

The City School

Unified Mid-Year Examinations

2018 - 2019

Class 10



SCHOOL NAME

INDEX NUMBER

--	--	--	--

DATE

CHEMISTRY

Paper 2 Theory

5070/22

1 hour 30 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your School name, Index number and Date in the spaces provided.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use paper clips, glue or correction fluid.

Section A

Answer all questions in this section.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer three questions in this section.

Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

A copy of Periodic Table is printed on page 20

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

Invigilated By: _____

Checked By: _____

Marks Talled By: _____

This document consists of 18 printed pages and 2 blank pages.

Section A

Answer **all** the questions in this section in the spaces provided.

The total mark for this section is 45.

A1 sodium chloride, NaCl, is an ionic compound.

(a) State the electronic configuration for each of the ions in Sodium chloride.

sodium ion

chloride ion [2]

(b) When **molten** sodium chloride is electrolysed, sodium and chlorine are formed.

Construct equations for the two electrode reactions.

reaction at the negative electrode

.....

reaction at the positive electrode

..... [2]

(c) Predict the products of the electrolysis of concentrated **aqueous** sodium chloride.

..... [1]

(d) Aluminium is extracted from aluminium oxide by electrolysis.

(i) State the name of the main ore of aluminium.

..... [1]

(ii) Suggest why aluminium is extracted by electrolysis and **not** by reduction with carbon.

..... [1]

(iii) Molten aluminium oxide is electrolysed using graphite electrodes. Predict the products of this electrolysis at

the positive electrode (anode)

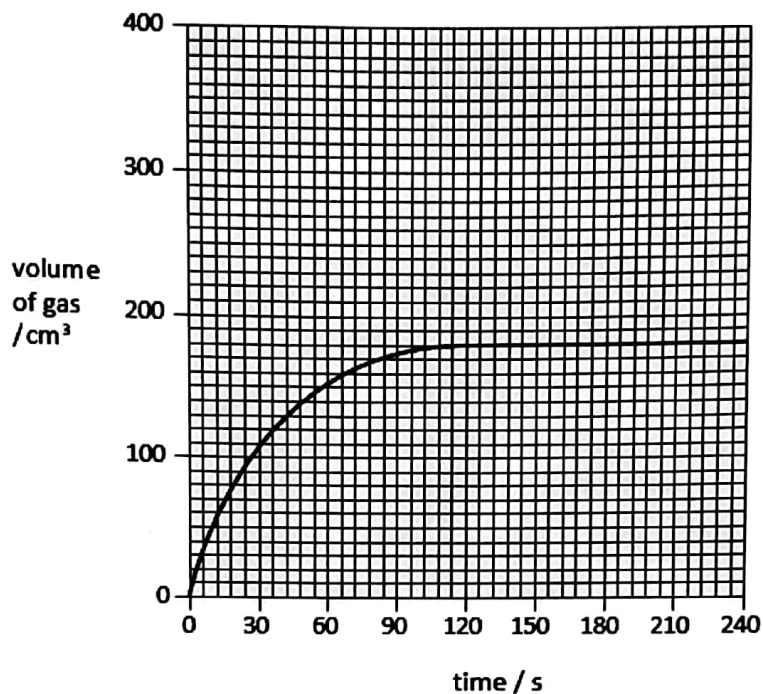
the negative electrode (cathode).....[2]

[Total: 9]

A2 When barium carbonate is added to dilute hydrochloric acid, carbon dioxide gas is formed.

A student carried out an experiment to measure the volume of gas formed as a reaction proceeds. The student added a small mass of powdered barium carbonate to an excess of 0.1 mol / dm^3 hydrochloric acid. A graph of the results was drawn.

The graph is shown.



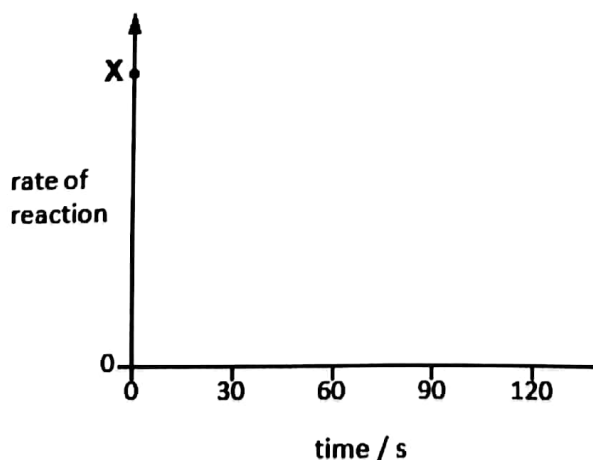
(a) Name the **two** pieces of apparatus needed to take the measurements shown on the graph.

1.

2. [2]

(b) On the axes below, sketch a graph to show how the rate of reaction changes as the reaction proceeds.

Assume the initial rate of reaction is represented by the point at X.



[2]

- (c) The total volume of gas collected was 180 cm^3 at room temperature and pressure. Calculate the mass, in grams, of barium carbonate used.

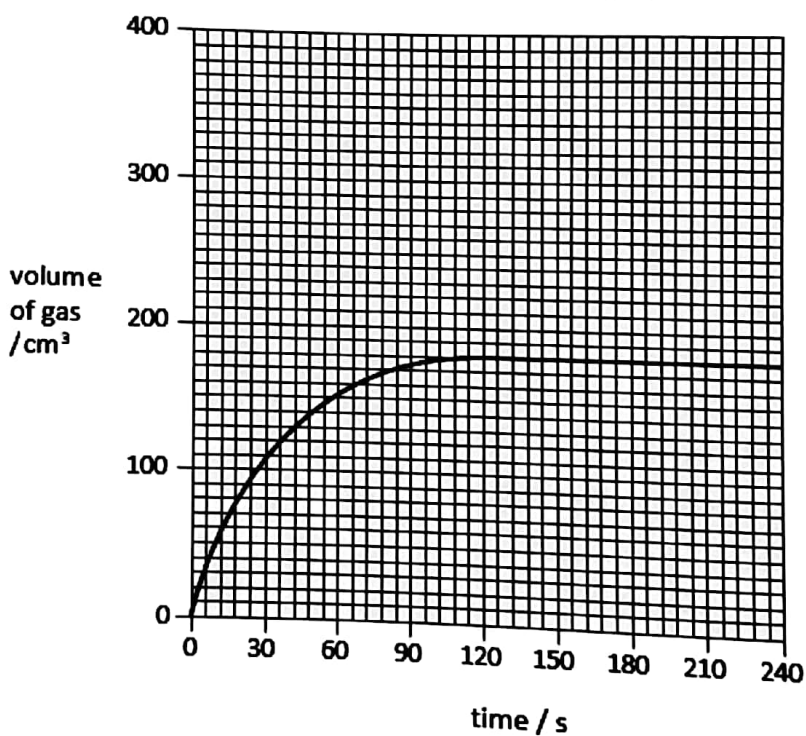


mass of barium carbonate = g [3]

- (d) The original graph has been drawn again.

On the grid, draw the graph expected if the same mass of barium carbonate is added as large lumps instead of as a powder. All other conditions are the same as in the original experiment.

Explain why your graph is different from the original graph.



.....

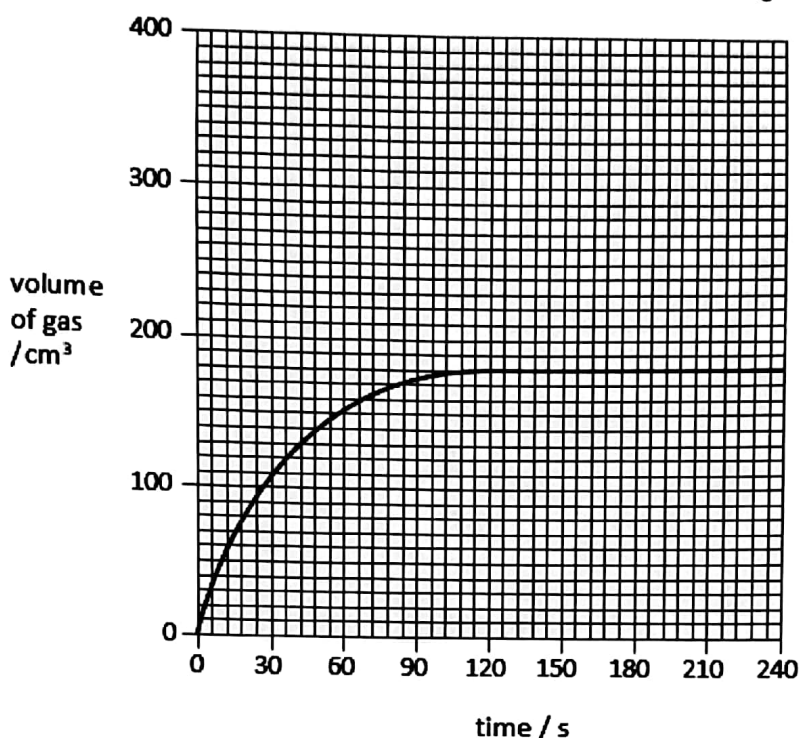
.....

..... [2]

(e) The original graph has been drawn again.

On the grid, draw the graph expected if the concentration of dilute hydrochloric acid is changed from 0.1 mol / dm^3 to 0.2 mol / dm^3 . All other conditions are the same as in the original experiment.

Explain, in terms of particles, why your graph is different from the original graph.



.....
.....
.....
..... [2]

(f) The experiment is changed and the mass of powdered barium carbonate is doubled. All other conditions are the same as in the original experiment. The acid is still in excess.

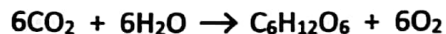
Deduce the volume of gas formed at room temperature and pressure, in cm^3 , in this experiment.

volume of gas = cm^3 [1]

[Total: 12]

A3 Photosynthesis is a reaction that occurs in the leaves of green plants.

Carbon dioxide and water are converted into glucose and oxygen.

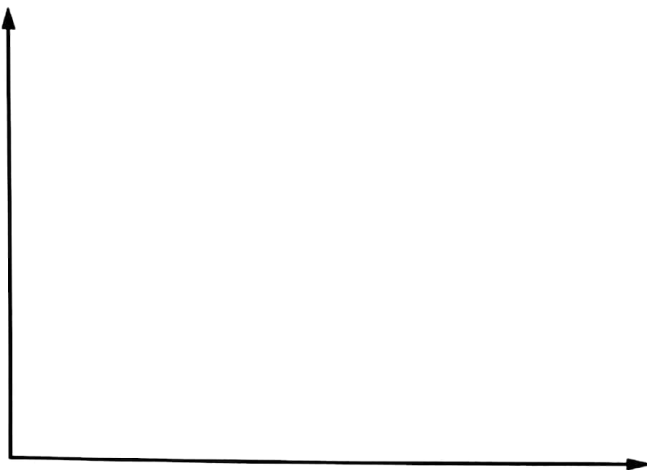


The reaction is endothermic and is catalysed by enzymes.

(a) Draw an energy profile diagram for photosynthesis using the axes shown.

Label

- the axes,
- the enthalpy change,
- the reactants and products.



[3]

(b) Explain in terms of bond breaking and making why the reaction is exothermic?

.....
..... [2]

(c) What is a catalyst?

.....
.....
.....
..... [2]

(d) Explain why the rate of photosynthesis increases as the temperature increases.

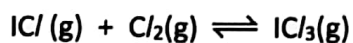
.....
.....
.....
..... [2]

[Total: 9]

A4 Iodine(I) chloride reacts with chlorine to form iodine(III) chloride.

This reaction is investigated at 200 °C in a sealed container.

A dynamic equilibrium mixture is established.



ICl (g) is a dark brown gas.

ICl₃(g) is a yellow gas.

(i) What is meant by the term *dynamic equilibrium*?

Refer to both rate of reaction and concentration in your answer.

.....
.....
.....
..... [3]

(ii) The pressure of the equilibrium mixture is increased.

The temperature is kept at 200 °C.

Predict and explain what will happen to the color of the equilibrium mixture.

.....
.....
.....
..... [2]

[Total: 5]

A5 Chemists have discovered that some noble gases can form compounds.

(a) A 1.000 g sample of one of these compounds contains 0.549 g of xenon, 0.134 g of oxygen and 0.317 g of fluorine.

Calculate the empirical formula of this compound.

empirical formula[2]

(b) Describe and explain how fractional distillation can be used to separate a mixture of neon, argon, krypton and xenon.

.....

.....

.....

..... [3]

[Total: 5]

A6 To a sample of $\text{Cu}(\text{NO}_3)_2(\text{aq})$, a student adds aqueous ammonia drop by drop until it is in excess.

(a) Describe what is observed.

.....
.....
.....
..... [2]

(b) The student repeats the experiment but adds aqueous sodium hydroxide instead of aqueous ammonia.

Describe what is observed.

.....
..... [1]

(c) Describe test for chromium ion.

.....
.....
.....
..... [2]

[Total: 5]

Section B

Answer **three** questions from this section in the spaces provided.

The total mark for this section is 30.

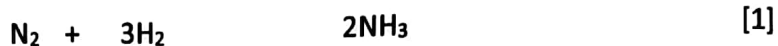
B7 Ammonia is manufactured by the reaction of nitrogen with hydrogen in the presence of a catalyst.

(a) What is the purpose of a catalyst?

..... [1]

(b) The reaction is reversible.

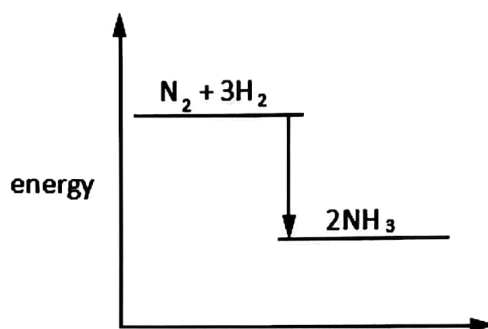
Complete the equation below by adding the sign for a reversible reaction.



(c) The energy level diagram for this reaction is shown.

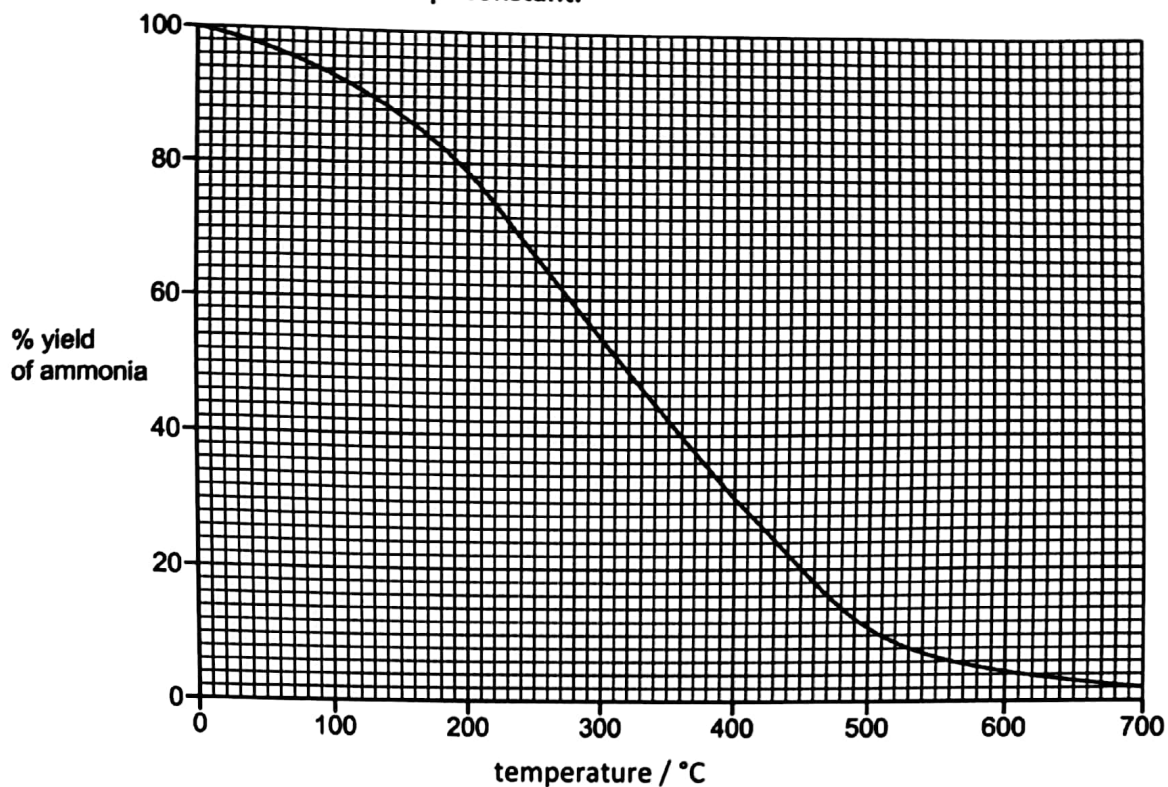
Is this reaction exothermic or endothermic?

Give a reason for your answer.



.....
..... [1]

- (d) The graph shows how the percentage yield of ammonia changes with temperature when the pressure is kept constant.



- (i) Describe how the percentage yield of ammonia changes with temperature.

..... [1]

- (ii) Determine the percentage yield of ammonia at 350°C.

..... [1]

- (e) Describe a test for ammonia.

Test

Result [2]

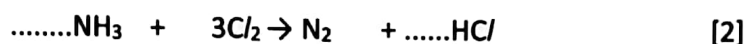
- (f) Ammonia is a weak base.

Describe how you would measure the pH of an aqueous solution of a weak base using Universal Indicator.

.....

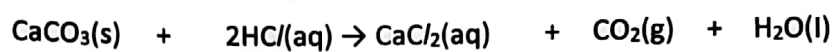
..... [1]

- (g) Complete the chemical equation for the reaction of ammonia with chlorine.



[Total: 10]

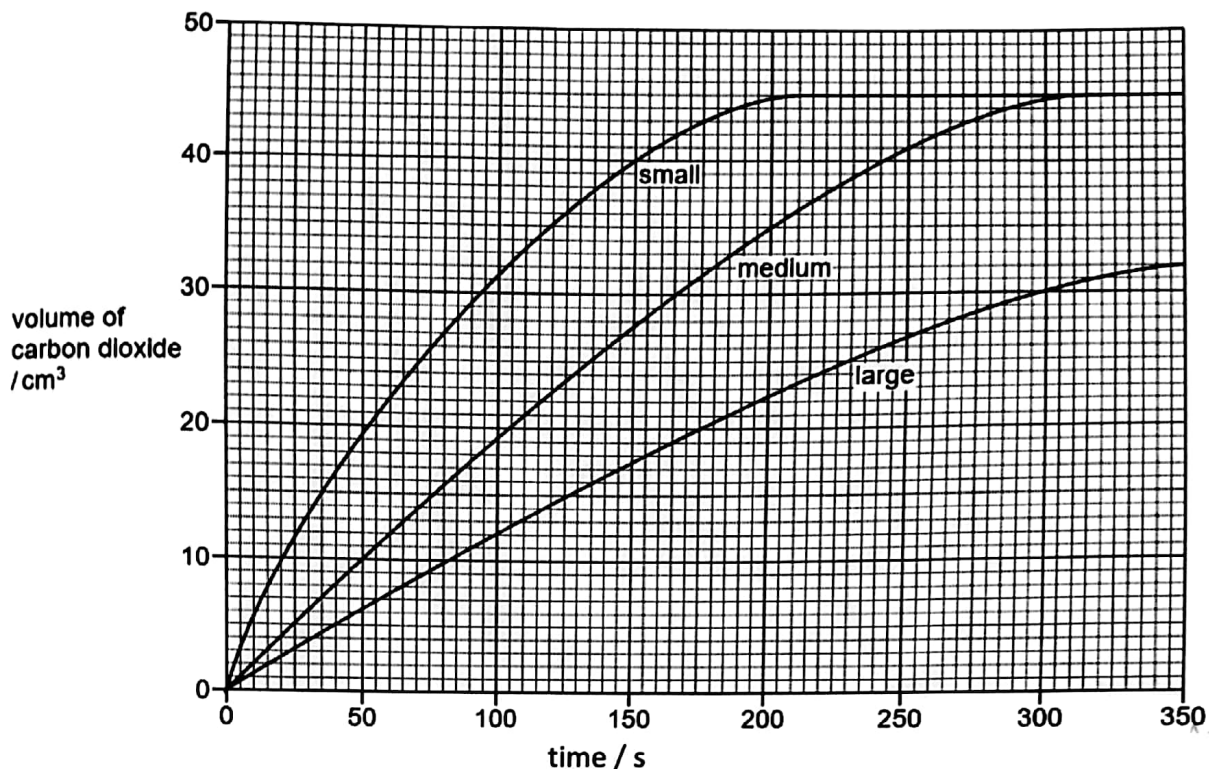
B8 Calcium carbonate reacts with dilute hydrochloric acid.



A student investigated this reaction by measuring the volume of carbon dioxide released every minute at constant temperature.

(a) Draw a diagram of the apparatus that the student could use to investigate this reaction. [3]

(b) The graph shows the results of this reaction using three samples of calcium carbonate of the same mass: large pieces, medium-sized pieces and small pieces.



(i) Which sample, large, medium or small pieces, gave the fastest initial rate of reaction?

Use the graph to explain your answer.

.....
 [2]

(ii) The experiment was repeated using powdered calcium carbonate of the same mass. Draw a line on the grid above to show how the volume of carbon dioxide changes with time for this experiment. [2]

(iii) At what time was the reaction just complete when small pieces of calcium carbonate were used?

..... [2]

(c) When calcium carbonate is heated strongly, calcium oxide is formed.

Give one use of calcium oxide.

..... [1]

[Total: 10]

B9 The table shows the properties of some metals.

metal	density in g/cm ³	melting point in °C	relative strength	relative electrical conductivity	cost
aluminium	2.7	660	7.0	4.0	expensive
iron	7.9	1535	21.0	1.1	cheap
lead	11.3	328	1.5	0.5	expensive
silver	10.5	962	2.0	6.7	very expensive
tungsten	19.4	3420	12.0	2.0	expensive

(a) Use the information in the table to answer the questions.

(i) Which metal would be most useful for making overhead power cables?

Give **two** reasons for your answer.

metal

reason 1

reason 2[3]

(ii) Why is iron and **not** tungsten used to reinforce concrete?

..... [1]

(iii) The front part of a space rocket is called a nose cone. The nose cone gets **very** hot as the space rocket moves through the air.

Which metal is best to make a space rocket nose cone? Explain your answer.

..... [1]

(b) Tungsten is a transition element.

State **two** physical properties of transition elements which are **not** shown by Group-I elements.

1.

2. [2]

(c) When extremely hot tungsten reacts with oxygen, tungsten(VI) oxide is formed.

Balance the chemical equation for this reaction.



(d) Some information about the reaction of four metals with oxygen is given.

cobalt: reacts slowly at high temperatures

iron: thin wire burns when heated strongly

magnesium: burns when heated

tungsten: reacts very slowly at extremely high temperatures

List these metals in order of their reactivity. Put the least reactive metal first.

least reactive



most reactive

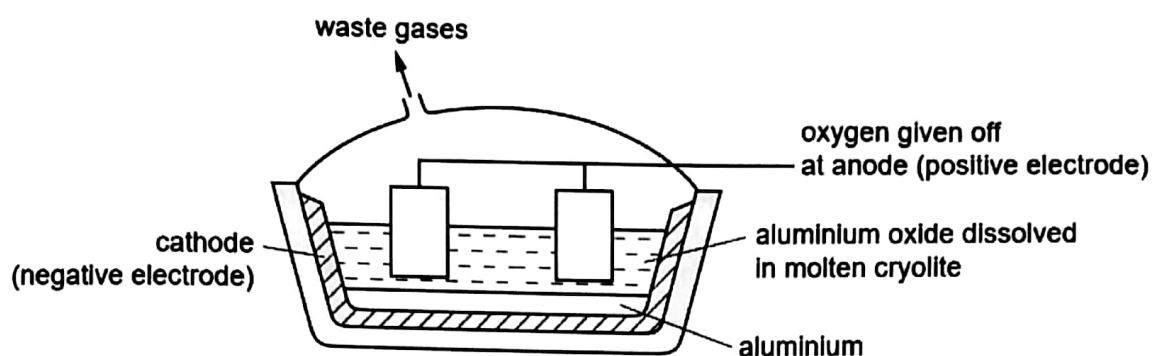
--	--	--	--

[2]

[Total: 10]

B10 Aluminium and iron are extracted from their ores by different methods.

Aluminium is extracted from its purified oxide ore by electrolysis



(a) The electrodes are both made of the same substance.

Name this substance.

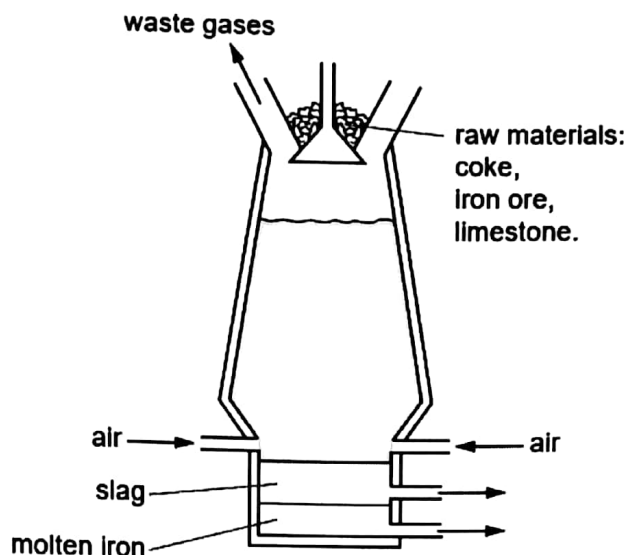
..... [1]

(b) Aluminium oxide is dissolved in molten cryolite before it is electrolysed.

Give **two** reasons why aluminium oxide dissolved in molten cryolite is electrolysed rather than molten aluminium oxide alone.

.....
..... [2]

(c) Iron is extracted from its oxide ore by reduction using carbon in a blast furnace.



(i) Place the elements aluminium, carbon and iron in order of reactivity with the least reactive element first.

..... [1]

(ii) Use your answer to (c)(i) to explain why iron is extracted by reduction using carbon but aluminium is not.

.....
 [1]

(d) What is the name of the ore of iron which consists mainly of iron(III) oxide?

..... [1]

(e) Write balanced equations for the reactions occurring in the blast furnace which involve

(i) the complete combustion of coke (carbon),

..... [1]

(ii) the production of carbon monoxide from carbon dioxide,

..... [1]

(iii) the reduction of iron(III) oxide,

..... [1]

(iv) the formation of slag.

..... [1]

[Total: 10]

