1. 0620/31/O/N/19/No.7

(a) Magnesium is manufactured by the electrolysis of molten magnesium chloride.

(i) The negative electrode is made of iron.

Suggest a non-metal which could be used for the positive electrode.
Give a reason for your answer.

.....

..... [2]

(ii) Predict the products of the electrolysis of molten magnesium chloride at:

the positive electrode .....

the negative electrode. .....

[2]

(b) The following statements are about the procedure for making crystals of hydrated magnesium chloride from magnesium and dilute hydrochloric acid.

A Leave the mixture until no more bubbles are seen.
B Leave the mixture at room temperature to form more crystals.
C Add an excess of magnesium to dilute hydrochloric acid.
D Warm the filtrate to the point of crystallisation.
E Filter off the crystals and dry between filter papers.
F Filter off the excess magnesium.

Put the statements **A**, **B**, **C**, **D**, **E** and **F** in the correct order.
The first one has been done for you.

C					

[2]

(c) Magnesium is a metal in Group II of the Periodic Table.
Copper is a transition element.
Copper has a higher melting point and a higher boiling point than magnesium.

Describe **two** other properties of copper which are different from those of magnesium.

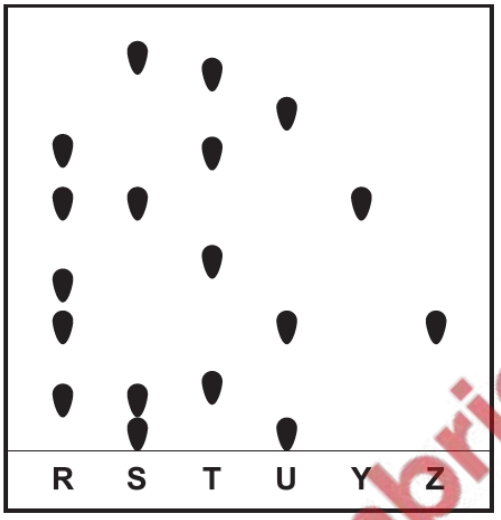
1 .....

2 .....

[2]

(d) Chromatography can be used to separate a mixture of ions from different transition element compounds.
Four samples, **R**, **S**, **T** and **U**, each containing transition element ions, were placed on a piece of chromatography paper.
Two solutions, **Y** and **Z**, each containing only one type of transition element ion were also placed on the same piece of chromatography paper.

The results of the chromatography are shown.



(i) Which sample, **R**, **S**, **T** or **U**, contains the same ions as both solution **Y and** solution **Z**?

..... [1]

(ii) Which sample, **R**, **S**, **T** or **U**, does **not** contain the same ions as either solution **Y** or solution **Z**?

..... [1]

(iii) In which sample, **R**, **S**, **T** or **U**, has the greatest number of transition element ions been separated?

..... [1]

[Total: 11]

2. 0620/32/O/N/19/No.4

An isotope of calcium is written as shown.

$$^{44}_{20}Ca$$

(a) (i) Deduce the number of protons, electrons and neutrons in this isotope of calcium.

number of protons .....

number of electrons .....

number of neutrons .....

[3]

(ii) State **one** industrial use of radioactive isotopes.

..... [1]

(b) Draw the electronic structure of a calcium atom.

[2]

(c) The table shows some information about the reaction of four metals with dry air at room temperature and on heating.

metal	reaction with dry air at room temperature	reaction with dry air on heating
iron	no reaction	only burns when in the form of a fine wire or powder
copper	no reaction	does not burn but the surface oxidises slowly
samarium	surface oxidises slowly	burns easily
sodium	surface oxidises rapidly	burns easily

Use this information to put the **four** metals in order of their reactivity.
Put the least reactive metal first.

least reactive ⟶ most reactive

[2]

[Total: 8]

3. 0620/33/O/N/19/No.7

Aluminium is manufactured by the electrolysis of molten aluminium oxide.

(a) Predict the products of the electrolysis of molten aluminium oxide at:

the positive electrode .....

the negative electrode. .....

[2]

(b) Complete these sentences about the uses of aluminium using words from the list.

conductivity	**corrosion**	**density**	**heavy**
malleability	**reduction**	**strong**	**weak**

Aluminium is used in the manufacture of aircraft because it is relatively ..... and has a low ..... . Aluminium is used for food containers because of its resistance to ..... .

[3]

(c) The following statements are about the procedure for making crystals of hydrated aluminium sulfate from aluminium hydroxide and sulfuric acid.

A Filter off the excess aluminium hydroxide.
B Filter off the crystals and dry between filter papers.
C Warm the filtrate to the point of crystallisation.
D Add aluminium hydroxide to warm dilute sulfuric acid and stir.
E Leave the mixture at room temperature to form more crystals.
F Add more aluminium hydroxide to the sulfuric acid until the aluminium hydroxide is in excess.

Put the statements **A**, **B**, **C**, **D**, **E** and **F** in the correct order.
The first one has been done for you.

D					

[2]

[Total: 7]

4. 0620/41/O/N/19/No.3

This question is about metals and metal oxides.

(a) Most metals have a high melting point.

State **one** other physical property that all metals have.

..... [1]

(b) Iron often rusts.

Name the **two** substances, other than iron, that must be present for iron to rust.

1 .....

2 .....

[1]

(c) Iron can be obtained by heating iron(III) oxide with zinc powder.

$$Fe_2O_3 + 3Zn \rightarrow 2Fe + 3ZnO$$

(i) What can be deduced about the reactivity of zinc from this reaction?

..... [1]

(ii) The ionic equation for this reaction is shown.

$$2Fe^{3+} + 3Zn \rightarrow 2Fe + 3Zn^{2+}$$

Identify the oxidising agent in this reaction. Explain your answer in terms of electron transfer.

oxidising agent .....

explanation .....

.....

[2]

(d) Zinc oxide is amphoteric.

Describe **two** simple experiments to show that zinc oxide is amphoteric.
Name the reagents you would use and describe the observations you would make.

reagent 1 .....

observation .....

reagent 2 .....

observation .....

[3]

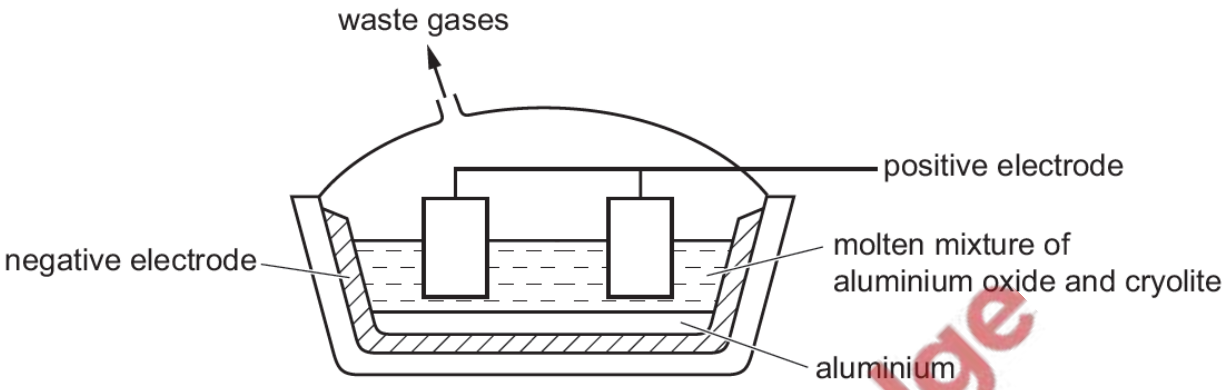
[Total: 8]

5. 0620/43/O/N/19/No.3

(a) Name the ore of aluminium which mainly consists of aluminium oxide.

..... [1]

(b) Aluminium is produced by the electrolysis of aluminium oxide dissolved in molten cryolite.



(i) Give **two** reasons why the electrolysis is done using a molten mixture of aluminium oxide and cryolite instead of molten aluminium oxide only.

1 .....

2 .....

[2]

(ii) Write ionic half-equations for the reactions occurring at the electrodes.

positive electrode .....

negative electrode .....

[2]

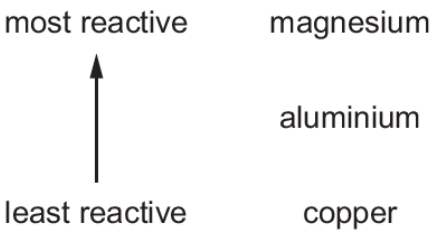
(iii) The anodes are made of carbon and have to be replaced regularly.

Explain why the carbon anodes have to be replaced regularly.

.....

..... [2]

(c) The positions of some common metals in the reactivity series are shown.



(i) When magnesium is placed in aqueous copper(II) sulfate a displacement reaction occurs immediately.

Write an ionic equation for the reaction. Include state symbols.

..... [2]

(ii) State **two** observations you would make when magnesium is placed in aqueous copper(II) sulfate.

1 .....

2 .....

[2]

(iii) When aluminium foil is added to aqueous copper(II) sulfate no immediate reaction takes place.

Explain why.

..... [1]

(d) Aluminium powder reacts with iron(III) oxide to produce aluminium oxide and iron.

Write a chemical equation for this reaction.

..... [2]

[Total: 14]