



Electricity Part 3

35 Questions

Name: _____

Class: _____

Date: _____

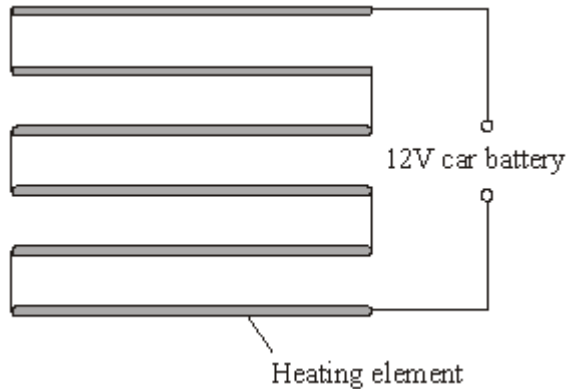
Time:

Marks:

Comments:

Q1.

The diagram shows a simple type of car rear window heater. The six heating elements are exactly the same.



Each heating element has a resistance of 5Ω . The current passing through each element is 0.4 A .

- (i) Calculate the total resistance of the six heating elements.

Show clearly how you work out your answer.

Total resistance = _____ ohms

(2)

- (ii) Why is the current passing through each element the same?

(1)

- (iii) What is the total current passing through the whole circuit?

(1)

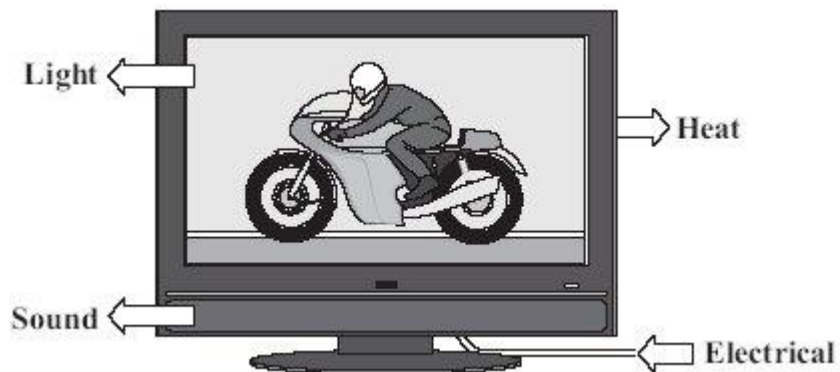
- (iv) How is the 12 volt potential difference of the car battery shared between the six heating elements?

(1)

(Total 5 marks)

Q2.

The diagram shows the energy transformations produced by a TV.



(a) Use words from the diagram to complete the following sentence.

The TV is designed to transform _____ energy into light and _____ energy.

(2)

(b) Which **one** of the following statements is **false**?

Put a tick (✓) in the box next to the **false** statement.

The energy transformed by the TV makes the surroundings warmer.

The energy transformed by the TV becomes spread out.

The energy transformed by the TV will be destroyed.

(1)

(c) Two different makes of television, **A** and **B**, transform energy at the same rate. Television **A** wastes less energy than television **B**.

Complete the following sentence by drawing a ring around the correct line in the box.

Television **A** has

<p>a higher efficiency than</p> <p>the same efficiency as</p> <p>a lower efficiency than</p>
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television **B**.

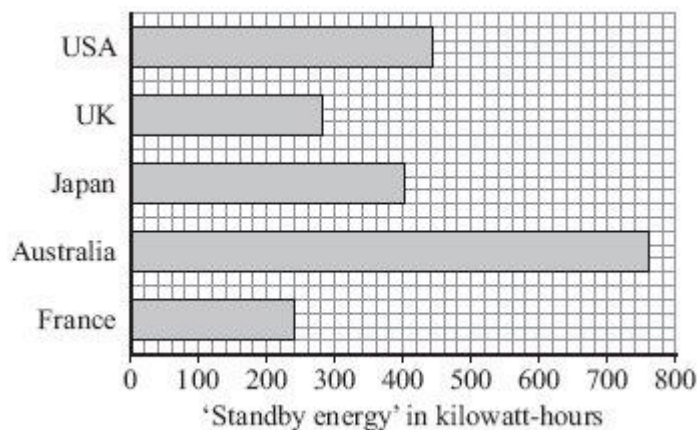
(1)

(Total 4 marks)

Q3.

Electrical appliances that are left on standby still use energy.

The bar chart compares the *average* amount of 'standby energy' wasted each year in every home in five countries.



- (i) In which country are the homes that waste, on average, the smallest amount of 'standby energy'?

Draw a ring around your answer.

Australia France Japan UK USA

(1)

- (ii) Suggest a reason why an *average* value is used for the 'standby energy' wasted in the homes.

(1)

- (b) (i) Australia has one of the lowest electricity prices in the world.

How does this low price seem to affect the amount of 'standby energy' wasted?

(1)

- (ii) In Australia, most electricity is generated in coal-burning power stations. The Australian government wants less electricity to be wasted.

Wasting less electricity would be good for the Australian environment.

Explain why.

(2)

- (c) Energy is not usually measured in kilowatt-hours.

Which **one** of the following units is usually used to measure energy?

Draw a ring around your answer.

hertz

joule

watt

(1)

- (d) (i) Electricity in Japan costs the equivalent of 17 pence per kilowatt-hour.

Use the information in the bar chart and the equation in the box to calculate how much the 'standby energy' used in an average Japanese home costs each year.

$$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$$

Show clearly how you work out your answer.

Give your answer in pence.

Cost = _____ pence

(3)

- (ii) In Japan, the largest proportion of electricity is generated using nuclear fuels.

Which **one** of the following statements gives a good reason for using nuclear fuels to generate electricity?

Put a tick (✓) in the box next to your answer.

A nuclear power station is very expensive to build.

A small amount of nuclear fuel generates a large amount of electricity.

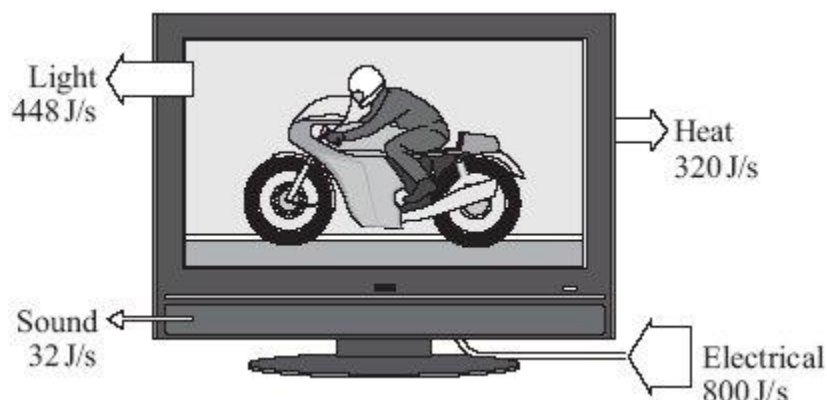
It is easy to store nuclear waste safely.

(1)

(Total 10 marks)

Q4.

- (a) The diagram shows the energy transformations produced by a TV.



- (i) Calculate the efficiency of the TV, using the information in the diagram..

Show clearly how you work out your answer.

Efficiency = _____

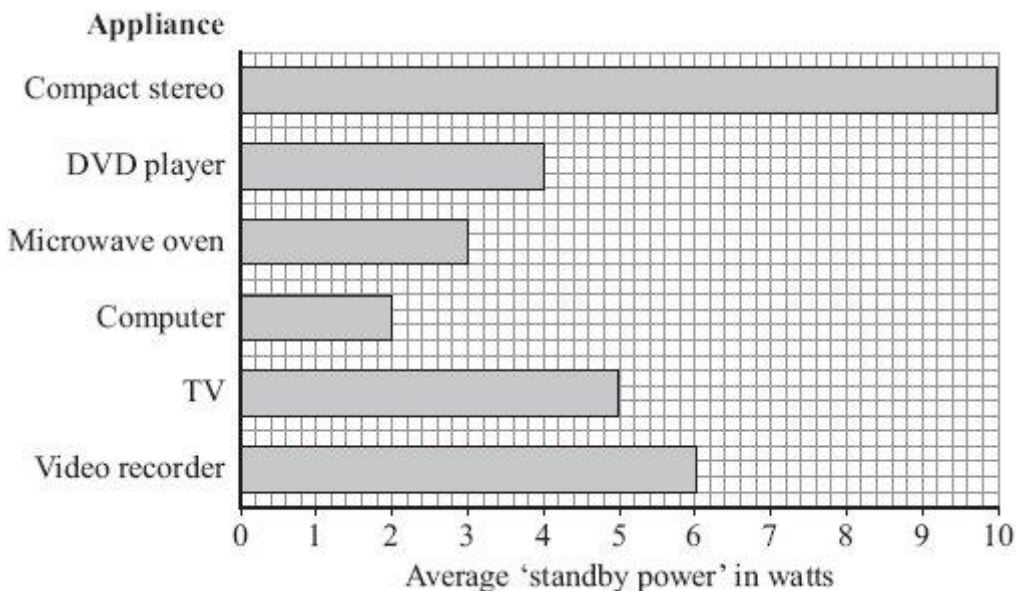
(2)

- (ii) What eventually happens to the useful energy transferred by the TV?

(1)

- (b) Electrical appliances left on standby use energy.

The bar chart shows the power for the appliances that one family leaves on standby when they go on holiday.



The family is on holiday for a total of 175 hours.

- (i) Use the information in the bar chart and the equation in the box to calculate the energy wasted by leaving the compact stereo on standby while the family is on holiday.

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)
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Show clearly how you work out your answer.

Energy wasted = _____ kilowatt-hours

(2)

- (ii) Electricity costs 12 p per kilowatt-hour.

Use the equation in the box to calculate the cost of leaving the compact stereo on standby while the family is on holiday.

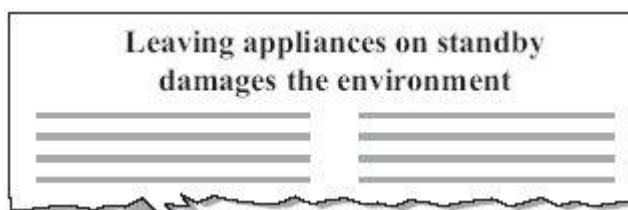
$$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$$

Show clearly how you work out your answer.

Cost = _____ p

(1)

- (c) A headline from a recent newspaper article is shown below.



Explain why leaving appliances on standby damages the environment.

(2)

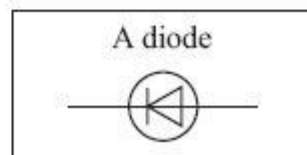
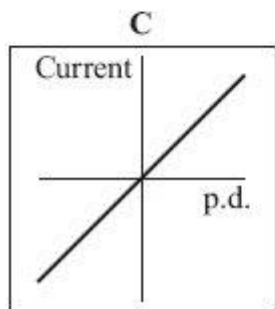
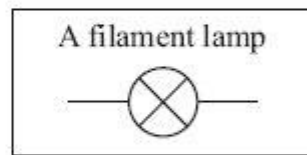
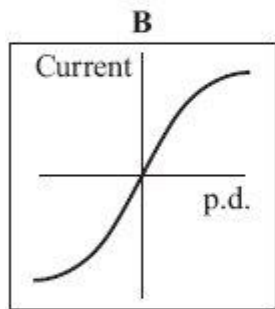
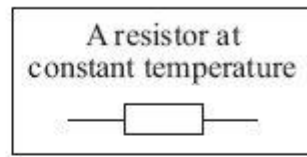
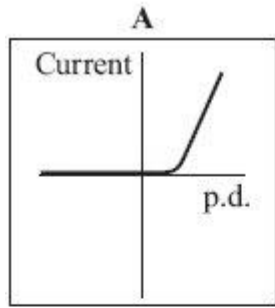
(Total 8 marks)

Q5.

- (a) The graphs, **A**, **B** and **C**, show how the current through a component varies with the potential difference (p.d.) across the component.

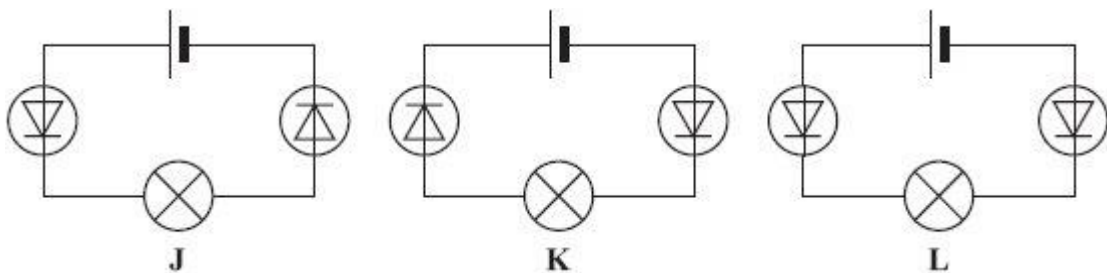
Draw a line to link each graph to the correct component.
Draw only **three** lines.

Component



(2)

(b) Each of the circuits, **J**, **K** and **L**, include two diodes.



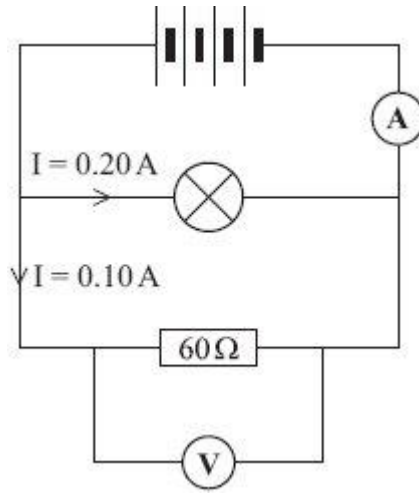
In which **one** of the circuits, **J**, **K** or **L**, would the filament lamp be on?

(1)

(Total 3 marks)

Q6.

A circuit was set up as shown in the diagram.



(a) Each cell provides a potential difference of 1.5 volts.

(i) What is the total potential difference provided by the four cells in the circuit?

Total potential difference = _____ volts

(1)

(ii) What will be the reading on the voltmeter?

(1)

(b) The current through the lamp is 0.20 amps.
The current through the resistor is 0.10 amps.

What is the reading on the ammeter?

Reading on ammeter = _____ amps

(1)

(c) Use a phrase from the box to complete the following sentence.

greater than	equal to	smaller than
---------------------	-----------------	---------------------

The resistance of the lamp is _____ 60 Ω.

Give a reason for your answer.

(2)

(Total 5 marks)

Q7.

(a) Each letter **A**, **B**, **C**, **D** and **E** represents an energy transformation.

A electrical to gravitational potential

B electrical to heat

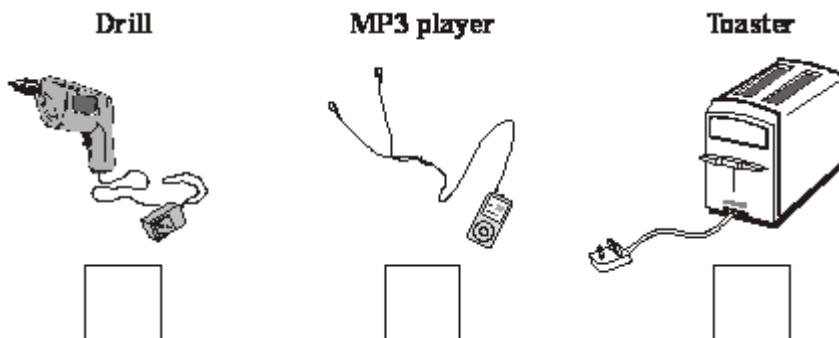
C electrical to kinetic

D electrical to light

E electrical to sound

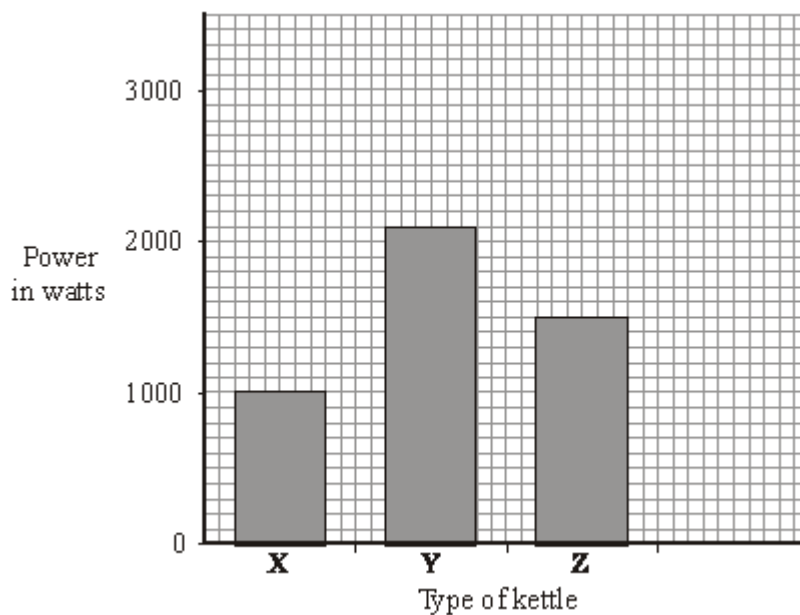
Match each of the following devices to the useful energy transformation that it is designed to make.

Write the correct letter, **A, B, C, D** or **E**, in the box below the device. Use each letter once or not at all.



(3)

(b) The bar chart shows the power of three electric kettles.



(i) What is the power of kettle Y?

(1)

(ii) In one week each kettle is used for a total of 30 minutes.

Which kettle costs the most to use?

(1)

(iii) A new 'express boil' kettle boils water faster than any other kettle.

Draw a fourth bar on the chart to show the possible power of an 'express boil' kettle.

(1)

(c) Some friends are going on holiday. They want to be able to boil water to make their own hot drinks. They cannot decide which to take, a travel kettle or a small portable immersion heater that can be placed in a mug.



Travel Kettle
<ul style="list-style-type: none">• 1 k W element• Holds 1 litre• Works on 110V or 230V• Washable water filter

Immersion heater
<ul style="list-style-type: none">• 0.4 k W element• Heates up to 0.5 litres of water• Works on 230 V only• Small compact size

(i) Give **one** advantage of taking the travel kettle.

(1)

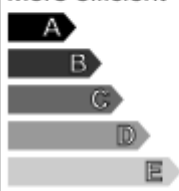

(ii) Give **one** advantage of taking the immersion heater.

(1)

(Total 8 marks)

Q8.

The diagram shows the label from a new freezer.

Model Energy A	SALE See inside for details
More efficient  Less efficient	
Energy consumption per year	225 kWh

- (a) An old freezer has an energy consumption per year of 350 kWh.

Use the equation in the box to calculate the extra cost of using the old freezer for one year compared with using a new 'A' rated freezer.

total cost = number of kilowatt-hours × cost per kilowatt-hour
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Assume 1 kilowatt-hour (kWh) of energy costs 12 p.

Show clearly how you work out your answer.

Extra cost per year = £ _____

(2)

- (b) The price of the new freezer was reduced in a sale.

Reducing the price reduces the payback time for replacing the old freezer from 12 years to 9 years.

Calculate, in pounds, how much the new freezer was reduced in the sale.

Show clearly how you work out your answer.

Price reduced by = £ _____

(2)

- (c) An advertisement in a shop claims that:

'Replacing an old freezer with a new 'A' rated freezer will benefit the environment.'

Do you agree that replacing the freezer will benefit the environment?

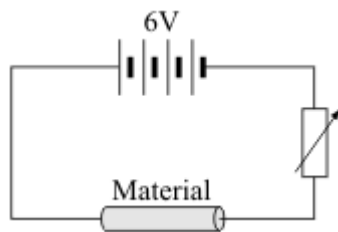
Answer yes or no. _____

Explain the reasons for your answer.

(2)
(Total 6 marks)

Q9.

- (a) The diagram shows the circuit used to investigate the resistance of a material. The diagram is incomplete; the ammeter and voltmeter are missing.

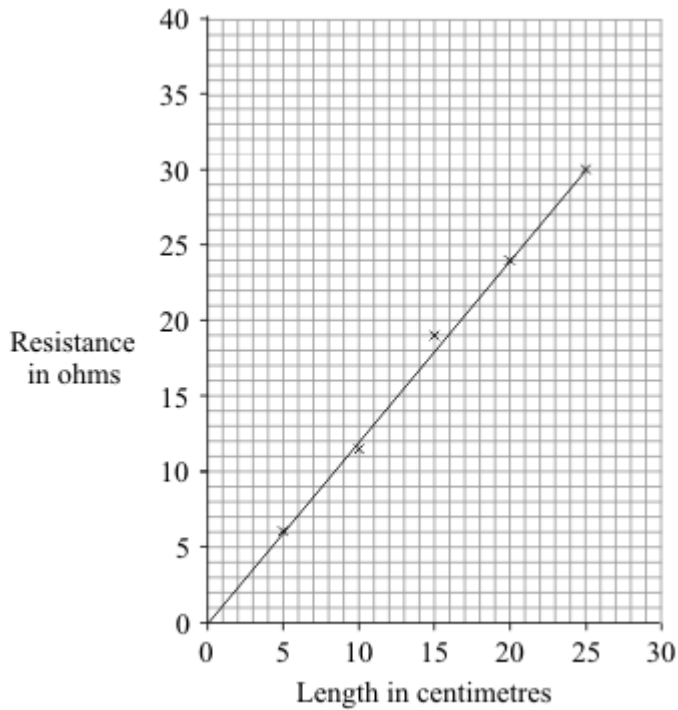


- (i) Draw the symbols for the ammeter and voltmeter on the diagram in the correct places. (2)
- (ii) How can the current through the material be changed? (1)

- (b) The material, called conducting putty, is rolled into cylinders of different lengths but with equal thicknesses.

Graph 1 shows how the resistance changes with length.

Graph 1



- (i) Why has the data been shown as a line graph rather than a bar chart?

(1)

- (ii) The current through a 30 cm length of conducting putty was 0.15 A.

Use **Graph 1** to find the resistance of a 30 cm length of conducting putty.

Resistance = _____ ohms

(1)

- (iii) Use your answer to (b)(ii) to calculate the potential difference across a 30 cm length of conducting putty.

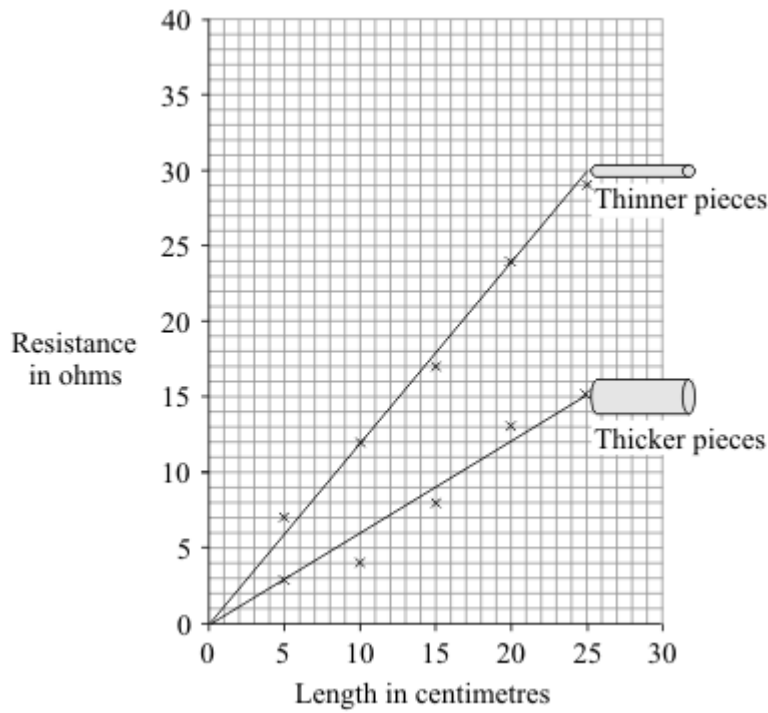
Show clearly how you work out your answer.

Potential difference = _____ volts

(2)

- (c) A second set of data was obtained using thicker pieces of conducting putty. Both sets of results are shown in **Graph 2**.

Graph 2



- (i) What is the relationship between the resistance and the thickness of the conducting putty?

(1)

- (ii) Name **one** error that may have reduced the accuracy of the results.

(1)

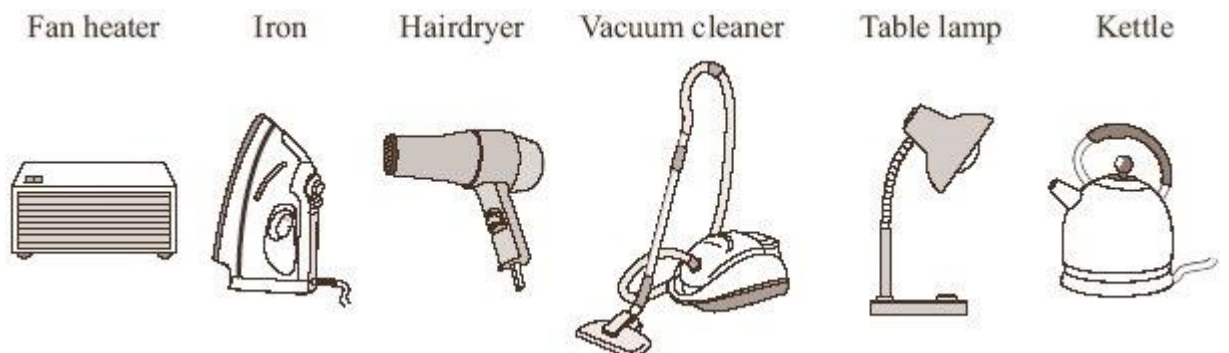
- (iii) How could the reliability of the data have been improved?

(1)

(Total 10 marks)

Q10.

The pictures show six different household appliances.



- (a) Four of the appliances, including the fan heater, are designed to transform electrical energy into heat.

Name the other **three** appliances designed to transform electrical energy into heat.

1. _____
2. _____
3. _____

(3)

- (b) Complete the following sentence using **one** of the words from the box.

chemical	heat	kinetic	sound
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Energy that is not usefully transformed by the fan heater is wasted as _____ energy.

(1)

- (c) The table gives information about two different fan heaters.

	Useful energy transferred each second in joules	Wasted energy transferred each second in joules
Fan heater L	1200	10
Fan heater M	1200	20

Complete the following sentence by drawing a ring around the line in the box that is correct.

Fan heater **L**

is more efficient than
has the same efficiency as
is less efficient than

 fan heater **M**.

(1)

(Total 5 marks)

Q11.

A householder was out shopping when her electricity meter reading should have been taken. The electricity company estimated the reading and sent the following bill. Unfortunately, the bill was damaged in the post.

AQA electricity Customer reference: 2634724983
Date sent out: 18 September 2007

Your electricity bill

Present reading: 62740 (e) taken on 13 September
 Previous reading: 62580 taken on 12 June

Used: 160 kWh

Cost per kWh = 12p (e) = estimated reading
 Cost of electricity used = _____

- (a) Use the equation in the box to calculate the cost of the electricity used between 12 June and 13 September.

total cost = number of kilowatt-hours \times cost per kilowatt-hour

Show clearly how you work out your answer.

Total cost = _____

(2)

- (b) The estimated reading shown on the bill was not very accurate. The correct reading was 62920.

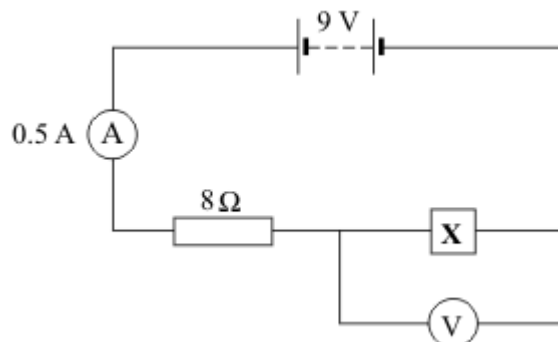
How many kilowatt-hours of electricity had the householder actually used between 12 June and 13 September?

(2)

(Total 4 marks)

Q12.

- (a) The circuit diagram drawn below includes a component labelled **X**.



- (i) Calculate the potential difference across the 8 ohm resistor.

Show clearly how you work out your answer.

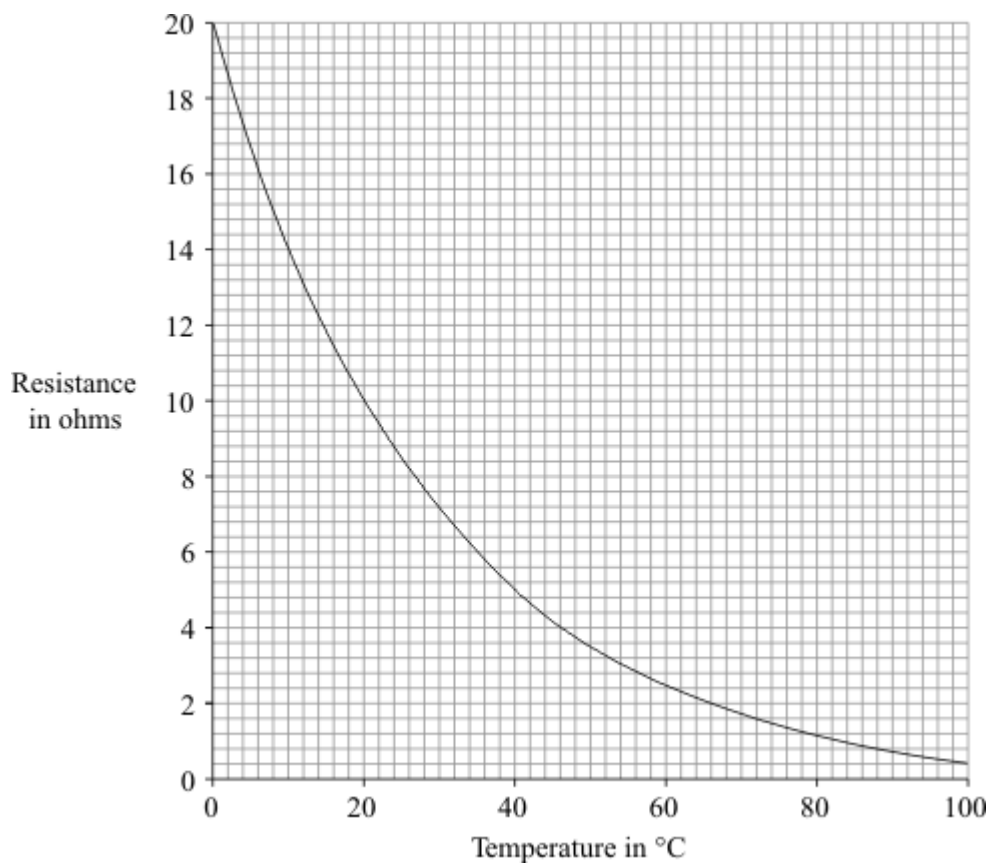
Potential difference = _____ volts

(2)

- (ii) What is the potential difference across component X?

(1)

- (b) The graph shows how the resistance of component X changes with temperature.



- (i) What is component X?

(1)

- (ii) Over which range of temperatures does the resistance of component X change the most?

Put a tick (✓) next to your choice.

0 °C to 20 °C

20 °C to 40 °C

40 °C to 60 °C

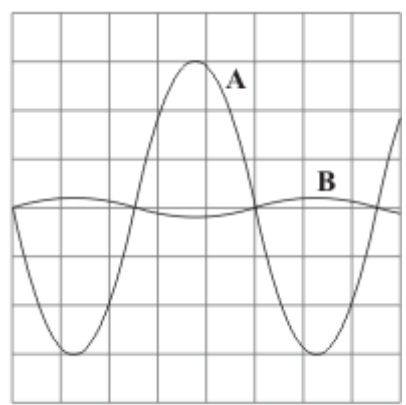
60 °C to 80 °C

80 °C to 100 °C

(1)
(Total 5 marks)

Q13.

The diagram shows two oscilloscope traces, **A** and **B**.



Trace **A** shows how the potential difference between the live and neutral terminals of an electricity supply changes with time.

(a) Describe how the potential of the live terminal varies with respect to the neutral terminal of the electricity supply.

(2)

(b) What does trace **B** show?

(1)

(c) Each horizontal division on the oscilloscope represents 0.005 s.

(i) What is the period of this electricity supply?

Period = _____ seconds

(1)

(ii) Calculate the frequency of the supply.

Frequency = _____ hertz

(1)

(Total 5 marks)

Q14.

- (a) The picture shows a new washing machine.



Complete the following sentence using **one** of the words in the box.

kinetic	light	sound
----------------	--------------	--------------

A washing machine is designed to transform electrical energy into heat and _____ energy

(1)

- (b) The instruction booklet for the washing machine contains the following information.

Wash cycle	Average power during cycle	Time taken to run cycle
HOT	1.5 kW	2 hours
COOL	1.1 kW	1½ hours
FAST	1.0 kW	¾ hour

- (i) Use the following equation to calculate the energy transferred, in kilowatt-hours, to the washing machine during the HOT wash cycle. Show how you work out your answer.

energy transferred = power × time

Energy transferred = _____ kWh

(2)

- (ii) Why does it cost more to use the washing machine on the HOT cycle than on the COOL or FAST cycle?

(1)

- (iii) Before buying a washing machine, a householder researched several makes to find out which washing machine was the most energy efficient.

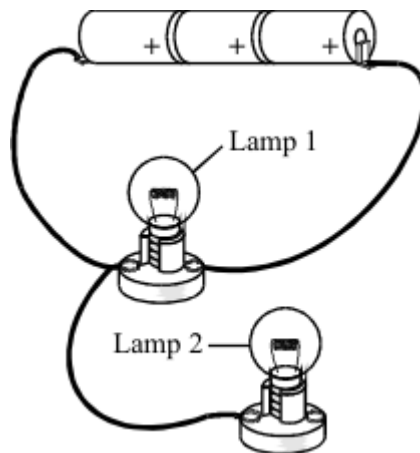
Write down **one** way that he could have done this research.

(1)

(Total 5 marks)

Q15.

The drawing shows three identical cells and two identical lamps joined in a circuit.



- (a) Use the correct symbols to draw a circuit diagram for this circuit.

(3)

- (b) Each of the cells provides a potential difference (voltage) of 1.5 volts. What is the total potential difference (voltage) provided by all three cells?

_____ volts

(1)

- (c) Complete this sentence by crossing out the **two** lines in the box that are wrong.

smaller than the same as bigger than
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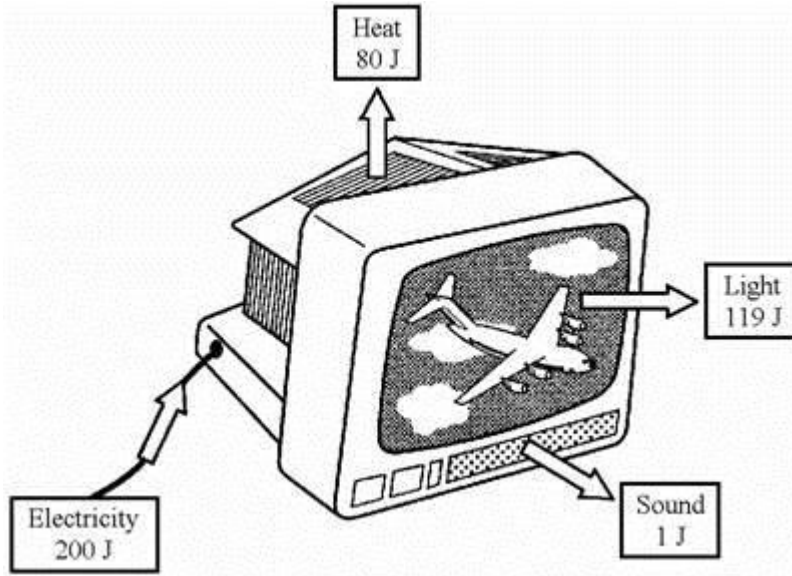
The current through lamp 2 will be _____ the current through lamp 1.

(1)

(Total 5 marks)

Q16.

- (a) The drawing shows the energy transferred each second by a television set.



- (i) What form of energy is transferred as waste energy by the television set?

(1)

- (ii) What effect will the waste energy have on the air around the television set?

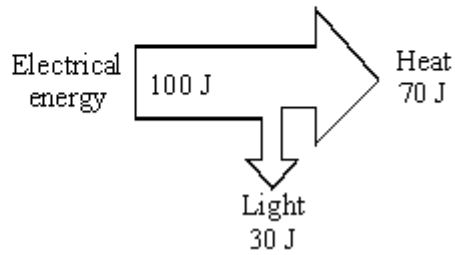
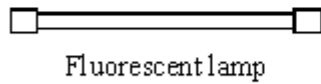
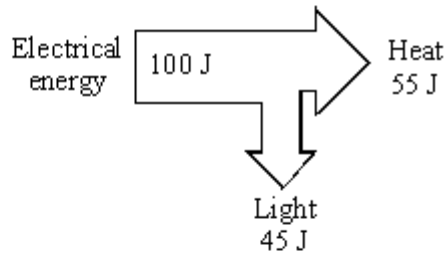
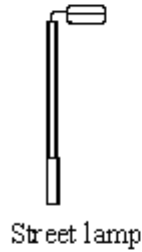
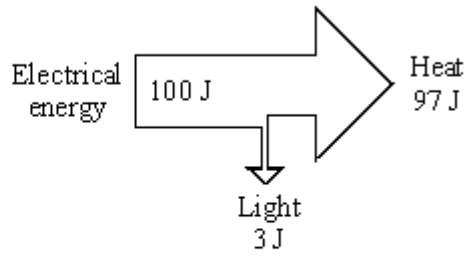
(1)

- (iii) Calculate the efficiency of the television set.

Efficiency = _____

(2)

- (b) The diagrams show the energy transferred each second for three different types of lamp. For each lamp the electrical energy input each second is 100 joules.



Which type of lamp is the most efficient?

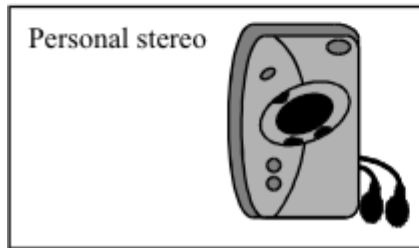
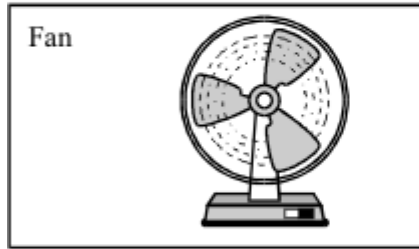
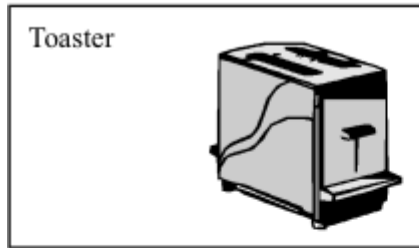
Give a reason for your choice.

(2)
(Total 6 marks)

Q17.

- (a) List **A** shows three electrical devices. List **B** gives different forms of useful energy. Draw a straight line from each of the devices in List **A** to the useful energy form it produces in List **B**. Draw only **three** lines.

**List A
Device**



**List B
Useful energy**

Light

Kinetic

Sound

Heat

(3)

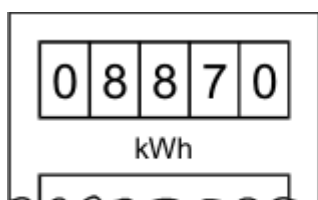
(b) The power of each device is given in the table.

Device	Power
Toaster	1.2 kW
Fan	30 W
Personal Stereo	10 W

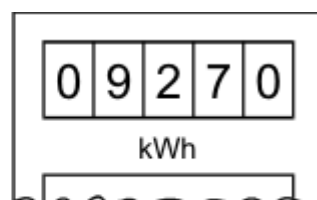
Which **one** of the devices will transfer the most energy in 10 minutes?

(1)

(c) The diagrams show the readings on a domestic electricity meter in April and July.



April



July

- (i) How many Units (kWh) of electricity were used between the two meter readings?

Number of Units = _____

(1)

- (ii) One Unit costs 6p.

Use the following equation to calculate the cost of the electrical energy used between the two meter readings. Show clearly how you work out your answer.

total cost = number of Units \times cost per Unit

Cost = _____

(2)

- (d) A 3000 watt electric cooker is switched on for 2 hours.

Use the following equation to calculate the number of Units of energy transferred by the cooker. Show clearly how you work out your answer.

energy transferred (kilowatt-hour, kWh) = power (kilowatt, kW) \times time (hour, h)

Energy transferred = _____ kWh

(2)

(Total 9 marks)

Q18.

A set of Christmas tree lights is made from twenty identical lamps connected in series.



- (a) Each lamp is designed to take a current of 0.25 A. The set plugs directly into the 230 V mains electricity supply.

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

(1)

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

Resistance = _____

(4)

- (iii) What is the total resistance of the set of lights?

Total resistance = _____

(1)

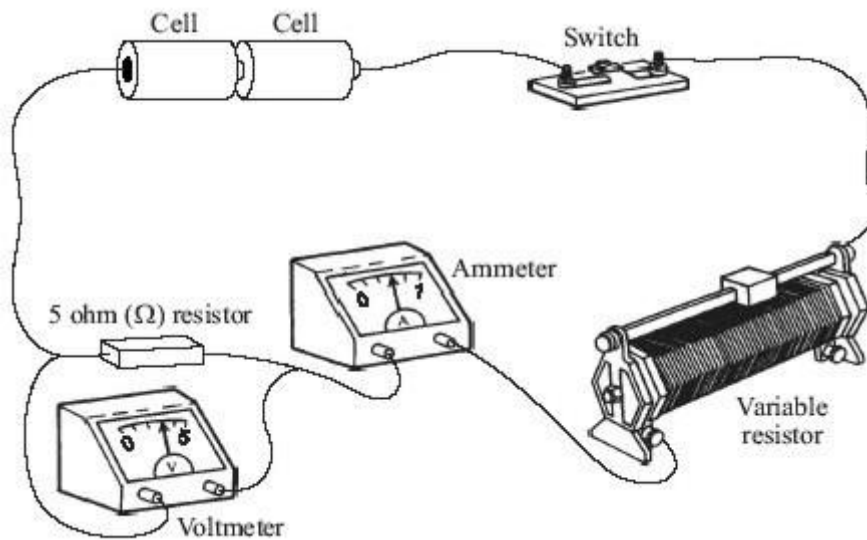
- (b) How does the resistance of a filament lamp change as the temperature of the filament changes?

(1)

(Total 7 marks)

Q19.

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)

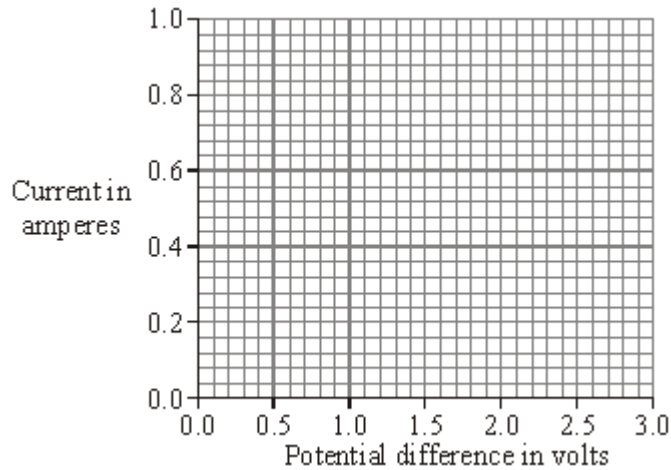
(ii) Calculate the potential difference across the 5 ohm (Ω) resistor when the current through the resistor equals 0.4 A. Show clearly how you work out your final answer.

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)

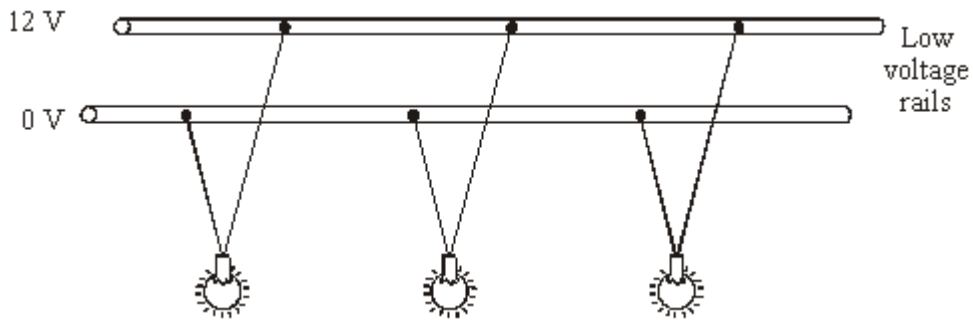
- (c) The resistor is replaced by a 3 V filament lamp. The resistance of the lamp increases as the potential difference across it increases. Why?

(1)

(Total 8 marks)

Q20.

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.

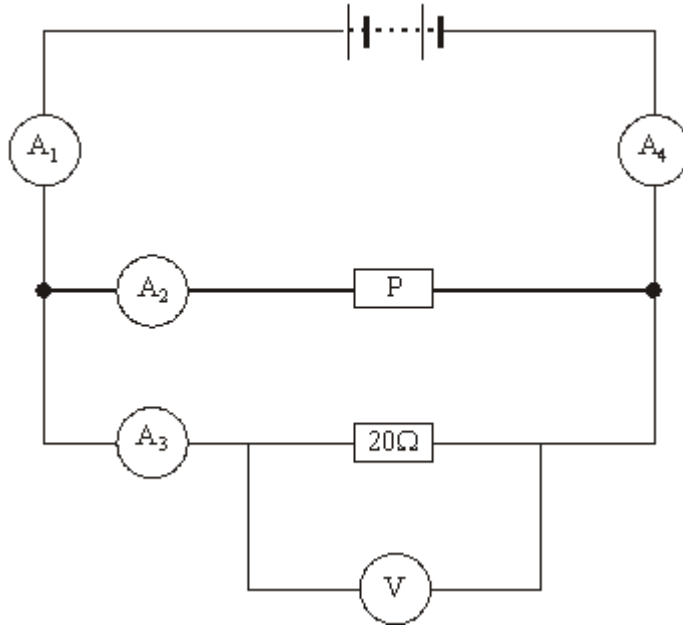
current = _____ A

(2)

(Total 3 marks)

Q21.

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 Ω.

The resistance of **P** is equal to 20 Ω.

The resistance of **P** is less than 20 Ω.

Give a reason for your choice.

(2)

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

_____ (1)

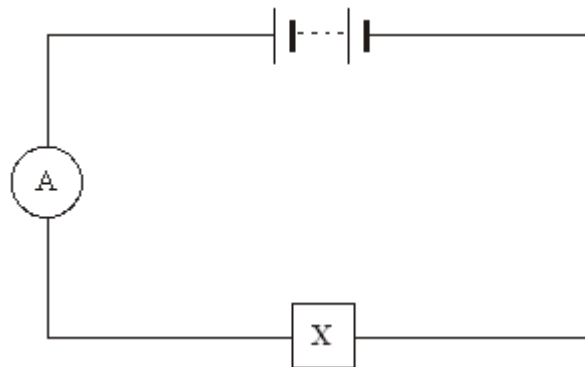
- (ii) Calculate the reading on the voltmeter. Show clearly how you work out your answer.

Voltmeter reading = _____ volts. (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.

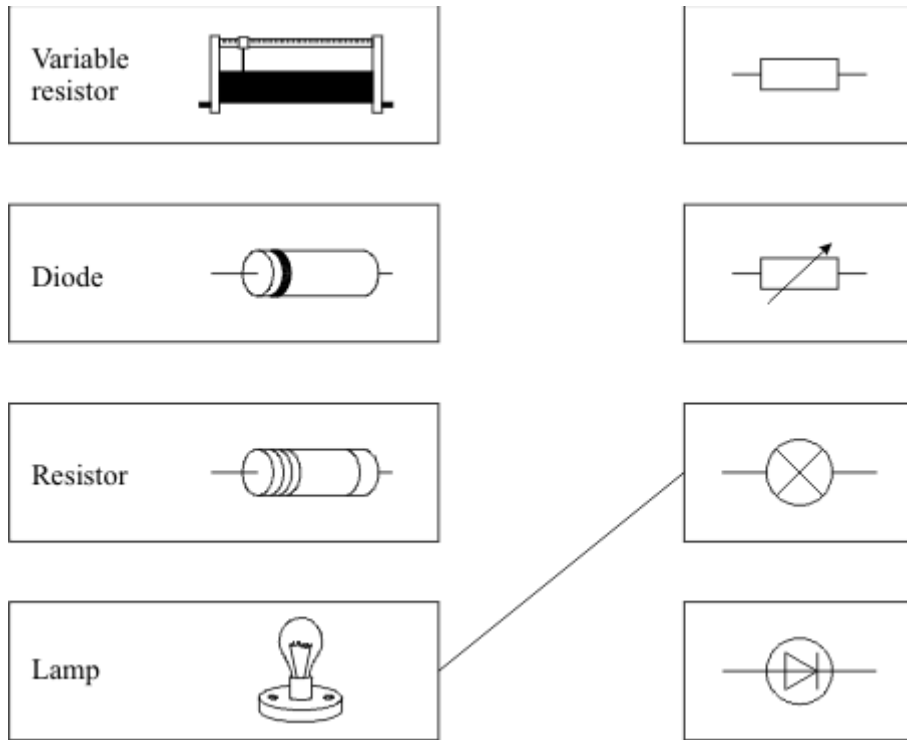
What is component X?

Give a reason for your answer.

(2)
(Total 10 marks)

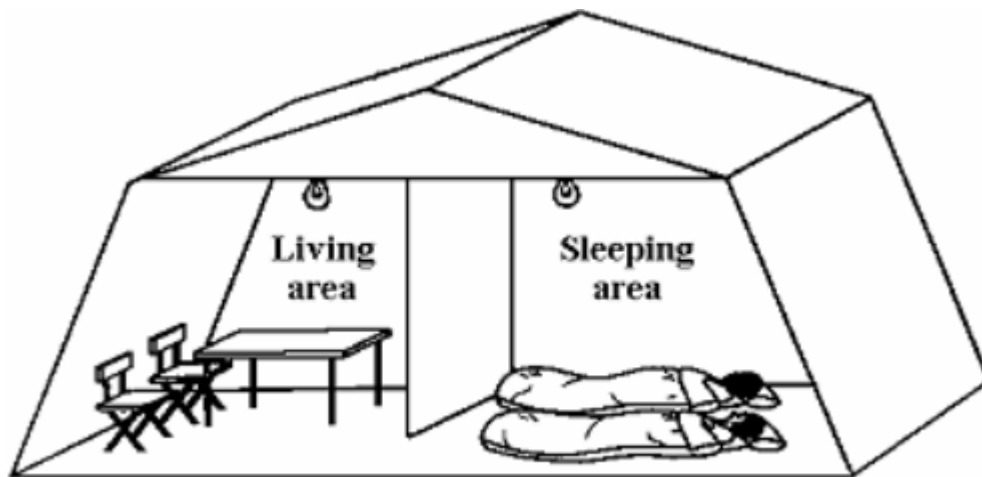
Q22.

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

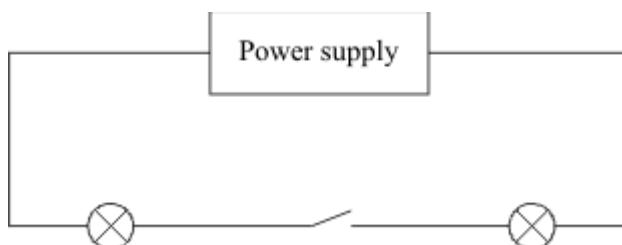


(2)

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



The diagram shows the first circuit used.



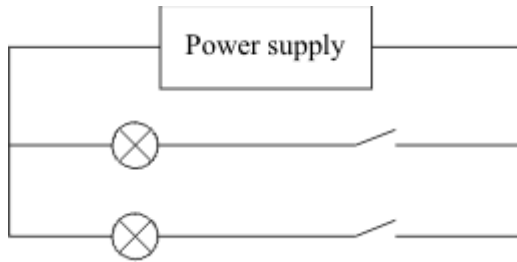
(i) Are the lamps connected in series or in parallel?

(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. _____

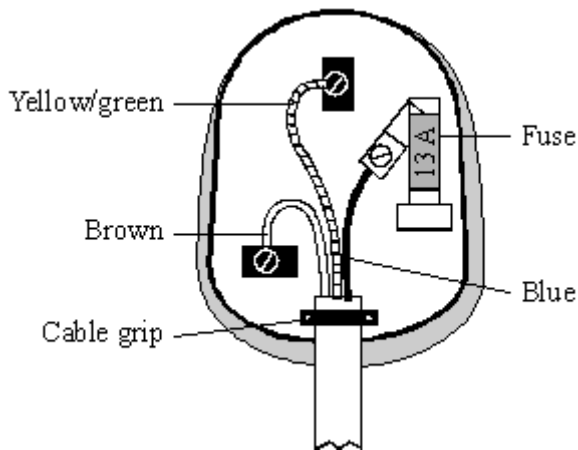
2. _____

(2)

(Total 6 marks)

Q23.

(a) The diagram shows a 13 amp plug.



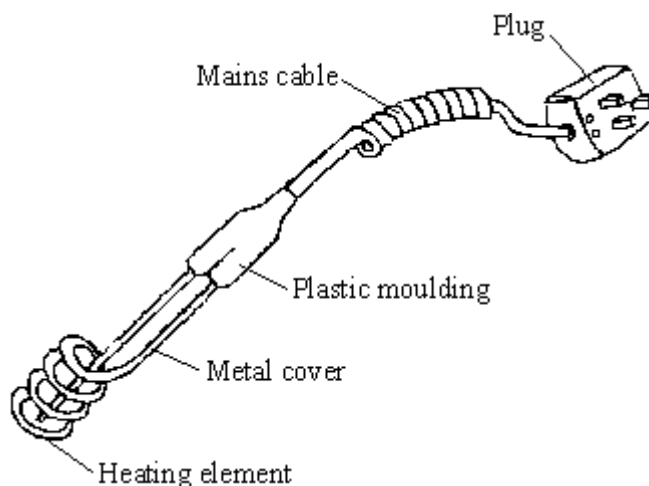
(i) What is wrong with the way this plug has been wired?

(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.



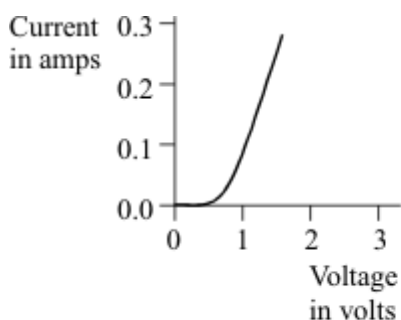
Which part of the immersion heater should be connected to the earth pin of the plug?

(1)

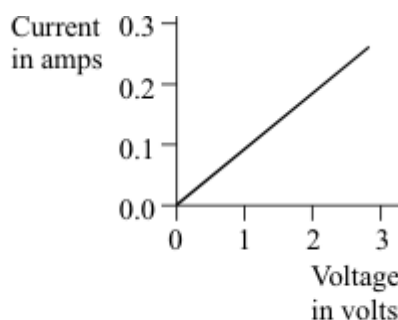
(Total 3 marks)

Q24.

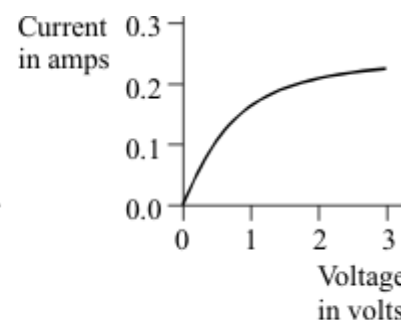
- (a) The diagram shows the voltage-current graphs for three different electrical components.



A



B

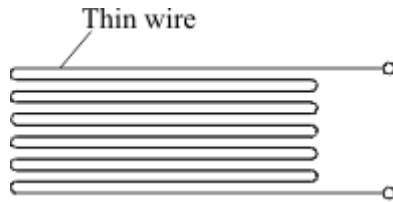


C

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)

Q25.

(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: _____

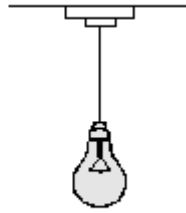
Symbol:

(2)

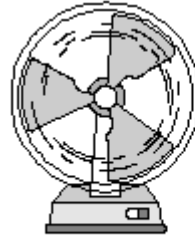
- (b) When an electric current flows through a wire, the wire will get hot. **Two** of the following make use of this heating effect. Which **two**?



Microwave oven



Light bulb



Fan



Hairdryer

1. _____

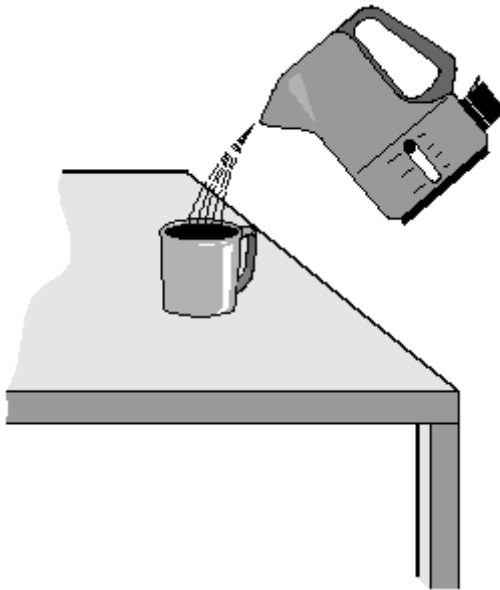
2. _____

(2)

(Total 5 marks)

Q26.

- (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.



Heat energy is being transferred from the _____ to
the _____.

(1)

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

(1)

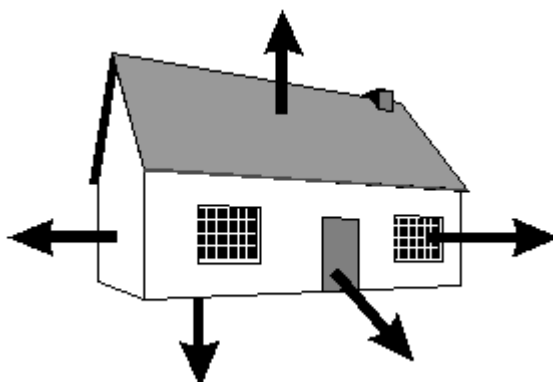
(b) In the box are the names of four types of fuel used to heat homes.

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	electric	evaporation	insulat
or				

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

_____.

(2)

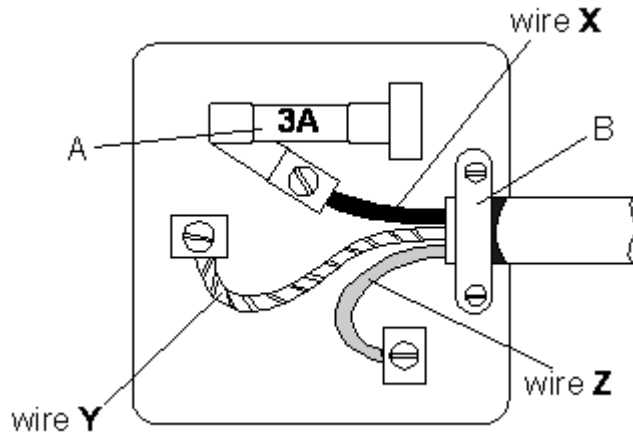
(ii) Write down **one** other way of reducing heat loss from a house.

(1)

(Total 6 marks)

Q27.

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.

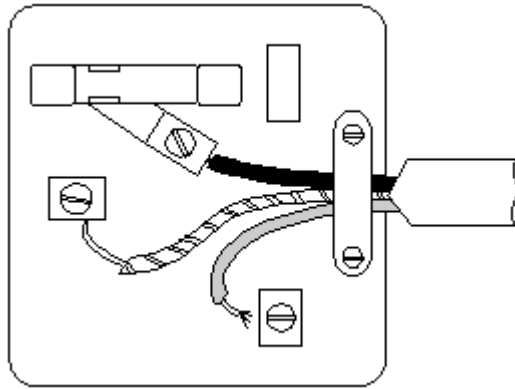
(i) What is the third wire called?

(1)

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

(1)

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



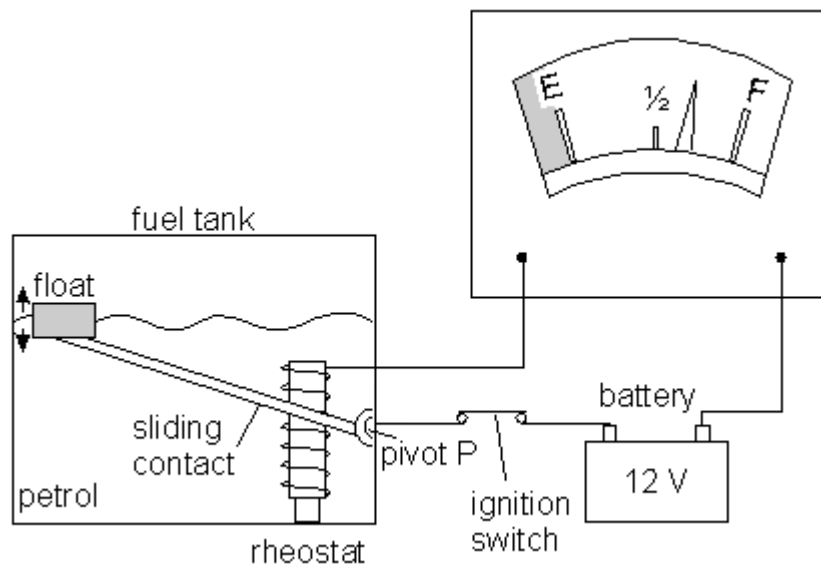
Look at the plug carefully. What **four** changes should be made to make the plug safe?

1. _____
- _____
2. _____
- _____
3. _____
- _____
4. _____
- _____

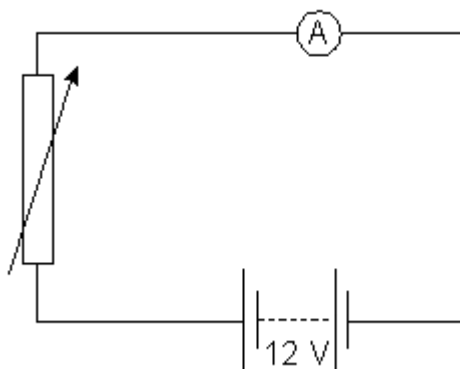
(4)
(Total 12 marks)

Q28.

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.

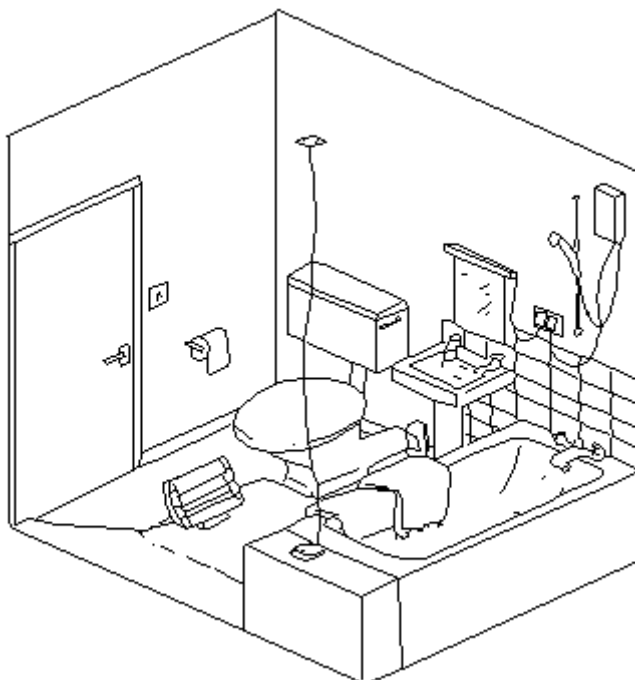


The petrol gauge is an ammeter. Explain why the reading on the ammeter falls as the petrol is used.

(Total 3 marks)

Q29.

(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)

Q30.

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 _____

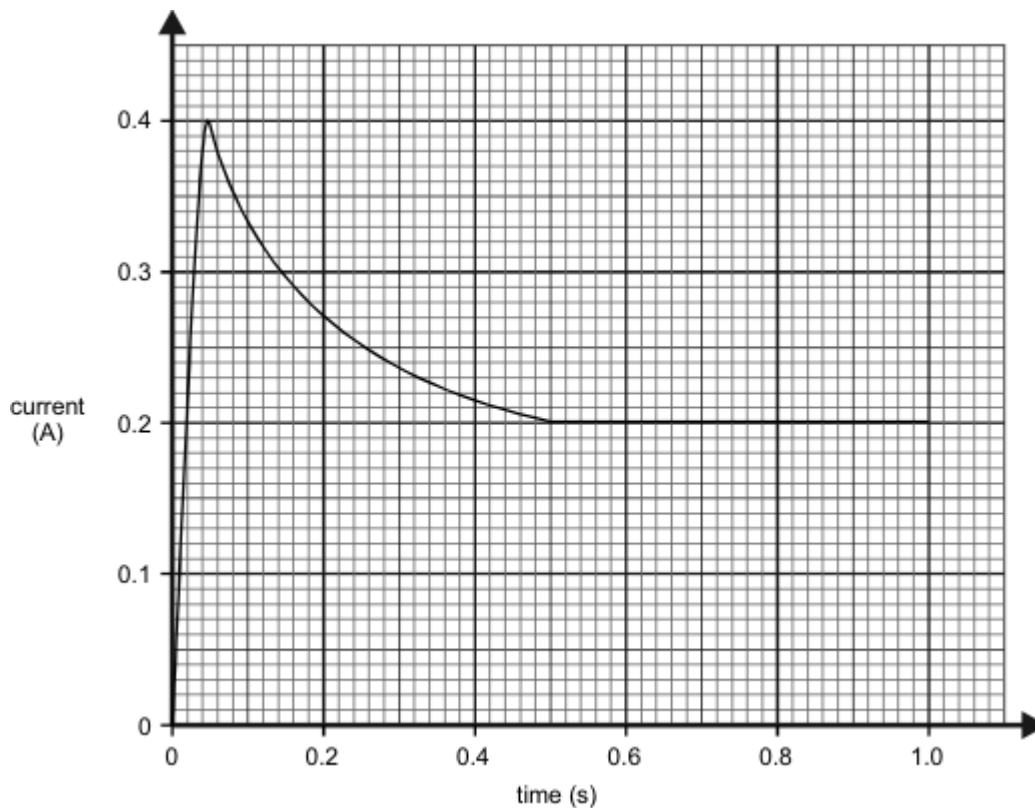
Use _____

(2)

(Total 8 marks)

Q31.

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)

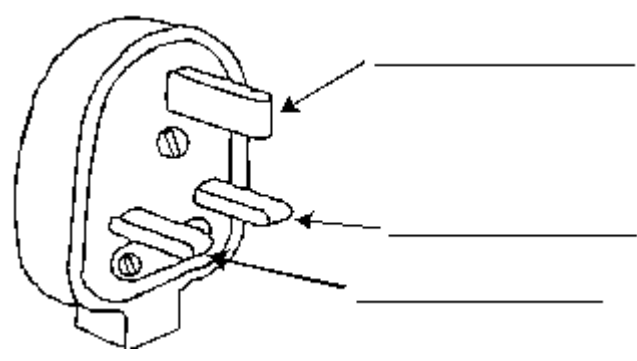
(e) Calculate the energy used by the lamp in six hours of normal use.

(3)

(Total 12 marks)

Q32.

(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.

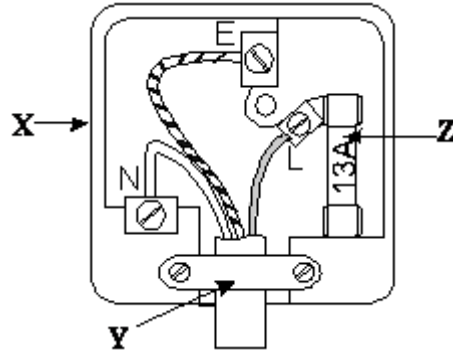


On the diagram, label each pin to show which is:

- 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.

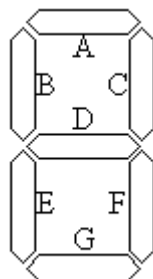
Which part of the electric fire is connected to the earth pin?

(5)

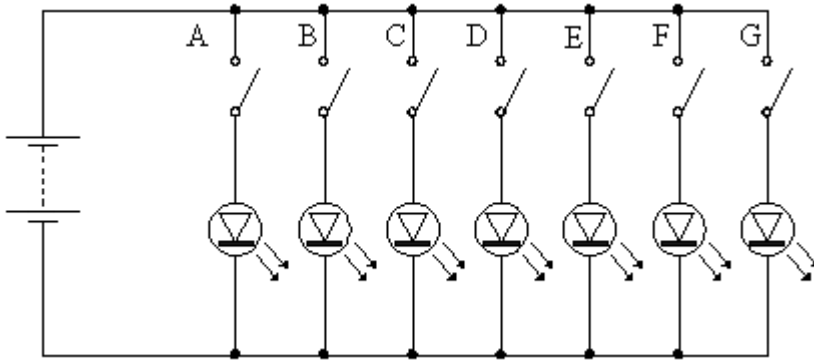
(Total 8 marks)

Q33.

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 _____

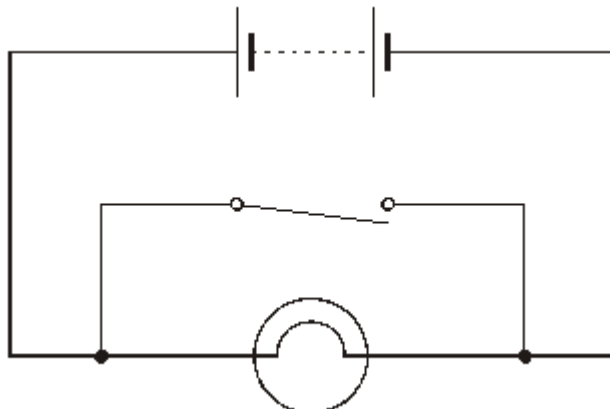
Explanation _____

(2)

(Total 6 marks)

Q34.

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)

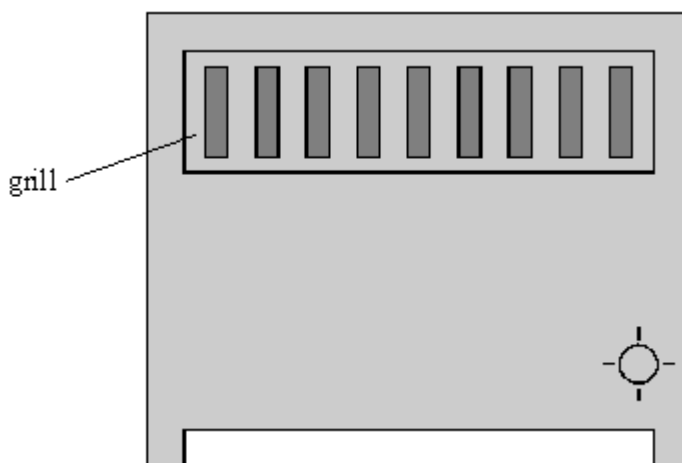
(c) In the space below draw a circuit diagram to show how the switch should be correctly connected to the lamp and battery.

(1)

(Total 4 marks)

Q35.

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)

Mark schemes

Q1.

- (i) 30
allow 1 mark for showing correct method i.e. 5×6 or $12 \div 0.4$
2
- (ii) connected in series
insufficient they are not connected in parallel
1
- (iii) 0.4
1
- (iv) equally/ evenly
the same is insufficient
allow credit for candidates that correctly mention pd across the connecting wires
accept (nearly) 2 V (each)
1

[5]

Q2.

- (a) electrical
1
- sound
correct order only
1
- (b) the energy transformed by the TV will be destroyed
1
- (c) a higher efficiency than
1

[4]

Q3.

- (a) (i) France
1
- (ii) any **one** from:
- different homes have different appliances(*)
 - different homes have different numbers of appliances(*)
() accept all homes are different*
 - standby power not the same for all appliances
 - some people will switch appliances off
accept named appliances
accept people waste different amounts of energy

- homes have different numbers of residents
 - can't measure every (individual) home
accept any sensible suggestions
*do **not** accept answers in terms of accurate / precise etc*
- 1
- (b) (i) increases amount of energy wasted
accept (encourages) people to leave appliances on (standby)
accept increases it
- 1
- (ii) any **two** from:
- less electricity needed / generated
 - fewer power stations needed
 - less coal is burned
*do **not** accept coal is non-renewable / running out*
answers in terms of fuel stocks neutral
 - less pollutant gases produced
accept named gases
accept harmful for pollutant
accept greenhouse gases
accept reduce / slow / stop global warming
accept reduces acid rain
- 2
- (c) joule
- 1
- (d) (i) 6800
*accept £68 for **3** marks an answer of 68 gains **2** marks*
*allow **2** marks for correct substitution ie 400×17*
*allow **1** mark for obtaining 400*
*answers of 7480, 4760, 12920, 4080 gain **2** marks*
- 3
- (ii) a small electricity
- 1

[10]

Q4.

- (a) (i) 0.6
accept 60 %
*allow **1** mark for useful energy = 480*
*answer 0.6 with any unit or 60 gains **1** mark only*
- 2
- (ii) transferred to surroundings
accept goes into the air
accept heats the surroundings up
accept gets spread out
accept transferred into heat (only)

do **not** accept wasted / lost unless qualified
destroyed negates mark
transferred into light / sound negates mark

1

(b) (i) 1.75

allow 1 mark for converting to kW

answers of 0.7, 0.525, 0.35, 0.875, 1.05, 5.25 gains 1 mark

answers of 1750 or 17.5 gains 1 mark

2

(ii) 21p or £0.21 or their (b)(i) × 12

1

(c) any **two** from:

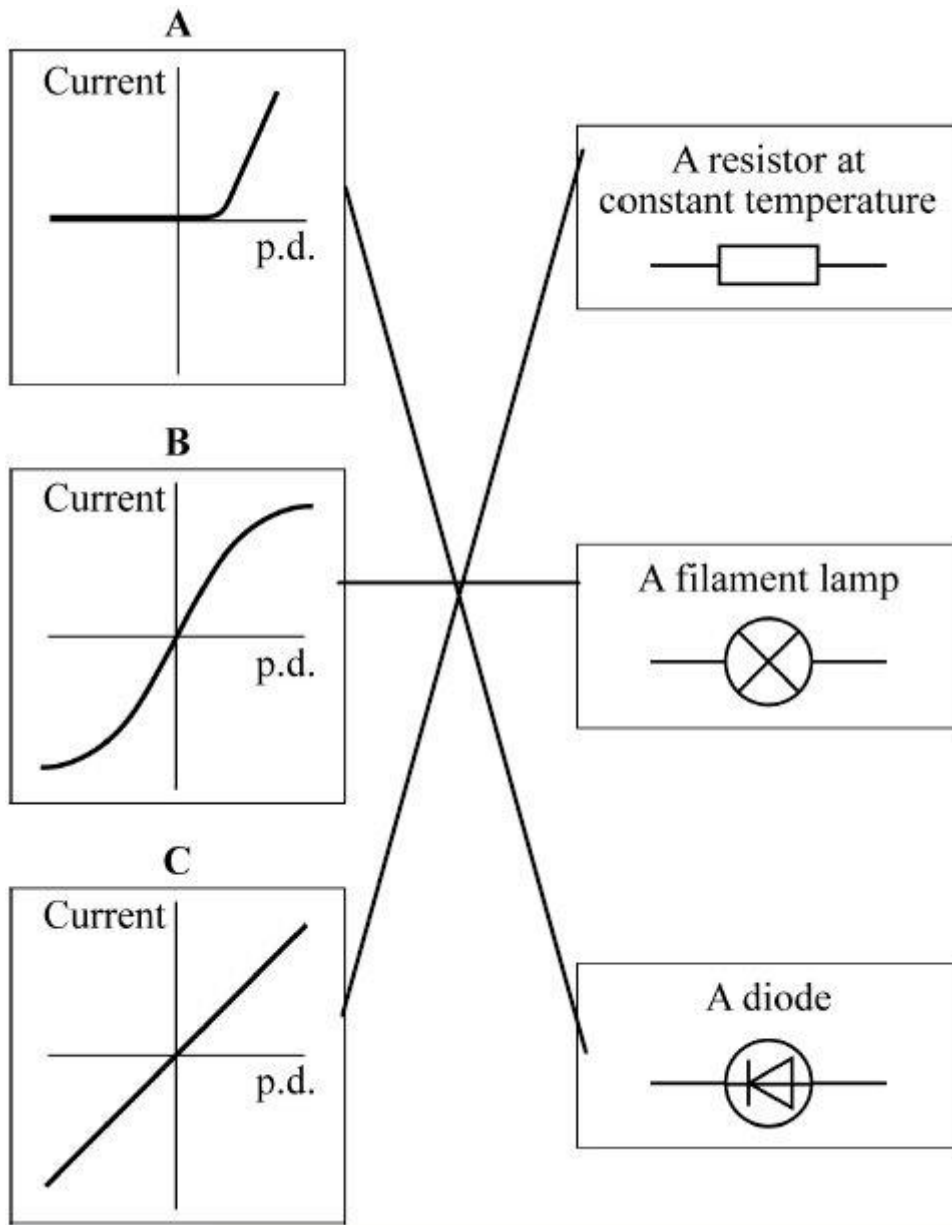
- (more) electricity needs to be generated
(more) electricity is being used
- (more) power stations needed
- (more) fossil fuels burnt
accept named fossil fuel
- (more) pollutant gases emitted
accept named gas
accept harmful for pollutant
accept greenhouse gases
accept atmospheric pollution
accept answer in terms of any form of electricity generation
and an associated environmental problem

2

[8]

Q5.

(a) **three** lines drawn correctly



allow 1 mark for 1 correct line
 if more than one line goes from a graph, both are incorrect

2

(b) J

1

[3]

Q6.

(a) (i) 6

1

(ii) 6 (volts)

accept their (a) (i) ignore any units

1

(b) 0.30

accept 0.3

1

(c) smaller(than)

accept correct alternatives to smaller than e.g. less than

1

a bigger current flows through the lamp

only accept if 'smaller than' is given

accept converse

accept a correct calculation

accept resistance is half of 60

accept resistance = 30 (Ω)

*do **not** accept answers in terms of p.d*

1

[5]

Q7.

(a) electric drill **C**

1

MP3 player **E**

1

toaster **B**

1

(b) (i) 2100

no unit required / ignore units

accept 2.1 kW must have units for this

1

(ii) **Y**

1

(iii) bar drawn with any height greater than **Y**

ignore width of bar

1

(c) (i) any **one** from:

answers must be a comparison

- holds more water
*do **not** accept 1 litre of water on its own*
- works in other countries
accept a named country
accept works at 2 voltages
- boils faster
- has a more powerful element
*do **not** accept 1 kW element on its own*
- can filter water

1

ignore can wash filter

(ii) any **one** from:

- it weighs less

- smaller to pack
 - cheaper to use
- answers must be a comparison
or state why the chosen feature is an advantage
accept boils enough for one drink*

1

[8]

Q8.

(a) £15

*allow 1 mark for use of 125 (kWh)
allow 1 mark for an answer 1500
allow **both** marks for 1500 pence / p
allow 1 mark for correct calculation of annual cost for either
freezer (£27 and £42)*

2

(b) £45

or their (a) $\times 3$

*allow 1 mark for correct use of 3
allow 1 mark for $12 - 9 = 3$*

2

(c) any two from:

the marks are for the explanation

yes **plus** explanation

- less electricity / energy needed / used
accept less energy wasted
- less (fossil) fuels burned
*accept a named fossil fuel
do **not** accept conserving (fossil) fuels*
- less polluting gases emitted
*accept a named polluting gas / greenhouse gases / carbon
emissions / reduce global warming
accept an answer in terms of nuclear fuel
eg less nuclear fuel required (1)
less nuclear waste (1)*

2

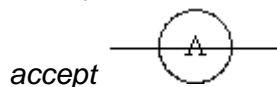
or no plus explanation

- old freezer must be disposed of
- hazardous chemicals inside freezer
accept CFC gases
- (lot of) energy used in producing new freezer

[6]

Q9.

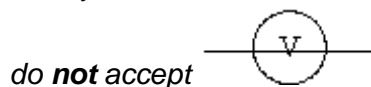
- (a) (i) ammeter symbol correct and drawn in series



do **not** accept lower case a

1

voltmeter symbol correct and drawn in parallel with the material



1

- (ii) adjust / use the variable resistor
accept change the resistance

or change the number of cells

accept battery for cell

accept change the p.d / accept change the voltage

accept increase / decrease for change

1

- (b) (i) data is continuous (variable)

1

- (ii) 36 (Ω)

correct answer only

1

- (iii) 5.4 or their (b)(ii) \times 0.15

allow **1** mark for correct substitution

2

- (c) (i) the thicker the putty the lower the resistance

answer must be comparative

accept the converse

1

- (ii) any **one** from:

- measuring length incorrectly
accept may be different length
- measuring current incorrectly
do **not** accept different currents
- measuring voltage incorrectly
do **not** accept different voltage
- ammeter / voltmeter incorrectly calibrated
- thickness of putty not uniform
- meter has a zero error
accept any sensible source of error eg putty at different temperatures
do **not** accept human error without an explanation
do **not** accept pieces of putty not the same unless qualified

do **not** accept amount of putty not same
do **not** accept systematic / random error

1

- (iii) repeat readings
accept check results again
accept do experiment again
accept do it again
accept compare own results with other groups
do **not** accept take more readings

1

[10]

Q10.

- (a) iron

1

hairdryer

1

kettle

answers can be in any order

1

- (b) sound

1

- (c) is more efficient than

1

[5]

Q11.

- (a) £19.20

allow 1 mark for correct substitution

ie 160×12

allow 1 mark for an answer (£)1920

*an answer of 1920p gains **both** marks*

*an answer of £40.80 gains **both** marks*

allow 1 mark for 340×12

2

- (b) 340

allow 1 mark for correctly using the reading 62580

ie $62920 - 62580$

*accept £40.80 for **both** marks*

2

[4]

Q12.

- (a) (i) 4 (V)

allow 1 mark for correct substitution

2

- (ii) 5 (V) or (9 – their (a)(i)) correctly calculated
e.c.f

do **not** allow a negative answer

- (b) (i) thermistor
c.a.o 1
- (ii) 0°C to 20°C 1

[5]

Q13.

- (a) alternates
accept switches
accept (constantly) changes
accept goes up and down 1
- between positive and negative 1
- (b) potential difference between the neutral and earth (terminal)
accept voltage for p.d
or potential of the neutral terminal with respect to earth 1
- (c) (i) 0.025 (s) 1
- (ii) 40 (Hz)
accept 1 ÷ their (a)(i) 1

[5]

Q14.

- (a) kinetic
accept movement 1
- (b) (i) 3 (kWh)
allow 1 mark for selecting the correct information 1
- (ii) transfers more energy
accept transform or use for transfer
accept electricity for energy
*allow higher (average) power **and** switched on for more time* 2
- (iii) any **one** from:
- use the internet
 - brochures
 - reading adverts

- visiting shops
- recommendation from friends / plumbers

1

[5]

Q15.

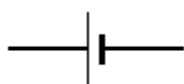
- (a) circuit symbol for a lamp correct



accept



accept any standard of drawing providing circuit would work



1

circuit symbol for a cell correct

1

2 lamps drawn in parallel with 3 cells

polarity of cells must be correct (+ to -) but cells may be either way around

1

- (b) 4.5

1

- (c) the same as

accept any clear indication of the correct answer

1

[5]

Q16.

- (a) (i) heat

1

- (ii) temperature increases **or** (cause) convection (currents)

accept gets warmer

accept gets hotter

1

- (iii) 60% **or** 0.6

60 without % scores 1 mark

0.6 with a unit scores 1 mark

60 with incorrect unit scores

1 mark

or correct substitution $\frac{120}{200}$

for 1 mark

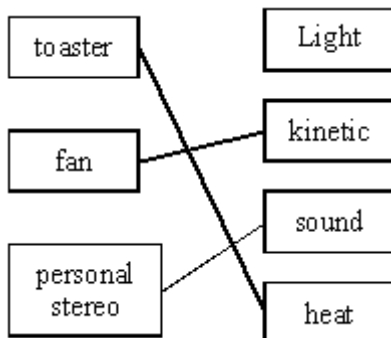
2

- (b) street 1
- more (energy transferred as) light or less (energy transferred as) heat or useful energy output the highest
- can only score this mark if first mark scored*
- all efficiencies calculated correctly score 2nd mark point* 1

[6]

Q17.

- (a) each correct line scores 1 mark



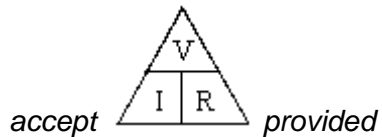
if more than 3 lines are drawn mark incorrect ones first, to a maximum of 3 lines

- (b) toaster 3
- accept 1.2 kW*
- (c) (i) 400 1
- (ii) £24 or 2400p 1
- full credit for their (c)(i) × 6p for full credit the correct numerical answer must have the correct unit*
- an answer of 24 or 2400 with no unit or the incorrect unit scores 1 mark*
- (c)(i) × 6 incorrectly evaluated scores 1 mark* 2
- (d) 6 2
- allow 6000 for 1 mark*
- allow 3 × 2 for 1 mark*

[9]

Q18.

- (a) (i) potential difference = current × resistance
- accept voltage or pd for potential difference*
- accept $V = I \times R$*
- accept correct transformation*
- do not accept $V = C \times R$*
- do not accept $V = A \times R$*



subsequent use of Δ correct
do **not** accept an equation expressed in units

1

(ii) 46

credit correct transformation for **1** mark
allow 1 mark for use of 11.5 V or division of final resistance by 20
a final answer of 920 gains **2** marks only

3

ohm(s)

accept symbol Ω
do **not** accept Ω s
unit / symbol mark can be awarded in (iii) provided unit / symbol is omitted in (ii)

1

(iii) 920 (ohms) **or** their (a)(ii) \times 20

1

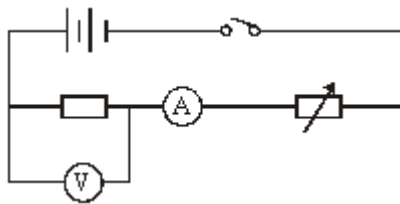
(b) as temperature increases, resistance increases
accept *hotter* for temperature increase
do **not** accept a reference to resistance only i.e. *it / resistance goes up*

1

[7]

Q19.

(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 \times resistance
 accept voltage or p.d. for potential difference
 accept $V = I \times R$

accept  provided I R subsequent use correct

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 through the origin
 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 increases
 accept filament lamp / it gets hotter
 allow heat for temperature

1

[8]

Q20.

- (i) power = potential difference \times current
 accept voltage for potential difference
 accept $P = V \times I$
 or correct transposition

accept  provided subsequent method correct

1

- (ii) 8

allow **1** mark for correct substitution or transformation **or** an
 answer 2.67 / 2.7

2

[3]

Q21.

- (a) (i) $A_1 = 0.5$
 ignore any units

1

$A_4 = 0.5$

allow 1 mark for $A_1 = A_4 \neq 0.5$

1

(ii) the resistance of **P** is more than 20Ω

1

a smaller current goes through P / A_2 (than 20Ω)

dependent on getting 1st mark correct

accept converse

1

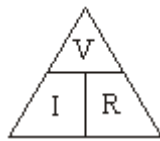
(b) (i) potential difference = current \times resistance

accept pd / voltage for potential difference

accept $V = I \times R$, correct symbols and correct case only

accept volts = amps \times ohms

accept



provided subsequent method is correct

allow combination of

physical quantities and named units

allow voltage = $I \times R$

1

(ii) 6

allow 1 mark for correct substitution

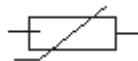
2

(iii) 6

accept their (b)(ii)

1

(c) thermistor or



accept correct circuit symbol

allow phonetic spelling

1

resistance goes down (as temperature of thermistor goes up)

*do **not** accept changes for goes down*

*do **not** accept an answer in terms of current only*

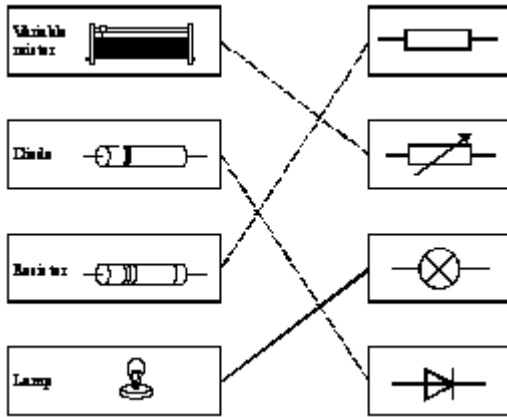
answers in terms of other components are incorrect

1

[10]

Q22.

(a) all 3 lines drawn correctly



(1 only correct, 1 mark)

deduct one mark if more than one line from or to a single box

2

(b) (i) series

1

(ii) any **one** from:

- both lamps **or** lights must be on together
- if one blows, the other goes out
- switch controls both bulbs
do not accept bulbs dimmer

1

(iii) any **two** from

- each lamp **or** light can be switched on independently
- if one lamp blows the other stays on
- switching the second lamp on does not affect brightness of first **or** bulbs brighter (than in first circuit) or energy explanation

2

[6]

Q23.

(a) (i) live and neutral wrong way around

accept blue and brown wrong way round or in the wrong place

for credit both wires must be given

do not accept the wires are in the wrong holes

1

(ii) to protect the appliance

*accept melt or blow **or** burns out if too much current **or** power or energy or electricity flows*

*accept to stop too much current **or** power **or** energy **or** electricity flowing*

*accept stop overheating **or** a fire*

do not accept 'safety' unless qualified by above

1

- (b) (metal) cover
 accept (heating) element
 do **not** accept the mains cable

1

[3]

Q24.

- (a) C
 award mark if A and B identified as not filament lamp

1

resistance increases
 negated by wrong statement e.g. current goes down

1

as the lamp gets hot
 accept as current (through lamp) **or** voltage (across lamp) increases
 do **not** accept non-ohmic reason independent of choice of component

1

- (b) ammeter wire and battery only in series
 non standard symbols acceptable if correctly identified (labelled) for ammeter, voltmeter and battery

1

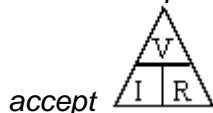
voltmeter only in parallel with wire **or** battery
 all in series **or** ammeter in parallel neither of these two marks awarded

1

all symbols correct
 ignore lines drawn through centres of symbols

1

- (c) (i) voltage = current \times resistance
 accept $V = I \times R$
 accept volts = amps \times ohms
 do **not** accept $V = C \times R$



if subsequent method correct

1

- (ii) 30
 accept correct substitution for 1 mark (9/0.3)

2

ohms
 accept correct symbol Ω

1

- (iii) goes up

*must be a comparison
accept calculation if answer is larger than c (ii)*

1

[11]

Q25.

(a) (i) electrons

1

(ii) ammeter

*do **not** accept ampmeter*

1



***must** be capital A
horizontal lines not required no e.c.f.*

1

(b) light bulb

answers in either order

1

hairdryer

1

[5]

Q26.

(a) (i) any **one** from:

water to the mug
water to the air
mug to the air
mug to the table

***both** required
direction of transfer must be correct*

1

(ii) when temperatures are the same

*accept a specific example eg when the temperature of the
water and mug are the same
accept radiant heat transfer will never stop*

1

(b) wood

1

(c) (i) conduction

accept convection if not given as 3rd answer

1

insulator

1

(ii) any **one** from:

*do **not** accept any rebuilding of house*

double glazing	
loft insulation <i>accept roof for loft</i>	1
carpets	
(cavity) wall insulation <i>do not accept closing doors and windows</i>	
draft excluders	
foil behind radiators <i>accept blocking chimney</i>	
paint inside walls white	

[6]

Q27.

(a) A – fuse B – (cable) grip <i>for 1 mark each</i>	2
(b) X – brown/red Y – green + yellow/green Z – blue/black <i>for 1 mark each</i>	3
(c) any plastic/rubber <i>for 1 mark</i>	1
(d) (i) earth <i>for 1 mark</i>	1
(ii) metal appliance needs earthing/safety qualified <i>for 1 mark</i>	1
(e) cut less insulation on earth; neutral wire needs connecting; fit fuse properly; cable grip needs to be an outer cable or allow identifying faults <i>for 1 mark each</i>	4

[12]

Q28.

level drops as petrol used;
causes circuit resistance to increase;
causes current to decrease
for 1 mark each

or if change not specified;

(one correct and two vague statements gains 2 marks,
 three vague statements gains 1 mark)
 e.g. level changes;)
 so resistance changes;) = 1 mark
 so current changes)

[3]

Q29.

- (a) Mains socket – once only
 Shower cable can get wet
 Trailing cable to fire (not heater unless fire clearly identified)
 Use of fire
 Free running cable from ceiling
 Appliance on side of bath
 Use of ordinary light switch
 Free cable to sink light
any 3 each for 1 mark 3
- (b) (i) 7, 4, 1, 80.5
Four right – 2
Three right – 1
All right in W – 1 2
- (ii) Toaster 1
- (iii) 32p
gets 3 marks
 Else 8×4
gets 2 marks
 Else unit cost = 8p
gets 1 mark 3

[9]

Q30.

- (a) Sun
 Any valid
for 1 mark each 2
- (b) From electric/pe or chemical in battery
for 1 mark
 to ke, light, sound, heat
3 for 1 mark each 4
- (c) Gravitational pe OR just pe
 For any gravity feed
OR Elastic pe
 any valid

OR Food
 For maintaining body/life etc.
OR Any descriptive answer
 e.g. water in a high lake used to produce hydroelectric power
2 for 1 mark each

2

[8]

Q31.

- (a) Current = 0.4A (1)
 $R = V/I$ or $240/0.4$ (1)
 $R = 600$ ohm (1)

3

- (b) Doubles
gets 2 marks

OR gets bigger
gets 1 mark

2

- (c) $P = V.I$ or 240×0.4
 $P = 96W$
for 1 mark each

2

- (d) $I = 0.2A$
 $P = 48W$
for 1 mark each
BUT may get equation mark here if not in (c)

2

- (e) $P = V.I.t$ (1)
 $P = 240 \times 0.2 \times 6 \times 3600$
OR $P = 48 \times 6 \times 3600$
gets 1 mark

$P = 1036800 W$
gets 1 mark

3

[12]

Q32.

- (a) Earth
 return/neutral
 live
for 1 mark each

3

- (b) (i) rubber/plastic
for 1 mark

1

- (ii) cable/wire/grip
 cable/wires
 fuse

for 1 mark each

3

(iii) case

for 1 mark

1

[8]

Q33.

(a) to switch on/off
independently OWTTE

for 1 mark each

2

(b) 9

for 1 mark

1

(c) B and E

for 1 mark

1

(d) 1

Two/least number of LED used

for 1 mark each

2

[6]

Q34.

(a) (i) the lamp will be on/will give out light

1

(ii) the lamp will be off/will not give out any light

1

(b) (very) large current flows
or damage the battery/overheat the battery
or short circuit
or wire get hot

1

(c) switch connected in series with lamp and battery

1

[4]

Q35.

(a) heat / thermal
kinetic / movement

each for 1 mark

2

- (b) (i) its a good (electrical) conductor
for 1 mark 1
- (ii) its a good (electrical) insulator / very poor conductor
for 1 mark 1
- (c) (i) 2.75×6
gains 1 marks
- but**
16.5
gains 2 marks 2
- (ii) (c)(i) $\times 7$ or no. of kW h \times cost/kW h
gains 1 marks
- but**
115.5 or e.c.f if correct
gains 2 marks 2
- (d) it would heat and melts / blows / burns out / breaks circuit
any two for 1 mark each (fuse wire just breaks – gains 1)
(blows up – gets 0)
(fuse causing wire to melt gets 1) 2