Metals – 2023 June IGCSE Chemistry 0620

1. June/2023/Paper_ 0620/11/No.23

Which gas is made when powdered zinc is added to dilute hydrochloric acid?

A carbon dioxide

B chlorine

C hydrogen

D oxygen

2. June/2023/Paper_ 0620/11/No.24

Which metal is used in aircraft manufacture because it has a low density?

A aluminium

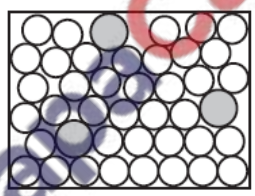
B copper

C iron

D potassium

3. June/2023/Paper_ 0620/11/No.25

The diagram represents the structure of a solid.



Which solids does the diagram represent?

	brass	graphite	sodium chloride
A	✓	✓	✗
B	✓	✗	✗
C	✗	✓	✓
D	✗	✗	✓

4. June/2023/Paper_ 0620/11/No.26

Three students, X, Y and Z, are told that solid P reacts with dilute acids and also conducts electricity.

The table shows the students' suggestions about the identity of P.

X	Y	Z
copper	iron	graphite

Which students are correct?

A X, Y and Z **B** X only **C** Y only **D** Z only

5. June/2023/Paper_ 0620/11/No.27

Which substances in the air are needed for iron to rust?

A oxygen and water

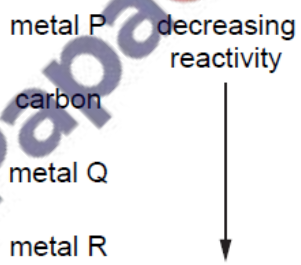
B oxygen only

C water and carbon dioxide

D water only

6. June/2023/Paper_ 0620/11/No.28

Part of the reactivity series of metals is shown.



Which row shows how each metal is extracted from its ore?

	metal P	metal Q	metal R
A	electrolysis of molten ore	electrolysis of molten ore	heating with carbon
B	heating with carbon	electrolysis of molten ore	electrolysis of molten ore
C	heating with carbon	heating with carbon	electrolysis of molten ore
D	electrolysis of molten ore	heating with carbon	heating with carbon

7. June/2023/Paper_ 0620/12/No.23

Which row identifies the properties of zinc?

	thermal conductivity	reacts with dilute acid
A	good	yes
B	good	no
C	poor	yes
D	poor	no

8. June/2023/Paper_ 0620/12/No.24

Uses of metals depend on their properties.

Which property is necessary for the use given?

	use of the metal	property of the metal
A	car bodies	ductile
B	cutlery	conducts heat
C	food containers	resists corrosion
D	overhead electrical cables	high density

9. June/2023/Paper_ 0620/12/No.26

P, Q, R and S are metals.

P reacts with dilute hydrochloric acid, forming hydrogen.

Q reacts violently with water.

R reacts with water to give hydrogen.

S is formed by heating its oxide with carbon.

Which row identifies the metals?

	P	Q	R	S
A	copper	sodium	potassium	iron
B	zinc	magnesium	calcium	iron
C	zinc	sodium	calcium	magnesium
D	iron	potassium	sodium	zinc

10. June/2023/Paper_ 0620/12/No.27

Which compound is formed when iron rusts?

A anhydrous iron(II) oxide

B anhydrous iron(III) oxide

C hydrated iron(III) hydroxide

D hydrated iron(III) oxide

11. June/2023/Paper_ 0620/12/No.28

Which reaction in the blast furnace releases heat energy?

A $C + O_2 \rightarrow CO_2$

B $CaCO_3 \rightarrow CaO + CO_2$

C $CO_2 + C \rightarrow 2CO$

D $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

12. June/2023/Paper_ 0620/13/No.24

Which statement about copper or aluminium is correct?

A Aluminium is more dense than copper.

B Aluminium is less reactive than copper.

C Copper has high ductility.

D Copper has poor electrical conductivity.

13. June/2023/Paper_ 0620/13/No.26

Calcium reacts with cold water to produce hydrogen.

Lead reacts slowly when heated in air to form an oxide but has almost no reaction with steam.

Silver does not react with either air or water.

Zinc reacts when heated with steam to produce hydrogen.

What is the order of reactivity starting with the least reactive?

	least reactive → most reactive			
A	calcium	lead	zinc	silver
B	calcium	zinc	lead	silver
C	silver	lead	zinc	calcium
D	silver	zinc	lead	calcium

14. June/2023/Paper_ 0620/13/No.27

Which statement about rusting is correct?

A Rust is anhydrous iron(II) oxide.

B Oxygen is required for iron to rust.

C Iron covered in grease rusts more quickly.

D Iron rusts more quickly in the absence of air.

15. June/2023/Paper_ 0620/13/No.28

Which statements about the extraction of iron in a blast furnace are correct?

1 The temperature inside the blast furnace is increased by burning carbon.

2 Iron(III) oxide is reduced to iron by carbon monoxide.

3 The thermal decomposition of calcium carbonate forms slag.

4 Slag reacts with acidic impurities.

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

16. June/2023/Paper_ 0620/21/No.23

Which gas is made when powdered zinc is added to dilute hydrochloric acid?

A carbon dioxide

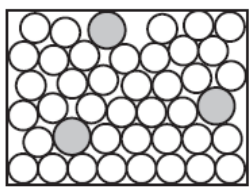
B chlorine

C hydrogen

D oxygen

17. June/2023/Paper_ 0620/21/No.24

The diagram represents the structure of a solid.



Which solids does the diagram represent?

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C	✗	✓	✓
D	✗	✗	✓

18. June/2023/Paper_ 0620/21/No.25

Steel is an alloy of iron.

Which statement explains why steel is stronger than iron?

A Steel contains carbon which is a very hard substance.

B The carbon atoms in steel bond together very strongly.

C The carbon atoms in steel make the iron atoms bond together very strongly.

D The carbon atoms prevent layers of iron atoms from sliding over each other.

19. June/2023/Paper_ 0620/21/No.26

Three students, X, Y and Z, are told that solid P reacts with dilute acids and also conducts electricity.

The table shows the students' suggestions about the identity of P.

X	Y	Z
copper	iron	graphite

Which students are correct?

A X, Y and Z **B** X only **C** Y only **D** Z only

20. June/2023/Paper_ 0620/21/No.27

Which statement explains why aluminium appears to be unreactive?

A It is coated in an oxide layer.

B It has a low density.

C It is low in the reactivity series.

D It is solid at room temperature.

21. June/2023/Paper_ 0620/21/No.28

During the electrolysis of aluminium oxide, the mass of the carbon anode changes.

Which row describes the change and gives a reason for this change?

	mass change of the anode	reason
A	decreases	carbon reacts to form carbon dioxide
B	decreases	carbon dissolves in molten cryolite
C	increases	electrodes become coated with cryolite
D	increases	electrodes become coated with aluminium

22. June/2023/Paper_ 0620/22/No.23

Which row identifies the properties of zinc?

	thermal conductivity	reacts with dilute acid
A	good	yes
B	good	no
C	poor	yes
D	poor	no

23. June/2023/Paper_ 0620/22/No.24

Uses of metals depend on their properties.

Which property is necessary for the use given?

	use of the metal	property of the metal
A	car bodies	ductile
B	cutlery	conducts heat
C	food containers	resists corrosion
D	overhead electrical cables	high density

24. June/2023/Paper_ 0620/22/No.26

P, Q, R and S are metals.

P reacts with dilute hydrochloric acid, forming hydrogen.

Q reacts violently with water.

R reacts with water to give hydrogen.

S is formed by heating its oxide with carbon.

Which row identifies the metals?

	P	Q	R	S
A	copper	sodium	potassium	iron
B	zinc	magnesium	calcium	iron
C	zinc	sodium	calcium	magnesium
D	iron	potassium	sodium	zinc

25. June/2023/Paper_ 0620/22/No.27

Which compound is formed when iron rusts?

A anhydrous iron(II) oxide

B anhydrous iron(III) oxide

C hydrated iron(III) hydroxide

D hydrated iron(III) oxide

26. June/2023/Paper_ 0620/22/No.28

Why is cryolite used in the extraction of aluminium by electrolysis?

A It dissolves the aluminium oxide.

B It protects the anodes from corrosion.

C It changes bauxite to aluminium oxide.

D It decreases the melting point of the aluminium.

27. June/2023/Paper_ 0620/23/No.24

Which statement about copper or aluminium is correct?

A Aluminium is more dense than copper.

B Aluminium is less reactive than copper.

C Copper has high ductility.

D Copper has poor electrical conductivity.

28. June/2023/Paper_ 0620/23/No.26

Calcium reacts with cold water to produce hydrogen.

Lead reacts slowly when heated in air to form an oxide but has almost no reaction with steam.

Silver does not react with either air or water.

Zinc reacts when heated with steam to produce hydrogen.

What is the order of reactivity starting with the least reactive?

	least reactive → most reactive			
A	calcium	lead	zinc	silver
B	calcium	zinc	lead	silver
C	silver	lead	zinc	calcium
D	silver	zinc	lead	calcium

29. June/2023/Paper_ 0620/23/No.27

Blocks of magnesium are attached to the bottom of a steel boat to prevent rusting.

Which equation describes a change that prevents the steel from rusting?

A $Fe \rightarrow Fe^{3+} + 3e^-$

B $Fe_2O_3 + 3Mg \rightarrow 2Fe + 3MgO$

C $3Mg^{2+} + 2Fe \rightarrow 2Fe^{3+} + 3Mg$

D $Mg \rightarrow Mg^{2+} + 2e^-$

30. June/2023/Paper_ 0620/23/No.28

Which statements about the extraction of iron in a blast furnace are correct?

1 The temperature inside the blast furnace is increased by burning carbon.

2 Iron(III) oxide is reduced to iron by carbon monoxide.

3 The thermal decomposition of calcium carbonate forms slag.

4 Slag reacts with acidic impurities.

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

31. June/2023/Paper_ 0620/31/No.5

This question is about metals.

(a) Iron is a transition element. Potassium is an element in Group I of the Periodic Table.

State **two** differences in the physical properties of iron compared to potassium.

1 .....

2 .....

[2]

(b) Carbon is used to extract iron from iron ore in a blast furnace.

State **two** uses of carbon in the extraction process.

1 .....

2 .....

[2]

(c) Steel is an alloy of iron.

(i) State the meaning of the term alloy.

.....

..... [1]

(ii) State why alloys are more useful than pure metals.

..... [1]

(d) Table 5.1 shows the observations made when four different metals react with dilute hydrochloric acid of the same concentration.

Table 5.1

metal	observations
iron	bubbles form slowly
lead	no bubbles formed
magnesium	bubbles form rapidly
nickel	bubbles form very slowly

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

least reactive → most reactive

[2]

[Total: 8]

32. June/2023/Paper_ 0620/32/No.5

This question is about metals.

(a) Carbon is used to extract iron from iron ore in a blast furnace.

(i) Name the main ore of iron.

..... [1]

(ii) Iron(III) oxide in the iron ore is reduced by carbon monoxide.

Name the **two** substances which react in the blast furnace to produce carbon monoxide.

..... and ..... [2]

(b) Iron rusts in the presence of oxygen and water.

State **one** method of preventing rusting.

..... [1]

(c) Table 5.1 shows some information about the reaction of four metals with steam.

Table 5.1

metal	reaction with steam when metal is cold
beryllium	reacts slowly
chromium	reacts slowly only when the metal is very hot
magnesium	reacts rapidly
silver	no reaction

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

least reactive → most reactive

[2]

[Total: 6]

33. June/2023/Paper_ 0620/33/No.5

This question is about metals.

(a) Nickel is a transition element. Sodium is an element in Group I of the Periodic Table.

State **two** differences in the physical properties of nickel compared to sodium.

1 .....

2 .....

[2]

(b) Stainless steel is an alloy that is used to make cutlery.

Give **one** reason why stainless steel is used to make cutlery.

..... [1]

(c) Table 5.1 shows some information about the reaction of four metals with oxygen.

Table 5.1

metal	reaction with oxygen
gold	no reaction
lanthanum	forms a layer of oxide rapidly but does not burn
magnesium	burns rapidly to form an oxide
nickel	forms a layer of oxide slowly but does not burn

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

least reactive → most reactive

[2]

(d) Complete the diagram in Fig. 5.1 to show the electronic configuration of a magnesium atom.

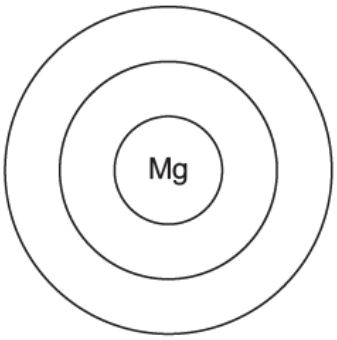

Fig. 5.1

[1]

[Total: 6]

34. March/2023/Paper_ 0620/12/No.22
Which description of brass is correct?

A a compound of copper and zinc

B a compound of copper and tin

C a mixture of copper and zinc

D a mixture of copper and tin

35. March/2023/Paper_ 0620/12/No.23
What is the symbol of the metal used in the manufacture of aircraft because of its low density?

A *Al* **B** Cu **C** Fe **D** Zn

36. March/2023/Paper_ 0620/12/No.24
Which property of stainless steel makes it suitable for making cutlery?

A It conducts electricity.

B It has a high melting point.

C It is resistant to rusting.

D It is ductile.

37. March/2023/Paper_ 0620/12/No.26

Which substances react to form hydrogen gas?

1 calcium and water

2 silver and dilute hydrochloric acid

3 magnesium and steam

4 zinc and dilute hydrochloric acid

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

38. March/2023/Paper_ 0620/22/No.25

Which description of brass is correct?

A a compound of copper and zinc

B a compound of copper and tin

C a mixture of copper and zinc

D a mixture of copper and tin

39. March/2023/Paper_ 0620/22/No.26

What is the symbol of the metal used in the manufacture of aircraft because of its low density?

A *Al* **B** Cu **C** Fe **D** Zn

40. March/2023/Paper_ 0620/22/No.27

Which substances react to form hydrogen gas?

1 calcium and water

2 silver and dilute hydrochloric acid

3 magnesium and steam

4 zinc and dilute hydrochloric acid

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

41. March/2023/Paper_ 0620/22/No.28

Coke (carbon) and limestone are two raw materials used in the extraction of iron from hematite.

Which type of reaction occurs when each substance is heated during the process?

	coke	limestone
A	redox	redox
B	redox	thermal decomposition
C	thermal decomposition	redox
D	thermal decomposition	thermal decomposition

42. March/2023/Paper_ 0620/32/No.4

This question is about metals and compounds of metals.

(a) Table 4.1 shows some properties of five metals, **A**, **B**, **C**, **D** and **E**.

Table 4.1

metal	density in g/cm^3	melting point in °C	colour of metal chloride
A	5.90	30	white
B	5.96	1890	green
C	11.34	328	white
D	8.90	1455	yellow
E	1.53	39	white

State which **two** of these metals, **A**, **B**, **C**, **D** and **E**, are transition elements.

Give two reasons for your answer using only the information in Table 4.1.

metals ..... and .....

reason 1 .....

reason 2 .....

[3]

(b) Choose the metal chloride that is insoluble in water.

Tick (✓) **one** box.

magnesium chloride ☐

potassium chloride ☐

silver chloride ☐

sodium chloride ☐

[1]

(c) Magnesium chloride is produced when magnesium burns in chlorine.

$$Mg + Cl_2 \rightarrow MgCl_2$$

Fig. 4.1 shows an incomplete reaction pathway diagram for this reaction.

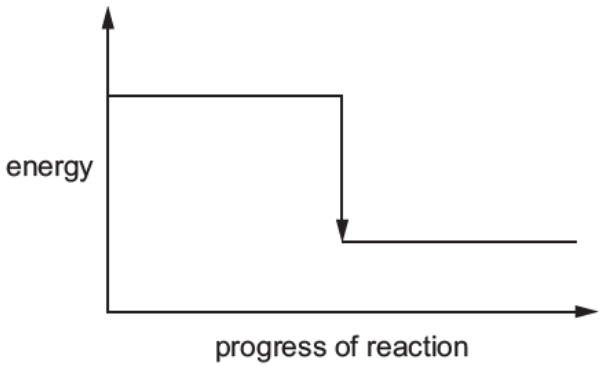

Fig. 4.1

(i) Complete Fig. 4.1 by writing these formulae on the diagram:

- $Mg + Cl_2$
- $MgCl_2$.

[1]

(ii) Explain how Fig. 4.1 shows that the reaction is exothermic.

.....

..... [1]

(d) Table 4.2 shows the reactions of four different metals with steam.

Table 4.2

metal	reaction with steam
iron	reacts slowly
magnesium	reacts very rapidly
nickel	reacts very slowly
niobium	does not react

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

least reactive ⟶ most reactive

[2]

(e) A compound of nickel has the molecular formula NiP_4F_{12}.

Complete Table 4.3 to calculate the relative molecular mass of NiP_4F_{12}.

Table 4.3

atom	number of atoms	relative atomic mass	
fluorine	12	19	12 × 19 = 228
nickel		59	
phosphorus		31	

relative molecular mass = ... [2]

[Total: 10]

43. March/2023/Paper_ 0620/32/No.7

This question is about iron.

(a) Iron is extracted from iron ore in a blast furnace.

(i) Name the main ore of iron.

..... [1]

(ii) The main ore of iron contains iron(III) oxide.

Describe the extraction of iron from iron ore in the blast furnace.

In your answer, describe:

- the production of carbon monoxide

.....

.....

.....

- the role of carbon monoxide

.....

- the role of calcium carbonate, added to the blast furnace.

.....

.....

.....

[4]

(iii) Iron collects at the base of the blast furnace as a liquid.

Describe the arrangement and motion of the particles in a liquid.

arrangement .....

.....

motion .....

.....

[2]

(b) The equation for the reaction of iron with steam is shown.

$$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$$

Describe how this equation shows that iron is oxidised.

..... [1]

(c) Rust is hydrated iron(III) oxide.

(i) Define the term hydrated.

.....

..... [1]

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

..... and ..... [2]

(d) Crystals of iron(II) chloride can be prepared by adding excess iron to dilute hydrochloric acid.

(i) Suggest how the unreacted iron is removed from the reaction mixture.

..... [1]

(ii) Describe how dry crystals of iron(II) chloride are made from a dilute solution of iron(II) chloride.

.....

.....

..... [2]

[Total: 14]

44. March/2023/Paper_ 0620/42/No.4(a, b)

Copper is element 29 in the Periodic Table.

(a) Brass contains copper.

(i) Name the other metal in brass.

..... [1]

(ii) State the term given to a mixture of a metal with another element.

..... [1]

(b) Copper can be stretched into wires. Copper wires conduct electricity.

(i) Name the property of metals which means that they can be stretched into wires.

..... [1]

(ii) Name the particles responsible for the conduction of electricity in solid copper.

..... [1]