

Energy Transfers

Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.2 Electricity
Sub-Topic	Energy Transfers
Difficulty Level	Bronze Level
Booklet	Question Paper 1

Time Allowed: 60 minutes

Score: /59

Percentage: /100

Grade Boundaries:

Q1. 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

☐

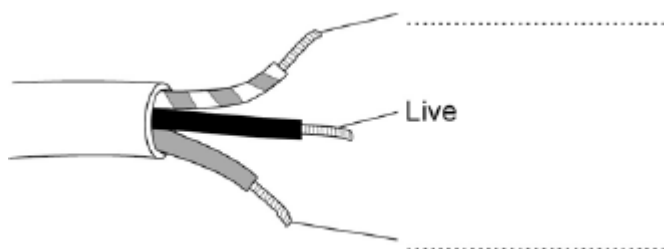
350 V

☐

(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.

☐

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

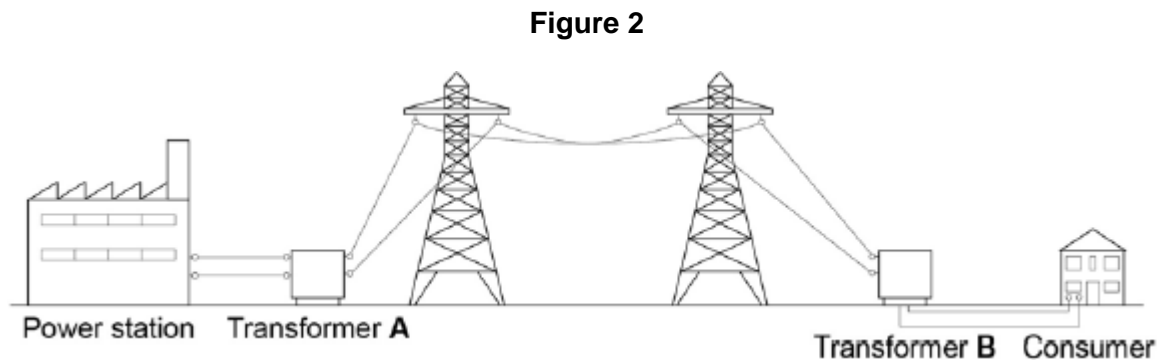
☐

150 Hz

☐

(1)

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



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

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)

Q2.Energy can be transferred through some materials by convection.

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

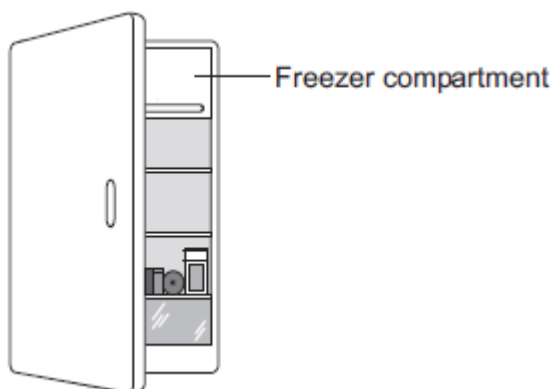
gas	liquid	solid
------------	---------------	--------------

Energy **cannot** be transferred by convection through a

(1)

- (b) The figure below shows a fridge with a freezer compartment.

The temperature of the air inside the freezer compartment is -5°C .



Use the correct answer from the box to complete each sentence.

Each answer may be used once, more than once or not at all.

decreased unchanged increased

When the air near the freezer compartment is cooled, the energy of the air particles is

The spaces between the air particles are

The density of the air is

(3)

- (c) The table below shows some information about three fridges, **A**, **B** and **C**.

The efficiency of each fridge is the same.

Fridge	Volume in litres	Energy used in one year in kWh
A	232	292
B	382	409
C	622	524

- (i) Which fridge, **A**, **B** or **C**, would cost the least to use for 1 year?

☐

Give **one** reason for your answer.

.....

(2)

- (ii) A householder looks at the data in the table above.

What should she conclude about the pattern linking the volume of the fridge and the energy it uses in one year?

.....

(1)

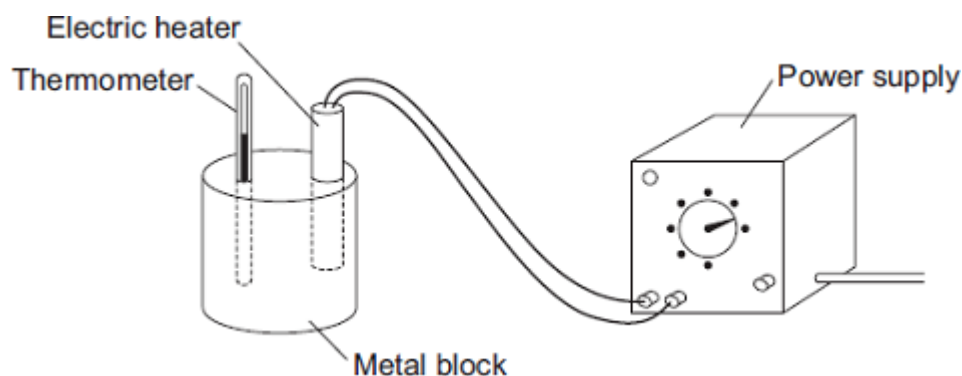
- (iii) The householder could not be certain that her conclusion is correct for all fridges.

Suggest **one** reason why not.

.....

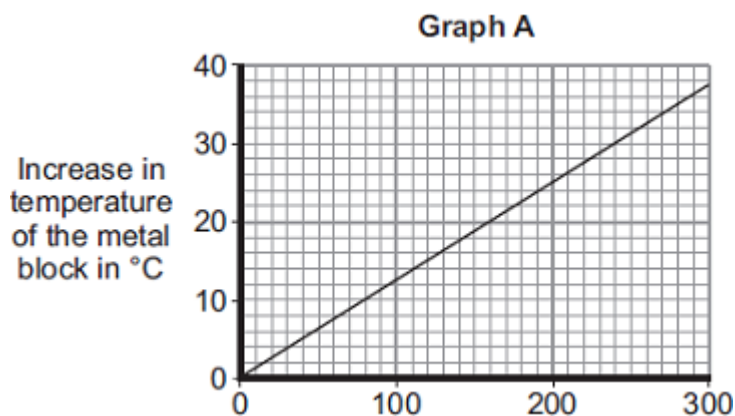
(1)
 (Total 8 marks)

- Q3.(a)** A student used the apparatus drawn below to investigate the heating effect of an electric heater.



- (i) Before starting the experiment, the student drew **Graph A**.

Graph A shows how the student expected the temperature of the metal block to change after the heater was switched on.



Describe the pattern shown in **Graph A**.

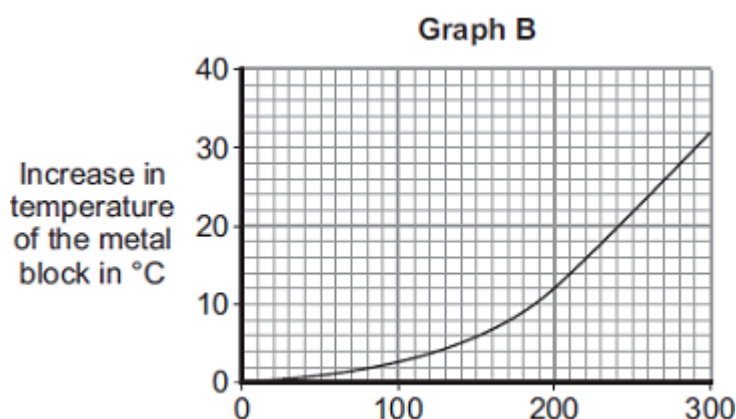
.....

.....

(2)

- (ii) The student measured the room temperature. He then switched the heater on and measured the temperature of the metal block every 50 seconds.

The student calculated the increase in temperature of the metal block and plotted **Graph B**.



After 300 seconds, **Graph B** shows the increase in temperature of the metal block is lower than the increase in temperature expected from **Graph A**.

Suggest **one** reason why.

.....

(1)

- (iii) The power of the electric heater is 50 watts.

Calculate the energy transferred to the heater from the electricity supply in 300 seconds.

.....

Energy transferred = J

(2)

- (b) The student uses the same heater to heat blocks of different metals. Each time the heater is switched on for 300 seconds.

Each block of metal has the same mass but a different specific heat capacity.

Metal	Specific heat capacity in J/kg°C
Aluminium	900
Iron	450
Lead	130

Which **one** of the metals will heat up the most?

Draw a ring around the correct answer.

aluminium

iron

lead

Give, in terms of the amount of energy needed to heat the metal blocks, a reason for your answer.

.....

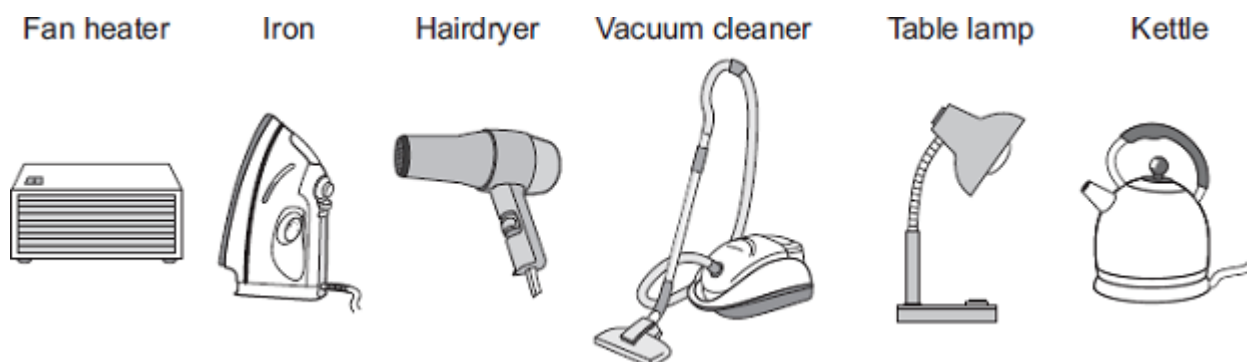
.....

.....

.....

(2)
(Total 7 marks)

Q4. 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.

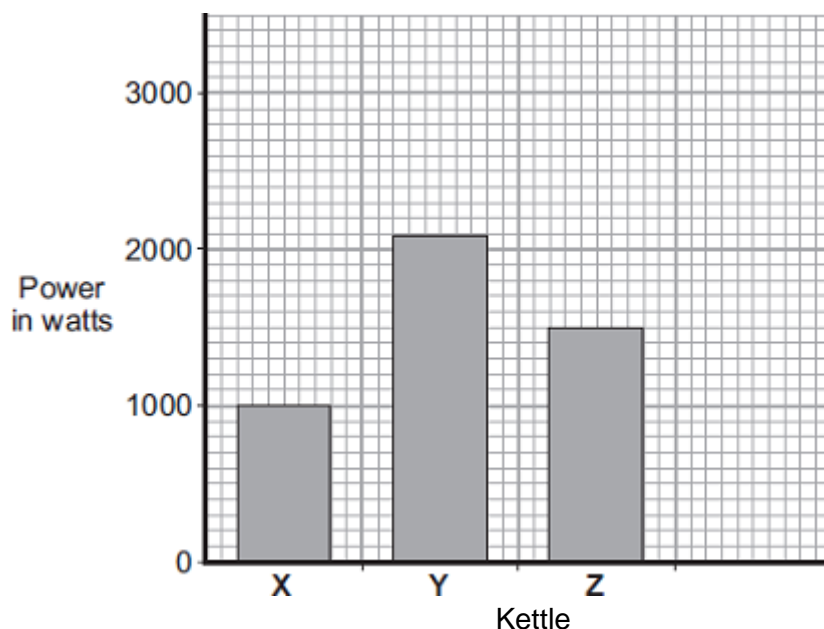
1

2

3

(3)

- (b) The bar chart shows the power of three electric kettles, X, Y and Z.



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

Which kettle costs the most to use?

Put a tick (✓) next to your answer.

X



Y



Y



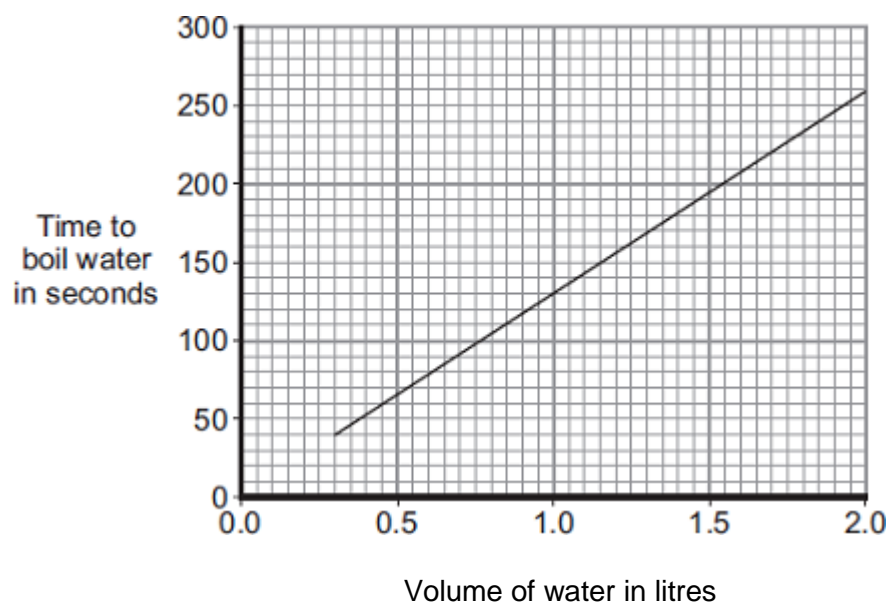
(1)

- (ii) 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) The graph shows how the time to boil water in an electric kettle depends on the volume of water in the kettle.



A householder always fills the electric kettle to the top, even when only enough boiling water for one small cup of coffee is wanted.

Explain how the householder is wasting money.

.....

.....

.....

.....

.....

.....

(3)
(Total 8 marks)

Q5.A 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 2012

Your electricity bill

Present reading: 53600 (e) 13 September
Previous reading: 53490 12 June

Used: 110 kWh

Cost per kWh = 15p (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.

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

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 53782.

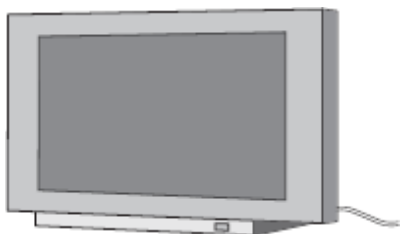
How many kilowatt-hours of electricity had the householder actually used between 12 June and 13 September?

.....
.....

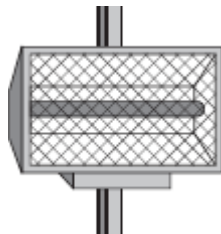
(2)

(Total 4 marks)

Q6. The data included in the diagrams gives the power of the electrical appliances.



TV
160 W



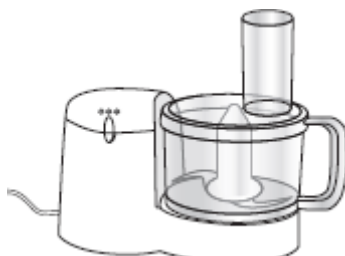
Radiant heater
1.0 kW



Hairdryer
1100 W



Sandwich toaster
1.1 kW



Food processor
0.4 kW



Table lamp
40 W

- (a) (i) Which appliance is designed to transform electrical energy to light and sound?

.....

(1)

- (ii) Which **two** appliances transform energy at the same rate?

..... and

(1)

- (b) During one week, the food processor is used for a total of 3 hours.

- (i) Use the equation in the box to calculate the energy transferred, in kilowatt-hours, by the food processor in 3 hours.

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

Show clearly how you work out your answer.

.....

Energy transferred = kWh

(2)

- (ii) Electricity costs 15 pence per kilowatt-hour.

Use the equation in the box to calculate the cost of using the food processor for 3 hours.

total cost	=	number of kilowatt-hours	×	cost per kilowatt-hour
------------	---	--------------------------	---	------------------------

Show clearly how you work out your answer.

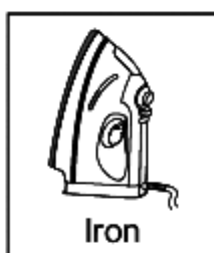
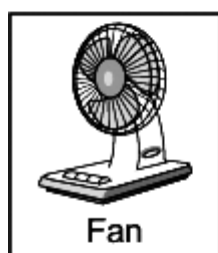
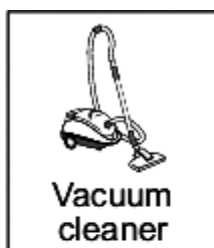
.....

.....
.....

Cost = pence

(2)
(Total 6 marks)

Q7. The appliances shown below transfer electrical energy to other types of energy.



(a) The vacuum cleaner is designed to transfer electrical energy to kinetic energy.

Three more of the appliances are also designed to transfer electrical energy to kinetic energy. Which **three**?

Draw a ring around each correct appliance.

3

(b) Which **two** of the following statements are true?

Tick (✓) **two** boxes.

Appliances only transfer part of the energy usefully.

☐

The energy transferred by appliances will be destroyed.

☐

The energy transferred by appliances makes the surroundings warmer.

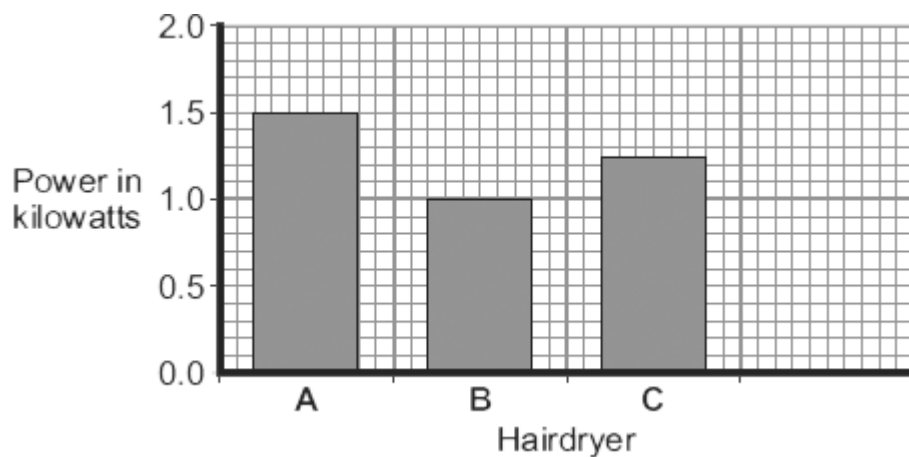
☐

The energy output from an appliance is bigger than the energy input.

☐

(2)
(Total 5 marks)

Q8. (a) The bar chart shows the power of three different electric hairdryers.



- (i) Which **one** of the hairdryers, **A**, **B** or **C**, would transfer the most energy in 5 minutes?

Write the correct answer in the box.

(1)

- (ii) A small 'travel' hairdryer has a power of 500 watts.

Draw a fourth bar on the bar chart to show the power of the 'travel' hairdryer.

(1)

- (b) A family shares the same hairdryer.
The hairdryer has a power of 1.2 kW. The hairdryer is used for a total of 2 hours each week.

- (i) Calculate how many kilowatt-hours (kWh) of energy the hairdryer transfers in 2 hours.

Show clearly how you work out your answer.

.....
.....

Energy transferred = kWh

(2)

- (ii) Electricity costs 15 pence per kWh.

Calculate the cost of using the hairdryer for 2 hours.

Show clearly how you work out your answer.

.....
.....

Cost = pence

(2)

(Total 6 marks)