

Name:

Date:

C4 - Test 4
CHEMICAL CHANGES
Intermediate

GCSE

CHEMISTRY

AQA - Triple Science

Mark

Grade

Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

Information

- The marks for the questions are shown in brackets

1.

Steels are used to make cars, bridges and knives.
The main element in steel is iron.

(a) Iron is extracted from an *ore* that contains about 60% iron oxide, Fe_2O_3

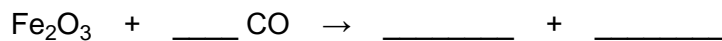
(i) What is the meaning of *ore*?

(1)

(ii) In a blast furnace, iron oxide reacts with carbon monoxide to produce iron.
The word equation for this reaction is:

iron oxide + carbon monoxide \rightarrow iron + carbon dioxide

Complete and balance the chemical equation for this reaction.



(2)

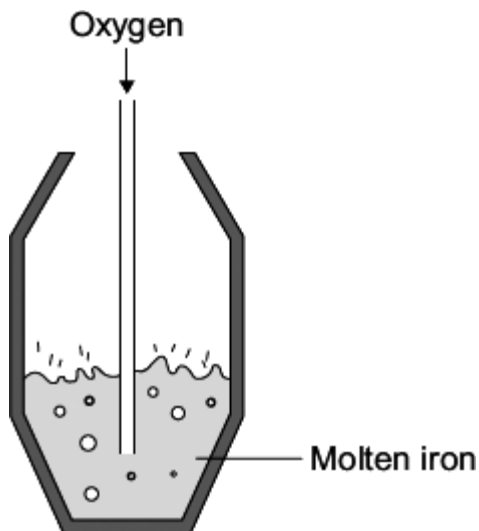
(iii) Name the type of reaction that produces a metal from its metal oxide.

(1)

(b) Steels are produced from molten iron in two stages:

Stage 1 blowing oxygen into molten iron from the blast furnace.

Stage 2 adding other metals to make different steels.



(i) In **Stage 1**, suggest how the oxygen removes most of the carbon from the molten iron.

(2)

(ii) **Stage 2** produces different steels.

Suggest why different steels are needed.

(1)

- (c) Old 5p and 10p coins in the UK were made from cupro-nickel.
Cupro-nickel is 75% copper and 25% nickel.

New 5p and 10p coins in the UK are now made from nickel-plated steel and not from cupro-nickel.

Explain why.

(2)
(Total 9 marks)

2.

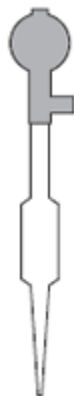
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student has to check if two samples of hydrochloric acid, **A** and **B**, are the same concentration.

Describe how the student could use the apparatus and the solutions in the diagram below to carry out titrations.



Burette



Pipette



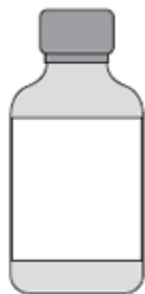
Conical flask



White tile



Indicator



Hydrochloric acid **A**



Hydrochloric acid **B**

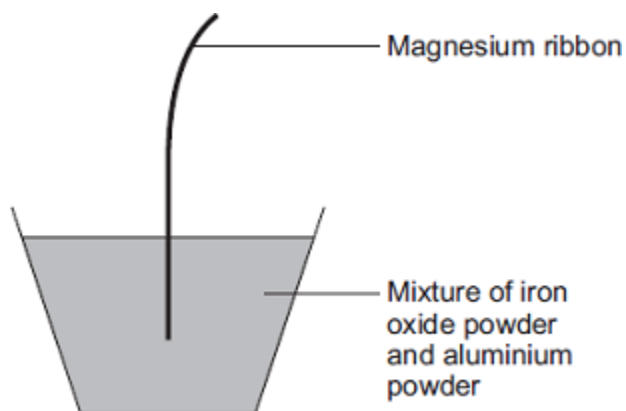


Sodium hydroxide solution

(Total 6 marks)

3.

The diagram shows one way of producing iron.



Iron oxide reacts with aluminium to produce iron.

The symbol equation for the reaction is:



(a) (i) Complete the word equation for this reaction.

iron oxide + aluminium \longrightarrow iron + _____

(1)

(ii) The magnesium ribbon is lit to start the reaction.

Why does the burning magnesium ribbon start the reaction?

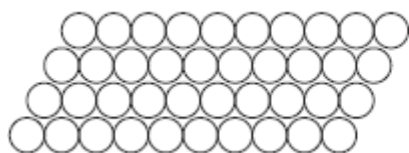
(1)

(b) In industry, iron is produced in the blast furnace when iron oxide is heated with carbon.

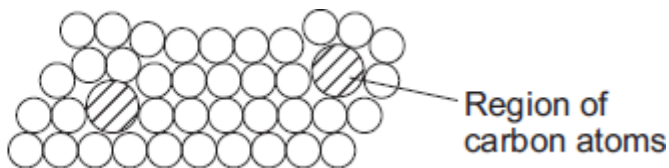
The iron from the blast furnace is called cast iron.

Cast iron contains carbon.

The diagrams show the structure of pure iron and cast iron.



Pure iron



Cast iron

Use the diagrams to help you answer the questions.

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

Pure iron is an element because pure iron

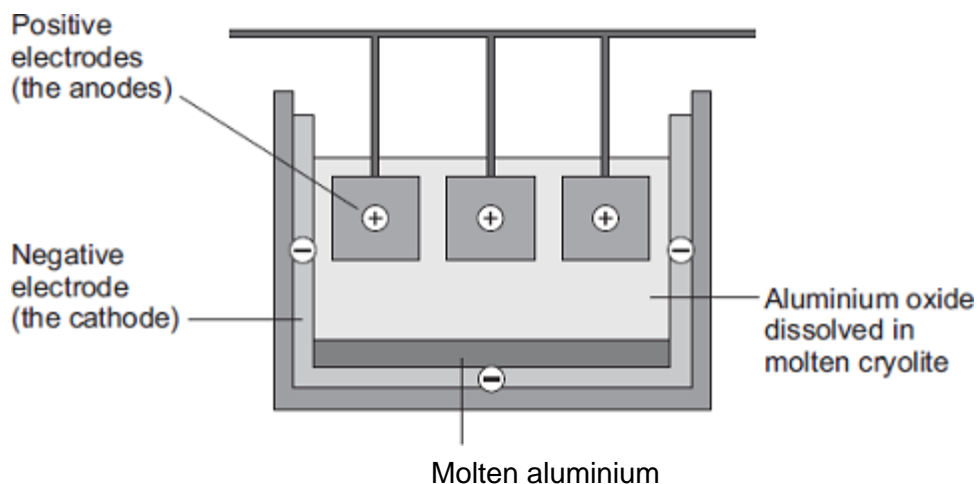
contains only one sort of atom.
is magnetic.
is a metal.

(1)

- (ii) Suggest why cast iron is harder than pure iron.

(2)

- (c) Aluminium is extracted by electrolysis using the ionic compound aluminium oxide.



- (i) Aluminium **cannot** be extracted by heating aluminium oxide with carbon.
Suggest why.

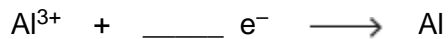
(1)

- (ii) Why is aluminium oxide dissolved in molten cryolite?

(1)

(iii) Aluminium metal is produced at the negative electrode (cathode).

Complete the half equation for the process.



(1)

(iv) Use the half equation to state why Al^{3+} ions are reduced.

(1)

(v) Explain why the positive electrodes (anodes) burn away.

Use your knowledge of the products of electrolysis to help you.

(4)

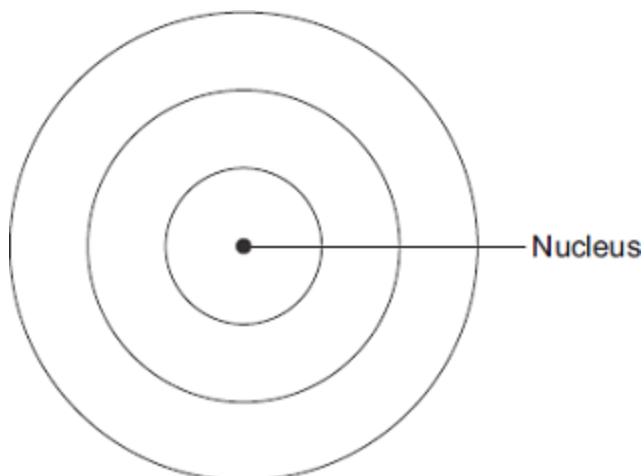
(Total 13 marks)

4.

Aluminium has many uses.

(a) An aluminium atom has 13 electrons.

(i) Draw the electronic structure of an aluminium atom.



(1)

(ii) Name the **two** sub-atomic particles in the nucleus of an aluminium atom.

_____ and _____

(1)

(iii) Why is there no overall electrical charge on an aluminium atom?

(1)

(b) Rail tracks are made from steel.

Molten iron is used to weld rail tracks.

The reaction of aluminium with iron oxide is used to produce molten iron.

(i) Balance the chemical equation for the reaction.



(1)

(ii) Why does aluminium react with iron oxide?

(1)

(Total 5 marks)

5.

Go Grease is a drain and oven cleaner.



The active ingredient in Go Grease is the alkali sodium hydroxide (NaOH).

(a) Name or give the formula of the ion that makes solutions alkaline.

(1)

(b) Sodium hydroxide is a *strong* alkali.

In terms of ionisation, what is meant by the word *strong*?

(1)

(c) You are given solutions of sodium hydroxide and ammonia of the same concentration.

Describe and give the results of a test to show that sodium hydroxide is a stronger alkali than ammonia solution.

(2)

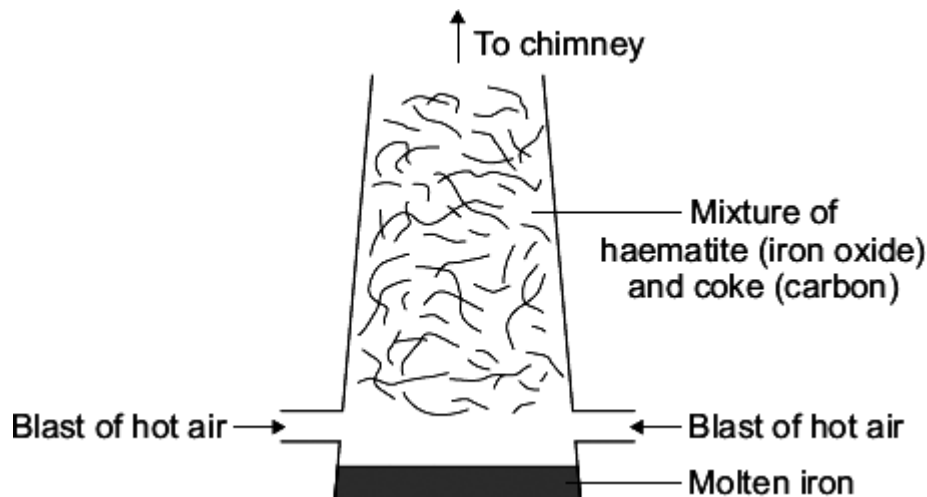
(Total 4 marks)

6.

Iron is produced by reacting a mixture of haematite and coke in a blast furnace.

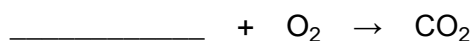
Haematite is an ore of iron containing iron oxide (Fe_2O_3).

Coke is made from coal and is almost pure carbon.



- (a) (i) The coke burns in air. This reaction heats the furnace to above $1300\text{ }^\circ\text{C}$.

Complete the chemical equation for carbon reacting with oxygen to form carbon dioxide.



(1)

- (ii) Carbon monoxide is also formed in the furnace. Carbon monoxide reacts with iron oxide to produce iron and carbon dioxide.

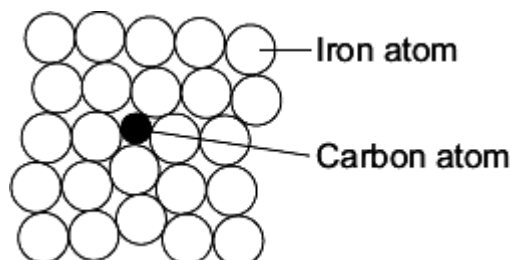


Complete and balance the chemical equation for the production of iron.



(2)

- (iii) Iron from a blast furnace is called cast iron and contains about 4% carbon.



Why is pure iron softer than cast iron?

(1)

- (b) Steel is made by reducing the percentage of carbon in cast iron and then adding different metals to form the type of steel required.

In the UK we use about 1.8 billion steel cans every year but only 30% of these are recycled. Recycling reduces waste. Producing steel from recycled cans requires only 25% of the energy needed to make steel from iron ore.

Give **three** environmental benefits of recycling a higher percentage of used steel cans.

1. _____

2. _____

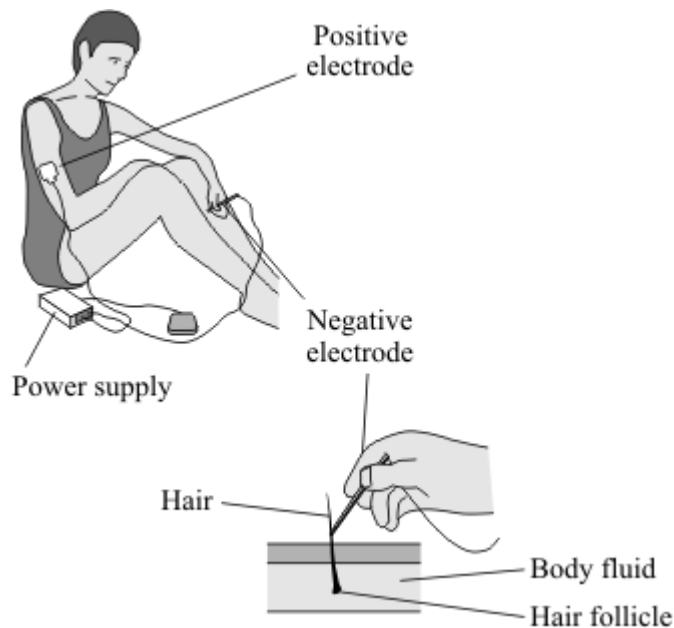
3. _____

(3)

(Total 7 marks)

7.

Electrolysis can be used to remove unwanted hair from the skin.



The positive electrode is connected by a patch to the skin.

The negative electrode is connected to the hair.

The body fluid is a solution that contains sodium chloride. The electricity causes the electrolysis of a small amount of this solution.

(a) In this solution hydrogen ions move to the negative electrode.

Complete the sentence using **one** word from the box.

negative	neutral	positive
-----------------	----------------	-----------------

Hydrogen ions move to the negative electrode because they have a _____ charge.

(1)

(b) Draw a ring around the name of the gas produced at the positive electrode during the electrolysis of sodium chloride solution.

chlorine

hydrogen

nitrogen

(1)

(c) The electrolysis of the sodium chloride solution forms a strong alkali around the hair follicle.

(i) Complete the name of this strong alkali using **one** of the words from the box.

chloride

hydroxide

nitrate

The name of this strong alkali is sodium _____ .

(1)

(ii) Suggest how this strong alkali helps to remove the hair.

(1)

(Total 4 marks)

8.

Copper sulfate (CuSO_4) is a salt that has many uses.

An aqueous solution of copper sulfate can be made by reacting copper oxide (CuO) with an acid.

(a) (i) Name this acid. _____

(1)

(ii) Write a balanced symbol equation, including state symbols, for this reaction.

(2)

(b) Copper oxide reacts much faster with acid at 40 °C than at 20 °C.

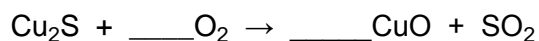
Explain why in terms of particles.

(2)

(Total 5 marks)

9.

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



(1)

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

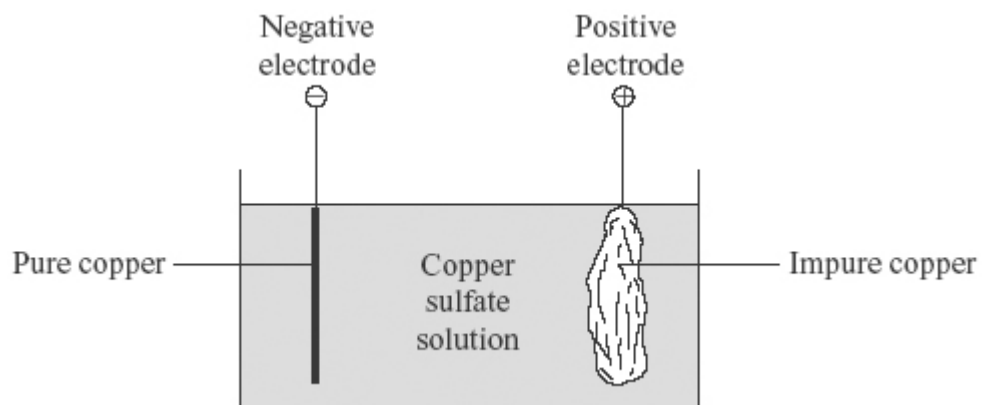
(2)

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

Describe and explain what happens during this reaction.

(2)

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



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

(1)

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

(1)

(d) Copper-rich ores are running out.

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

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

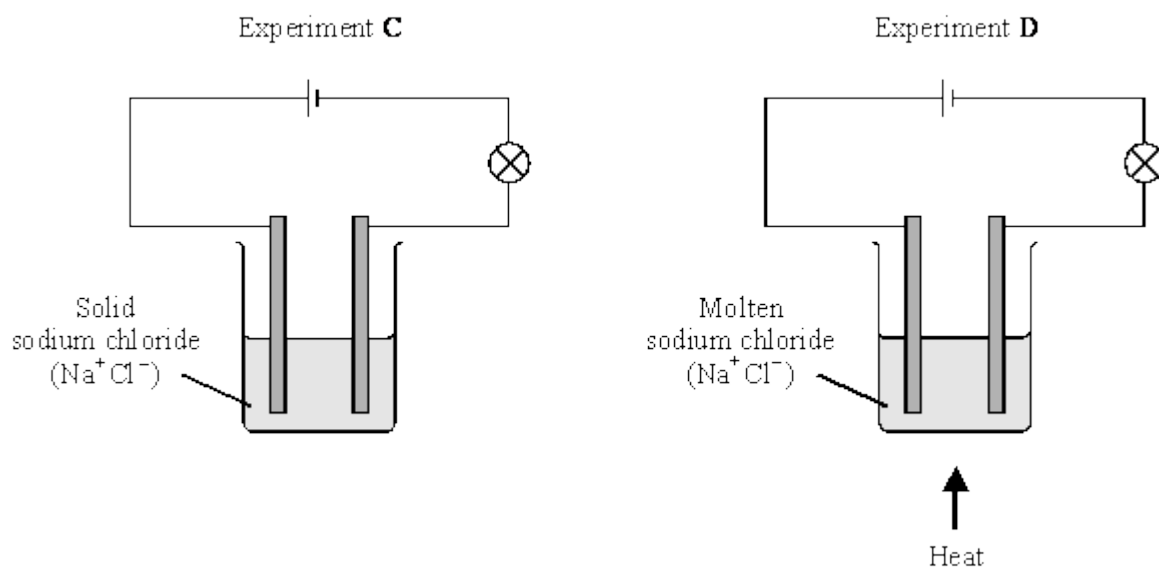
Explain why.

(3)

(Total 10 marks)

10.

(a) Two experiments were set up as shown.



(i) Give **two** observations which would be seen only in Experiment D.

1. _____

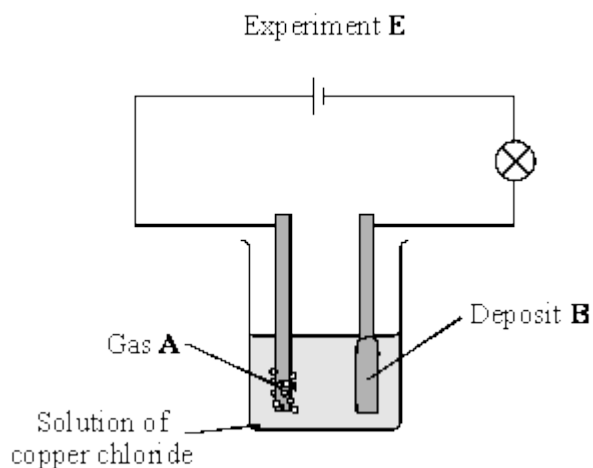
2. _____

(2)

(ii) Explain why in Experiment C no changes would be seen.

(2)

(b) Another *electrolysis* experiment used an aqueous solution of copper chloride.



(i) What does *electrolysis* mean?

(2)

(ii) Name the gas **A** and the deposit **B**.

(2)

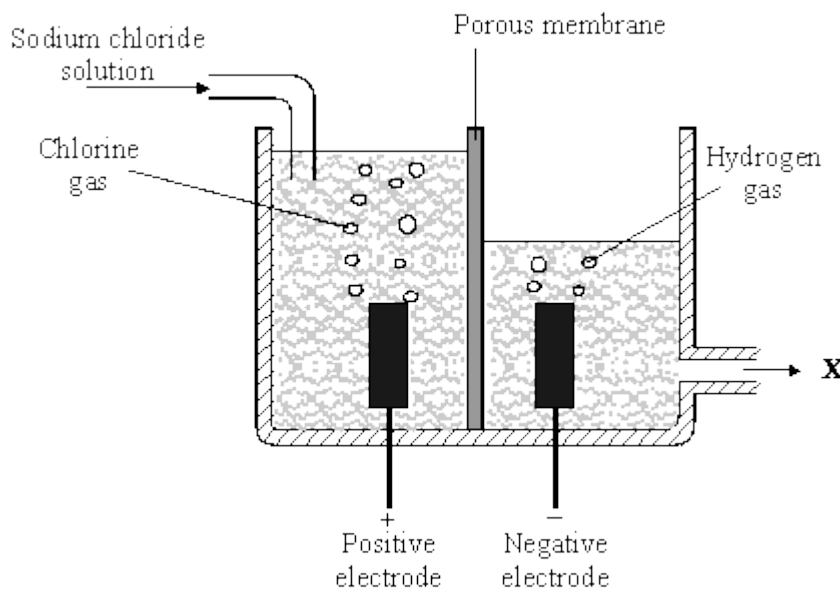
(c) Give **one** industrial use of electrolysis.

(1)

(Total 9 marks)

11.

Sodium chloride solution is a useful raw material for the manufacture of other substances.



(i) What is the name of the process shown?

(1)

(ii) Chloride ions lose electrons at the positive electrode. What is the name of this type of reaction?

(1)

(iii) The solution formed at **X** is alkaline. What causes this solution to be alkaline?

(2)

(iv) Give a balanced ionic equation for the formation of hydrogen gas at the negative electrode.

(3)

(Total 7 marks)