

# Physics revision

1. Do this on **slideshow** so the answers come up as an animation
2. You need a **calculator** at hand
3. You need to **take your time** and check each questions answers if you want to learn
4. **Don't miss things out**

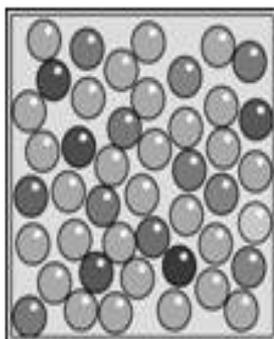
# Chapter 1:

Energy transfer by heating

# Answer these questions first

1. What does energy allow us to do? **1. Silver**
2. Name as many types of energies as you can. **2. Heat (thermal), sound, light, electrical, chemical, potential energy, kinetic**
3. What is an energy source/resource? **3. Where we obtain energy from**
4. What is the electromagnetic spectrum? **4. A group of waves that are arranged in terms of frequency**
5. What is infrared radiation? **5. One of the electromagnetic waves. We feel it as heat**
6. What surfaces are good absorbers of infrared radiation? **6. Dark matt surfaces**
7. What surfaces are poor absorbers of infrared radiation? **7. Light shiny surfaces**
8. What are the three states of matter? **8. Solid, liquid, gas**
9. Why are solids better conductors of heat? **9. The particles are close together so energy is transferred easily**
10. What are the three ways we can transfer heat? **10. convection, conduction and radiation**
11. What are the properties of a good insulator? **11. A good insulator is a poor conductor of heat**
12. Why is air a better insulator than a solid? **12. Air is a poor conductor of heat**
13. What is a fluid? **13. A liquid or gas**
14. Describe convection. **14. -Plastic top/cap- reduces heat loss by conduction and convection**
15. What is evaporation? **15. The change of state from liquid to gas**
16. What is condensation? **16. The change of state from gas to liquid**
17. Describe how a vacuum flask works. **17. -Plastic top/cap- reduces heat loss by conduction and convection. -Cavity wall insulation - reduces heat loss by conduction and convection**
18. What is specific heat capacity? **18. The amount of energy needed to raise the temperature of 1kg of a substance by 1°C**
19. How can we improve the energy efficiency of a house? **19. -Cavity wall insulation - reduces heat loss by conduction and convection. -Double glazing - reduces heat loss by conduction and convection. -Loft insulation - reduces heat loss by conduction and convection. -Draught proofing - reduces heat loss by convection.**
20. What does 'payback time' mean? **20. How many years it takes for an appliance or installation to pay for itself in terms of energy savings.**

Marbles inside a box can be used as a model for the particles in a solid, a liquid or a gas.



Use words from the box to complete the following sentences. Each word can be used once, more than once or not at all.

<b>gas</b>	<b>liquid</b>	<b>solid</b>
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- (a) The particles in a ..... **solid** ..... vibrate about fixed positions. (1)
- (b) The particles in a ..... **gas** ..... move at high speed in any direction. (1)
- (c) The particles in a ..... **solid** ..... are arranged in a pattern. (1)

(1)  
(Total 3 marks)

(ii) What is the main way heat is transferred through the walls of a house?

.....  
ii) conduction

**The walls are solid, so it can't be convection this time**

(a) It is important that the energy loss by evaporation increases during the race.

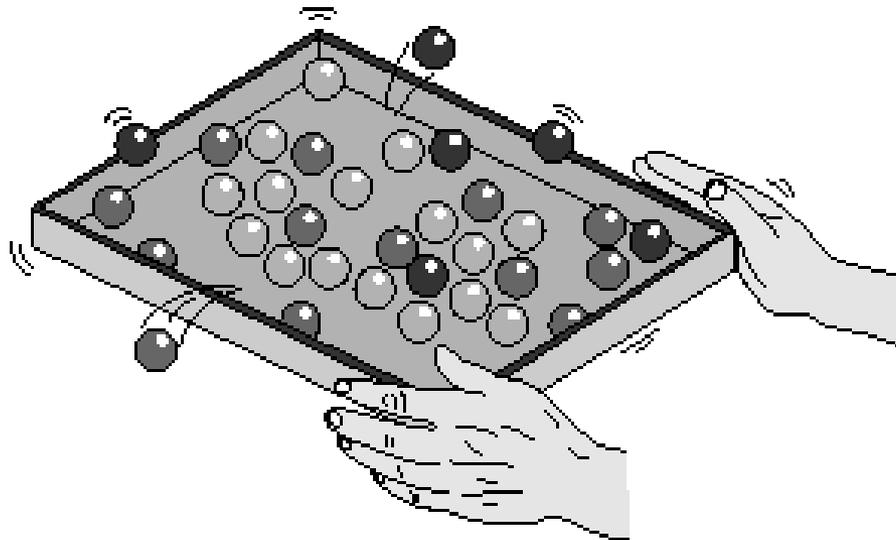
Explain why.

(a) energy needed to produce evaporation comes from the body

Evaporation from the body (e.g. through sweat) increases heat loss.

therefore this stops the body temperature rising

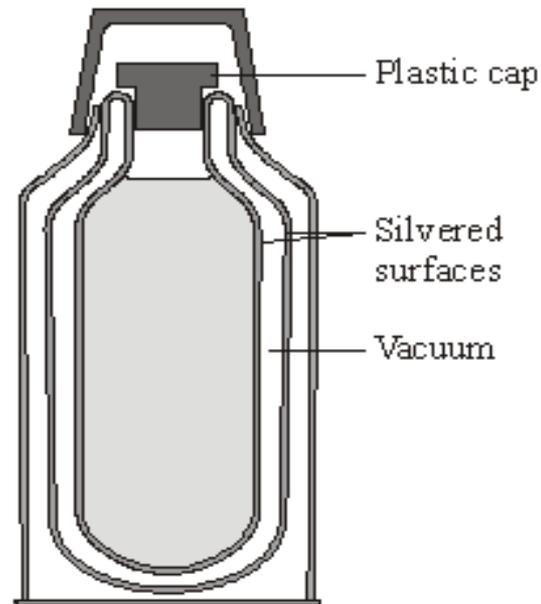
- (a) The diagram shows a tray of marbles being shaken from side to side. As this happens some of the marbles jump out of the tray.



Explain how the tray of marbles is acting as a model for the evaporation of a liquid.

-the marbles model / act as molecules  
-Some of the molecules are leaving the liquid  
which suggests evaporation is occurring

A vacuum flask is designed to reduce the rate of heat transfer.



- (a) (i) Complete the table to show which methods of heat transfer are reduced by each of the features labelled in the diagram.

The first row has been done for you.

Feature	Conduction	Convection	Radiation
vacuum	✓	✓	
silvered surfaces			✓
plastic cap	✓	✓	

- (b) The metal skewers help the potatoes to cook by transferring heat to the inside of the potatoes.

By what method is heat transferred through a metal skewer?

(b) conduction

(1)

- (c) When the potatoes are taken from the oven, they start to cool down.

Suggest **one** factor that will affect how fast a potato cools down.

- temperature of the potato OR
- temperature of the surroundings
- size/surface area of the potato

(1)

- (d) If the potatoes need to be kept hot, they may be wrapped in shiny aluminium foil.

Why does this help to keep the potatoes hot?

(foil) it is silver remember- is a poor emitter (of heat radiation)

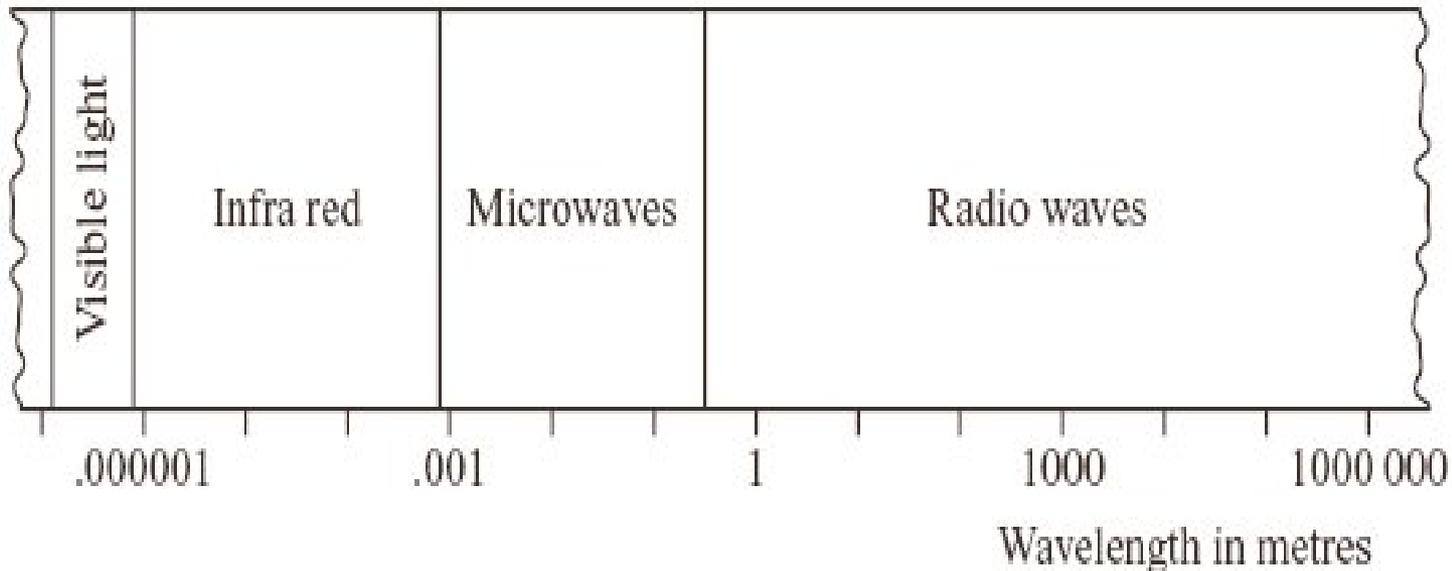
(1)

(Total 6 marks)

(b) What happens to the wasted energy?

(b) transferred to surroundings /  
atmosphere  
**or** becomes spread out

The diagram represents part of the electromagnetic spectrum.



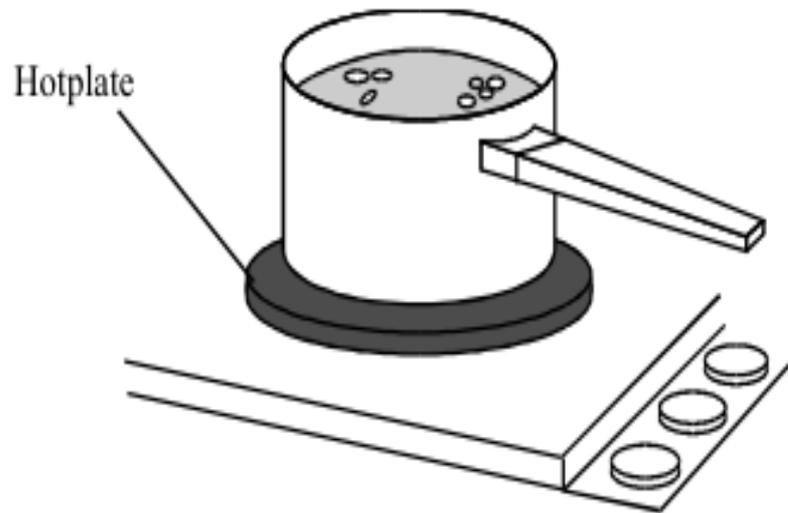
- (i) Visible light travels through air at 300 000 000 m/s.

Why can we assume that radio waves travel through air at the same speed as light?

(i) all electromagnetic waves travel at the same speed through a vacuum, (so assume same speed in air)

(1)

The drawing shows water being heated in a metal saucepan.



(a) Explain, in terms of the particles in the metal, how heat energy is transferred through the base of the saucepan.

(a) ions / **electrons gain (kinetic) energy**  
accept atom / particles / molecules for ion  
accept ions **vibrate faster**  
accept ions vibrate with a bigger amplitude  
accept ions vibrate more  
do not accept ions move faster

1

(free) electrons transfer energy by collision with ions  
**or energy transferred by collisions between vibrating ions**

(2)

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

<b>conduction</b>	<b>convection</b>	<b>radiation</b>
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Draughts transfer heat energy by .... convection ..... (1)

(iii) State **one** way of reducing the heat transfer by draughts.

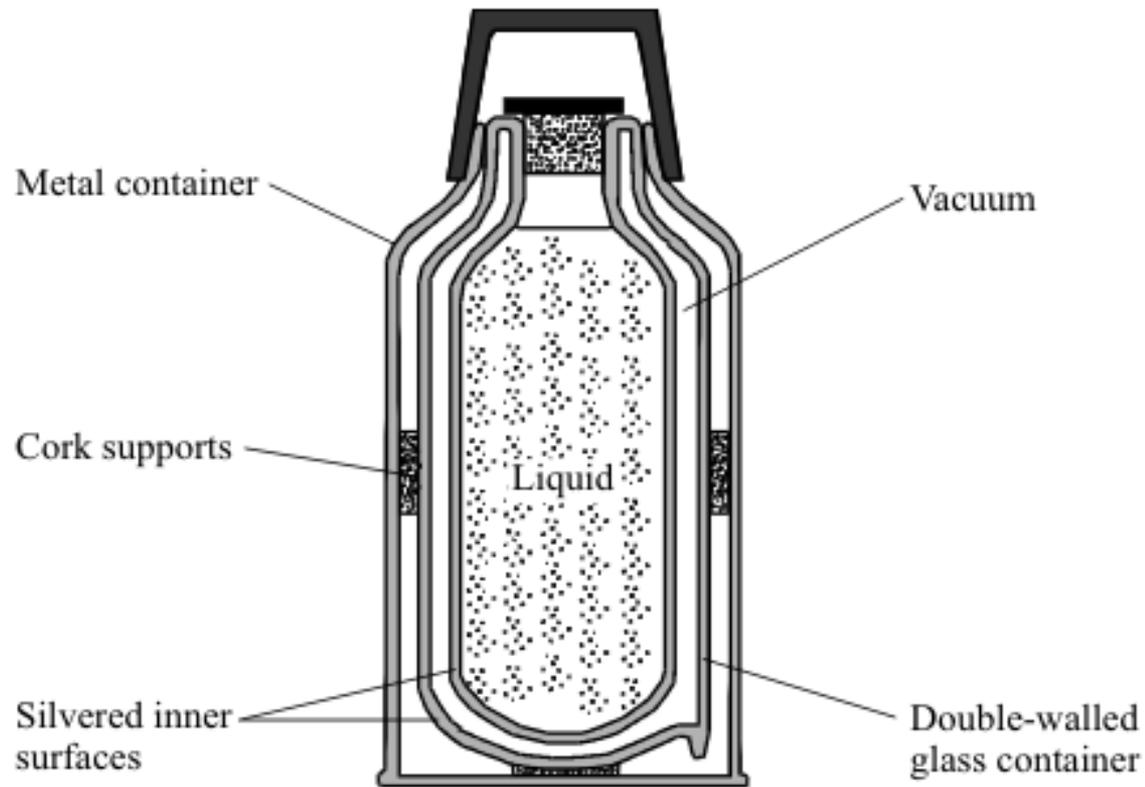
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(1)

- fit draughtproof strips OR
- lay carpet OR
- fit curtains OR
- close doors / windows / curtains

‘double glazing’ alone is insufficient

The vacuum flask shown has five features labelled, each one designed to reduce heat transfer.



(a) (i) Which labelled feature of the vacuum flask reduces heat transfer by both conduction and convection?

i) vacuum  
do not allow stopper

It has to be the vacuum because out of the three types of heat transfer (conduction, convection and radiation), only radiation can travel through a vacuum. So vacuums reduce heat transfer by not allowing conduction or convection to occur.

## Vacuum flask questions

(1)

- (ii) Explain how this feature reduces heat transfer by **both** conduction and convection.

in a vacuum, (absence of particles) means no (transfer of energy between) particles for conduction OR convection  
accept particles **or** atoms **or** molecules **or** electrons

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

(2)

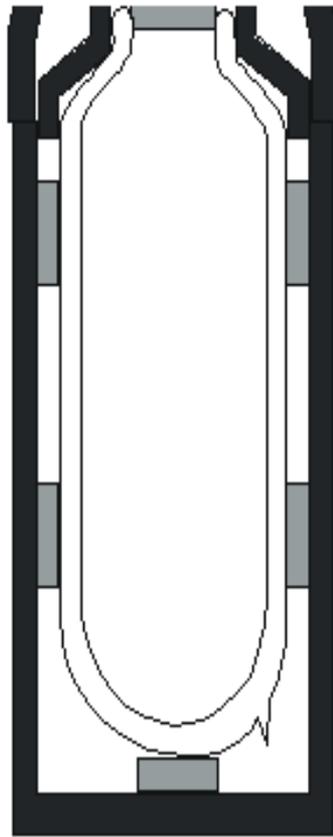
- (b) (i) Which labelled feature of the vacuum flask reduces heat transfer by radiation?

..... **silvered surface** .....

(1)

- (ii) Explain how this feature reduces heat transfer by radiation.

..... **silvered is a bad emitter/radiator** .....



(a) Give **two** features of the flask which reduce heat loss by conduction.

1. ....
2. ....

3 to choose from:

plastic/glass walls;  
vacuum;  
insulating top

(2)

(a) When an electric kettle is switched on it will take a few minutes to boil the water. Once switched off it will gradually cool down.

(i) When the kettle is switched on the water heats. Explain how all of the water is heated.

Carries heat up (as convection current)

(ii) The kettle is now switched off and begins to cool.

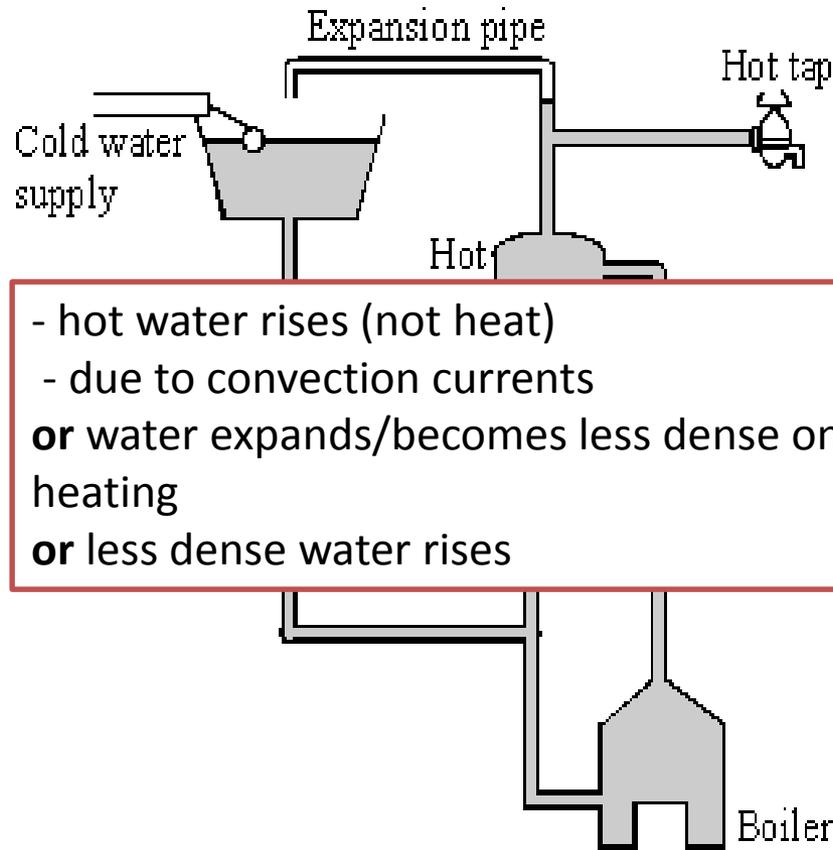
(1) Describe how heat energy is transferred **through** the walls of the kettle.

By conduction or from molecule to molecule

(2) Describe how the heat energy is transferred **from** the walls of the kettle.

By radiation or as IR

(a) The diagram shows a hot water system.



- hot water rises (not heat)
- due to convection currents
- or** water expands/becomes less dense on heating
- or** less dense water rises

(i) Explain why the boiler is below the hot water tank.

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(ii) Why is heat energy transferred from hot water in the tank to the surrounding air?

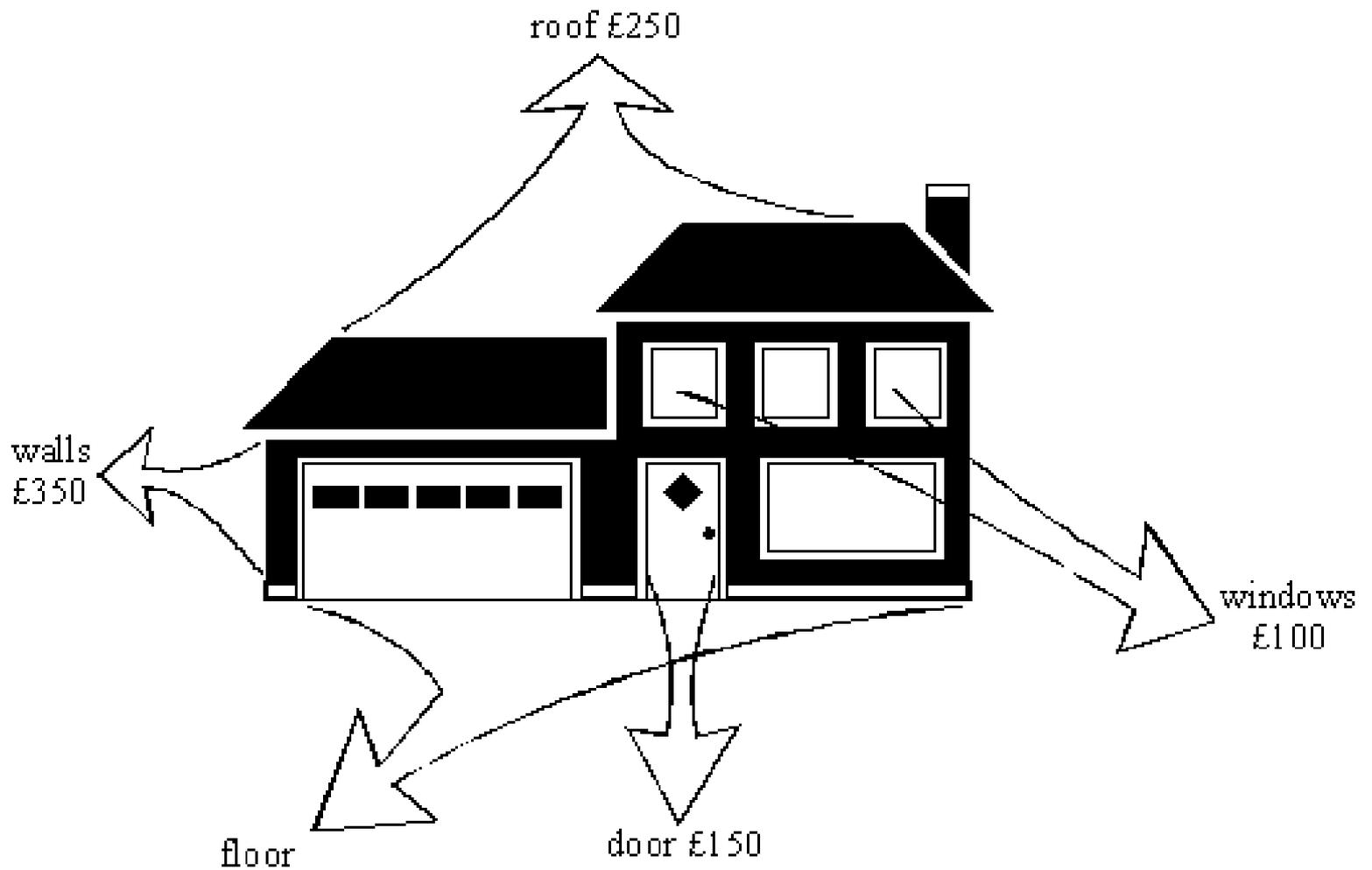
inside hotter (than outside)

(iii) Name the process by which energy is transferred through the sides of the tank.

(heat transfer by) conduction

(iv) How may heat loss from the hot water tank be reduced?

surround/cover/insulate tank with poor  
conductor or named insulator

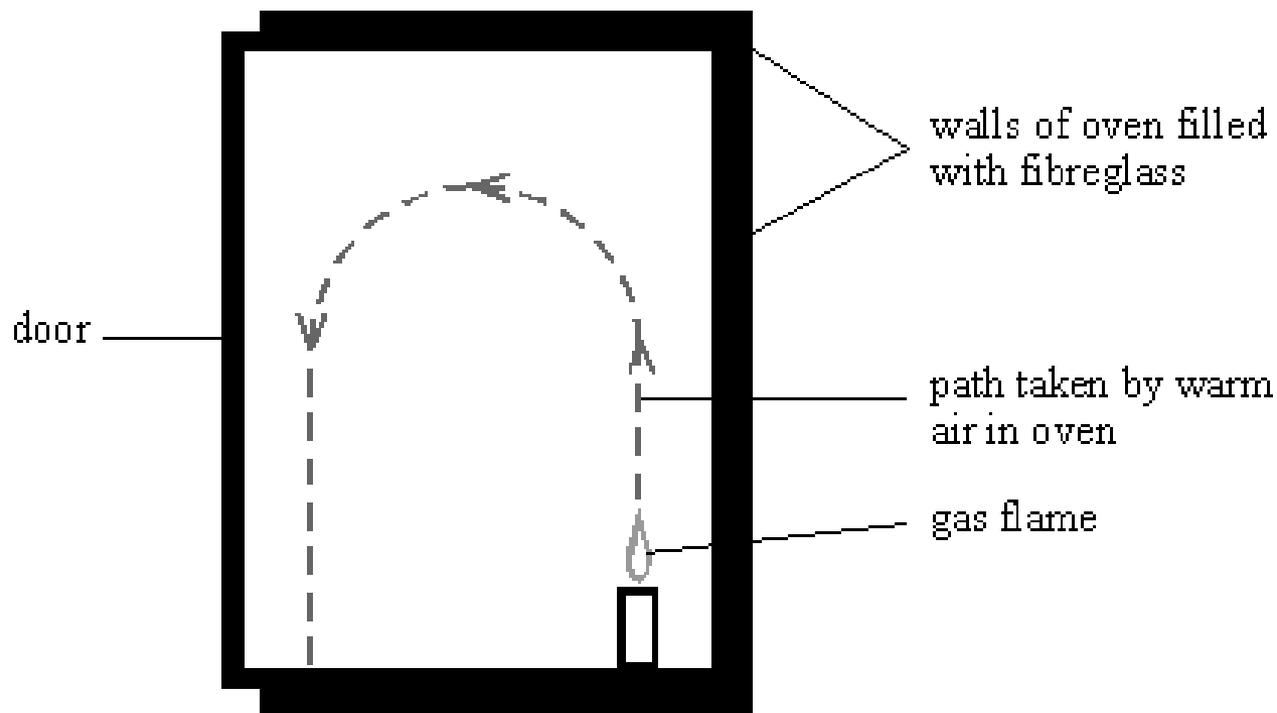


(a) The total cost of the energy lost during one year is £1000.

(i) What is the cost of the energy lost through the floor?

$$\text{£}1000 - (100 + 350 + 250 + 150) = \text{£}150$$

The diagram shows a section through a gas oven.



Use words from the list to complete the sentences.

**conduction**

**convection**

**insulation**

**radiation**

**resistance**

The outside of the door gets hot because energy is transferred through

the door by ..... ..... Conduction (the door is solid remember) .....

Use words from the list to complete the sentences.

**conduction**

**convection**

**insulation**

**radiation**

**resistance**

The outside of the door gets hot because energy is transferred through

the door by .....

conduction

Energy is transferred from the gas flame to the rest of the oven by the movement of air.

This type of energy transfer is called .....

convection

The walls of the oven are packed with fibreglass to reduce energy transfer. Energy transfer

is reduced because fibreglass provides good .....

insulation

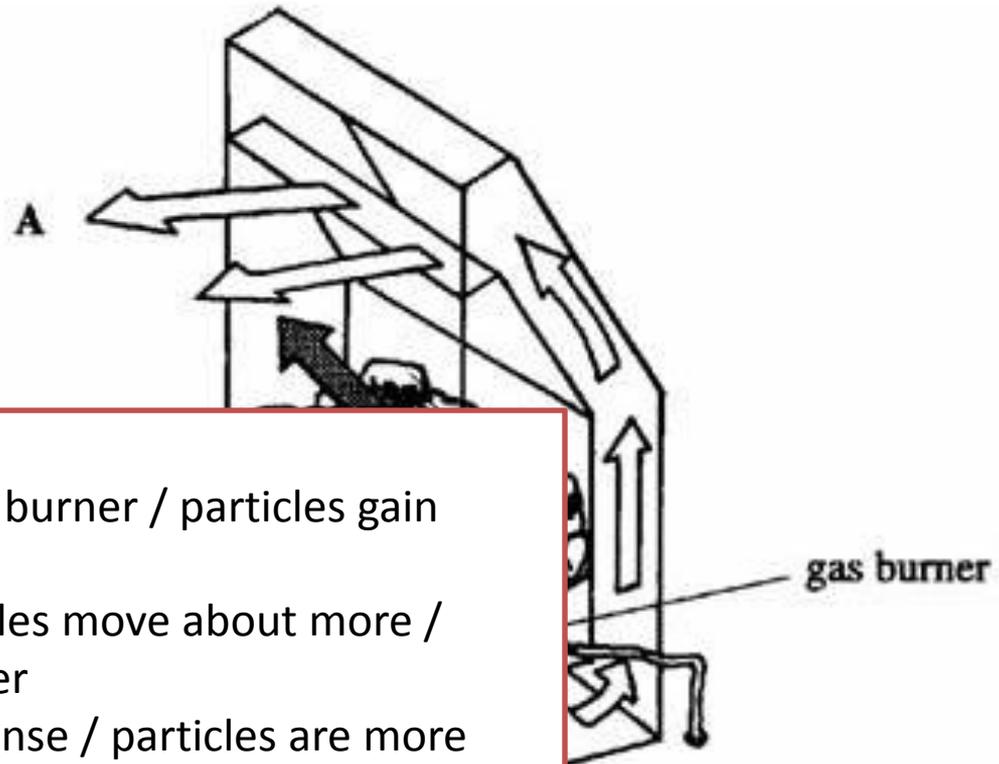
The outside of the cooker is white and shiny.

This reduces energy transfer by .....

radiation

(Total 4 marks)

The diagram comes from a leaflet about a “coal effect” gas fire.  
It shows how air circulates through the fire.



(a) convection  
air is heated by the burner / particles gain energy  
air expands / particles move about more / particles move faster  
air becomes less dense / particles are more spread out

(a) air rises / particles rise - *not* heat rises  
air from C moves into the heater / particles from C move into the heater to replace it / them  
any four for 1 mark each

## Experiment 1

- The student put the same volume of cold water into the two cans.
- He then switched on the heater.
- Ten minutes later the water in the can with the dull black surface was much hotter than the water in the other can.

## Experiment 2

- The student filled both cans with boiling water.
- This time he left the heater off.
- Ten minutes later the water in the can with the dull black surface was much cooler than the water in the other can.

Use words from the box to complete the sentences.

absorber

conductor

emitter

reflector

**Experiment 1** shows that the dull black surface is a good .. absorber .... of radiation and that the shiny silver surface is a good .. reflector .... of radiation.

**Experiment 2** shows that the dull black surface is a good ..... emitter ..... of radiation.

(Total 3 marks)

The table gives information about some methods of conserving energy in a house.

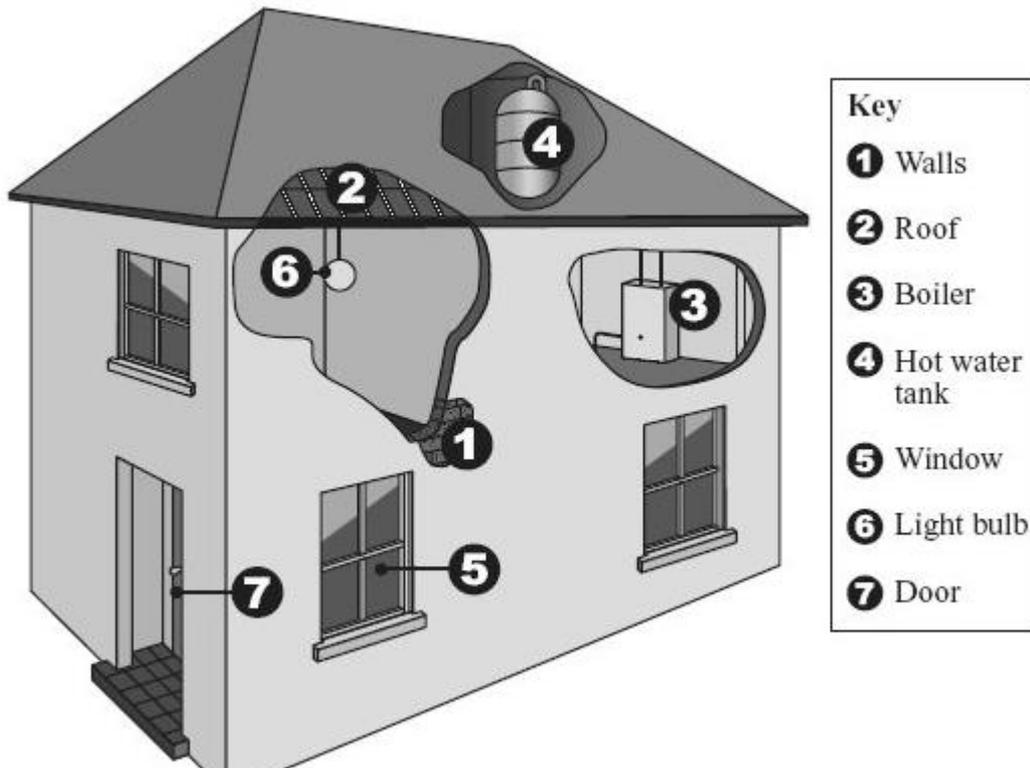
Conservation method	Installation cost in £	Annual saving on energy bills in £
Cavity wall insulation	500	60
Hot water tank jacket	10	15
Loft insulation	110	60
Thermostatic radiator valves	75	20

- (a) Explain which of the methods in the table is the most cost effective way of saving energy over a 10 year period. To obtain full marks you must support your answer with calculations.

(a) loft insulation  
energy saved in 10 years £600  
net saving  $(600 - 110)$  £490

**OR**

hot water jacket  
energy saved in 10 years £140  
This is the highest percentage saving on cost



(a) Give **one** way in which the amount of energy lost can be reduced from each of the following parts of the house.

1, 2 and 4 ..... Insulation- allow example e.g fibreglass

5 ..... double glazing- allow curtains

7 ..... draught excluder

(b) E ..... allow double glazing / close fitting door  
 bu ..... allow turning down thermostat once only / turn down the heating

(3)

nt light

What is meant by a *more efficient* light bulb?

transfers more useful energy

People do a number of things to reduce the energy loss from their homes.

(a) Describe **one** thing they may do to cut down the energy loss through:

(i) the roof;

(insulate it) with **fibre glass or foam**

(1)

(ii) the outside walls;

fill the cavity with fibre glass **or** foam

(1)

(iii) the glass in the windows;

double glaze **or** draw the curtains **or**  
blinds **or** thicker glass

(1)

(iv) gaps around the front and back doors.

put in draught excluder (or described)  
**or** strip **or** description of filling gaps  
**or** seal gaps

(1)

Choose from the words above to complete the following sentences. You may use a word once, more than once or not at all.

(i) The vacuum between the glass walls reduces

conduction

and

convection

(2)

(ii) The silvered surfaces of the glass walls reduce

radiation

(1)

(iii) The stopper in the opening of the flask reduces

evaporation

and

convection

(2)

(iv) Heat is transferred by the air molecules, away from the vacuum flask, by

convection

(1)

(v) The plastic of the plastic stopper is preferred to metal because it cuts down

conduction

The diagram shows four identical pieces of aluminium. Each had been painted with a different type of paint. A drop of water was placed on each and they were then heated by a radiant heater held about one metre above them.



**A** Shiny white



**B** Shiny black



**C** Matt white



**D** Matt black

(i) Suggest in which order the pieces of aluminium would become dry.

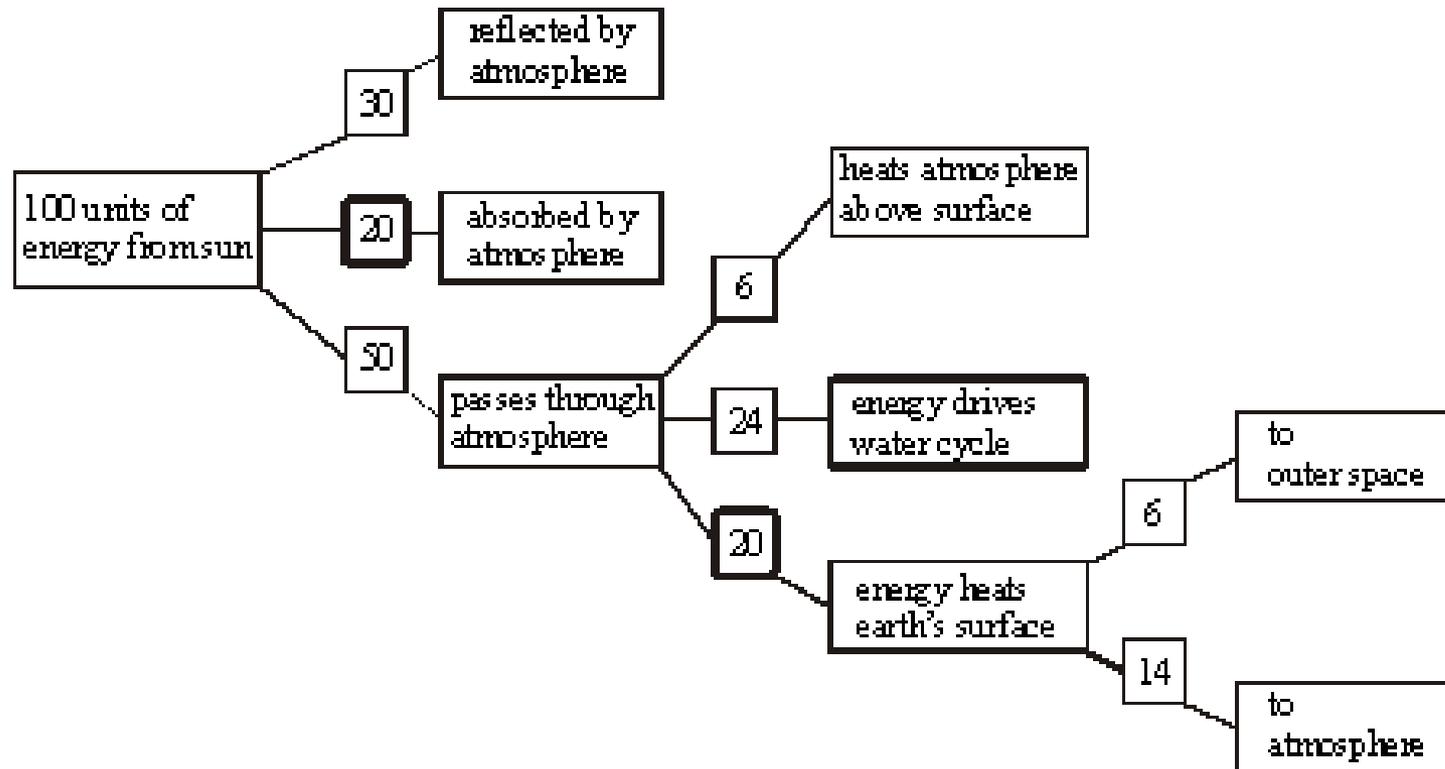
first ..... **D, C or B, in either order, then A** ..... last

(1)

(ii) Explain why you chose your order.

- matt absorbs energy (better than shiny)
- the opposite arguments are acceptable
- black absorbs energy (better than white)

Complete the boxes on the chart to show what happens to the energy from the Sun.



*each for 1 mark*

*allow 'error carried forward' to the last box'*

(Total 3 marks)

# Chapter 2:

Using energy

# Complete these questions first

1. What does the law of conservation say?  
1. Energy can't be created or destroyed
2. What does energy allow us to do?  
2. Work
3. What is useful energy?  
3. Energy that is transferred into the form we want
4. What is wasteful energy?  
4. Energy that is not usefully transferred.
5. Where does most of the wasteful energy go?  
5. To the surroundings
6. What is most wasteful energy?  
6. heat, but not all
7. What does efficiency mean?  
7. How useful an appliance is
8. What does an 'efficient light bulb' mean?  
8. It transfers more light energy and less heat energy
9. How do you calculate the efficiency of an appliance?  
$$\frac{\text{Useful energy}}{\text{Total energy}} \times 100$$
10. What are the units for energy?  
10. Joules (J)

**List A**  
**Appliance**



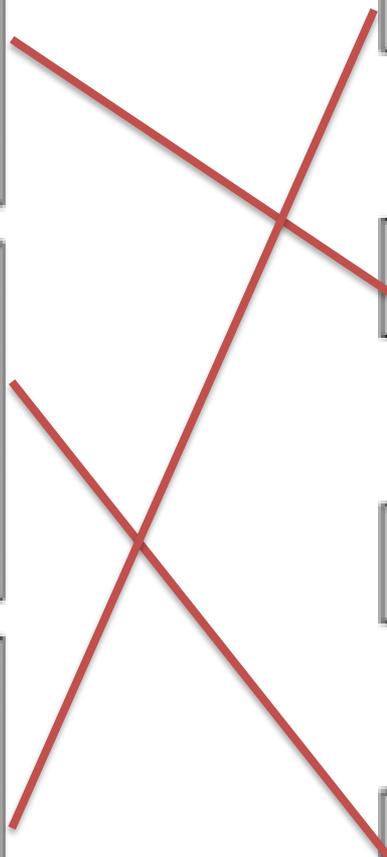
**List B**  
**Useful energy output**

Light

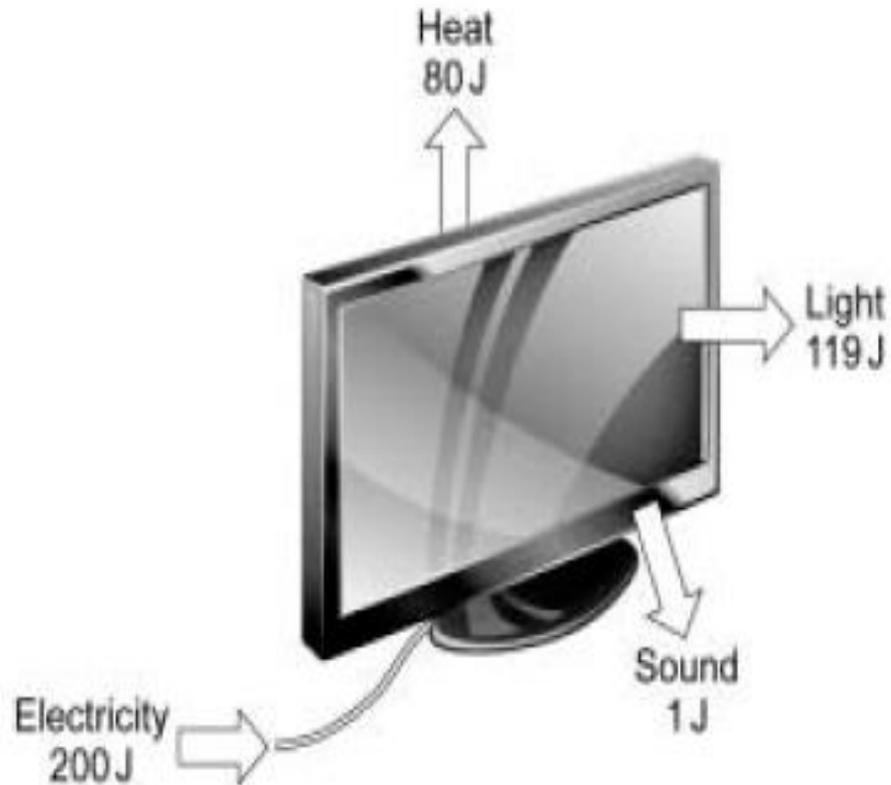
Sound

Electrical

Kinetic



- (a) The diagram shows the average energy transferred each second by a television.



- (i) Calculate the average efficiency of the television.

Show clearly how you work out your answer.

(a) (i) 0.6  
or  
60%



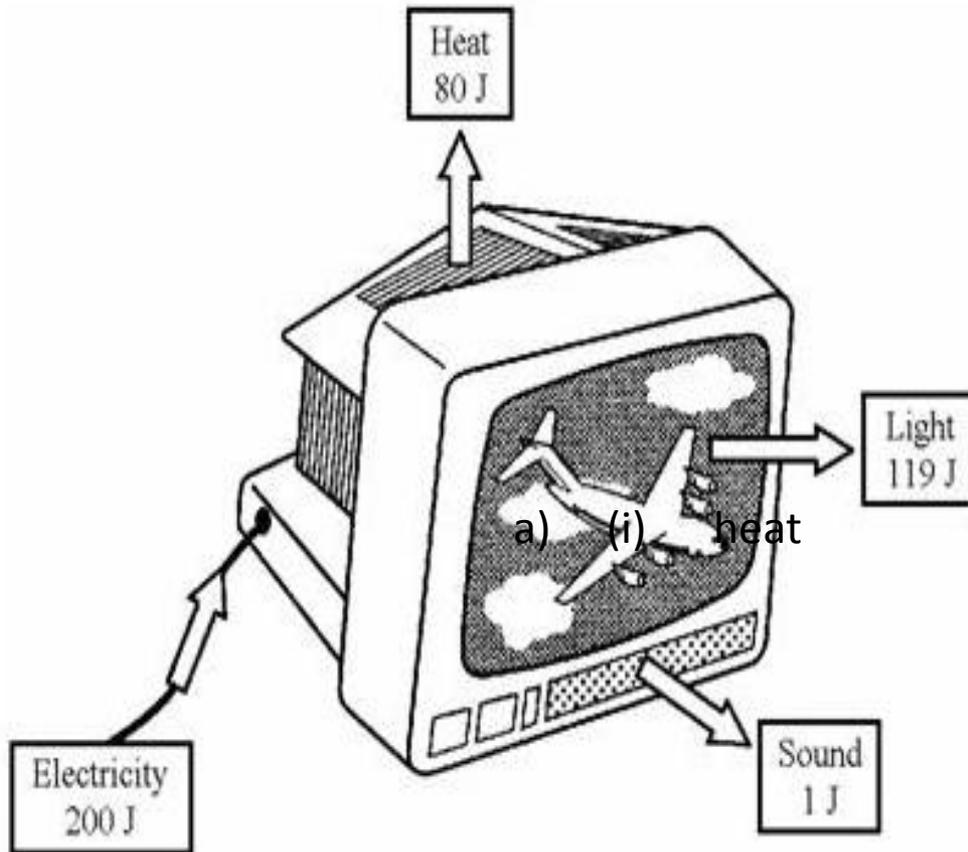
Photo by NASA.

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

<b>electrical</b>	<b>heat</b>	<b>light</b>	<b>sound</b>
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Solar cells are designed to transform ..... **light** ..... energy into  
..... **electrical** ..... energy.

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

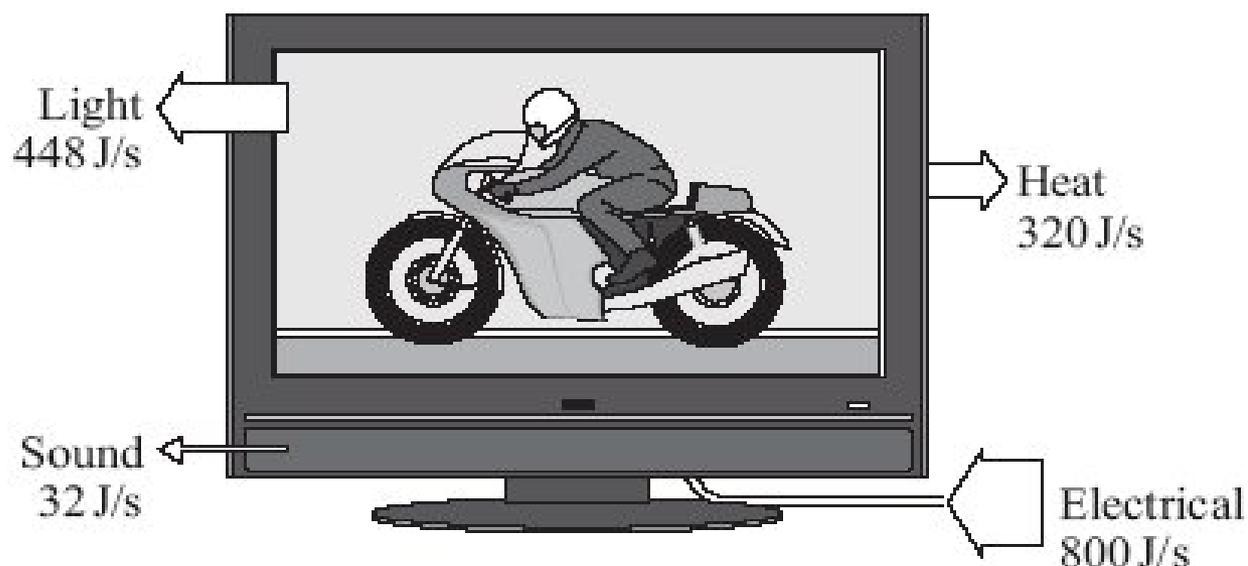


(i) What form of energy is transferred as waste energy by the television set?

heat

(1)

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



- (i) Use the information in the diagram and the equation in the box to calculate the efficiency of the TV.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

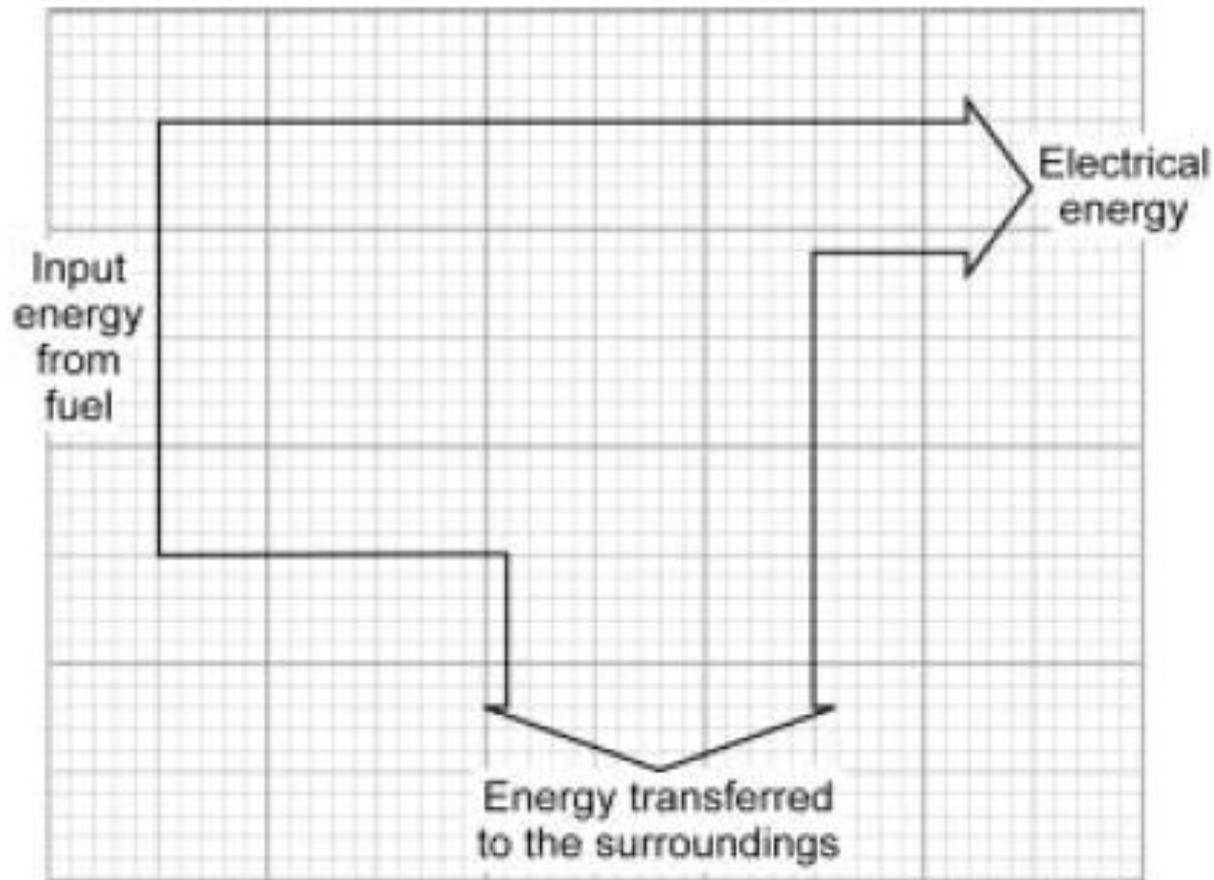
Show clearly

$$448 + 32 = 480 / 800$$

**0.6**

accept 60 %

(b) The diagram shows the energy transformations in a coal burning power station.



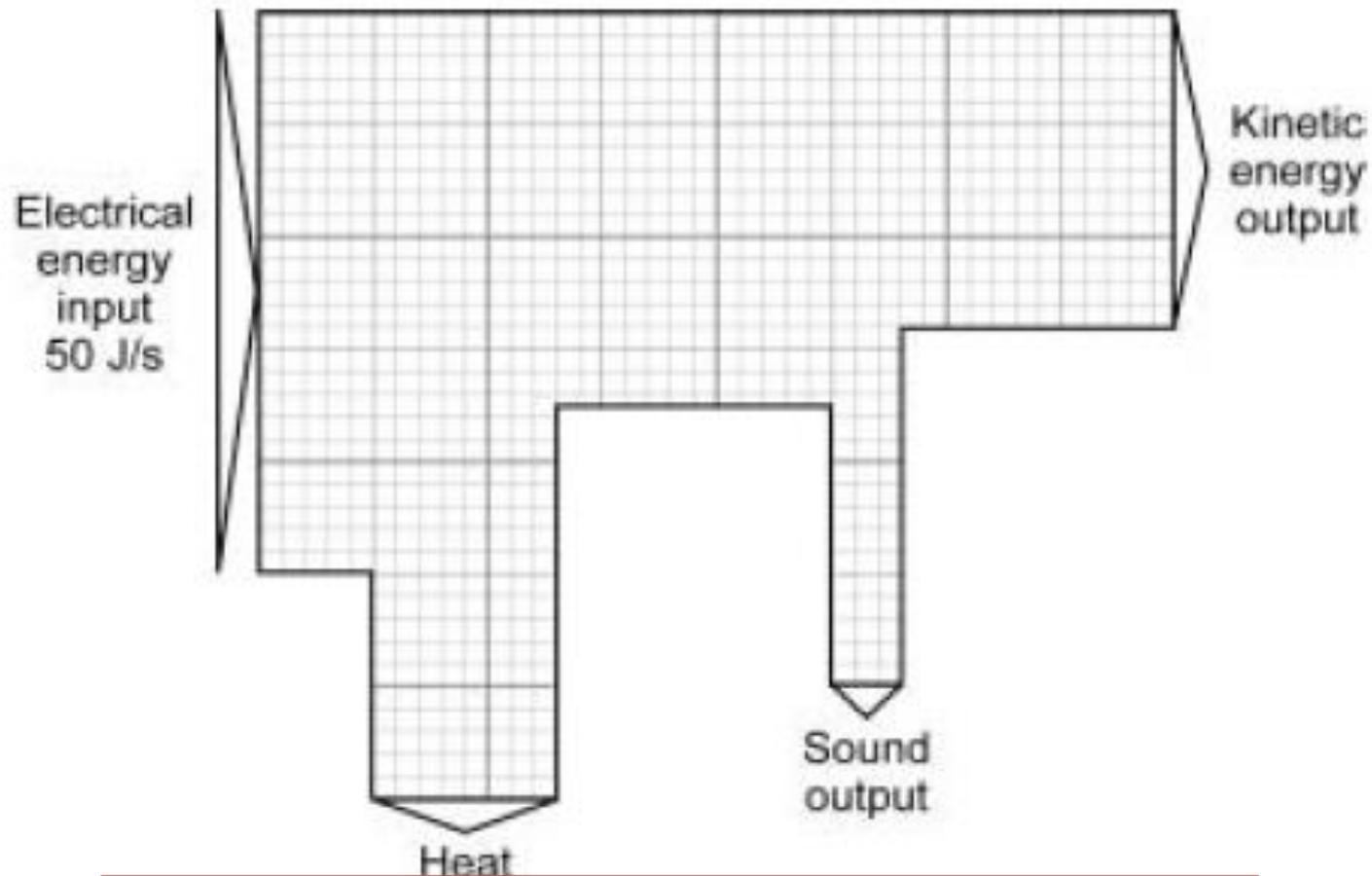
Calculate the efficiency of the power station.

Write down the equation you use, and then show clearly how you work out your answer.

0.3 or 30%

(a) We can use Sankey diagrams to show how efficient electrical appliances are.

This is a Sankey diagram for a small electric motor.



(i)

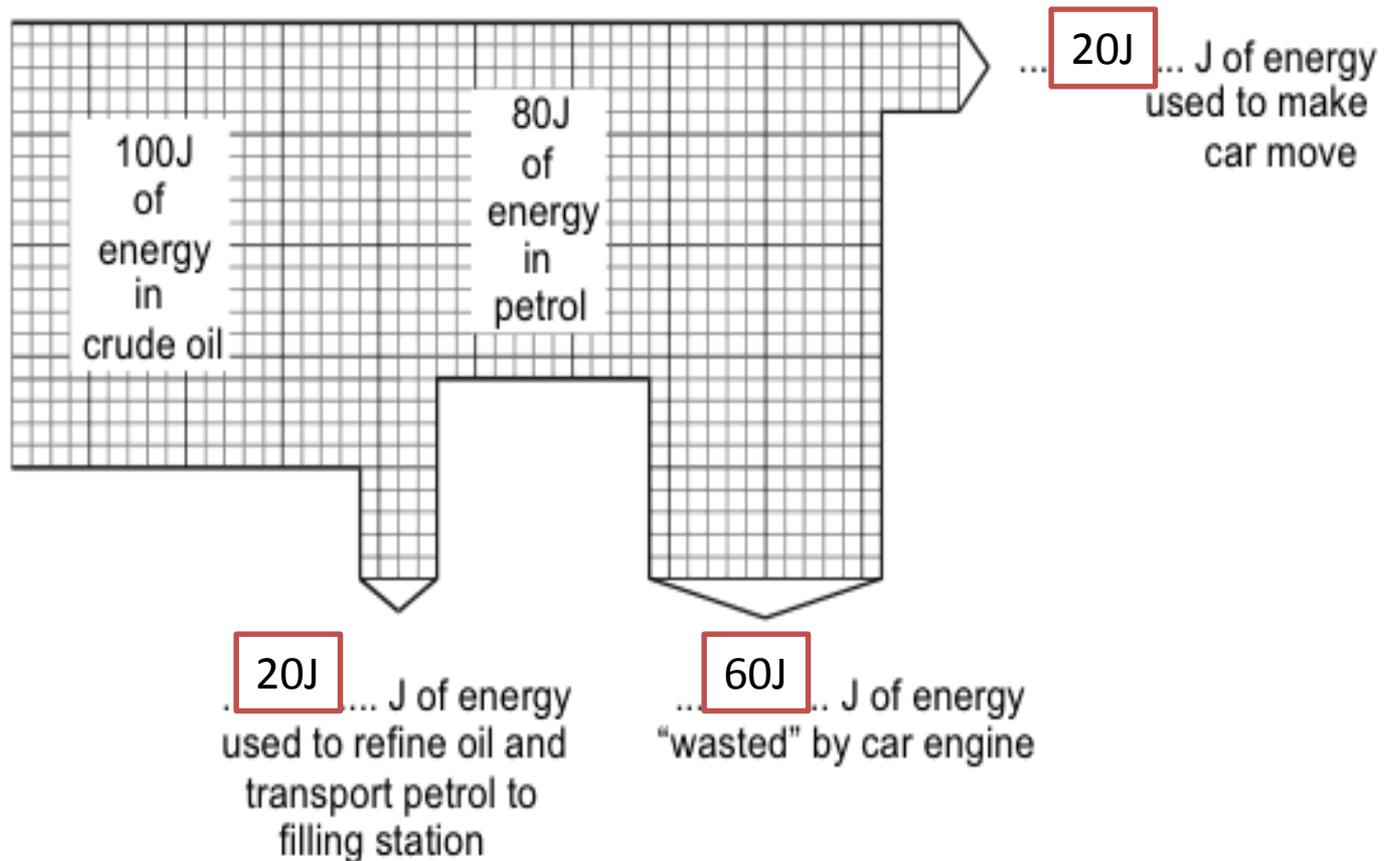
In an electric motor, the wasted energy is heat and sound. So if you add them up, it makes 22.

(i) **22 (J/s)**

wasted?

The diagram shows what happens to each 100 joules of energy from crude oil when it is used as petrol in a car.

The widths of the arrows show exactly how much energy is transferred in each particular way.



(a) Complete the diagram by adding the correct energy value alongside each arrow.

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

temperature increases **or** (cause) convection  
(currents)  
accept gets warmer  
accept gets hotter

(1)

(iii) Use the following equation to calculate the efficiency of the television set.

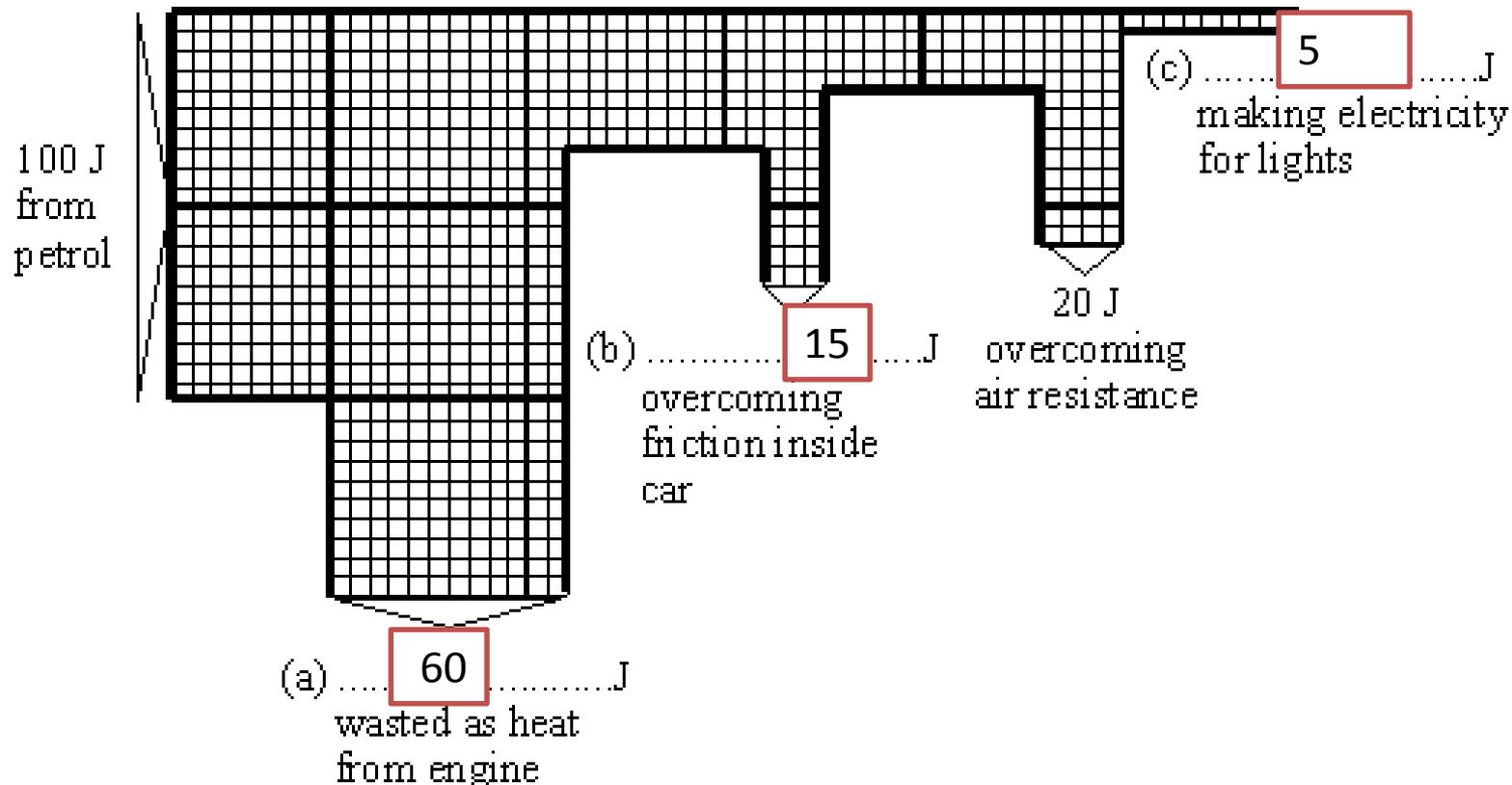
$$\text{efficiency} = \frac{\text{useful energy transferred by device}}{\text{total energy supplied to device}}$$

$$\text{Efficiency} = \begin{array}{l} \text{(ii)} \quad 1 \\ \text{(iii)} \quad 60\% \text{ or } 0.6 \end{array}$$

(2)

A car burns petrol as it travels along a flat road.

The diagram shows what happens to each 100 joules (J) of energy released by burning the petrol.



Complete the diagram by adding the missing numbers.

(c) The table gives information about three types of house insulation.

Type of insulation	Cost to install	Money save each year on heating bills	Payback time
Double glazing	£4000	£200	20 years
Loft insulation	£300	£100	3 years
Cavity wall insulation	£600	£150	

(i) Use the information in the table to calculate the payback time for cavity wall insulation.

$$600/150 = 4$$

4 years

(1)

An energy minister said that people could do more to conserve energy.

He advised home owners to fit insulating jackets to their hot water tanks.

- (a) A home owner paid £10 to fit a hot water tank jacket. By doing this, he saved £15 a year on his fuel bill.

How many months would it take to pay back the cost of fitting a hot water tank jacket?

.....  
**(a)  $10 \div 15 = 2/3$  or  $0.67$**

**1**

**$12 \times 2/3$  or  $12 \times 0.67$**

**$= 8$  (months)**

..... months

(2)

(a) The table gives information about some ways of reducing the energy consumption in a house.

Method of reducing energy consumption	Installation cost (£)	Annual energy saving (£)
Fit a new hot water boiler	1800	200
Fit a solar water heater	2400	100
Fit underfloor heating	600	50
Fit thermostatic radiator valves	75	20

Which way of reducing energy consumption is the most cost-effective?

To obtain full marks you must show your calculations.

.....

.....

(a) four calculations correctly shown

$$200 \times 10 - 1800 = \text{£}200$$

$$100 \times 10 - 2400 = -\text{£}1400$$

$$50 \times 10 - 600 = -\text{£}100$$

$$20 \times 10 - 75 = 125$$

accept four final answers only **or** obvious rejection of solar water heater and underfloor heating, with other two calculations completed any 1 complete calculation correctly

shown **or** showing each saving  $\times 10$  of all four calculations = 1 mark answers in terms of percentage?

savings as a percentage of installation cost **may** score savings mark only

2

hot water boiler

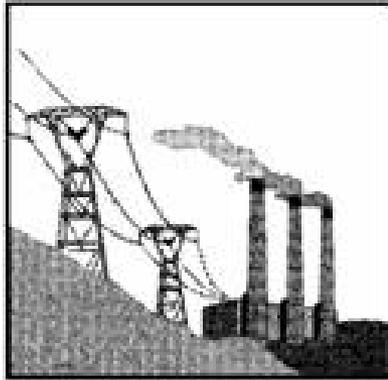
correct answers only

# Chapter 3: electrical energy

# Answer these questions first

1. Give examples of electrical appliances. 1. kettle, hair dryer, washing machine
2. What does power mean? 2. The rate at which an electrical appliance
3. How do you calculate power transfer? 3.  $\text{power} = \text{energy} / \text{time}$
4. How do you calculate the total cost? 4. Number of kWh  $\times$  cost per kWh
5. What does cost effectiveness mean? 5. Value for money
6. What does pay back time mean? 6. How many years it takes for an appliance
7. What are the units for power?
8. A thousand Watts is.... 8. 1 kilowatt! (kW)

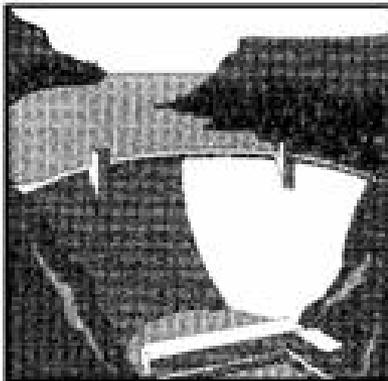
Coal-fired power station



Coal

Chemical  $\longrightarrow$  electrical

Hydroelectric power station



Stored  
water

gravitational or potential  $\longrightarrow$  electrical

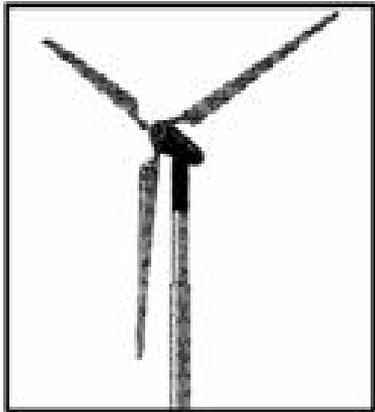
Solar cell in calculator



Sun

light  $\longrightarrow$  electrical

Wind turbine

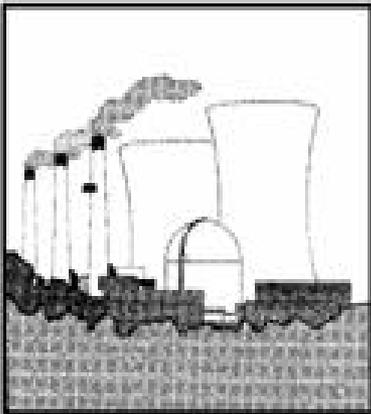


Wind

kinetic or movement

electrical

Gas-fired power station



Gas

chemical

→ electrical

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

(iii) **transferred to surroundings**

accept goes into the air

accept heats the surroundings up

accept gets spread out

(1)

(Total 7 marks)

(b) A microwave oven has a power rating of 850 W.

If the microwave oven is turned on for 6 minutes, how much energy will it use?

Show clearly how you work out your answer.

State the units in your answer.

**b) energy = power × time (we have reversed the equation)**

1

power = 0.85 kW, time = 0.1

1

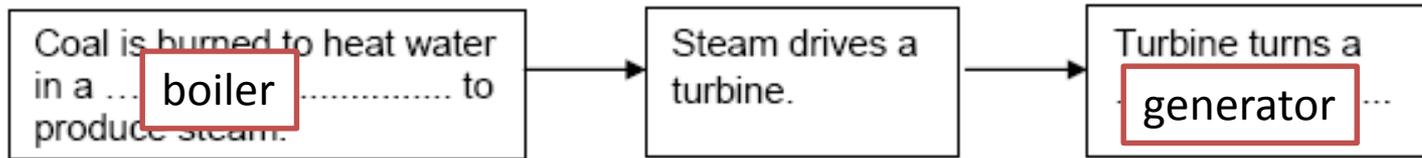
energy = **0.085 kWh**

# Chapter 4: generating electricity

# Answer these questions first

1. Is electricity a type of energy? 1. yes
2. Name the three fossil fuels 2. coal, oil and gas
3. What is a fossil fuel? 3. Dead animal or plant that has turned into fuel over millions of years
4. Which one has a quick start-up time? 4. gas
5. What is a power station? 5. Where electricity is generated from burning fuels like coal, oil, gas or nuclear power
6. What is the difference between a fossil fuel power station and a renewable energy power station? 6. Fossil fuel power stations involve burning fossil fuels (coal, oil or gas) to generate electricity. Renewable energy power stations use another source of energy like wind, tidal, hydroelectric, geothermal... to generate electricity.
7. Name some renewable energy sources 7. wind, tidal, hydroelectric, geothermal...
8. What is an energy source? 8. Where we generate energy from (like wind, solar, tidal, hydroelectric, geothermal, biomass, etc.) and the energy released from it.
9. What is geothermal energy? 9. Heat from the Earth that can be used to generate electricity.
10. What is the national grid? 10. A network of cables and pylons that connects power stations to our homes.
11. What is the job of a step-up transformer? 11. Increases the voltage of electricity so it can be transported (transmitted) to our homes.
12. What is the job of a step-down transformer? 12. Reduces the voltage so it is safe enough to go to our homes so we can use it- 230V
13. What does start-up time mean? 13. How long it takes to start generating electricity in power stations. Gas-fired power stations are the fastest and nuclear power stations are the longest.

(a) The block diagram shows the important parts of a coal burning power station.



Use words from the box to complete the block diagram

**boiler**      **condenser**      **furnace**      **generator**

(2)

Know this!

Some of the electricity that we use in our homes is generated from fossil fuels.

(a) Use words from the box to complete the sentences about electricity generation.

burnt	heat	turbine	generator	
light	sound	boiler	condensed	mined

When a fossil fuel such as coal is **burnt**, the  
**heat** energy released changes water in pipes into steam.

The steam turns a **turbine**, which drives  
a **generator**.

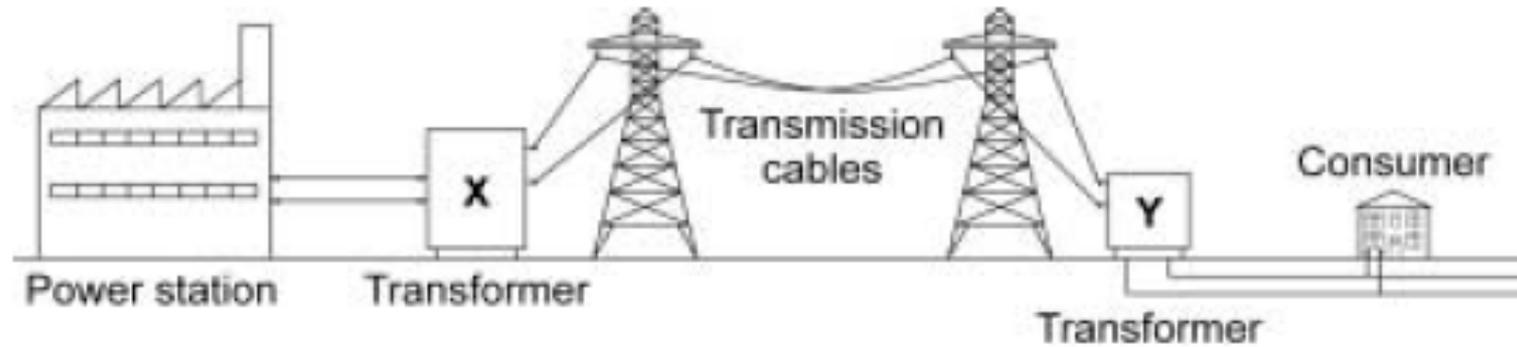
(4)

(b) Give **one** environmental problem that is linked with using fossil fuels for electricity generation.

(b) **acid rain or global warming**

(1)

The diagram shows the National Grid system.



Transformers X and Y are an essential part of the National Grid system. Explain why.

transformer X reduces the current through the transmission cables by INCREASING THE VOLTAGE. this reduces the energy loss from the cables so it is more efficient.

transformer Y is essential as it reduces the voltage to a safe working value for consumers, e.g. in homes.

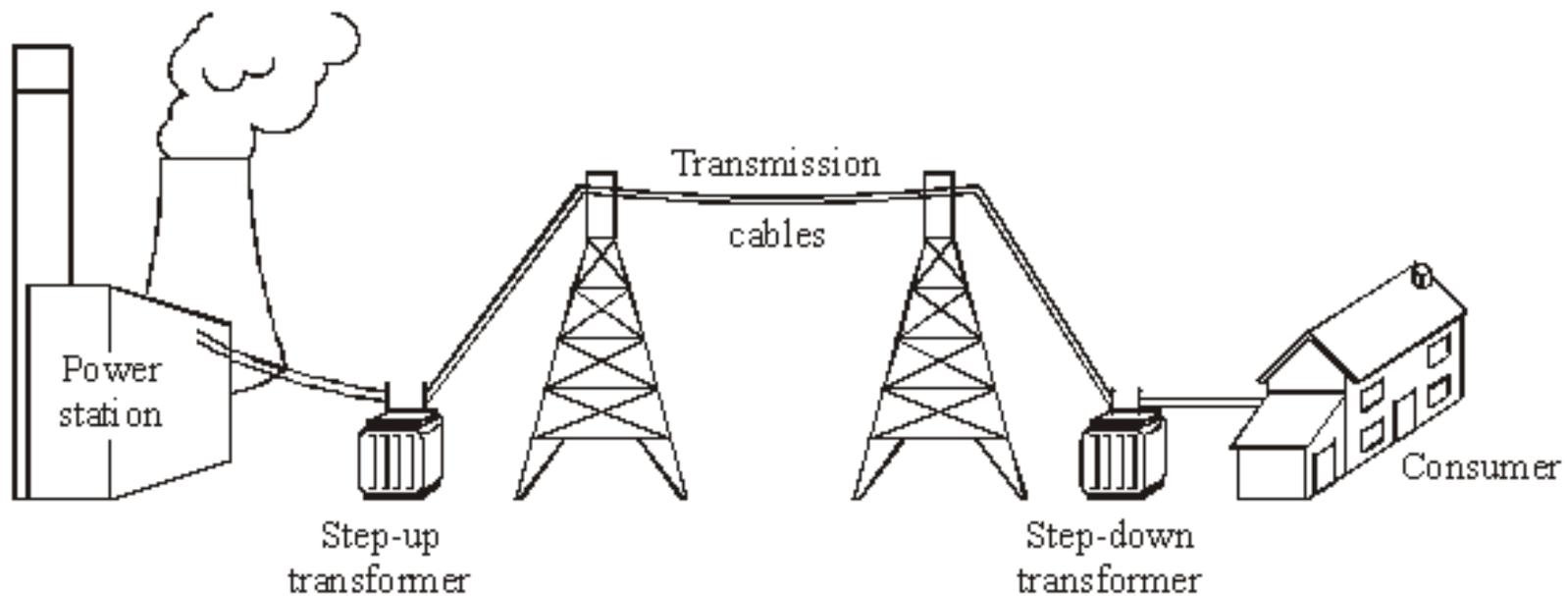
Describe, in as much detail as you can, how the energy stored in coal is transferred into electrical energy in a power station.

**THIS IS AN EXCELLENT ANSWER- REMEMBER THIS!!!**

coal has chemical energy  
when burnt heat/energy  
produced longest  
used to boil water/make  
steam sequence  
used to turn turbine(s)  
which now have ke  
turbine(s) turn generator(s)  
(where (ke) transferred electrical energy)  
(or electrical energy produced )  
any 5 for 1 mark each

(Total 5 marks)

The diagram shows how electricity gets from power stations to consumers.



(a) Complete the following sentences by drawing a ring around the correct line in each box.

(i) The network of cables and transformers linking power stations to consumers is

called the national

grid  
line  
network

grid

(ii)

A step-up transformer

decreases voltage  
increases current  
increases voltage ←

(1)

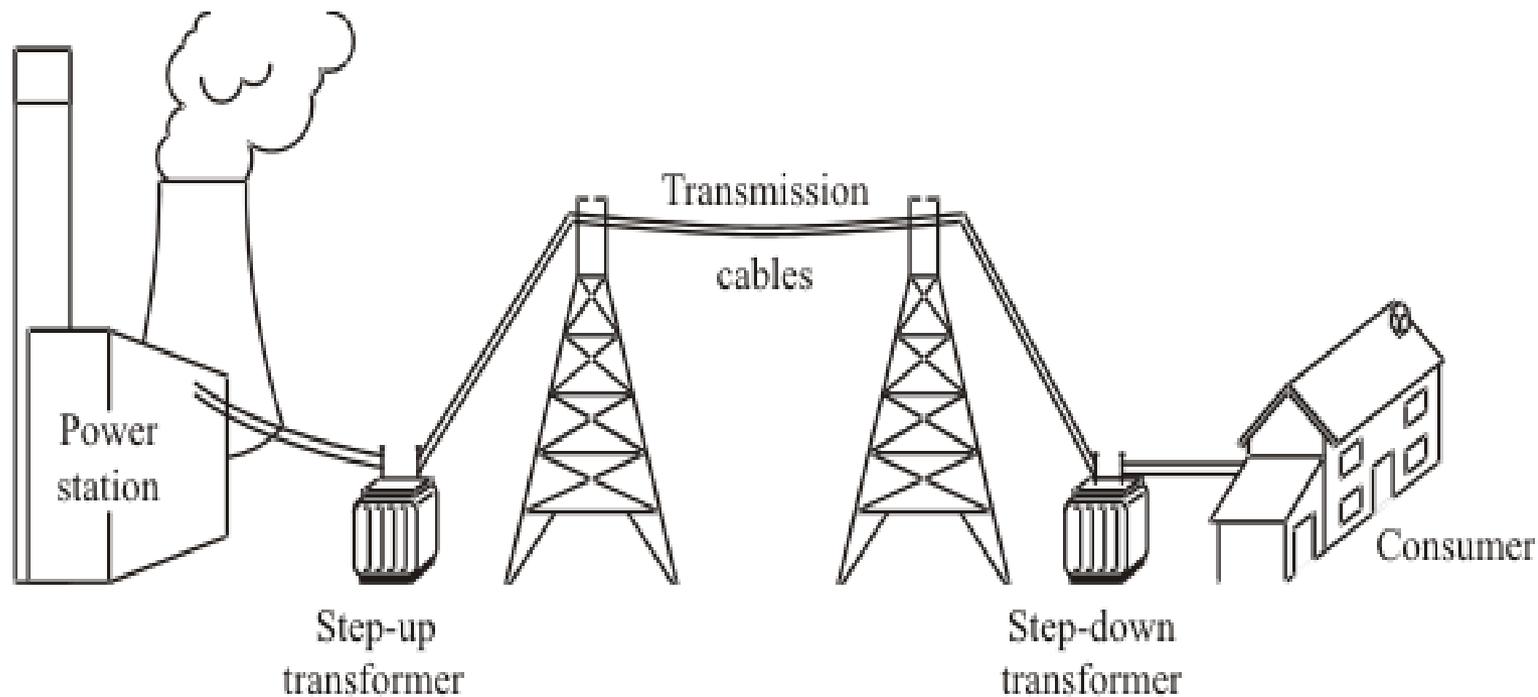
(iii)

Electricity is supplied to consumers' homes at

230 V ←  
25 000 V  
400 000 V

(1)

The diagram shows how electricity is distributed from power stations to consumers.



- (a) (i) What name is given to the network of cables and transformers that links power stations to consumers?

national grid

(1)

- (ii) What does a step-up transformer do?

increases voltage (that's enough to get you the mark) so decreases the current so it is

(iii) Explain why step-up transformers are used in the electricity distribution system.

any **two** from:

- reduces current so reduces energy loss (from cables) accept reduces heat loss
- increases efficiency (of distribution)

(2)

(b) Most of the world's electricity is generated in power stations that burn fossil fuels.

State **one** environment

(iii) 2

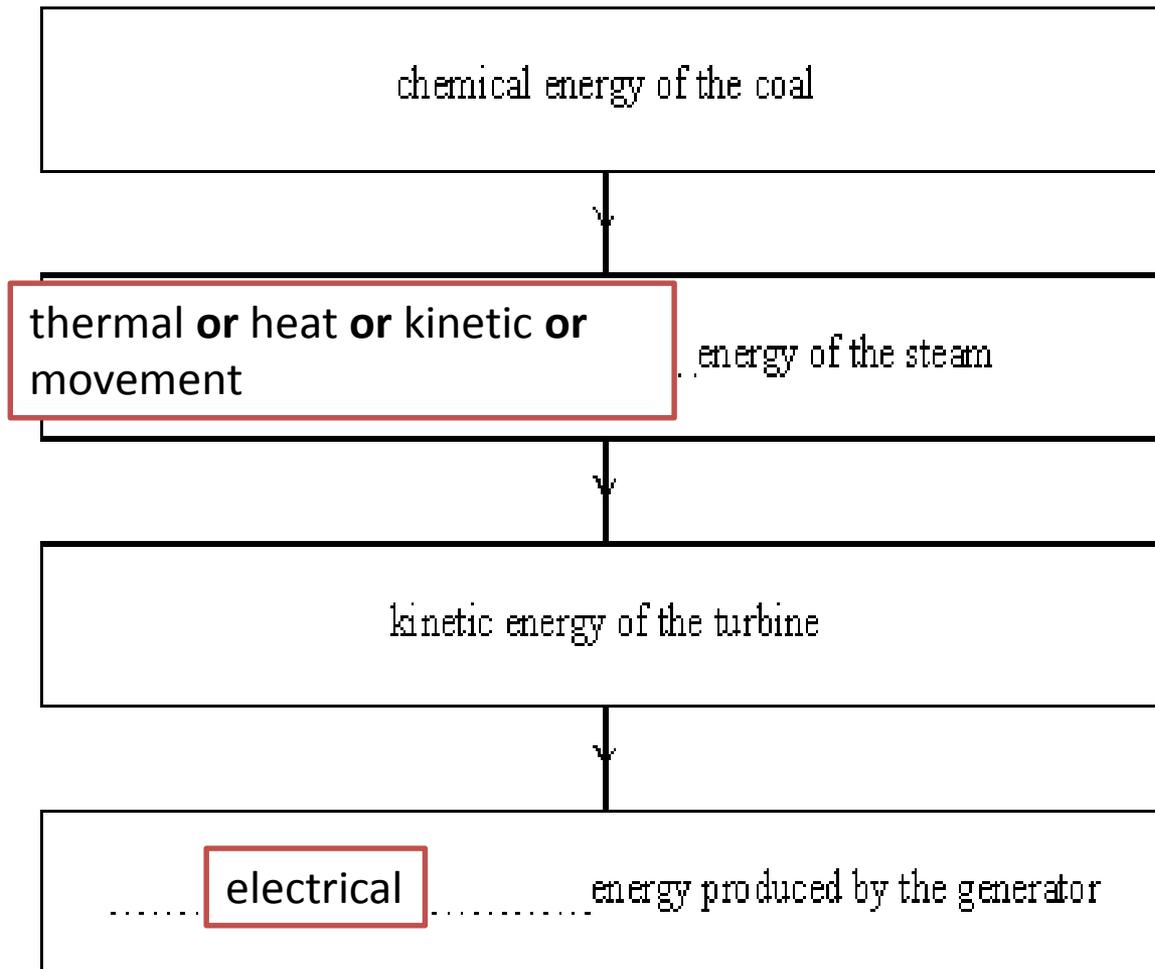
(b) any **one** from:

- produces pollutant gases  
accept produces carbon dioxide / sulfur dioxide / nitrogen oxides  
accept global warming / greenhouse effect / carbon emissions / air pollution / acid rain  
ignore ozone layer  
do **not** accept carbon monoxide
- produces solid waste / ash / smoke  
accept global dimming  
ignore produces pollution

(1)

(a) Most electricity in Britain is generated by coal fired power stations.

Complete the sequence of useful energy transfers which take place in the power station.



(a) (i) A student wrote "Coal traps energy from the Sun". Explain what the student means.

photosynthesis for growth  
accept plants require sunlight for growth  
1  
plants change into coal

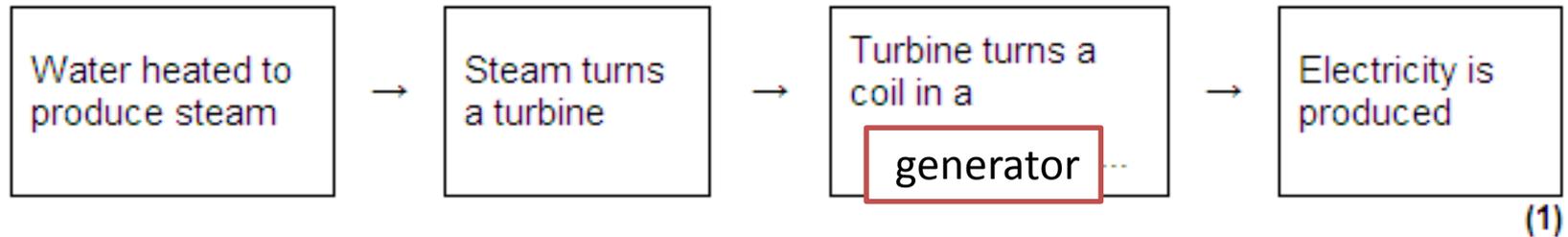
(2)

(ii) How is energy released from coal?

(ii) burning  
do **not** accept heating  
accept combustion

(1)

- (a) In Britain most power stations burn fuel to produce heat. The diagram shows the stages by which the heat is transferred into electrical energy. Complete the diagram by filling in the missing word.



- (b) A fuel burning power station uses 2000 joules of fuel energy to generate 600 joules of electrical energy. The rest of the fuel energy is wasted as heat.

- (i) For every 600 joules of electrical energy generated, how much fuel energy is wasted as heat?

.....  
.....

(b) (i) 1400

(1)

(a) Electricity is distributed from power stations to consumers along the National Grid.

(i) Transformers are part of the National Grid. Transformers are *efficient* devices. What is meant by a device being *efficient*?

(a) (i) small proportion of energy / power

is wasted

accept little / less energy / power / heat is

wasted

(1)

(ii) Why do **not** accept it wastes no energy / power

Exp **or** transfers most / more / a lot of energy

power usefully

1

formed into heat.

energy lost as heat.

(ii) it decreases the current / uses low

current

**or it** increases the voltage difference

accept pd for potential difference

1

**or** uses high voltage / potential difference

smaller the current the smaller the

energy loss

accept power / heat for energy

(2)

(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)

(1)

- (d) Some types of power station generate electricity by burning a biofuel.

Give **one** example of a biofuel.

any named biofuel eg wood, ethanol, straw

(1)

- (e) Nuclear power stations generate electricity without burning a fuel.

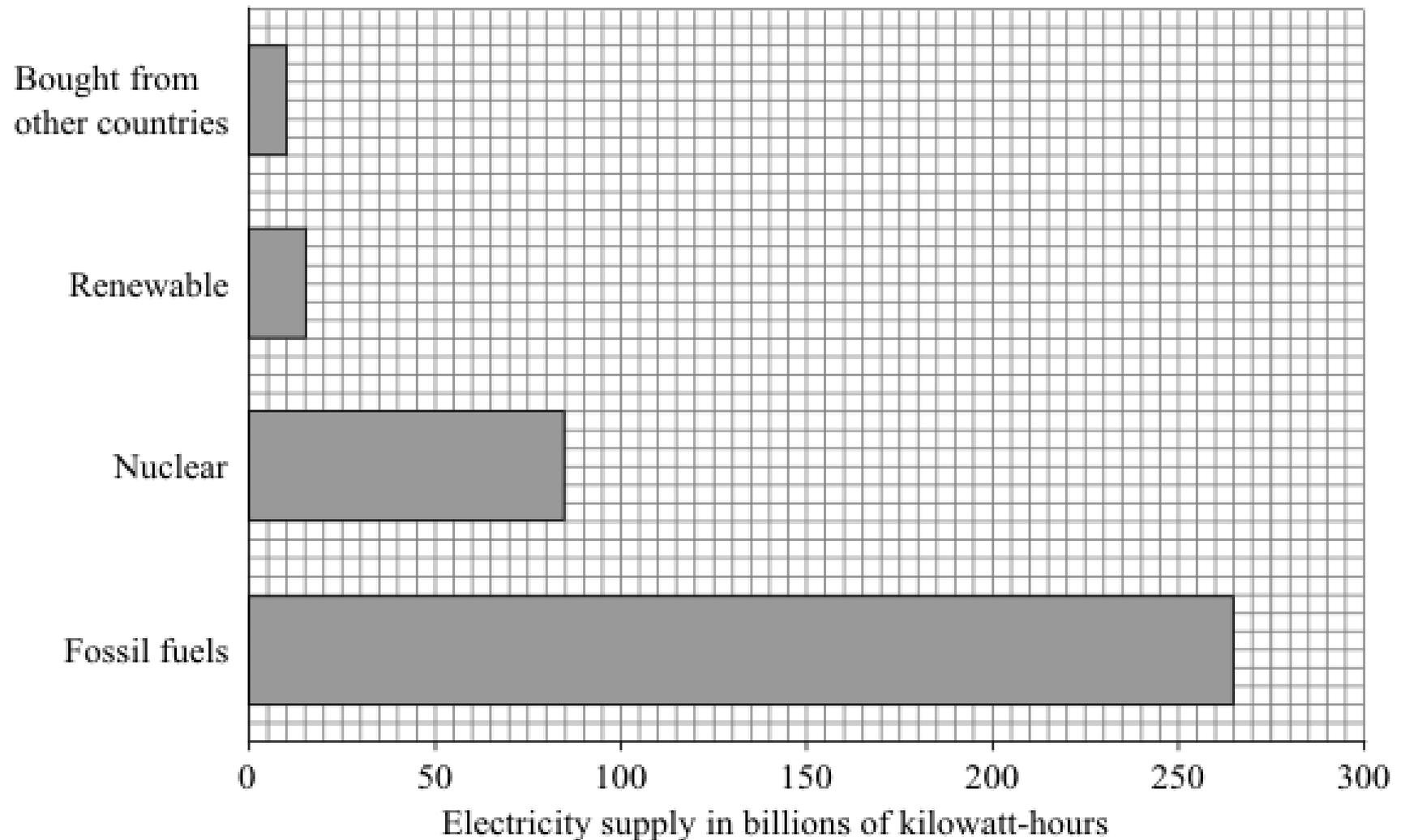
Name the process by which a nuclear fuel provides the energy needed to generate electricity.

(e) (nuclear) fission

(1)

(Total 7 marks)

The bar chart shows how the UK's electricity demands in 2007 were met.



(a) What proportion of electricity was generated using renewable energy sources?

(a)  $1/25$  or  $1:25$  or  $0.04$

State and explain the advantages and disadvantages of using nuclear power stations to produce electricity.

max. 3 advantages (e.g. cheap fuel, good availability, saving fossil fuels, low running costs, reliable, more energy / kg, less fuel needed, no greenhouse gases emitted, no SO<sub>2</sub> causing acid rain)

max. 3 disadvantages (e.g. danger to health of local community, non renewable, high cost of decommissioning, long half life of waste materials, need for safe storage of waste, high cost of commissioning, danger involved in transporting fuel / waste)

max. 4 marks

(Total 4 marks)

a) **Using wind (advantage)**

any **one** from

can be used in remote locations

renewable

clean

accept does not cause pollution to the air / land

**Using wind (disadvantage)**

any **one** from

does not generate much (electrical) energy

many hundreds wind turbines would be needed

accept many hundreds wind turbines would be needed **or** too much land would be needed for wind farms **or** wind energy is 'dilute'

the wind is unreliable

accept the wind does not blow all of the time **or** the wind is not always strong enough

noise / visual pollution

do **not** accept just the word pollution

**Using coal (advantage)**

any **one** from

can generate electricity all of the time

accept reliable electrical / energy supply

generates a lot of (electrical) energy

**Using coal (disadvantage)**

any **one** from

pollution by carbon dioxide / greenhouse gas

accept slow start-up time **or** production of ash **or** difficult to transport (coal) **or** there's not much

The table shows the main sources of energy used to generate electricity.

<b>Energy source</b>	<b>Percentage (%)</b>
coal	35
hydroelectric	5
natural gas	25
nuclear	20
oil	15

(a) Complete the table by writing in the percentage for nuclear power.

(1)

# Chapter 5:

waves

# Answer these questions first

1. What is a wave?

2. What is a transvers

3. What is a longitudinal

4. What are electromagn

5. What are mechanical

6. What does frequency

7. How do you calcul

8. What are the unit

9. What does reflect

10. What does refrac

11. What does diffrac

12. What is sound?

13. What is pitch?

2. The oscillations (the vibrations) of the particles are

3. The oscillations (vibrations) of the particles are parallel to the

4. A range of waves that all travel at the same speed through a

5. These types of waves travel through a medium (material). The

6. The number of waves PER SECOND.

7. Wave speed = frequency x wavelength

9. Reflection occurs when a wave bounces from the surface of an

obsta

None

wavel

after r

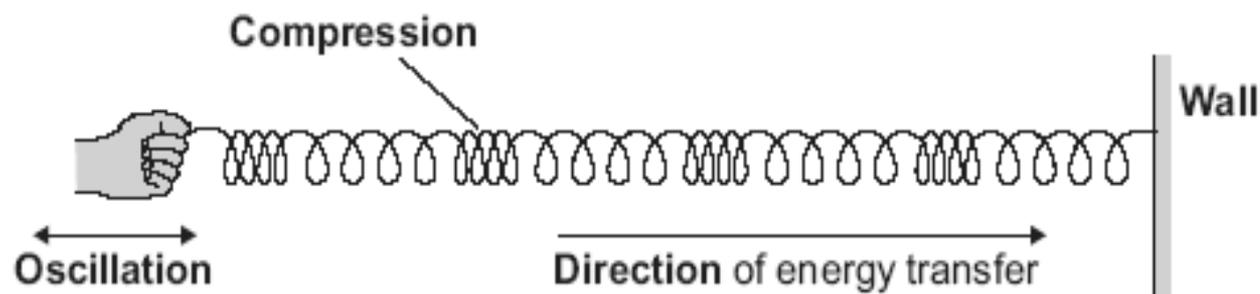
wave

13. The higher the frequency (number of waves per second) the higher the pitch of the sound. This is nothing to do with loudness. Loudness is increased by a greater amplitude.

after diffraction. Again, the only change is the direction in which the wave is travelling.

When a wave passes through a gap the diffraction effect is greatest when the width of the gap is about the same size as the wavelength of the wave.

- (a) The diagram shows a longitudinal wave being produced in a stretched spring.



- (i) Use the bold words from the diagram to complete the following sentence. Put only **one** word in each space.

A longitudinal wave is one in which the ..... **oscillation** ..... causing  
the wave is parallel to the ..... **direction** ..... of energy transfer.

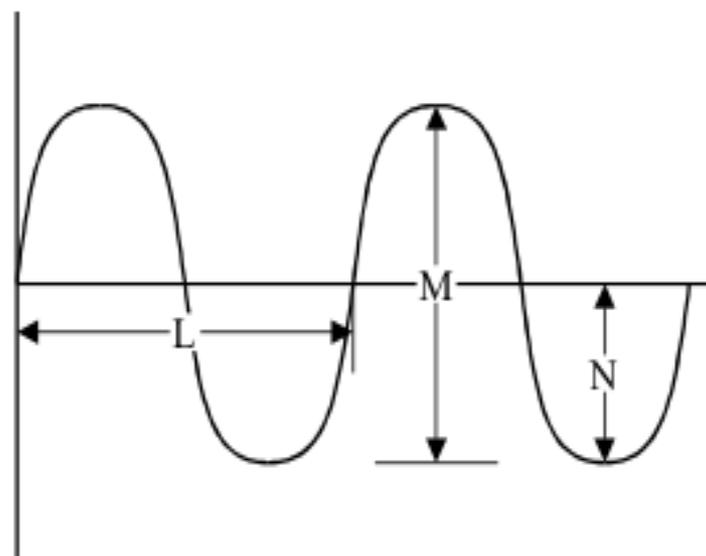
(2)

- (ii) Name the type of energy that is transferred by longitudinal waves.

(ii) sound

(1)

(a) The diagram shows a wave pattern.

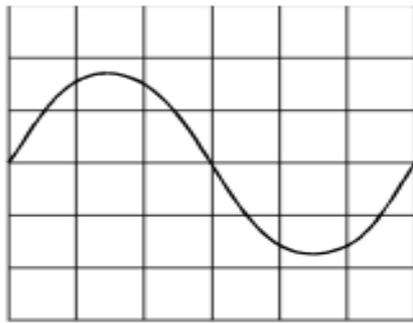


Which letter, **L**, **M** or **N** shows:

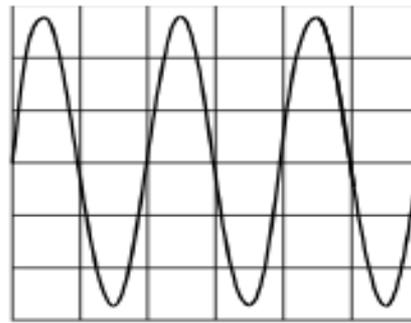
(i) the wavelength? ... **L** .....

(ii) the amplitude? ... **N** .....

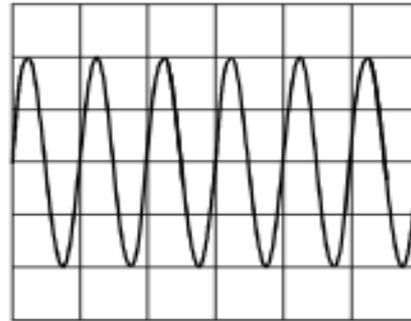
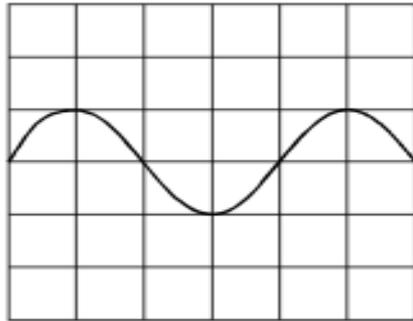
(2)



**A**



**B**



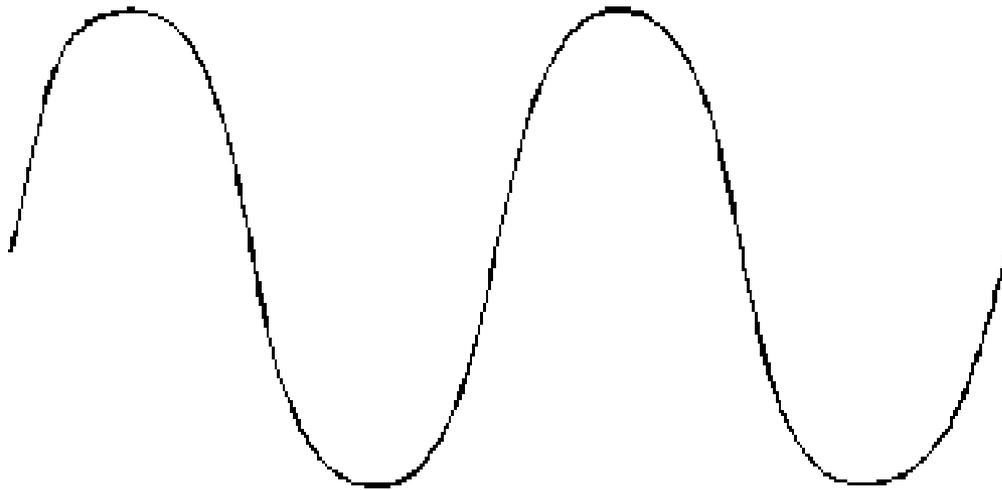
Which **one** of the waves traces, **A**, **B**, **C** or **D**, has:

(i) the largest amplitude, ..... **B** ..... (1)

(ii) the lowest frequency? ..... **A** ..... (1)

(Total 2 marks)

(a) On the wave drawn below, mark the amplitude and wavelength.



(2)

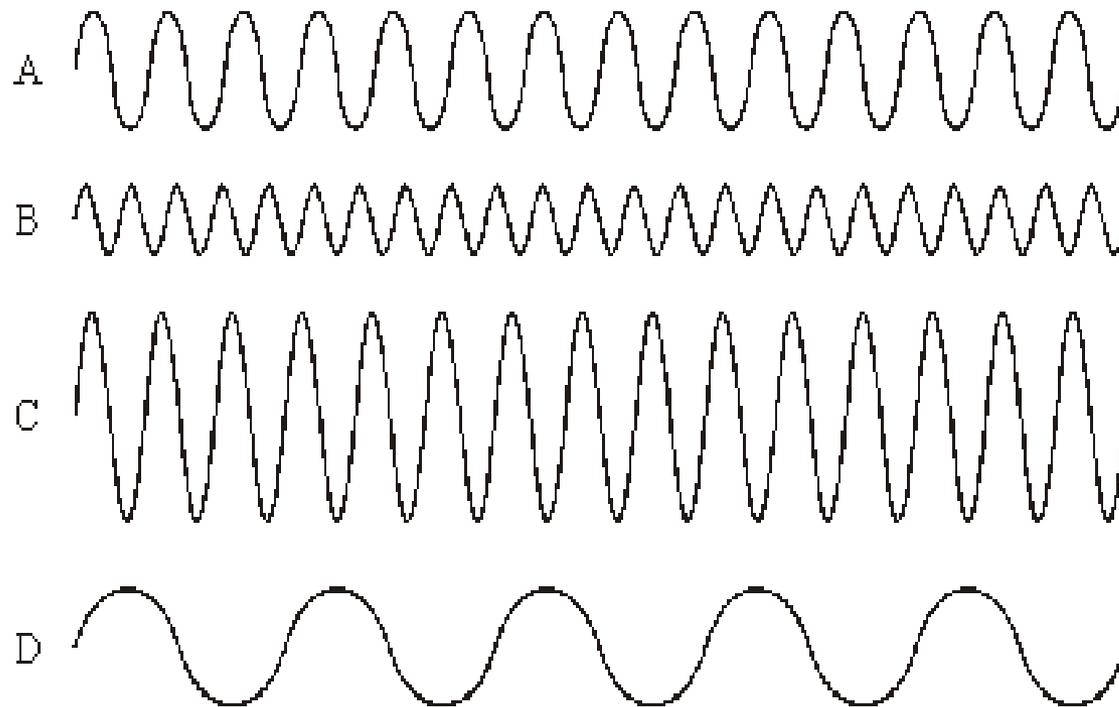
(b) A wave is said to have a frequency of 25 Hz.

Explain what the term *frequency* means.

the number of waves each second

(1)

The diagram shows oscilloscope traces of four waves, **A**, **B**, **C** and **D**. All four waves are drawn to the same scale.



Which wave has:

- (a) the longest wavelength; ... **D**
- (b) the greatest amplitude; ... **C**
- (c) the highest frequency? ... **B**

- (i) Use the words frequency, wavelength and wave speed to write an equation which shows the relationship between them.

..... (i) (wave) speed = frequency  $\times$  wavelength .....

(1)

- (ii) Calculate the speed of a sound wave with a frequency of 250 Hz and a wavelength of 1.3 m.

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

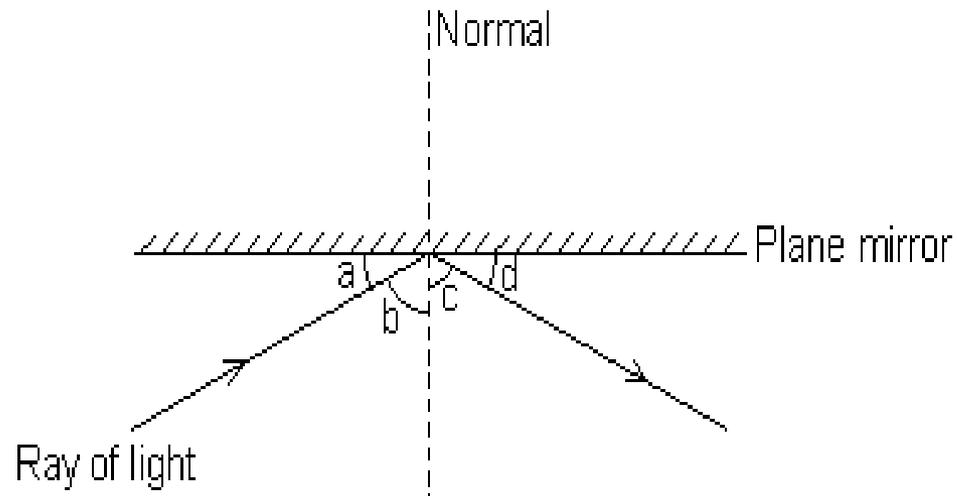
.....  
.....

Speed = ..... 325 .....

(2)

(Total 3 marks)

(a) The diagram shows a ray of light being reflected by a plane mirror.



Which of the angles, **a**, **b**, **c** or **d**, is:

the angle of incidence;

**b**

the angle of reflection?

**c**

(2)

The diagram shows a plane mirror used by a dentist to see the back of a patient's tooth.



- (a) Use a ruler to draw a ray of light on the diagram to show how the dentist is able to see the tooth labelled **Z**.

ray drawn from tooth to mirror to eye

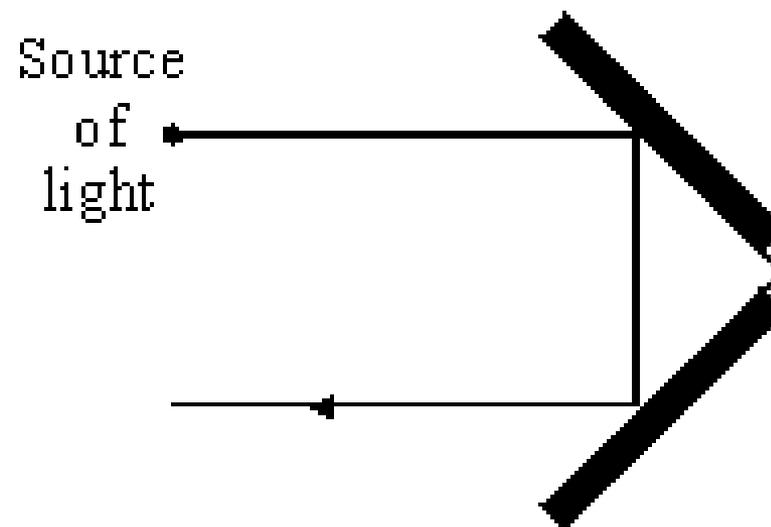
(3)

- (a) The diagram shows two mirrors at right angles to each other. A ray of light shines onto one mirror as shown.

Carefully draw the path of the ray which is reflected from both mirrors.

Draw an arrow on the ray to show the direction of the light.

- (a) first reflection vertically down to the fourth hatch line or just to the left of it reaching mirror (must come from incident ray given)



(3)

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



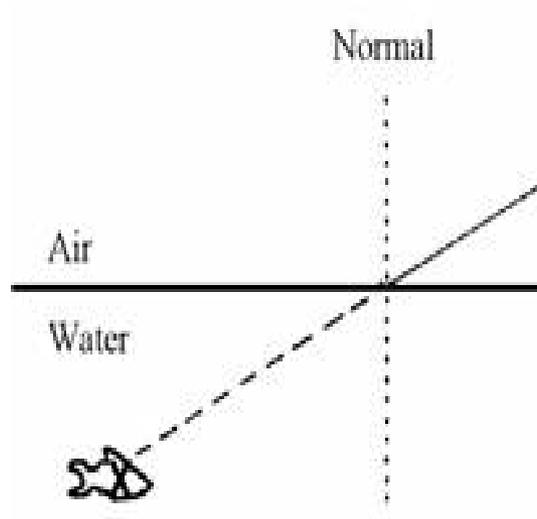
The CRO  
do?

oes the microphone

a) changes the sound wave(s)  
to a varying **or** changing (electric)  
potential difference **or** p.d. **or** voltage  
**or** current **or** to an irregular alternating current  
or a.c. **or** transfers  
sound energy to electrical energy (1) mark is  
vibrations **or** pulses **or** of  
sound **or** in air become electrical waves  
do not credit just 'to electricity' **or** 'to a.c'

A man is walking along the bank of a river.

He sees a fish which seems to be at X.



(a) line (from fish) to complete ray to eye  
*[mark awarded even if begins outside the box]*  
*[credit only if fish shown to left of normal]*

- fish within the region shown or X or start of ray  
*(i. e. not necessarily directly below x) each for 1 mark*

(b) bent/refracted/deviated/speeded up  
*for 1 mark*

(a) Show, on the diagram, where the ray of light goes from the fish to the man's eye.

Complete the ray of light which goes from the fish into the man's eye.

(2)

(b) Complete the sentence.

The ray of light is ..... as it passes from the water into the air.

(1)

# Chapter 6: electromagnetic waves

# Answer these questions first

1. What is an electromagnetic wave?
2. Which electromagnetic wave has the longest wavelength?
3. Which electromagnetic wave has the highest frequency?
4. What speed do all electromagnetic waves travel at?
5. Which electromagnetic wave can we feel?
6. Which electromagnetic wave can we see?
7. Which electromagnetic waves can be used for communication?
8. Which electromagnetic waves can be transmitted through optical fibres?
9. Why do scientists think that the universe is expanding?
10. What is the Doppler effect?
11. What is the Big Bang theory?
12. What is Cosmic microwave background radiation?

1. Electric and magnetic disturbances

2. Radio waves

3. Gamma waves

4. 300million m/s they all travel at the same speed

5. Infrared

7. Radio and microwaves- because they have been divided into different BANDS-

8. Visible light or infrared radiation

10. A change in the frequency of waves (e.g. Light or sound waves)

12. As the universe is expanding, so must the wavelength of the waves. so scientists predicted that these must be around the microwave length. And when they tested to see if this was true, they did in fact find microwaves coming from every direction in space called- COSMIC

Radio waves, ultra-violet, visible light and X-rays are all types of electromagnetic radiation.

(a) Choose wavelengths from the list below to complete the table.

$3 \times 10^{-8} \text{ m}$     $1 \times 10^{-11} \text{ m}$     $5 \times 10^{-7} \text{ m}$     $1500 \text{ m}$

TYPE OF RADIATION	WAVELENGTH (m)
Radio waves	radio – 1500
Ultra-violet	ultra violet $3 \times 10^{-8}$
Visible light	visible – $5 \times 10^{-7}$
X-rays	X-rays – $1 \times 10^{-11}$

(4)

Scientists have observed that the wavelengths of the light given out from galaxies that are moving away from the Earth are longer than expected.

(a) (i) What name is given to this observation?

Red-shift

(1)

(ii) Draw a ring around the correct answer to complete the following sentence.

This observation gives evidence for the idea that the Universe is

shrinking.

not changing.

expanding. ←

(1)

- (a) Explain how the spectrum 'shift' of the dark line supports the theory that the Universe began from a very small initial point.

the observed wavelength of the dark line from the distant galaxy has increased  
1  
therefore the distant galaxy must be moving away from the Earth  
1  
suggesting the Universe is expanding outwards from a small initial point

(3)

- (b) Name **one** other piece of evidence that supports the theory that the Universe began from a very small initial point.

existence of cosmic microwave background radiation  
accept existence of CMBR

(b) The light from distant galaxies shows a *red-shift*.

(i) What is *red-shift*?

wavelength (of light) increases  
accept answers in terms of frequency decrease  
accept wavelength stretched but **not** wave stretched

**or** wavelength / light moves to red end of spectrum

(1)

(ii) Why does red-shift provide evidence against 'steady state' theory?

do **not** accept galaxy moves to the red end of the spectrum

do **not** accept light becomes red / redder

red-shift is evidence / supports idea of expanding universe

accept prove for support

1

both theories use the idea / accept / explain why the universe is expanding

(2)

We use many different types of electromagnetic waves in our homes.

(a) Which type of electromagnetic wave is used in:

(i) TV remote controls .....  .....

(1)

(ii) Fibre optic cables ..

(1)

(a) Microwaves are one type of electromagnetic wave.

(i) Which type of electromagnetic wave has a lower frequency than microwaves?

..... radio(waves) .....

(1)

(ii) What do all types of electromagnetic wave transfer from one place to another?

..... energy .....

(1)

Radiographers work in hospitals to produce images using X-rays.

These images help doctors to diagnose what is wrong with a patient.

(a) Which **two** statements about X-rays are correct?

Tick (✓) **two** boxes.

X-rays pass through dense material.

X-rays are used to diagnose broken bones.

X-rays are stopped by dense material.

X-rays can be used to view soft tissues.

- (a) A student listens to the sound waves produced by a car siren. When the car is stationary, the student hears a constant frequency sound.

Describe how the wavelength and frequency of the sound waves heard by the student change when the car is driven away from the student.

(a) wavelength increases  
accept the crests are further apart  
ignore waves are further apart  
1  
frequency decreases  
accept pitch decreases  
ignore references to amplitude  
1

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

(2)

- (b) Satellites fitted with various telescopes orbit the Earth. These telescopes detect different types of electromagnetic radiation.

Why are telescopes that detect different types of electromagnetic waves used to observe the Universe?

.....  
.....

(b) stars / galaxies / sources emit all /  
different types of electromagnetic waves /  
radiation  
accept two or more named electromagnetic  
waves  
accept answers in terms of frequencies /  
wavelengths

.....  
.....

(1)

(a) The new Tetra communications system to be used by the police transmits *digital signals* using microwaves of wavelength 75 cm.

(i) Use the following equation to calculate the frequency of the microwaves used by the Tetra system. Show clearly how you work out your answer.

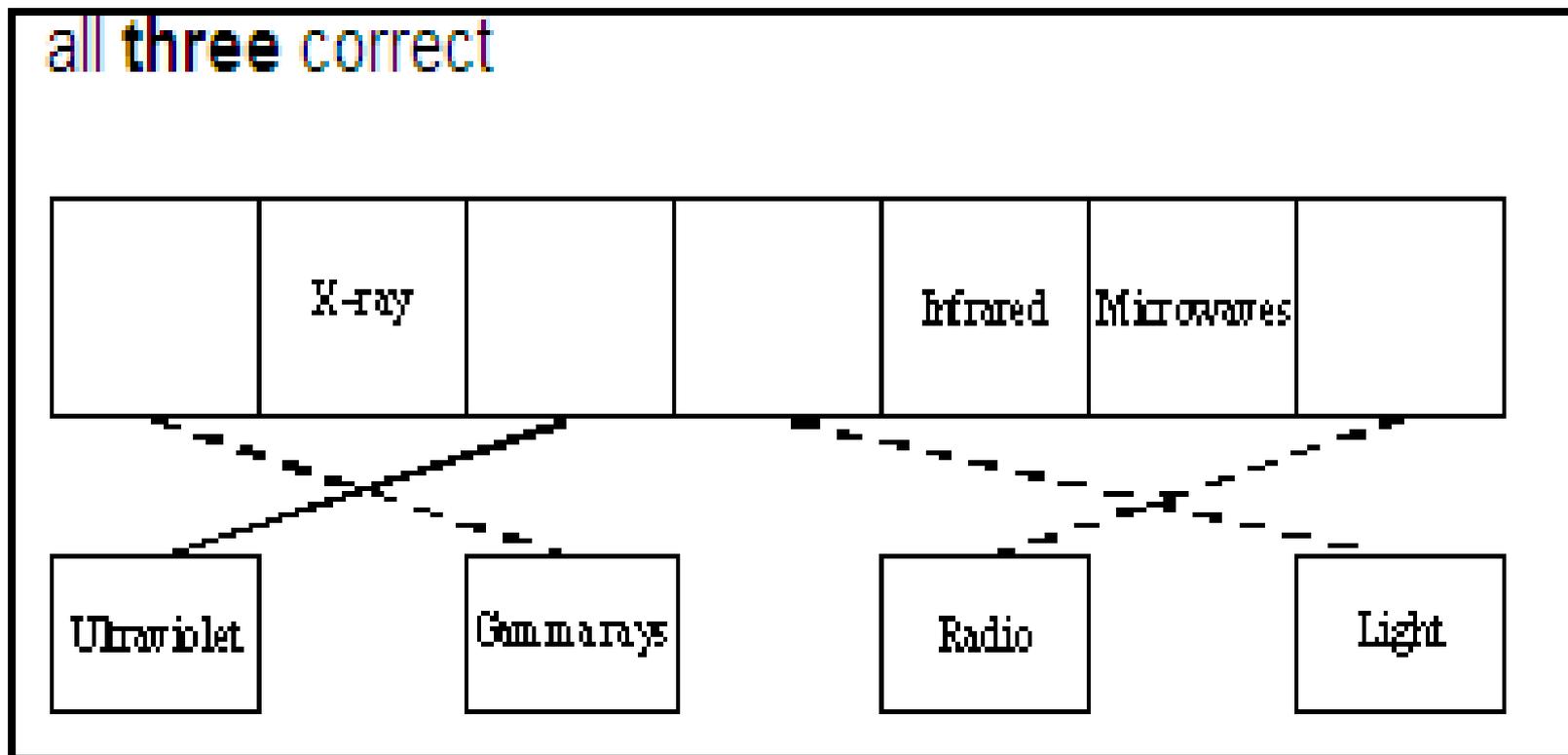
$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

(i) 400 000 000

Frequency = ..... hertz

(2)

- (a) The diagram represents the electromagnetic spectrum. Four of the waves have not been named. Draw lines to join each of the waves to its correct position in the electromagnetic spectrum. One has been done for you.



A student listens to the sound waves produced by a car siren. When the car is stationary, the student hears a constant frequency sound.

- (a) When the car drives away from the student the sound she hears changes.

What name is given to this effect?

Doppler effect

(1)

- (b) Describe how the wavelength and frequency of the sound waves heard by the student change.

(b) the wavelength increases

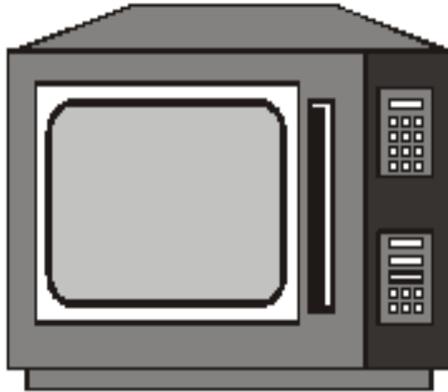
1

the frequency decreases

(2)

(Total 3 marks)

Microwave ovens can be used to heat many types of food.



(i) Describe, in

(i) absorbed by water / water heated

1

hot water heats (rest of) food / idea of  
particle vibration

(2)

(ii) Microwaves have a frequency of 10 000 million Hz. Their wavelength is 0.03 m.

Calculate the speed of microwaves.

(ii)  $300\,000\,000 / 3 \times 10^8$



(ii) Which **one** of the following gives a use of gamma rays?

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

to communicate with satellites

to see objects

to kill cancer cells

(1)

(iii) Complete the following sentence by drawing a ring around the correct word in the box.

All electromagnetic waves move

energy

gases

particles

from one place to another.

- (a) The wavelengths of four different types of electromagnetic wave, including visible light waves, are given in the table.

Type of wave	Wavelength
Visible light	0.0005 mm
A	1.1 km
B	100 mm
C	0.18 mm

Which of the waves, **A**, **B** or **C**, is an infra red wave? ..... C or 0.18 mm

(1)