

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
March 2007



SCIENCE: SINGLE AWARD A (MODULAR)
Materials and Reactions (Module 15)

346015

Wednesday 7 March 2007 Morning Session

For this paper you must have:

- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

Time allowed: 30 minutes

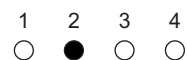
Instructions

- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Materials and Reactions' printed on it.
- Attempt **one Tier only**, either the Foundation Tier **or** the Higher Tier.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only.
- Do all rough work in this book, **not** on your answer sheet.

Instructions for recording answers

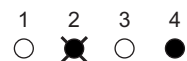
- Use a **black ball-point pen**.

- For each answer **completely fill in the circle** as shown:

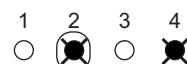


- Do **not** extend beyond the circles.

- If you want to change your answer, **you must** cross out your original answer, as shown:



- If you change your mind about an answer you have crossed out and now want to choose it, draw a ring around the cross as shown:



Information

- The maximum mark for this paper is 36.

Advice

- Do **not** choose more responses than you are asked to. You will lose marks if you do.
- Make sure that you hand in both your answer sheet and this question paper at the end of the test.
- If you start to answer on the wrong side of the answer sheet by mistake, make sure that you cross out **completely** the work that is not to be marked.

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 14 of this booklet.

FOUNDATION TIER

SECTION A

Questions **ONE** to **FIVE**.

In these questions, match words from the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

This question is about iron and substances which contain iron.

Match words from the list with the numbers **1–4** in the table.

haematite

iron

iron oxide

stainless steel

Substance	Type of substance
1	it is a compound
2	it is an alloy
3	it is an element
4	it is an iron ore

QUESTION TWO

This question is about reactions used to make salts.

When acids react with alkalis, salts are formed.

Match words from the list with the numbers **1–4** in the table.

ammonia solution

hydrochloric acid

potassium nitrate

sulphuric acid

Acid	Alkali	Salt formed
nitric acid	1	ammonium nitrate
nitric acid	potassium hydroxide	2
3	potassium hydroxide	potassium sulphate
4	potassium hydroxide	potassium chloride

QUESTION THREE

This question is about cracking hydrocarbons.

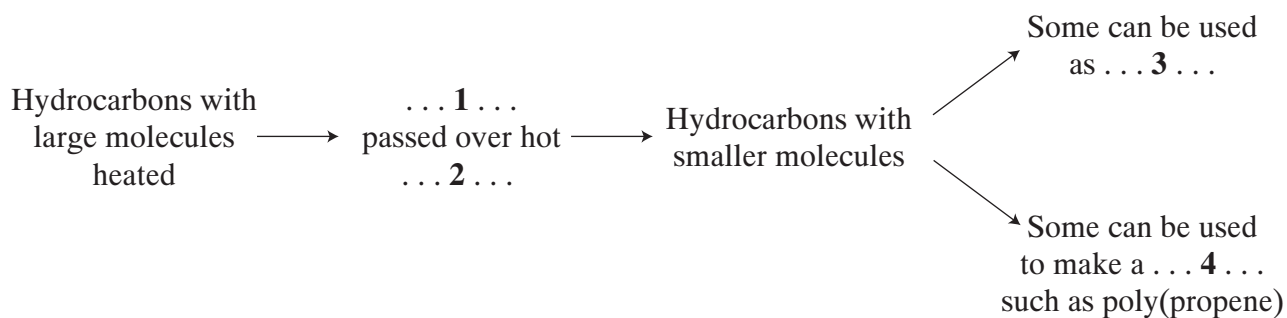
Match words from the list with the numbers **1–4** in the sequence.

catalyst

fuel

plastic

vapour



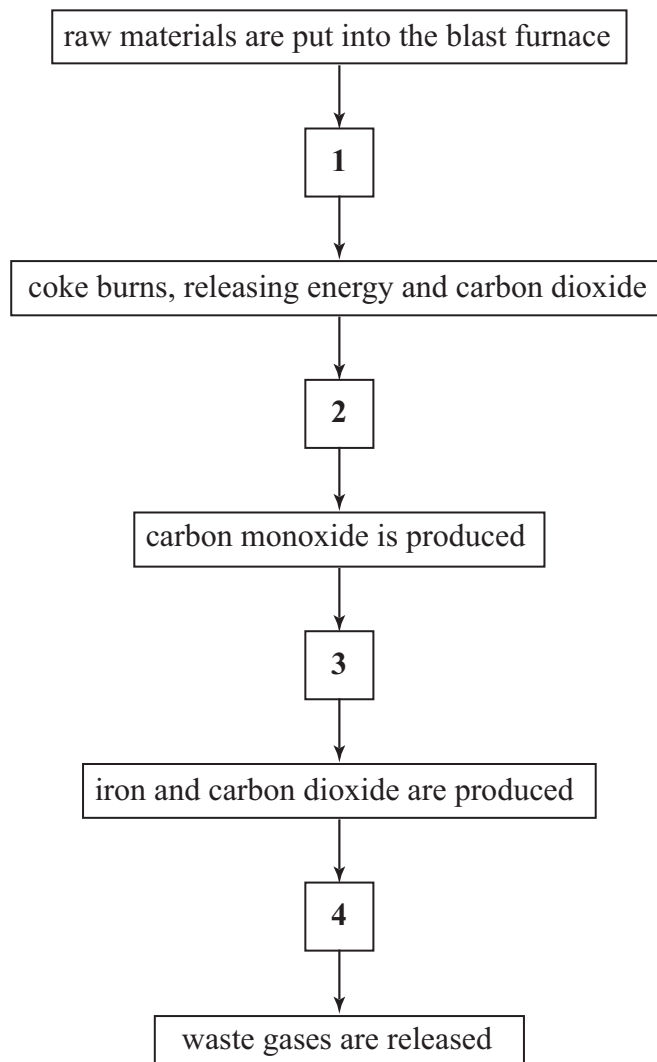
Turn over ►

QUESTION FOUR

The flow chart shows stages in the manufacture of iron in a blast furnace.

Match statements, **J**, **K**, **L** and **M**, from the list with the numbers 1–4 in the flow chart, to explain what happens in this process.

- J** carbon dioxide reacts with coke
- K** carbon monoxide reacts with iron oxide
- L** hot air is blown into the furnace
- M** molten iron flows to the bottom of the furnace



QUESTION FIVE

This question is about the reactivity series.

Metal **K** can be extracted from its oxide by reacting the hot oxide with hydrogen.

Metal **J** will displace metal **K** from a solution of its nitrate but will not displace aluminium from a solution of aluminium nitrate.

Metal **G** can only be extracted from its compounds by electrolysis.

When put into water, metal **G** reacts more quickly than metal **H**.

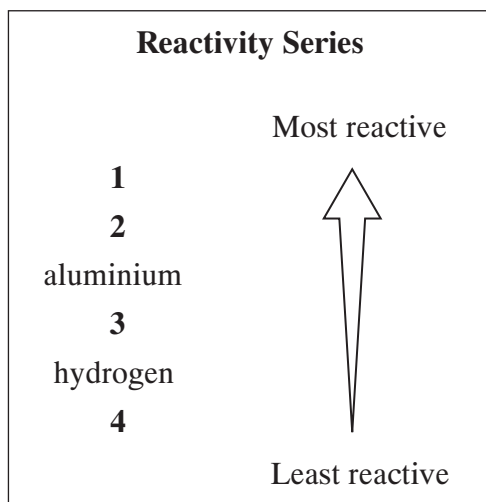
Match metals from the list with the numbers 1–4 in the reactivity series.

metal G

metal H

metal J

metal K



Turn over ►

SECTION BQuestions **SIX** and **SEVEN**.In these questions choose the best **two** answers.Do **not** choose more than two.Mark your choices on the answer sheet.

QUESTION SIX

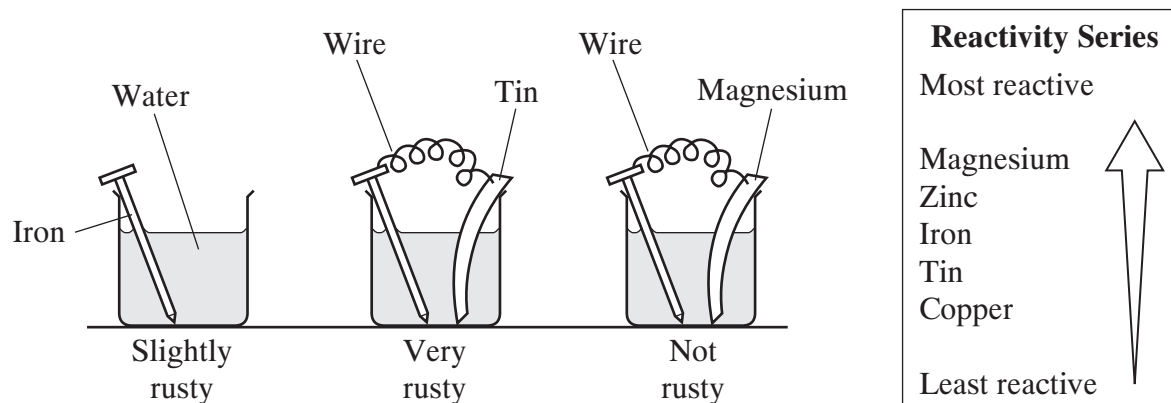
The gases released into the air when oil burns may include:

- carbon dioxide
- sulphur dioxide
- water vapour.

Which **two** statements are correct?**oil is a compound that contains oxygen****sulphur dioxide is an element****these three gases are oxides****water vapour is a fluoride of hydrogen****when oil burns, the carbon it contains reacts with oxygen**

QUESTION SEVEN

Iron reacts with oxygen from the air to form rust. This reaction happens only if water is also present. The diagrams show the amount of rusting after 24 hours if the iron is connected to other metals.



Which **two** of the statements, **N**, **P**, **Q**, **R** and **S**, are correct?

- N** magnesium connected to iron protects the iron from corrosion
- P** the experiment suggests that a less reactive metal can protect iron from corrosion
- Q** the experiment suggests that a more reactive metal can protect iron from corrosion
- R** tin connected to iron protects the iron from corrosion
- S** tin corrodes more quickly than magnesium

Turn over for the next question

Turn over ►

SECTION CQuestions **EIGHT** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

QUESTION EIGHT

This question is about the periodic table. The diagram shows the symbols for some of the elements in part of the table.

The Group number is shown at the top of each column.

1		2								3	4	5	6	7	0
	Be														
Na	Mg								Al						Ar
	Ca				Cr		Fe			Zn					

8.1 Which of the following elements has the highest relative atomic mass?

- A Na (sodium)
- B Mg (magnesium)
- C Al (aluminium)
- D Ar (argon)

8.2 Which of the following is a transition element?

- A Na (sodium)
- B Ca (calcium)
- C Fe (iron)
- D Ar (argon)

8.3 Which two elements are most similar in their chemical properties?

- A Na (sodium) and Mg (magnesium)
- B Mg (magnesium) and Ca (calcium)
- C Mg (magnesium) and Al (aluminium)
- D Ca (calcium) and Cr (chromium)

8.4 Haematite is not found in the periodic table because . . .

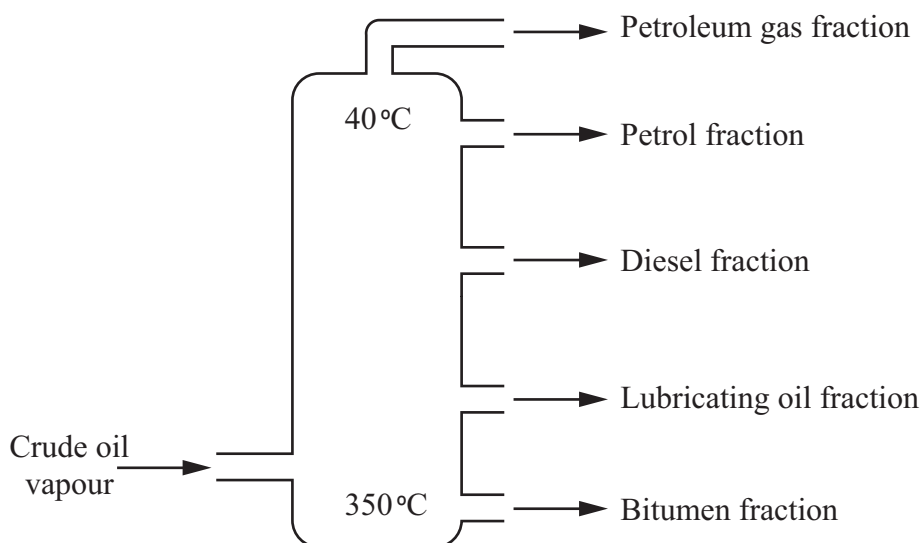
- A it has properties different from the metals in any other group.
- B it is not an element.
- C it is only a recent discovery.
- D its relative atomic mass is too great.

Turn over for the next question

Turn over ►

QUESTION NINE

Fractional distillation is used to separate crude oil into fractions.



9.1 Crude oil can be separated into fractions by fractional distillation because the fractions have different . . .

- A boiling points.
- B chemical properties.
- C densities.
- D viscosities.

9.2 The hydrocarbons in the petrol fraction have . . .

- A a similar number of oxygen atoms in each molecule.
- B different chemical properties.
- C different colours.
- D similar boiling points.

9.3 The hydrocarbons in the petrol fraction have 4–12 carbon atoms in each molecule.

In which fraction will the hydrocarbons CH_4 and C_2H_6 be found?

- A Bitumen fraction
- B Diesel fraction
- C Lubricating oil fraction
- D Petroleum gas fraction

9.4 Which line describes the properties of a hydrocarbon in the bitumen fraction?

- A Boiling point $40\text{ }^\circ\text{C}$, very volatile
- B Boiling point $100\text{ }^\circ\text{C}$, ignites fairly easily
- C Boiling point $200\text{ }^\circ\text{C}$, difficult to ignite, flows quite easily
- D Boiling point over $300\text{ }^\circ\text{C}$, viscous

Turn over for the next question

Turn over ►

QUESTION TEN

This question is about salts.

10.1 Which group of elements forms soluble hydroxides?

- A Alkali metals
- B Group 0 elements
- C Non-metal elements
- D Transition metals

This is the equation for the reaction between ammonia solution (ammonium hydroxide) and hydrochloric acid.



10.2 Salt X is . . .

- A ammonium chloride.
- B ammonium hydroxide.
- C ammonium nitrate.
- D ammonium sulphate.

10.3 Substance Y is . . .

- A carbon dioxide.
- B hydrogen.
- C oxygen.
- D water.

10.4 Calcium carbonate will also react with hydrochloric acid.

calcium carbonate + hydrochloric acid → salt **Z** + water + carbon dioxide

Salt **Z** is . . .

- A** ammonium chloride.
- B** calcium chloride.
- C** carbon chloride.
- D** carbonate chloride.

END OF TEST

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Foundation Tier is earlier in this booklet.

HIGHER TIER

SECTION A

Questions **ONE** and **TWO**.

In these questions, match words from the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

This question is about the reactivity series.

Metal **K** can be extracted from its oxide by reacting the hot oxide with hydrogen.

Metal **J** will displace metal **K** from a solution of its nitrate but will not displace aluminium from a solution of aluminium nitrate.

Metal **G** can only be extracted from its compounds by electrolysis.

When put into water, metal **G** reacts more quickly than metal **H**.

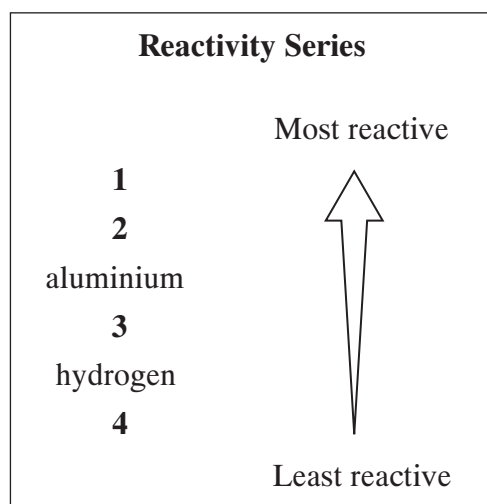
Match metals from the list with the numbers **1–4** in the reactivity series.

metal G

metal H

metal J

metal K



QUESTION TWO

The word equations show what happens when some substances are heated together.

zinc oxide + hydrogen → no reaction

copper oxide + hydrogen → copper + water

zinc oxide + carbon → zinc + carbon dioxide

carbon dioxide + carbon → carbon monoxide

Match words from the list with the numbers 1–4 in the table.

carbon dioxide

copper

hydrogen

zinc

Substance	What we can say about the substance
1	it is above hydrogen but below carbon in the reactivity series
2	it is below hydrogen in the reactivity series
3	it is oxidised to water
4	it is reduced to carbon monoxide

Turn over for the next question

Turn over ►

SECTION B

Questions **THREE** and **FOUR**.

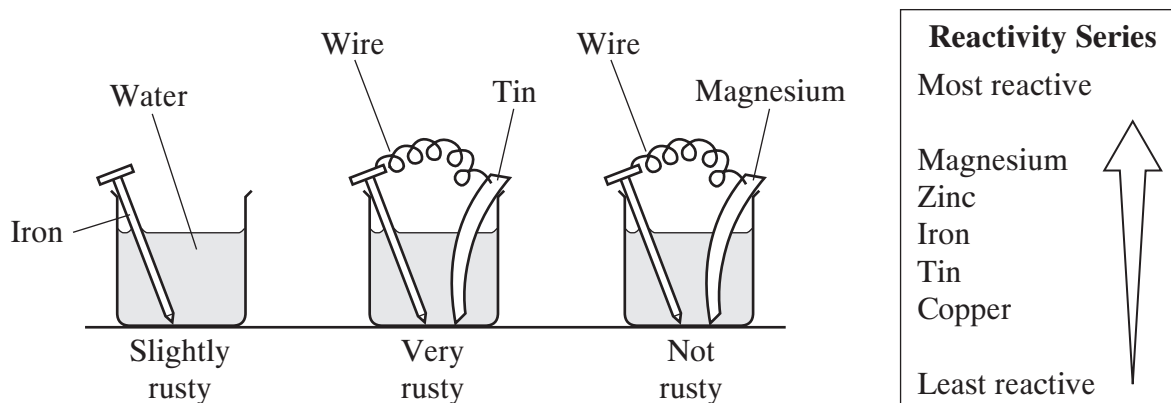
In these questions choose the best **two** answers.

Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

Iron reacts with oxygen from the air to form rust. This reaction happens only if water is also present. The diagrams show the amount of rusting after 24 hours if the iron is connected to other metals.



Which **two** of the statements, **N**, **P**, **Q**, **R** and **S**, are correct?

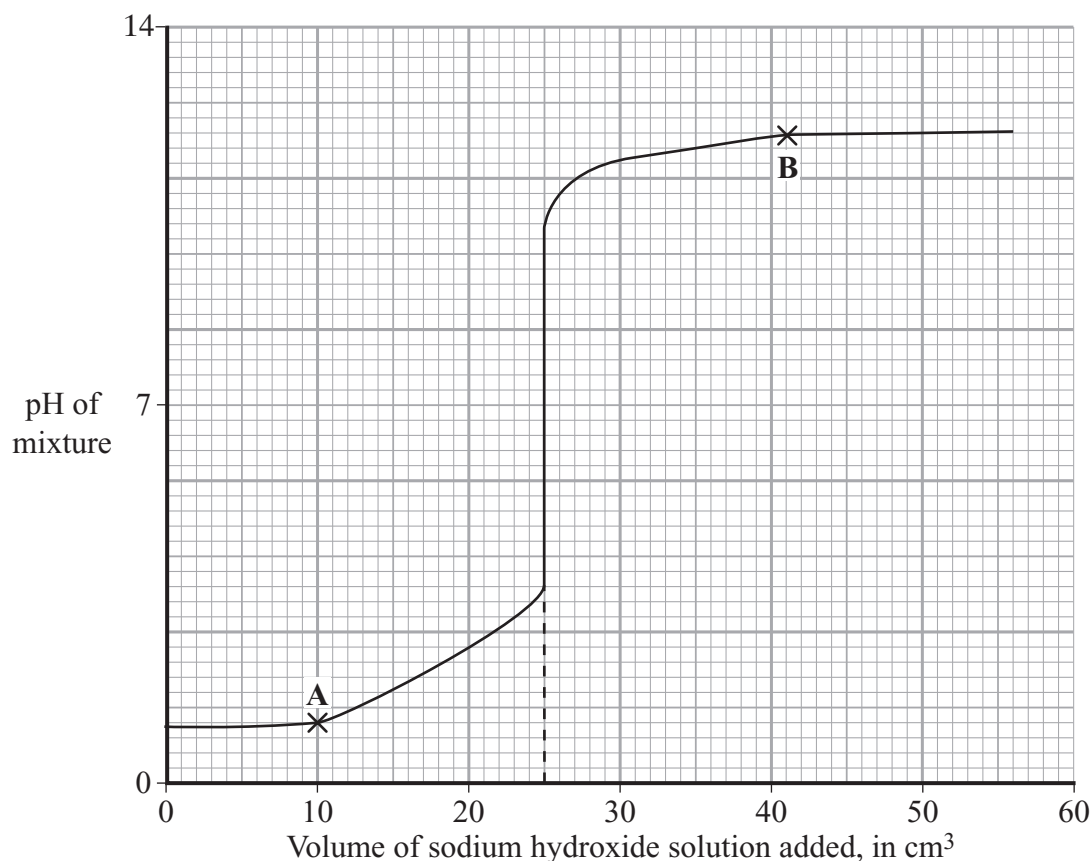
- N** magnesium connected to iron protects the iron from corrosion
- P** the experiment suggests that a less reactive metal can protect iron from corrosion
- Q** the experiment suggests that a more reactive metal can protect iron from corrosion
- R** tin connected to iron protects the iron from corrosion
- S** tin corrodes more quickly than magnesium

QUESTION FOUR

Sodium hydroxide solution was slowly added to 25 cm³ dilute hydrochloric acid.

The mixture was stirred and its pH was measured.

The graph shows how the pH changed as the sodium hydroxide solution was added.



Which **two** of the statements, **D**, **E**, **F**, **G** and **H**, are correct?

- D** 25 cm³ of hydrochloric acid are exactly neutralised by 20 cm³ of sodium hydroxide
- E** 25 cm³ of hydrochloric acid are exactly neutralised by 25 cm³ of sodium hydroxide
- F** at pH7, the mixture contains water and sodium chloride only
- G** at pH7, the mixture contains water, sodium chloride and hydrochloric acid
- H** the concentration of H⁺ ions is the same at points A and B on the graph

Turn over ►

SECTION CQuestions **FIVE** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION FIVE

This question is about the periodic table. The diagram shows the symbols for some of the elements in part of the table.

The Group number is shown at the top of each column.

1	2																		0
	Be																		
Na	Mg																		Ar
	Ca				Cr						Zn								

5.1 Which of the following elements has the highest relative atomic mass?

- A** Na (sodium)
- B** Mg (magnesium)
- C** Al (aluminium)
- D** Ar (argon)

5.2 Which of the following is a transition element?

- A** Na (sodium)
- B** Ca (calcium)
- C** Fe (iron)
- D** Ar (argon)

5.3 Which two elements are most similar in their chemical properties?

- A** Na (sodium) and Mg (magnesium)
- B** Mg (magnesium) and Ca (calcium)
- C** Mg (magnesium) and Al (aluminium)
- D** Ca (calcium) and Cr (chromium)

5.4 Haematite is not found in the periodic table because . . .

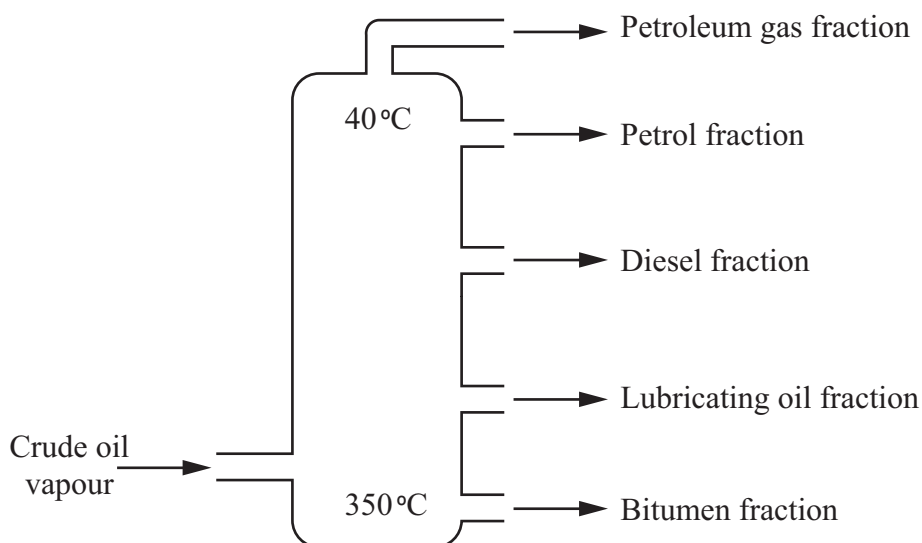
- A** it has properties different from the metals in any other group.
- B** it is not an element.
- C** it is only a recent discovery.
- D** its relative atomic mass is too great.

Turn over for the next question

Turn over ►

QUESTION SIX

Fractional distillation is used to separate crude oil into fractions.



6.1 Crude oil can be separated into fractions by fractional distillation because the fractions have different . . .

- A boiling points.
- B chemical properties.
- C densities.
- D viscosities.

6.2 The hydrocarbons in the petrol fraction have . . .

- A a similar number of oxygen atoms in each molecule.
- B different chemical properties.
- C different colours.
- D similar boiling points.

6.3 The hydrocarbons in the petrol fraction have 4–12 carbon atoms in each molecule.

In which fraction will the hydrocarbons CH_4 and C_2H_6 be found?

- A Bitumen fraction
- B Diesel fraction
- C Lubricating oil fraction
- D Petroleum gas fraction

6.4 Which line describes the properties of a hydrocarbon in the bitumen fraction?

- A Boiling point 40°C , very volatile
- B Boiling point 100°C , ignites fairly easily
- C Boiling point 200°C , difficult to ignite, flows quite easily
- D Boiling point over 300°C , viscous

Turn over for the next question

Turn over ►

QUESTION SEVEN

This question is about salts.

7.1 Which group of elements forms soluble hydroxides?

- A** Alkali metals
- B** Group 0 elements
- C** Non-metal elements
- D** Transition metals

This is the equation for the reaction between ammonia solution (ammonium hydroxide) and hydrochloric acid.



7.2 Salt **X** is . . .

- A** ammonium chloride.
- B** ammonium hydroxide.
- C** ammonium nitrate.
- D** ammonium sulphate.

7.3 Substance **Y** is . . .

- A** carbon dioxide.
- B** hydrogen.
- C** oxygen.
- D** water.

7.4 Calcium carbonate will also react with hydrochloric acid.

calcium carbonate + hydrochloric acid → salt **Z** + water + carbon dioxide

Salt **Z** is . . .

- A ammonium chloride.
- B calcium chloride.
- C carbon chloride.
- D carbonate chloride.

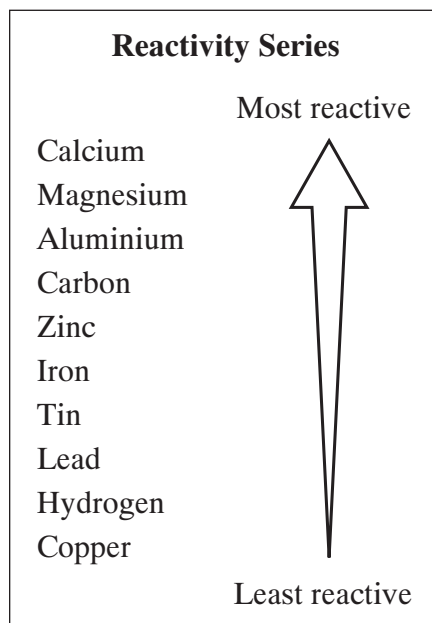
Turn over for the next question

Turn over ►

QUESTION EIGHT

Iron is obtained from iron oxide in a blast furnace.

The word equations show two of the reactions which take place in the furnace.



8.1 The substance oxidised in **both** these reactions is . . .

- A carbon.
- B carbon dioxide.
- C carbon monoxide.
- D oxygen.

8.2 How is the iron obtained from the iron oxide?

- A The iron ore is decomposed by the heat energy produced.
- B The iron oxide is reduced by carbon dioxide.
- C The iron oxide is reduced by carbon monoxide.
- D The iron ore reacts with limestone.

8.3 Most of the oxygen from the iron oxide leaves the furnace . . .

- A as an oxide of carbon.
- B as an oxide of hydrogen.
- C as oxygen in the waste gases.
- D in the molten slag.

8.4 Another way in which iron can be displaced from iron oxide is by reaction with . . .

- A aluminium.
- B copper.
- C lead.
- D tin.

Turn over for the next question

Turn over ►

QUESTION NINE

This question is about hydrocarbons.

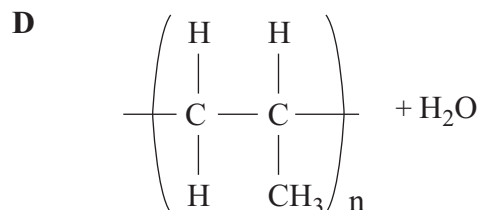
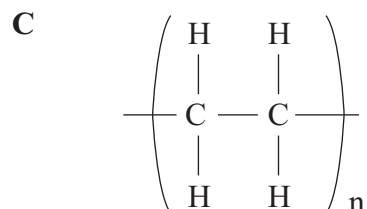
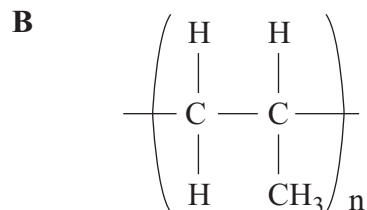
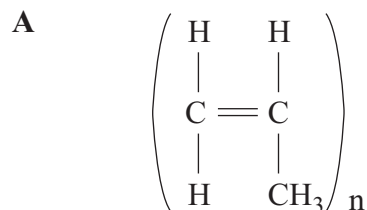
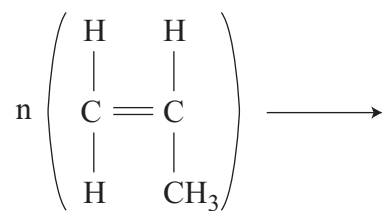
9.1 Which of the following could be a saturated hydrocarbon?

- A** All the carbon atoms in its molecule are linked by double covalent bonds.
- B** All the carbon atoms in its molecule are linked by single covalent bonds.
- C** It can form addition polymers.
- D** It has the formula C_2H_4

9.2 How are polymers formed?

- A** By cracking saturated hydrocarbons
- B** By joining together many small alkane molecules
- C** By joining together many small molecules of monomers
- D** By thermal decomposition of saturated hydrocarbons

9.3 What is formed in this polymerisation reaction?



9.4 Which of the following statements is **not** true of poly(ethene) molecules?

- A** They are hydrocarbons.
- B** They are saturated.
- C** They are unsaturated.
- D** They have a long spine of carbon atoms.

Turn over ►

QUESTION TEN

This question is about reactions between acids and alkalis.

10.1 A solution of an acid is completely neutralised by an alkali and the products are left in solution.

This reaction can be represented by . . .



10.2 Which of these salts can be made by the reaction of an acid with an alkali?

A Iron sulphate

B Lead sulphate

C Potassium sulphate

D Zinc sulphate

10.3 Which word equation shows a correct reaction to produce sodium sulphate?

A sodium hydroxide + sulphuric acid \rightarrow sodium sulphate + hydrogen

B sodium hydroxide + sulphuric acid \rightarrow sodium sulphate + water

C sodium nitrate + sulphuric acid \rightarrow sodium sulphate + hydrogen

D sodium nitrate + sulphuric acid \rightarrow sodium sulphate + water

10.4 There are two sodium salts of sulphuric acid (H_2SO_4). They are sodium sulphate (Na_2SO_4) and sodium hydrogensulphate (NaHSO_4).

There is only one sodium salt of hydrochloric acid (HCl), called sodium chloride (NaCl).

This is because . . .

- A** sulphuric acid has larger molecules than hydrochloric acid.
- B** sulphuric acid has two hydrogen atoms in each molecule, but hydrochloric acid has only one.
- C** sulphuric acid is stronger than hydrochloric acid.
- D** sulphuric acid reacts more vigorously than hydrochloric acid.

END OF TEST

There are no questions printed on this page

There are no questions printed on this page

There are no questions printed on this page