

# Chemistry Revision Material

## CORE

### TOPICS 1-9

**Topic 1** ATOMIC STRUCTURE AND ELEMENTS

**Topic 2** THE PERIODIC TABLE

**Topic 3** COMPOUNDS

**Topic 4** RATES OF CHEMICAL CHANGE

**Topic 5** USING CHEMICAL REACTIONS

**Topic 6** ACIDS, BASES AND SALTS

**Topic 7** NANOTECHNOLOGY

**Topic 8** PRODUCTION AND USE OF FUELS

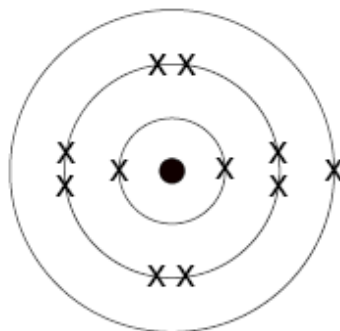
**Topic 9** THE ATMOSPHERE

**1. ATOMIC STRUCTURE and ELEMENTS**

**Candidates should:**

- (a) know that atoms consist of a central nucleus containing protons and neutrons surrounded by 'orbiting' electrons
- (b) use data, given in the form  ${}_{11}\text{Na}$ , to represent the electronic structure of elements with atomic numbers 1 to 20 inclusive, in the following form: (w(i)a)

for sodium



- (c) understand that elements are the basic building blocks of all substances and cannot be broken down into simpler substances by chemical means.
- (d) use data to establish the relationship between electronic structure and the position of the element in the first three rows of the modern periodic table (w(i)a)
- (e) be aware that MendeléeV, in developing the modern form of the periodic table, observed recurring patterns in the properties of elements when arranged in order of increasing relative atomic mass, but used creative thought to realise that he needed to leave gaps for elements that had not been discovered at that time; this enabled him to predict the properties of the undiscovered elements (w(i)b,c;(iv)c)



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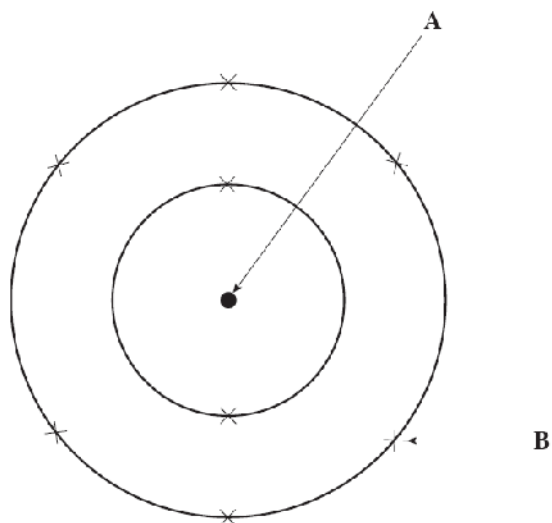
**NAME:** \_\_\_\_\_

**Topic 1: Atomic Structure and Elements**

<b>Use traffic lights to assess what you know now, and again at the end of this topic</b>	<b>Start</b>	<b>End</b>
1) I can draw and label an atom, showing the nucleus, protons, neutrons and electrons		
2) I understand the term mass number		
3) I understand the term atomic number		
4) I can use given data eg ${}_{11}\text{Na}$ , to calculate the number of electrons in an atom		
5) I understand that electrons are arranged in shells or orbits around the nucleus		
6) I know how many electrons can occupy each shell		
7) I can give the electron arrangement for elements 1-20 and represent them in a diagram		
8) I know the definition of an element		
9) I can place an element into the correct position in the first three rows of the periodic table by using data about its electronic structure		
10) I know that Mendeleev developed the modern form of the periodic table		
11) I know that Mendeleev observed recurring patterns in the properties of elements when arranging the elements in order of increasing relative atomic mass, when developing the periodic table		
12) I know that Mendeleev left gaps for undiscovered elements and was able to predict the properties of these elements		

Answer all questions.

1. (a) The diagram below shows an atom of oxygen.

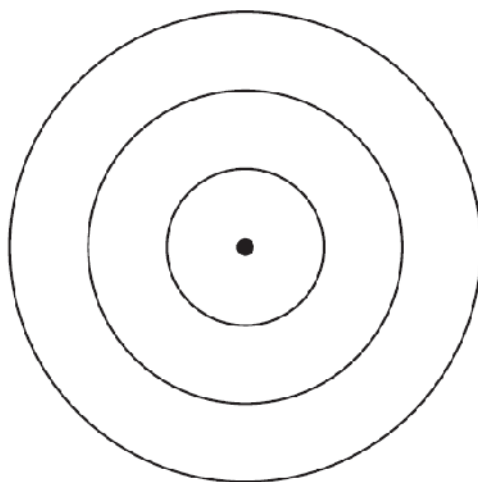


Use the words in the box below to complete the following sentences.

electron	neutrons	nucleus	protons
----------	----------	---------	---------

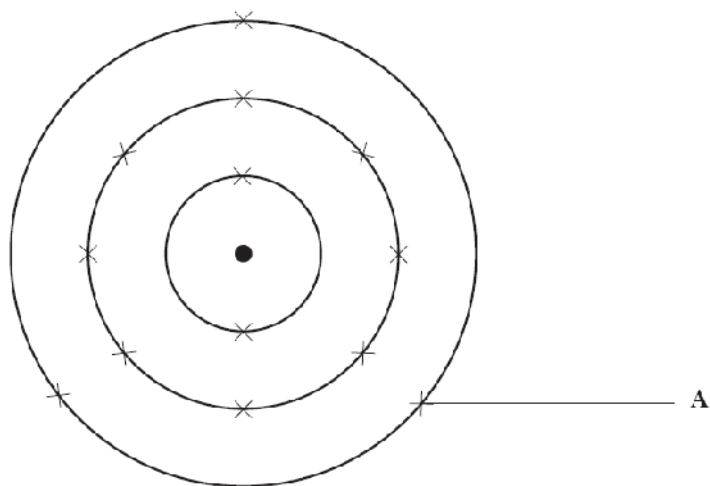
- (i) The centre of the atom, labelled **A**, is called the ..... [1]
- (ii) The centre of the atom contains  
..... and ..... [2]
- (iii) The particle labelled **B** is an ..... [1]
- (b) The chemical formula of sodium sulphate is  $\text{Na}_2\text{SO}_4$ .
- (i) State how many sulphur atoms are present in the formula,  $\text{Na}_2\text{SO}_4$ . ..... [1]
- (ii) Give the **total** number of atoms shown in the formula. .... [1]

7. (a) Use the **data** and **key** on the Periodic Table of Elements, shown on the **back page** of the examination paper, to complete the following sentences.
- (i) The chemical **symbol** for the smallest atom in Group 1 is ..... [1]
- (ii) The element with the atomic number 12 is ..... [1]
- (iii) The element which has the electronic structure 2, 8, 8 is ..... [1]
- (iv) The element which is in Group 4 and Period 3 is ..... [1]
- (b) Using **X** to represent an electron, complete the following diagram to show the electronic structure for an atom of sodium. [1]



Answer **all** questions.

1. (a) The following diagram shows an atom of aluminium.



2	3	8	13	27
---	---	---	----	----

- (i) Use only the numbers from the box above to complete the following sentences.

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

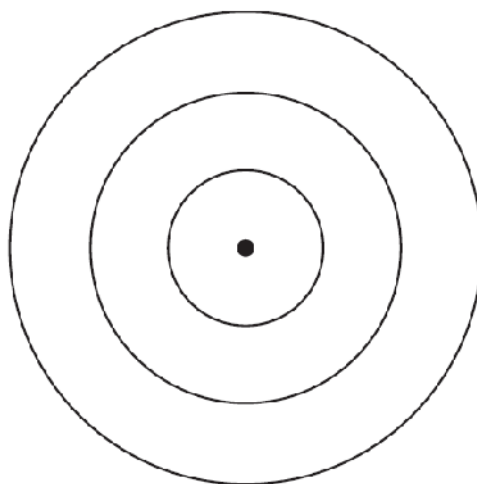
- I. The electronic structure for an atom of aluminium is 2,8, ..... [1]
- II. Aluminium can be found in Group ..... of the Periodic Table of Elements. [1]
- III. The atomic number of aluminium is ..... [1]
- IV. Aluminium can be found in Period ..... of the Periodic Table of Elements. [1]

- (ii) The box below shows particles found in atoms. Choose a particle from this box to complete the following sentence.

electron	neutron	proton
----------	---------	--------

The ..... is the particle labelled A in the diagram. [1]

7. (a) Use the **data** and **key** on the Periodic Table of Elements shown on the **back page** of this **examination paper** to complete the following sentences.
- (i) The chemical symbol for phosphorus is ..... [1]
  - (ii) The element with the atomic number 10 is ..... [1]
  - (iii) The element which has the electronic structure 2, 8, 6 is ..... [1]
  - (iv) The element which is in Group 3 and Period 2 is ..... [1]
- (b) Using **X** to represent an electron, complete the following diagram to show the electronic structure for an atom of magnesium. [1]



**2. THE PERIODIC TABLE.**

- (a) use and interpret given data to distinguish between metals and non-metals (w(i)a)
- (b) use data about the physical properties of elements in Group 1 and Group 7 to establish trends within each group and to make predictions based on these trends (w(i)a)
- (c) investigate the chemical reactions of Group 1 elements with oxygen in the air, with water and with Group 7 elements, by observation or using secondary sources, in order to draw conclusions about patterns of similarity and difference within the group and be able to write and interpret word and balanced symbol equations for the reactions (w(i)a)
- (d) investigate the displacement reactions of Group 7 elements in order to establish the trend in reactivity within the group, be able to make predictions based on this trend and write and interpret word and balanced symbol equations for the reactions (w(i)a)
- (e) be able to use flame tests and silver nitrate solution to distinguish between sodium chloride, sodium iodide, potassium chloride and potassium iodide
- (f) examine evidence that has led to the fluoridation of the water supply in some areas, including how data is collected (survey technique), and be able to discuss the factors involved in decision-making, including ethical issues (w(i)a,d;(iv)a,b)
- (g) understand that the uses of a material depend on its properties
- (h) be able to link the common uses of chlorine, iodine, helium, neon and argon to their properties



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**Topic 2: The Periodic Table**

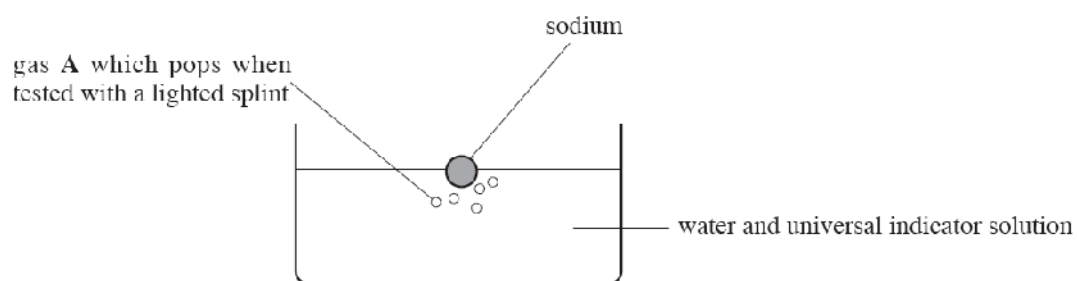
<b>Use traffic lights to assess what you know now, and again at the end of this topic</b>	<b>Start</b>	<b>End</b>
1) I can list the differences in physical properties between metals and non-metals and can use this list to distinguish between them		
2) I know that there is a gradual change in physical properties of elements within a group and I can make predictions about physical properties of elements based on given data		
3) I can name the elements in Group 1 and Group 7		
4) I can describe the reactions of Group 1 elements with oxygen in the air, water and Group 7 elements and can name the products of these reactions		
5) I can write word and symbol equations for the reactions of Group 1 elements with oxygen, water and with Group 7 elements		
6) I can describe the displacement reactions of Group 7 elements and use these reactions to explain the trend in reactivity within the group and can make predictions based on this trend		
7) I can write and interpret word and balanced symbol equations for the displacement reactions of Group 7 elements		
8) I can use flame tests and silver nitrate solution to distinguish between sodium chloride, sodium iodide, potassium chloride and potassium iodide		
9) I can examine evidence that has led to the fluoridation of the water supply in some areas and I know how the data is collected		
10) I can discuss the factors involved in the decision-making that leads to the fluoridation of drinking water		
11) I understand that the uses of a material depend on its properties		
12) I can list the uses of chlorine, iodine, helium, neon and argon and relate the uses to their properties		

2. This question is about the reactions of the Group 1 element sodium.

Use only the words in the box below to answer parts (i), (ii) and (iii).

hydrogen	lilac	sodium	sodium chloride
sodium hydroxide	sodium oxide	yellow-orange	

(i) The diagram below shows sodium reacting with water.



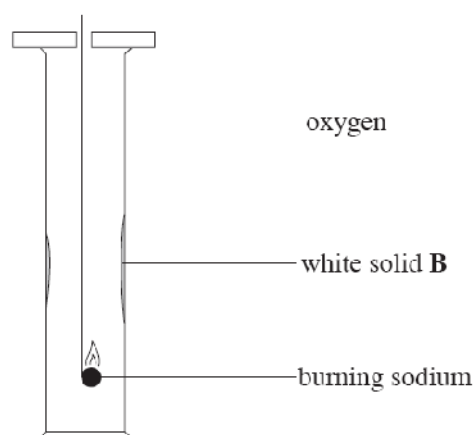
I. Name gas A. [1]

II. The universal indicator solution turns purple showing that a strong alkali is formed during the reaction.

Name the strong alkali formed. [1]

.....

(ii) The diagram below shows sodium reacting with oxygen.



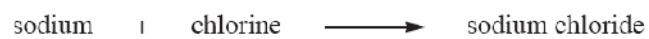
I. Name the white solid **B**. [1]

.....

II. State the **colour** seen when sodium burns in oxygen. [1]

.....

(iii) The **word** equation below represents the reaction between sodium and chlorine.



I. Name the **metal** in the word equation. [1]

.....

II. Name the **product** in the reaction. [1]

7. (a) The following table gives information about some elements.  
The Periodic Table of Elements is shown on the back page of this examination paper.

<i>Element</i>	<i>Electronic structure</i>	<i>Group number</i>	<i>Period in which element is found</i>
lithium	2,1	1	2
chlorine	.....	7	3
magnesium	2,8,2		
.....	2,8,1	1	3

- (i) Complete the table above. [4]
- (ii) Describe how the electronic structure of an element can be used to work out
- I. the group number of the element, [1]
- .....
- .....
- II. the number of the period in which the element is found, [1]
- .....
- .....
- III. the atomic number of the element. [1]

- (c) The diagram below shows part of the periodic table as constructed by Mendeleev in 1869. Elements which had not been discovered in 1869 are shown by an asterisk, \*.

<i>Group 1</i>	<i>Group 2</i>	<i>Group 3</i>	<i>Group 4</i>	<i>Group 5</i>	<i>Group 6</i>	<i>Group 7</i>
H						
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca	*	Ti	V	Cr	Mn
Cu	Zn	*	*	As	Se	Br
Rb	Sr	Y	Zr	Nb	Mo	*
Ag	Cd	In	Sn	Sb	Te	I

Use the Periodic Table of Elements shown on the **back page of this examination paper** to help you answer parts (i) and (ii).

- (i) Name **two** elements found in Group 2 of Mendeleev's periodic table which are **not** found in Group 2 in the present day Periodic Table.

..... and .....

[1]

- (ii) Lead is found in Group 4 of the present day Periodic Table but was unknown in 1869. Give the **symbol** of the other element found in Group 4 of the present day Periodic Table which was unknown in 1869.

.....

[1]

6. (a) The table below shows some physical properties of Group 1 and 7 elements.

Group 1				Group 7			
<i>Element</i>	<i>Melting point / °C</i>	<i>Boiling point / °C</i>	<i>Density / g cm<sup>-3</sup></i>	<i>Element</i>	<i>Melting point / °C</i>	<i>Boiling point / °C</i>	<i>Density / g cm<sup>-3</sup></i>
Lithium	180	1340	0.50	Fluorine	-220	-188	0.0016
Sodium	98	880	0.98	Chlorine	-101	-35	0.0029
Potassium	63	760	0.86	Bromine	-7	59	3.1

- (i) Describe the trends in the melting points of Group 1 and 7 elements on going down the groups. [2]

.....

.....

- (ii) Give the state (solid, liquid or gas) at 60 °C of these

I. Group 1 elements, .....

II. Group 7 elements, .....

[2]

- (b) Sodium reacts with chlorine, Cl<sub>2</sub>, to form sodium chloride.

- (i) Write a balanced symbol equation for this reaction. [3]



- (ii) Describe how a flame test and the addition of silver nitrate solution can be used to identify sodium chloride. [2]

Flame test .....

Silver nitrate solution

8. (a) (i) A series of experiments was carried out to investigate the displacement reactions of Group 7 elements (halogens). Each halogen was added to a solution containing a different halide ion.

Complete the table below by **either** entering a tick (✓) in a box where you would expect a displacement reaction to occur **or** a cross (×) where you would expect no reaction.

Two entries have been done for you.

[2]

Halogen	Solution of halide ion		
	Sodium chloride	Sodium bromide	Sodium iodide
Bromine, Br <sub>2</sub>	×		✓
Chlorine, Cl <sub>2</sub>			
Iodine, I <sub>2</sub>			

- (ii) Complete and balance the following **symbol** equation for the reaction between bromine and sodium iodide solution. [2]



- (b) Sodium iodide is used in medicine to treat thyroid disorders.

A pupil was asked to identify the presence of sodium ions and iodide ions in a sample of sodium iodide.

State the result the pupil should expect if

- (i) a flame test was carried out on the sample,

..... [1]

- (ii) silver nitrate solution was added to a solution of the sample.

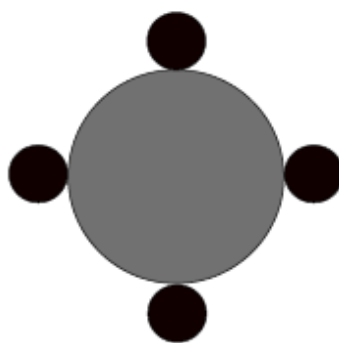
..... [1]

### **3. COMPOUNDS**

**Candidates should:**

- (a) know that new substances called compounds are formed when two or more different elements combine together and that each compound has its own chemical formula.
- (b) be able to interpret a given formula, name the elements and number the atoms present
- (c) be able to write formulae for simple binary compounds formed between Group 1 or 2 elements and elements of Group 6 or 7, using the formulae of the ions that they contain. (w(i)c)
- (d) **be able to write formulae for ionic compounds containing hydroxide, nitrate, sulphate or carbonate ions, using the formulae of the ions that they contain.** (w(i)c)
- (e) be able to draw and interpret space filler type diagrams for simple molecules using a key, (w(i)c)

*e.g. for methane*





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Topic 3: Compounds

Use traffic lights to assess what you know now, and again at the end of this topic	Start	End
1) I know that new substances called compounds are formed when two or more different elements combine together and that each compound has its own chemical formula		
2) I can interpret a given formula, name the elements and number of atoms present		
3) I can write a formulae for simple binary compounds formed between Group 1 or 2 elements and elements of Group 6 or 7, using the formulae of the ions that they contain		
<b>4) I can write formulae for ionic compounds containing hydroxide, nitrate, sulphate or carbonate ions using the formulae of the ions that they contain</b>		
5) I can draw and interpret space filler type diagrams for simple molecules using a key		

Answer all questions.

1. The following table shows some compounds and their formulae.

<i>Name of compound</i>	<i>Formula</i>
water	H <sub>2</sub> O
methane	CH <sub>4</sub>
carbon dioxide	CO <sub>2</sub>
ammonia	NH <sub>3</sub>
hydrogen chloride	HCl

Use the information in the above table to answer the following questions.

- (i) Name the compound that consists of the elements

I. carbon and hydrogen,

.....

[1]

II. nitrogen and hydrogen.

.....

[1]

- (ii) Name the elements present in a molecule of

I. water,

..... and .....

[1]

II. hydrogen chloride.

..... and .....

[1]

- (iii) Describe what is meant by the term *compound*.

[1]

.....  
 .....

(b) The key below represents atoms of some elements.



Methane,  $\text{CH}_4$ , can be represented by the following diagram:



Use the key given above to draw diagrams representing the molecules:

(i) water,  $\text{H}_2\text{O}$ ; [1]

(ii) carbon dioxide,  $\text{CO}_2$ . [1]

3. Read the information in the box below.

Compounds are formed when two or more different elements join together. Every compound has its own formula.

Some compounds, such as iron oxide,  $\text{Fe}_2\text{O}_3$ , and sodium chloride,  $\text{NaCl}$ , are used as raw materials by the chemical industry. Iron oxide is used to make iron,  $\text{Fe}$ . Sodium chloride is used to make hydrogen,  $\text{H}_2$ , chlorine,  $\text{Cl}_2$ , and sodium hydroxide,  $\text{NaOH}$ .

The chemical industry makes many useful compounds such as sulphuric acid,  $\text{H}_2\text{SO}_4$  and ammonia,  $\text{NH}_3$ .

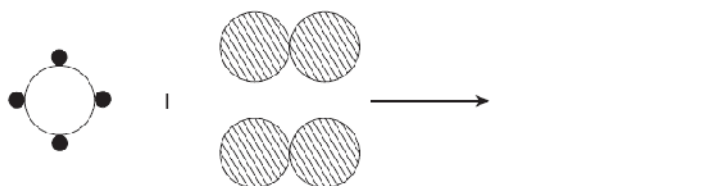
Use **only** the information in the box above to answer parts (i) and (ii).

- (i) Give an example of
- I. a compound,
- II. an element.
- ..... [2]
- (ii) State how compounds are formed. [1]
- (iii) Use the Periodic Table of Elements shown on the **back page of this examination paper** to help you answer this part of the question.
- Name the elements present in sulphuric acid,  $\text{H}_2\text{SO}_4$ . [1]
- ..... and .....
- (iv) Give the **total** number of atoms shown in the formula  $\text{NaOH}$ . [1]
- .....

4. (a) (i) The symbol equation below represents the burning of methane in air.



Complete the diagram below which represents the above reaction.



[2]

- (ii) State **two** ways in which the symbol equation above shows that a chemical reaction is taking place. [2]

1. ....

2. ....

- (b) Refer to the table of common ions inside the back cover of this answer book to answer this question.

Give the chemical **formula** for magnesium fluoride. [1]

.....

- (c) The chemical formula for sodium sulphate is  $\text{Na}_2\text{SO}_4$ .

Give the **total** number of atoms represented in the formula. [1]

**4. RATES OF CHEMICAL CHANGE**

**Candidates should:**

- (a) know that chemical reactions use up reactants and produce new substances called products.
- (b) explore the effects of changing concentration, temperature, and particle size on the rates of chemical reactions, using ICT where appropriate; this should include:
  - planning the collection of reliable data, analysing the data, drawing conclusions and evaluating the procedures used,
  - understanding the advantages of using ICT tools, in terms of recording, continuous monitoring and instantaneous display,
  - explaining the outcomes in terms of particle theory. (w(i)a-c;(iv)a)
- (c) understand the meaning of the term catalyst and know that the development of better catalysts is extremely important as it can lead to new ways of making materials that may use less energy, use renewable raw materials or use fewer steps. (w(iv)a)



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Topic 4: Rates of Chemical Change

Use traffic lights to assess what you know now, and again at the end of this topic	Start	End
1) I know that chemical reactions use up reactants and produce new substances called products		
2) I can explain, using particle theory, why changing the concentration, temperature and particle size changes the rate of a chemical reaction		
3) I can plan how to collect reliable data, how to analyse data and how to draw conclusions and evaluate procedures used		
4) I understand the advantages of using ICT tools in terms of recording, continuous monitoring and instantaneous display		
5) I understand the meaning of the term catalyst and I can explain why the development of better catalysts is extremely important		

5. (a) When magnesium ribbon is added to excess hydrochloric acid, magnesium chloride and hydrogen gas are produced.

(i) Give a **word equation** for the reaction taking place. [2]

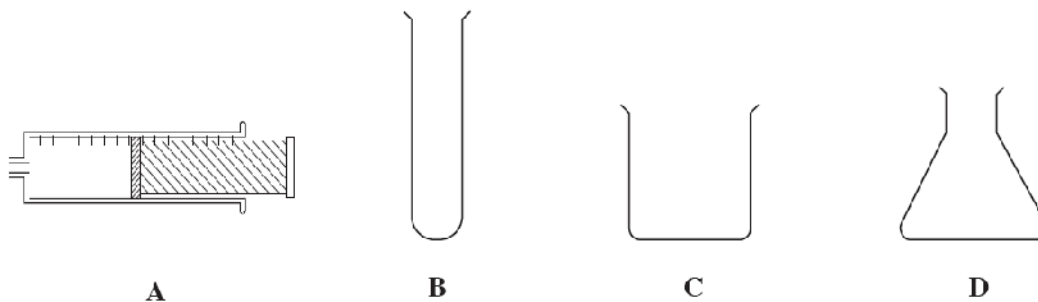
..... | .....  $\longrightarrow$  ..... | .....

(ii) Describe **two** changes you would expect to observe during this reaction. [2]

*Observation 1* .....

*Observation 2* .....

(iii) The following diagrams show some pieces of chemical apparatus.

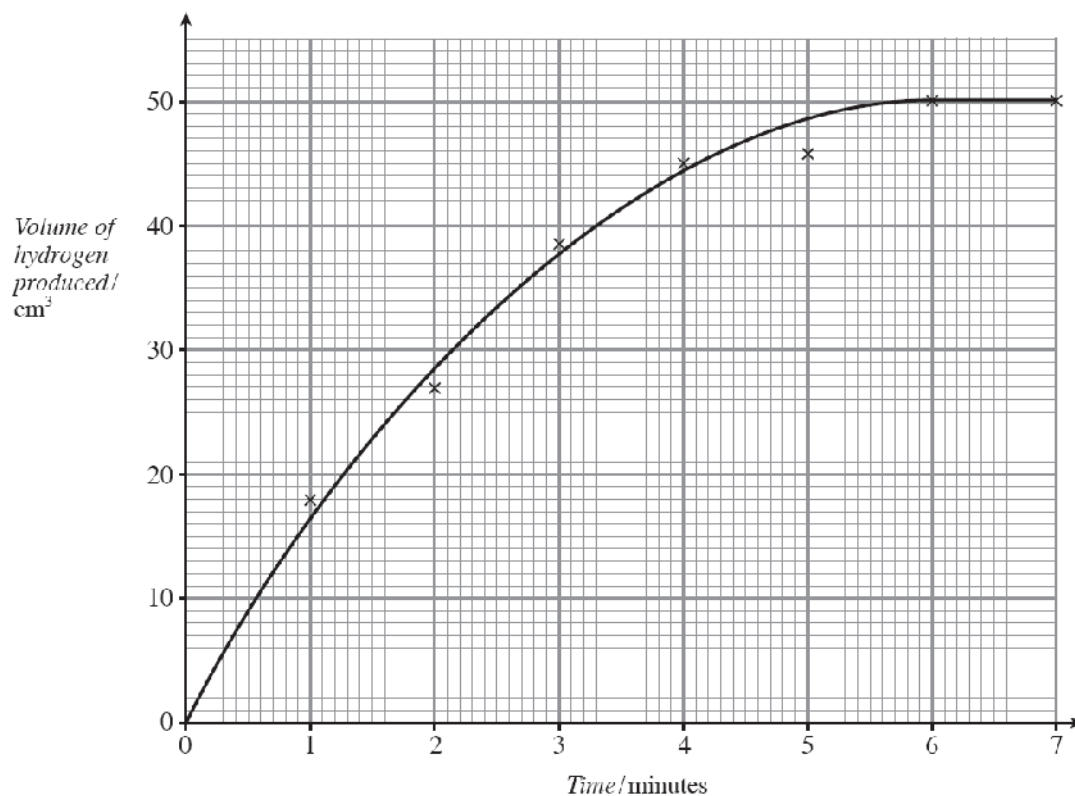


Give the letter, A, B, C or D and the name of the piece of apparatus that would give the **most accurate** measurement of the volume of gas produced during the reaction.

[2]

*Letter* ..... *Name* .....

- (b) A scientist recorded the volume of gas produced over a period of time in the above reaction. The reaction was carried out at room temperature, 20 °C. The results obtained are shown in the graph below.



- (i) From the graph above give
- I. the total volume of gas produced,  
 $\text{cm}^3$  [1]
  - II. the time taken for the reaction to end.  
 minutes [1]
- (ii) The reaction was repeated at 40 °C using the same amounts of magnesium and acid. On the graph above, sketch the graph you would expect to be obtained at 40 °C. [2]

10  
reacts with dilute sulphuric acid forming hydrogen. 6. Magnesium ribbon reacts with dilute sulphuric acid forming hydrogen.

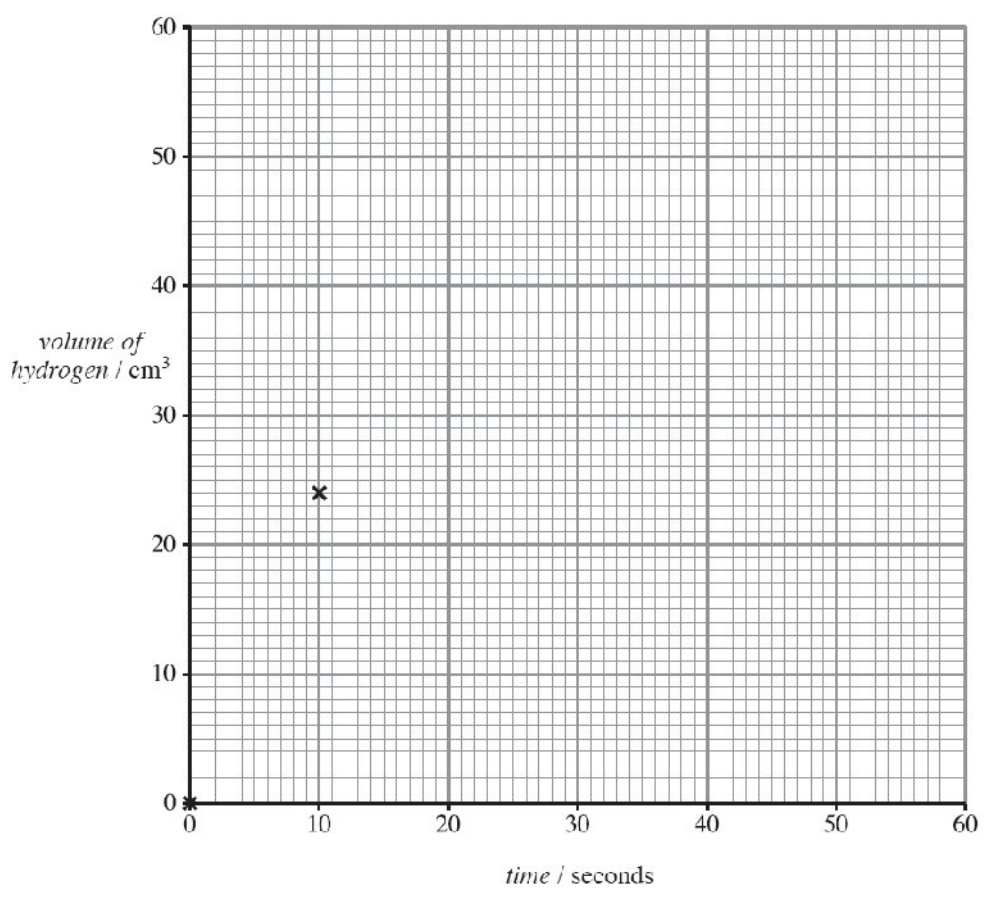
0.03g of magnesium ribbon was placed in excess dilute sulphuric acid.

The volume of hydrogen produced was recorded every 10 seconds.

The experiment was carried out at room temperature. The results obtained are shown below.

<i>time / seconds</i>	0	10	20	30	40	50	60
<i>volume of hydrogen / cm<sup>3</sup></i>	0	24	37	45	49	50	50

- (i) Plot the results from the table on the grid below and, using these points, draw a smooth curve of best fit. The first two points have been plotted for you. [3]



- (ii) Use the graph to find the
- I. volume of hydrogen formed after 15 seconds, [1]  
.....  $\text{cm}^3$
- II. time taken to form  $40 \text{ cm}^3$  of hydrogen. [1]  
..... seconds

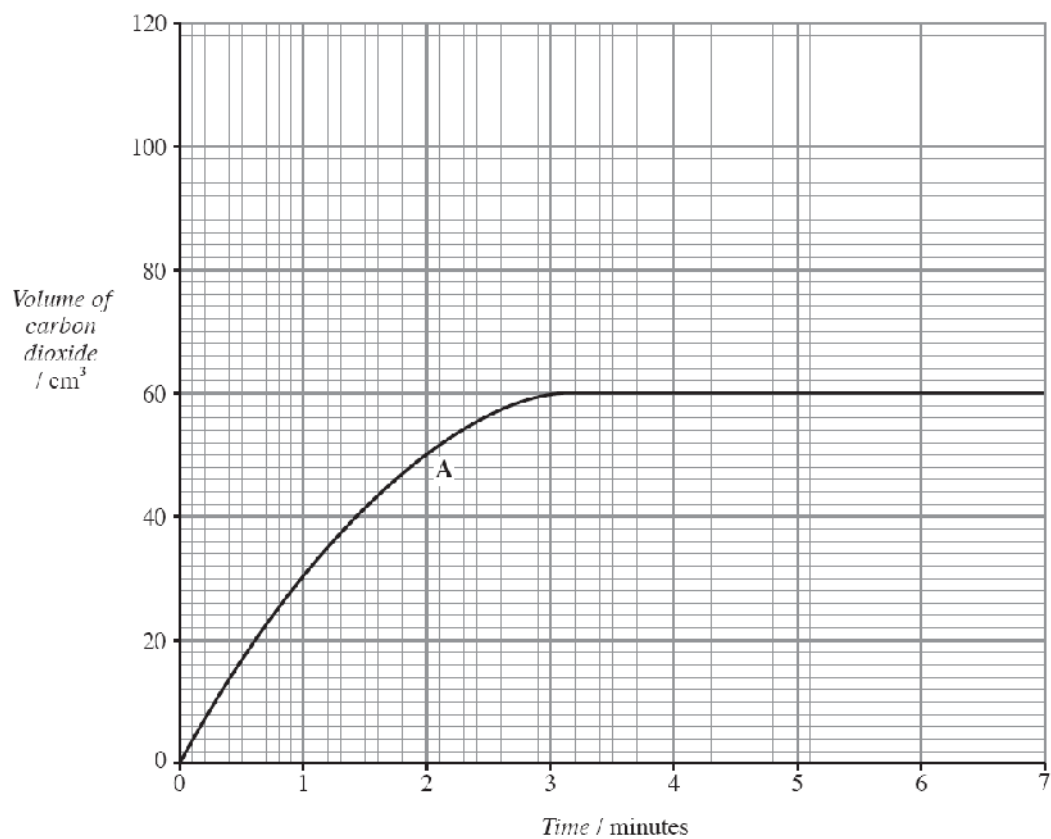
(iii) Choose statements from the box below to complete the sentences that follow.

**Each statement can be used once, more than once or not at all.**

decrease	increase	stay the same
----------	----------	---------------

- I. Using a higher concentration of sulphuric acid causes the **rate** of reaction to  
..... [1]
- II. Using sulphuric acid at a lower temperature causes the **rate** of reaction to  
..... [1]
- III. Cutting the magnesium ribbon into tiny pieces causes the **rate** of reaction to  
..... [1]

5. Graph A below shows the volume of carbon dioxide formed during a reaction between marble chips and *excess* dilute hydrochloric acid.



- (i) On the same grid, sketch carefully the graph that would be obtained if the marble chips had been ground to a **powder** with the volume and concentration of the acid as for graph A. [2]
- (ii) Explain your answer to part (i). [2]
-

**5. USING CHEMICAL REACTIONS TO MAKE NEW MATERIALS**

**Candidates should:**

- (a) know that the chemical industry obtains raw materials from the earth, sea and air and that chemical reactions are then used to change raw materials into useful products, such as fuels, plastics, medicines, fertilisers, metals, etc.
- (b) know that in a chemical reaction, atoms are rearranged but no new atoms are produced nor are any atoms destroyed.
- (c) recognise that signs of a chemical change occurring may include colour change, formation of a precipitate, gas evolution and temperature change.
- (d) know that reactions in which the temperature rises are exothermic and that reactions in which the temperature falls are endothermic.
- (e) **know that breaking a chemical bond requires energy and making a chemical bond releases energy. (w(i)c)**
- (f) **understand that if energy released from forming new bonds is greater than energy needed to break existing bonds, the reaction is exothermic and vice-versa for an endothermic reaction. (w(i)c)**
- (g) **use given data (energy needed to break bonds), to predict whether a reaction is exothermic or endothermic and calculate the overall energy change (w(i)c)**



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Topic 5: Using chemical reactions to make new materials

Use traffic lights to assess what you know now, and again at the end of this topic	Start	End
1) I know what a raw material is		
2) I can give examples of raw materials obtained from the earth, sea and air and I know what useful products they are turned to		
3) I know that in a chemical reaction, atoms are rearranged but no new atoms are produced nor are any atoms destroyed		
4) I know that signs of a chemical change may include colour change, formation of a precipitate, gas evolution and temperature change		
5) I know that the temperature rises in exothermic reactions and falls in endothermic reactions		
<b>6) I know that breaking a chemical bond requires energy and making a chemical bond releases energy</b>		
<b>7) I understand that a reaction is exothermic if the energy released is greater than the energy taken in and vice-versa for an endothermic reaction</b>		
<b>8) I can use given data to predict whether a reaction is exothermic or endothermic and I can calculate the overall energy change</b>		

3. The chemical industry uses raw materials and changes them into useful products.

(a) The following list shows some materials:

**iron      iron ore      crude oil**

**air      petrol**

Place the above materials into the correct columns in the table below.  
One has been done for you.

[2]

<i>Raw materials</i>	<i>Useful products</i>
iron ore	

(b) The following test was carried out in the laboratory.

Sodium carbonate powder is added to hydrochloric acid. Bubbles are produced, the temperature rises and the sodium carbonate disappears to form a colourless solution.

I. Give **two** reasons why this shows a chemical change has taken place. [2]

*Reason 1*

*Reason 2* .....

II. Name the gas produced in the reaction. [1]

.....

(b) Methane,  $\text{CH}_4$ , is an important petroleum gas. It is used in domestic heating and cooking. When methane burns in air, carbon dioxide and water are formed.

(i) Some scientists believe that the carbon dioxide produced by burning fuels, such as methane, is causing the temperature of the Earth's atmosphere to increase.

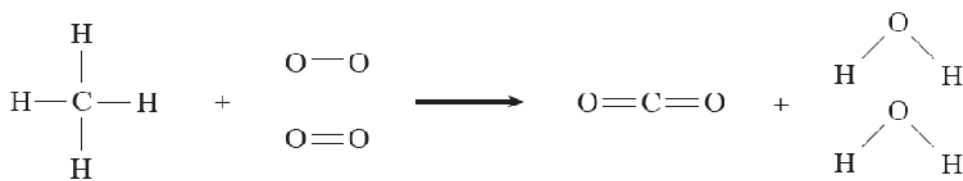
I. State the term used to describe the increase in the temperature of the Earth's atmosphere. [1]

.....

II. Give **one** environmental problem caused by an increase in temperature of the Earth's atmosphere. [1]

.....

(ii) The equation below represents the burning of methane.



The relative amounts of energy needed to break the bonds in the above reaction are shown in the table.

Bond	Amount of energy needed to break the bond / kJ
$\text{O}=\text{O}$	498
$\text{O}-\text{H}$	464
$\text{C}-\text{H}$	413
$\text{C}-\text{O}$	805

*NOTE: The amount of energy released in making a bond is equal and opposite to that needed to break the bond.*

I. Use the bond energy values in the table to calculate the relative energy

1. needed to break **all** the bonds in the **reactants**, [2]

.....  
.....

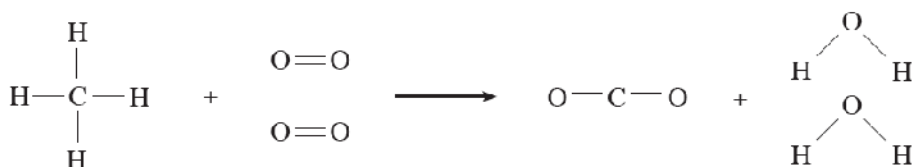
2. released when **all** the bonds in the **products** are formed. [2]

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

II. Use your answers to part I. to show why the relative overall energy change is exothermic. [1]

.....  
.....

- (b) Methane (natural gas) is also found in crude oil. When it burns in air, the following reaction takes place:



The relative amounts of energy needed to break the bonds in the above reaction are shown in the table below.

Bond	Amount of energy needed to break the bond / kJ
C—H	413
O=O	498
C—O	805
H—O	464

The amount of energy released in making a bond is equal and opposite to that needed to break the bond.

- (i) Use the bond energy values in the table to calculate the relative energy

I. needed to break all the bonds in the reactants, [2]

.....

.....

.....

II. released when the bonds in the products are formed. [2]

.....

.....

.....

- (ii) Calculate the overall energy change for the reaction. Use your answer to state and explain whether the reaction is exothermic or endothermic. [2]

.....

.....

**6. ACIDS, BASES and SALTS**

**Candidates should:**

- (a) interpret given data about indicators (colour/pH) and to recognise acidic, alkaline and neutral substances and the relative strength of acids and alkalis.
- (b) name the products and write word equations that represent the characteristic reactions of dilute acids with:
  - metals
  - bases (including alkalis)
  - carbonates
- (c) understand that alkalis are soluble bases
- (d) identify hydrogen gas from the metal and acid reaction, by its action on a burning splint.
- (e) use given data on the reactivity series to predict which metals will react with dilute acids to produce hydrogen and a salt
- (f) identify carbon dioxide gas from the carbonate and acid reaction, by its action with limewater.
- (g) describe the preparation of salts by:
  - insoluble base/metal/carbonate reacting with dilute sulphuric acid
  - alkali (sodium hydroxide) reacting with dilute hydrochloric and sulphuric acid
- (f) drawing conclusions about the patterns that exist and using these patterns to make predictions, test for carbonates and plan procedures to distinguish between named substances, e.g. sodium chloride and sodium carbonate (w(i)a)



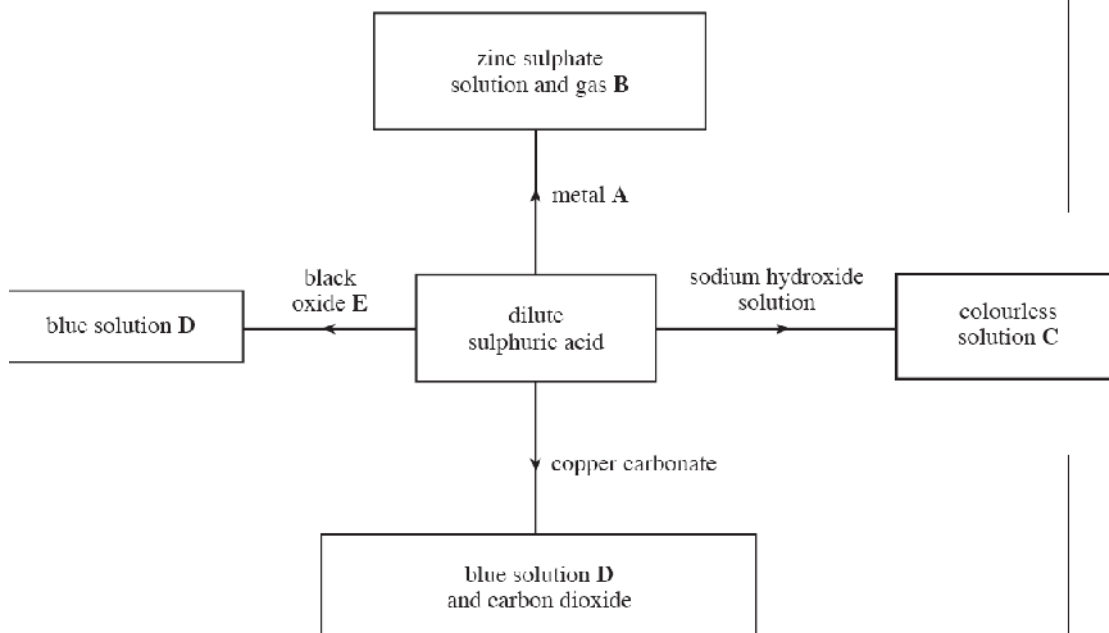
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**Topic 6: Acids, Bases and Salts**

<b>Use traffic lights to assess what you know now, and again at the end of this topic</b>	<b>Start</b>	<b>End</b>
1) I can work out whether a substance is acidic, alkaline or neutral from given data about indicators and can work out the relative strength of acids and alkalis given the pH		
2) I can name the products and write word equations for the reactions of dilute acids with metals, bases (including alkalis) and carbonates		
3) I know that alkalis are soluble bases		
4) I know how to test for hydrogen gas using a burning splint		
5) I can use the reactivity series to predict which metals will react with dilute acids		
6) I know how to test for carbon dioxide gas using limewater		
7) I can describe how to prepare a salt by reacting an insoluble base/metal/carbonate with dilute sulphuric acid		
8) I can describe how to prepare a salt by reacting an alkali with dilute hydrochloric acid and dilute sulphuric acid		
9) I know how to test for carbonates and can use it to distinguish between a carbonate compound and a compound that isn't a carbonate e.g. sodium chloride and sodium carbonate		

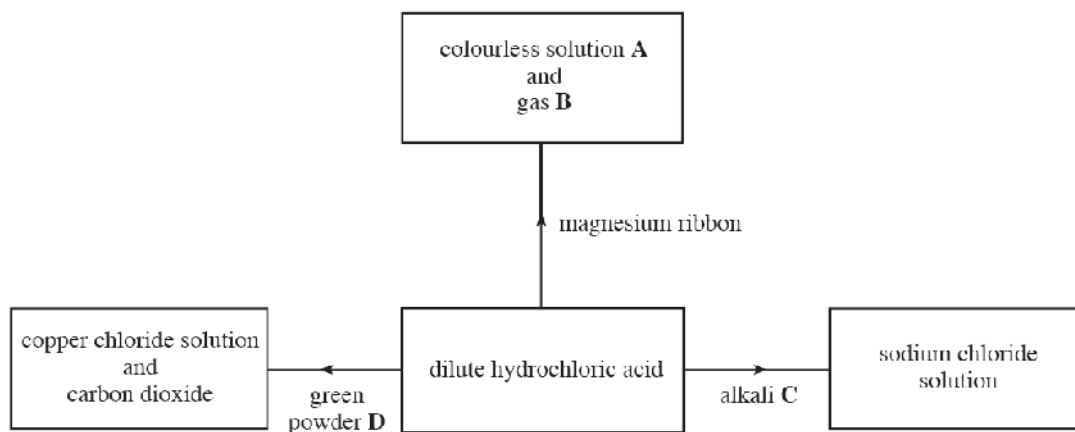
9. The diagram below shows some reactions of dilute sulphuric acid.



Give the name for

- |  |       |     |
|--|-------|-----|
| (i) metal <b>A</b> ,                     | ..... | [1] |
| (ii) gas <b>B</b> ,                      | ..... | [1] |
| (iii) the colourless solution <b>C</b> , | ..... | [1] |
| (iv) the blue solution <b>D</b> ,        | ..... | [1] |
| (v) black oxide <b>E</b> .               | ..... | [1] |

9. The diagram below shows some reactions of dilute hydrochloric acid.



Give the name for

- (i) colourless solution A ..... [1]
- (ii) gas B ..... [1]
- (iii) alkali C ..... [1]
- (iv) green powder D ..... [1]

**7. NANOSCIENCE**

**What is a nanoparticle?**

**What are the potential benefits and drawbacks of advances in nanotechnology?**

**Candidates should:**

- (a) understand the concept of nanometre and appreciate that nano-science involves the study and use of particles that have sizes in the range 1-100 nm.
- (b) be aware that reducing the size of particles to the nano-scale can produce new properties in a material, which may lead to new uses, e.g. the antibacterial, antiviral and antifungal properties of nano-sized silver particles used in sterilising sprays to clean operating theatres in hospitals and to coat the inner surfaces of refrigerators.
- (c) discuss the potential benefits, risks and drawbacks associated with developments in nanoscience (w(i)d;(iv)a,b)



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**Topic 7: Nanoscience**

<b>Use traffic lights to assess what you know now, and again at the end of this topic</b>	<b>Start</b>	<b>End</b>
1) I understand the concept of a nanometre and appreciate that nano-science involves the study and use of particles that have sizes in the range 1-100nm		
2) I am aware that reducing the size of particles to the nano-scale can produce new properties in a material and this can lead to new uses		
3) I can give an example of a use of nanotechnology		
4) I can discuss the potential benefits, risks and drawbacks associated with developments in nanoscience		

2. Nanoscience involves the study of very small particles.

(i) Choose from the box below the size range of nanoparticles.

<b>1-100 cm</b>	<b>1-100m</b>	<b>1-100 nm</b>
-----------------	---------------	-----------------

Nano-sized particles have sizes in the range ..... [1]

(ii) Nano-sized silver particles have antibacterial properties. Choose from the box below a use that depends on this property. [1]

<b>jewellery</b>	<b>sun-block</b>	<b>sterilising sprays</b>
------------------	------------------	---------------------------

*Use* .....

(iii) Nanomaterials are used more and more in everyday life. State why some scientists are concerned about their use. [1]

.....  
.....

## **8. THE PRODUCTION AND USE OF FUELS**

**How do we make fuels?**

**What are the drawbacks of using fossil fuels?**

**Why is the amount of carbon dioxide in the atmosphere increasing slightly and why are scientists worried about this?**

**Candidates should:**

- (a) understand the principles involved in the fractional distillation of crude oil
- (b) use the combustion of hydrocarbons to recognise that new substances are produced in a chemical reaction as a result of the making and breaking of bonds and that the combustion of a hydrocarbon involves the breaking of the C–C and C–H bonds followed by the formation of bonds with oxygen atoms. (w(i)c)
- (c) explain the environmental effects of the combustion of fossil fuels and evaluate the social, economic and environmental impact (w(i)ad;(iv)a,b)
- (d) know that there is debate in the scientific community on the issue of global warming and be aware that many scientists attribute the main cause of global warming to the increase in carbon dioxide in the atmosphere caused by the combustion of fossil fuels (w(i)d;(iv)b,c)
- (e) examine and evaluate given data on global warming (w(i)a)
- (f) appreciate some effects and consequences of global warming
- (g) evaluate given data with regard to proposed solutions to the problem of global warming (w(i)a,d;(iv)a,b)
- (h) evaluate given data with regard to proposed solutions to the problem of acid rain (w(i)a,d;(iv)a,b)



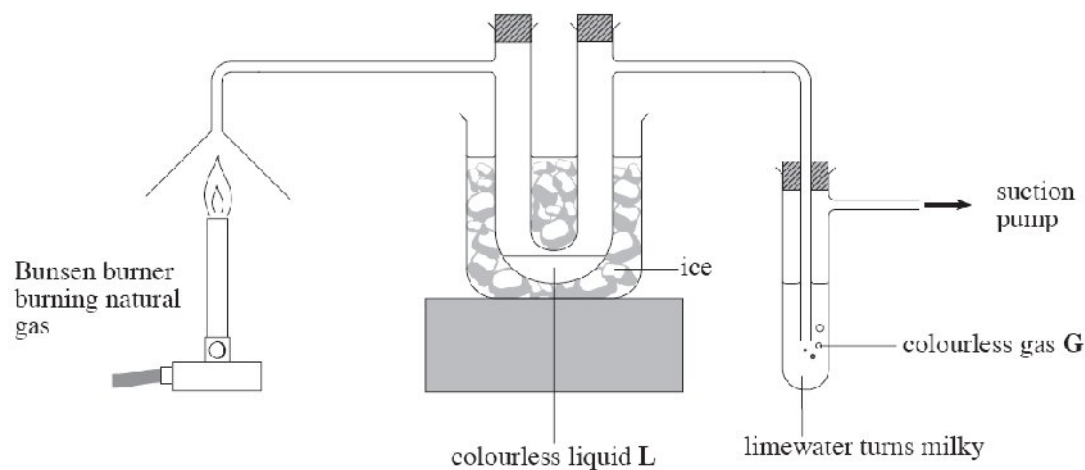
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**Topic 8: The Production and use of Fuels**

<b>Use traffic lights to assess what you know now, and again at the end of this topic</b>	<b>Start</b>	<b>End</b>
1) I can explain how fractional distillation is used to separate crude oil		
2) I know that new substances are formed in the combustion of hydrocarbons as a result of the making and breaking of bonds		
3) I know what bonds are broken and what bonds are formed during combustion		
4) I can explain the environmental effects of the combustion of fossil fuels		
5) I can evaluate the social, economic and environmental impact of the combustion of fossil fuels		
6) I know that there is a debate on the issue of global warming and am aware what scientists think this is caused by		
7) I can examine and evaluate given data on global warming		
8) I know some effects and consequences of global warming		
9) I can evaluate given data with regard to proposed solutions to the problem of global warming		
10) I can evaluate given data with regard to proposed solutions to the problem of acid rain		

6. The following diagram shows the apparatus that can be used to investigate the products formed during the combustion of fuels.



- (i) Natural gas contains methane,  $\text{CH}_4$ . Tick (✓) the box below that gives the name of the group of substances to which methane belongs. [1]

Alkali metals

Halogens

Hydrocarbons

- (ii) During the combustion of methane, new substances are formed. Name the product that is
- I. colourless liquid L, ..... [1]
- II. colourless gas G. [1]
- (iii) Name the gas present in air that is necessary for the combustion of methane. [1]

.....

- (iv) If the limewater is replaced by universal indicator, the indicator turns red indicating that an acidic substance is formed. This may be due to sulphur impurities in the methane.

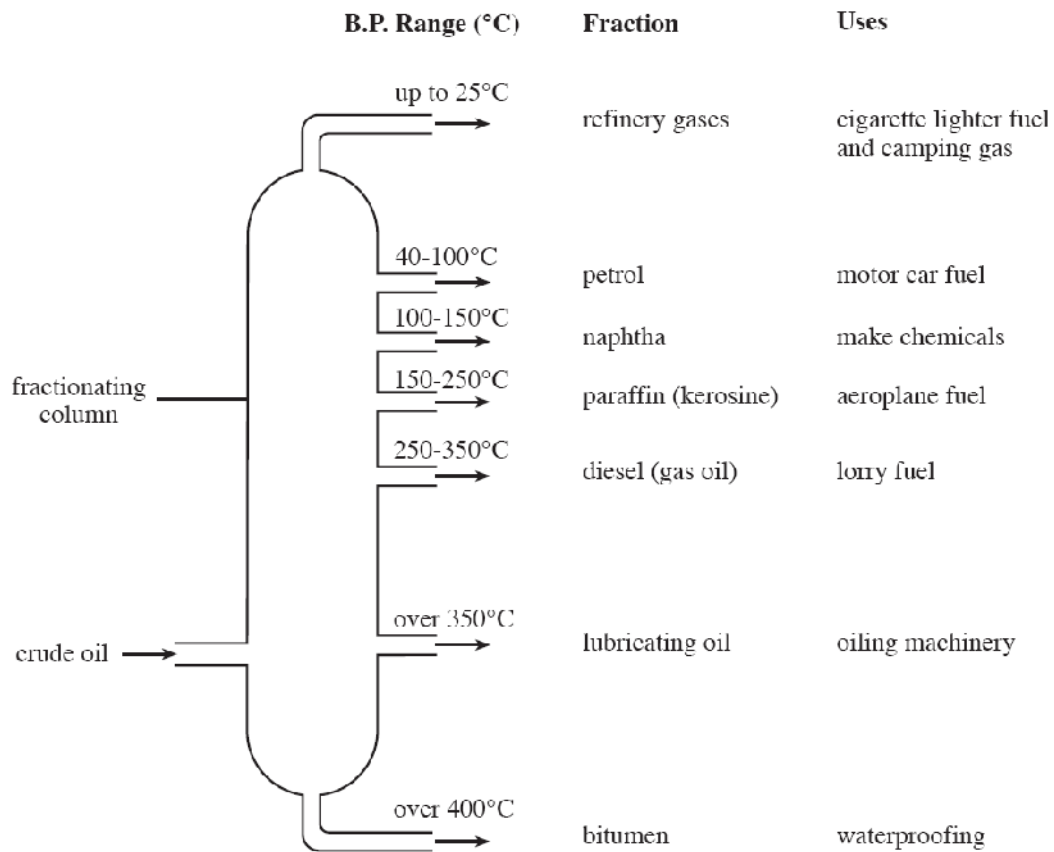
I. Name the gas produced **from sulphur** that could be the cause of this. [1]

.....

II. Give the **name** of the environmental problem caused by this gas. [1]

.....

5. (i) Crude oil is separated into fractions in a fractionating column.



- I. State what must be done to the crude oil as it enters the fractionating column. [1]  
 .....
- II. Name the fraction with the boiling point range 250 - 350 °C. [1]
- III. Name **one** fraction **not** used as a fuel. [1]  
 .....

**9. EVOLUTION AND MAINTENANCE OF THE ATMOSPHERE  
and GEOLOGICAL PROCESSES**

**Candidates should:**

- (a) investigate data on the composition of the atmosphere over geological time in order to draw conclusions about the changes in composition that have taken place (w(i)a)
- (b) be aware of the accepted explanation for the origin of the atmosphere and the changes that have occurred over geological time (w(i)d)
- (c) understand the roles of respiration, combustion and photosynthesis in the maintenance of the levels of oxygen and carbon dioxide in the atmosphere
- (d) use the development of the theory of continental drift to display their understanding that observations, through creative thought, lead to an idea to explain them but the explanation may not be accepted until sufficient evidence exists, as follows:
  - in 1915, Alfred Wegener suggested that the Earth's continents were once joined and had moved apart to their present positions;
  - he based his idea on the close fit of coastlines, and the similar patterns of rocks and fossils, of continents separated by large oceans;
  - he was unable to convincingly explain how the continents could move;
  - the current theory of plate tectonics became widely accepted in the 1960's, by which time other scientists had found evidence to show that it is the Earth's plates that move and that they do so as a result of convection currents in the mantle. (w(i)a-c;(iv)c)

- (e) use evidence about the location of earthquakes and volcanoes to appreciate that the Earth's lithosphere is composed of a number of large pieces called plates, which are moving very slowly, and know that this movement drives the rock cycle (w(i)a,c)
- (f) know that rocks can be:
- formed where tectonic plates move apart and magma rises to fill the gap producing new igneous rock
  - deformed and/or recycled where tectonic plates move towards each other driving down the denser plate which may melt to form magma that on cooling forms igneous rock.



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**Topic 9: Evolution and maintenance of the atmosphere and geological process**

<b>Use traffic lights to assess what you know now, and again at the end of this topic</b>	<b>Start</b>	<b>End</b>
1) I can explain how the changes in the composition of the atmosphere have occurred		
2) I know what the accepted explanation for the origin of the atmosphere is and also the changes to it over geological time		
3) I can explain how respiration, combustion and photosynthesis maintain the levels of oxygen and carbon dioxide in the atmosphere		
4) I can use the development of the theory of continental drift to explain the current theory of plate tectonics		
5) I can evaluate the social, economic and environmental impact of the combustion of fossil fuels		
6) I can use evidence about the location of earthquakes and volcanoes to suggest that the Earth's lithosphere is composed of a number of large pieces called plates		
7) I can draw the rock cycle		
8) I can explain how new igneous rock is formed		
9) I know how rocks are deformed and/or recycled		

3. Read the information in the box below.

In 1915, a scientist called Alfred Wegener came up with the idea that the Earth's continents were once joined. He suggested they had moved apart to their present positions. His evidence was the close fit of the coastlines and the similar rocks and fossils found on the separate continents.

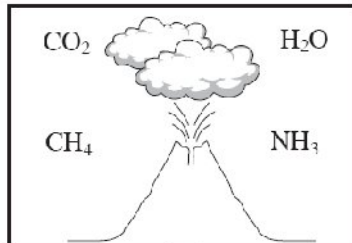
His idea was not accepted by other scientists because he could not explain what caused the continents to move.

In the 1960s, Wegener's idea was finally accepted when scientists found that convection currents deep inside the Earth were causing the continents to move.

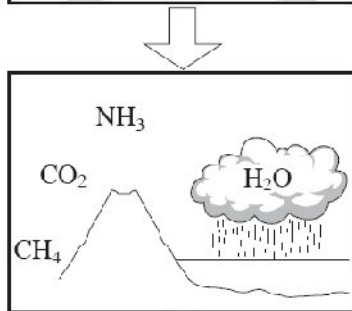
Use only the information in the box above to answer part (a).

- (a) (i) State the idea that was suggested by Alfred Wegener in 1915. [1]  
.....
- (ii) Give **one** piece of evidence used by Alfred Wegener to support his idea. [1]  
.....
- (iii) State what scientists discovered that resulted in Wegener's idea being accepted. [1]  
.....
- (b) Give **one** way in which people might have learned about Wegener's idea. [1]

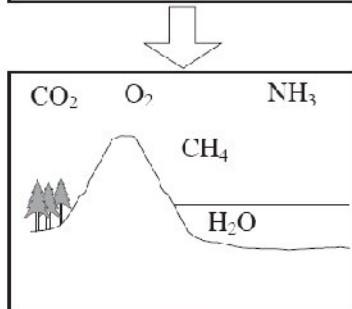
5. The diagrams below show a model of some of the major changes in the Earth's atmosphere since its formation 4500 million years ago.



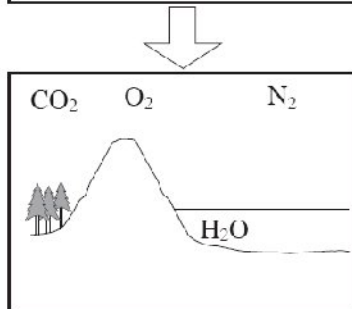
**Stage 1**  
Atmosphere formed from volcanic gases



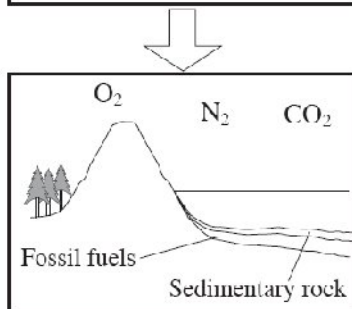
**Stage 2**  
Oceans formed



**Stage 3**  
Photosynthesis taking place



**Stage 4**  
Methane,  $\text{CH}_4$ , and ammonia,  $\text{NH}_3$ , change to form water, carbon dioxide and nitrogen



**Stage 5**  
Most of the carbon dioxide becomes locked in fossil fuels and sedimentary rocks.

- (i) Name the gas present in both **Stages 1** and **5**. [1]

.....

- (ii) I. In **Stage 2**, the oceans were formed from water vapour. Name this process. [1]

.....

- II. State what must have happened to the temperature of the atmosphere for this process to occur. [1]

.....

- (iii) I. Name the gas which is formed as a result of photosynthesis in **Stage 3**. [1]

.....

- II. Name the type of living thing that carries out photosynthesis. [1]

.....

- (iv) Name **one** example of a fossil fuel formed in **Stage 5**. [1]

.....

4. Read the information in the box below.

In 1915, a scientist called Alfred Wegener suggested that the Earth's continents were once joined together. He suggested that the continents moved apart in a process called 'continental drift'. He gave two pieces of evidence to support his idea.

1. The coastlines of different continents fit together like a jigsaw.
2. Fossils found on different continents were very similar despite the continents being separated by large oceans.

Other scientists did not believe Wegener. They believed that the continents and other features formed as the Earth cooled.

It was not until after Wegener died that his ideas were accepted. It is now known that the Earth's crust (lithosphere) is made up of a number of pieces called tectonic plates. These plates are moving very slowly and it is this movement that is believed to be responsible for continental drift.

Use only the information in the box above to answer the following questions.

- (i) Name the process by which the continents are believed to have moved apart. [1]

.....

- (ii) Describe how the coastlines of continents provide evidence for this process. [1]

.....  
.....

- (iii) State how fossils provide evidence for this process. [1]

.....  
.....

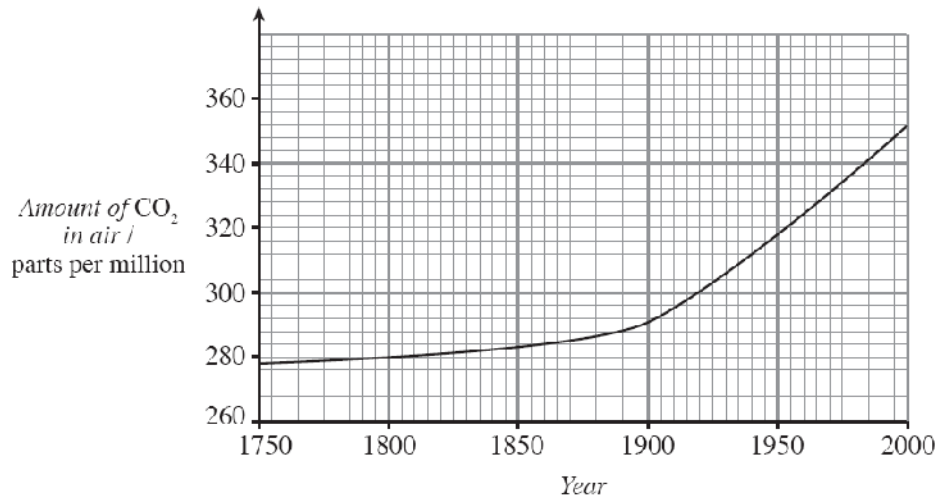
- (iv) State why other scientists did not believe Wegener. [1]

.....  
.....

- (v) Describe what we now believe to be the reason for the separation of the continents. [2]

.....  
.....

8. The following graph shows how levels of carbon dioxide in the air have changed between 1750 and the year 2000.



- (i) Compare the pattern of change shown in the graph before and after 1900. [2]

.....

- (ii) Give **two** possible reasons for the change seen after 1900. [2]

.....

- (iii) I. Describe what effect these changes in levels of carbon dioxide are believed to be having on the temperature of the Earth's atmosphere. [1]

.....

- II. What is the name given to this effect? [1]

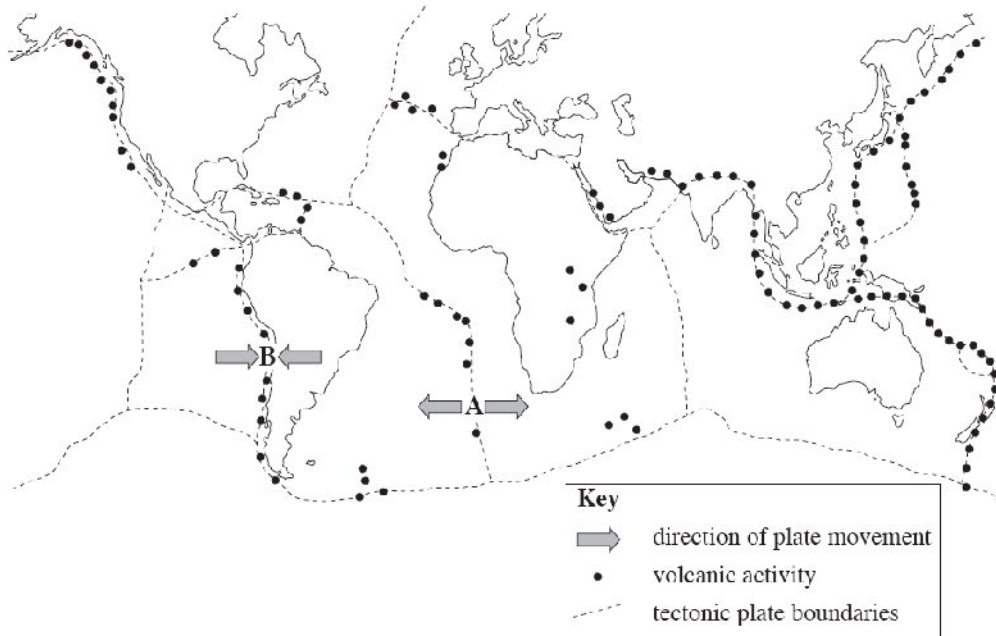
.....

- III. Give **one** possible result of this change in the temperature of the Earth's atmosphere. [1]

.....

.....

8. (a) The diagram below shows the Earth's tectonic plate boundaries and volcanic activity.



(i) Apart from volcanoes, give **one** other natural geological event that occurs at plate boundaries. [1]

.....

(ii) In terms of events relating to the **rock cycle**, state what happens when plates move  
 I. apart, as labelled **A** above, [1]

.....

II. towards each other, labelled **B** above. [1]

.....

(b) Evidence for continental drift was proposed by Alfred Wegener in 1915 but was not accepted by other scientists until the 1960s.

(i) State **one** piece of evidence that Alfred Wegener used to support his idea of continental drift. [1]

.....

(ii) State the reason for other scientists not immediately accepting Alfred Wegener's ideas. [1]

.....









