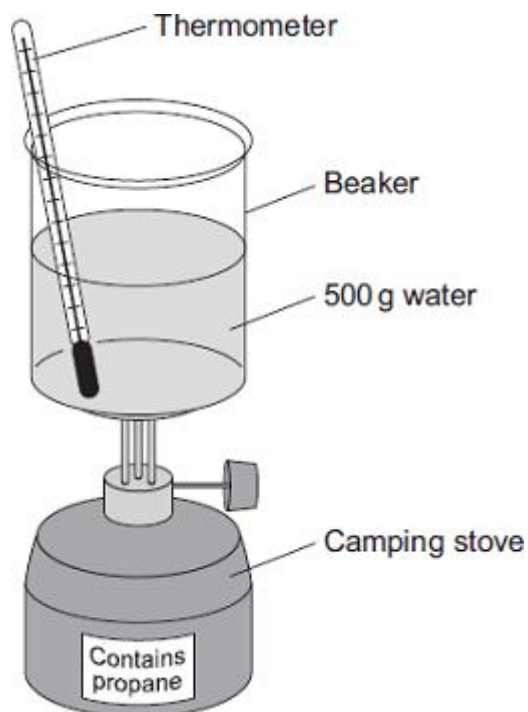


Chemistry of the atmosphere part 2

Q1.

A camping stove uses propane gas.



- (a) A student did an experiment to find the energy released when propane is burned.

The student:

- put 500 g water into a beaker
- measured the temperature of the water
- heated the water by burning propane for 1 minute
- measured the temperature of the water again.

The student found the temperature change was 20 °C.

The student can calculate the energy released, in joules (J), using the equation:

$$\text{energy released (J)} = \text{mass of water (g)} \times 4.2 \times \text{temperature change (}^\circ\text{C)}$$

- (i) Use the student's result to calculate the energy released in joules (J).

Energy released = _____ J

(2)

- (ii) State **two** safety precautions that the student should take during the experiment.

1. _____

2. _____

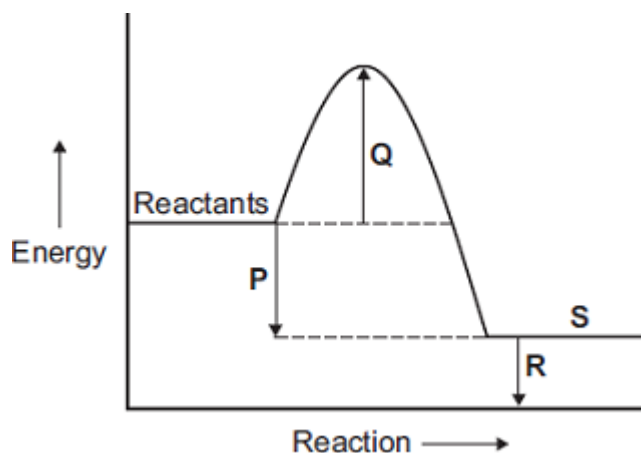
(2)

(iii) Tick (✓) **two** boxes which describe how the student could make his result more accurate.

	Tick (✓)
Stir the water before measuring the temperature.	
Heat the water until it boils.	
Place a lid on the beaker.	
Use a larger beaker for the water.	

(2)

(b) The change in energy when propane is burned can be shown in an energy level diagram.



Draw **one** line from each description to the correct letter.

Description

Letter

products

P

activation energy

Q

energy released by the reaction

R

- (c) Propane and hydrogen are both used as fuels.

Some information about propane and hydrogen is given in the table.

Fuel	Resource	Products formed when fuel burned
propane	crude oil	carbon dioxide and water
hydrogen	water	water

Use the information in the table to suggest **two** disadvantages that propane has as a fuel compared to hydrogen.

1. _____

2. _____

(2)

(Total 11 marks)

Q2.

A mixture of petrol and air is burned in a car engine.
Petrol is a mixture of alkanes. Air is a mixture of gases.

The tables give information about the composition of petrol and the composition of air.

Petrol		Air	
Alkane	Formula	Gas	Percentage (%)
hexane	C_6H_{14}	nitrogen	78
heptane		oxygen	21
octane	C_8H_{18}	carbon dioxide	0.035
nonane	C_9H_{20}	Small amounts of other gases and water vapour	
decane	$C_{10}H_{22}$		

- (a) Use the information above to answer these questions.

- (i) Give the formula for heptane

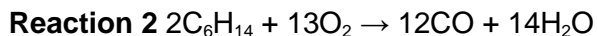
(1)

- (ii) Complete the general formula of alkanes.
n = number of carbon atoms

C_nH

(1)

- (b) Alkanes in petrol burn in air.
The equations represent two reactions of hexane burning in air.



Reaction 2 produces a different carbon compound to **Reaction 1**.

- (i) Name the carbon compound produced in **Reaction 2**.

(1)

- (ii) Give a reason why the carbon compounds produced are different.

(1)

- (c) The table shows the percentages of some gases in the exhaust from a petrol engine.

Name of gas	Percentage (%)
nitrogen	68
carbon dioxide	15
carbon monoxide	1.0
oxygen	0.75
nitrogen oxides	0.24
hydrocarbons	0.005
sulfur dioxide	0.005
other gases	

- (i) What is the percentage of the other gases in the table?

(1)

- (ii) What is the name of the compound that makes up most of the other gases?

(1)

- (iii) Give a reason why sulfur dioxide is produced in a petrol engine.

(1)

(iv) State how nitrogen oxides are produced in a petrol engine.

(2)

(d) Many scientists are concerned about the carbon dioxide released from burning fossil fuels such as petrol.

Explain why.

(2)

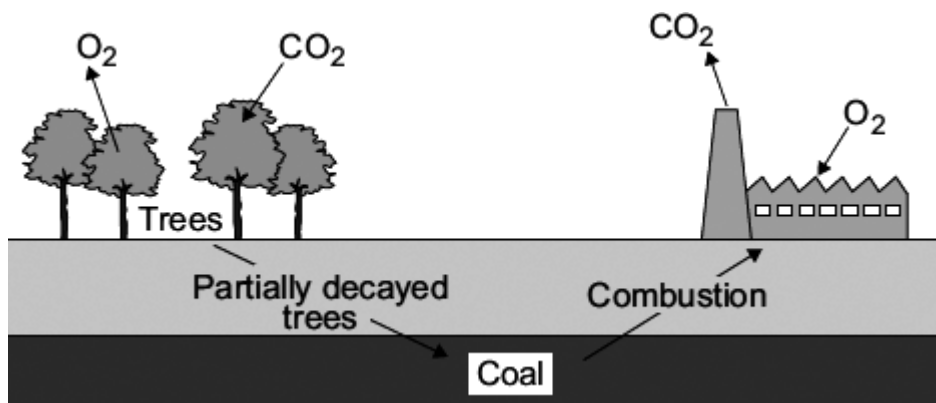
(Total 11 marks)

Q3.

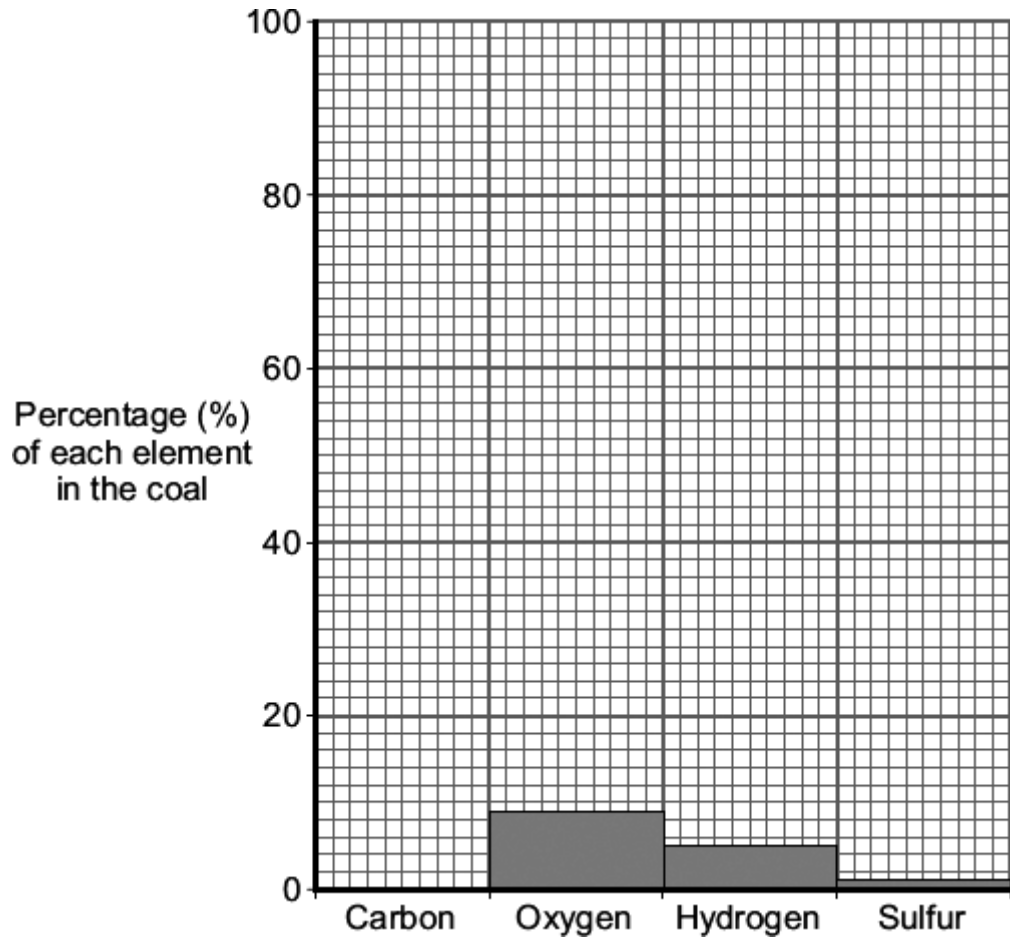
About 3000 million years ago carbon dioxide was one of the main gases in the Earth's early atmosphere.

About 400 million years ago plants and trees grew on most of the land. When the plants and trees died they were covered by sand and slowly decayed to form coal.

Today coal is burned in power stations to release the energy needed by industry.



(a) The bar chart shows the percentage of some of the elements in this coal.

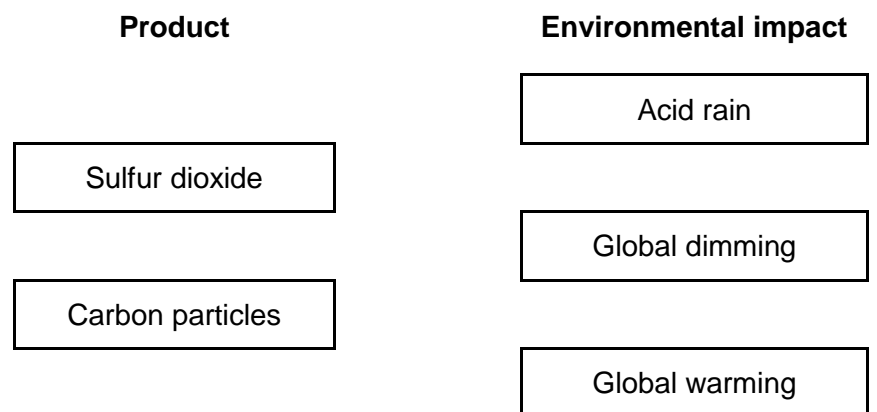


(i) This coal contains 85 % carbon. Draw the bar for carbon on the chart.

(1)

(ii) Coal is burned in the atmosphere to release energy. Two of the products of burning coal are shown.

Draw **one** line from each product to its environmental impact.



(2)

(b) Use the information above and your knowledge and understanding to answer these questions.

(i) How did the formation of coal decrease the amount of carbon dioxide in the Earth's early atmosphere?

(1)

- (ii) How does burning coal affect the amount of carbon dioxide in the Earth's atmosphere?
Explain your answer.

(2)

(Total 6 marks)

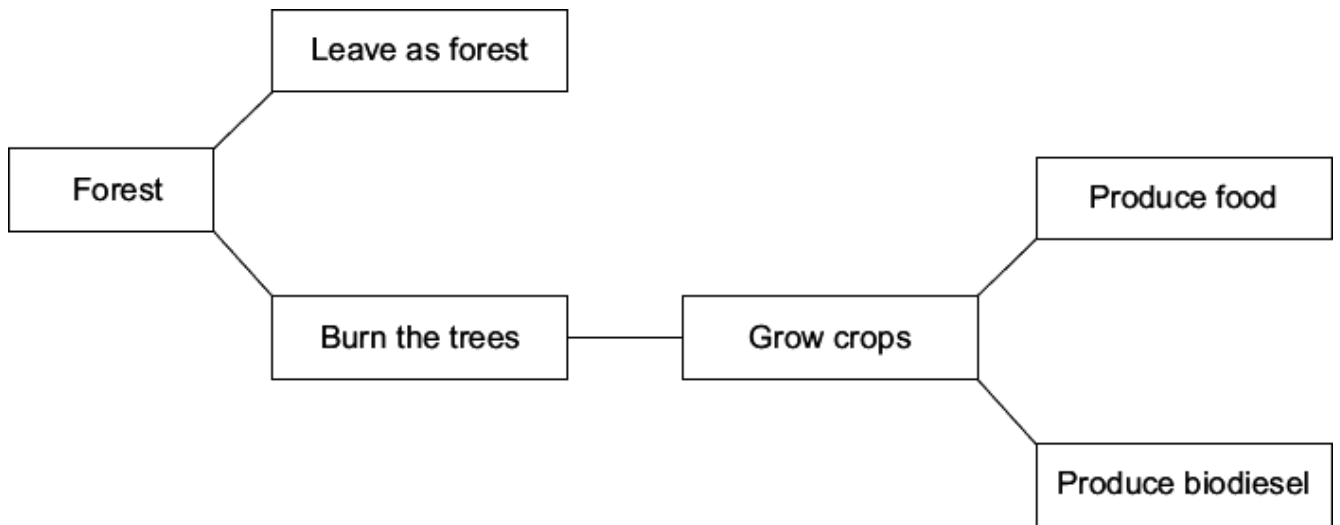
Q4.

Petroleum diesel is a fuel made from crude oil.

Biodiesel is a fuel made from vegetable oils.

To make biodiesel, large areas of land are needed to grow crops from which the vegetable oils are extracted.

Large areas of forest are cleared by burning the trees to provide more land for growing these crops.



- (a) Use this information and your knowledge and understanding to answer these questions.

- (i) Carbon neutral means that there is no increase in the amount of carbon dioxide in the atmosphere.

Suggest why adverts claim that using biodiesel is carbon neutral.

(2)

- (ii) Explain why clearing large areas of forest has an environmental impact on the atmosphere.

(2)

- (b) Why is there an increasing demand for biodiesel?

(1)

- (c) Suggest why producing biodiesel from crops:

- (i) causes ethical concerns

(1)

- (ii) causes economic concerns.

(1)

(Total 7 marks)

Q5.

About 3000 million years ago, carbon dioxide was one of the main gases in the Earth's atmosphere.

About 400 million years ago, plants and trees grew on most of the land. When the plants and trees died they were covered by sand and slowly decayed to form coal.

- (a) Describe and explain how the composition of the Earth's atmosphere was changed by the formation of coal.

(3)

- (b) Today, coal is burned in power stations to release the energy needed by industry. Carbon dioxide, water and sulfur dioxide are produced when this coal is burned.

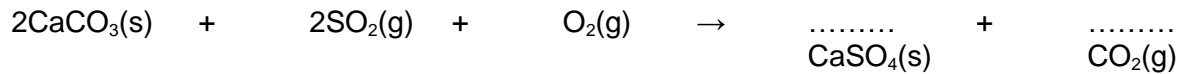
Name **three** elements that are in this coal.

(2)

- (c) In some power stations coal is mixed with calcium carbonate (limestone). The mixture is crushed before it is burned.

- (i) Many chemical reactions happen when this mixture is burned. The chemical equation represents one of these reactions.

Balance the chemical equation.



(1)

- (ii) Explain how the use of calcium carbonate in the mixture:

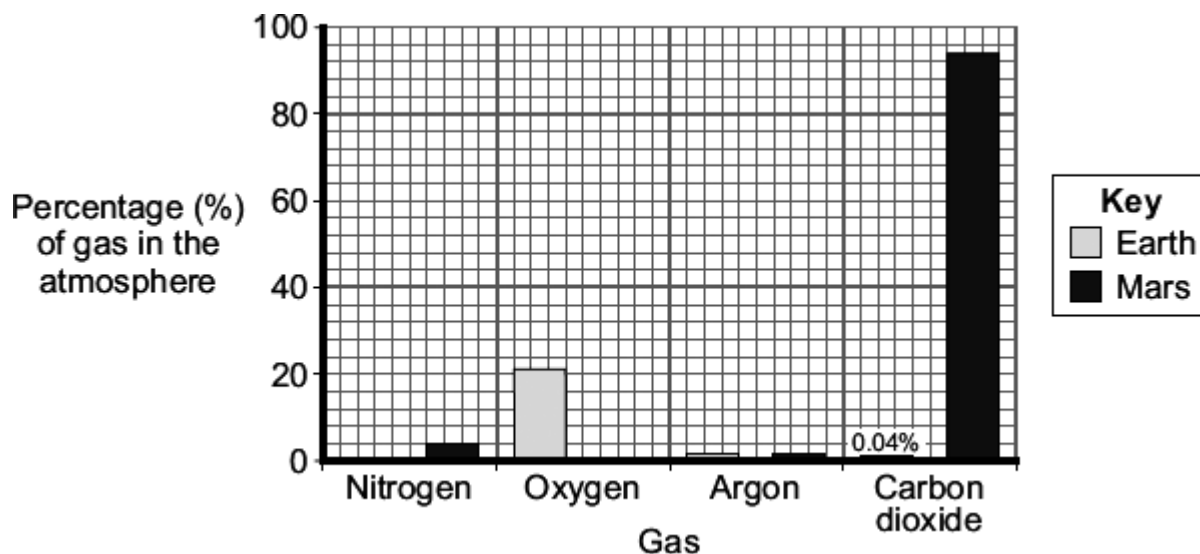
increases atmospheric pollution

decreases atmospheric pollution.

(4)

Q6.

The bar chart shows some of the gases in the atmospheres of Earth today and Mars today.



(a) Complete the bar chart to show the percentage of nitrogen in the Earth's atmosphere today.

(1)

(b) Some scientists suggest that the Earth's early atmosphere was like the atmosphere of Mars today.

(i) There is **not** much oxygen in the atmosphere of Mars.

Suggest why.

(1)

(ii) The percentage of argon in the Earth's atmosphere today is the same as it was in the Earth's early atmosphere.

Suggest why.

(1)

(c) Compared with the percentage of carbon dioxide in the Earth's early atmosphere there is **not** much carbon dioxide in the Earth's atmosphere today.

Give **one** reason for this change.

(1)

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

Some theories suggest that the Earth's early atmosphere was

made by

burning fossil fuels.
the formation of oceans.
the eruption of volcanoes.

(1)

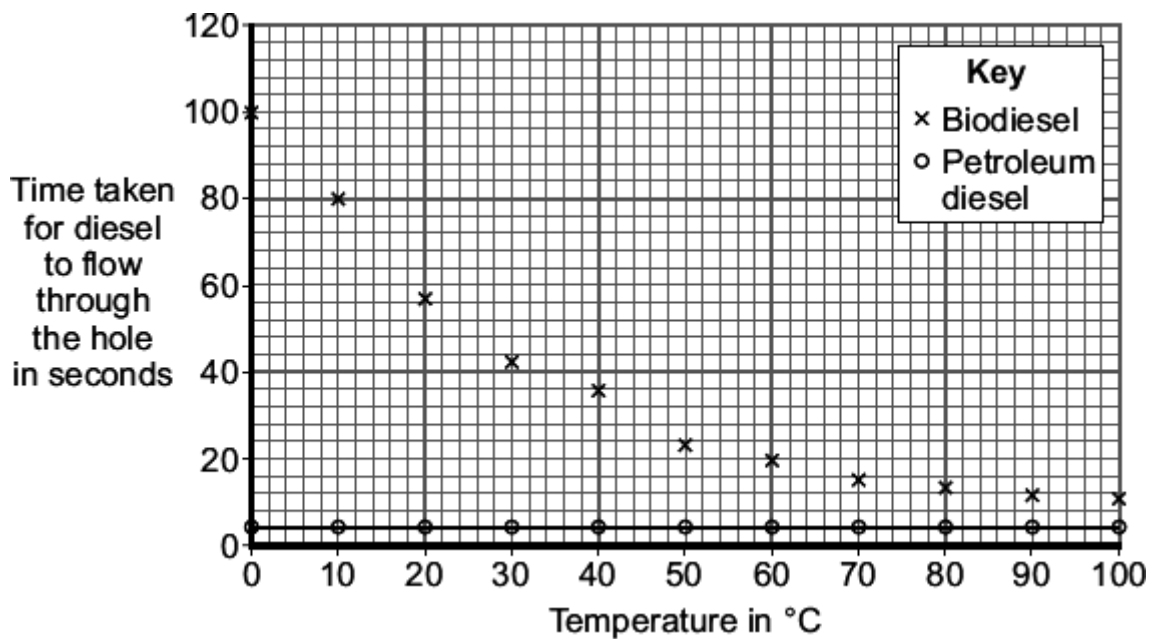
(Total 5 marks)

Q7.

There are two main types of diesel fuel used for cars:

- biodiesel, made from vegetable oils
- petroleum diesel, made from crude oil.

(a) A scientist compared the viscosity of biodiesel with petroleum diesel at different temperatures.
The scientist measured the time for the same volume of diesel to flow through a small hole in a cup.
The scientist's results are plotted on the grid.



(i) Draw a line of best fit for the biodiesel results.

(1)

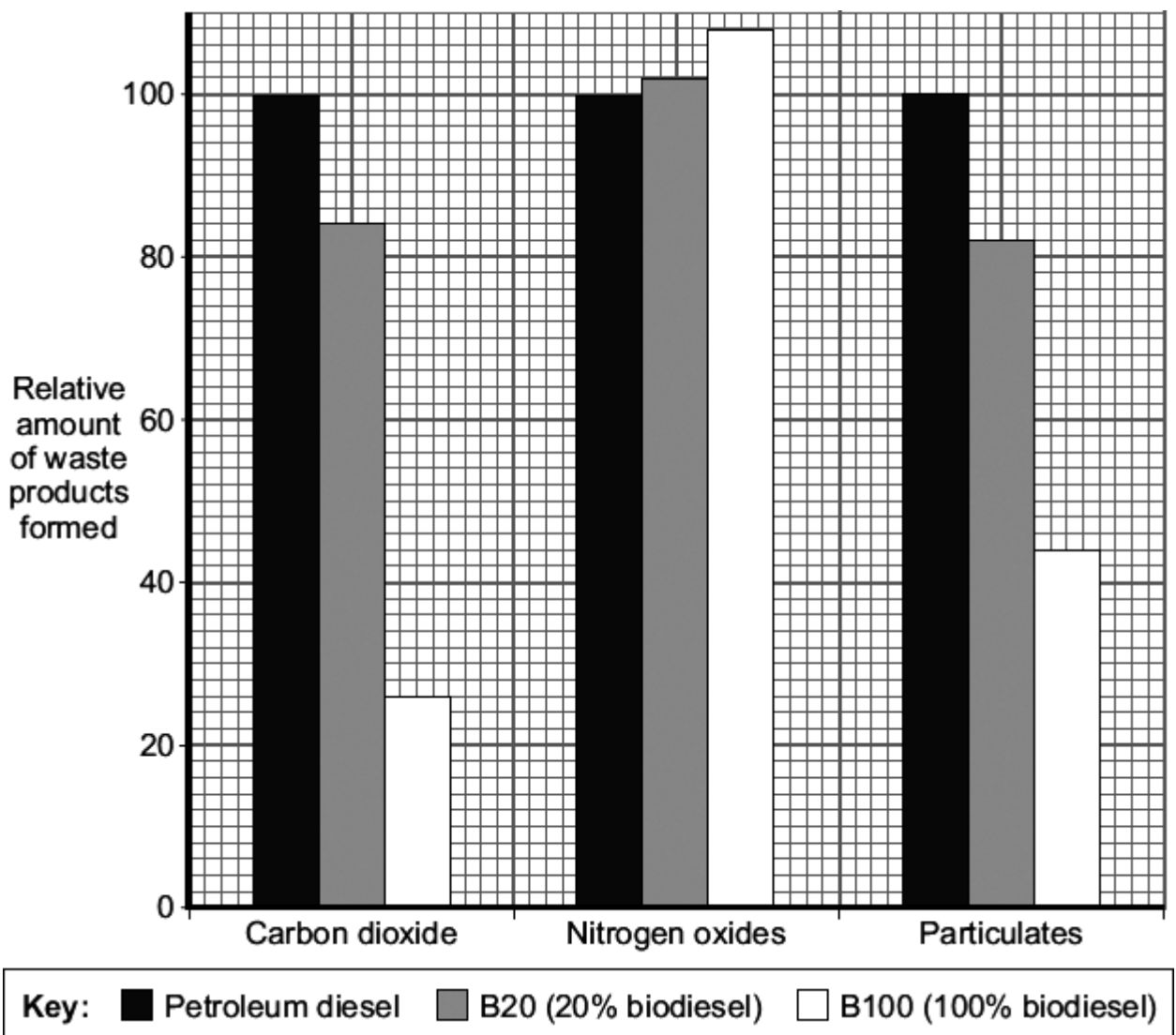
(ii) What conclusions can the scientist make about the viscosity of biodiesel compared with the viscosity of petroleum diesel at different temperatures?

(2)

- (iii) Biodiesel may be less suitable than petroleum diesel as a fuel for cars. Use these results to suggest **one** reason why.

(1)

- (b) Biodiesel can be mixed with petroleum diesel to make a fuel for cars. In a car engine, the diesel fuel burns in air. The waste products leave the car engine through the car exhaust system. The bar chart compares the relative amounts of waste products made when three different types of diesel fuel burn in a car engine.



Nitrogen oxides and sulfur dioxide cause a similar environmental impact.

- (i) What environmental impact do particulates from car exhaust systems cause?

(1)

(ii) What is the percentage reduction in particulates when using B100 instead of petroleum diesel?

_____ >

(1)

(iii) Replacing petroleum diesel with biodiesel increases one type of environmental pollution.

Use the bar chart and the information given to explain why.

(2)

(iv) A carbon neutral fuel does **not** add extra carbon dioxide to the atmosphere.

Is biodiesel a carbon neutral fuel?

Use the bar chart and your knowledge to explain your answer.

(2)

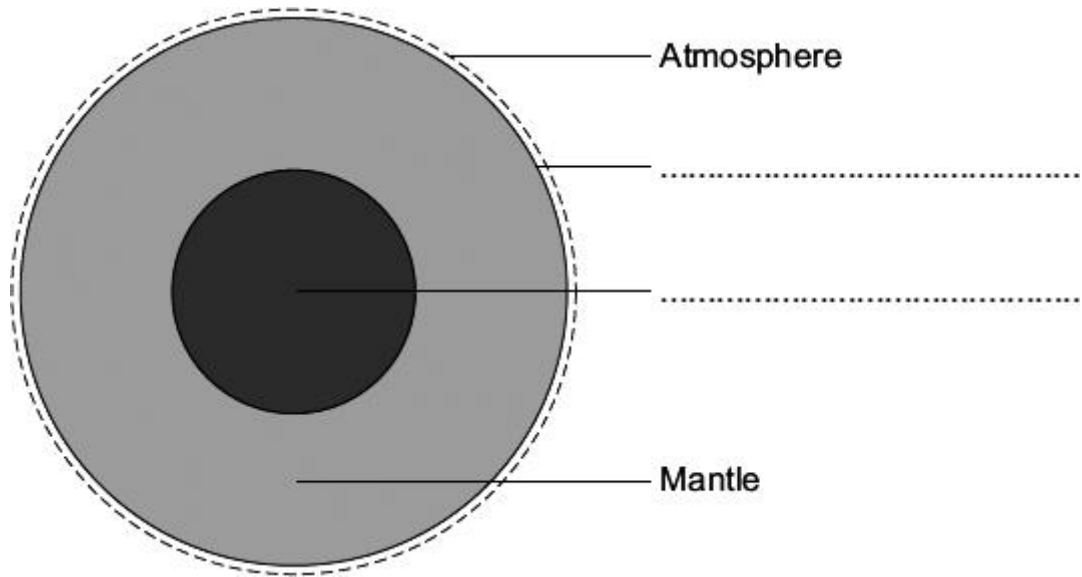
(Total 10 marks)

Q8.

The Earth has a layered structure and is surrounded by an atmosphere.

(a) The diagram shows the layers of the Earth.

Complete the labels on the diagram.

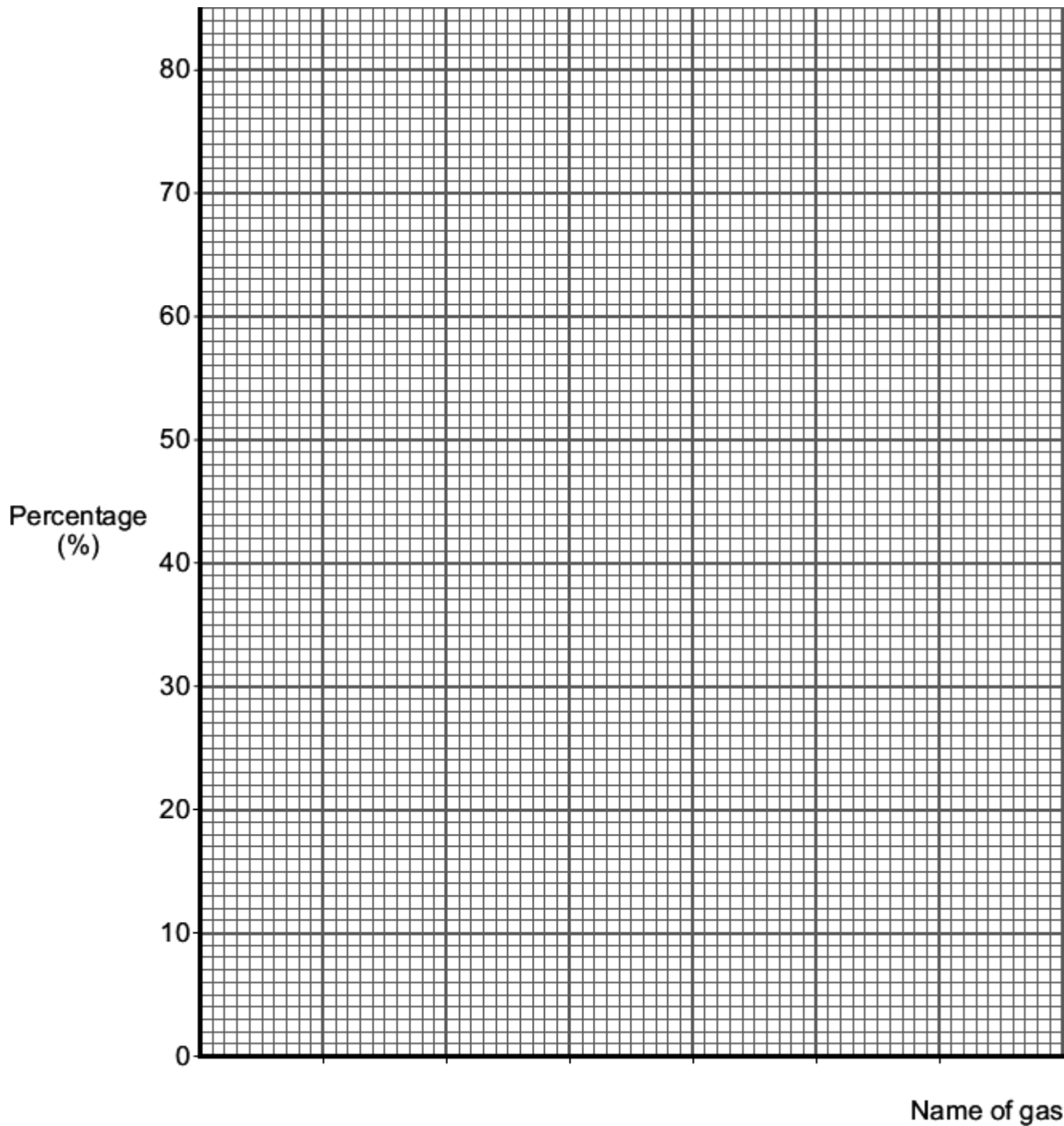


(2)

- (b) The data in the table shows the percentages of the gases in the Earth's atmosphere.

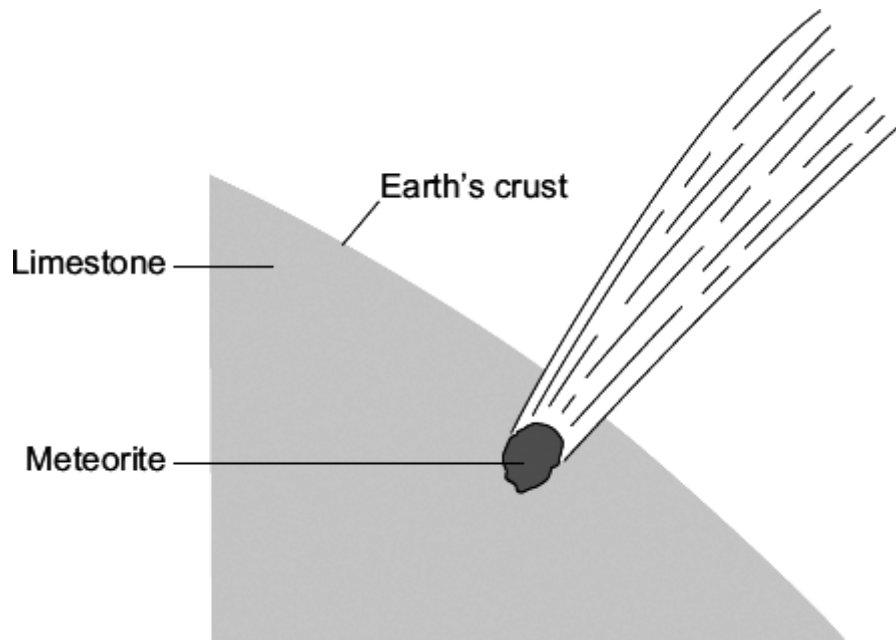
Name of gas	Percentage (%) of gas
Nitrogen	78
Oxygen	21
Other gases	1

Present the data in the table on the grid below.



(3)

- (c) Millions of years ago a large meteorite hit the Earth. The meteorite heated limestone in the Earth's crust to a very high temperature. The heat caused calcium carbonate in the limestone to release large amounts of carbon dioxide.



Draw a ring round the correct answer to complete each sentence.

(i) Carbon dioxide was released because the calcium carbonate was

- decomposed.
- evaporated.
- reduced.

(1)

(ii) More carbon dioxide in the Earth's atmosphere causes

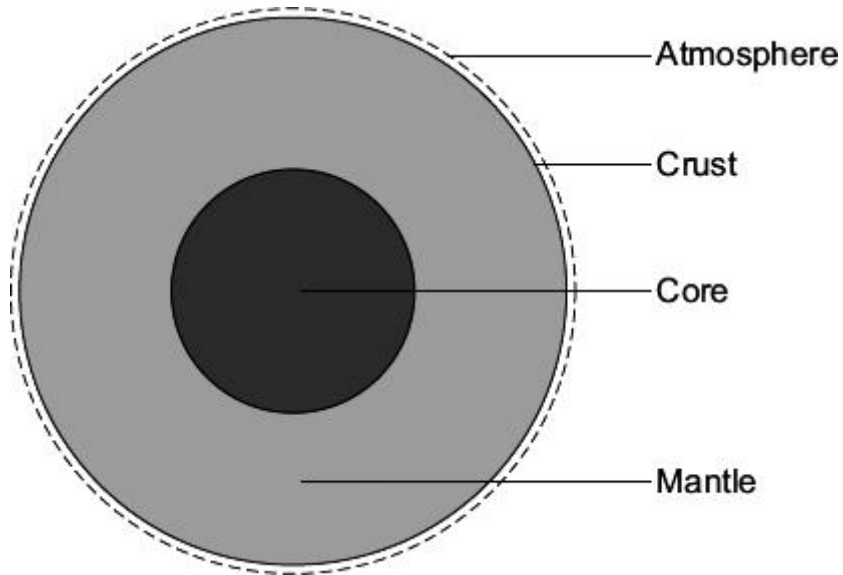
- acid rain.
- global dimming.
- global warming.

(1)

(Total 7 marks)

Q9.

The Earth has a layered structure and is surrounded by an atmosphere.



(a) Scientists believe that the Earth's atmosphere was formed by volcanoes releasing gases.
 This early atmosphere was about 95 % carbon dioxide.
 The composition of the Earth's atmosphere is always changing.

(i) The Earth's atmosphere today contains about 0.035 % carbon dioxide.

What happened to most of the carbon dioxide that was in the Earth's early atmosphere?

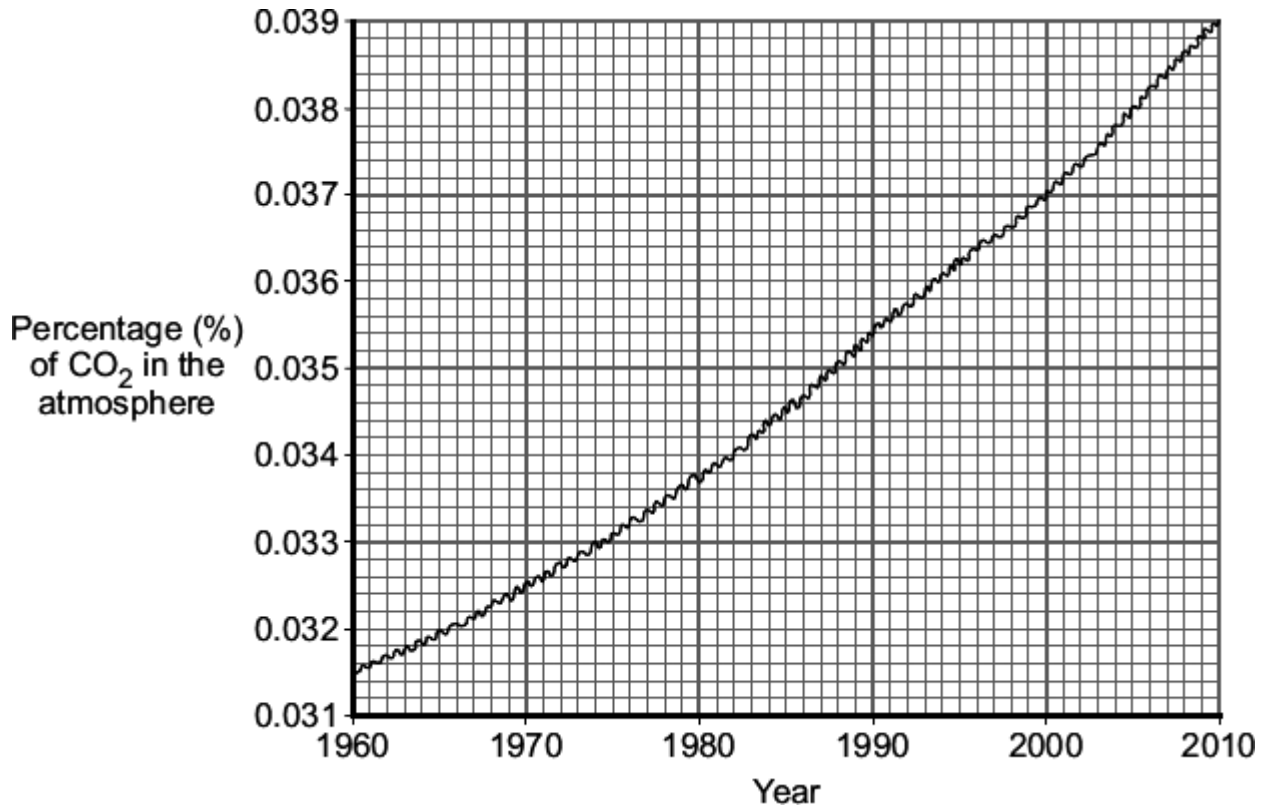
(2)

(ii) About 60 million years ago a large meteorite hit the Earth.
 This meteorite heated limestone in the Earth's crust causing the release of large amounts of carbon dioxide.

Explain how carbon dioxide is released from limestone.

(2)

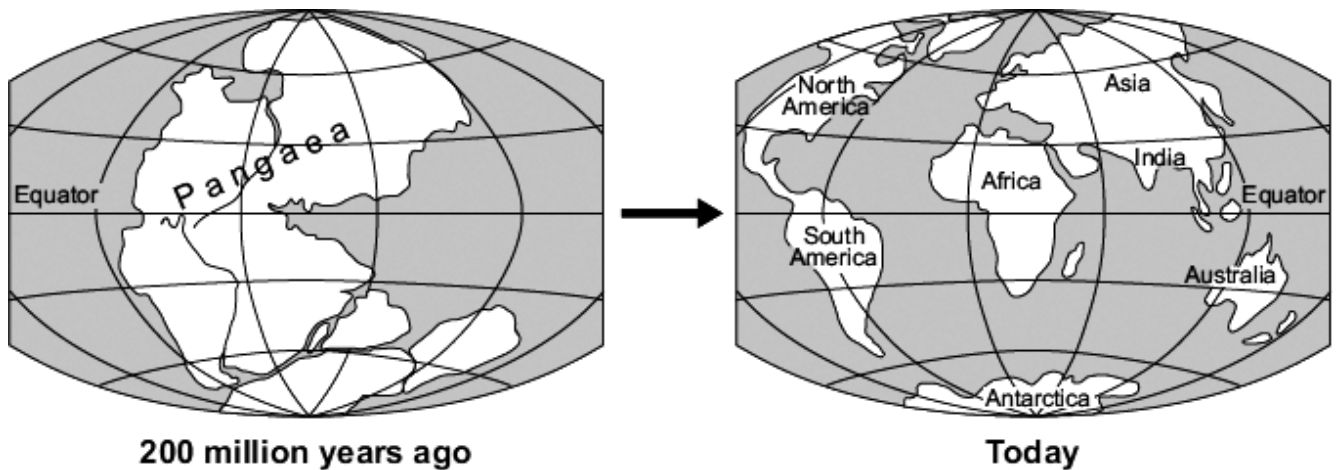
(b) The graph shows the percentage of carbon dioxide in the Earth's atmosphere over the last 50 years.



Explain, as fully as you can, why we should be concerned about the information displayed on this graph.

(3)

- (c) Scientists believe that all the continents of the Earth were once joined together. The huge 'supercontinent' was called Pangaea.



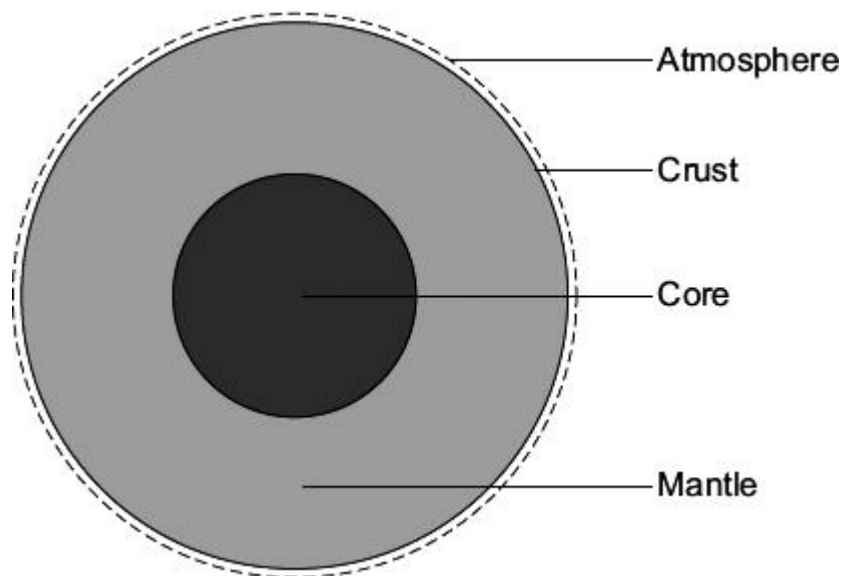
In 1915, Alfred Wegener had an idea that the change shown in the diagram was caused by *continental drift*. Most scientists could not accept his idea.

- (i) Suggest why most scientists in 1915 could not accept Wegener's idea of *continental drift*.

(1)

To help you with this question, the information and diagram from the beginning of the question are reproduced here.

The Earth has a layered structure and is surrounded by an atmosphere.



- (ii) Use this information and your knowledge and understanding to explain how continents move.

(3)

(Total 11 marks)

Q10.

This information about diesel was printed in a magazine.

Almost all of the crops that we eat can be converted into fuel for cars.
Vegetable oils can be used as biodiesel. Diesel from crude oil is called fossil diesel.

When either biodiesel or fossil diesel burn they both produce similar amounts of carbon dioxide.

Both types of diesel produce carbon monoxide. However, biodiesel produces fewer carbon particles and less sulfur dioxide.

- (a) Carbon monoxide can be produced when diesel burns in a car engine. Explain how.

(2)

- (b) Use the information at the start of this question and your knowledge and understanding to evaluate the use of biodiesel compared with fossil diesel as a fuel for cars.

Remember to give a conclusion to your evaluation.

(5)

(Total 7 marks)

Q11.

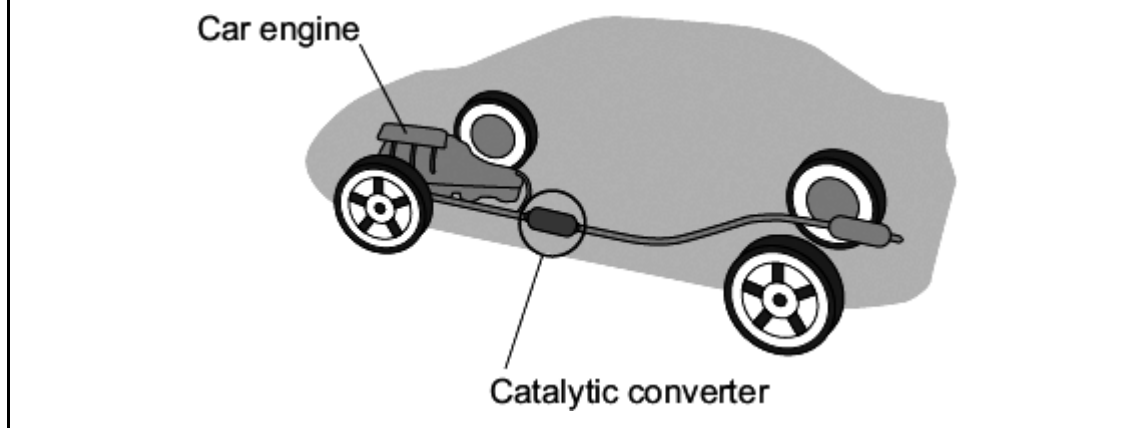
Read the information about car engines.

Burning petrol in air is an exothermic reaction. This reaction is used in car engines.

When petrol burns it produces harmful substances such as nitrogen oxides and

carbon monoxide.

A catalytic converter stops these harmful substances being released into the air.



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

(i) The exothermic reaction makes the temperature

of the engine

- decrease.
- increase.
- stay the same.

(1)

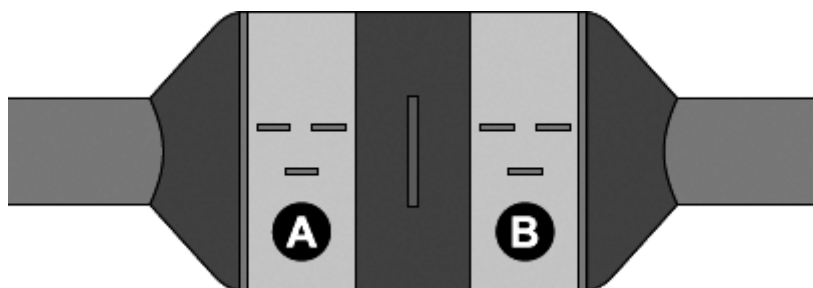
(ii) This is because during

exothermic reactions

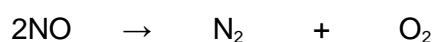
- energy is taken in from the surroundings.
- energy is given out to the surroundings.
- there is no energy change.

(1)

(b) The diagram shows a catalytic converter which removes harmful substances. The catalytic converter has two parts, **A** and **B**, which contain different catalysts.



(i) The equation for the reaction that takes place in part **A** is:

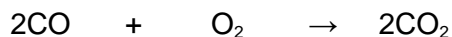


Which **one** of the substances shown in the equation is a compound?

Give the formula of this compound.

_____ (1)

(ii) The equation for the reaction that takes place in part **B** is:



Why is it important to stop carbon monoxide (CO) from being released into the air?

(1)

(c) The table lists some statements about catalysts. Only **two** statements are correct.

Tick (✓) the **two** correct statements.

Statement	Tick (✓)
A catalyst can speed up a chemical reaction.	
A catalyst is used up in a chemical reaction.	
Different reactions need different catalysts.	
A catalyst does not change the rate of a chemical reaction.	

(2)

(d) Modern catalytic converters contain nanosized particles of catalyst. Less catalyst is needed when nanosized catalyst particles are used.

(i) Complete the sentence.

The size of nanosized particles is _____ than normal sized particles.

(1)

(ii) The catalysts contain platinum.

Suggest why a manufacturer of catalytic converters would want to use less catalyst.

(1)
(Total 8 marks)

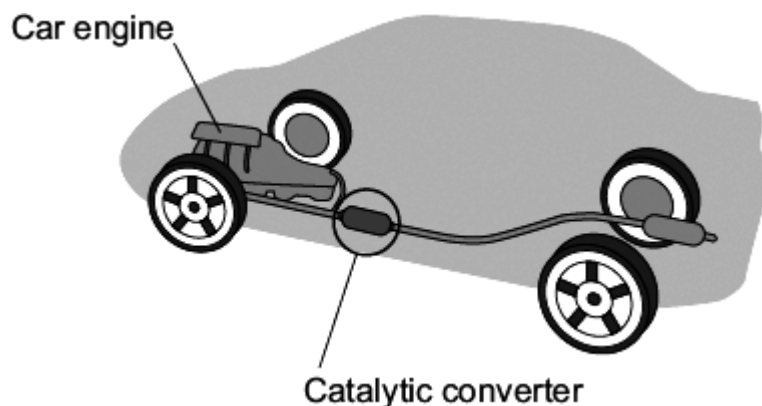
Q12.

Read the information about car engines.

Burning petrol in air is an *exothermic* reaction. This reaction is used in car engines.

When petrol burns it produces harmful substances such as nitrogen oxides and carbon monoxide.

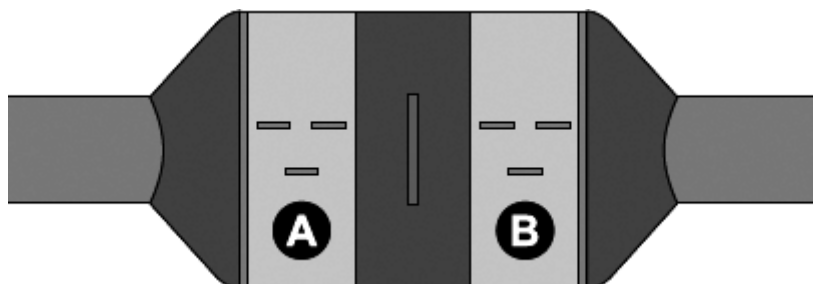
A catalytic converter stops these harmful substances being released into the air.



- (a) The reaction is *exothermic*. What is the meaning of *exothermic*?

(1)

- (b) The catalytic converter has two parts shown as **A** and **B** in the diagram.



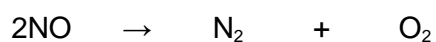
Part **A** contains a catalyst made from platinum and rhodium.

Part **B** contains a catalyst made from platinum and palladium.

- (i) Why are catalysts used in chemical reactions?

(1)

- (ii) One reaction in part **A** is shown by this equation.

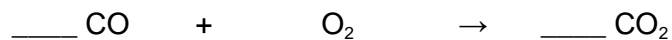


Suggest why this reaction helps the environment.

(1)

(iii) The equation for one of the reactions in part **B** is shown below.

Balance this equation.



(1)

(iv) The catalytic converter works for many years without replacing the catalyst.

Explain why the catalyst does not need to be replaced.

(1)

(v) Suggest why different catalysts are used in parts **A** and **B**.

(1)

(c) Modern catalytic converters contain nanosized particles of catalyst. Using nanosized particles reduces the cost of the catalytic converter.

Suggest and explain why the use of nanosized catalyst particles reduces the cost of the catalytic converter.

Your answer should include information about the size and surface area of the particles.

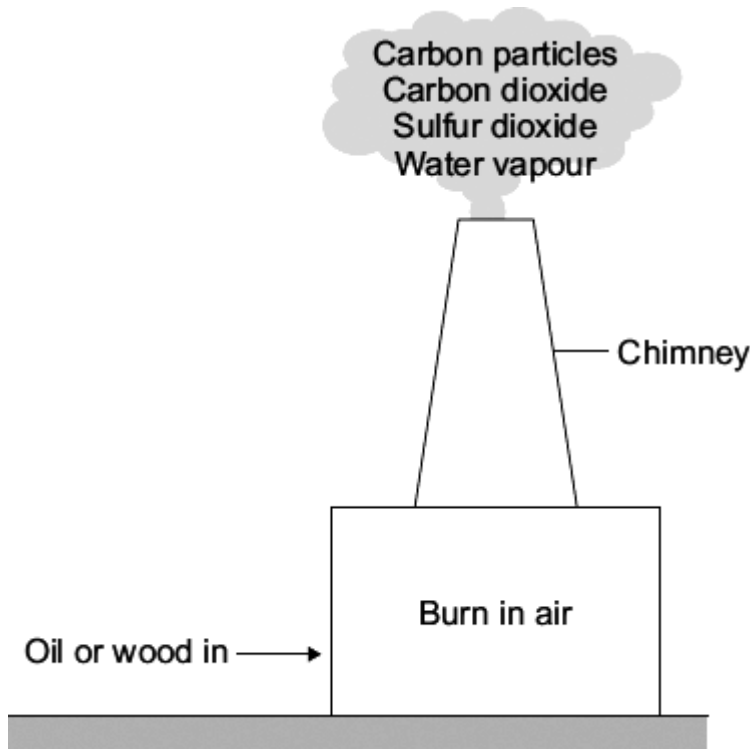
(3)

(Total 9 marks)

Q13.

In the future:

- there will be fewer oil burning power stations
- there may be more wood burning power stations.



(a) Which **one** of the emissions from the chimney can cause acid rain?

(1)

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

Carbon particles in the Earth's atmosphere cause

- | |
|-----------------|
| acid rain. |
| global dimming. |
| global warming. |

(1)

(c) Which gas in the air is needed for oil or wood to burn?

(1)

(d) Suggest why there will be **fewer** power stations burning oil in the future.

(1)

(e) Some power stations burn wood.
The wood comes from trees grown in forests.

Suggest why burning wood in power stations is said to be 'carbon-neutral'.

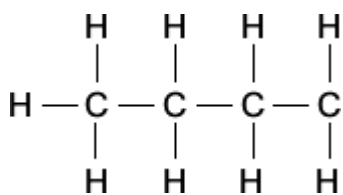
(2)
(Total 6 marks)

Q14.

Crude oil is a mixture of hydrocarbons. Most of these hydrocarbons are alkanes.

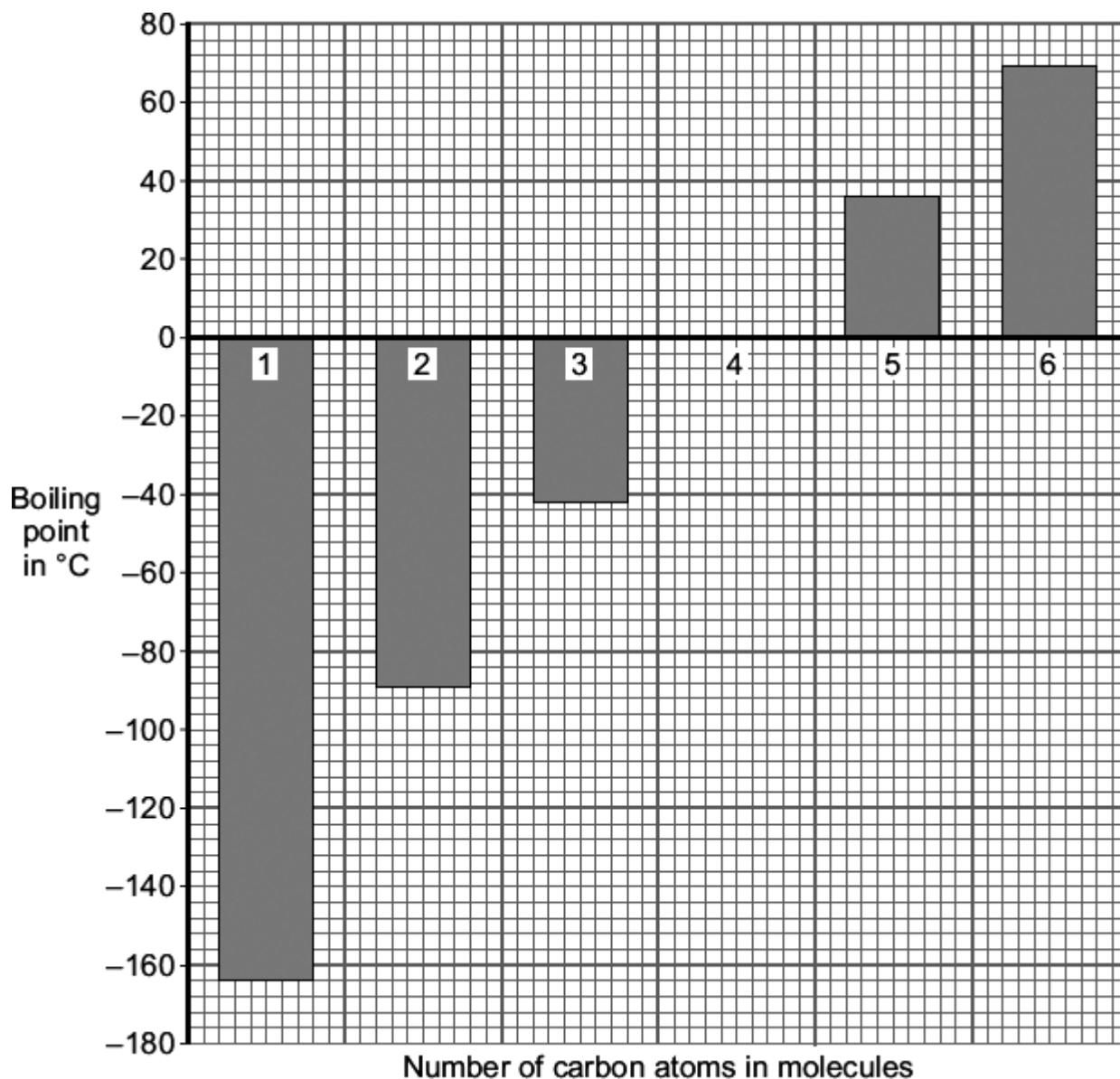
- (a) The general formula of an alkane is C_nH_{2n+2}

Complete the structural formula for the alkane that has **six** carbon atoms in its molecules.



(1)

- (b) The boiling points of alkanes are linked to the number of carbon atoms in their molecules.



- (i) Describe the link between the number of carbon atoms in an alkane molecule and its boiling point.

(1)

- (ii) Suggest **two** reasons why all of the alkanes in the bar chart are better fuels than the alkane with the formula $C_{30}H_{62}$

1. _____

2. _____

(2)

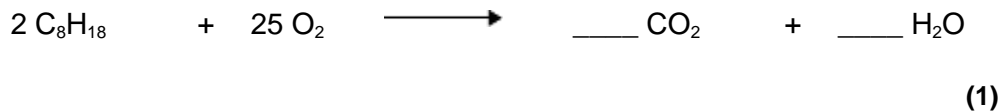
- (c) During the last 200 million years the carbon cycle has maintained the percentage of carbon dioxide in the atmosphere at about 0.03 %.
Over the last 100 years the percentage of carbon dioxide in the atmosphere has

increased to about 0.04 %.

Most of this increase is caused by burning fossil fuels to heat buildings, to generate electricity and to power our transport.

Fossil fuels contain carbon that has been locked up for millions of years.

- (i) Burning fossil fuels, such as petrol, releases this locked up carbon. Balance the chemical equation for the combustion of one of the alkanes in petrol.



- (ii) Where did the carbon that is locked up in fossil fuels come from?

(1)

- (iii) The burning of fossil fuels has caused the percentage of carbon dioxide in the atmosphere to increase to above 0.03 %. Explain why.

(2)

(Total 8 marks)

Q15.

Petroleum diesel is produced from crude oil.

Most vehicles that use petroleum diesel as fuel can also use biodiesel or a mixture of these two fuels. In the UK (in 2010) there must be 5 % biodiesel in all petroleum diesel fuel.

Biodiesel is produced from plant oils such as soya. The crops used to produce biodiesel can also be used to feed humans. The benefit that biodiesel is 'carbon neutral' is outweighed by the increasing demand for crops. This increasing demand is causing forests to be burnt to provide land for crops to produce biodiesel. Only a huge fall in the price of petroleum diesel would halt the increasing use of biodiesel.

The graph shows the average percentage change in exhaust emissions from vehicles using different mixtures of petroleum diesel and biodiesel.

(5)
(Total 5 marks)

Q16.

Many human activities result in carbon dioxide emissions.
Our carbon footprint is a measure of how much carbon dioxide we each cause to be produced.

- (a) Why should we be concerned about our carbon footprint?

(1)

- (b) Most power stations in the UK burn coal.
Coal was formed from tree-like plants over millions of years.

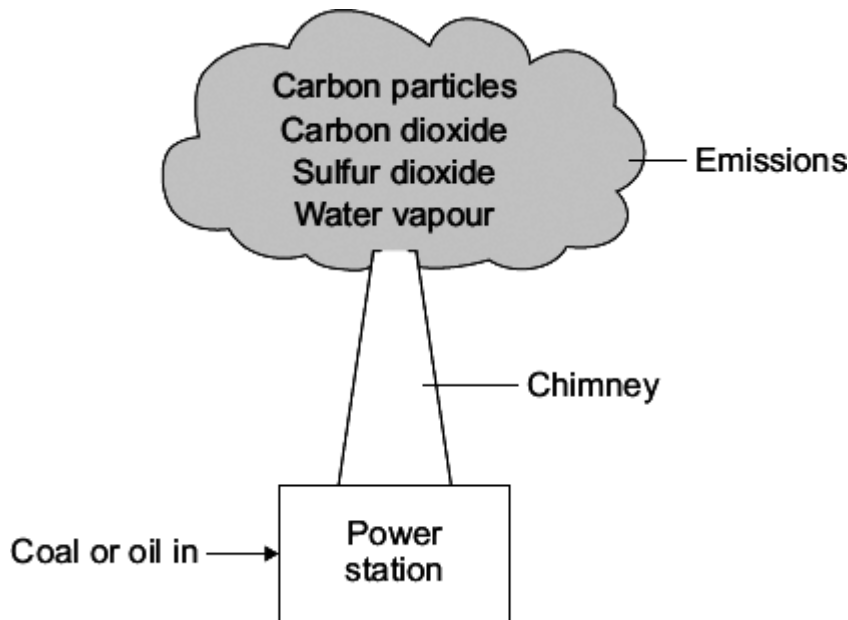
Suggest why burning wood instead of coal would help to reduce our carbon footprint.

(3)

(Total 4 marks)

Q17.

In the future more coal-fired and fewer oil-fired power stations will be used to generate electricity.
When coal and oil are burned they produce the same types of emissions which can cause environmental problems.



- (a) Emissions from the chimney can cause acid rain, global dimming and global warming. Draw **one** straight line from each possible environmental problem to the emission that causes it.

Possible environmental problem

acid rain

global warming

global dimming

Emission that causes it

carbon particles

carbon dioxide

sulfur dioxide

water vapour

(3)

- (b) Draw a ring around the correct word in the box to complete each sentence.

- (i) Incomplete combustion of coal or oil is caused by too little

carbon dioxide.
nitrogen.
oxygen.

(1)

- (ii) A gas formed by the incomplete combustion of coal or oil is

carbon monoxide.
hydrogen.
oxygen.

(1)

(c) The table shows the world production for both coal and oil in 2000.

The world production figures after 2000 are predicted.

Year	World production of coal (billions of tonnes per year)	World production of oil (billions of barrels per year)
2000	3.5	12.5
2050	4.5	5.6
2100	5.0	1.7
2150	5.5	0.5
2200	6.0	0.0

(i) How is the world production of oil predicted to change from 2000 to 2200?

(1)

(ii) Suggest **two** reasons why the world production of coal is predicted to increase.

1. _____

2. _____

(2)

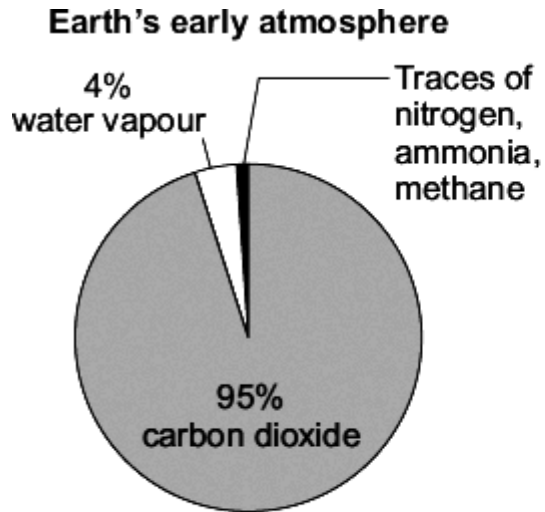
(Total 8 marks)

Q18.

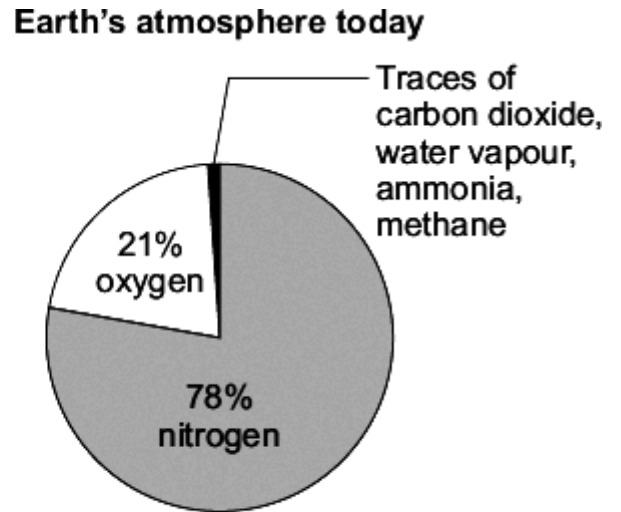
(a) Scientists have suggested that:

- the Earth formed as a molten ball of rock and minerals
- the rock and minerals cooled slowly
- the surface of the Earth was covered by volcanoes
- the volcanoes released gases that formed the Earth's early atmosphere.

The pie charts show the approximate percentages of gases in the Earth's early atmosphere and in the Earth's atmosphere today.



Average surface temperature above 400 °C



Average surface temperature 20 °C

- (i) Explain what has happened to most of the water vapour in the Earth's early atmosphere.

(2)

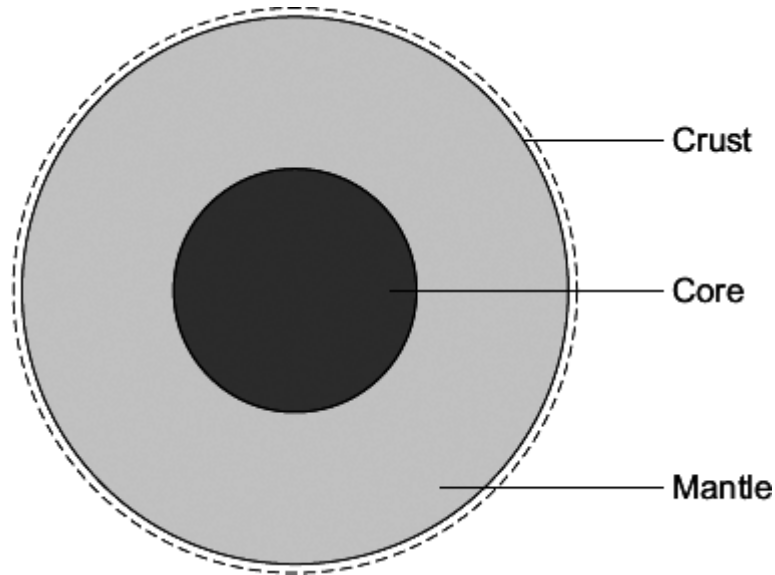
- (ii) Give **two** reasons why the percentage of carbon dioxide in the Earth's early atmosphere decreased.

1. _____

2. _____

(2)

- (b) Scientists have suggested that the Earth consists of a core, mantle and crust.



A 'traditional' theory is that the core is made of iron and nickel.

A 'controversial' theory is that the core is like a nuclear reactor made of the radioactive elements uranium and plutonium.

(i) Why can scientists **not** prove which theory about the core is correct?

(1)

(ii) How can the 'controversial' theory be used to explain why the Earth's tectonic plates move?

(3)

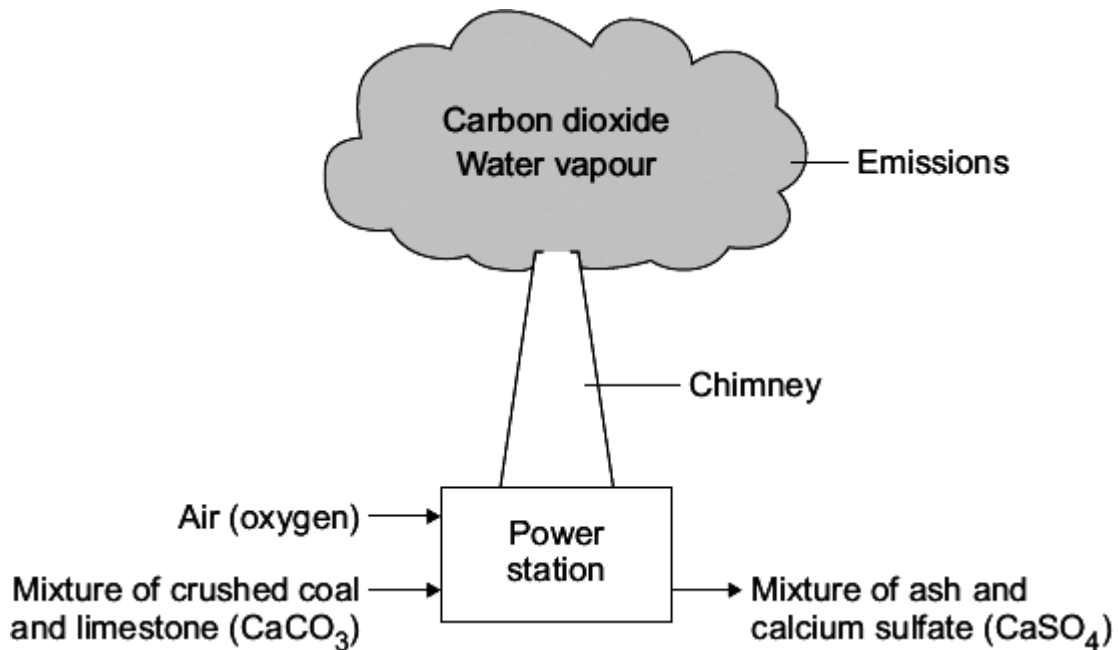
(Total 8 marks)

Q19.

Most power stations burn coal to generate electricity. Burning coal gives off sulfur dioxide gas which can be removed from the waste gases by using limestone.

This prevents sulfur dioxide from entering the atmosphere and causing acid rain.

One disadvantage of using limestone in a power station is that it releases 'locked up carbon dioxide' into the atmosphere.



(a) How does the limestone used in a power station:

(i) release carbon dioxide

(1)

(ii) remove sulfur dioxide?

(1)

(b) The waste gases from the chimney are monitored. One toxic gas that should not be released is carbon monoxide.

Explain how carbon monoxide would be formed.

(2)

(c) The use of limestone in a power station releases 'locked up carbon dioxide' into the atmosphere.

(i) Explain the meaning of 'locked up carbon dioxide'.

(2)

- (ii) Why does the release of this carbon dioxide cause an environmental problem?

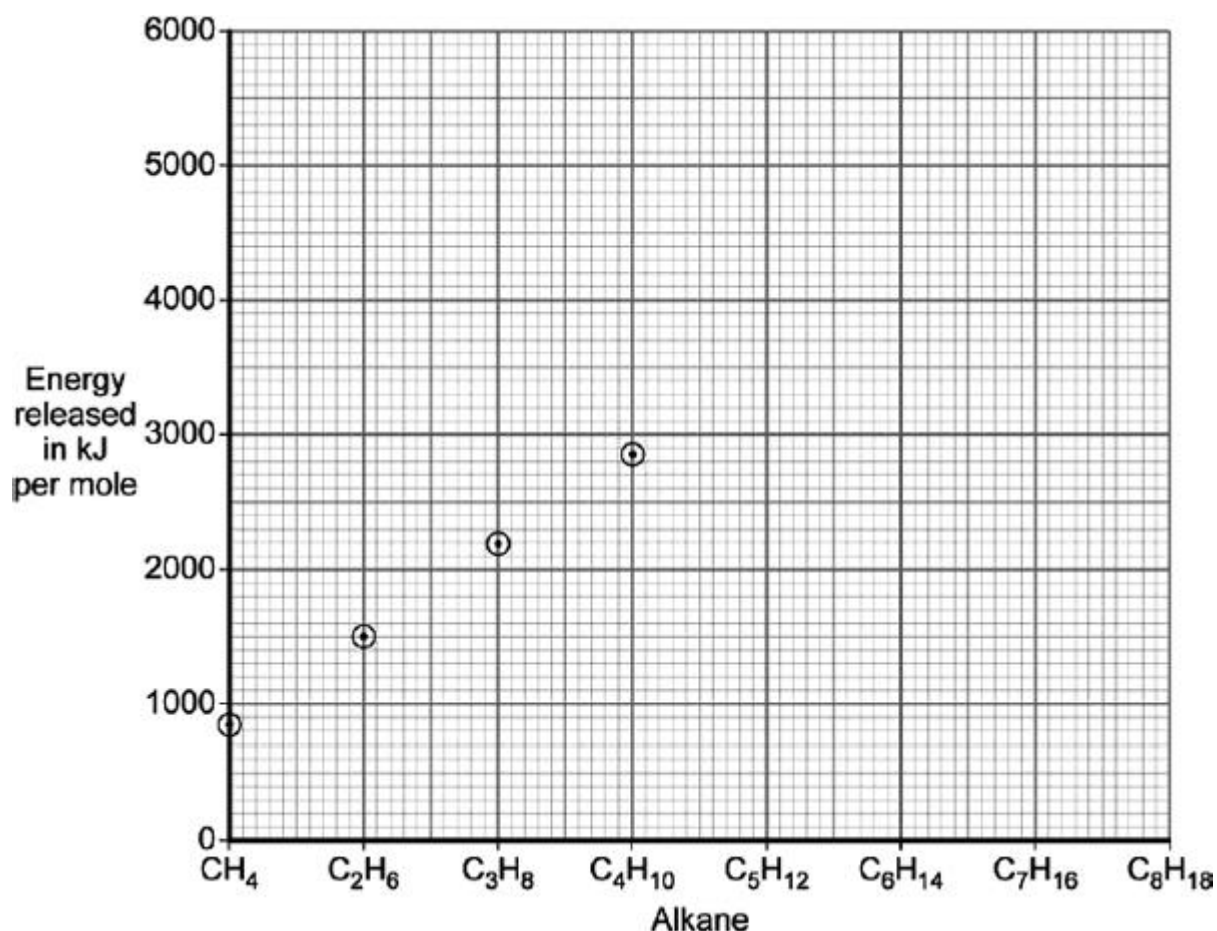
(1)

(Total 7 marks)

Q20.

- (a) Alkanes are important hydrocarbon fuels. They have the general formula C_nH_{2n+2}

The points on the graph show the amount of energy released when 1 mole of methane (CH_4), ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}) are burned separately.



- (i) Draw a line through the points and extend your line to the right-hand edge of the graph.

(1)

- (ii) Use the graph to estimate the amount of energy released when 1 mole of octane (C_8H_{18}) is burned.

Energy released = _____ kJ

(1)

- (iii) Suggest why we can make a good estimate for the energy released by 1 mole of pentane (C_5H_{12}).

(1)

- (iv) A student noticed that octane (C_8H_{18}) has twice as many carbon atoms as butane (C_4H_{10}), and made the following prediction:

“When burned, 1 mole of octane releases twice as much energy as 1 mole of butane.”

Use the graph to decide if the student’s prediction is correct. You **must** show your working to gain credit.

(2)

- (b) Some information about four fuels is given in the table.

Fuel	Type	Heat released in kJ per g	Combustion products			Type of flame
			CO ₂	SO ₂	H ₂ O	
Bio-ethanol	Renewable	29	✓		✓	Not smoky
Coal	Non-renewable	31	✓	✓	✓	Smoky
Hydrogen	Renewable	142			✓	Not smoky
Natural gas	Non-renewable	56	✓		✓	Not smoky

From this information a student made two conclusions.

For each conclusion, state if it is correct **and** explain your answer.

- (i) “Renewable fuels release more heat per gram than non-renewable fuels.”

(2)

- (ii) "Non-renewable fuels are better for the environment than renewable fuels."

(2)
(Total 9 marks)

Q21.

Water sold in plastic bottles has a high 'carbon cost'.

The 'carbon cost' depends on the amount of carbon dioxide emitted in making and transporting the product.

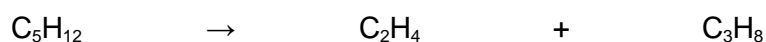
The more carbon dioxide emitted, the higher the 'carbon cost'.

- (a) Plastic water bottles are made from a polymer.
The polymer is made from ethene.
Ethene is made by cracking hydrocarbons.

- (i) Name the polymer made from ethene.

(1)

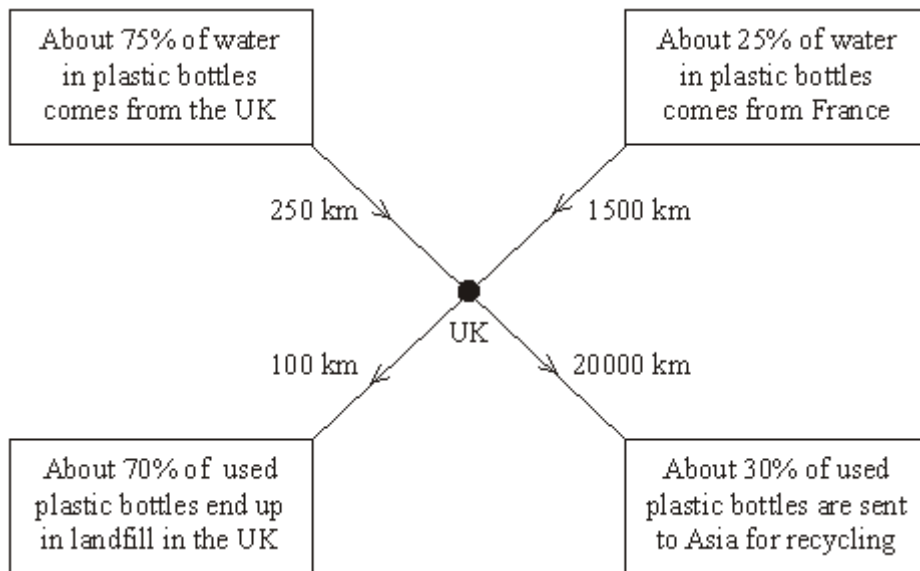
- (ii) Ethene can be made by cracking the hydrocarbon pentane, C_5H_{12} .



Explain why there is a 'carbon cost' for the process of cracking a hydrocarbon.

(2)

- (b) The diagram shows information about water sold in plastic bottles in the UK.
The diagram also shows the average distances that water and plastic bottles are transported.



Suggest how the high 'carbon cost' of water sold in plastic bottles could be reduced.

(3)
(Total 6 marks)

Q22.

Billions of years ago, the Earth's early atmosphere was probably like the atmosphere of Venus today.

The table shows a comparison of the atmospheres of the Earth and Venus today.

Name of gas	Percentage composition of atmosphere	
	Earth today	Venus today
Nitrogen	78	3.5
Oxygen	21	a trace
Argon	0.97	a trace
Carbon dioxide	0.03	96.5
Average surface temperature	20 °C	460 °C

(a) Use the names of gases from the table to complete the sentences.

(i) In the Earth's atmosphere today, the main gas is

_____.

(1)

(ii) In the Earth's atmosphere billions of years ago, the main gas was

_____.

(1)

(b) (i) Scientists do **not** know the accurate composition of the Earth's early atmosphere. Suggest why.

(1)

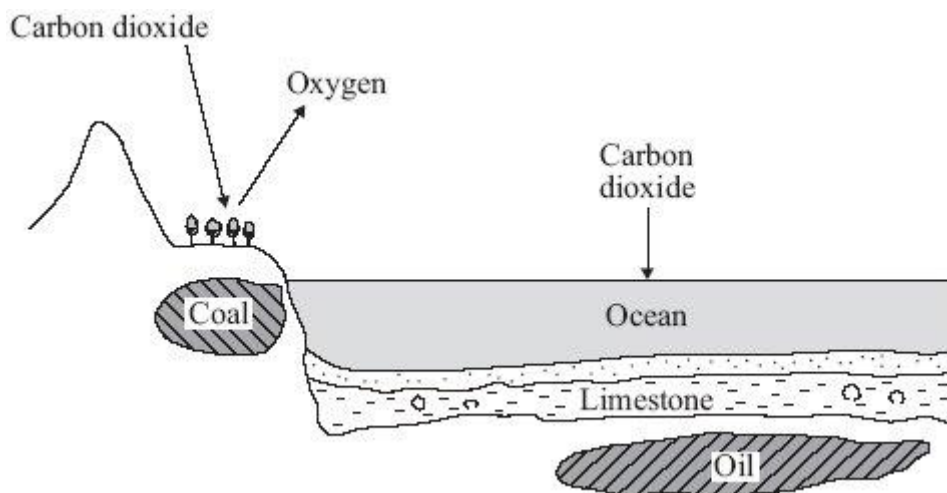
(ii) Use information from the table to answer this question.

Water vapour is present in the atmospheres of the Earth and Venus today. The Earth's surface is mainly covered by water.

Suggest why there is no water on the surface of Venus.

(1)

(c) The diagram shows how carbon dioxide is removed from the Earth's atmosphere.



Describe what happened to the carbon dioxide in the Earth's early atmosphere. Use the diagram to help you.

(3)
(Total 7 marks)

Q23.

There are many ideas about the formation of the Earth and its atmosphere from a molten ball of rock and minerals.

- (a) One idea is that the Earth's early atmosphere and average surface temperature were probably like that of Venus today.

The table shows information about the Earth and Venus today.

Name of gas	Percentage composition of atmosphere	
	Earth today	Venus today
Nitrogen	78	3.5
Oxygen	21	a trace
Argon	0.97	a trace
Carbon dioxide	0.03	96.5
Average surface temperature	20 °C	460 °C

There is a variable amount of water vapour in both atmospheres.

- (i) How was the Earth's early atmosphere formed?

(1)

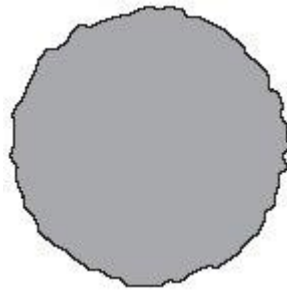
- (ii) The Earth's average surface temperature decreased over time. At what temperature would oceans have started to form?

Temperature = _____ °C

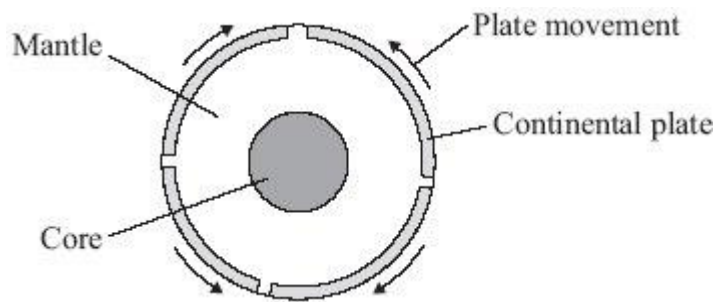
(1)

- (iii) Describe how the evolution of plants changed the Earth's atmosphere.

- (b) Another idea was that the Earth's mountains and continents formed in fixed positions as the molten ball of rock and minerals cooled and wrinkled.



Wegener, in 1915, had the idea that the Earth's crust and the upper part of the mantle had cracked into plates that were able to move. His idea meant that the mountains and continents were not in fixed positions.



- (i) Give **one** piece of evidence that led to Wegener's idea being accepted.

(1)

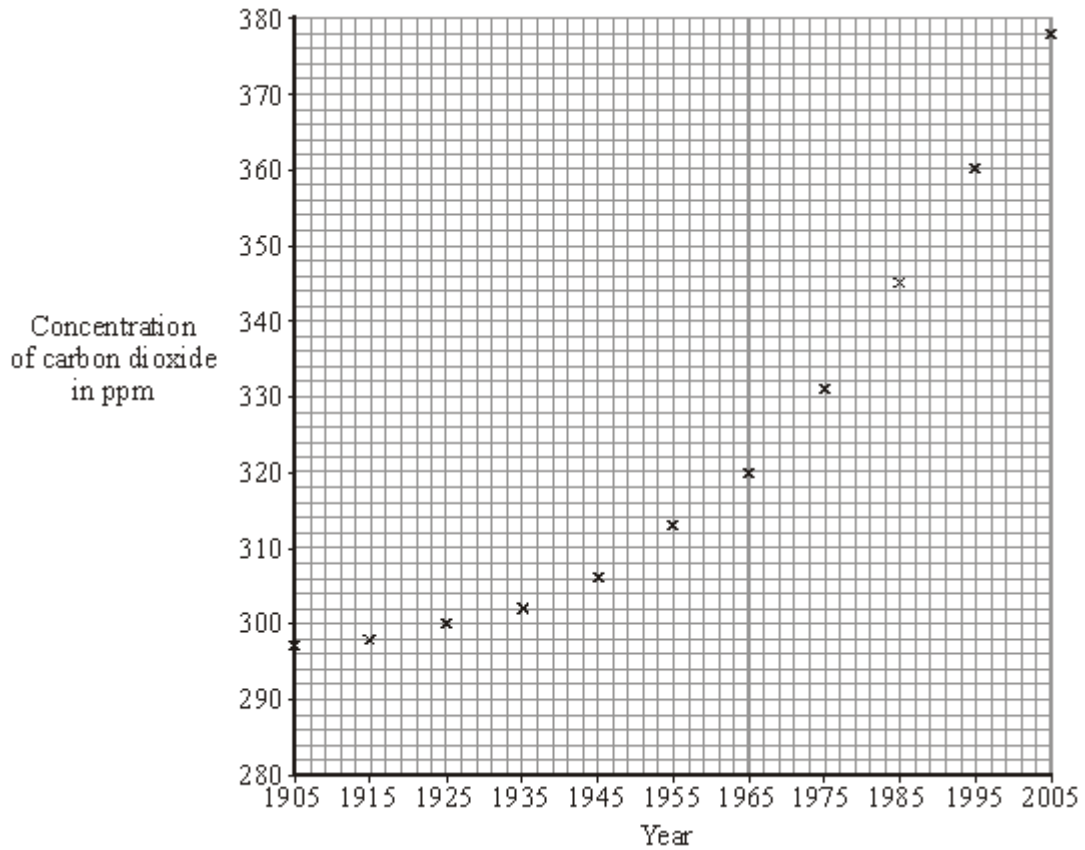
- (ii) Describe what causes the Earth's tectonic plates to move.

(3)

(Total 8 marks)

Q24.

Global warming is thought to be happening because of the increased burning of fossil fuels. The concentration of carbon dioxide in the air from 1905 to 2005 has been calculated.



(a) Draw a line of best fit for these points.

(1)

(b) (i) What was the concentration of carbon dioxide in 1955?

_____ ppm

(1)

(ii) In what year did the concentration of carbon dioxide reach 350 ppm?

(1)

(c) Use the graph to describe, in as much detail as you can, what happened to the concentration of carbon dioxide from 1905 to 2005.

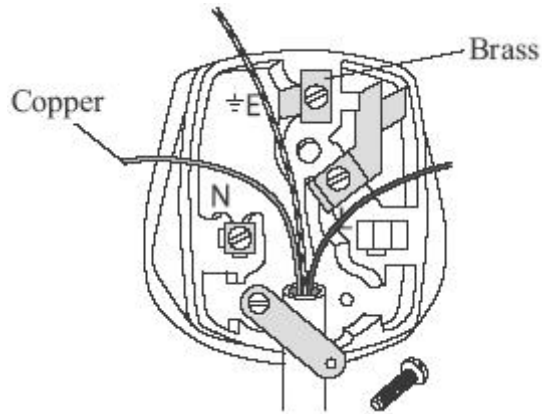
(2)

(Total 5 marks)

Q25.

Copper metal is used for electric wires.

An alloy of copper, called brass, is used for pins and terminals of electric plugs.



- (a) Copper metal is relatively soft and flexible.

Give another reason why copper is used for electric wires.

(1)

- (b) Brass is an *alloy*.

What is an *alloy*?

(1)

- (c) Open-cast mining of copper ore makes a very large hole.



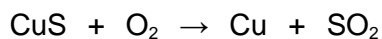
- (i) Suggest **one** environmental problem that is caused by open-cast mining of

copper ore.

(1)

- (ii) Some copper ores contain copper sulfide, CuS.

Copper sulfide is heated in air to produce copper and sulfur dioxide.



Suggest **one** environmental problem caused by heating copper sulfide in air.

(1)

- (d) The amount of copper-rich ores is estimated to last only a few more years. New houses need several kilometres of copper wire.

- (i) Explain why the need to use so much copper will cause a problem in the future.

(1)

- (ii) Suggest **two** ways in which society could overcome this problem.

1. _____

2. _____

(2)

(Total 7 marks)

Q26.

Since 2000 there has been a lot more research into alternative, environmentally-friendly fuels for road transport.

Several pollutants are found in the exhaust emissions produced when fossil fuels are used for road transport.

Carbon monoxide (CO) interferes with the way that red blood cells carry oxygen. Carbon dioxide (CO₂) increases the level of carbon dioxide in the atmosphere and causes global warming.

Oxides of nitrogen (NO_x) are produced at high temperatures when nitrogen and oxygen from the atmosphere combine.

Sulfur dioxide (SO₂) is produced when sulfur impurities in the fuel combine with oxygen in the atmosphere.

Tiny particles of solids are produced when the fuel does not burn completely.

This increases the level of particulates (PM10) in the atmosphere.

(a) Name the environmental effect caused by:

(i) oxides of nitrogen (NO_x) and sulfur dioxide (SO_2)

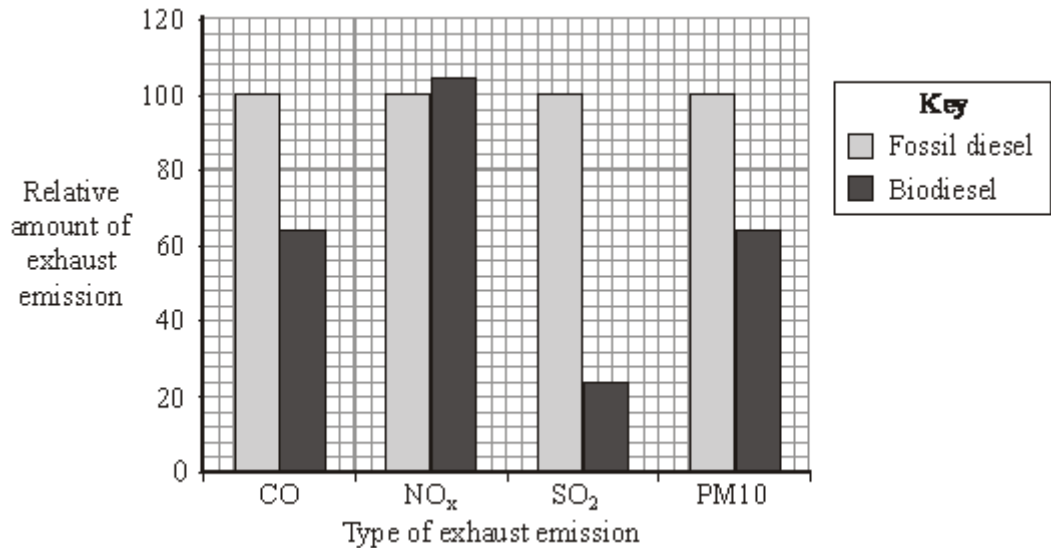
(1)

(ii) the increased level of particulates (PM10).

(1)

(b) Diesel obtained from crude oil is often called fossil diesel. Biodiesel can be made from many vegetable oils. One research project compared the exhaust emissions when fossil diesel or biodiesel were used as fuels.

Some of the relative amounts of these exhaust emissions are shown in the bar chart.



(i) Use your knowledge and the information above to explain the environmental benefits of using biodiesel as a sustainable, low pollution fuel.

(3)

(ii) Biodiesel is called a green fuel.

This is because the life-cycle emission of carbon dioxide from biodiesel is less

than that from fossil diesel.

Use your knowledge and the information above to explain why biodiesel's contribution to global warming is considered to be much less than that of fossil diesel.

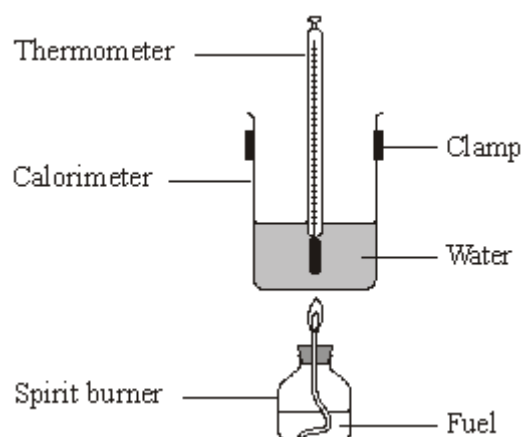
(3)

(Total 8 marks)

Q27.

A student burned four fuels and compared the amounts of energy they produced.

The student set up the apparatus as shown in the diagram.



The heat produced when each fuel was burned was used to raise the temperature of 100 g of water. The student noted the mass of fuel burned, the increase in temperature and whether the flame was smoky.

The results are shown in the table.

Fuel	Mass of fuel burned (g)	Temperature increase (°C)	Type of flame
Ethanol	4	24	Not smoky
Methanol	3	9	Not smoky
Peanut oil	2	20	Smoky
Vegetable oil	1	15	Smoky

(a) The student suggested that the vegetable oil was the best fuel for producing heat.

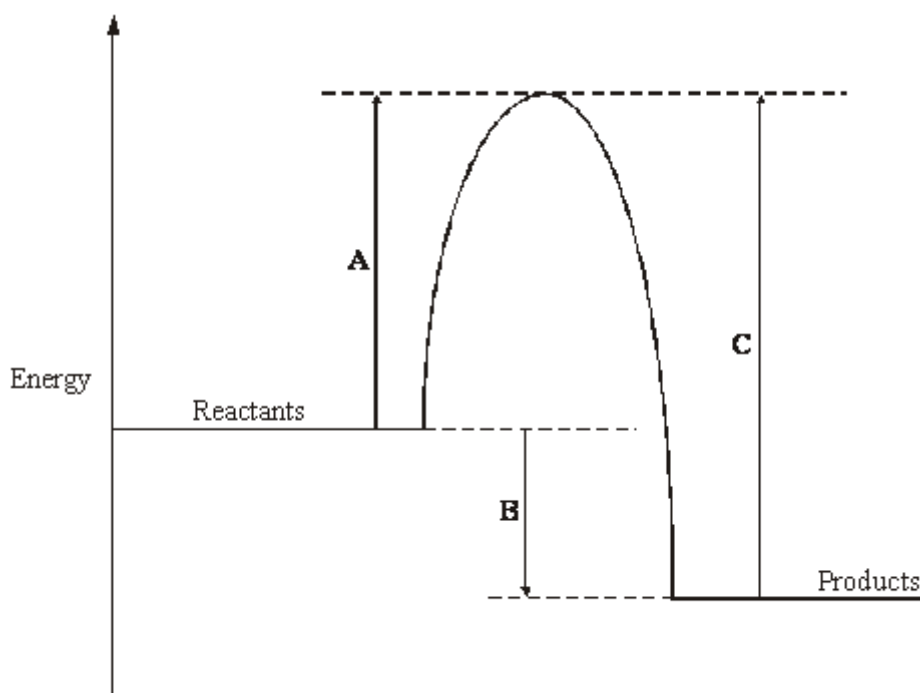
Explain why.

(2)

(b) Suggest an environmental problem that could be caused when large amounts of vegetable oil are burned. Suggest how the problem could be overcome.

(2)

(c) An energy level diagram for the burning of vegetable oil is shown below.



Which of the energy changes **A**, **B** or **C**:

(i) represents the activation energy

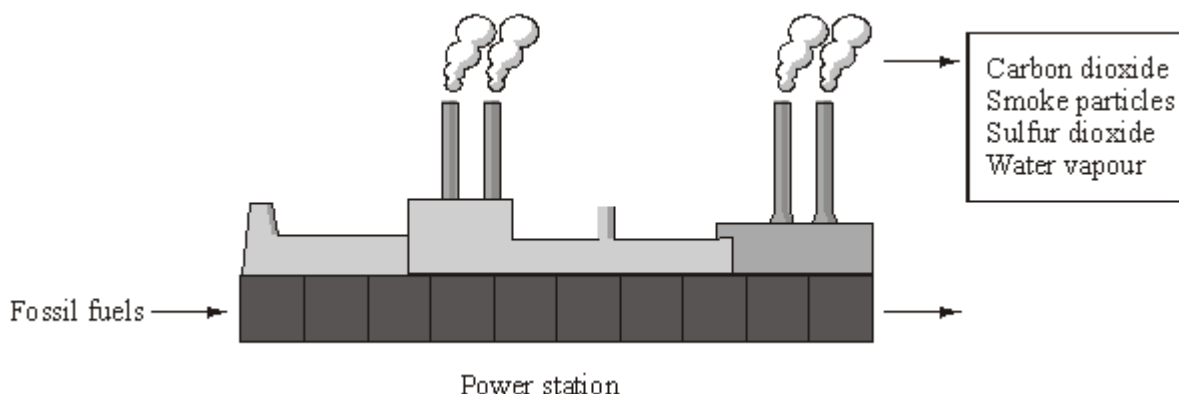
(1)

(ii) shows the amount of energy given out during the reaction?

(1)

Q28.

Most electricity in the UK is generated in power stations that burn fossil fuels. The diagram lists some of the substances released into the air when fossil fuels are burned.



(a) (i) Which **one** of the substances released into the air causes acid rain?

(1)

(ii) In the sentence below, draw a ring around the correct answer.

The type of environmental pollution caused by

smoke particle
is

- global dimming
- global warming
- rising sea levels

(1)

(iii) Suggest how the burning of fossil fuels may cause climate change.

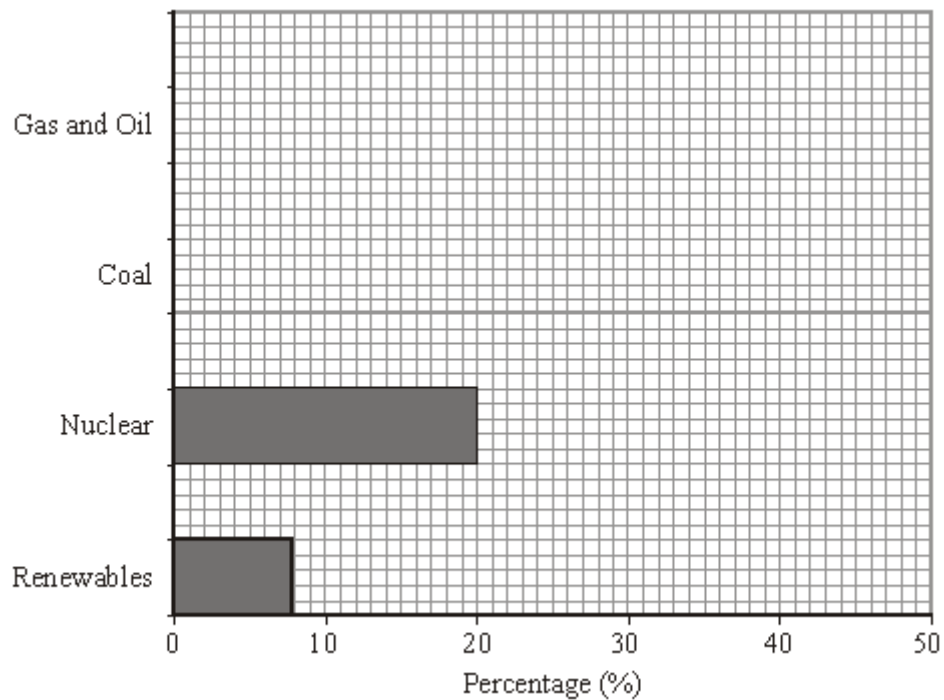
(2)

(b) The table shows the percentage of electricity generated by different energy sources.

Energy sources	Renewables	Nuclear	Coal	Gas and Oil
Percentage	8	20	32	40

(%)

Complete the bar chart to show the percentage of electricity generated by coal and by gas and oil.

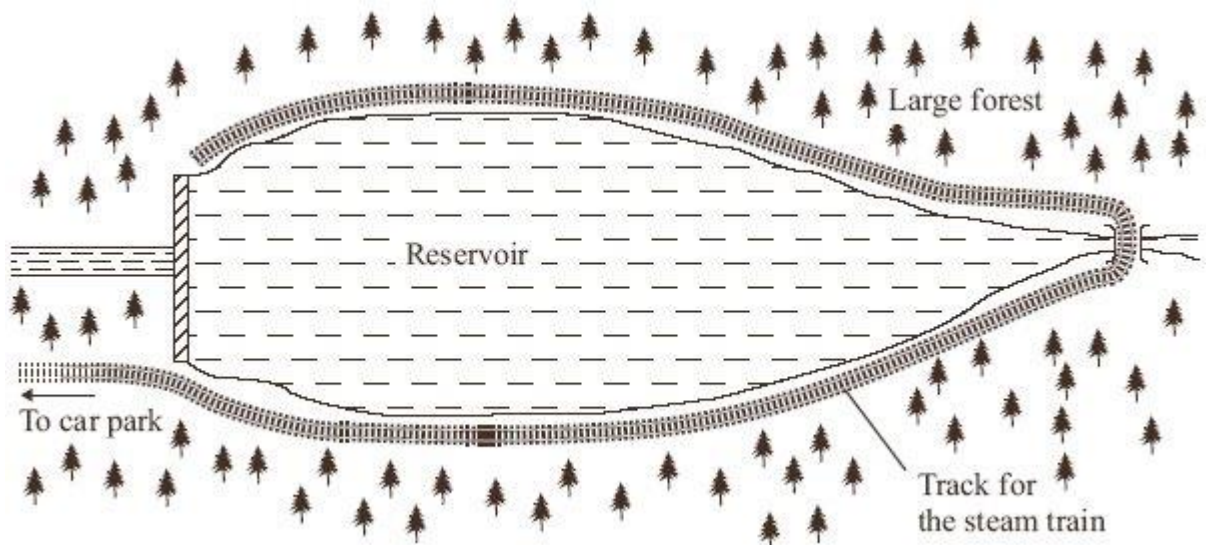


(2)

(Total 6 marks)

Q29.

A large reservoir is surrounded by trees. Planners need to protect the environment. The distance around the reservoir is many kilometres. There will be only one road access to a car park a few kilometres from the reservoir. From the car park people would be transported to accommodation, activities or places of interest by steam train.



- (a) Coal contains carbon and small amounts of sulfur. The steam train would cause environmental problems if coal were used as the fuel.

Explain why.

(4)

- (b) The planners have stated that, as a result of using the steam train, there must be no overall increase of carbon dioxide added to the atmosphere. The steam train would be considered as 'carbon neutral' if wood, from the surrounding forest, were used as the fuel.

Suggest why.

(3)

(Total 7 marks)

Q30.

Scientists study the atmosphere on planets and moons in the Solar System to understand how the Earth's atmosphere has changed.

- (a) Millions of years ago the Earth's atmosphere was probably just like that of Mars today.

The table shows data about the atmospheres of Mars and Earth as they are now.

Mars		Earth	
nitrogen	3%	nitrogen	78%
oxygen	trace	oxygen	21%
water	trace	water	trace

carbon dioxide	95%	carbon dioxide	trace
Average surface temperature $-23\text{ }^{\circ}\text{C}$		Average surface temperature $15\text{ }^{\circ}\text{C}$	

Suggest what has caused the main gases in the Earth's atmosphere of millions of years ago to change to the present-day atmosphere.

(2)

- (b) Titan is the largest moon of the planet Saturn. It has an atmosphere that, like the Earth's, contains mainly nitrogen. Methane is the other main gas.

Main gases in Titan's atmosphere	Percentage (%)	Boiling point in $^{\circ}\text{C}$
Nitrogen	95	-196
Methane	5	-164
Average surface temperature $-178\text{ }^{\circ}\text{C}$		

When it rains on Titan, it rains methane! Explain why.

(2)

- (c) Ultraviolet radiation from the Sun produces simple alkenes, such as ethene and propene, from methane in Titan's atmosphere.

- (i) Draw the structure of propene, C_3H_6 , to show the covalent bonds.

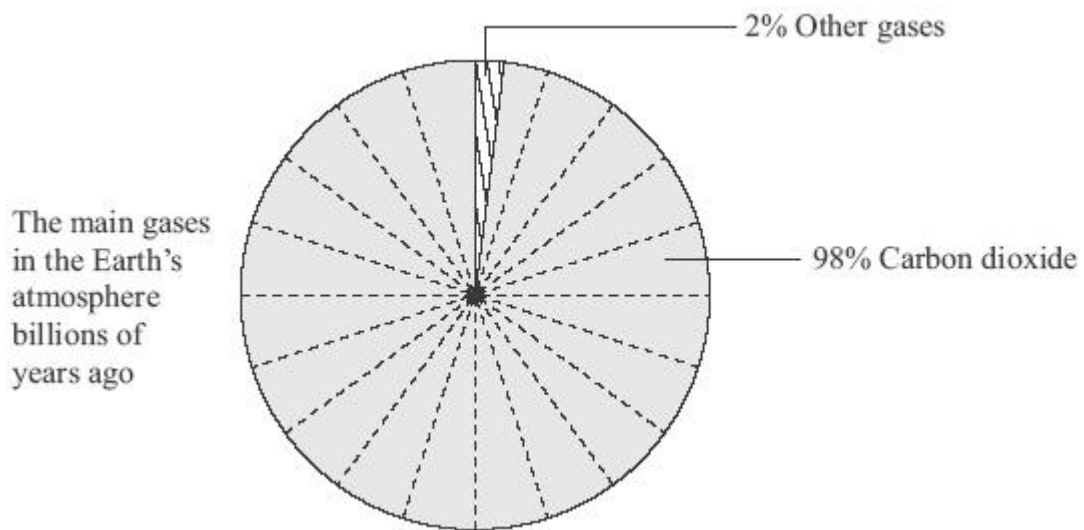
(1)

- (ii) Explain how propene molecules form a polymer. You should name the polymer formed.

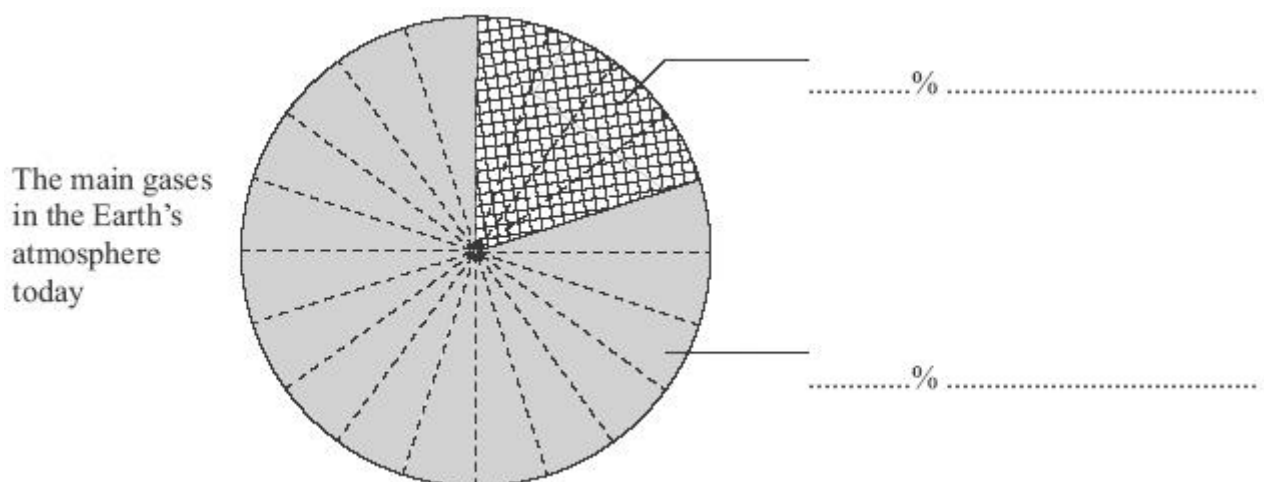
(3)
(Total 8 marks)

Q31.

Life on Earth would not exist without the atmosphere. Billions of years ago the composition of the Earth's atmosphere was very different from the composition today.



- (a) Label the pie chart below to show the percentages and names of the two main gases in the Earth's atmosphere today.



(2)

- (b) There is evidence that the composition of the Earth's atmosphere is still changing. One possible reason is that many power stations generate electricity by burning fossil fuels such as coal, oil or natural gas. Sulfur dioxide, SO_2 , is produced when coal burns in air.

(i) What environmental problem does sulfur dioxide cause?

(1)

(ii) How could this environmental problem be reduced in coal-fired power stations?

(1)

(iii) Gas-fired power stations burn methane, CH₄, in air.

Complete the word equation for this reaction.

methane + _____ → carbon dioxide + _____

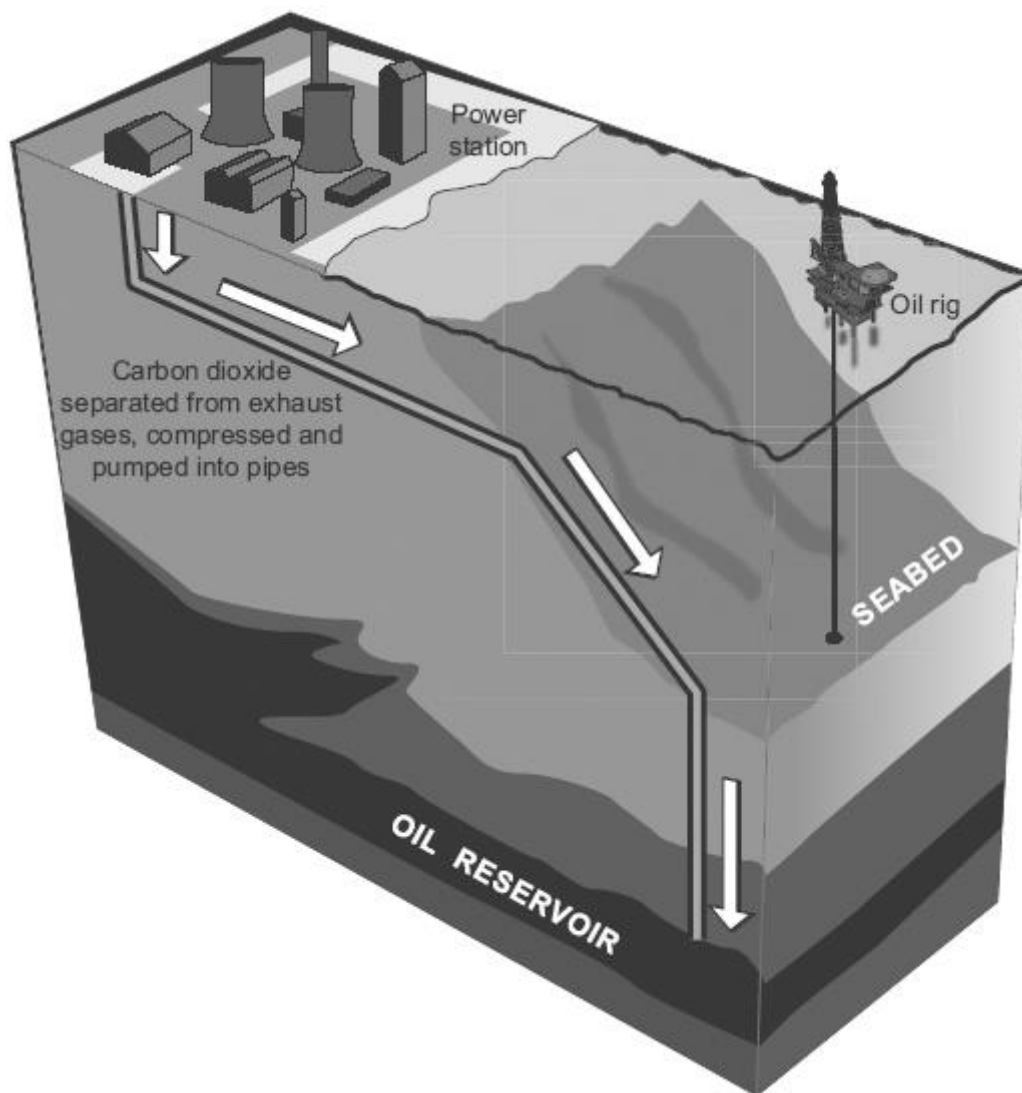
(2)

(c) Excess carbon dioxide should be prevented from entering the atmosphere.

Explain why.

(2)

(d) Carbon dioxide is produced when fossil fuels burn in power stations. The diagram represents one idea to prevent excess carbon dioxide from entering the atmosphere.



Use the diagram to explain how carbon dioxide can be prevented from entering the atmosphere.

(2)

(Total 10 marks)

Q32.

Crude oil is a natural resource from which useful fuels can be separated.

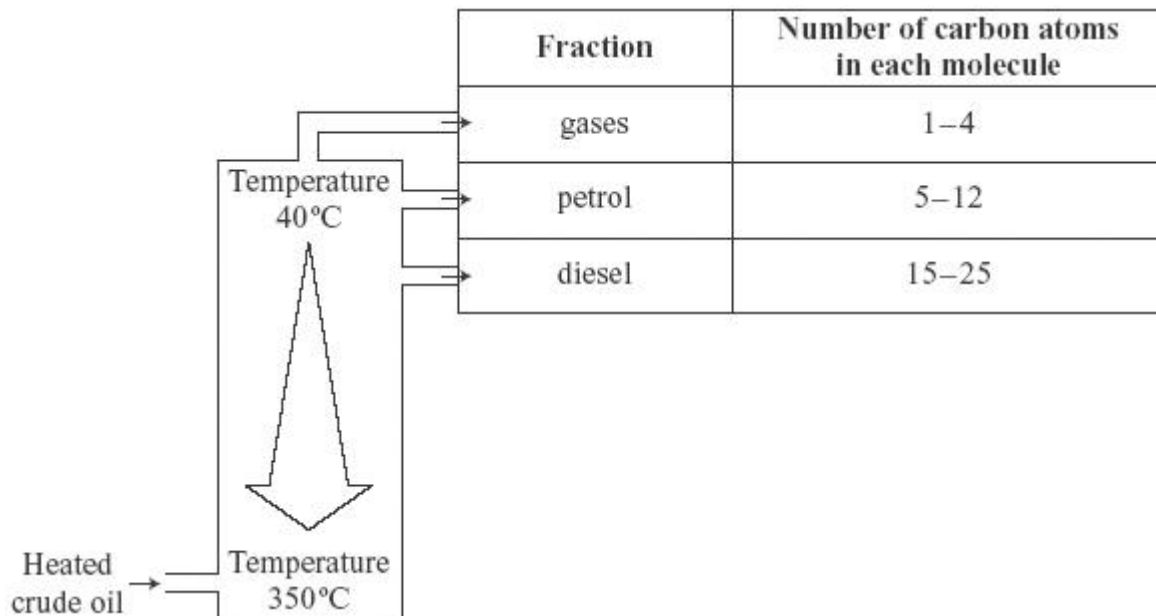
- (a) Crude oil is a mixture of hydrocarbons.

Complete the sentence about a hydrocarbon molecule.

A hydrocarbon molecule is made up of _____ and carbon atoms only.

(1)

- (b) Many fuels come from crude oil. Some of these fuels are shown in the diagram.



Suggest **two** properties of these fuels that allow them to be separated from crude oil.

(2)

(c) Fuels from crude oil burn to provide heat energy.

When a fuel burns, it combines with oxygen in the air and produces carbon dioxide and water. When there is not enough oxygen, the fuel burns and also produces carbon monoxide and carbon particles.

Draw a straight line from each substance that links it to a possible environmental problem.

One has been done for you.

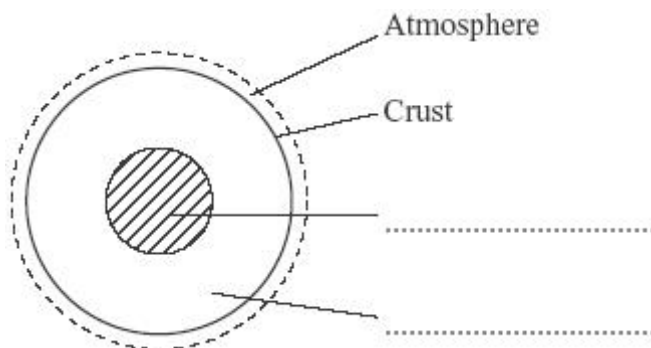
Substance	Possible environmental problem
Carbon dioxide	Causes global dimming
Carbon particles	Causes global warming
Crude oil	Non-polluting liquid
Water	Non-renewable resource
	Toxic gas

(3)
(Total 6 marks)

Q33.

The Earth is shaped like a ball and is surrounded by an atmosphere.

(a) The diagram shows the layered structure of the Earth.



Choose words from the box to complete the labels on the diagram.

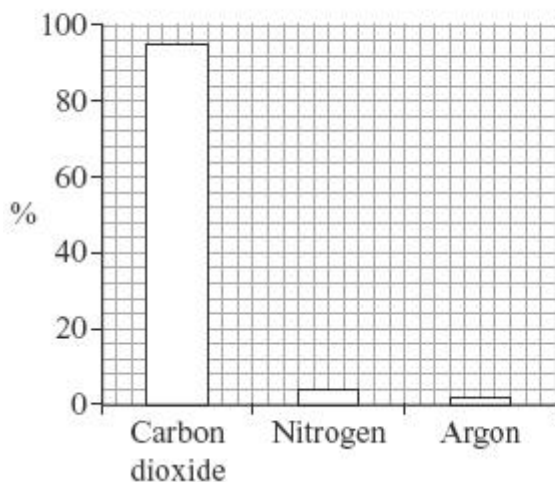
core mantle plate

(2)

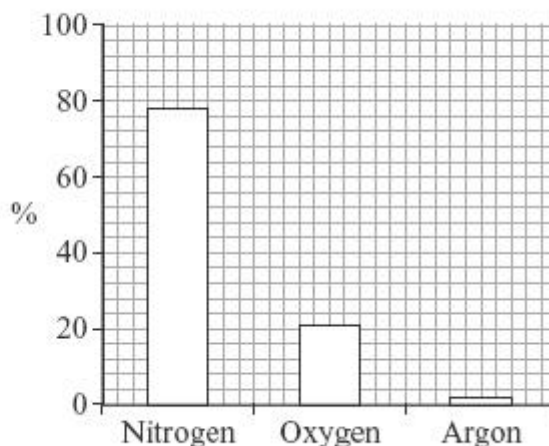
(b) Some theories suggest that the Earth's early atmosphere was like the atmosphere of Mars today.

The bar charts show the three most common gases in each atmosphere today.

The atmosphere of Mars today



The atmosphere of Earth today



- (i) Use the bar charts to complete the sentence by writing in the correct gases.

In the atmosphere of Mars today there is mainly _____ and no

_____.

(2)

- (ii) Use the bar charts to complete the sentence by writing in the correct number.

These theories suggest that there was about _____ % nitrogen in the Earth's early atmosphere.

(1)

- (iii) The atmosphere of the Earth today has much more nitrogen than in the early atmosphere. Denitrifying bacteria released most of this nitrogen into the atmosphere.

There are other differences between the Earth's early atmosphere and the atmosphere of the Earth today.

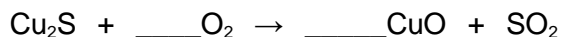
Use the bar charts to describe and explain **two** of these other differences.

(3)

(Total 8 marks)

Q34.

Copper is a widely used metal. The main ore of copper contains copper sulfide. Copper can be extracted from copper sulfide in a three stage process.



(1)

- (ii) Explain why there would be an environmental problem if the gas from this reaction were allowed to escape into the atmosphere.

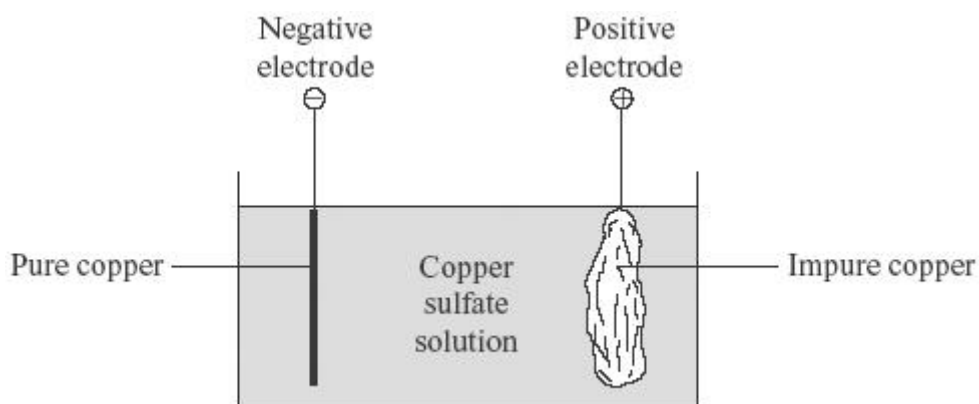
(2)

- (b) In the second stage copper oxide, CuO, is reduced using carbon.

Describe and explain what happens during this reaction.

(2)

- (c) During the third stage the copper can be purified as shown in the diagram.



- (i) What is the name of the type of process used for this purification?

(1)

- (ii) Give **one** use of purified copper.

(1)

- (d) Copper-rich ores are running out.

New ways of extracting copper from low grade ores are being researched.

Recycling of copper may be better than extracting copper from its ores.

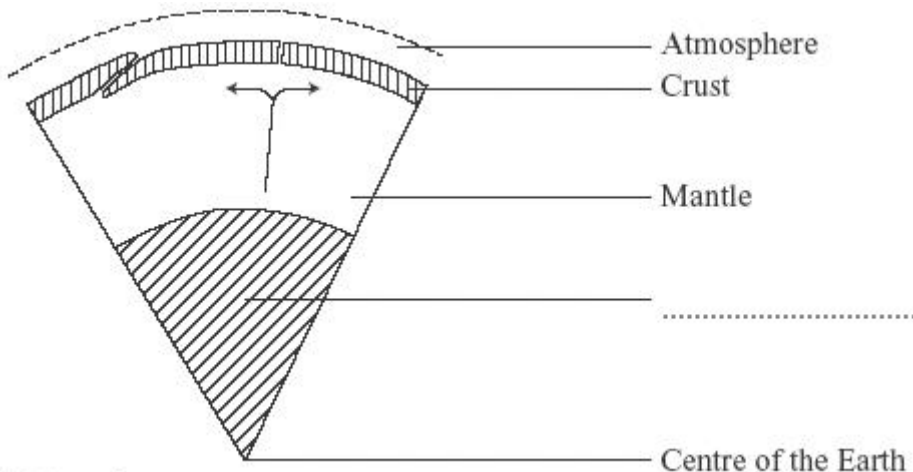
Explain why.

(3)
(Total 10 marks)

Q35.

The Earth is shaped like a sphere and is surrounded by an atmosphere.

(a) The diagram shows a section of the layered structure of the Earth.



Not to scale

(i) Complete the diagram by writing in the missing label.

(1)

(ii) Earthquakes within the Earth's crust can be sudden and disastrous. Scientists cannot accurately predict when earthquakes will occur.

Explain why.

To obtain full marks you must support your answer with a description of what causes earthquakes.

(4)

- (b) Some theories suggest that the Earth's early atmosphere was like the atmosphere of Mars today.

Gases	The atmosphere of Mars today	The atmosphere of Earth today
Carbon dioxide %	95	0.03
Nitrogen %	3	
Argon %	1.5	0.97
Oxygen %	0.5	21

- (i) Complete the table by writing in the percentage of nitrogen in the atmosphere of Earth today.

(1)

- (ii) Use the information in the table to describe the changes that have happened to **two** of the gases in the Earth's atmosphere.

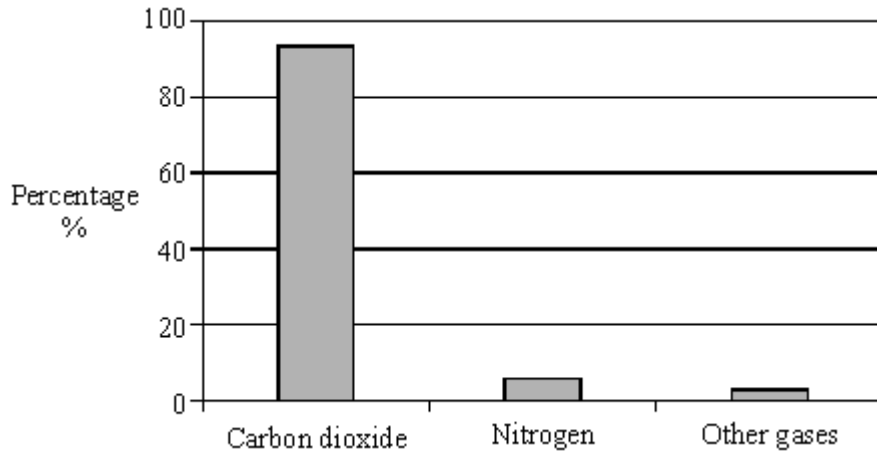
Explain what has caused these changes.

(4)

(Total 10 marks)

Q36.

The bar chart shows the percentage composition of the atmosphere on Mars.



(a) State **three** ways in which the atmosphere on Earth today is different from that on Mars.

- 1 _____

- 2 _____

- 3 _____

(3)

(b) The atmosphere on Earth may once have been like that on Mars. The evolution of green plants has changed the atmosphere on Earth.

Explain why.

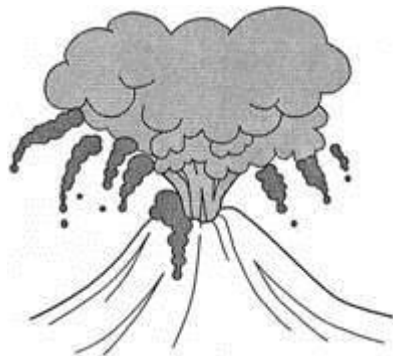
- _____
- _____
- _____
- _____

(2)

(Total 5 marks)

Q37.

(a) During the first billion years of the Earth's existence, there were many active volcanoes. The volcanoes released the gases that formed the early atmosphere.



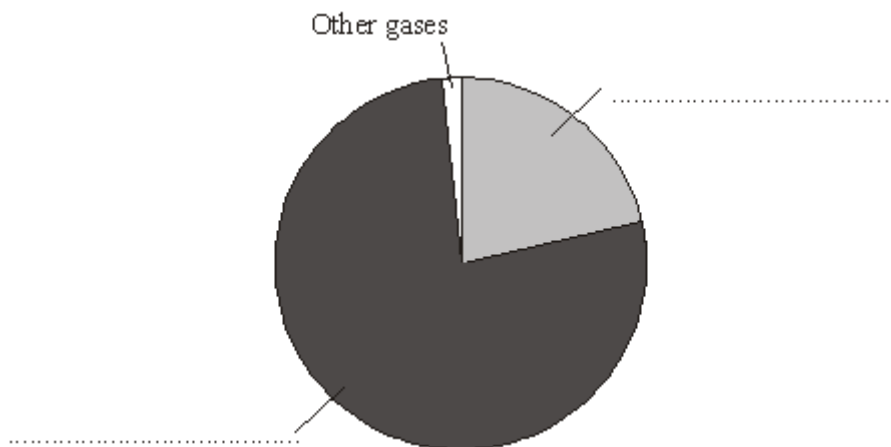
Describe how volcanoes caused the oceans to be formed.

(2)

(b) The atmosphere on Earth today is very different from the early atmosphere.

The pie chart shows the amounts of different gases in the air today. Choose gases from the box to label the pie chart.

argon carbon dioxide hydrogen nitrogen oxygen



(2)

(Total 4 marks)

Q38.

The table gives some data about four fuels, **A**, **B**, **C** and **D**.

Fuel	Cost in pence per 100 g	Energy in kJ per 100 g	Energy per penny in kJ	Gas (✓) formed on burning		
				Carbon	Sulphur	Water

(4)

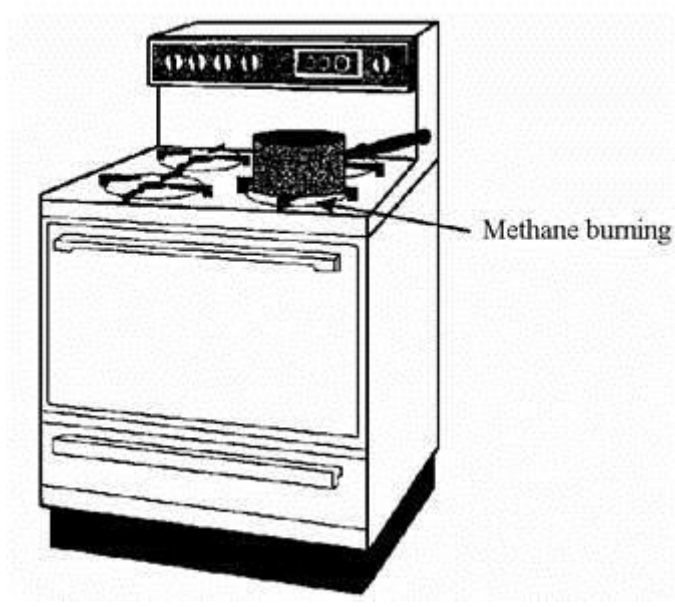
(b) The amount of carbon dioxide in the atmosphere has increased over the last one hundred years. Suggest **two** reasons why this has happened.

(2)

(Total 6 marks)

Q40.

Some gas cookers burn natural gas, methane. Methane, CH_4 , is a *hydrocarbon*.



(a) What is meant by *hydrocarbon*?

(2)

(b) When methane burns there must be a good supply of air.

(i) Complete the word equation by choosing the correct **two** chemicals from the box.

carbon dioxide	hydrogen	oxygen	water
----------------	----------	--------	-------

methane + oxygen → _____ + _____

(2)

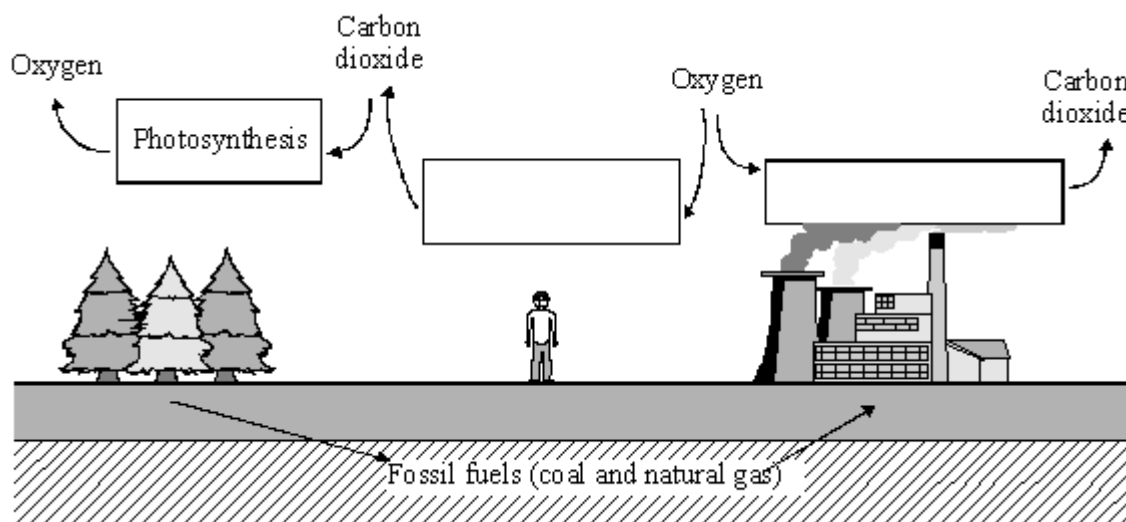
(ii) Without a good supply of air, carbon monoxide is formed. Why is carbon monoxide a dangerous gas?

(1)

(Total 5 marks)

Q41.

In the carbon cycle the amounts of carbon dioxide and oxygen in the air are changed by several processes.



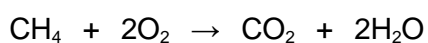
(a) The names of some processes are given in the box below.

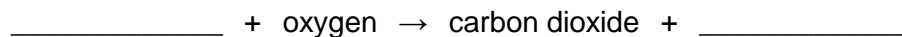
combustion	decomposition	neutralisation
photosynthesis	respiration	

Choose the correct process for each box in the diagram. The first one has been done for you.

(2)

(b) Fossil fuels, such as natural gas, react with oxygen.





Complete the word equation for this reaction

(2)

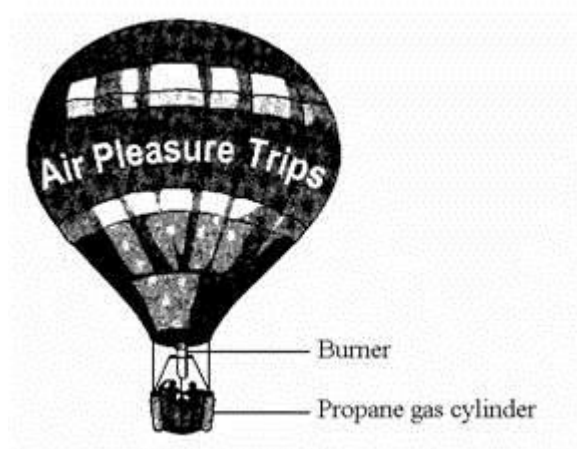
- (c) What problem is caused by the formation of large amounts of carbon dioxide?

(1)

(Total 5 marks)

Q42.

Hot air balloons are used mainly for pleasure trips.



- (a) Air is a mixture of gases. Complete the table. (Carbon dioxide has been done for you.)

Gas	Chemical formula	% in air
nitrogen		78
oxygen	O ₂	
argon		0.9
carbon dioxide	CO ₂	0.03

(3)

- (b) The air in the balloon is heated using a propane burner. Propane, C₃H₈, is a *hydrocarbon* that burns in air forming carbon dioxide, CO₂, and water, H₂O.

- (i) What does *hydrocarbon* mean?

(1)

- (ii) Which gas, in the air, reacts with propane when it burns?

_____ (1)

(iii) What type of chemical reaction happens when a hydrocarbon burns?

_____ (1)

(iv) The formation of more carbon dioxide causes global problems. Explain why.

(2)
(Total 8 marks)

Q43.

This question is about hydrocarbons.

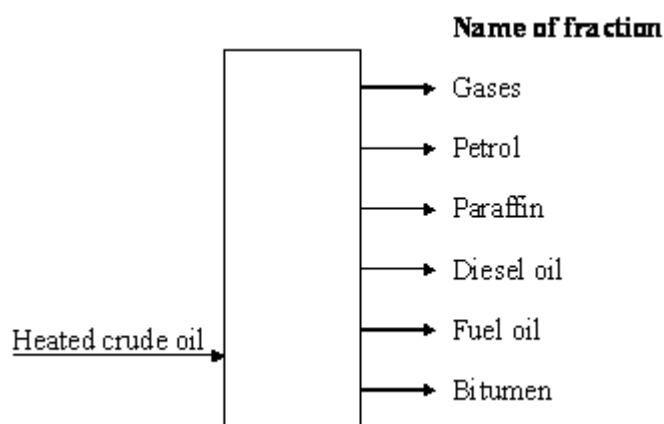
(a) Use **two** of the words in the box to complete the sentence.

air finite organic renewable sediment water

Crude oil is a mixture of hydrocarbons. It was formed from
_____ materials that were trapped in
_____ over a very long period of time.

(2)

(b) Petrol is separated from crude oil by fractional distillation.



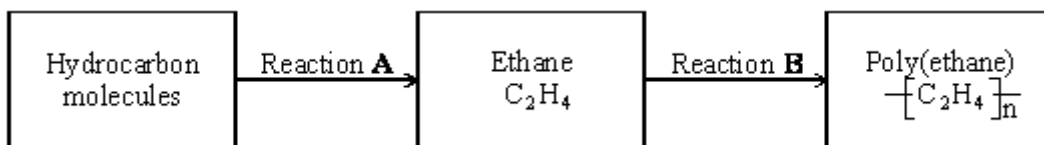
(i) Which fraction has the lowest boiling point?

(1)

(ii) Which fraction has the highest density?

(1)

- (c) Some of the fractions containing larger hydrocarbon molecules are used to make plastics, such as poly(ethene).



- (i) What type of chemical change is Reaction **A**?

(1)

- (ii) Explain what happens in Reaction **B**.

(2)

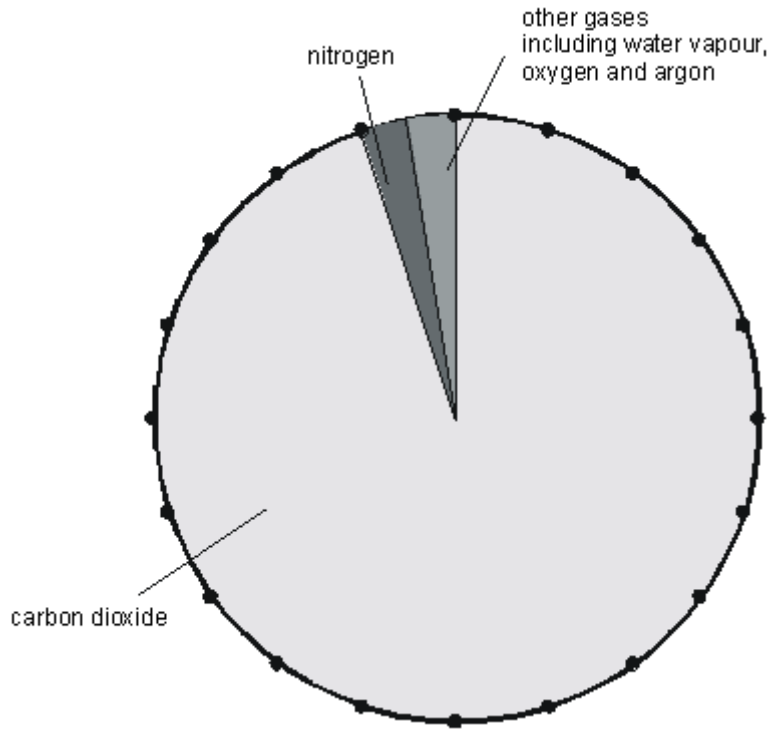
- (d) Natural gas contains the hydrocarbon called methane. Some water heaters use methane as a fuel. People could die from breathing the fumes produced by heaters that have not been checked and serviced. Explain how these fumes are produced and why they are dangerous.

(3)

(Total 10 marks)

Q44.

The pie chart below shows the composition of the atmosphere on the planet Mars.



- (a) Use the pie chart above to calculate the percentage of carbon dioxide in the atmosphere on Mars.

%

(2)

- (b) The atmosphere on Earth is very different from that on Mars. One important difference is that the Earth's atmosphere contains a large amount of oxygen.

Give **two** other ways in which the Earth's atmosphere is different from the atmosphere on Mars.

1. _____

2. _____

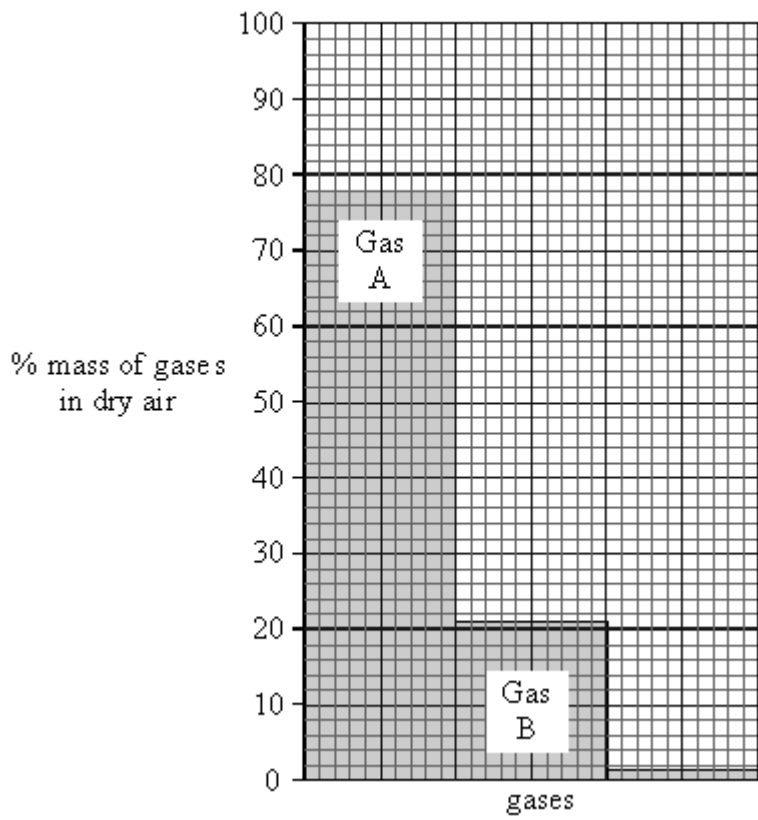
(2)

- (c) When the Earth was formed its atmosphere is thought to have been similar to the atmosphere on Mars. Explain how green plants and other organisms have changed the composition of the Earth's atmosphere.

(4)
(Total 8 marks)

Q45.

The bar chart below shows the percentage by mass of gases in dry air. Two of the gases are labelled as A and B.



What are the names of gas A and gas B?

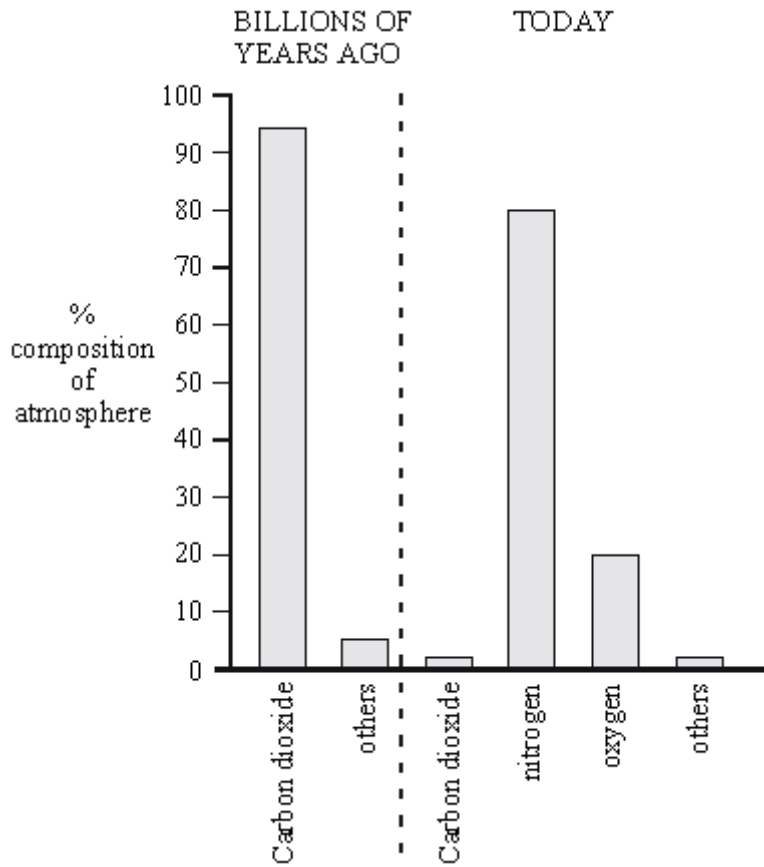
Gas A is _____

Gas B is _____

(Total 2 marks)

Q46.

The bar chart shows the composition of the Earth's atmosphere today, and as it was billions of years ago.



- (a) Use information from the bar chart to describe how the atmosphere today is different from the atmosphere of billions of years ago.

(2)

- (b) Describe the processes which have brought about the changes in the proportions of these gases in the air over billions of years.

(4)

(Total 6 marks)

Q47.

- (a) Burning fuels changes the Earth's atmosphere. The new substances produced are mainly gases.

The following is a list of types of reaction.

combustion

cracking

electrolysis

fermentation

neutralisation

reduction

Choose, from the list, the word which has the same meaning as burning.

(1)

- (b) The table shows the gases formed when four fuels, **A** to **D**, are completely burned in air.

FUEL	GAS FORMED ON BURNING		
	CARBON DIOXIDE CO ₂	WATER VAPOUR H ₂ O	SULPHUR DIOXIDE SO ₂
A	✓	✓	✗
B	✗	✓	✗
C	✓	✗	✗
D	✓	✓	✓

Which fuel, **A** to **D**, is hydrogen, H₂? _____

(1)

(Total 2 marks)

Q48.

For 200 million years the proportions of the different gases in the atmosphere have been much the same as today. Over the past 150 years the amount of carbon dioxide in the atmosphere has increased from 0.03% to 0.04%.

- (a) Describe how carbon dioxide is released into the atmosphere:

- (i) by human and industrial activity;

(2)

- (ii) from carbonate rocks by geological activity.

(2)

(b) Explain how the seas and oceans can decrease the amount of carbon dioxide in the atmosphere.

(3)

(c) (i) Give **one** reason why the amount of carbon dioxide in the atmosphere is increasing gradually.

(1)

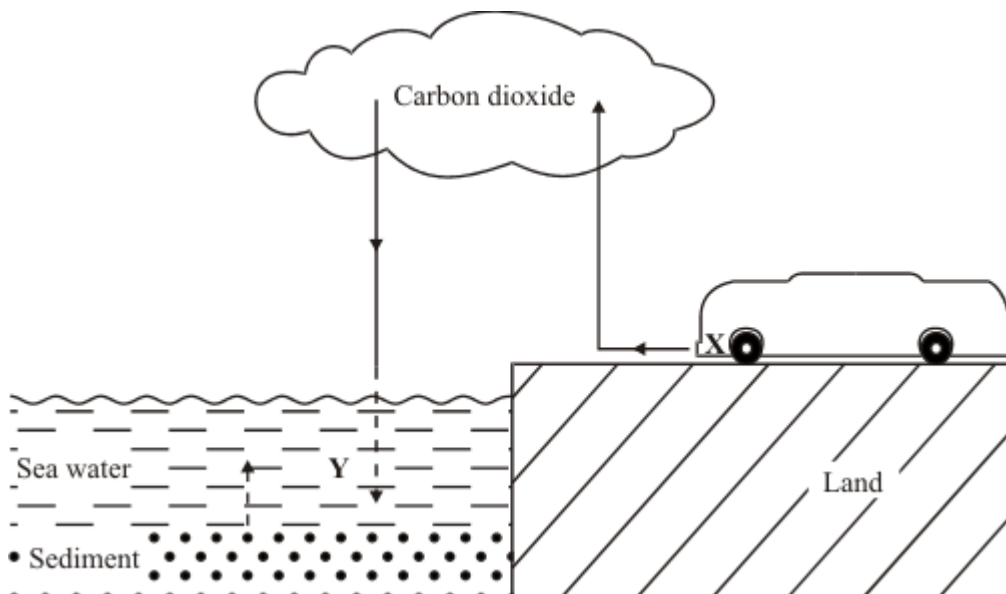
(ii) Give **one** effect that increasing levels of carbon dioxide in the atmosphere may have on the environment.

(1)

(Total 9 marks)

Q49.

The amount of carbon dioxide in the atmosphere is increased by reactions that occur in internal combustion engines (X) and is decreased by reactions in sea water (Y).



Describe, in as much detail as you can, the reactions which take place at **X** and **Y**.

(a) **X** _____

(2)

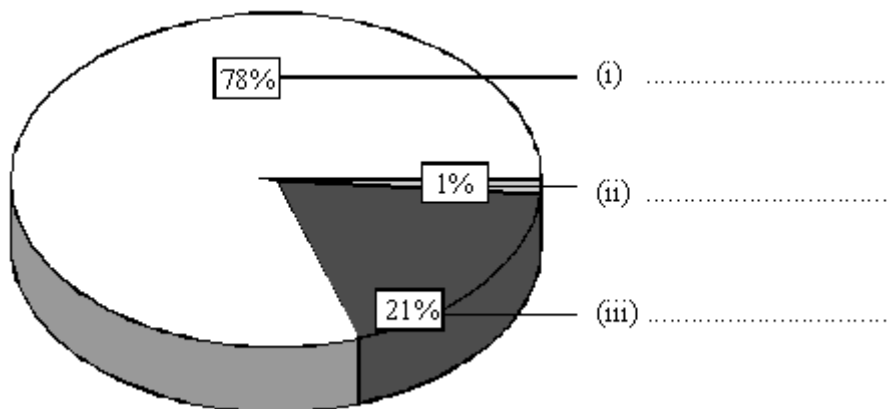
(b) **Y** _____

(3)

(Total 5 marks)

Q50.

(a) Air is a mixture of gases. The pie chart shows the percentages, by volume, of the main gases in dry air. Complete the chart by adding the names of these **three** gases.



(3)

(b) Complete each of the **four** spaces in the sentences by choosing the best word from the box.

condenses condensing evaporates evaporating
melts sea trees vapour

The air in the atmosphere above this country always contains _____ .

Most of this is the result of water _____ from the surface of the _____ . Some of it _____ to form millions of tiny drops of water in clouds.

(4)

- (c) Thousands of millions of years ago the Earth's early atmosphere was formed. Complete the following sentence.

The carbon dioxide in this early atmosphere probably came from _____
_____.

(1)

(Total 8 marks)

Q51.

Crude oil and natural gas are mixtures of hydrocarbons. They are obtained from wells drilled into rocks where they are trapped.

- (a) (i) What is the name of the process used to separate the different hydrocarbons in crude oil?

(1)

- (ii) Methane is one of the gases obtained when crude oil is separated.

Give the name of another hydrocarbon gas obtained from this process.

(1)

- (b) A fuel used in gas cookers is natural gas. It is mainly methane, CH₄.

- (i) Complete the word equation for the complete combustion of methane.

methane + oxygen → _____ + _____

(2)

- (ii) What different gas is produced by the incomplete combustion of methane?

(1)

(Total 5 marks)

Q52.

Read the passage, which is from the start of a magazine article. It will help you to answer the questions.

Third rock from the Sun

Geologists now have evidence that the Earth's crust began to form about four and a half billion years ago. The surface of the Earth was then at temperatures well above 100 °C and the atmosphere was mostly carbon dioxide with some ammonia, methane and water vapour. About a quarter of a billion years after it had first formed, the crust had become thicker and had cooled down to below 100 °C.

Slowly, over a period of about three billion years, oxygen became established in the

atmosphere. Some was released from the Earth's interior by volcanoes and some was produced, by the process of photosynthesis, by algae which had evolved in the seas.

- (a) Explain how the first seas formed.

(2)

- (b) Briefly describe **two** processes which reduced the proportion of carbon dioxide in the Earth's atmosphere over the period of three billion years.

1. _____

2. _____

(2)

(Total 4 marks)

Q53.

- (a) Apart from water vapour, two gases account for about 99% of the present atmosphere of our planet.

What are the names of these gases?

_____ and _____

(1)

- (b) Scientists now have evidence that, over three billion years ago, our planet's atmosphere was mostly a mixture of water vapour, carbon dioxide, methane and ammonia. Since then the mixture has gradually changed.

- (i) Suggest why there is now less water vapour in the atmosphere.

(2)

- (ii) Suggest why there is now less carbon dioxide in the atmosphere.

- (c) The following information suggests that the continents of Africa and South America were once joined together but then began to move apart.

Fossilised remains of a large fern-like plant called Glossopteris have been found in the rocks of the Carboniferous period in both Africa and South America.

Fossilised remains of a freshwater reptile called Mesosaurus have been found in the rocks of the Permian period in both Africa and South America.

No fossils of identical organisms have been found in the rocks of the Jurassic or the Cretaceous period in Africa or South America.

The following table gives the names of some of the periods in our planet's geological history.

Start of the period millions of years ago	Name of the period
2	Quaternary
65	Tertiary
136	Cretaceous
190	Jurassic
225	Triassic
280	Permian
345	Carboniferous
395	Devonian
435	Silurian
500	Ordovician
570	Cambrian

- (i) Use this information to suggest when Africa and South America began to move apart.

About _____ million years ago.

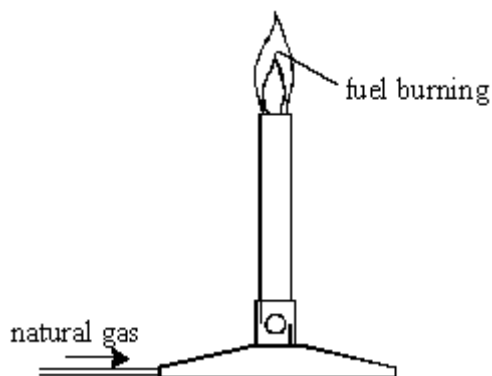
(1)

- (ii) What conditions were necessary for Africa and South America to move apart?

(3)
(Total 9 marks)

Q54.

Natural gas is a fuel.



(a) Complete these sentences.

When the fuel burns completely, we cannot see the new substances produced because

they are mainly colourless _____ .

The energy of the fuel is released as _____ .

(3)

(b) Choose words from this list to complete the sentence below.

carbon carbon dioxide hydrogen nitrogen
oxygen sulphur dioxide water vapour

Three gases which can be produced when fuels burn are:

1. _____

2. _____

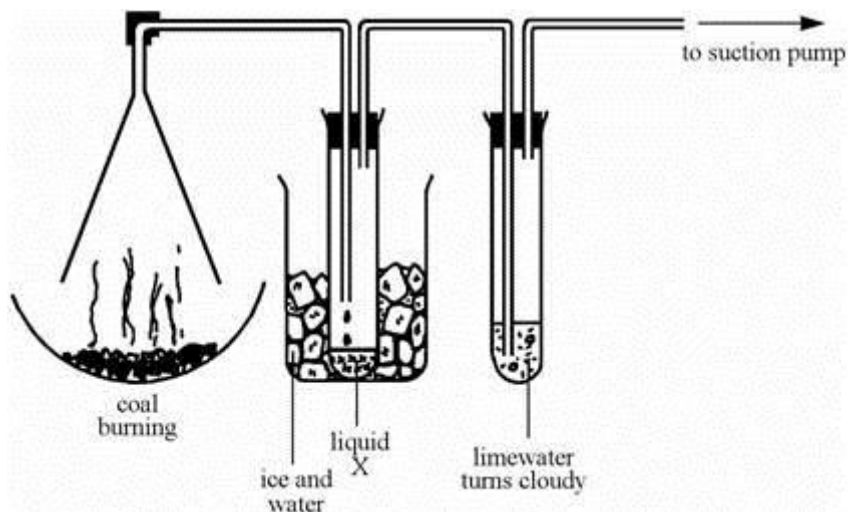
3. _____

(3)

(Total 6 marks)

Q55.

The gases produced when coal burns are cooled by ice and then bubbled through limewater.



(a) Complete these sentences.

- (i) The coal is reacting with _____ when it burns.
- (ii) During burning, elements in the coal are converted to compounds called _____

(2)

(b) Choose words from this list to complete the sentences.

carbon carbon dioxide sulphur sulphur dioxide
sodium water

- (i) Liquid X is a compound made from hydrogen and oxygen.
 It is called _____
- (ii) Sulphur dioxide is an acidic gas. It is given off when coal burns, because coal contains the element _____
- (iii) Most fuels are compounds of hydrogen and _____

(3)

(c) Burning coal is an exothermic reaction.

Explain what "exothermic" means.

(1)

(d) (i) Which gas turns limewater cloudy?

(ii) Which element in the coal is oxidised to form this gas?

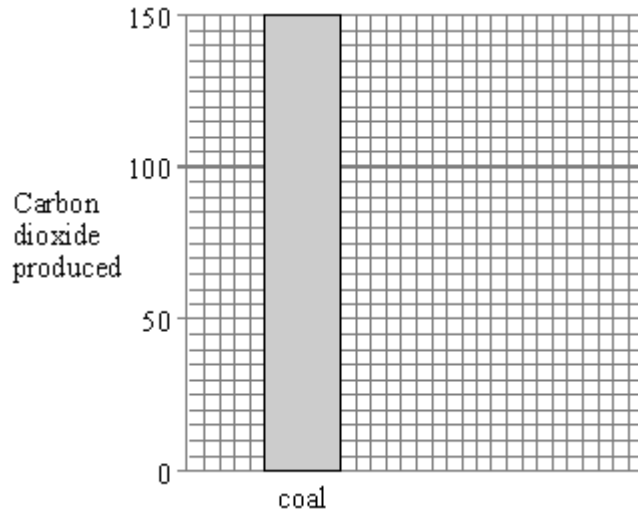
(2)

(Total 8 marks)

Q56.

The table shows how much carbon dioxide is produced when you transfer the same amount of energy by burning coal, gas and oil.

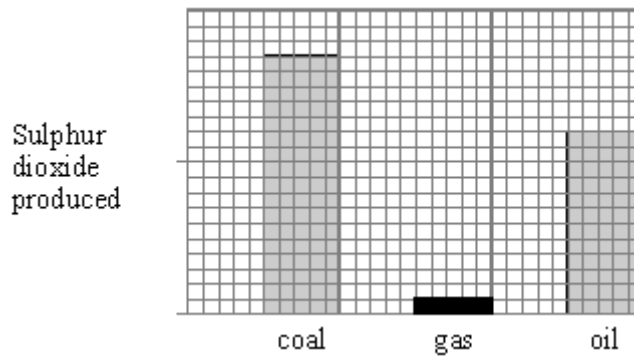
	Carbon dioxide (based on oil = 100)
coal	150
gas	75
oil	100



(a) Use the information from the table to complete the bar-chart.

(3)

(b) The second bar-chart shows how much sulphur dioxide is produced by burning the same three fuels.



Compare the amount of sulphur produced by burning gas with the amount produced by burning coal.

(2)

(c) (i) Coal and oil produce carbon dioxide and sulphur dioxide when they burn. What elements must they contain?

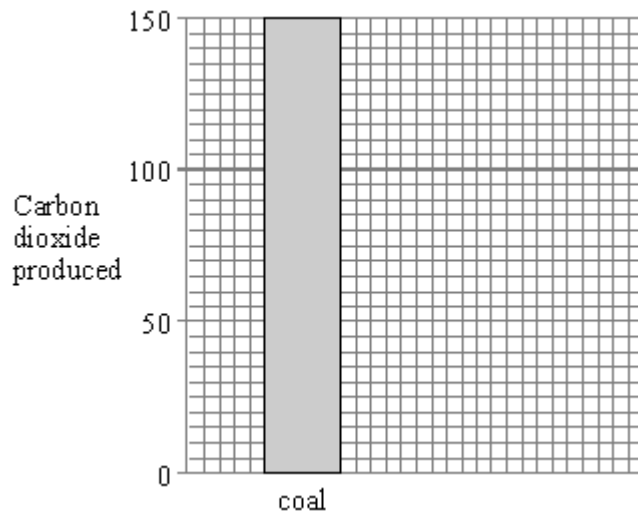
(2)

(ii) Burning fuels also produce nitrogen oxides, even though the fuels contain no nitrogen. Explain why this happens.

Q57.

The table shows how much carbon dioxide is produced when you transfer the same amount of energy by burning coal, gas and oil.

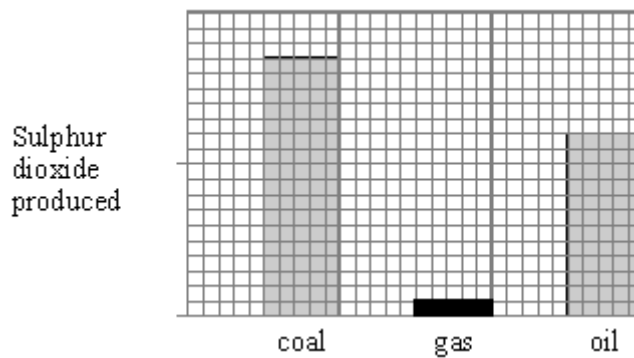
	Carbon dioxide (based on oil = 100)
coal	150
gas	75
oil	100



(a) Use the information from the table to complete the bar-chart.

(2)

(b) The second bar-chart shows how much sulphur dioxide is produced by burning the same three fuels.



Compare the amount of sulphur produced by burning gas with the amount produced by burning coal.

(1)

(c) Burning fuels also produces nitrogen oxides, even though the fuels contain no nitrogen. Explain why this happens.

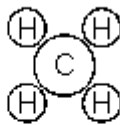
(2)

- (d) When you release the same amount of energy from coal, gas and oil, different amounts of carbon dioxide are produced.
Use the information below to explain why.

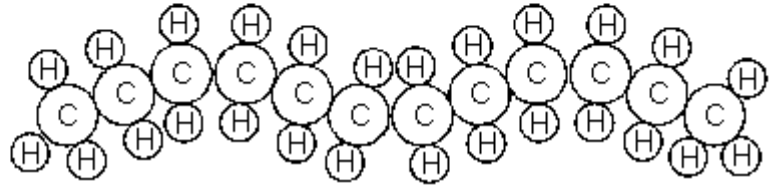
Coal is mainly
carbon



North Sea gas is
mainly methane



Oil is made from molecules similar to
the one shown



(3)

- (e) What other element do coal and oil usually contain?

(1)

(Total 9 marks)

