AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.2.3 DOMESTIC USES AND SAFETY (PACK 3)

SCORE	PERCENTAGE
/115	%

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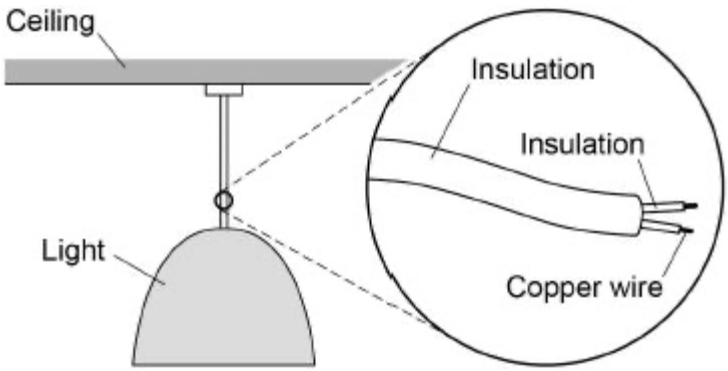
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Q1.

Some ceiling lights in the home are connected to the mains by a two-core cable.

Figure 1 shows a ceiling light.

Figure 1



(a) Suggest why some ceiling lights do **not** have an earth wire.

_____

_____

_____

_____

(2)

(b) Write down the equation that links charge flow, current and time.

_____

(1)

(c) There is a current of 2.95 A in one of the copper wires for 60 seconds.

Calculate the charge flow through the wire.

Use your equation from part **(b)**

_____

_____

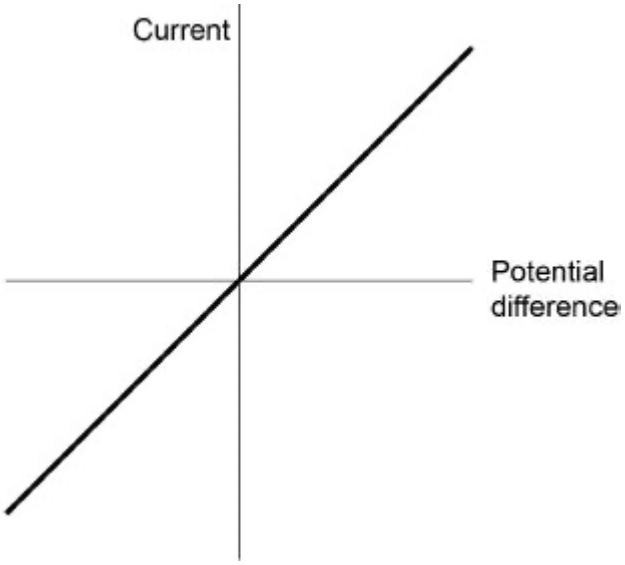
Charge flow = _____ C

(2)

(d) **Figure 2** shows a current potential difference graph for a piece of copper wire.

Figure 2

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Draw another line on **Figure 2** for a wire with a different resistance.

(2)

Some fuses have a thin piece of copper that melts if the current is too large.

(e) Draw the circuit symbol for a fuse.

(1)

(f) Describe how the movement of the copper particles in the wire changes when copper melts.

_____

_____

_____

_____

(2)

(g) Old copper wires are melted when they are recycled.

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Calculate the energy needed to melt 500 kg of copper at its melting point.

Specific latent heat of fusion of copper = 200 kJ/kg

Use the Physics Equations Sheet.

_____

_____

Energy = _____ J

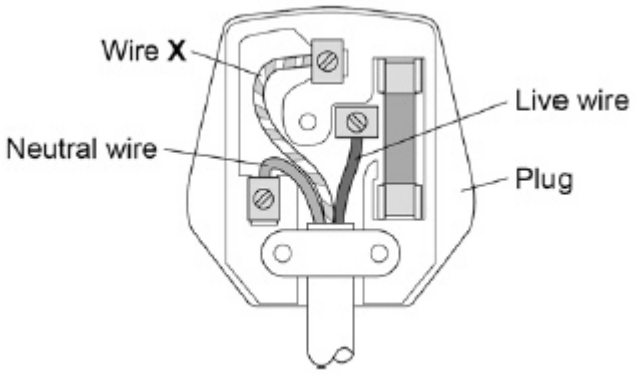
(3)

(Total 13 marks)

Q2.

Figure 1 shows a three pin plug connected to the cable of a metal toaster.

Figure 1



(a) Name wire **X**.

_____

(1)

(b) What does wire **X** do?

Tick **one** box.

It provides extra energy to the toaster when needed.	☐
It completes the circuit in the toaster.	☐
It can prevent an electric shock from the toaster.	☐
It supplies the current to the toaster.	☐

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(1)

(c) The toaster is plugged in to the mains electricity supply.

What is the potential difference between the live and neutral wires?

Tick **one** box.

0 V ☐ 120 V ☐ 230 V ☐ 460 V ☐

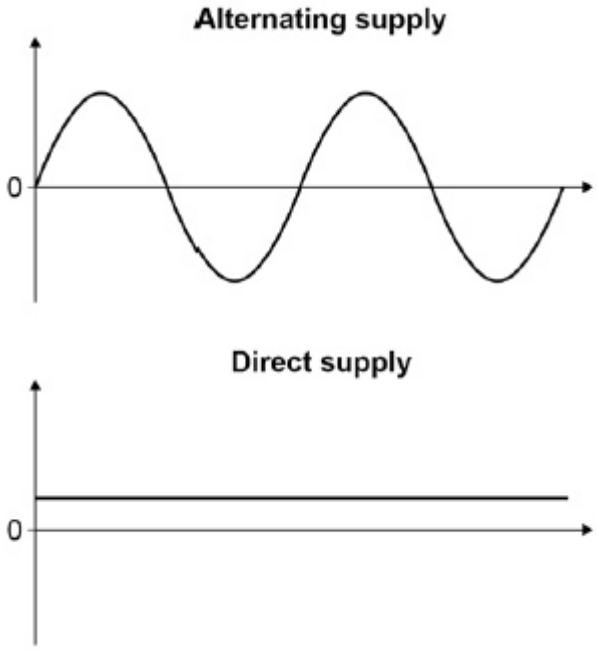
(1)

(d) Mains electricity is an alternating supply.

A battery is a direct supply.

Figure 2 shows an alternating supply and a direct supply.

Figure 2



Give **two** differences between the alternating supply and the direct supply.

1. _____

2. _____

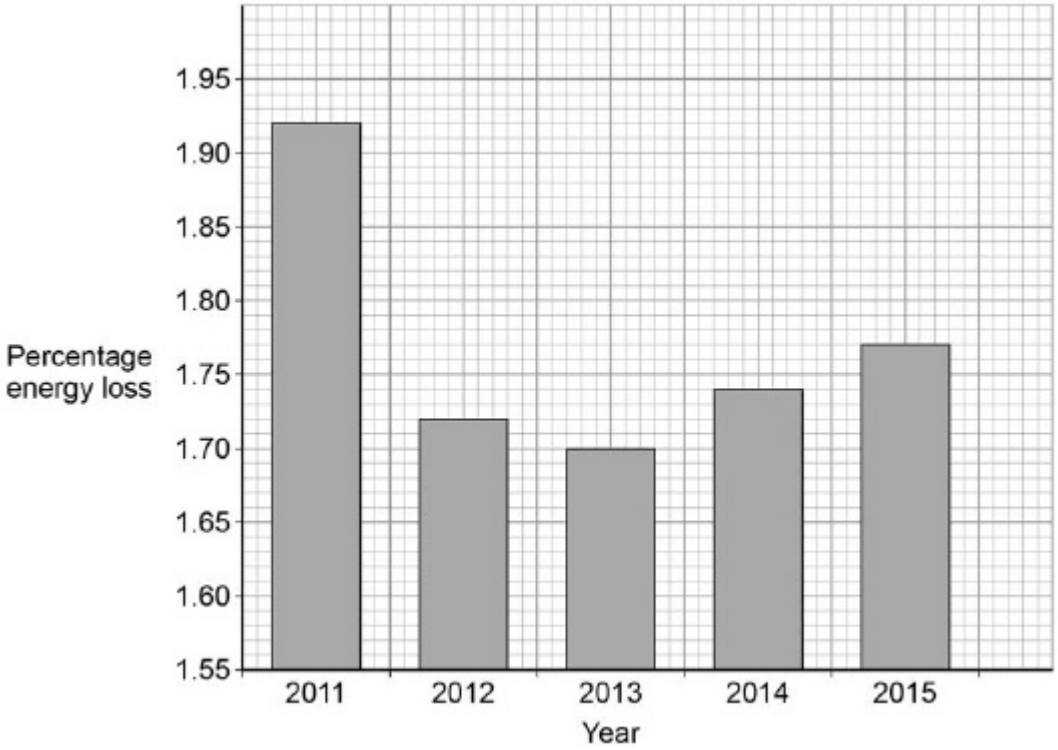
(2)

Energy is transferred to homes by the National Grid.

Figure 3 shows the percentage energy losses over the National Grid for different years.

Figure 3

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(e) Describe the changes in percentage energy loss.

_____

_____

_____

_____

(2)

(f) Calculate the mean percentage energy loss per year in **Figure 3**.

_____

_____

_____

_____

_____

_____

Mean energy loss per year = _____ %

(3)

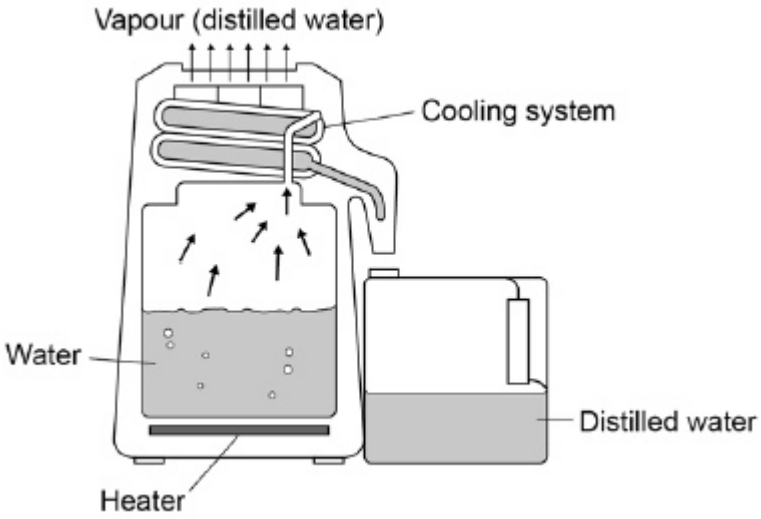
(Total 10 marks)

Q3.

Figure 1 shows a water distiller which is used to purify water.

Figure 1

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The distiller boils water and then condenses most of the water vapour back to water.

(a) The water distiller is filled with 5.0 kg of water at 20 °C

The specific heat capacity of water = 4 200 J/Kg °C

Calculate the energy needed to raise the temperature of the water to 100 °C

Use the Physics Equations sheet.

_____

_____

_____

_____

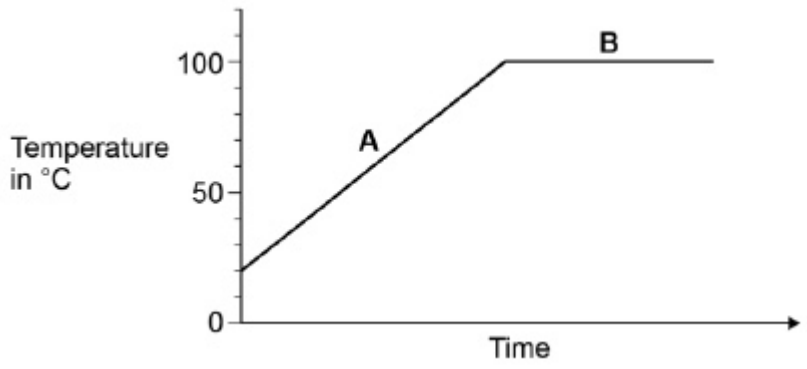
_____

Energy = _____ J

(3)

Figure 2 shows how the temperature of the water in the distiller changes with time.

Figure 2



(b) Energy is transferred to the water at a constant rate.

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Explain why the graph is a different shape in parts **A** and **B**.

(3)

(c) When the water drops to a low level, the heater automatically switches off.

Explain what problem would be caused if the heater did **not** automatically switch off.

(3)

(d) The distiller is connected to the mains by a three-core cable.

The wires are covered by different coloured insulation.

What colour is the insulation covering each of the wires?

Live wire _____

Neutral wire _____

Earth wire _____

(2)

(e) Which statement gives the purpose of the earth wire?

Tick **one** box.

- It carries an alternating potential difference. ☐
- It melts if the current in the circuit is too high. ☐
- It provides a connection to complete the circuit. ☐

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It stops the casing of the appliance becoming live. ☐

(1)

(f) The heating element has a power of 2.5 kW

The resistance of the heating element is 17 Ω

Calculate the current in the heating element.

Give your answer to 2 significant figures.

Write any equations that you use.

Current = _____ A

(5)

(Total 17 marks)

Q4.

Figure 1 shows the information label from a hairdryer.

Figure 1

50 Hz	230 V	2100 W

(a) What is the power of the hairdryer?

Tick **one** box.

50 Hz ☐

230 V ☐

2100 W ☐

(1)

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(b) What is the equation which links current, potential difference and power?

Tick **one** box.

power = potential difference × current ☐

$$\text{power} = \frac{\text{potential difference}}{\text{current}}$$ ☐

$$\text{power} = \frac{\text{current}}{\text{potential difference}}$$ ☐

(1)

(c) The mains electricity supply in the UK is an alternating current (ac).

What is the frequency of the UK ac supply?

_____

(1)

(d) Some electrical appliances use batteries.

What type of current does a battery supply?

Tick **one** box.

Alternating current (ac) only ☐

Direct current (dc) only ☐

Both ac and dc ☐

Not ac or dc ☐

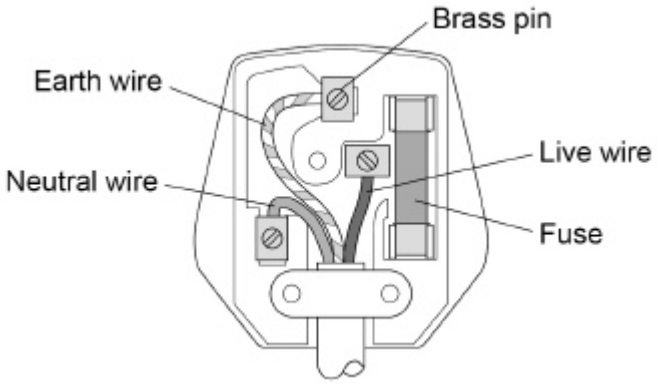
(1)

The hairdryer is connected to the mains electricity supply by a plug.

Figure 2 shows the inside of a plug.

Figure 2

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(e) Draw **one** line from each wire to the colour of insulation around the wire.

Wire	Colour of insulation around wire
	Blue
Live	Brown
	Green
Neutral	White
	Yellow

(2)

(f) The insulation around the Earth wire has two colours.

What are the **two** colours?

_____ and _____

(1)

(g) Brass is an alloy of copper and zinc.

Give **two** properties of brass that make it suitable to use in the plug.

1. _____

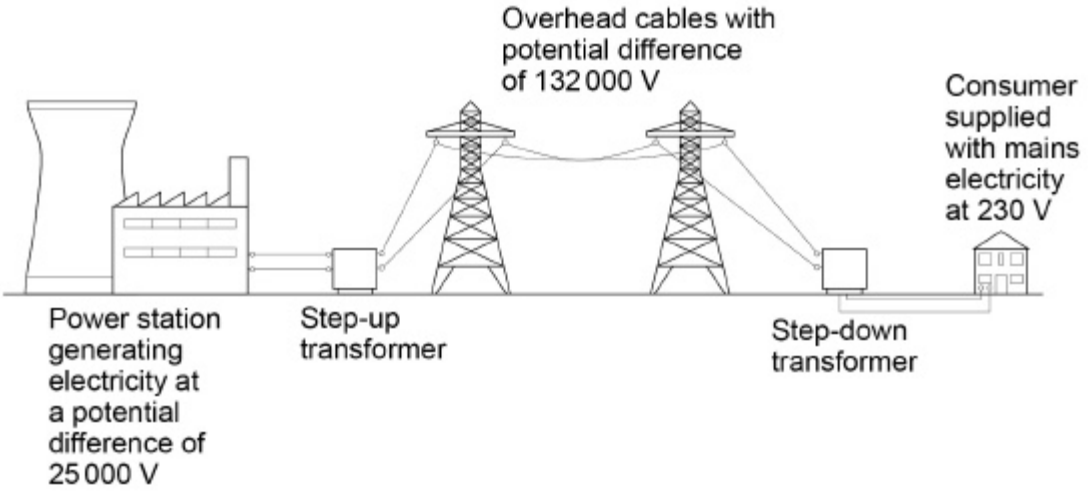
2. _____

(2)

(h) **Figure 3** shows how the National Grid links power stations to consumers.

Figure 3

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Describe how electrical power is transferred from power stations to consumers by the National Grid.

(4)

(Total 13 marks)

Q5.

Some electrical appliances use electricity from the mains supply and some use electricity from a battery.

(a) Explain the differences between the current supplied by the mains supply and the current supplied by a battery.

(2)

(b) Which set of units correctly links current, potential difference and power?

Tick **one** box.

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one watt = one volt × one amp ☐

one watt = $\frac{\text{one amp}}{\text{one volt}}$ ☐

one watt = $\frac{\text{one volt}}{\text{one amp}}$ ☐

(1)

Electrical appliances can be connected to the mains supply using three-core cables.

The cables contain the mains wires.

(c) What are the colours of the insulation around the wires?

Tick **one** box.

Earth	**Live**	**Neutral**	**Tick one box**
Blue	Brown	Green and yellow	
Blue	Green and yellow	Brown	
Brown	Blue	Green and yellow	
Brown	Green and yellow	Blue	
Green and yellow	Blue	Brown	
Green and yellow	Brown	Blue	

(1)

(d) Touching the live wire of an appliance is dangerous when the appliance is connected to the mains electricity supply.

Explain why.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

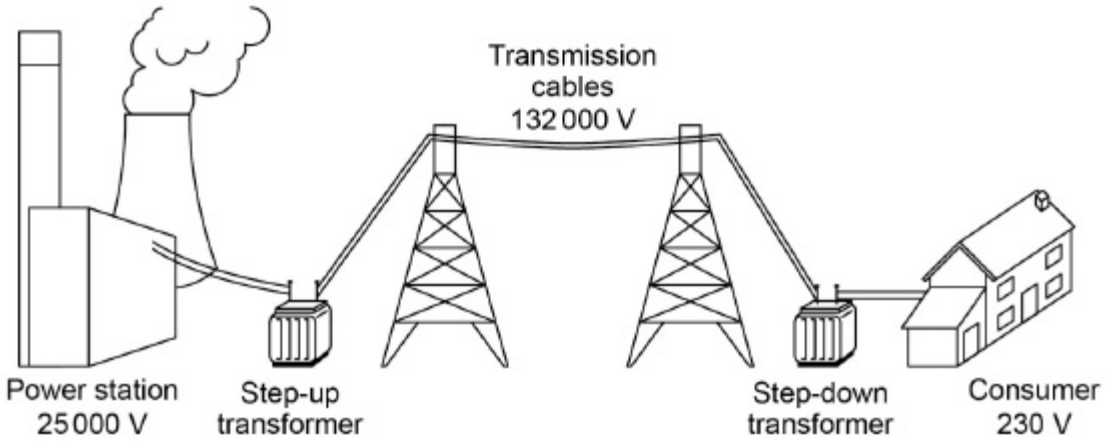
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Q6.

The National Grid is used to transfer electrical power around the country.

Figure 1 shows a simplified diagram of the National Grid.

Figure 1



(a) The gas-fired power station shown in **Figure 1** uses a non-renewable energy resource.

Some power stations use renewable energy resources.

What is the difference between renewable and non-renewable energy resources?

_____

_____

_____

_____

(2)

(b) Explain how transformers are used in the National Grid.

_____

_____

_____

_____

_____

_____

(3)

(c) The current in the transmission cables is 8 700 A

The current causes energy to be transferred to the surroundings by heating.

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The power is 9.135 MW for a 1 km length of cable.

Calculate the resistance of 1 km of cable.

Resistance = _____ Ω

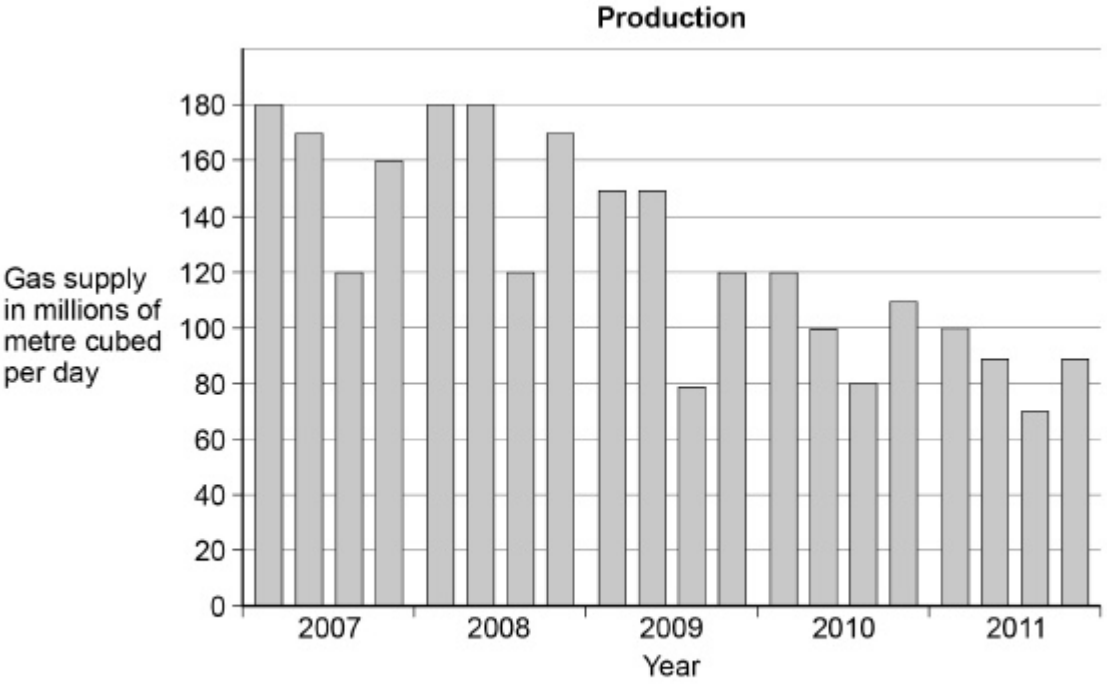
(3)

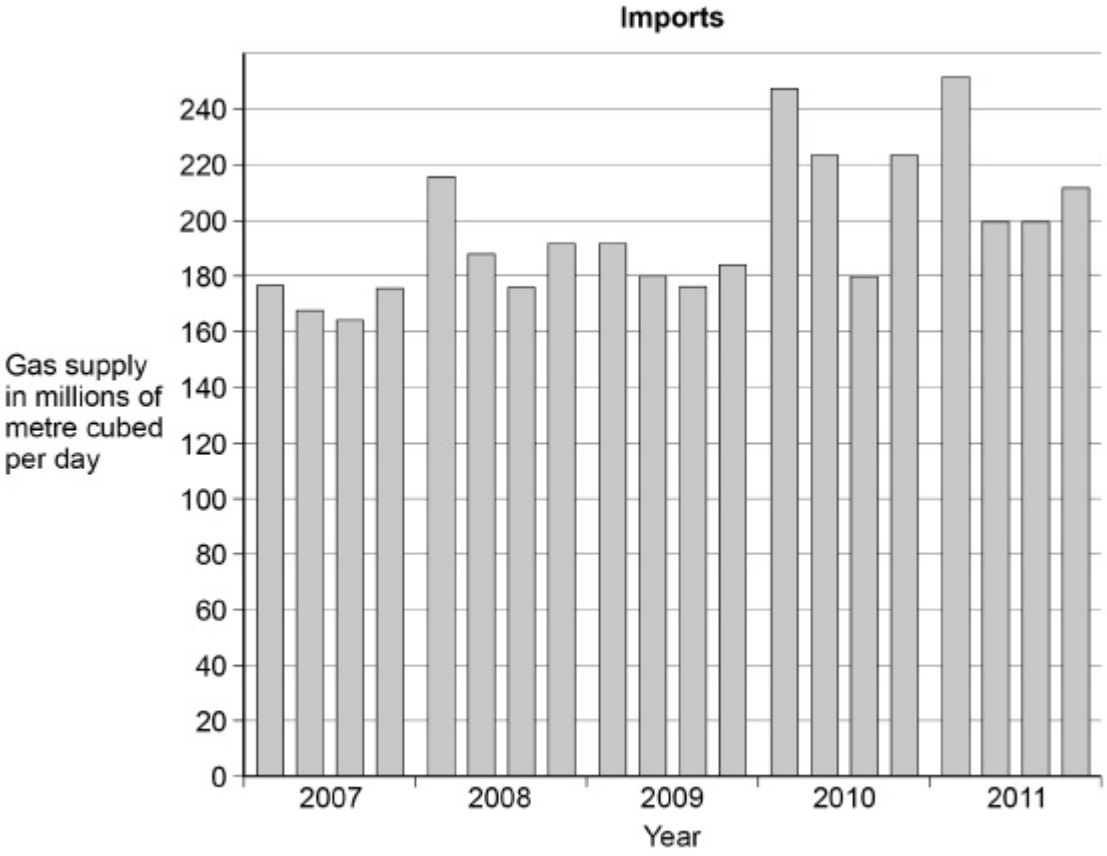
(d) The UK produces natural gas. The UK also imports natural gas from other countries.

Figure 2 shows how the supply of natural gas varied over a 5-year period.

Figure 2

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Give **three** conclusions you can make from **Figure 2**.

1. _____

_____

2. _____

_____

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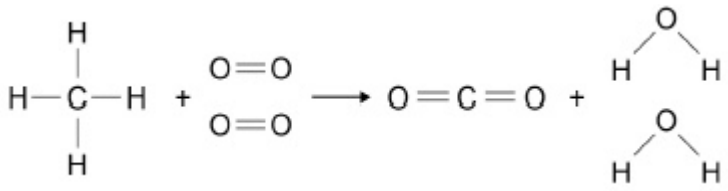
3. _____

_____

(3)

(e) Natural gas contains methane.

The displayed equation for the combustion of methane is:



The table shows bond energies.

Bond	Bond energy in kJ/mol
C–H	413
O=O	498
C=O	805
O–H	464

The energy input to the power station in one second from the combustion reaction is 2.29×10^6 kJ

Calculate:
- the overall energy change in kJ/mol for the reaction
- the number of moles of methane used in the power station in one second.

Use the displayed equation and the table.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

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Overall energy change = _____ kJ/mol

Number of moles of methane = _____ mol

(5)

(Total 16 marks)

Q7.

Most electrical appliances are connected to the mains electricity using three-core cables.

(a) What is the approximate value of the potential difference of the UK mains electricity supply?

Tick **one** box.

23 V ☐

230 V ☐

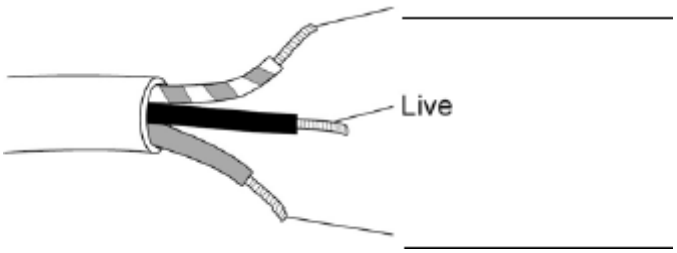
300 V ☐

350 V ☐

(1)

(b) **Figure 1** shows a three-core cable.

Figure 1



Use answers from the box to label the wires and complete **Figure 1**.

Earth	**Negative**	**Neutral**

(2)

(c) In the UK the three wires in a three-core cable are always the same colours.

Why are the wires always the same colours?

Tick **one** box.

Each wire is made by a different company. ☐

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It is easy to identify each wire. ☐

They are cheaper to manufacture. ☐

(1)

(d) Touching the live wire is dangerous.

Use answers from the box to complete the sentences.

current	**resistance**	**shock**	**force**	**voltage**

Touching the live wire causes a large potential difference to exist across the body.

This causes a _____ through the body, which

results in an electric _____

(2)

(e) What is the approximate frequency of the UK mains electricity supply?

Tick **one** answer.

50 Hz ☐

75 Hz ☐

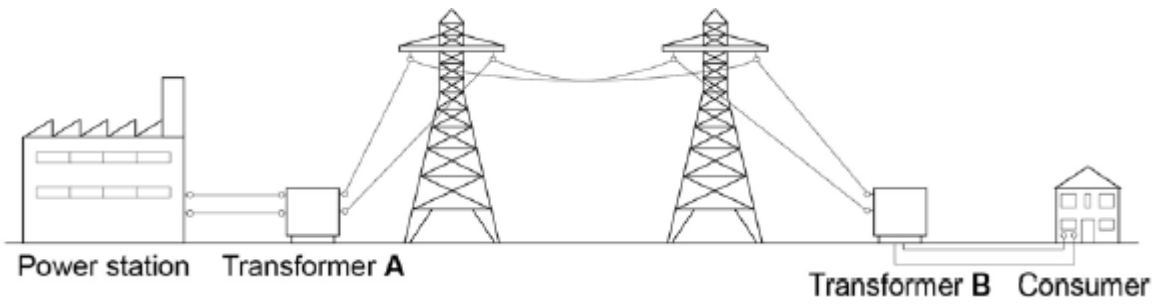
100 Hz ☐

150 Hz ☐

(1)

(f) **Figure 2** shows how power stations transfer electrical power to consumers using the National Grid.

Figure 2



The power station generates electricity at a voltage of 25 kV.

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Transformer **A** increases the voltage by a factor of 16.

What is the voltage output of transformer **A**?

_____

_____

_____

Output voltage = _____ kV

(2)

(g) Why is the voltage increased by transformer **A**?

Tick **one** box.

To reduce the energy lost due to heating	☐
To increase the power	☐
To increase the current	☐

(1)

(h) Why is it important that the voltage is decreased by transformer **B**?

Tick **one** box.

Less energy is used by consumers	☐
It is safer for consumers	☐
It reduces consumers' electricity bills	☐

(1)
(Total 11 marks)

Q8.

An electric current is a flow of electrical charge through a circuit.

(a) Complete the sentence.

Use a word from the box.

atoms	**electrons**	**ions**	**molecules**

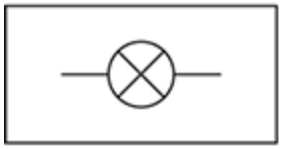
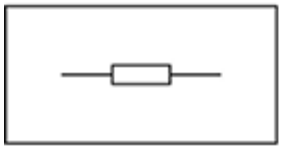
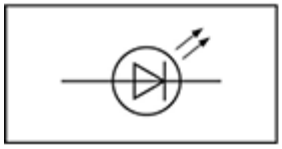
Metals are good conductors of electricity because electrical charge is transferred

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by delocalised _____

(1)

(b) Draw **one** line from each symbol to the name of the component.

Standard symbol	**Name of component**
	Battery
	Lamp
	LED
	Resistor
	Switch

(3)

(c) The table below shows information about some electrical appliances.

Electrical appliance	**Power in watts**
 Hairdryer	1500
 Kettle	2500
 Electric hob	3000
 Television	360

A student plugs all four of the appliances into one multi-way socket.

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The mains electricity is 230 V.

The highest safe current in the socket is 30 A.

Explain why it is not safe to use all four appliances at the same time.

In your answer you should:

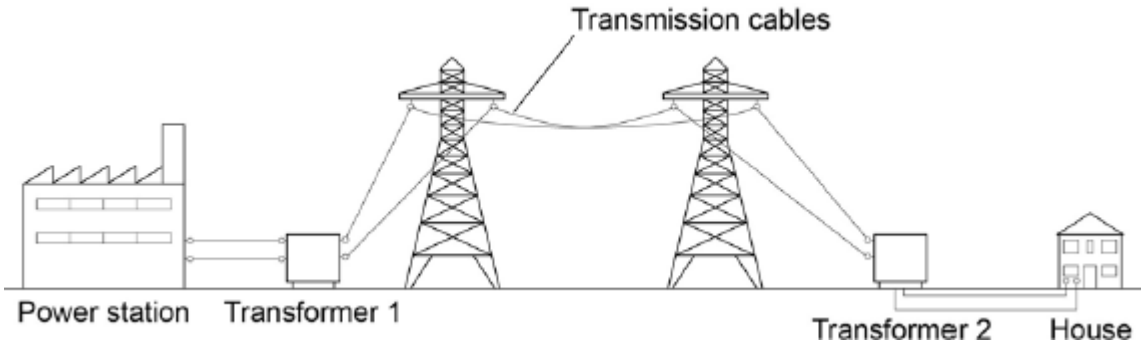
- calculate the total power needed
- use the equation

  current = power ÷ potential difference

to calculate the total current needed.

(4)

(d) The figure below shows how electrical power is transferred from power stations to consumers using the National Grid.



Transformer 1 is a step-up transformer.

Explain why step-up transformers are used in the National Grid.

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_____

_____

(3)

(e) What is the purpose of Transformer 2?

_____

_____

(1)

(f) In a power station 900 MJ of thermal energy were released by burning natural gas.

Write down the equation that links efficiency, useful input energy transfer and useful output energy transfer.

_____

(1)

(g) In a power station 900 MJ of thermal energy were released by burning natural gas.

Only 405 MJ was generated.

Calculate the efficiency of this energy transfer.

_____

_____

_____

Efficiency = _____

(2)

(Total 15 marks)

Q9.

We use mains electricity in our homes.

(a) What is the frequency of the UK mains electricity supply?

Tick **one** box.

23 Hz ☐

50 Hz ☐

230 Hz ☐

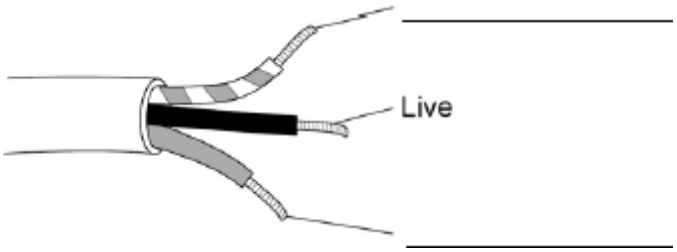
500 Hz ☐

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(1)

(b) Many appliances in the home use three-core electrical cable.

Look at the figure below.



Label the wires in the cable in the figure above.

Use words from the box.

Earth	**Negative**	**Neutral**	**Positive**

(2)

(c) The sentences explain how touching the live wire in a cable can cause an electric shock.

Complete the sentences.

Use words from the box.

current	**force**	**resistance**	**potential difference**

Touching the live wire causes a large _____ to exist across the body.

This causes a _____ through the body, which results in an electric shock.

(2)

(d) A heater has a power rating of 2500 W.

The heater is turned on for 180 seconds.

Calculate the energy transferred by the heater.

Use the equation:

energy transferred = power × time

Give your answer in kilojoules (kJ).

_____

_____

_____

Energy transferred = _____ kJ

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(3)

(e) Write down the equation that links charge flow, energy transferred and potential difference.

_____

(1)

(f) The mains electricity supply is at 230 V.

A different heater transfers 4200 J of energy.

Calculate the charge flow through the heater.

_____

_____

_____

Charge flow = _____ C

(3)

(Total 12 marks)

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