Metals – 2021 IGCSE 0620

1. Nov/2021/Paper_11,12,13,21,22&23/No.25

Which statement is correct for **all** metals?

A They conduct electricity when molten.

B They gain electrons when they form ions.

C They have a low density.

D They have a low melting point.

2. Nov/2021/Paper_11&21/No.26

Which statement about the extraction of metals is correct?

A Aluminium is extracted from the ore bauxite by electrolysis.

B Aluminium is extracted from the ore hematite by electrolysis.

C Iron is extracted from the ore bauxite by electrolysis.

D Iron is extracted from the ore hematite by electrolysis.

3. Nov/2021/Paper_11/No.27

Which row identifies a use of mild steel and a use of stainless steel?

	mild steel	stainless steel
A	chemical plant and cutlery	car bodies and machinery
B	car bodies and chemical plant	machinery and cutlery
C	machinery and chemical plant	car bodies and cutlery
D	car bodies and machinery	chemical plant and cutlery

4. Nov/2021/Paper_12/No.26

Which row describes the method of extraction of aluminium and iron from their ores?

	aluminium	iron
A	electrolysis	electrolysis
B	electrolysis	reduction with carbon
C	reduction with carbon	electrolysis
D	reduction with carbon	reduction with carbon

5. Nov/2021/Paper_12/No.27

Which statement about metals and their uses is correct?

A Aluminium is used to make food containers because it is resistant to corrosion.

B Aluminium is used to make aircraft wings because it is strong and has a high density.

C Iron is used to make electrical wires because it is a good insulator of electricity.

D Iron is used to make cooking utensils because it is easily recycled.

6. Nov/2021/Paper_13&23/No.26

Chromium is a more reactive metal than iron but less reactive than zinc.

Which statements are correct?

1 Chromium does not react with dilute hydrochloric acid.

2 Chromium oxide is reduced when it is heated with carbon.

3 Chromium reacts with zinc oxide to form zinc.

4 Chromium reacts with steam to form hydrogen gas.

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

7. Nov/2021/Paper_13/No.27

Some properties of copper are listed.

1 It conducts electricity.

2 It conducts heat.

3 It is ductile.

4 It has a high melting point.

Which properties of copper make it useful as a cooking pan?

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

8. Nov/2021/Paper_21/No.28

Which statements about the thermal decomposition of copper(II) nitrate are correct?

1 A brown gas is given off.

2 A gas which relights a glowing splint is given off.

3 The solid residue is an acidic oxide.

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

9. Nov/2021/Paper_22/No.26

Carbon dioxide is produced during the extraction of aluminium from bauxite.

Which statement describes how this carbon dioxide is made?

A Carbon monoxide reduces aluminium oxide forming carbon dioxide and aluminium.

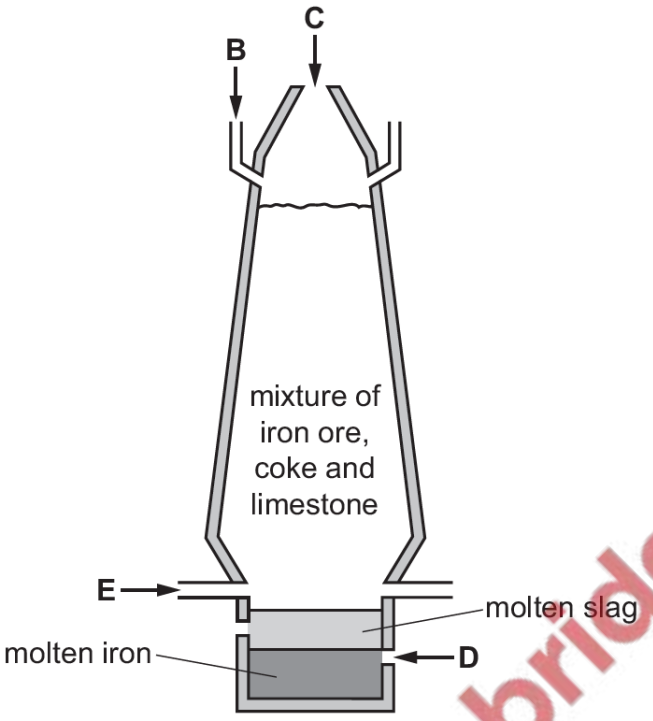
B Carbon is burned in the blast furnace to release heat energy.

C Oxygen made in the process reacts with the carbon electrode.

D The ore of aluminium undergoes thermal decomposition.

10. Nov/2021/Paper_31/No.3

The diagram shows a blast furnace used in the extraction of iron.



(a) Air is blown into the furnace.

State which letter on the diagram, **B**, **C**, **D** or **E**, shows where air is blown into the furnace.

..... [1]

(b) **(i)** Complete the chemical equation for the reduction of iron(III) oxide in the blast furnace.

Fe_2O_3 + 3C → .....Fe + ...CO [2]

(ii) Explain how this equation shows that iron(III) oxide is reduced.

..... [1]

(c) Calcium carbonate (limestone) is added to the blast furnace.
The calcium carbonate undergoes thermal decomposition.

(i) Complete the word equation for this reaction.

calcium carbonate	→	....	+	....

[2]

(ii) One of the products of this reaction reacts with impurities in the iron to form slag.

Use the information in the diagram to suggest how you know that molten slag is less dense than molten iron.

..... [1]

(d) (i) Use words from the list to complete these sentences about how steel is made from iron.

acidic basic chlorides methane neutral

nitrogen oxides oxygen sulfates

A gas is blown through the molten iron. The name of this gas is ..... .

Acidic gases are formed. These acidic gases react with ....

[3]

(ii) State **one** use of mild steel.

..... [1]

(iii) Metals such as chromium are added to iron to make stainless steel.

The symbol for an isotope of chromium is shown.

$^{53}_{24}Cr$

Deduce the number of electrons, neutrons and protons in one atom of this isotope of chromium.

number of electrons .....

number of neutrons .....

number of protons .....

[3]

(e) Chromium conducts electricity and is shiny.

Give two **other** physical properties of chromium that are characteristic of all metals.

1 .....

2 .....

[2]

[Total: 16]

11. Nov/2021/Paper_32/No.3

Iron is extracted from iron ore in a blast furnace.

(a) Name an ore of iron.

..... [1]

(b) **(i)** Complete the chemical equation for the reduction of iron(III) oxide in the blast furnace.

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

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

..... [1]

(c) Calcium carbonate (limestone) is added to the blast furnace.
The calcium carbonate undergoes thermal decomposition.

State the meaning of the term *thermal decomposition*.

.....

..... [2]

(d) Iron can be made into stainless steel.

(i) Give **one** use of stainless steel.

..... [1]

(ii) Describe **one** advantage of stainless steel compared with pure iron.

.....

..... [1]

(e) The symbol for an isotope of iron is shown.

$$^{57}_{26}Fe$$

Deduce the number of electrons, neutrons and protons in one atom of this isotope of iron.

number of electrons .....

number of neutrons .....

number of protons .....

[3]

(f) Iron is a good conductor of heat and electricity.

Give two **other** physical properties of iron that are characteristic of **all** metals.

1 .....

2 .....

[2]

(g) Iron rusts.

Name the **two** substances needed for iron to rust.

1 .....

2 .....

[2]

[Total: 15]

12. Nov/2021/Paper_33/No.3

Iron is extracted in a blast furnace using a mixture of iron ore, coke (carbon), air and calcium carbonate (limestone).

(a) Give **two** reasons why air is blown into the blast furnace.

1 .....

2 .....

[2]

(b) Magnetite is an ore of iron which contains a compound of iron with the formula Fe_3O_4.

(i) Give the name of another ore of iron.

..... [1]

(ii) In the blast furnace Fe_3O_4 is reduced to Fe.

Complete the chemical equation for the reduction of Fe_3O_4.

$$Fe_3O_4 + 4CO \rightarrow .....Fe + ...CO_2$$ [2]

(iii) Explain how this equation shows that Fe_3O_4 is reduced.

..... [1]

(c) Calcium carbonate (limestone) is added to the blast furnace.
The calcium carbonate undergoes thermal decomposition.

Give the meaning of the term *thermal decomposition*.

..... [2]

(d) Iron can form alloys such as vanadium steel.

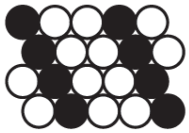
(i) State the meaning of the term *alloy*.

.....

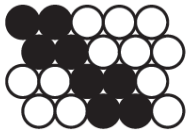
..... [1]

(ii) Choose from the diagrams, **B**, **C**, **D** or **E**, the structure which best represents an alloy.

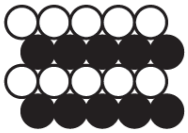
B



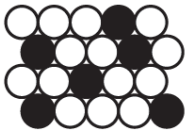
C



D



E



structure ..... [1]

(iii) The symbol for an isotope of vanadium is shown.

$$^{51}_{23}V$$

Deduce the number of electrons, neutrons and protons in one atom of this isotope of vanadium.

number of electrons .....

number of neutrons .....

number of protons .....

[3]

(iv) Vanadium is malleable and conducts electricity.

Give two **other** physical properties of vanadium that are characteristic of **all** metals.

1 .....

2 .....

[2]

[Total: 15]

13. Nov/2021/Paper_33/No.7

This question is about aluminium and the extraction of metals.

(a) When aluminium is heated above 660 °C it changes from solid to liquid.

(i) Name the change of state from solid to liquid.

..... [1]

(ii) Use the kinetic particle theory to describe the differences between solid aluminium and liquid aluminium in terms of:

- the separation of the particles

.....

.....

.....

- the motion of the particles.

.....

.....

.....

[4]

(b) Aluminium is extracted from aluminium ore by electrolysis.

Explain why aluminium is extracted by electrolysis and **not** by reduction with carbon.

..... [1]

(c) Give **two** reasons why aluminium is used in the manufacture of aircraft.

1 .....

2 .....

[2]

(d) Give **one** advantage of recycling aluminium.

.....

..... [1]

(e) The table compares the ease of reduction of four metal oxides when heated with carbon.

metal oxide	ease of reduction
aluminium oxide	not reduced at 2080 °C
nickel(II) oxide	reduced at 540 °C
titanium(IV) oxide	reduced at 1600 °C
zinc oxide	reduced at 850 °C

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

least reactive → most reactive

[2]

(f) Methane is used as a fuel in the extraction of some metals.

(i) State the main source of methane.

..... [1]

(ii) State **one** adverse effect of methane on the environment.

..... [1]

[Total: 13]

14. Nov/2021/Paper_43/No.3

Lead is a metallic element in Group IV. One of the ores of lead is galena, which is an impure form of lead(II) sulfide, PbS.

Lead also occurs in the ore cerussite, which contains lead(II) carbonate, $PbCO_3$.

(a) Calculate the relative formula mass, M_r, of $PbCO_3$.

M_r of $PbCO_3$ = ... [1]

(b) The M_r of PbS is 239.

Calculate the percentage of lead by mass in PbS.

percentage of lead by mass in PbS = ... [1]

(c) The percentage of lead by mass in $PbCO_3$ is 77.5%.

Use this information and your answer to **(b)** to suggest whether it would be better to extract lead from $PbCO_3$ or PbS.

Give a reason for your answer.

.....

..... [1]

(d) When lead(II) carbonate is heated it decomposes into lead(II) oxide, PbO, and carbon dioxide.

Write a chemical equation for this reaction.

..... [1]

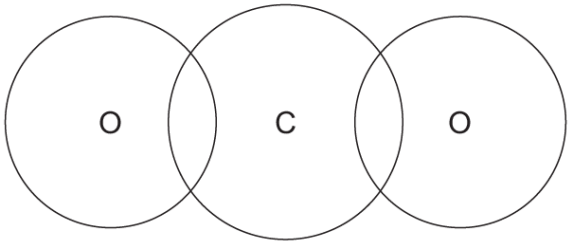
(e) Lead(II) carbonate reacts with dilute nitric acid. One of the products is aqueous lead(II) nitrate, $Pb(NO_3)_2$.

Write a chemical equation for this reaction.

..... [2]

(f) Lead(II) oxide and carbon dioxide are oxides of Group IV elements.

(i) Complete the diagram to show the electron arrangement in one molecule of CO_2. Show only the outer electrons.



[2]

(ii) The melting points of lead(II) oxide and carbon dioxide are shown.

	melting point / °C
lead(II) oxide	886
carbon dioxide	–56

Use your knowledge of structure and bonding to explain why lead(II) oxide has a much higher melting point than carbon dioxide.

Your answer should refer to:

- the types of particles involved
- the relative strength of the forces of attraction between the particles.

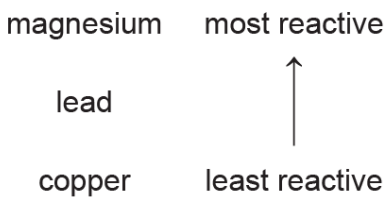
.....

.....

.....

..... [3]

(g) Part of the reactivity series is shown.



Aqueous lead(II) nitrate contains Pb^{2+} ions.

Two experiments are carried out.

In Experiment 1, magnesium is added to aqueous lead(II) nitrate.

In Experiment 2, copper is added to aqueous lead(II) nitrate.

Write an ionic equation for any reaction that occurs in each experiment. If no reaction occurs write 'no reaction'.

Experiment 1 .....

Experiment 2 .....

[2]

(h) When lead(II) nitrate is heated it decomposes to produce the same gaseous products as when copper(II) nitrate is heated.

(i) One of the gaseous products is oxygen.

Describe a test for oxygen.

test .....

observations .....

[2]

(ii) Name the other gaseous product.

..... [1]

[Total: 16]