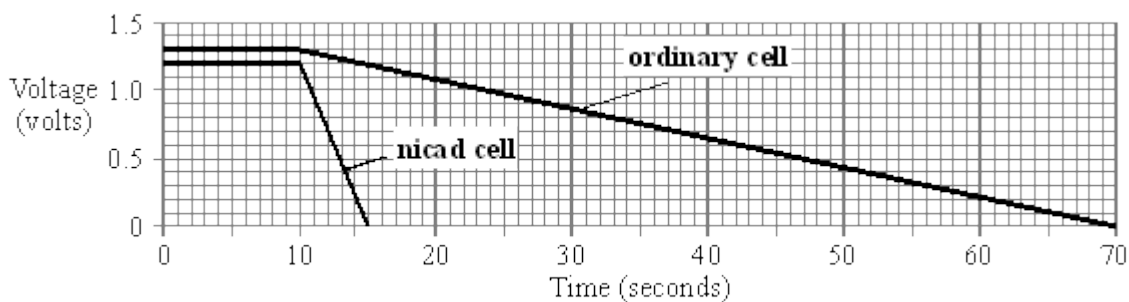
(4)

(Total 9 marks)

57

A small torch uses a single cell to make the bulb light up.

- (a) The graphs show the voltage across two different types of cell as they transfer the last bit of their stored energy through the torch bulb.



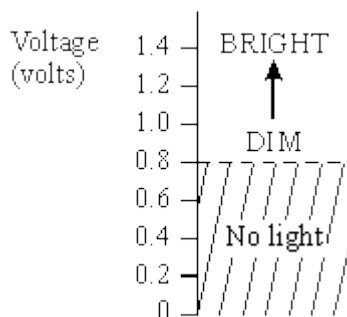
Describe the differences that the graphs show between the two types of cell.

.....

.....

(3)

- (b) The diagram shows how bright the torch bulb is for different voltages.



From the point when the voltage of each cell starts to fall, how long will the bulb stay lit:

- (i) with the ordinary cell?

.....

- (ii) with the nicad cell?

.....

(4)

- (c) When the voltage across the bulb falls to half, the current through the bulb falls by **less than** half. Why is this?

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.....

.....

.....

(3)
(Total 10 marks)