

Name:	Target Grade:	Actual Grade:
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METALS

MCQ and STRUCTURED QUESTIONS

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Find a quiet, comfortable spot free place from distractions.
2. Spend one minute on each mark.
3. Time yourself for every single question.
4. Every chapter has their own question types. Ensure that you know the different question type for each chapter.
5. Make a conscientious effort to remember your mistakes, especially in terms of answering techniques. E.g Take a picture for the mistakes that you made, keep it in a photo album, and revise it over and over again.
6. Highlight question types that you tend to keep making mistakes and review them nearing exams.
7. Always review the common questions and question type that you tend to make mistakes nearing exams.
8. During exams, classify the question type and recall what you have learnt, how you need to analyse the questions for the different question type, what you need to take note of and answer with the correct answering techniques!

🌟 Wishing you all the best for this test!

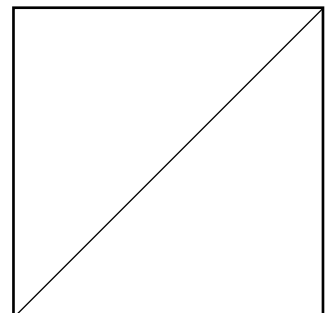
You've got this!

💡 With lots of love,
Bright Culture 🧡

If you are struggling in this paper, means you need to work harder!

If you need any professional guidance and further advice on how to advance, feel free to WhatsApp us at 91870820 or find us at www.bright-culture.com/. We are committed to connect you to your future to reach your goals.

MARKS



METALS MCQ

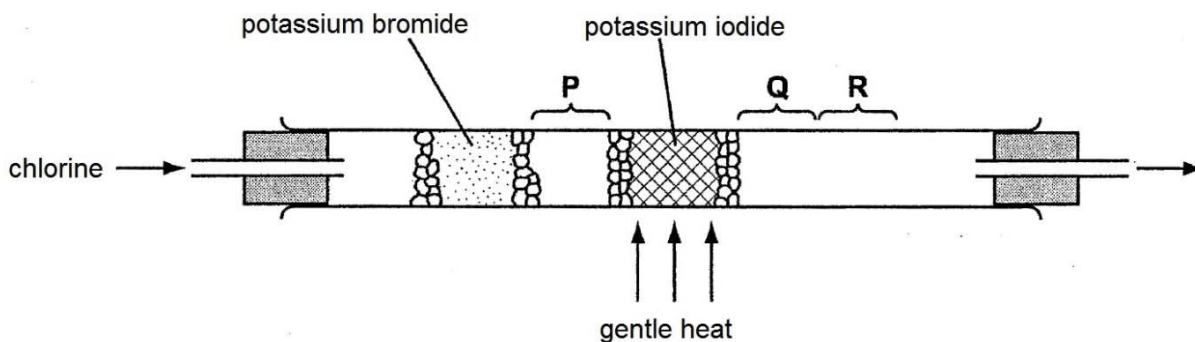
Paper 1

- 1 An excess sample of an alloy, containing two metals, was dissolved in dilute sulfuric acid. Aqueous sodium hydroxide was then added to the solution. A precipitate was formed. An excess of the alkali caused the mass of the precipitate to decrease leaving a dirty green solid and a colourless solution.

What were the two metals present in the alloy?

- A** calcium and zinc
- B** copper and iron
- C** copper and lead
- D** iron and zinc

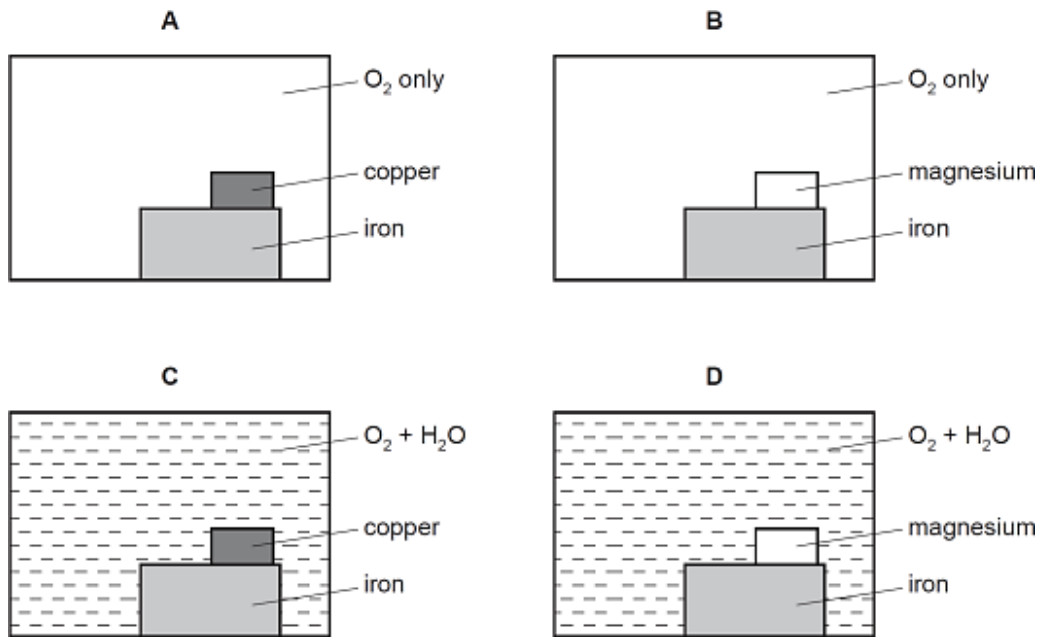
- 2 Using the apparatus shown, chlorine is passed through the tube. After a short time, coloured substances are seen at **P**, **Q** and **R**.



What are these coloured substances?

	P	Q	R
A	reddish-brown vapour	violet vapour	black solid
B	reddish-brown vapour	reddish-brown vapour	reddish-brown vapour
C	green gas	violet vapour	black solid
D	green gas	reddish-brown vapour	reddish-brown liquid

3 Which diagram correctly shows the conditions necessary for rusting of iron and also the metal that can be used to prevent rusting by sacrificial protection?

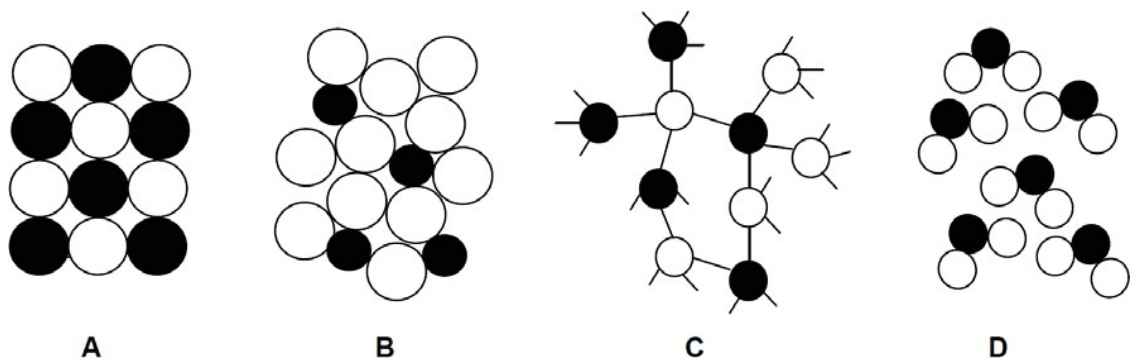


4 Scrap iron is often recycled.

Which reason for recycling is **not** correct?

- A It reduces the amount of pollution at the site of the ore extraction.
- B It reduces the amount of waste taken to landfill sites.
- C It reduces the need to collect the scrap iron.
- D It saves natural resources.

5 Which diagram below shows the structure of an alloy?



6 Which of the following statements best explains why 99.99% copper is used in manufacturing high quality electrical wires for audio equipment?

- A Copper is a good conductor of electricity.
- B Copper is a very reactive metal.
- C 99.99% copper is less ductile and cannot be stretched easily.
- D Copper is of high purity and is able to conduct electric current.

- 7 Statement 1: Alloying iron with other materials to form stainless steel prevents iron from rusting by excluding oxygen.

Statement 2: Painting, oiling and electroplating are all methods of preventing iron from rusting.

Which is correct?

- A Both statements are correct and statement 2 explains statement 1.
B Both statements are correct but statement 2 does not explain statement 1.
C Statement 1 is correct but statement 2 is incorrect.
D Statement 2 is correct but statement 1 is incorrect.
- 8 Iron is extracted from hematite in a blast furnace.
Which reaction contributes most of the heat in the blast furnace as it increases the temperature to over 1500°C?
- A calcium carbonate → calcium oxide + carbon dioxide
B calcium oxide + silicon dioxide → calcium silicate
C carbon + oxygen → carbon dioxide
D carbon dioxide + carbon → carbon monoxide
- 9 What are the main gases that escape from the top of the blast furnace in the manufacture of iron by the blast furnace?
- A Nitrogen, steam and oxygen
B Oxygen, carbon dioxide and steam
C Nitrogen, carbon monoxide and carbon dioxide
D Carbon monoxide, carbon dioxide and nitrogen monoxide

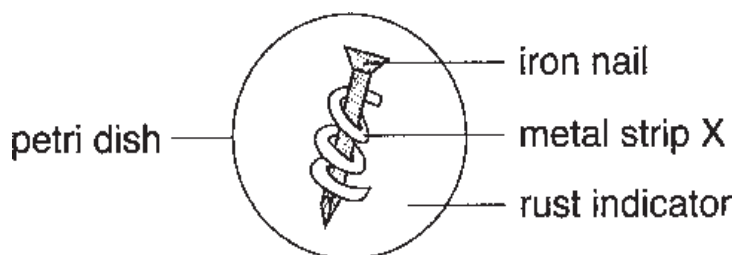
- 10 The statements give some information about metals R, S, T and U.

- Carbonate of U does not decompose on heating.
- Only oxides of R and T can be reduced by heating with carbon.
- R and S react with dilute hydrochloric acid but not with cold water.
- T reacts with neither dilute hydrochloric acid nor water.

Which is the correct order of increasing reactivity of the four metals?

- A $T < R < S < U$
B $T < S < R < U$
C $U < S < R < T$
D $U < T < R < S$

11 Consider the following set-up.



The rust indicator will turn blue in the presence of rust.

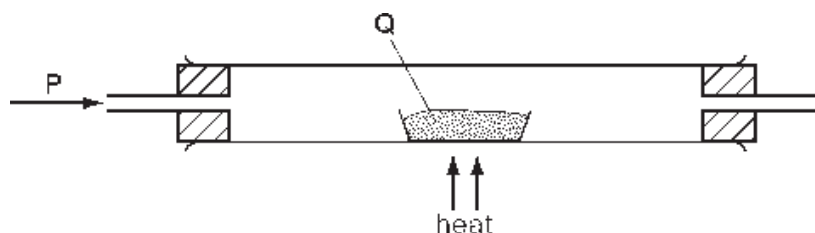
Some statements concerning the experiment are given below.

- (I) If **X** is copper, the iron nail will not corrode readily.
- (II) If **X** is iron, the iron nail will not corrode readily.
- (III) If **X** is silver, a blue colour is observed around the iron nail.

Which of the following statements is/are correct?

- A** (I) only
- B** (III) only
- C** (I) and (II) only
- D** (II) and (III) only

12 In the apparatus shown, gas **P** is passed over solid **Q**.



Which of the following identities of **P** and **Q** would **not** result in a reaction?

	P	Q
A	carbon monoxide	copper (II) oxide
B	carbon monoxide	lead (II) oxide
C	hydrogen	iron (III) oxide
D	hydrogen	zinc oxide

13 Which of the following combinations below correctly states how the increase in the percentage of carbon in steel affects its properties?

	strength	malleability	melting point	brittleness
A	↑	↑	↓	↓
B	↑	↓	↑	↓
C	↑	↓	↓	↑
D	↓	↑	↑	↓

Key:

↑ = increase

↓ = decrease

- 14 The positions of three metals X, Y and Z are indicated in the reactivity series below.

Most reactive potassium X
 sodium zinc
 Y
 iron
Least reactive Z

How are the metals obtained from their ores?

	electrolysis	reduction with carbon	found uncombined
A	X	Y	Z
B	X	Z	Y
C	Y	X	Z
D	Z	X	Y

Paper 2 Section A

- 1 Two experiments were carried out to find out the positions of the metals cobalt (Co), gallium (Ga) and bismuth (Bi) in the reactivity series.

In experiment I, hydrogen gas was passed separately over the heated oxides of the three metals in the combustion tube. The results are given in Table 3.1.

Table 3.1

metal oxide	formula	appearance before heating	appearance after heating
cobalt oxide	CoO	green powder	grey powder and a colourless liquid on the side of the glass tube
gallium oxide	Ga ₂ O ₃	white powder	white powder; no liquid on glass tube
bismuth oxide	Bi ₂ O ₃	yellow powder	grey powder and a colourless liquid on the side of the glass tube

In experiment II, pieces of Bi, Ga and Co were added separately to a solution of Pb(NO₃)₂. The results are given in Table 3.2.

Table 3.2

cobalt	gallium	bismuth
Grey solid formed on cobalt. The solution slowly turned pink.	Grey solid formed on gallium. The solution remained colourless.	No change in bismuth metal or in solution.

- (a) From the results of both experiments, place Bi, Ga, Co and Pb in the correct order in the reactivity series.

most reactive

.....

least reactive

.....

[2]

- (b) Name the colourless liquid observed when Bi₂O₃ and CoO are heated in hydrogen.

..... [1]

- (c) State the property hydrogen shows when it reacts with bismuth oxide.

..... [1]

- (d) Write an ionic equation for the reaction between Ga and Pb(NO₃)₂ solution.

..... [2]

- (e) Describe what you would observe if a piece of cobalt is placed in aqueous bismuth nitrate.

.....
[2]

[Total: 8]

2 Table 3.1 shows the results of some of the chemical reactions of **four** unknown metals.

Table 3.1

Metals	Thermal decomposition of metal carbonates	Reaction of metal with cold water
A	Greenish-blue solid turns black. White precipitate formed when gas produced is being passed through limewater	No reaction
B	White solid remains. No gas was produced.	Very vigorous reaction
C	White solid turns yellow, turns back to white after when cooled. White precipitate formed when gas produced is being passed through limewater	No reaction
D	White solid remains white. White precipitate formed when gas produced is being passed through limewater	Little bubbles formed on the surface of the metal.

- (a) Arrange the metals in ascending order of their chemical reactivity.

.....[1]

- (b) Metal **A** and **D** are placed into two separate beakers of iron(III) sulfate solution. Describe the observations you will see in each beaker.

.....

[3]

- (c) Pure iron can be extracted using the Blast furnace in the presence of carbon monoxide.

- (i) Write a balanced equation for the reaction mentioned above.

.....[1]

(ii) State and explain if the reaction written in (ci) is a redox reaction.

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

(d) Iron oxidises to form iron(III) oxide, which is a reddish-brown deposit commonly known as rust.

Using your knowledge of the reactivity series of metals, describe and explain how rusting of iron can be prevented.

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

[Total: 8 marks]

Paper 2 Section B

- 1 Zinc is extracted from an ore called zinc blende, which consists mainly of zinc sulfide, ZnS. The zinc blende is first crushed to powder and then treated by froth flotation (*mineral processing, where it is used in the extraction of several metals*).

Zinc blende reacts with oxygen in the air to produce zinc oxide and a gas which escapes as waste gas.

- (a) (i) Explain why zinc blende is crushed to powder before treatment? [1]

.....
.....

- (ii) Write a chemical equation for the reaction in (a)(i). [1]

.....

- (b) Zinc oxide is converted into zinc. Zinc oxide and coke are fed into a furnace. Hot air is blown into the bottom of the furnace. Zinc has a melting point of 420 °C and a boiling point of 907 °C. The temperature inside the furnace is over 1000 °C.

- (i) Explain how zinc oxide is converted into zinc. Your answer should include details of how the heat is produced and equations for all the reactions you describe. [3]

.....
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.....

- (ii) Give **two** reasons why the zinc produced inside the furnace is in gaseous state. [2]

.....
.....

- (iii) State the name of the physical change for conversion of gaseous zinc into molten zinc. [1]

.....

(c) Rusting of steel can be prevented by coating the steel with a layer of zinc.

Explain, in terms of electron transfer, why steel does not rust even if the layer of zinc is scratched and the steel is exposed to air and water.

.....

.....

.....

[Total: 10]

2 Lead is widely used to make lead-acid car batteries.

Lead can be extracted from cerrusite, $PbCO_3$, in a two-stage process.



(a) Explain if the reaction from stage 1 is exothermic or endothermic.

.....

.....[2]

(b) Explain why the gas from stage 2 must be removed for the safety of the workers.

.....[1]

(c) In the laboratory, two experiments were set up using lead metal, as shown in Fig. 5.1.

Both experiments were conducted at room temperature of $25^\circ C$.

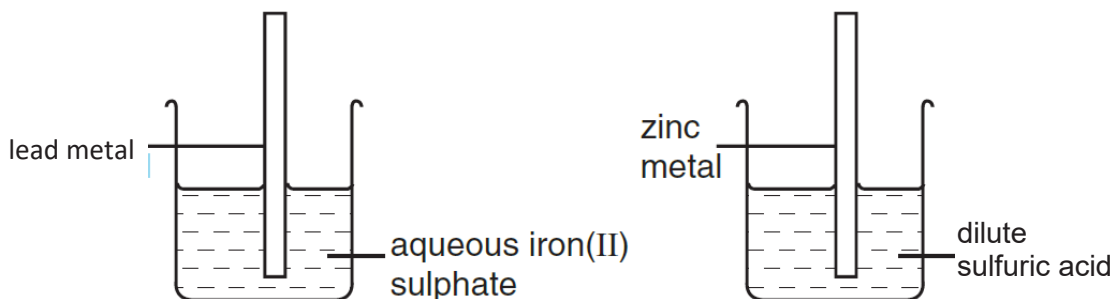


Fig. 5.1

For each experiment, describe what you would observe and how you would test any gas(es) evolved, if any. Write an equation for any **one** of the reactions in Fig. 5.1.

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.....[4]

3 Predict the observations for the following and explain your reasoning, using equations to illustrate where appropriate.

(a) A piece of magnesium is dipped into iron(II) chloride solution.

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.....

[4]

(b) Lead metal is dipped into zinc nitrate solution.

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.....
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[2]

4. Alloys are mixtures of elements with pure metals.

(a) With reference to the structure of an alloy, explain why they are less malleable than pure metals.

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[3]

(b) Give an example of an alloy, stating its constituent elements and one of its uses.

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.....

[3]

ANSWER FOR METALS MCQ

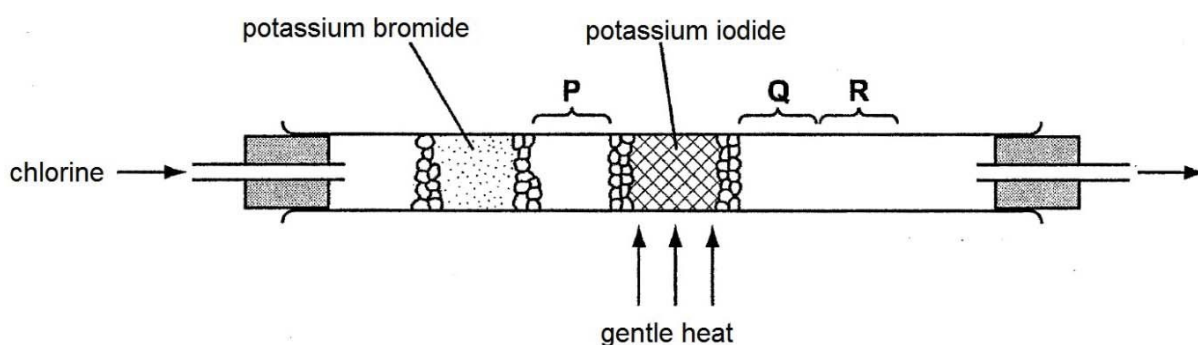
Paper 1

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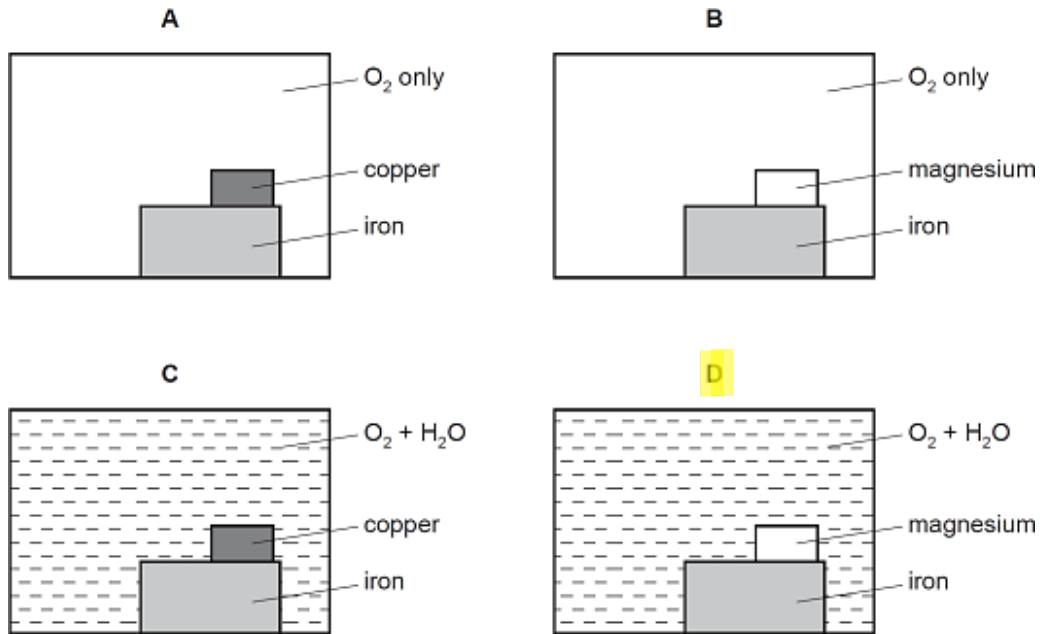
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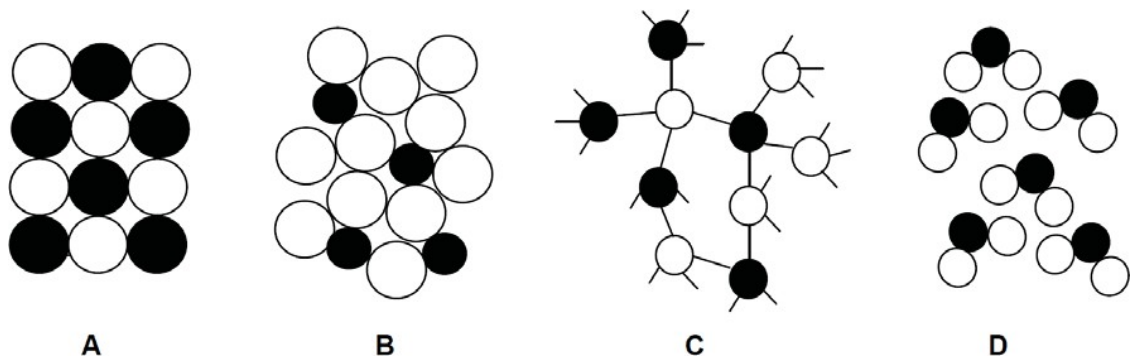


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Which reason for recycling is **not** correct?

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- D It saves natural resources.

- 5 Which diagram below shows the structure of an alloy? **Ans: B**



- 6 Which of the following statements best explains why 99.99% copper is used in manufacturing high quality electrical wires for audio equipment?

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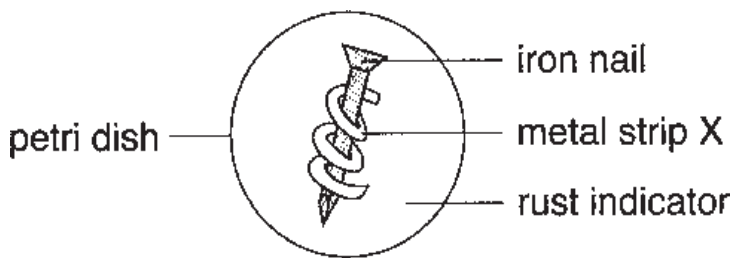
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Which is the correct order of increasing reactivity of the four metals?

- A** T < R < S < U
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C U < S < R < T
D U < T < R < S

11 Consider the following set-up.



The rust indicator will turn blue in the presence of rust.

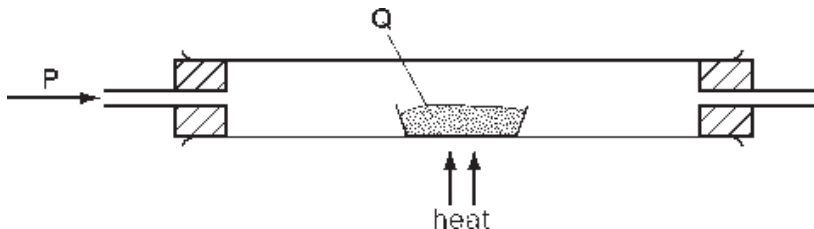
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Which of the following statements is/are correct?

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12 In the apparatus shown, gas P is passed over solid Q.



Which of the following identities of P and Q would **not** result in a reaction?

	P	Q
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	strength	malleability	melting point	brittleness
A	↑	↑	↓	↓
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D	↓	↑	↑	↓

Key:

↑ = increase

↓ = decrease

14 The positions of three metals X, Y and Z are indicated in the reactivity series below.

Most reactive	potassium X
	sodium zinc
	Y
	iron
Least reactive	Z

How are the metals obtained from their ores?

	electrolysis	reduction with carbon	found uncombined
A	X	Y	Z
B	X	Z	Y
C	Y	X	Z
D	Z	X	Y

Paper 2 Section A

- 1 Two experiments were carried out to find out the positions of the metals cobalt (Co), gallium (Ga) and bismuth (Bi) in the reactivity series.

In experiment I, hydrogen gas was passed separately over the heated oxides of the three metals in the combustion tube. The results are given in Table 3.1.

Table 3.1

metal oxide	formula	appearance before heating	appearance after heating
cobalt oxide	CoO	green powder	grey powder and a colourless liquid on the side of the glass tube
gallium oxide	Ga ₂ O ₃	white powder	white powder; no liquid on glass tube
bismuth oxide	Bi ₂ O ₃	yellow powder	grey powder and a colourless liquid on the side of the glass tube

In experiment II, pieces of Bi, Ga and Co were added separately to a solution of Pb(NO₃)₂. The results are given in Table 3.2.

Table 3.2

cobalt	gallium	bismuth
Grey solid formed on cobalt. The solution slowly turned pink.	Grey solid formed on gallium. The solution remained colourless.	No change in bismuth metal or in solution.

- (a) From the results of both experiments, place Bi, Ga, Co and Pb in the correct order in the reactivity series.

most reactive Gallium/ Ga
 Cobalt/ Co
 Lead/ Pb
 Bismuth/ Bi

least reactive

[2]

- (b) Name the colourless liquid observed when Bi₂O₃ and CoO are heated in hydrogen.

water

[1]

- (c) State the property hydrogen shows when it reacts with bismuth oxide.

Hydrogen is a reducing agent.
 (Accept Hydrogen is more reactive than Bismuth)

[1]

(d) Write an ionic equation for the reaction between Ga and $\text{Pb}(\text{NO}_3)_2$ solution.



½ mark – correct formula

½ mark – correct state symbols

1 mark correct balancing

[2]

(e) Describe what you would observe if a piece of cobalt is placed in aqueous bismuth nitrate.

Grey solid formed on cobalt.

The solution turned pink.

[2]

[Total: 8]

2 Table 3.1 shows the results of some of the chemical reactions of **four** unknown metals.

Table 3.1

Metals	Thermal decomposition of metal carbonates	Reaction of metal with cold water
A	Greenish-blue solid turns black. White precipitate formed when gas produced is being passed through limewater	No reaction
B	White solid remains. No gas was produced.	Very vigorous reaction
C	White solid turns yellow, turns back to white after when cooled. White precipitate formed when gas produced is being passed through limewater	No reaction
D	White solid remains white. White precipitate formed when gas produced is being passed through limewater	Little bubbles formed on the surface of the metal.

(a) Arrange the metals in ascending order of their chemical reactivity.

A, B, C, D

[1]

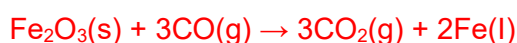
(b) Metal A and D are placed into two separate beakers of iron(III) sulfate solution. Describe the observations you will see in each beaker.

Metal A: No visible observation [1]

Metal D: Metal D dissolves/brown solution becomes colourless/ Grey solid produced (Any 2 for 2 marks) [3]

(c) Pure iron can be extracted using the Blast furnace in the presence of carbon monoxide.

(i) Write a balanced equation for the reaction mentioned above.



[1]

(ii) State and explain if the reaction written in (ci) is a redox reaction.

Yes, it is redox as Fe_2O_3 loses oxygen to form Fe and CO gains oxygen to form CO_2 . [1]

(d) Iron oxidises to form iron(III) oxide, which is a reddish-brown deposit commonly known as rust.

Using your knowledge of the reactivity series of metals, describe and explain how rusting of iron can be prevented.

Sacrificial Protection.

A more reactive metal like magnesium or zinc can be placed beside iron. It will corrode in place of iron [2]

[Total: 8 marks]

Paper 2 Section B

- 1 Zinc is extracted from an ore called zinc blende, which consists mainly of zinc sulfide, ZnS. The zinc blende is first crushed to powder and then treated by froth flotation (*mineral processing, where it is used in the extraction of several metals*).

Zinc blende reacts with oxygen in the air to produce zinc oxide and a gas which escapes as waste gas.

- (a) (i) Explain why zinc blende is crushed to powder before treatment?

Larger surface area [1] for collision to occur hence higher rate of reaction [1]

- (ii) Write a chemical equation for the reaction in (a)(i). [1]



- (b) Zinc oxide is converted into zinc. Zinc oxide and coke are fed into a furnace. Hot air is blown into the bottom of the furnace. Zinc has a melting point of 420 °C and a boiling point of 907 °C. The temperature inside the furnace is over 1000 °C.

- (i) Explain how zinc oxide is converted into zinc. Your answer should include details [3] of how the heat is produced and equations for all the reactions you describe.

[1] heat produced by carbon/ coke (burning in) oxygen/ air;

[1] $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ produces heat/ exothermic;

OR

$2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$ produces heat/ exothermic

[1] $\text{ZnO} + \text{CO} \rightarrow \text{Zn} + \text{CO}_2$;

OR

$\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$; OR

$2\text{ZnO} + \text{C} \rightarrow 2\text{Zn} + \text{CO}_2$

- (ii) Give **two** reasons why the zinc produced inside the furnace is in gaseous state.

Temperature (inside the furnace) is above 907 °C OR

Temperature (inside the furnace) is above the boiling point (of zinc) OR

1000°C is above the boiling point (of zinc)

- (iii) State the name of the physical change for conversion of gaseous zinc into molten zinc. [1]

Condensation

(c) Rusting of steel can be prevented by coating the steel with a layer of zinc.

Explain, in terms of electron transfer, why steel does not rust even if the layer of zinc is scratched and the steel is exposed to air and water.

Zinc is more reactive than iron / Zinc higher in the reactivity series than iron / Zinc reacts more readily with oxygen than iron. [1]
 Zinc loses electrons more easily and it is able to react with the air and water [1]

[Total: 10]

2 Lead is widely used to make lead-acid car batteries.

Lead can be extracted from cerrusite, PbCO_3 , in a two-stage process. Stage 1 $\text{PbCO}_3 \rightarrow \text{PbO} + \text{CO}_2$

Stage 2 $\text{PbO} + \text{C} \rightarrow \text{Pb} + \text{CO}$

(a) Explain if the reaction from stage 1 is exothermic or endothermic.

.....
[2]

(b) Explain why the gas from stage 2 must be removed for the safety of the workers.

.....[1]

(c) In the laboratory, two experiments were set up using lead metal, as shown in Fig. 5.1.

Both experiments were conducted at room temperature of 25°C.

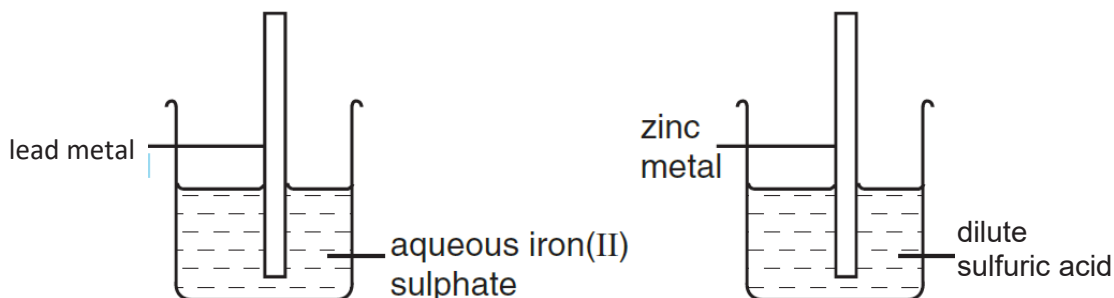


Fig. 5.1

For each experiment, describe what you would observe and how you would test any gas(es) evolved, if any. Write an equation for any **one** of the reactions in Fig. 5.1.

.....

.....

.....

.....

.....[4]

Answer:

2	(a)	Endothermic [1], because heat is taken in during decomposition [1] to break down the lead(II) carbonate into smaller compounds	[2]
	(b)	Carbon monoxide is a toxic (poisonous) gas/pollutant. or carbon monoxide combines with haemoglobin in our red blood cells to form a stable carboxyhaemoglobin, which deprives our body of oxygen. Reject: CO is an air pollutant / causes death / breathing difficulty as no scientific explanation was given	
	(c)	<p>Reaction of lead metal with aqueous copper(II) sulfate: NOTE: Lead is a more reactive metal than copper and hence able to displace copper from copper(II) sulfate. Observation: blue copper(II) sulfate fades (turns colourless) / Reddish-brown (pink) deposits seen</p> <p>Equation: $\text{Pb} + \text{CuSO}_4 \rightarrow \text{PbSO}_4 + \text{Cu}$</p> <p>Reaction of lead metal with dilute sulfuric acid: NOTE: Lead(II) sulfate is an insoluble salt, which prevents further reaction of lead with dilute sulfuric acid. Hence, reaction will not go to completion and that lead will appear as if it is unreactive with the acid. No effervescence will be seen as the reaction is way too slow. Observation: no visible (observable) change or white deposits on lead metal</p> <p>Reject: Effervescence (bubbles) seen. / Hydrogen gas evolved, which extinguishes the lighted splint with a 'pop' sound</p> <p>Equation: $\text{Pb} + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + \text{H}_2$ [2] (but reaction will NOT go to completion)</p>	<p>[1]</p> <p>[2]</p> <p>[1]</p>

- 3 Predict the observations for the following and explain your reasoning, using equations to illustrate where appropriate.

(a) A piece of magnesium is dipped into iron(II) chloride solution.

The magnesium dissolves [1] into the solution and some solid forms [1] on the magnesium. Iron is lower in the reactivity series and hence it is displaced [1] by Magnesium. $Fe^{2+}(aq) + Mg(s) \rightarrow Mg^{2+}(aq) + Fe(s)$ [1]

[4]

(b) Lead metal is dipped into zinc nitrate solution.

There would be no visible reaction [1]. Since lead is lower in the reactivity series [1] than zinc, the zinc ions would remain as ions and would not be displaced by lead

[2]

4. Alloys are mixtures of elements with pure metals.

(a) With reference to the structure of an alloy, explain why they are less malleable than pure metals.

The elements that are mixed in with the metal are of different sizes [1], and they disrupt the regular lattice arrangement [1] of the metal ions. Hence, the layers of ions cannot slide over each other as easily [1], making them less malleable than pure metals

[3]

[3]

(b) Give an example of an alloy, stating its constituent elements and one of its uses.

Example: brass made up of copper and zinc which is used in electric plug or steel made up of iron and carbon which is used in cars and cargo ships.

[3]
