AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.2.4 ENERGY TRANSFERS (PACK 2)

SCORE	PERCENTAGE
/153	%

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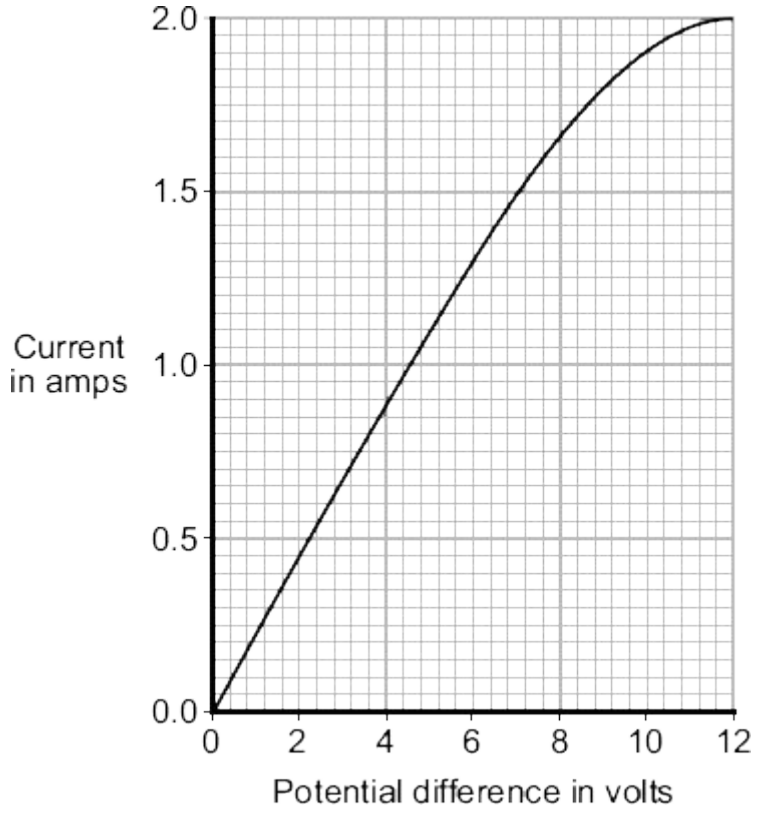
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Q1.

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



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

electric current

_____

_____

potential difference

_____

_____

(2)

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

Explain why.

_____

_____

_____

_____

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_____

_____

_____

_____

(3)

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

Show clearly how you work out your answer.

_____

_____

Rate of energy transfer = _____ W

(2)

(Total 7 marks)

Q2.

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

A electrical to chemical
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 the device is designed to make.

Write the correct letter, **A**, **B**, **C**, **D** or **E**, in the box below each device.

Use each letter no more than once.

Fan	**Kettle**	**Lamp**	**Radio**
			
☐	☐	☐	☐

(Total 4 marks)

Q3.

A homeowner had a new gas boiler installed.

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(a) The following information is an extract from the information booklet supplied with the boiler.

Fuel	Natural Gas
Water temperature	60 °C
Energy supplied to gas boiler	8.0 kJ/s (8.0 kW)
Efficiency	0.95

(i) Calculate the energy transferred each second by the gas boiler to the water inside the boiler.

Show clearly how you work out your answer.

_____

_____

Energy transferred by the gas boiler each second = _____ kJ

(2)

(ii) The energy value of the gas used in a home is measured in kilowatt-hours (kWh).

The homeowner has a pre-payment meter and pays £30 into his account. With a pre-payment meter, gas costs 15p per kilowatt-hour.

Calculate the total number of hours that the gas boiler would operate for £30.

Show clearly how you work out your answer.

_____

_____

_____

_____

Number of hours = _____

(2)

(b) Although the gas boiler is very efficient, some energy is wasted.

Explain what happens to the waste energy.

_____

_____

_____

_____

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(2)
(Total 6 marks)

Q4.

The diagram shows four electrical appliances. Each appliance is designed to transform electrical energy into one form of output energy.


Kettle


Toaster


Radio


Hair straighteners

(a) Which **one** of the appliances is designed to give a different form of output energy from the other three appliances?

_____

Give a reason for your answer.

_____

_____

(2)

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

Appliance	Power
Kettle	2.5 kW
Toaster	920 W
Radio	15 W
Hair straighteners	75 W

Each appliance is switched on for 5 minutes.

Which appliance transforms the most energy?

_____

(1)

(c) The 75 watt hair straighteners are switched on for a few minutes each day.
In one year, the amount of energy transferred from the mains electricity supply to the hair straighteners is 4 kilowatt-hours.

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Electricity costs 15 p per kilowatt-hour.

Use the equation in the box to calculate the yearly cost of using the hair straighteners.

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

Show clearly how you work out your answer.

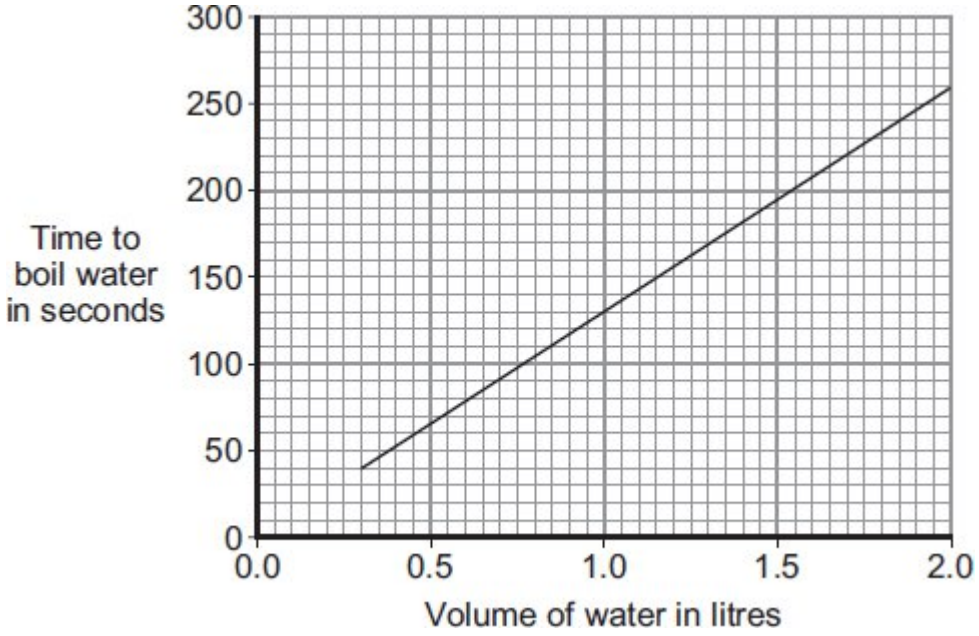
_____

_____

Total cost = _____ pence

(2)

(d) 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 required.

Explain how the householder is wasting money.

_____

_____

_____

_____

_____

_____

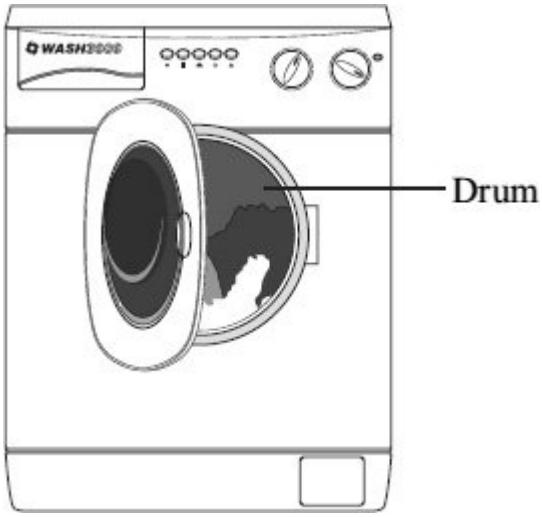
(3)

(Total 8 marks)

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Q5.

The picture shows a new washing machine. When the door is closed and the machine switched on, an electric motor rotates the drum and washing.



(a) What happens to the energy wasted by the electric motor?

_____

_____

(1)

(b) The diagram shows the label from the new washing machine.

Model – Wash 3000 **Energy A**	
More efficient A B C D E Less efficient	A
Energy consumption kWh/wash cycle (based on 40 °C wash)	1.1

An 'A' rated washing machine is *more energy efficient* than a 'C' rated washing machine.

Explain what being *more energy efficient* means.

_____

_____

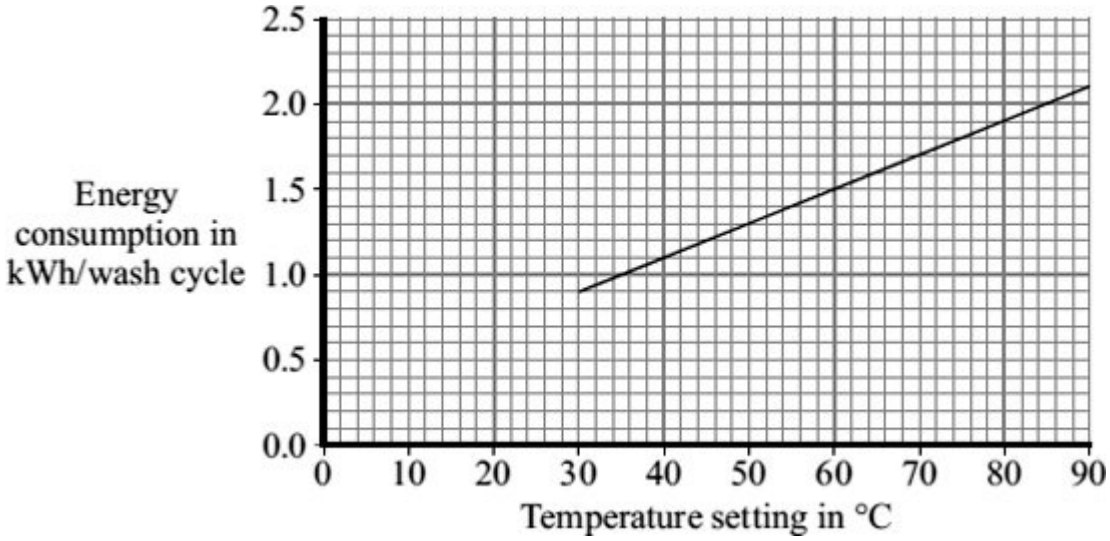
_____

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_____

(2)

(c) The graph shows that washing clothes at a lower temperature uses less energy than washing them at a higher temperature. Using less energy will save money.



(i) Electricity costs 12 p per kilowatt-hour (kWh).
The temperature setting is turned down from 40 °C to 30 °C.

Use the graph and equation in the box to calculate the money saved each wash cycle.

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

Show clearly how you work out your answer.

_____

_____

Money saved = _____ p

(2)

(ii) Suggest why reducing the amount of energy used by washing machines could reduce the amount of carbon dioxide emitted into the atmosphere.

_____

_____

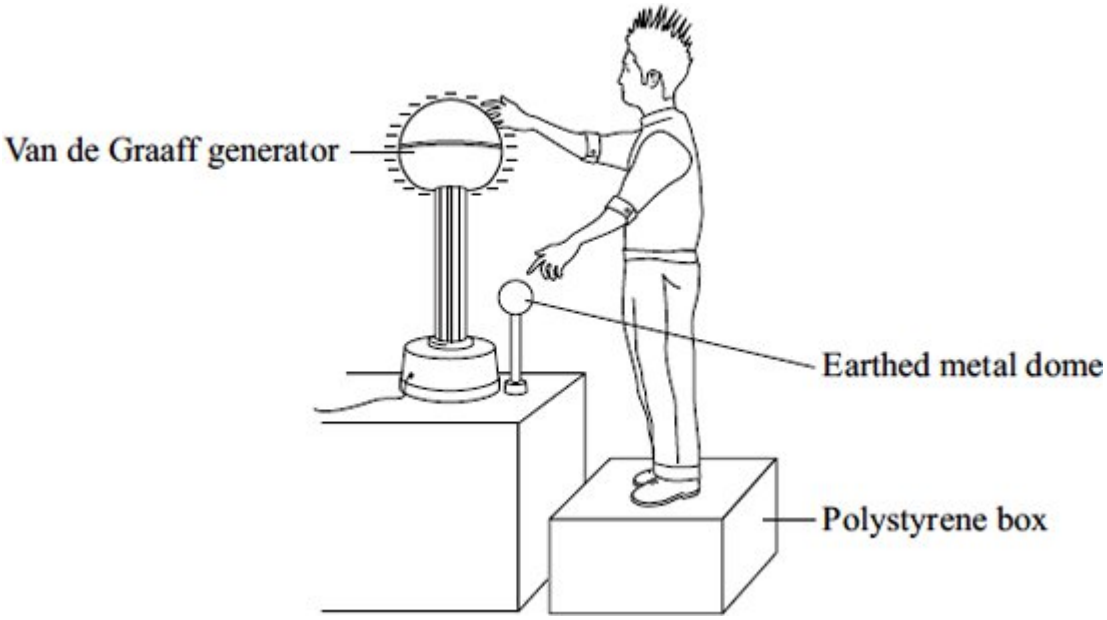
(1)

(Total 6 marks)

Q6.

(a) The diagram shows a student touching the metal dome of a Van de Graaff generator.
When the generator is switched on, the metal dome becomes negatively charged.

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Explain why the student's hair stands on end when the generator is switched on.

_____

_____

_____

(2)

(b) When the potential difference between the student and a nearby earthed metal dome reached 15 kV, a spark jumped between the student and the earthed dome. The spark transformed 30 mJ of energy into heat, light and sound. (1 mJ = 0.001 J)

Calculate the charge carried by the spark.

_____

_____

Charge transferred =_____ coulombs

(2)

(c) What name is given to the rate of flow of charge?

_____

(1)

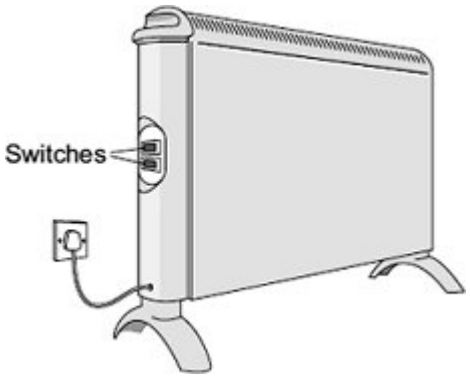
(Total 5 marks)

Q7.

(a) The diagram shows two switches on a room heater. The heater has three power settings. The power produced by two of the settings is given in the table.

Setting	Power in kW

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Low	0.5
Medium	1.5
High	

(i) When both switches are on, the heater works at the high power setting.

What is the power of the heater when it is switched to the **high** power setting?

_____

Power = _____ kW

(1)

(ii) The heater is used on the **medium** power setting. It is switched on for three hours.

Use the equation in the box to work out the energy transferred from the mains to the heater in three hours.

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

Show clearly how you work out your answer.

_____

_____

Energy transferred = _____ kWh

(2)

(iii) Electricity costs 12 pence per kilowatt-hour.

Use the equation in the box to calculate how much the heater costs to use on **medium** power for three hours.

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

Show clearly how you work out your answer.

_____

_____

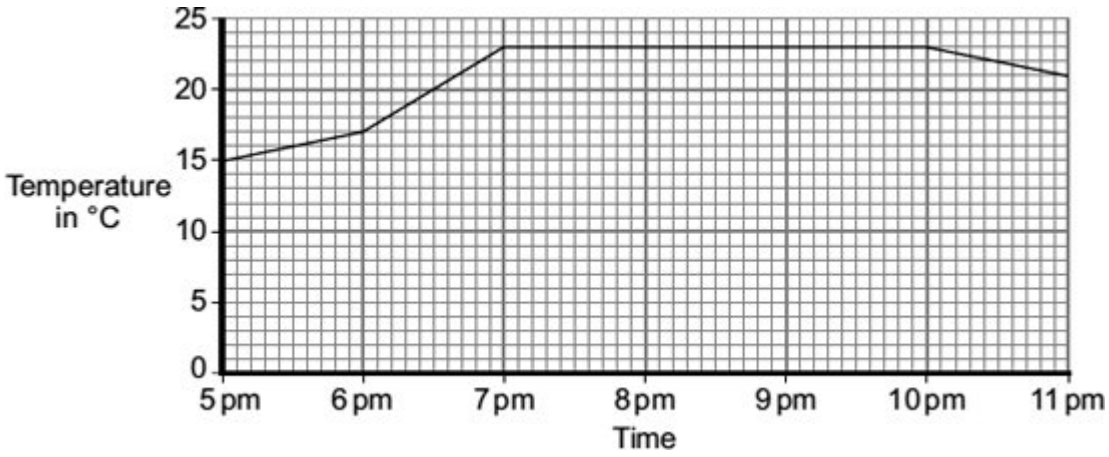
Total cost = _____ pence

(2)

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(b) The heater is used to warm a room.

The graph shows how the temperature of the room changes from the moment the heater is switched on.



The heater was first used on the medium setting.

(i) At what time was the heater setting changed to the **high** setting?

_____

Give a reason for your answer.

_____

_____

_____

(2)

(ii) From 7 pm until 10 pm, the temperature of the room is **not** changing.

Which **one** of the following statements gives the reason why the temperature of the room is **not** changing?

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

The room is losing energy slower than the heater supplies energy. ☐

The room is losing energy as fast as the heater supplies energy. ☐

The room is losing energy faster than the heater supplies energy. ☐

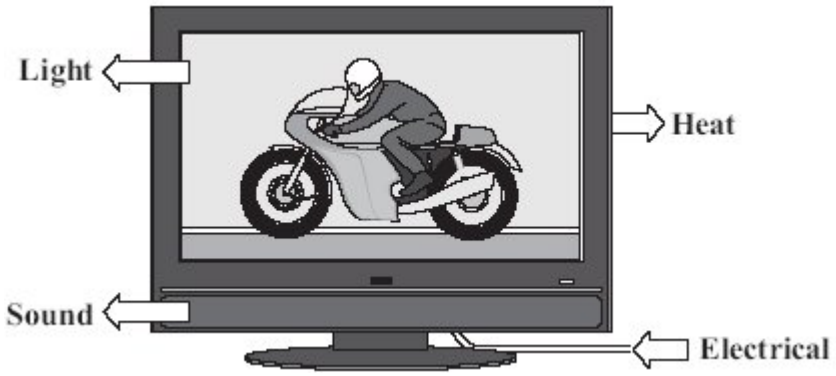
(1)

(Total 8 marks)

Q8.

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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

a higher efficiency than
the same efficiency as
a lower efficiency than

television **B**.

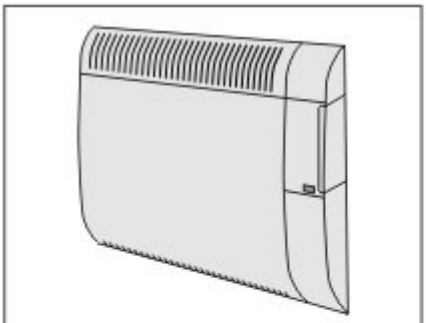
(1)

(Total 4 marks)

Q9.

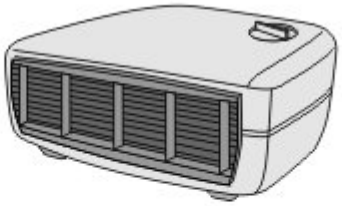
The pictures show three different types of electric heater.

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400W oil-filled panel heater (wall mounted)

- 3 heat settings
- Efficient background heat
- Safety overheat cut-out



3kW fan heater

- 2 heat settings
- Power indicator light
- Cool air fan setting



1800W ceramic heater

- 2 heat settings
- 8 hour timer
- Power indicator light
- Safety overheat cut-out

(a) The ceramic heater is run on full power for 5 hours.

Use the following equation to calculate, in joules, the amount of energy transferred from the mains to the heater.

energy transferred = power × time

Show clearly how you work out your answer.

_____

_____

Energy transferred = _____ joules

(2)

(b) Which heater will be the most expensive to run on its highest heat setting?

_____

(1)

(c) A heater is needed for a small office.

Comparing each type of heater with the other two, give **one** advantage of using each type of heater in the office.

oil-filled panel heater _____

_____

fan heater _____

_____

ceramic heater _____

_____

(3)

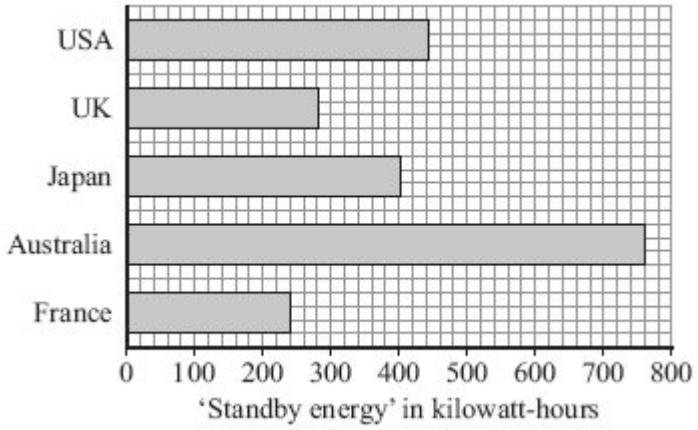
(Total 6 marks)

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Q10.

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.

_____

_____

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_____

_____

(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.

total cost = number of kilowatt-hours × 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. ☐

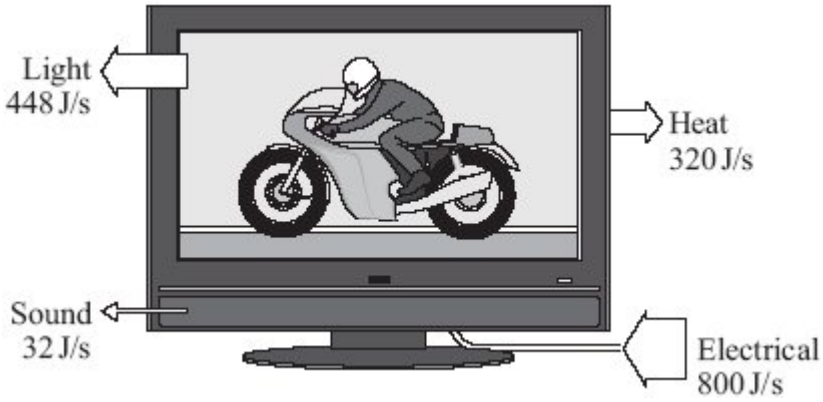
(1)

(Total 10 marks)

Q11.

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

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(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?

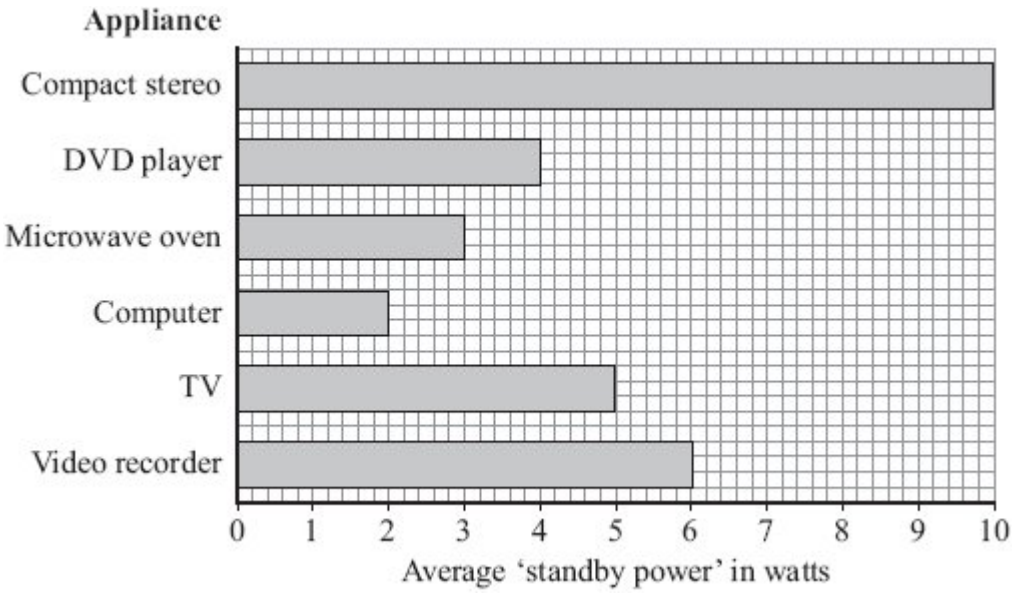
_____

_____

(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.

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(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)

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.

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

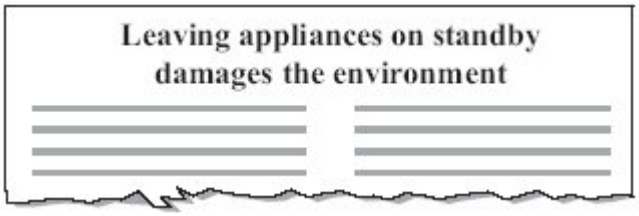
Show clearly how you work out your answer.

_____

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)

Q12.

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

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A electrical to gravitational potential

B electrical to heat

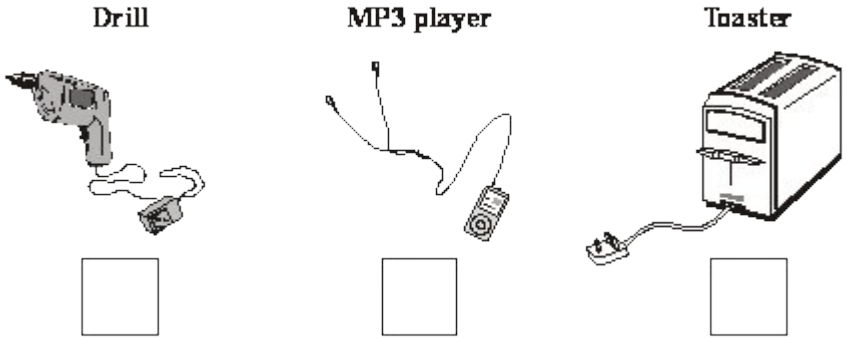
C electrical to kinetic

D electrical to light

E electrical to sound

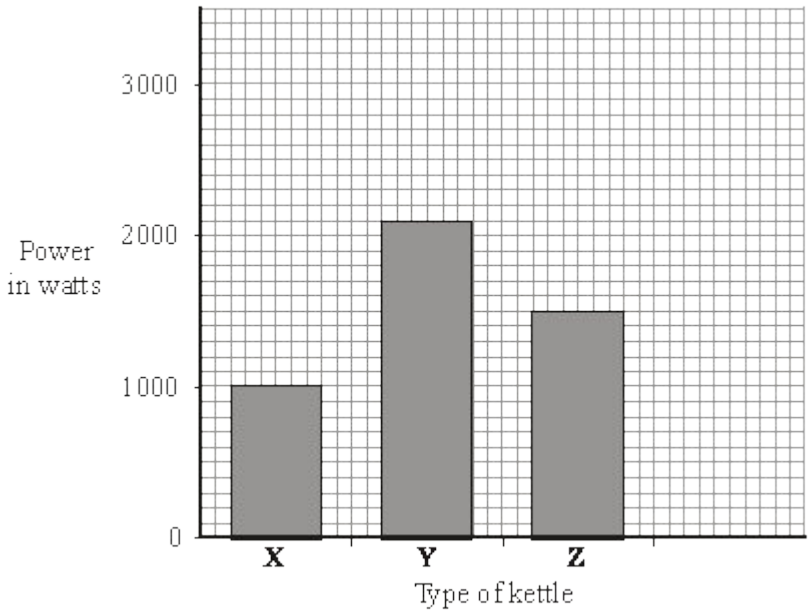
Match each of the following devices to the useful energy transformation that it is designed to make.

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?

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_____

(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
• 1 k W element
• Holds 1 litre
• Works on 110V or 230V
• Washable water filter

Immersion heater
• 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.

_____

_____

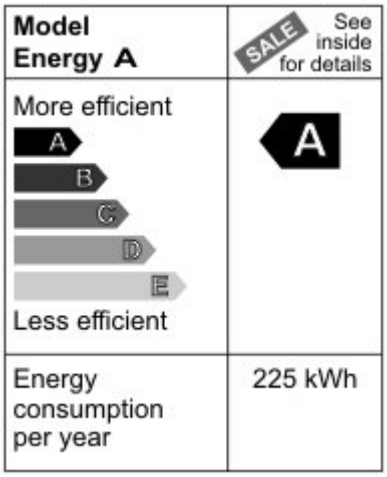
(1)

(Total 8 marks)

Q13.

The diagram shows the label from a new freezer.

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(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

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. _____

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Explain the reasons for your answer.

_____

_____

_____

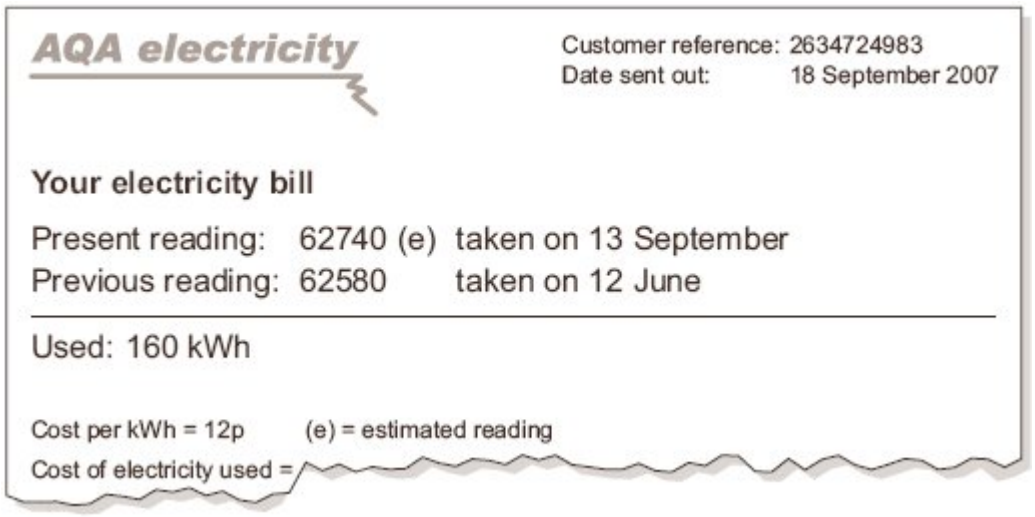
_____

(2)

(Total 6 marks)

Q14.

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.



(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 × 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?

_____

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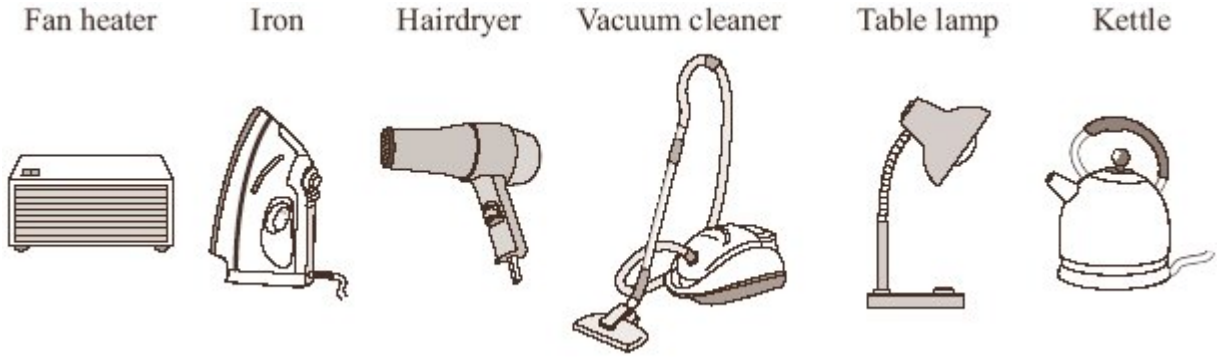
_____

(2)

(Total 4 marks)

Q15.

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**

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.

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Fan heater **L**	is more efficient than has the same efficiency as is less efficient than	fan heater **M**.

(1)

(Total 5 marks)

Q16.

(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

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_____

_____

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.

_____

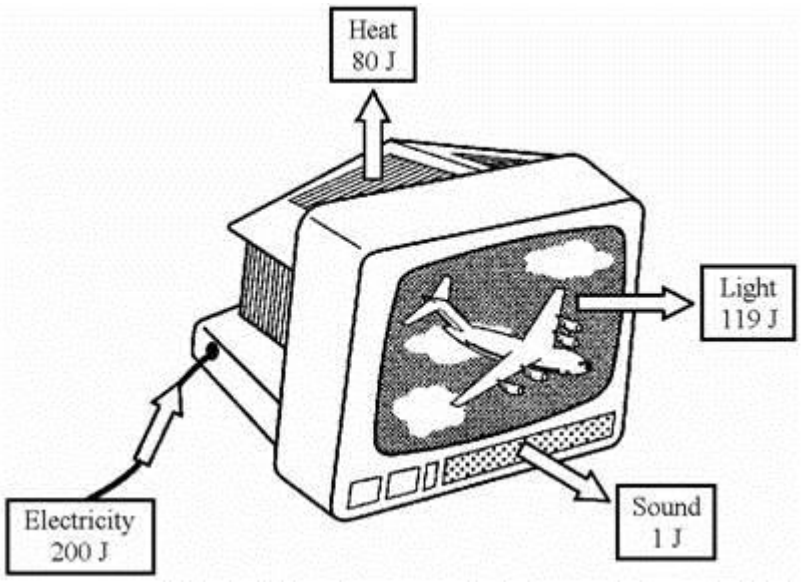
_____

(1)

(Total 5 marks)

Q17.

(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)

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(iii) Calculate the efficiency of the television set.

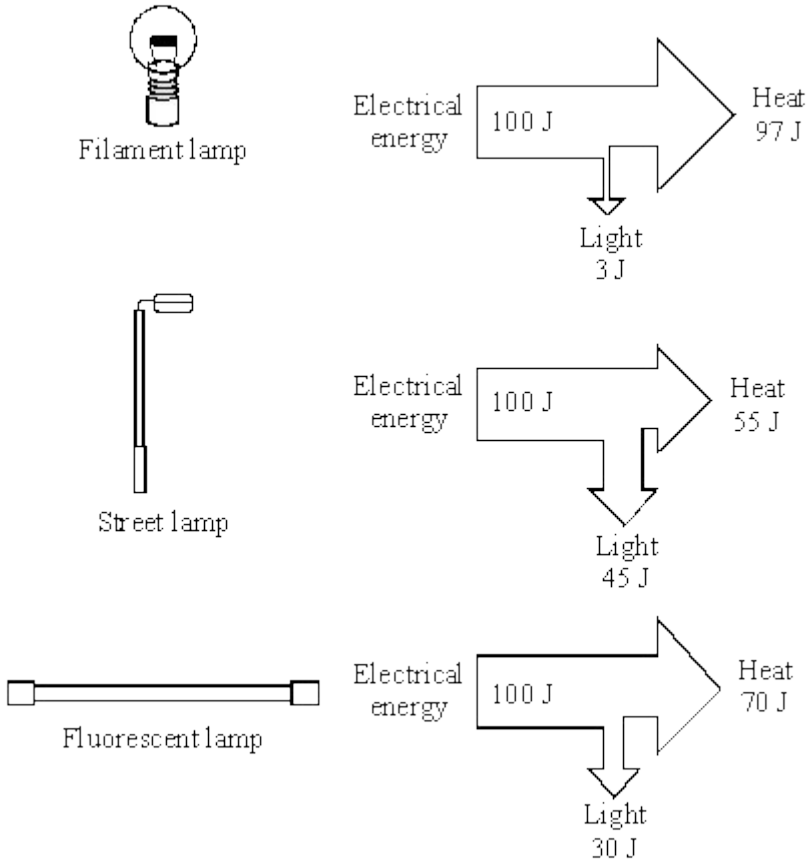
_____

_____

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)

Q18.

(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.

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List A Device		List B Useful energy
Toaster		Light
Fan		Kinetic
Personal stereo		Sound
		Heat

(3)

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

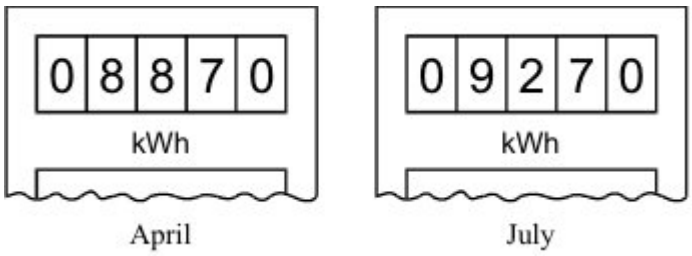
Device	**Power**
Toaster	1.2 kW
Fan	30 W
Personal Stereo	10 W

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.



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(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 × 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)	×	time (hour, h)

_____

_____

Energy transferred = _____kWh

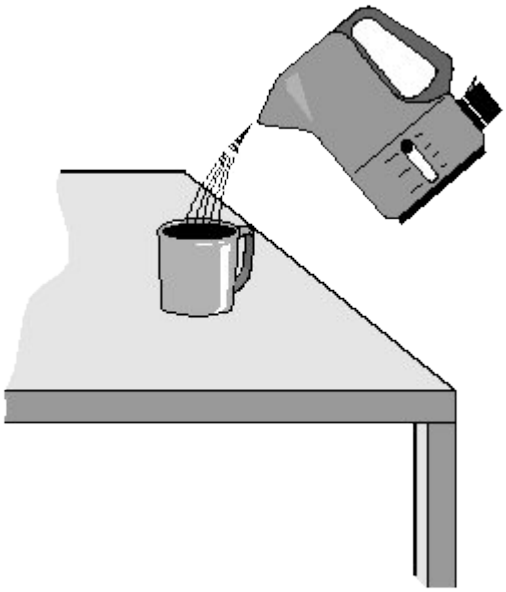
(2)

(Total 9 marks)

Q19.

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

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

air	mug	table	water

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

(1)

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

_____

_____

(1)

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

coal	gas	oil	wood

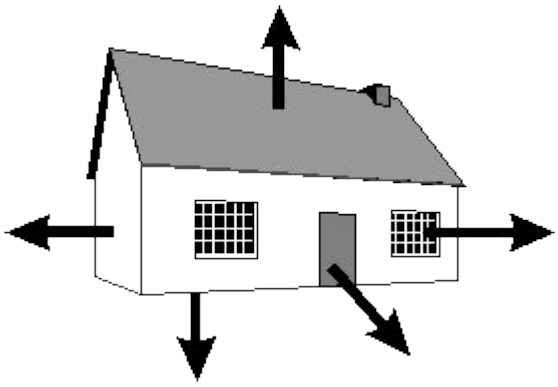
Which **one** of these types of fuel is renewable?

_____

(1)

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

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(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	insulator

The amount of heat energy lost through the windows by

_____ can be reduced by using thick

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

_____ .

(2)

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

_____

_____

(1)

(Total 6 marks)

Q20.

(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?

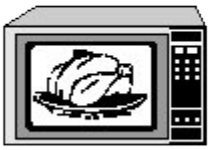
Name: _____

Symbol:

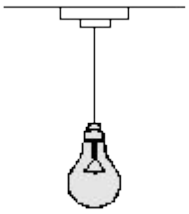
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(2)

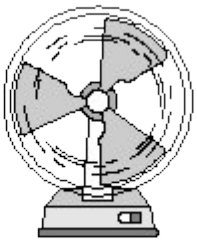
(b) When an electric current flows through a wire, the wire will get hot. **Two** of the following make use of this heating effect. Which **two**?



Microwave oven



Light bulb



Fan



Hairdryer

1. _____

2. _____

(2)

(Total 5 marks)

Q21.

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 _____

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Use _____

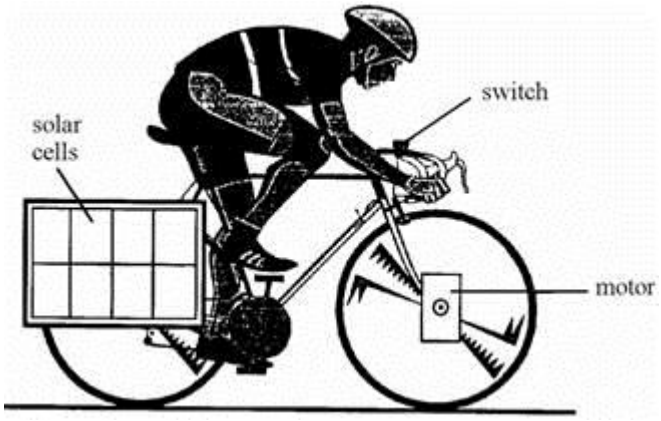
_____

(2)

(Total 8 marks)

Q22.

The diagram shows an experimental solar-powered bike.



A battery is connected to the solar cells.
The solar cells charge up the battery.
There is a switch on the handlebars.
When the switch is closed, the battery drives a motor attached to the front wheel.

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

chemical **electrical** **heat (thermal)** **kinetic**

light **potential** **sound**

(i) The solar cells transfer _____ energy to _____ energy.

(ii) When the battery is being charged up, _____ energy is transferred to _____ energy.

(iii) The motor is designed to transfer _____ energy to _____ energy.

(6)

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

_____

_____

Power _____ W

(2)

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

_____

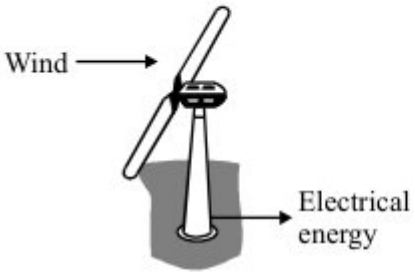
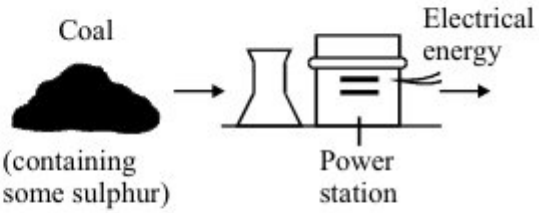
(1)

(Total 9 marks)

Q23.

Electricity is a useful form of energy.

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

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

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

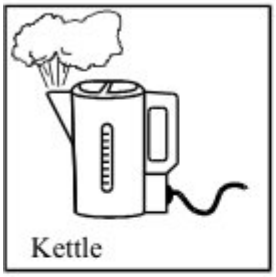
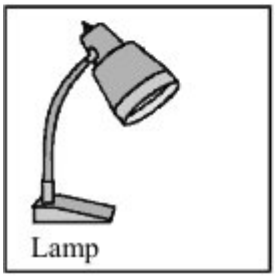
Advantage	**Disadvantage**
Using wind _____ _____ _____	Using wind _____ _____ _____
Using coal _____ _____ _____	Using coal _____ _____ _____

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(4)

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

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

List A **Electrical device**	**List B** **Useful energy transferred**
 Kettle	heat
 Radio	light
 Lamp	sound

(2)
(Total 6 marks)

Q24.

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

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

_____

_____

_____

(2)

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

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

_____

(1)

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

_____

(1)

(Total 4 marks)

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