# Metals – 2022 Nov IGCSE Chemistry 0620

**1.** Nov/2022/Paper_11/No.24

Metal M is placed between zinc and iron in the reactivity series.

Which row shows the reactions of M and its oxide?

| | M can be extracted by heating its oxide with carbon | M reacts with dilute hydrochloric acid |
|---|---|---|
| **A** | no | no |
| **B** | no | yes |
| **C** | yes | no |
| **D** | yes | yes |

**2.** Nov/2022/Paper_11/No.25

Which statement about sodium is correct?

**A** It is a reactive grey solid which does not conduct electricity.

**B** It is a very reactive element that forms ions with a single negative charge.

**C** It reacts slowly with water to form oxygen.

**D** It reacts rapidly with water to form its hydroxide.

**3.** Nov/2022/Paper_11/No.26

Iron from a blast furnace can be converted to steel.

Which statements about steel are correct?

1 Steel contains more carbon than the iron obtained from the blast furnace.

2 Steel is produced by blowing oxygen through the iron.

3 Calcium oxide is added to molten iron to remove basic oxides.

**A** 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 2 only

**4.** Nov/2022/Paper_11/No.27

Which row links a property of aluminium to its stated use?

| | property | use |
|---|---|---|
| **A** | high strength | food containers |
| **B** | resistance to corrosion | food containers |
| **C** | high density | manufacture of aircraft |
| **D** | good electrical conductivity | manufacture of aircraft |

**5.** Nov/2022/Paper_12/No.5

Which statement about an alloy is correct?

**A** It is a compound made of two or more elements, one of which is a metal.

**B** It is a layer of a metal plated onto another metal.

**C** It is a mixture of a metal with one or more other elements.

**D** It is a single element.

**6.** Nov/2022/Paper_12/No.24

Which property is correct for all metals?

**A** They are good conductors of electricity.

**B** They are hard.

**C** They have high melting points.

**D** They react with dilute acids.

**7.** Nov/2022/Paper_12/No.25

Silver is below copper in the reactivity series.

Which row describes the reactions of silver?

| | reaction with steam | reaction with dilute hydrochloric acid |
|---|---|---|
| **A** | no reaction | no reaction |
| **B** | no reaction | reacts to produce hydrogen gas |
| **C** | reacts to produce hydrogen gas | no reaction |
| **D** | reacts to produce hydrogen gas | reacts to produce hydrogen gas |

**8.** Nov/2022/Paper_12/No.26

Which types of reaction do hematite and limestone undergo in the blast furnace?

| | hematite | limestone |
|---|---|---|
| **A** | reduction | reduction |
| **B** | reduction | thermal decomposition |
| **C** | thermal decomposition | reduction |
| **D** | thermal decomposition | thermal decomposition |

**9.** Nov/2022/Paper_12/No.27

Some properties and uses of different metals are shown.

| | metal | property | use |
|---|---|---|---|
| 1 | aluminium | low density | aircraft |
| 2 | copper | good conductor of electricity | electrical wiring |
| 3 | copper | poor conductor of heat | cooking utensils |
| 4 | stainless steel | corrodes easily | cutlery |

Which rows link a use of the metal to its stated property?

**A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

**10.** Nov/2022/Paper_13/No.5

Which process is a physical change?

**A** burning wood

**B** cooking an egg

**C** melting an ice cube

**D** rusting iron

**11.** Nov/2022/Paper_13/No.24

Which statements about the metals zinc, magnesium, iron and sodium are correct?

1 They all conduct electricity.

2 They all have high melting points and boiling points.

3 They all form negative ions.

4 They all react with dilute acids to form hydrogen.

**A** 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

**12.** Nov/2022/Paper_13/No.25

Which statement about the reactions of metals is correct?

**A** Iron and carbon dioxide are produced when iron(III) oxide is heated with carbon.

**B** Magnesium reacts with dilute hydrochloric acid producing hydrogen and chlorine.

**C** Potassium reacts vigorously with water producing hydrogen and an acidic solution.

**D** Zinc reacts with dilute sulfuric acid producing sulfur dioxide.

**13.** Nov/2022/Paper_13/No.26

Which metal is obtained by heating its oxide with carbon?

**A** aluminium

**B** calcium

**C** magnesium

**D** zinc

**14.** Nov/2022/Paper_13/No.27

Which row links the property of the stated metal with its use?

| | metal | property | use |
|---|---|---|---|
| **A** | aluminium | does not corrode | food containers |
| **B** | copper | high strength | chemical plant |
| **C** | mild steel | good conductor of electricity | electrical wiring |
| **D** | stainless steel | low density | aircraft |

**15.** Nov/2022/Paper_21/No.24

Which statement about the extraction of aluminium by electrolysis is correct?

**A** Aluminium is extracted from its ore, cryolite.

**B** Aluminium is formed at the positive electrode.

**C** Bauxite is used to lower the temperature of the extraction process.

**D** Graphite is used for both the positive and negative electrodes.

**16.** Nov/2022/Paper_21/No.25

Copper(II) nitrate and zinc carbonate are heated strongly in separate test-tubes.

Which row identifies the gases produced?

| | copper(II) nitrate | zinc carbonate |
|---|---|---|
| **A** | oxygen and nitrogen dioxide | carbon dioxide only |
| **B** | oxygen and nitrogen dioxide | carbon dioxide and oxygen |
| **C** | nitrogen dioxide only | carbon dioxide and oxygen |
| **D** | nitrogen dioxide only | carbon dioxide only |

**17.** Nov/2022/Paper_21/No.26

Iron from a blast furnace can be converted to steel.

Which statements about steel are correct?

1 Steel contains more carbon than the iron obtained from the blast furnace.

2 Steel is produced by blowing oxygen through the iron.

3 Calcium oxide is added to molten iron to remove basic oxides.

**A** 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 2 only

**18.** Nov/2022/Paper_21/No.27

Which metal is used to galvanise steel?

**A** copper

**B** lead

**C** tin

**D** zinc

**19.** Nov/2022/Paper_22/No.24

The reactions of four metals, W, X, Y and Z, are listed.

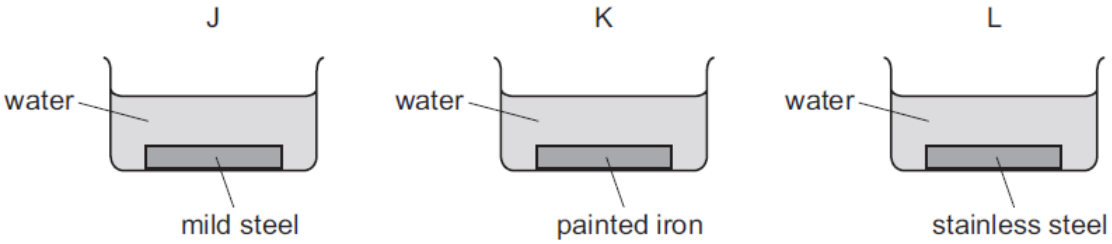
- Metal W displaces metal X from the oxide of metal X.
- Metal Y has a greater tendency to form positive ions than metal W.
- Aqueous ions of metal Z are reduced by metal X.

What is the order of reactivity of the metals?

| | least reactive → | | | most reactive |
|---|---|---|---|---|
| **A** | Y | W | X | Z |
| **B** | Y | X | W | Z |
| **C** | Z | W | X | Y |
| **D** | Z | X | W | Y |

**20.** Nov/2022/Paper_22/No.25

Three experiments, J, K and L, are set up to investigate rusting.




In which experiments does rusting occur?

| | J | K | L |
|---|---|---|---|
| **A** | ✗ | ✓ | ✓ |
| **B** | ✗ | ✓ | ✗ |
| **C** | ✓ | ✗ | ✗ |
| **D** | ✓ | ✗ | ✓ |

key

✓ = yes

✗ = no

**21.** Nov/2022/Paper_22/No.26

Silver is below copper in the reactivity series.

Which row describes the reactions of silver?

| | reaction with steam | reaction with dilute hydrochloric acid |
|---|---|---|
| **A** | no reaction | no reaction |
| **B** | no reaction | reacts to produce hydrogen gas |
| **C** | reacts to produce hydrogen gas | no reaction |
| **D** | reacts to produce hydrogen gas | reacts to produce hydrogen gas |

**22.** Nov/2022/Paper_22/No.27

Iron is galvanised by coating it in zinc.

Brass is made by mixing copper with zinc.

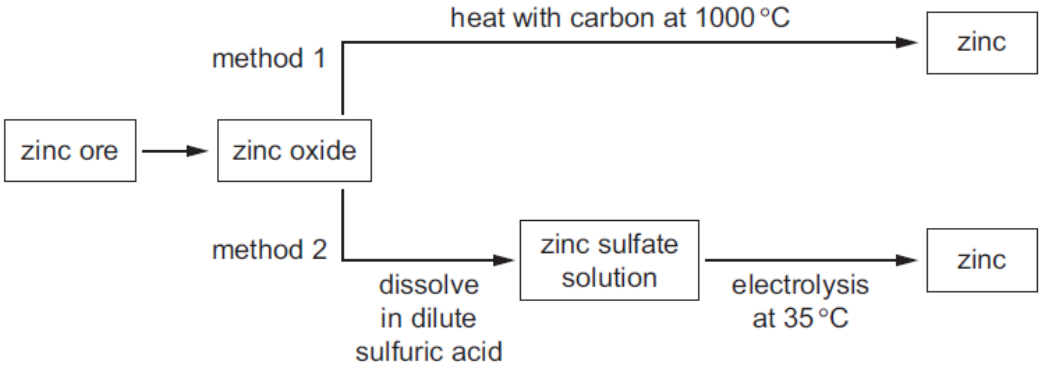
Which row gives the reasons for each of these uses of zinc?

| | reason for galvanising iron | reason for making brass |
|---|---|---|
| **A** | prevents corrosion | produces a softer metal |
| **B** | prevents corrosion | produces a harder metal |
| **C** | produces a harder metal | produces a softer metal |
| **D** | produces a harder metal | produces a harder metal |

**23.** Nov/2022/Paper_23/No.24

Zinc is a metal with a boiling point of 907 °C.

Two methods of making zinc are shown.




Which statement is correct?

**A** Carbon oxidises zinc oxide in method 1.

**B** Zinc vapour is produced in both methods.

**C** Zinc is produced at the anode in method 2.

**D** Zinc compounds are reduced in both methods.



**24.** Nov/2022/Paper_23/No.25

Which statement about the reactions of metals is correct?

**A** Iron and carbon dioxide are produced when iron(III) oxide is heated with carbon.

**B** Magnesium reacts with dilute hydrochloric acid producing hydrogen and chlorine.

**C** Potassium reacts vigorously with water producing hydrogen and an acidic solution.

**D** Zinc reacts with dilute sulfuric acid producing sulfur dioxide.

**25.** Nov/2022/Paper_31/No.2(c)

**(c)** Iron is extracted from iron ore.

**(i)** Name an ore of iron.

..... [1]

**(ii)** Iron ore contains iron(III) oxide.
Iron(III) oxide is reduced by carbon monoxide in a blast furnace.

Complete the chemical equation for this reaction.

$$Fe_2O_3 + 3CO \rightarrow .....Fe + .....CO_2$$ [2]

**(iii)** Calcium carbonate is added to the blast furnace, where it undergoes thermal decomposition.
Calcium oxide is formed.

State the meaning of the term *thermal decomposition*.

.....

..... [2]

**(iv)** Choose the correct statement about the reaction of calcium oxide in the blast furnace.

Tick (✓) **one** box.

| | |
|---|---|
| It reacts with carbon monoxide to form slag. | ☐ |
| It reacts with carbon to form carbon dioxide and calcium. | ☐ |
| It reacts with impurities in the iron ore to form slag. | ☐ |
| It catalyses the removal of oxygen from iron(III) oxide. | ☐ |

[1]

**(v)** State one advantage of recycling iron.

..... [1]

**26.** Nov/2022/Paper_31/No.8

This question is about metals.

**(a)** Nickel is a transition element. Sodium is an element in Group I of the Periodic Table. Nickel has a higher melting and boiling point than sodium.

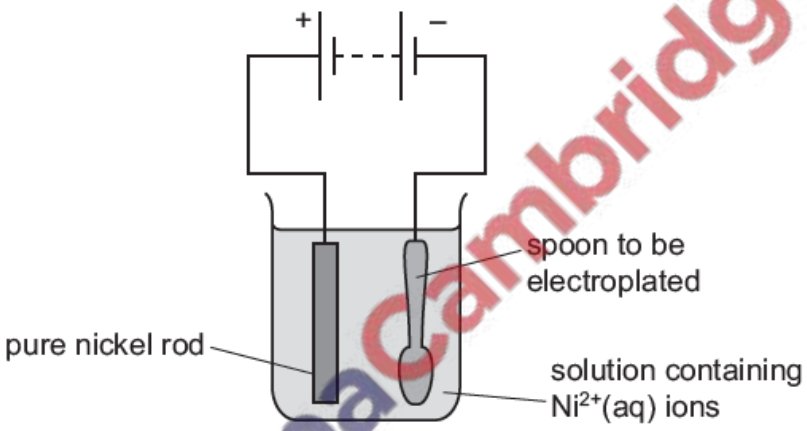
Give two **other** ways in which the physical properties of nickel differ from the physical properties of sodium.

1 .....

2 .....

[2]

**(b)** A steel spoon can be electroplated with nickel.
The apparatus is shown.




**(i)** Choose a word from the list which describes the nickel rod.

Draw a circle around your answer.

**anion** **anode** **cathode** **cation** **electrolyte** [1]

**(ii)** Describe the observations made during this electroplating at the:

pure nickel rod .....

.....

spoon. .....

.....

[2]

**(iii)** State **one** reason for electroplating an object.

..... [1]

**(c)** Deduce the number of electrons and neutrons in one atom of the isotope of nickel shown.

$^{62}_{28}Ni$

number of electrons .....

number of neutrons .....

[2]

**(d)** A compound of nickel has the formula $NiC_4O_4$.

Complete the table to calculate the relative molecular mass of $NiC_4O_4$.

| atom | number of atoms | relative atomic mass | |
|---|---|---|---|
| nickel | 1 | 59 | 1 × 59 = 59 |
| carbon | | 12 | |
| oxygen | | 16 | |

relative molecular mass = ..... [2]

**(e)** The table shows the rates of reaction of four metals with steam.

| metal | rate of reaction |
|---|---|
| magnesium | fast |
| nickel | slow |
| sodium | very fast |
| tin | very slow |

Put the four metals in order of their reactivity.
Put the least reactive metal first.

least reactive → most reactive

| | | | |
|---|---|---|---|
| | | | |

[2]

[Total: 12]

**27.** Nov/2022/Paper_32/No.2(c_ d)

**(c)** Iron reacts with oxygen to form an oxide of iron with the formula $Fe_3O_4$.

**(i)** Complete the chemical equation for this reaction.

$$.....Fe + .....O_2 \rightarrow Fe_3O_4$$ [2]

**(ii)** Complete these sentences about the extraction of iron from iron ore in a blast furnace using words from the list.

**air** **decomposed** **dioxide** **hydrogen** **iron**

**monoxide** **oxidised** **reduced** **slag**

The raw materials put into the blast furnace are iron ore, limestone and ..... .

Carbon monoxide reacts with iron(III) oxide to produce iron. In this reaction iron(III) oxide is ..... .

Limestone decomposes to produce calcium oxide and carbon ..... .

Calcium oxide reacts with impurities in the iron ore to form ..... .

[4]

**(d)** Iron is converted to steel using oxygen and one other type of compound.

**(i)** Explain how the oxygen removes the carbon.

..... [1]

**(ii)** Choose from the list the name of the other type of compound used to convert iron into steel.

**acidic oxide**
**alcohol**
**basic oxide**
**hydrocarbon**

..... [1]

**(iii)** Steel is an alloy.

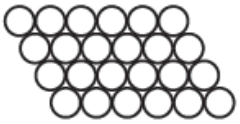
Choose the diagram, **J**, **K**, **L** or **M**, which best represents an alloy.

**J**

**K**

**L**

**M**



..... [1]

**28.** Nov/2022/Paper_32/No.8

This question is about metals.

**(a)** Chromium is a transition element. Potassium is an element in Group I of the Periodic Table. Chromium has a higher density than potassium.

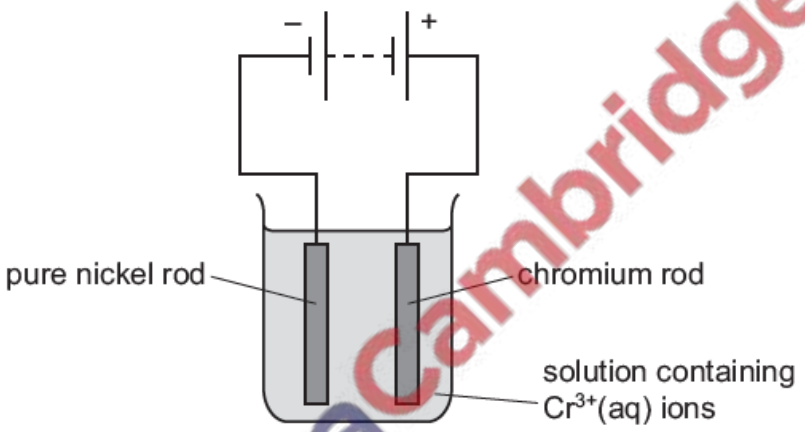
Give two **other** ways in which the physical properties of chromium differ from the physical properties of potassium.

1 .....

2 .....

[2]

**(b)** The apparatus used to electroplate a nickel rod with chromium is shown.




**(i)** Choose a word from the list which describes the nickel rod.

Draw a circle around your answer.

**anode** **cathode** **cation** **electrolyte** **mixture** [1]

**(ii)** One use of electroplating is to make objects attractive.

Describe one **other** reason for electroplating an object.

..... [1]

**(c)** Deduce the number of electrons and neutrons in one atom of the isotope of chromium shown.

$^{54}_{24}Cr$

number of electrons .....

number of neutrons .....

[2]

**(d)** A compound of chromium has the formula $CrH_2O_6$.

Complete the table to calculate the relative molecular mass of $CrH_2O_6$.

| atom | number of atoms | relative atomic mass | |
|---|---|---|---|
| chromium | 1 | 52 | $1 \times 52 = 52$ |
| hydrogen | | 1 | |
| oxygen | | 16 | |

relative molecular mass = ..... [2]

**(e)** The table shows the rates of reaction of four metals with air.

| metal | rate of reaction |
|---|---|
| chromium | reacts very slowly only when heated strongly |
| silver | does not react at room temperature or when heated strongly |
| sodium | reacts quickly at room temperature |
| uranium | reacts slowly at room temperature |

Put the four metals in order of their reactivity.
Put the least reactive metal first.

least reactive → most reactive

| | | | |
|---|---|---|---|
| | | | |

[2]

[Total: 10]

**29.** Nov/2022/Paper_33/No.2(c, d)

**(c)** Iron is extracted from iron(III) oxide in a blast furnace.

**(i)** Explain why air is blown into the blast furnace.

.....

..... [1]

**(ii)** In the blast furnace, carbon dioxide reacts with carbon to produce carbon monoxide.

Complete the chemical equation for this reaction.

$$CO_2 + C \rightarrow .....CO$$ [1]

**(iii)** Carbon monoxide reduces iron(III) oxide to iron.

State the meaning of the term *reduction*.

..... [1]

**(iv)** When 80 g of iron(III) oxide reacts with excess carbon monoxide, 56 g of iron is produced.

Calculate the minimum mass of iron(III) oxide needed to produce 14 g of iron.

..... g [1]

**(d)** Steel is an alloy of iron.

**(i)** Choose **two** substances from the list that are used in the conversion of iron from the blast furnace into steel.

**calcium oxide**
**carbon dioxide**
**hydrogen**
**nitrogen**
**oxygen**
**silicon(IV) oxide**
**sulfur dioxide**

1 .....

2 .....
[2]

**(ii)** State the meaning of the term *alloy*.

.....

..... [1]

**30.** Nov/2022/Paper_33/No.8

This question is about metals.

**(a) (i)** Copper is a transition element. Sodium is an element in Group I of the Periodic Table. Copper is harder than sodium.

Give two **other** ways in which the physical properties of copper differ from the physical properties of sodium.

1 .....

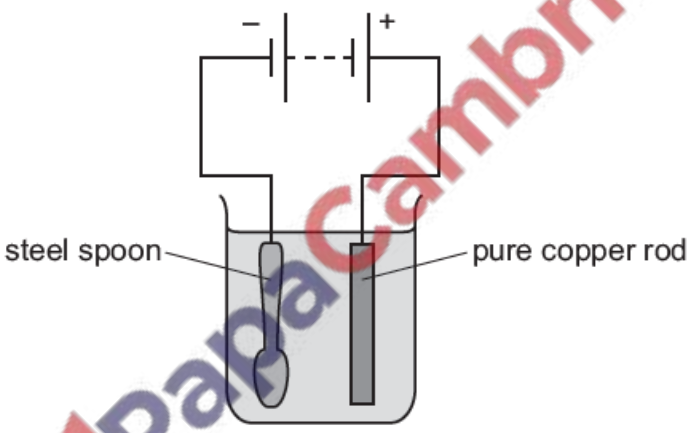
2 .....

[2]

**(ii)** Give **one** use of copper.

..... [1]

**(b)** The apparatus used to electroplate a steel spoon with copper is shown.




**(i)** Label the diagram to show:

- the anode
- the electrolyte.

[2]

**(ii)** Describe the observations made during this electroplating at the:

steel spoon .....

.....

copper rod. .....

.....

[2]

**(c)** Deduce the number of electrons and neutrons in one atom of the isotope of copper shown.

$^{65}_{29}Cu$

number of electrons .....

number of neutrons .....

[2]

**(d)** A compound of copper has the formula $K_2CuF_4$.

Complete the table to calculate the relative molecular mass of $K_2CuF_4$.

| atom | number of atoms | relative atomic mass | |
|---|---|---|---|
| potassium | 2 | 39 | 2 × 39 = 78 |
| copper | | 64 | |
| fluorine | | 19 | |

relative molecular mass = ..... [2]

**(e)** The table shows the rates of reaction of four metals with steam.

| metal | rate of reaction with steam |
|---|---|
| zinc | reacts quickly |
| gold | does not react |
| iron | reacts slowly |
| lanthanum | reacts very quickly |

Put the four metals in order of their reactivity.
Put the least reactive metal first.

least reactive ⟶ most reactive

| | | | |
|---|---|---|---|
| | | | |

[2]

[Total: 13]

**31.** Nov/2022/Paper_43/No.3

Aluminium is extracted from its ore by electrolysis.

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

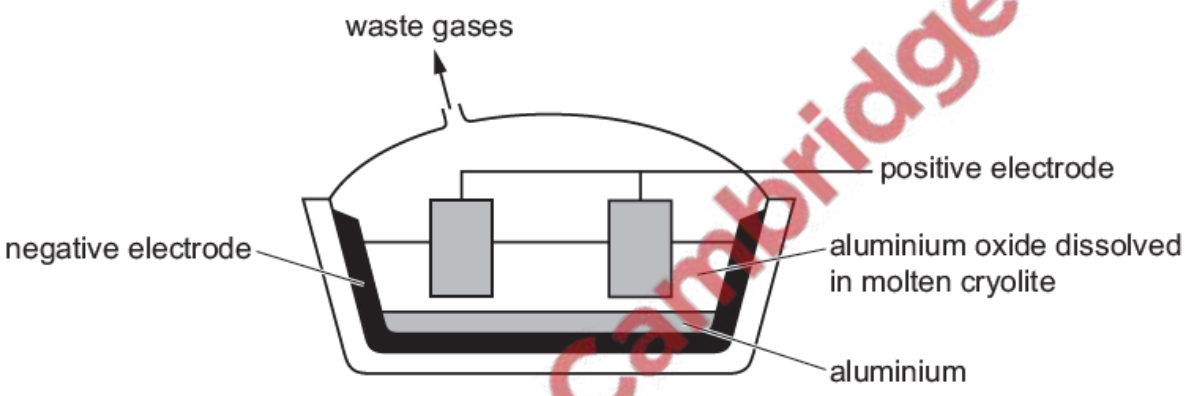
..... [1]

**(b)** State what is meant by the term *electrolysis*.

.....

..... [2]

**(c)** Electrolysis is carried out on aluminium oxide dissolved in molten cryolite.




**(i)** Give **two** reasons why the electrolysis is carried out on aluminium oxide dissolved in molten cryolite instead of electrolysing molten aluminium oxide only.

1 .....

2 .....

[2]

**(ii)** Write the ionic half-equation for the reaction occurring at the negative electrode.

..... [2]

**(iii)** The positive electrodes are made of carbon.

Explain why the positive carbon electrodes are replaced regularly.

.....

..... [2]

**(d)** Aluminium is more reactive than copper.

When aluminium is added to aqueous copper(II) sulfate, no immediate reaction is seen.

Explain why.

..... [1]

**(e)** Aluminium reacts with oxygen to form an amphoteric oxide.

**(i)** State what is meant by the term *amphoteric*.

.....

..... [1]

**(ii)** The reaction between aluminium oxide and aqueous sodium hydroxide forms a salt containing the negative ion $AlO_2^-$. The only other product is water.

Write a chemical equation for the reaction between aluminium oxide and aqueous sodium hydroxide.

..... [2]

**(f)** Gallium is in the same group as aluminium and forms similar compounds.

Predict the formulae of:

gallium(III) chloride .....

gallium(III) sulfate. .....

[2]

[Total: 15]