

## Questions

Q1.

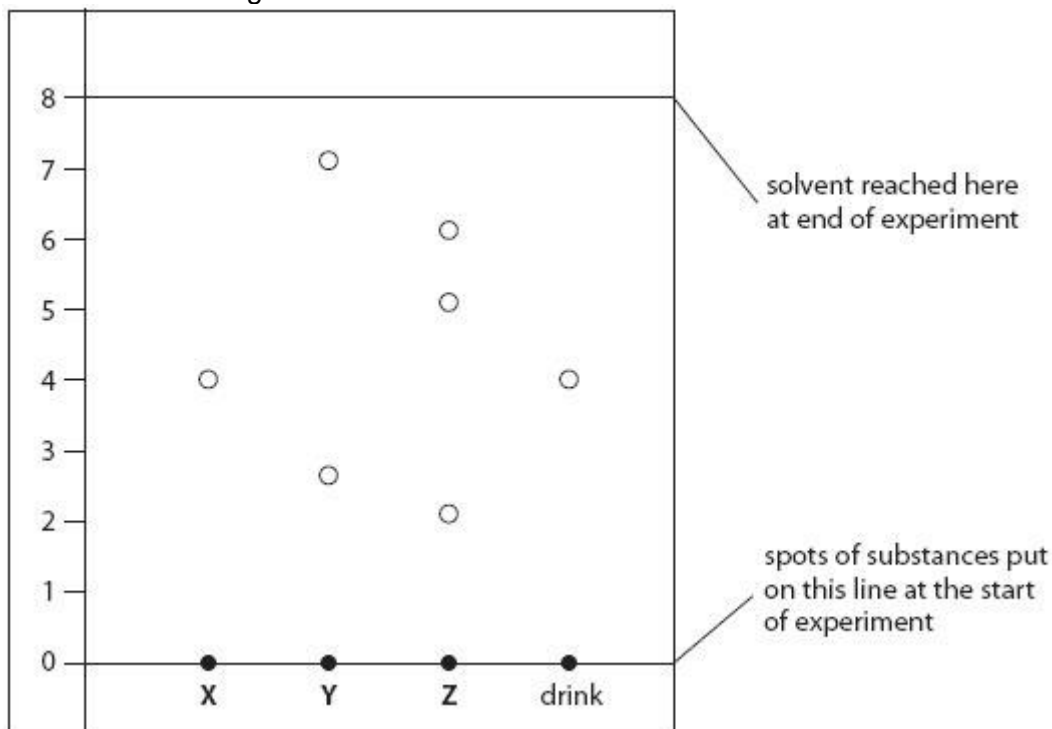
Some food colourings are a mixture of coloured substances. Paper chromatography can be used to separate the coloured substances in food colourings.

Charles carried out a chromatography experiment to test which food colouring was present in a coloured drink.

He used samples of three food colourings, **X**, **Y** and **Z**.

He also tested a sample of the colouring in the drink.

Charles obtained this chromatogram.



(i) Charles looked at the chromatogram to find out which food colourings contained more than one coloured substance.

State all the food colourings that contain more than one coloured substance.

(1)

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(ii) Food colouring **Y** is banned.

Explain how Charles can tell that the drink that he tested did **not** contain the banned food colouring.

(2)

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(iii) Calculate the  $R_f$  value for the coloured substance in food colouring **X**.

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$R_f =$  .....

**Q2.**

An atom of phosphorus contains 15 electrons.

Describe how these 15 electrons are arranged in a phosphorus atom.

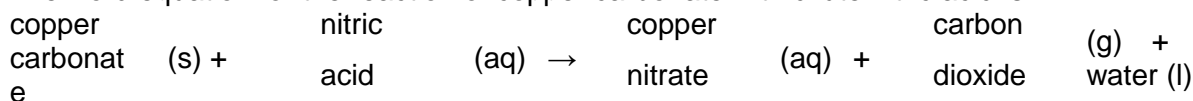
(2)

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**Q3.**

Acids also react with metal carbonates.

The word equation for the reaction of copper carbonate with dilute nitric acid is



(i) State **two** things you would **see** when solid copper carbonate reacts with dilute nitric acid.

(2)

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(ii) Write the balanced equation for the reaction of copper carbonate with dilute nitric acid.

(3)

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**Q4.**

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

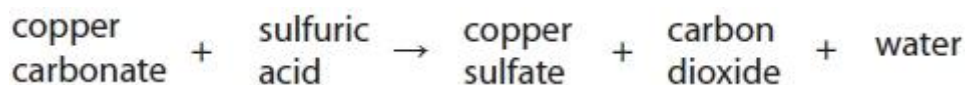
Acids are neutralised by metal hydroxides to form

(1)

- A salt only
- B salt and hydrogen only
- C salt and oxygen only
- D salt and water only

(ii) Acids can also be neutralised by metal carbonates.

Dilute sulfuric acid is neutralised by copper carbonate as shown in the word equation.



Copper carbonate is a green powder.

Describe what you would **see** when copper carbonate powder is added to dilute sulfuric acid.

(2)

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**Q5.**

Scrap iron can be recycled.

Explain an advantage of recycling scrap iron rather than extracting iron from iron compounds found in the Earth.

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**Q6.**

Lithium, sodium and potassium are metals in group 1 of the periodic table.

They are good conductors of heat and electricity.

The freshly-cut metals are shiny.

(a) (i) Give another physical property of all three of these metals.

(1)

(ii) Explain, in terms of electrons in their atoms, why lithium, sodium and potassium are in group 1 of the periodic table.

(2)

(b) A small piece of potassium is added to water.

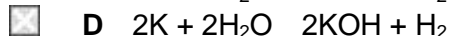
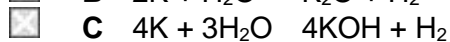
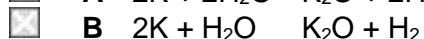
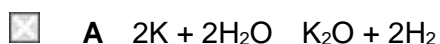
(i) Describe what you would **see** in this reaction.

(2)

(ii) Which of these is the balanced equation for this reaction?

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

(1)



(c) There is an increase in reactivity of these group 1 metals from lithium to potassium.

Explain this increase in reactivity.

(2)

**(Total for Question is 8 marks)**

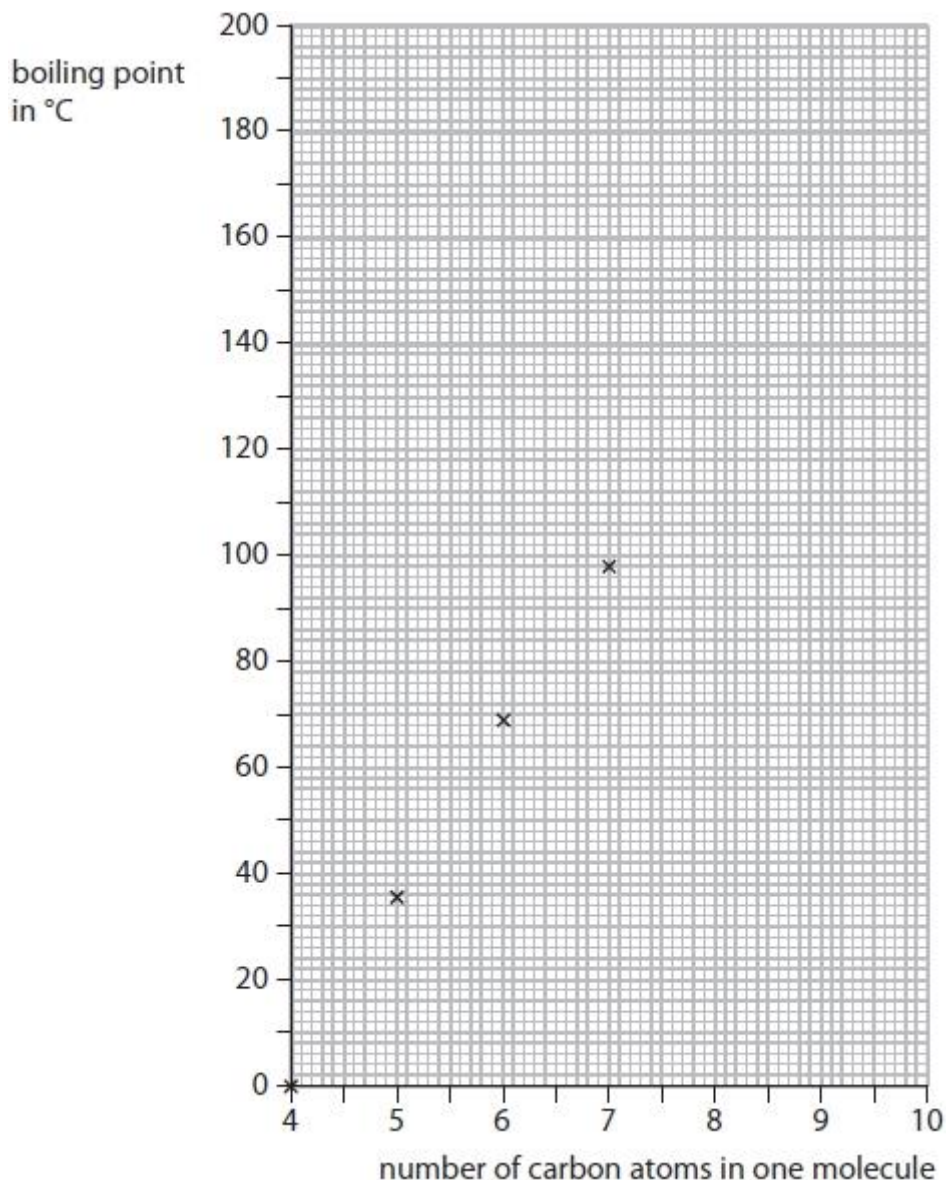
**Q7.**

The alkanes are hydrocarbons.

The table shows the number of carbon atoms per molecule and the boiling point for some alkanes.

alkane	number of carbon atoms in one molecule	boiling point (°C)
butane	4	0
pentane	5	36
hexane	6	69
heptane	7	98
octane	8	126
nonane	9	151

The boiling points for butane, pentane, hexane and heptane are plotted on the graph.



(i) Plot the boiling points for octane and nonane and draw the line of best fit.

(2)

(ii) Describe the trend shown by the line of best fit on the graph.

(2)

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(iii) Extend the line on your graph to estimate the boiling point of the alkane with ten carbon atoms in one of its molecules.

(2)

boiling point = .....

(iv) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

All alkanes

- A** have molecules containing oxygen atoms
- B** form a colourless mixture when shaken with bromine water
- C** can burn in a limited supply of air to form carbon monoxide
- D** have molecules that each have a C=C bond

**(Total for question = 7 marks)**

**Q8.**

- (a) Ethane and propane are both alkanes.  
 Ethene and propene are both alkenes.  
 (i) Which of the following statements about ethene is correct?  
 Put a cross (  ) in the box next to your answer.

- A** ethene can form a polymer  
 **B** ethene is a saturated hydrocarbon  
 **C** an ethene molecule has a double bond between two hydrogen atoms  
 **D** an ethene molecule contains four carbon atoms

(1)

(ii) Complete the table:

(3)

name	formula of molecule	structure of molecule
propene	C <sub>3</sub> H <sub>6</sub>	
		<pre>       H   H   H                 H — C — C — C — H                       H   H   H                     </pre>

(iii) Describe a test to show that a compound is an alkene rather than an alkane.

(2)

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\*(b) Many plastic bags are used by shoppers and then thrown away.  
 Most of these plastic bags are sent to landfill sites.  
 Two ways of reducing the amount of plastic in landfill sites are to recycle the plastic or to burn it.  
 Describe the possible environmental advantages and disadvantages of recycling and of burning plastics.

(6)

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**(Total for Question is 12 marks)**

**Q9.**

When ammonium nitrate crystals are dissolved in water, heat energy is taken in.  
A student puts some water in a beaker.  
He puts a thermometer in the water.  
He adds some ammonium nitrate crystals and stirs the mixture.  
Describe what the student would **see**.

(2)

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**Q10.**

Mendeleev's original periodic table is different from the modern periodic table.

An atom of argon contains 18 electrons, 22 neutrons and 18 protons.

(i) State the atomic number of argon.

(1)

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(ii) Argon is in group 0 of the periodic table.

Give the symbol of another element in the same group as argon.

(1)

.....

(iii) Which row of the table shows the correct relative charges of an electron, a neutron and a proton?

Put a cross (☒) in the box next to your answer.

(1)

relative charge of			
	electron	neutron	proton
<input checked="" type="checkbox"/> <b>A</b>	-1	+1	0
<input checked="" type="checkbox"/> <b>B</b>	+1	0	-1
<input checked="" type="checkbox"/> <b>C</b>	-1	0	+1
<input checked="" type="checkbox"/> <b>D</b>	0	-1	+1

(Total for question = 3 marks)

**Q11.**



The positions of five elements, **A**, **B**, **C**, **D** and **E**, are shown in the periodic table. These letters are not the atomic symbols of these elements.

1	2																3	4	5	6	7	0	
	<b>A</b>																			<b>D</b>		<b>E</b>	
	<b>B</b>																						
														<b>C</b>									

(c) An atom of element **E** has atomic number 10 and mass number 22.

(i) How many electrons does this atom contain?

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

- A** 10
- B** 12
- C** 22
- D** 32

(1)

(ii) 10% of the atoms in a sample of element **E** have a mass number of 22.

All the other atoms in this sample have a mass number of 20.

Calculate the relative atomic mass of element **E**.

(3)

relative atomic mass = .....

**Q12.**

(a) The table shows the number of electrons, neutrons and protons in particles P, Q, R, S, T and V.

particle	number of		
	electrons	neutrons	protons
P	1	0	1
Q	3	4	3
R	8	8	8
S	13	14	13
T	18	16	16
V	18	20	20

(i) Which particle is a negatively charged ion?

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

- A** P
- B** S
- C** T
- D** V

(1)

(ii) Which particles are atoms of metals?

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

- A** P and R
- B** Q and R
- C** Q and S
- D** Q, S and V

(1)

(b) Each element has an atomic number.

(i) State what is meant by **atomic number**.

(1)

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.....

(ii) The atomic number of boron is 5.

Boron exists as two isotopes boron-10 and boron-11.

Use this information to explain why boron-10 and boron-11 are isotopes.

(2)

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(c) (i) Explain what is meant by the term relative atomic mass.

(2)

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(ii) A sample of boron contains

19.7% of boron-10.

80.3% of boron-11.

Use this information to calculate the relative atomic mass of boron.

(3)

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**(Total for Question = 10 marks)**

**Q13.**

The atomic number of carbon is 6.

The atomic number of hydrogen is 1.

Draw a dot and cross diagram of a molecule of methane, CH<sub>4</sub>.

Show the outer shell electrons only.

(2)

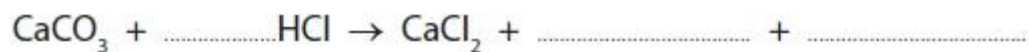
**Q14.**

Marble chips react with dilute hydrochloric acid.

Marble is a form of calcium carbonate.

(i) Complete the balanced equation for this reaction.

(2)



(ii) Explain how using smaller sized marble chips affects the rate of this reaction, when all the other conditions remain the same.

(2)

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(iii) Explain, in terms of collisions between particles, how increasing the concentration of the hydrochloric acid affects the rate of this reaction, when all the other conditions remain the same.

(2)

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**(Total for question = 6 marks)**

**Q15.**

Barium reacts with chlorine to produce barium chloride, BaCl<sub>2</sub>.

Write the balanced equation for this reaction.

(2)

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**Q16.**

(a) Barium sulfate contains

barium ions,  $\text{Ba}^{2+}$   
sulfate ions,  $\text{SO}_4^{2-}$

(i) Give the formula of barium sulfate.

(1)

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(ii) Give the meaning of the term **ion**.

(1)

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(b) This is an X-ray photograph of part of a patient's body.

Before the photograph was taken a suspension of barium sulfate was introduced into his body to show the required part.



Source: andi-sheba.blogspot.com

Many barium salts are toxic.  
Barium sulfate is insoluble in water.

Explain why it is safe for the patient to have barium sulfate in his body.

(2)

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\*(c) Barium sulfate is prepared by reacting barium chloride with sodium sulfate.  
The barium sulfate is formed as a precipitate.

Describe an experiment to prepare a pure, dry sample of barium sulfate, starting with barium chloride crystals and sodium sulfate crystals.

(6)

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(d) Barium reacts with chlorine to produce barium chloride,  $\text{BaCl}_2$ .

Write the balanced equation for this reaction.

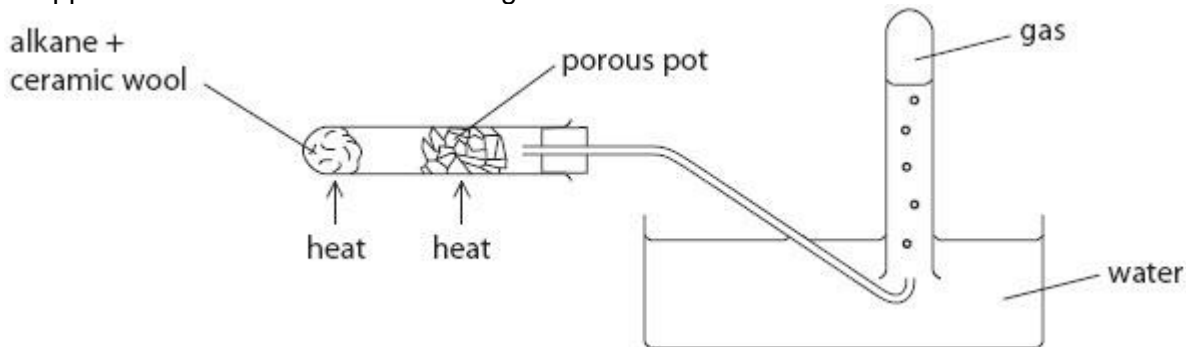
(2)

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**(Total for Question = 12 marks)**

**Q17.**

This apparatus is used to break down large alkane molecules into smaller alkane and alkene molecules.



What is the name of the process taking place in this apparatus?

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

- A burning
- B cracking
- C distillation
- D polymerisation

(1)

**Q18.**

The simplest ratio of aluminium atoms to chlorine atoms in aluminium chloride is 1 : 3.

The empirical formula of aluminium chloride is  $\text{AlCl}_3$ .

The simplest ratio of aluminium atoms to oxygen atoms in aluminium oxide is 2 : 3.

Give the empirical formula of aluminium oxide.

(1)

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**(Total for question = 1 mark)**

**Q19.**

Calculate the percentage by mass of nitrogen in ammonium nitrate,  $\text{NH}_4\text{NO}_3$ .

(relative atomic masses: H = 1.0, N = 14, O = 16)

(3)

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percentage by mass of nitrogen = ..... %

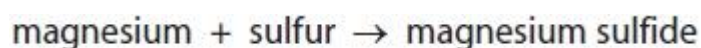
(Total for question = 3 marks)

**Q20.**

Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Magnesium reacts with sulfur to form magnesium sulfide



In magnesium sulfide 24 g of magnesium are combined with 32 g of sulfur.

The ratio of magnesium atoms to sulfur atoms in magnesium sulfide is

(relative atomic masses: Mg = 24, S = 32)

ratio of magnesium atoms : sulfur atoms	
<input type="checkbox"/> A	1 : 1
<input checked="" type="checkbox"/> B	1 : 2
<input type="checkbox"/> C	2 : 1
<input type="checkbox"/> D	3 : 4

(Total for question = 1 mark)

**Q21.**

One of the gases in today's atmosphere is carbon dioxide.

Carbon dioxide is detected by bubbling it through limewater.

A white precipitate forms in the test tube showing that the gas is carbon dioxide.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Limewater is a solution of

A hydrochloric acid

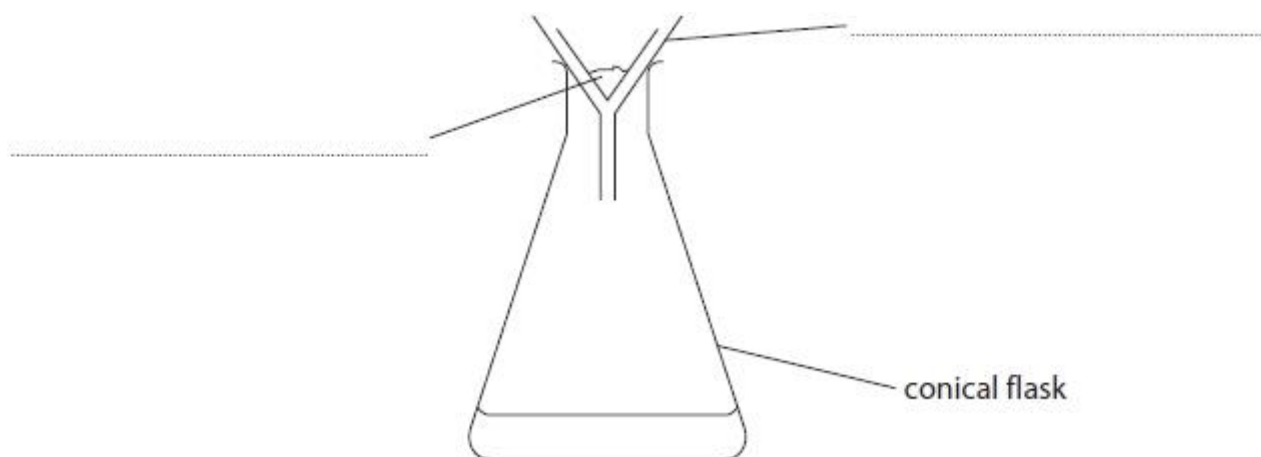
B calcium hydroxide

C sodium chloride

D sodium hydroxide

(ii) The white precipitate formed is filtered off.

The diagram shows the results of the filtration.



Complete the two labels on the diagram.

(2)

**(Total for question = 3 marks)**

**Q22.**

(a) Which of these shows the relative amounts of carbon dioxide and oxygen in the Earth's early atmosphere?

(1)

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

- A** large amount of carbon dioxide and large amount of oxygen
- B** large amount of carbon dioxide and small amount of oxygen
- C** small amount of carbon dioxide and large amount of oxygen
- D** small amount of carbon dioxide and small amount of oxygen

(b) The concentration of carbon dioxide in the Earth's atmosphere depends on the balance between the processes that remove carbon dioxide from the atmosphere and those that release carbon dioxide into the atmosphere.

(i) Explain how carbon dioxide is removed from the atmosphere.

(2)

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(ii) Explain how carbon dioxide is released into the atmosphere.

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(c) Describe the test to show that a gas is carbon dioxide.

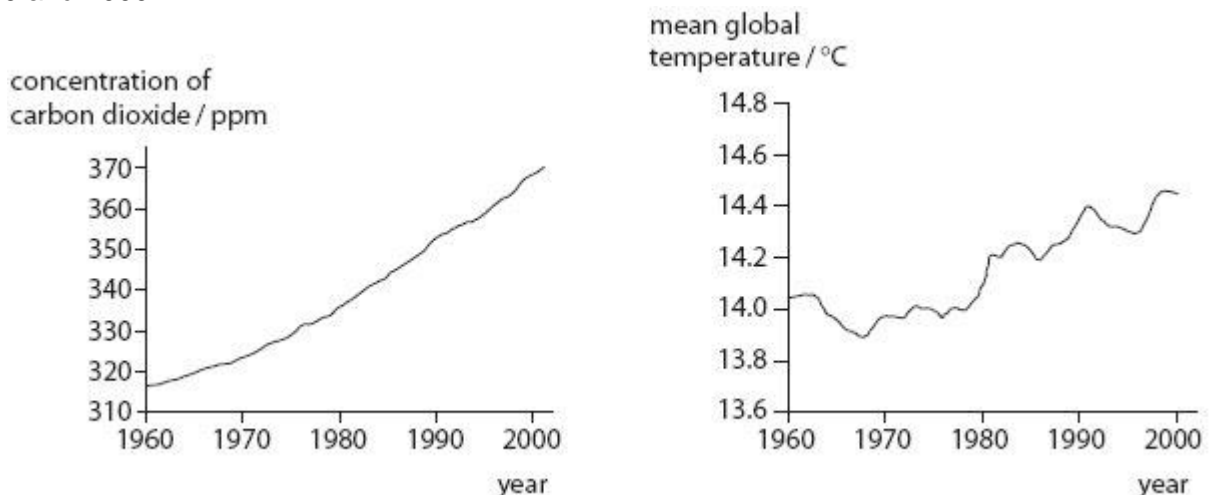
(2)

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(d) The graphs show the concentration of carbon dioxide in the atmosphere and the mean global temperature between 1960 and 2000.



Explain whether or not these graphs provide evidence that human activity is causing the Earth's

temperature to rise.

(3)

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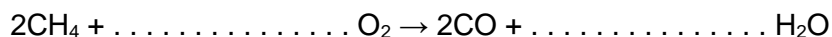
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**(Total for Question is 10 marks)**

**Q23.**

Carbon monoxide gas, CO, can be formed when methane, CH<sub>4</sub>, undergoes incomplete combustion.

(i) Balance this equation for the incomplete combustion of methane by putting numbers in the spaces provided.



(2)

(ii) Carbon monoxide is a toxic gas and can cause death.

Explain how carbon monoxide can cause death.

(2)

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**Q24.**

Chlorine gas reacts with sodium hydroxide solution to form sodium chlorate(I), NaOCl, sodium chloride and water.

Write the balanced equation for this reaction.

(3)

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**Q25.**

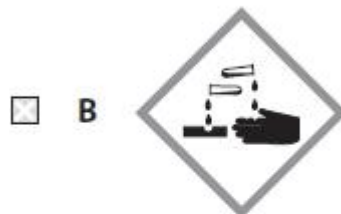
Chlorine, bromine and iodine are elements in group 7 in the periodic table.

(i) Chlorine is a toxic gas.

Which of the following hazard symbols would you expect to see on a container filled with chlorine?

Put a cross (☒) in the box next to your answer.

(1)



(ii) At room temperature, chlorine is a yellow-green gas and iodine is a grey solid.  
Describe the appearance of bromine at room temperature.

(2)

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(iii) Chlorine reacts with hydrogen to form hydrogen chloride.  
Hydrogen chloride dissolves in water to form a solution.  
Explain how this solution affects universal indicator.

(2)

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**(Total for question = 5 marks)**

Catalytic converters in the exhaust systems of cars contain catalysts.

(i) Explain what is meant by the term **catalyst**.

(2)

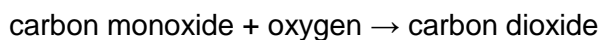
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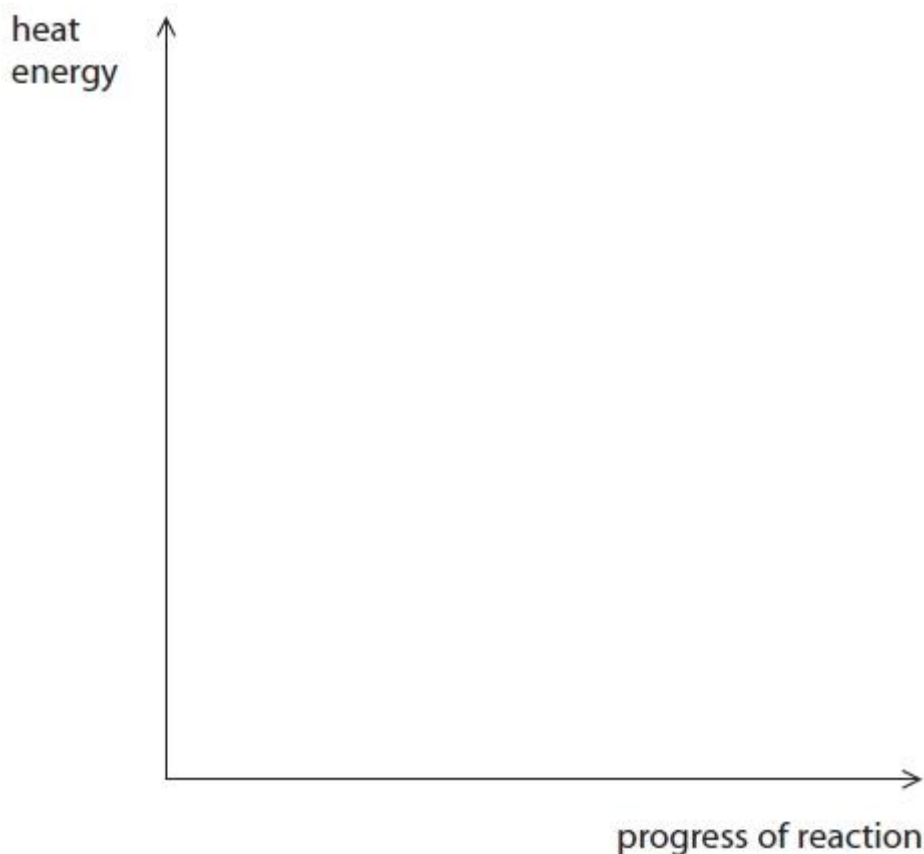
(ii) This reaction takes place in a catalytic converter



This reaction is exothermic.

On the axes below, draw labelled lines to show the relative energies of the reactants and products in this reaction.

(2)



(iii) Another reaction in a catalytic converter is the reaction of hydrocarbons with excess oxygen to form carbon dioxide and water.

Write the balanced equation for the reaction of the hydrocarbon heptane,  $C_7H_{16}$ , with excess oxygen.

(3)

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**Q27.**

Copper hydroxide, copper oxide and copper sulfide are three compounds of copper.

(i) In solution copper chloride,  $\text{CuCl}_2$ , reacts with potassium hydroxide,  $\text{KOH}$ , to form copper hydroxide,  $\text{Cu}(\text{OH})_2$ , and potassium chloride.

Write the balanced equation for this reaction.  
State symbols are not required.

(3)

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(ii) Copper hydroxide is formed as a precipitate.

Which state symbol would be used in the equation to show that copper hydroxide is a precipitate?  
Put a cross (☒) in the box next to your answer.

(1)

A (aq)

B (g)

C (l)

D (s)

**(Total for question = 4 marks)**

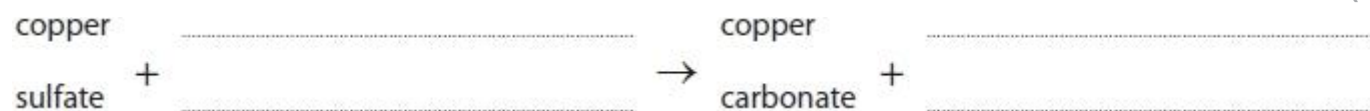
**Q28.**

Copper sulfate solution is added to sodium carbonate solution.

A green precipitate of copper carbonate is formed.

(i) Complete the word equation for this reaction.

(2)



(ii) Describe how to obtain a pure, dry sample of solid copper carbonate from the mixture.

(3)

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**(Total for question = 5 marks)**

**Q29.**

Potassium chloride contains potassium ions,  $K^+$ , and chloride ions,  $Cl^-$

(i) State the formula of potassium chloride.

(1)

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(ii) Explain how a chlorine atom,  $Cl$ , forms a chloride ion,  $Cl^-$ .

(2)

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**(Total for question = 3 marks)**

**Q30.**

Copper hydroxide, copper oxide and copper sulfide are three compounds of copper.

In an analysis of copper sulfide, 12.7 g of copper was found to be combined with 3.2 g of sulfur.

Calculate the empirical formula of the copper sulfide.

Show your working.

(relative atomic masses:  $Cu = 63.5$ ,  $S = 32$ )

(3)

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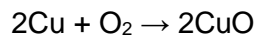
empirical formula = .....

**(Total for question = 3 marks)**

**Q31.**

Copper hydroxide, copper oxide and copper sulfide are three compounds of copper.

Copper reacts with oxygen to form copper oxide.



Calculate the maximum mass of copper oxide that could be formed by reacting 25.4 g of copper with excess oxygen.

(relative atomic masses: O = 16, Cu = 63.5;  
relative formula mass: CuO = 79.5)

(2)

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maximum mass of copper oxide = ..... g

**(Total for question = 2 marks)**

**Q32.**

One product obtained when hydrocarbons burn in air is carbon dioxide.

Describe a test to show that a gas is carbon dioxide.

(2)

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**Q33.**

Ethane, C<sub>2</sub>H<sub>6</sub>, is present in crude oil.

Write the balanced equation for the complete combustion of ethane.

(3)

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**Q34.**

The complete combustion of fossil fuels releases gases into the atmosphere.

Explain how these gases could cause an increase in the temperature of the Earth.

(2)

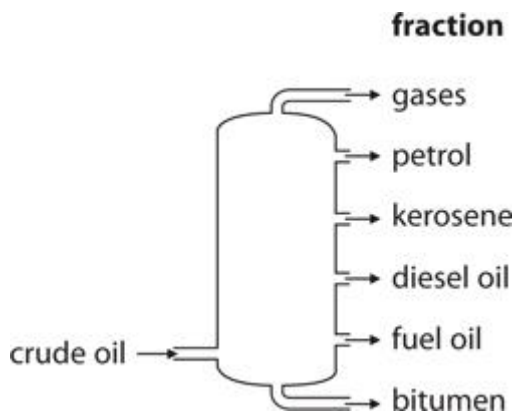
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**Q35.**

Fractional distillation is used to separate crude oil into fractions.

A fractionating column is used for the process.

The diagram shows a fractionating column and the fractions obtained when crude oil is fractionally distilled.



Some fractions obtained from crude oil are cracked to produce alkenes.

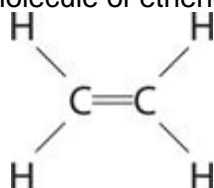
(i) Explain what is meant by **cracking**.

(2)

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(ii) One alkene obtained is ethene.

The diagram shows the structure of a molecule of ethene.



Ethene is unsaturated.

Ethene is a hydrocarbon.

Explain why ethene is described as an **unsaturated hydrocarbon**.

(3)

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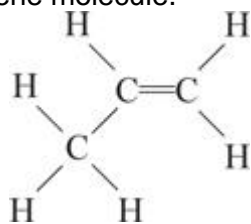
(iii) Describe what you would **see** when a sample of ethene is shaken with bromine water.

(2)

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**Q36.**

The diagram shows the structure of a propene molecule.



Propene can form the polymer poly(propene).

Draw a diagram to show the part of a poly(propene) molecule formed from two propene molecules.

(2)

**Q37.**

Chlorine is an element in group 7 of the periodic table.

Chlorine, Cl<sub>2</sub>, is a simple molecular, covalent substance.

The atoms in a molecule of chlorine are held together by a covalent bond.

(i) Explain what is meant by the term **covalent bond**.

(2)

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(ii) Phosphorus reacts with chlorine to form phosphorus trichloride, PCl<sub>3</sub>.

A phosphorus atom has five electrons in its outer shell.

A chlorine atom has seven electrons in its outer shell.

Draw the dot and cross diagram to show the bonding in a molecule of phosphorus trichloride, PCl<sub>3</sub>.  
Show outer electrons only.

(2)

(iii) Aluminium reacts with chlorine to form aluminium chloride,  $\text{AlCl}_3$ .

Write the balanced equation for this reaction.

(2)

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**(Total for question = 6 marks)**

**Q38.**

14.3 g of an oxide of copper contained 12.7 g of copper.

Calculate the empirical formula of this oxide.

Show your working.

(Relative atomic masses: Cu = 63.5, O = 16)

(3)

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answer = .....

**Q39.**

Copper nitrate contains copper ions,  $\text{Cu}^{2+}$ , and nitrate ions,  $\text{NO}_3^-$ .

(i) Describe, in terms of electrons, how a copper atom, Cu, becomes a copper ion,  $\text{Cu}^{2+}$ .

(2)

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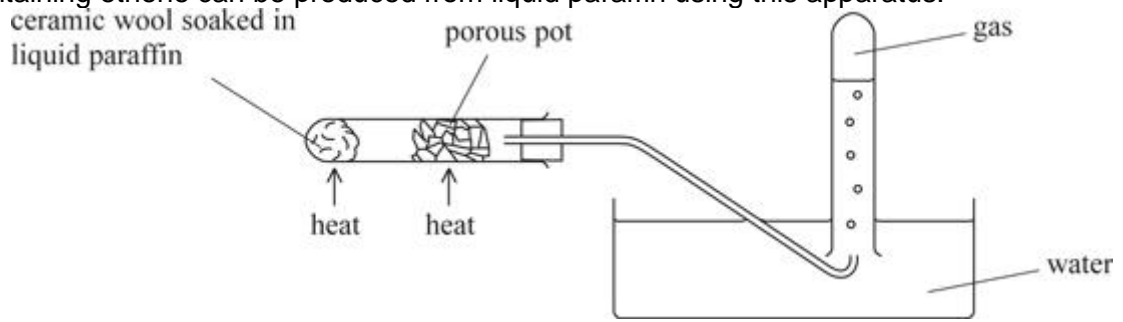
(ii) Write the formula for copper nitrate.

(1)

.....

**Q40.**

A gas containing ethene can be produced from liquid paraffin using this apparatus.



Describe how liquid paraffin becomes ethene in this experiment.

(3)

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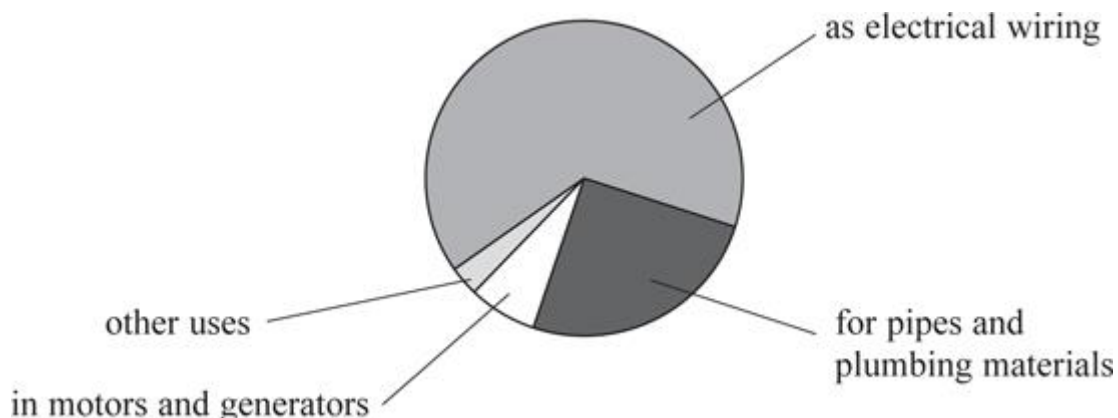
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**Q41.**  
**Metals**

The pie chart shows the main uses of copper.



(a) Use the pie chart to give the biggest use for copper.

(1)

(b) Copper can be extracted from a naturally occurring substance called malachite. State the name given to naturally occurring substances from which metals are extracted.

(1)

(c) Overhead power cables supported on pylons are used to carry electricity.



The table shows information about three metallic substances.

metallic substance	density / kg m <sup>-3</sup>	cost per tonne / £	relative strength	relative ability to conduct electricity	relative resistance to corrosion
copper	8920	5279	high	very good	good
aluminium	2700	1425	high	good	good
steel	7820	505	very high	good	poor

(i) The pylons are made of steel.

Use information from the table to explain which properties of steel make it the most suitable of these three metals for the pylons.

(2)

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 .....  
 .....



