

SECTION A

1. Use the Periodic Table on page 2 to help you answer the following questions.

(a) What is the symbol of the element that has an atomic number of 16?

..... (1)

(b) What is the symbol of the element that has a relative atomic mass of 16?

..... (1)

(c) Which group contains elements whose atoms form ions with a 1+ charge?

..... (1)

(d) How many protons are in an atom of helium?

..... (1)

(e) Which element is in both Period 3 and Group 3?

..... (1)

(Total 5 marks)

Q1



2. (a) Crude oil is a source of many useful substances.

Use words from the box to complete the information about crude oil.

Each word can be used once, more than once, or not at all.

burned	bottom	carbohydrates	condenses
decomposition	distillation	freezes	
heated	hydrocarbons	top	

Crude oil is a mixture of compounds, most of which are
because they contain only the two elements hydrogen and carbon.

Crude oil is to separate it into fractions by a process
called fractional

In this process, fractions with lower boiling ranges are collected near
the of a fractionating column.

To collect a fraction, its vapour is cooled so that it
to a liquid.

(5)

(b) A fraction containing only hydrocarbons burns completely in air.

Name the two compounds that form in this reaction.

1

2

(2)

(Total 7 marks)

Q2



3. Use the following shortened form of the reactivity series to help you answer this question.

Most reactive	sodium
	magnesium
	iron
	hydrogen
Least reactive	copper

(a) Name one metal in this series that:

(i) does not react with dilute hydrochloric acid;

..... (1)

(ii) has an ion which can be detected using a flame test;

..... (1)

(iii) forms ions with 2+ and 3+ charges;

..... (1)

(iv) has a sulphate which dissolves in water to give a blue solution.

..... (1)

(b) Put a cross (☒) in **two** boxes next to correct statements about the elements in this reactivity series.

- copper reacts with iron(III) oxide ☒
- hydrogen reacts with copper(II) oxide ☒
- iron reacts with copper(II) oxide ☒
- magnesium oxide reacts with copper ☒
- sodium oxide reacts with copper ☒

(2)

(Total 6 marks)

Q3



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4. The following equation represents a reversible reaction.



The reaction is described as reversible because it can be made to go in either direction.

(a) Use words from the box to describe this reaction.

Each word may be used once or not at all.

black	colourless	decomposition
neutralisation	white	

The reactant is a solid.

The products are gases.

The forward reaction is

(3)

(b) Give the name of NH_4Cl .

.....

(1)

(c) When $\text{NH}_4\text{Cl(s)}$ dissolves in water, the solution that forms contains $\text{NH}_4^+\text{(aq)}$ and $\text{Cl}^-\text{(aq)}$ ions.

(i) What is seen when silver nitrate solution is added to the solution of NH_4Cl ?

.....

(1)

(ii) Which gas is given off when the solution of NH_4Cl is warmed with sodium hydroxide solution?

.....

(1)

Q4

(Total 6 marks)



5. Dilute sulphuric acid reacts with solid zinc carbonate to form water, carbon dioxide gas and a zinc compound.

(a) Write a **word** equation for this reaction.

.....
.....
(2)

(b) Describe a test to show that the gas is carbon dioxide.

Test

Result

(2)

(c) When a teacher demonstrates this reaction, the gas is given off slowly.

State two changes the teacher could make so that the gas will be given off more quickly when the experiment is repeated.

Change 1

Change 2

(2)



(d) Some of the carbon dioxide gas is bubbled through pure water.

The solution formed is slightly acidic.

(i) Name the acid that forms.

..... (1)

(ii) Put a cross (☒) in the box next to the most likely pH value of the solution.

- 2
 - 5
 - 7
 - 9
 - 12
- (1)

(iii) A sample of the solution is tested with universal indicator paper. State the final colour of the indicator.

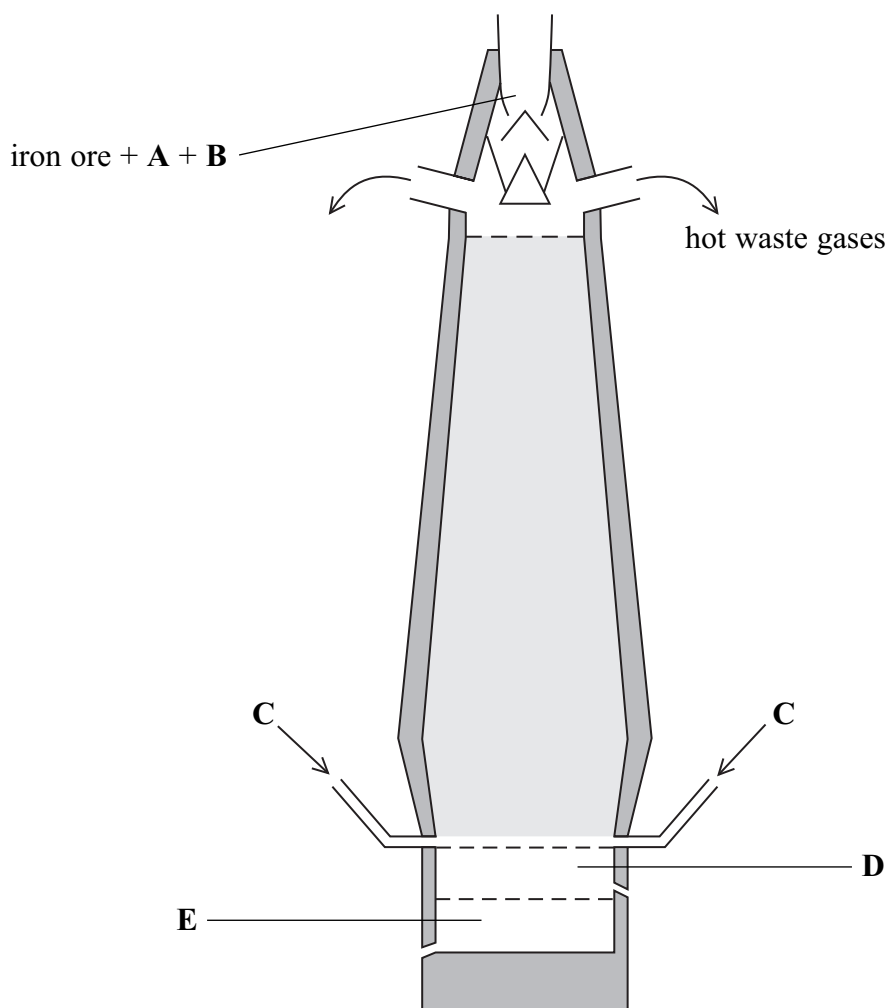
..... (1)

(Total 9 marks)

Q5



6. The diagram shows how iron is extracted from its ore in a blast furnace.



(a) The letters on the diagram show where three substances, other than iron ore, are added to the blast furnace, and where two products collect.

Write the name of each of these substances and products opposite the correct letter.

A

B

C

D

E

(5)



(b) One substance added to the blast furnace is composed mostly of carbon.

(i) Carbon burns in air to form carbon dioxide.

Write a **chemical** equation for this reaction.

.....
(1)

(ii) The carbon dioxide formed then reacts with more carbon to form a different oxide of carbon.

Write a **word** equation for this reaction.

.....

(1)

(iii) The oxide of carbon formed in (b)(ii) acts as a reducing agent when it reacts with the iron ore, Fe₂O₃.

Explain why this is a reduction reaction.

.....

(1)

(c) Another substance added to the blast furnace is composed mostly of calcium carbonate.

(i) In the blast furnace the calcium carbonate decomposes to form calcium oxide and carbon dioxide.

Write a **chemical** equation, including state symbols, for this reaction.

.....
(2)

(ii) The calcium oxide formed in (c)(i) then reacts with silicon dioxide, SiO₂, an impurity in the iron ore.

Give the **formula** of the product of this reaction.

.....
(1)

(Total 11 marks)

Q6

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7. Iron has many uses, but often the iron needs to be prevented from rusting.

(a) Rust is seen as a brown colour on the surface of the iron.

What substance is responsible for the brown colour?

.....
(1)

(b) Name **two** substances needed for iron to rust.

1

2
(2)

(c) Identify **one** method used to prevent iron from rusting in each of the following uses.

A bicycle chain

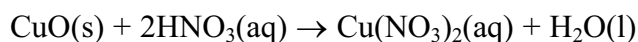
A bucket
(2)

(Total 5 marks)

Q7



8. The following equation represents a reaction used in the preparation of crystals of copper(II) nitrate.



(a) State the colour of

CuO(s)

Cu(NO₃)₂(aq)

(2)

(b) A pupil wrote these instructions for the preparation of copper(II) nitrate crystals.

Step 1 Pour some dilute nitric acid into a beaker and warm it

Step 2 Add some copper(II) oxide to the acid and stir with a glass rod

Step 3 Keep adding copper(II) oxide with stirring until the solution stays cloudy

Step 4 Filter the contents of the beaker into an evaporating basin

Step 5 Leave the evaporating basin in a warm place for a couple of days

Step 6 Remove the crystals and place them on filter paper

Explain the purpose of each of the following:

(i) adding copper(II) oxide until the solution goes cloudy in Step 3;

.....

(1)

(ii) filtering in Step 4;

.....

(1)

(iii) using a warm place in Step 5;

.....

(1)

(iv) using filter paper in Step 6.

.....

(1)

(Total 6 marks)

Q8

TOTAL FOR SECTION A: 55 MARKS



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SECTION B

9. (a) Complete the table of information about the three types of particle found in an atom.

Name of particle	Relative mass	Relative charge
electron		-1
neutron	1	
proton		

(4)

(b) An atom of chlorine can be represented by the symbol



(i) Explain the meaning of the term **mass number**. State the mass number of this chlorine atom.

.....

(2)

(ii) How many neutrons are in this atom of chlorine?

.....

(1)

(c) There are two types of boron atoms. Some contain 5 protons and 5 neutrons while others contain 6 neutrons.

(i) How many protons do the second type of boron atoms contain?

.....

(1)

(ii) What name is given to atoms of the same element with different numbers of neutrons?

.....

(1)

(Total 9 marks)

Q9



10. Propanone and water are both covalently bonded compounds. The table shows their boiling points.

Compound	Boiling point (°C)
propanone	56
water	100

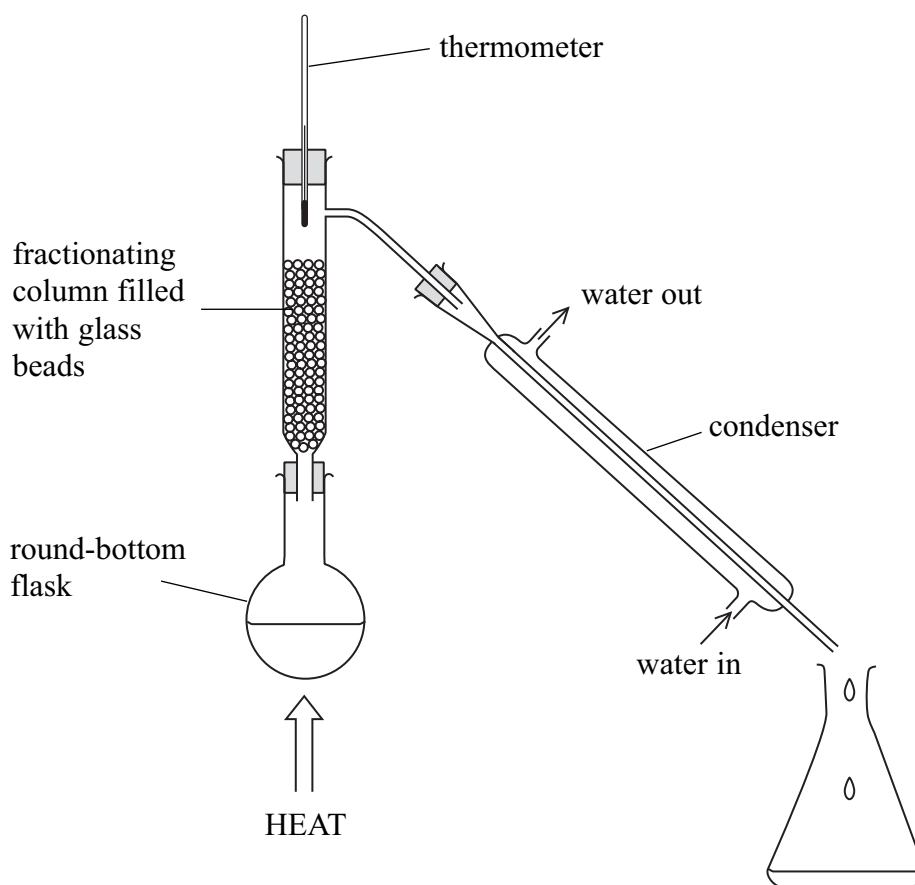
(a) Some anhydrous copper(II) sulphate was added to a mixture of propanone and water. What colour change would be seen?

Colour at start

Colour at end

(2)

(b) Propanone can be obtained from a mixture of propanone and water using the apparatus shown.



(i) Name the method of separation carried out using this apparatus.

.....

(2)



(ii) Why can propanone and water be separated by this method?

..... (1)

(iii) Outline how a sample of pure propanone can be obtained from the mixture.

.....

 (3)

(c) Propanone and water both have simple molecular structures. They have low boiling points. Place a cross (☒) in **one** box from **each** column of statements to explain why they have low boiling points.

the covalent bonds between their atoms are strong ☒

the covalent bonds between their atoms are weak ☒

the attractive forces between their molecules are strong ☒

the attractive forces between their molecules are weak ☒

AND

these require a lot of energy to be overcome ☒

these require little energy to be overcome ☒

these get weaker as the temperature increases ☒

(2)

Q10

(Total 10 marks)

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11. A sodium atom has the electronic configuration 2.8.1
An oxygen atom has the electronic configuration 2.6

(a) State, in terms of electrons, what happens to a sodium atom when it reacts with oxygen. Give the symbol of the sodium species formed.

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

(2)

(b) State, in terms of electrons, what happens to an oxygen atom when it reacts with sodium. Give the symbol of the species formed from the oxygen atom.

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

(2)

(c) State the name and formula of the compound formed when sodium reacts with oxygen.

Name

Formula

.....

(2)

(Total 6 marks)

Q11



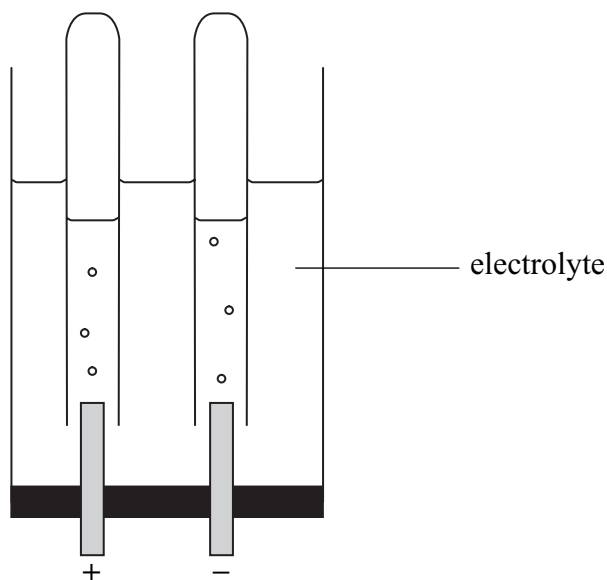
12. This question is about chlorine and other elements in Group 7 of the Periodic Table.

(a) Complete the table to show the colours and states of some elements in Group 7.

Name of element	Colour	State at room temperature
chlorine	green	gas
bromine	brown	
iodine		solid

(2)

(b) The diagram shows the electrolysis of an aqueous solution of a compound. The electrolysis produces chlorine and another gas.



(i) Add a label to the diagram to show the chlorine gas.

(1)

(ii) Identify the other gas produced during the electrolysis.

.....

(1)

(iii) What is the electrolyte used in the industrial production of chlorine?

.....

(1)



(c) When chlorine gas is bubbled into colourless sodium bromide solution a reaction takes place. The solution becomes brown.

(i) Write a word equation for the reaction which takes place.

.....
(2)

(ii) What name is given to this type of reaction?

.....
(1)

(iii) What does this reaction indicate about the reactivity of chlorine compared to bromine?

.....
(1)

(Total 9 marks)

Q12



13. The table shows the structures of some organic compounds.

$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $ <p style="text-align: center;">A</p>	$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array} $ <p style="text-align: center;">B</p>
$ \begin{array}{c} \text{H} \quad \quad \quad \text{H} \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{H} \quad \quad \quad \text{H} \\ \quad \quad \quad \diagdown \quad \diagup \\ \quad \quad \quad \text{C} \\ \quad \quad \quad \diagup \quad \diagdown \\ \quad \quad \quad \text{H} \quad \quad \quad \text{H} \end{array} $ <p style="text-align: center;">C</p>	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{Br} \quad \text{Br} \end{array} $ <p style="text-align: center;">D</p>
$ \begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array} $ <p style="text-align: center;">E</p>	$ \begin{array}{c} \text{H} \quad \quad \quad \text{H} \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{H} \quad \quad \quad \text{H} \end{array} $ <p style="text-align: center;">F</p>

(a) Explain why compound **C** is not a saturated hydrocarbon.

.....

 (1)

(b) Explain why compound **D** is not a hydrocarbon.

.....

 (1)

(c) Give the letters of two compounds that are isomers of each other.

.....
 (1)



- (d) Give the letters of two compounds that are members of the same homologous series but have different molecular formulae.

.....
(1)

- (e) Name and give the general formula of the homologous series to which compound E belongs.

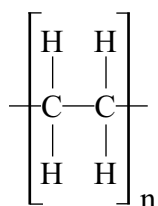
Name of homologous series

General formula
(2)

- (f) What colour change is seen when bromine water is added to compound F?

.....
.....
(2)

- (g) A polymer has the structure:



- (i) Give the letter of the monomer which is used to make this polymer.

.....
(1)

- (ii) Give the name of the polymer.

.....
(1)

- (iii) What type of polymer is this?

.....
(1)

Q13

(Total 11 marks)

TOTAL FOR SECTION B: 45 MARKS

TOTAL FOR PAPER: 100 MARKS

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