

Reactivity Series

Question Paper

Level	GCSE
Subject	Chemistry
Exam Board	Edexcel IGCSE
Module	Double Award (Paper 1C)
Topic	Chemistry of the Elements
Sub-Topic	Reactivity Series
Booklet	Question Paper

Time Allowed: 91 minutes

Score: /76

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	75%	70%	60%	55%	50%	<50%

Edexcel (I)GCSE

Chemistry

Double Award (Paper 1C)

Chemistry of The Elements: Reactivity Series

Total Marks: 76

You must have:

Ruler

Calculator

Instructions:

Use black ink or ball-point pen.

Answer All questions.

Answer the questions in the spaces provided there may be more space than you need

Show all the steps in any calculations and state the units.

Information:

The total mark for this paper is 76

The marks for each question are shown in brackets use this as a guide as to how much time to spend on each question.

Advice:

Read each question carefully before you start to answer it.

Keep an eye on the time.

Write your answers neatly and in good English.

Try to answer every question.

Check your answers if you have time at the end.

1 Iron is a useful metal. One problem with using iron is that it can rust.

(a) (i) Name the iron compound present in rust.

(1)

.....
(ii) Name the **two** substances that iron reacts with when it rusts.

(2)

1

2

(b) What type of reaction occurs in the rusting of iron?

Place a cross (☒) in **one** box.

(1)

- combustion
- decomposition
- displacement
- oxidation

(c) Galvanising can prevent iron from rusting. In this process, the iron is coated with another metal.

(i) Identify the other metal.

(1)

.....
(ii) Identify one object suitable for galvanising.

Place a cross (☒) in **one** box.

(1)

- bicycle chain
- bucket
- car engine
- drink can

(d) State **two** other methods used to prevent iron from rusting.

(2)

1

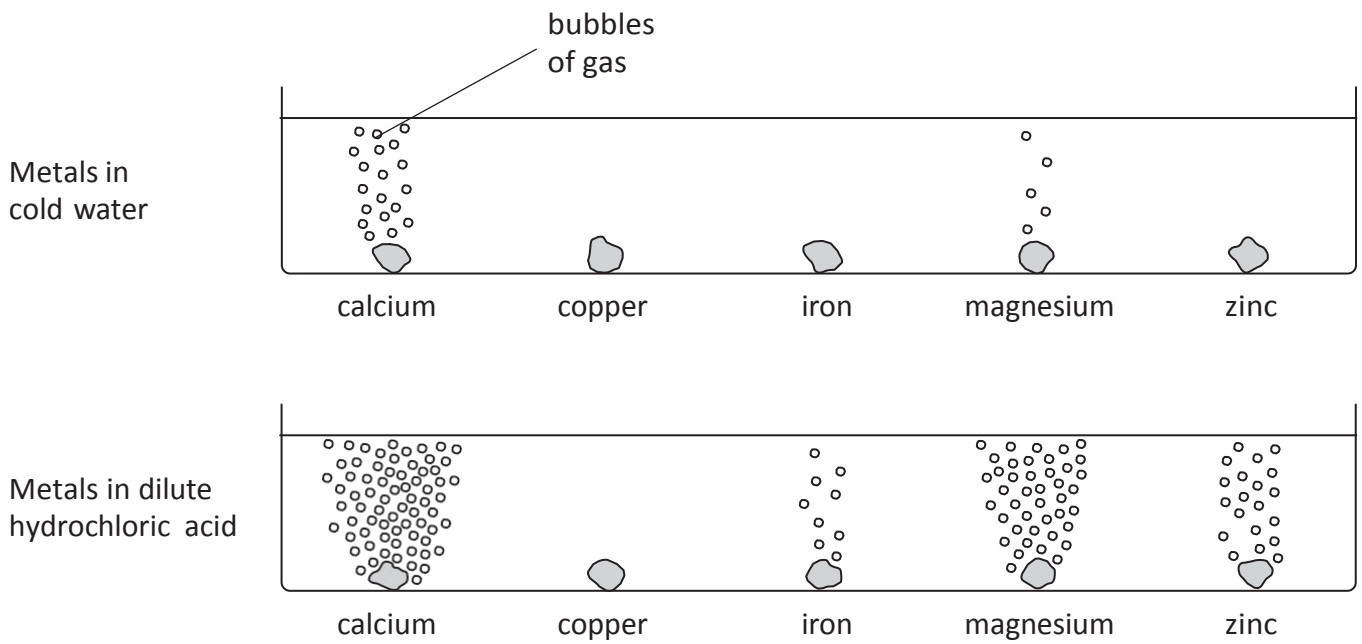
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2

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(Total for Question 1 = 8 marks)

2 The diagrams show the reactions of some metals with cold water and with dilute hydrochloric acid.



(a) Answer the following questions, using only the metals that appear in the diagrams.

(i) Name **two** metals that react with cold water.

(2)

..... and

(ii) Name **one** metal that reacts with dilute hydrochloric acid but **not** with cold water.

(1)

.....

(iii) Arrange the five metals in order of reactivity.

(3)

Most reactive metal

.....

.....

.....

Least reactive metal

(b) Some magnesium powder is added to dilute sulfuric acid in a test tube.
A colourless solution is formed and a gas is given off.

When more magnesium is added, the reaction continues for a while and then stops,
leaving some magnesium powder in the test tube.

When a flame is placed at the mouth of the test tube, the gas burns with a
squeaky pop.

(i) Identify the gas produced. (1)

.....

(ii) Suggest why the reaction stops. (1)

.....

.....

(iii) State the name of the colourless solution. (1)

.....

(iv) How could you separate the magnesium powder from the colourless solution? (1)

.....

.....

(c) In some fireworks, magnesium powder reacts quickly with oxygen in the air.
During this reaction heat energy is produced.

(i) What name is given to reactions in which heat energy is produced? (1)

.....

(ii) Name the compound formed when magnesium reacts with oxygen. (1)

.....

(Total for Question 2 = 12 marks)

3 The table gives information about barium salts.

Barium salt	Formula	Solubility in water	Toxic (poisonous)
barium chloride		soluble	yes
barium nitrate	$\text{Ba}(\text{NO}_3)_2$	soluble	yes
barium carbonate		insoluble	no
barium sulfate	BaSO_4	insoluble	no

(a) Complete the table by giving the formula of barium chloride and of barium carbonate. (2)

(b) The human stomach contains hydrochloric acid.

Suggest why barium carbonate may cause poisoning when it enters the stomach. (2)

.....

.....

.....

(c) Before patients have stomach X-rays they are given a barium salt to swallow.

Which salt in the table is safe to use? (1)

.....

(d) A student accidentally swallowed a small amount of barium hydroxide solution, which is poisonous.

Suggest a reason why a solution of magnesium sulfate could be given to the student to swallow as a first aid treatment. Write a word equation for the reaction that takes place.

(3)

Reason.....

.....

.....

Word equation

.....

(e) The table gives information about the first five elements in Group 2 of the Periodic Table.

Element	Atomic number	Reaction with cold water	Reaction with air
beryllium	4	no reaction	burns when strongly heated
magnesium	12	reacts very slowly	burns when heated
calcium	20	reacts slowly	reacts slowly without heating
strontium	38	reacts quickly	reacts quickly without heating
barium	56		

Use the information in the table to help you answer the questions.

(i) Suggest how barium reacts with cold water and with air.

(2)

Reaction with cold water

.....

Reaction with air

.....

(ii) Use your answer to (e)(i) to suggest how barium should be stored.

(1)

.....

.....

(iii) Suggest a connection between the atomic number and the reactivity of the elements in Group 2.

(1)

.....

.....

(Total for Question 3 = 12 marks)

4 Air is a mixture of gases.

The table gives the formulae of three gases and their approximate percentage by volume in a sample of dry, unpolluted air.

Gas	Percentage by volume
CO ₂	0.04
N ₂	78
O ₂	21

(a) (i) Give the names of the two main gases in the sample of air. (1)

..... and

(ii) Give the name of the gas that makes up most of the remaining 0.96% of the air. (1)

.....

(b) State a use for N₂ (1)

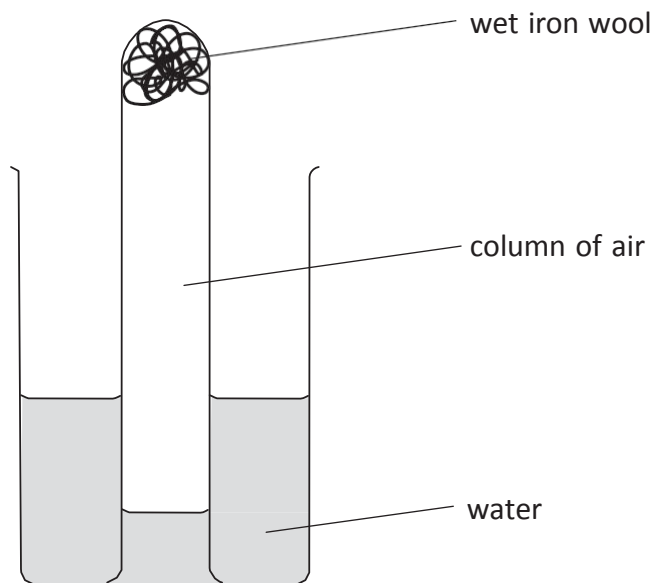
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(c) Give the name of a gas present in **polluted** air that causes acid rain. (1)

.....

(d) A student used this apparatus to find the percentage by volume of oxygen in a sample of air.



She used this method.

- place some wet iron wool in the bottom of a test tube
- invert the test tube in a beaker containing water
- measure the height of the column of air in the test tube
- leave the test tube for one week
- measure the new height of the column of air

The table shows her results.

Initial height of column of air in mm	80
Final height of column of air in mm	63

(i) Some of the iron turned into rust.

Write a word equation for this reaction.

(2)

(ii) Use the student's results to calculate the percentage of oxygen in this sample of air.

(2)

Percentage of oxygen

(e) The student left the apparatus for another week and measured the height of the column of air again.

From this measurement, how could she tell whether all of the oxygen in the test tube had been used up in the first week?

(1)

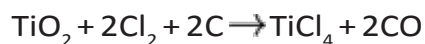
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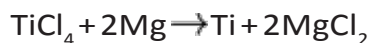
(Total for Question 4 = 9 marks)

5 Titanium is extracted from its main ore, rutile, in a three-stage process.

Stage 1 Rutile is heated with chlorine and coke (carbon) at a temperature of about 900 °C.



Stage 2 TiCl_4 is then added to liquid magnesium at a temperature of about 800 °C in an atmosphere of argon.



During the reaction the temperature rises to about 1100 °C.

Stage 3 The magnesium chloride is removed by distillation from the mixture formed in stage 2, leaving behind pure titanium.

(a) In stage 1, is the carbon oxidised or reduced?

Give a reason for your answer.

(1)

.....

.....

(b) What does the reaction in stage 2 indicate about the reactivity of magnesium compared to the reactivity of titanium?

Explain your answer.

(2)

.....

.....

.....

.....

(c) In stage 3, suggest why distillation can be used to remove magnesium chloride from titanium.

(1)

.....

.....

(d) Titanium has these properties.

- it is corrosion resistant
- it has a high melting point
- it has a very high strength-to-weight ratio
- it is non-toxic

Complete the table to suggest an important property of titanium for each use.

Choose from the four properties listed.

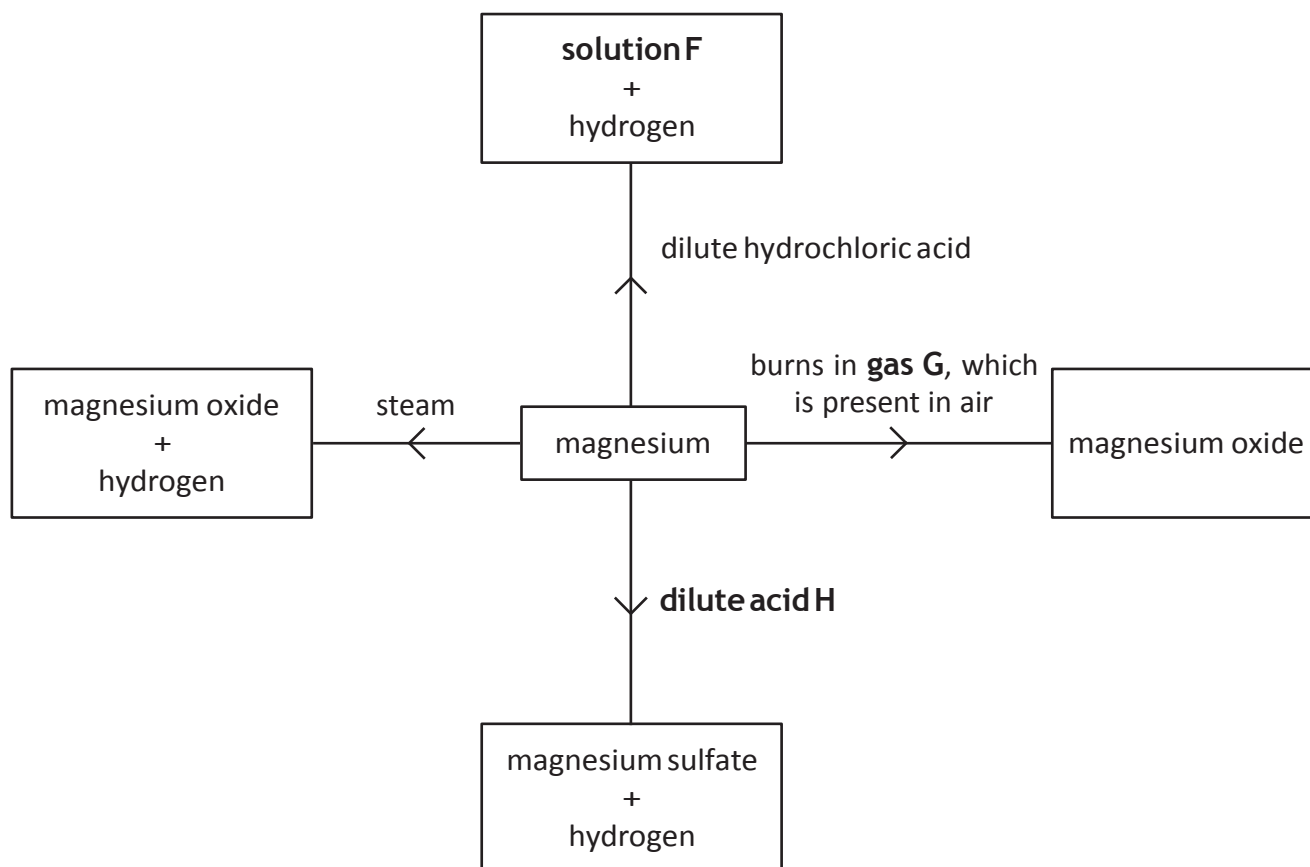
You must choose a different property for each use.

(3)

Use	Property
aircraft engines	
replacement hip joints	
propellers for boats	

(Total for Question 5 = 7 marks)

6 The diagram shows some of the reactions of magnesium.



(a) Complete the table to give the identity of substances F, G and H.

(3)

Substance	Identity
solution F	
gas G	
dilute acid H	

(b) Write a chemical equation for the reaction between magnesium and steam.

(1)

(Total for Question 6 = 4 marks)

7 Aluminium and iron have some similar properties.

Both metals

- are malleable
- are ductile (can be drawn into a wire)
- are good conductors of electricity
- are good conductors of heat
- have a high melting point

(a) (i) Choose two properties from the list that make iron a suitable metal for saucepans. (2)

1

2

(ii) Choose two properties from the list that make aluminium a suitable metal for power cables.

(2)

1

2

(b) Steel is an alloy containing iron.

These are three differences between steel and aluminium.

steel can rust but aluminium resists corrosion

steel has a higher density than aluminium

steel is much stronger than aluminium

(i) Use information from the list to suggest why steel is the better metal for making bridges.

(1)

.....

.....

.....

(ii) Use information from the list to suggest why aluminium is the better metal for making aircraft bodies.

(1)

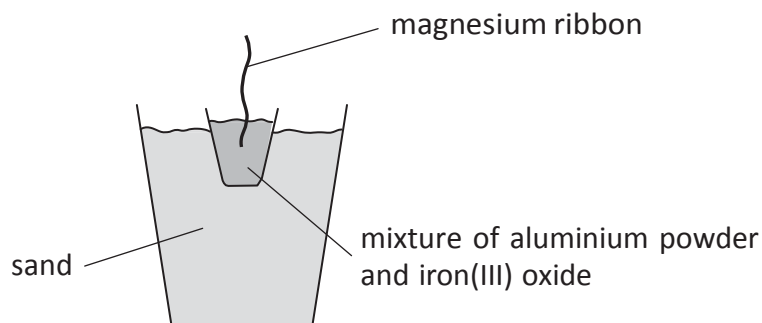
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(c) The reaction between aluminium and iron(III) oxide is known as a thermite reaction.

The diagram shows how this thermite reaction can be carried out.



The magnesium ribbon is lit to ignite the reaction mixture.

The reaction is highly exothermic.

The equation for the reaction is



(i) What is meant by the term **exothermic**?

(1)

.....

.....

.....

(ii) What does the reaction suggest about the reactivity of aluminium compared to the reactivity of iron?

Explain your answer.

(2)

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(iii) Which element is oxidised in this thermite reaction?

Give a reason for your answer.

(2)

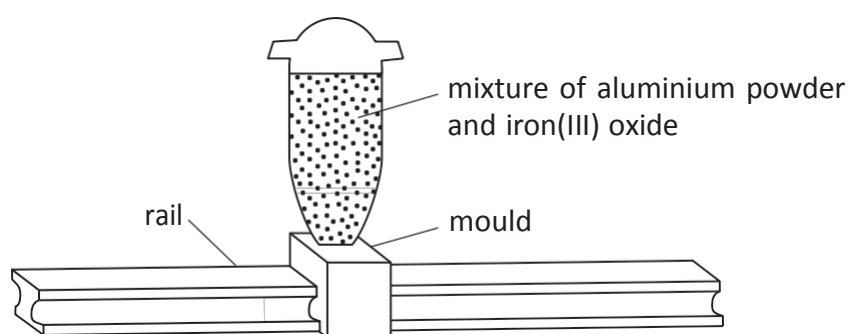
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(d) This thermite reaction can be used to join together two rails on a railway line.



The reaction mixture is ignited and molten iron pours into the mould. The mould is removed and the molten iron solidifies to create a join between the two rails.

Explain why the iron produced in the reaction is molten.

(1)

.....

.....

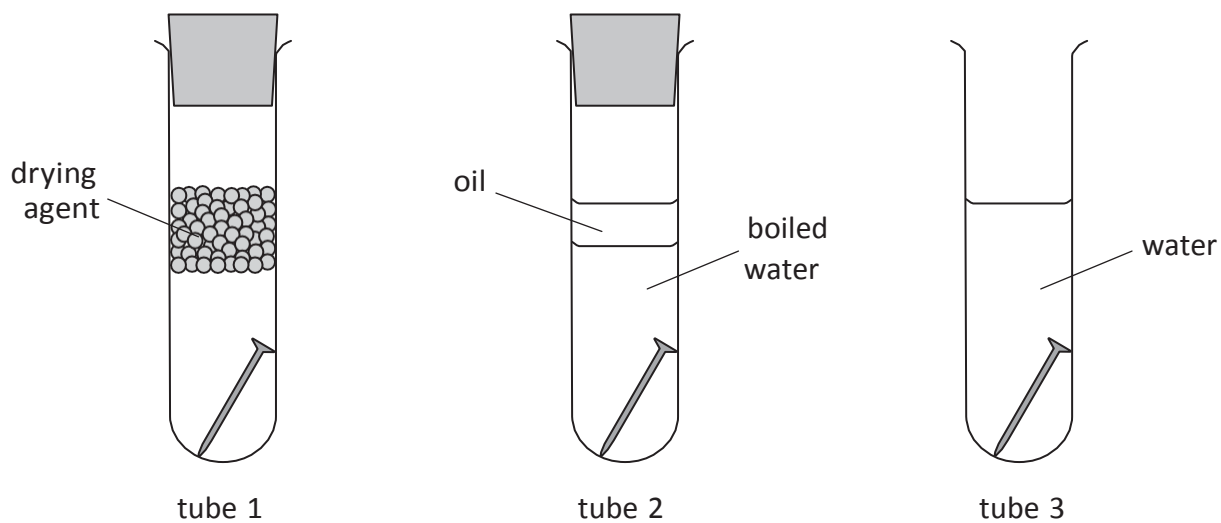
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(Total for Question 7 = 12 marks)

8 This question is about ways of preventing iron nails from rusting.

(a) This experiment is set up with three iron nails.



(i) What is the name of the main compound in rust?

(1)

.....

(ii) Why does the nail in tube 1 not rust?

(1)

.....

.....

(iii) What is the purpose of the layer of oil in tube 2?

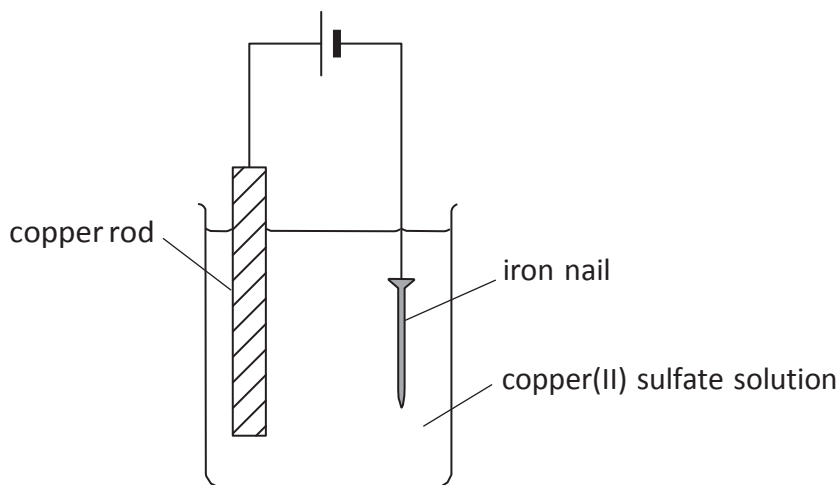
(1)

.....

.....

(c) Electroplating is another method of rust prevention.

This apparatus can be used to electroplate an iron nail.



(i) Equation 1 shows the reaction at the copper rod.



Name this type of reaction, giving a reason for your answer.

(2)

type of reaction

reason

(ii) Equation 2 shows the reaction at the iron nail.



Use equations 1 and 2 to explain why the colour of the copper(II) sulfate solution does not change during the experiment.

(2)

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

(Total for Question 8= 12 marks)