Metals – 2022 IGCSE

1. June/2022/Paper_11/No.11

Overhead power cables made from (steel-cored) aluminium are used to carry electricity over long distances.

Which property of (steel-cored) aluminium makes it suitable for use in power cables?

A Aluminium has a low density.

B Aluminium has low strength.

C Steel is a good conductor of heat.

D Steel is resistant to corrosion.

2. June/2022/Paper_11/No.26

Which statements about the general properties of metals are correct?

1 They are good conductors of heat and electricity.

2 They have low melting points.

3 They react with dilute acids to form a salt and water.

4 They react with oxygen to form basic oxides.

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

3. June/2022/Paper_11/No.27

Reactions of three metals and their oxides are shown.

metal	add dilute hydrochloric acid to metal	heat metal oxide with carbon
1	✓	✓
2	✓	✗
3	✗	✓

key

✓ = reacts

✗ = does not react

What is the order of reactivity of these metals, from most reactive to least reactive?

A $1 \rightarrow 2 \rightarrow 3$ **B** $1 \rightarrow 3 \rightarrow 2$ **C** $2 \rightarrow 1 \rightarrow 3$ **D** $2 \rightarrow 3 \rightarrow 1$

4. June/2022/Paper_11/No.28

Which uses of the metals shown are correct?

	aluminium	stainless steel
A	aircraft bodies	car bodies
B	car bodies	aircraft bodies
C	chemical plant	food containers
D	food containers	cutlery

5. June/2022/Paper_11/No.29

Which statement about the reactions in the blast furnace is correct?

A Carbon reacts with oxygen and heats the furnace.

B Carbon monoxide removes the silicon dioxide impurity forming slag.

C Iron(III) oxide is oxidised to iron.

D Limestone reduces iron(III) oxide to iron.

6. June/2022/Paper_11/No.30

Iron rusts when exposed to air.

Which two substances in air cause iron to rust?

A carbon dioxide and oxygen

B nitrogen and oxygen

C oxygen and water

D carbon dioxide and water

7. June/2022/Paper_12/No.23

Some properties of element E are listed.

It has a high density.

It has a high melting point.

What is E?

A aluminium

B bromine

C iron

D lithium

8. June/2022/Paper_12/No.25

The reactions of metals P, Q, R and S are shown.

metal	reaction with water	reaction with hydrochloric acid	reduction of the metal oxide with carbon
P	no reaction	no reaction	reduced
Q	slow	vigorous	no reaction
R	vigorous	vigorous	no reaction
S	very slow	vigorous	reduced

What is the order of reactivity of the metals?

	least reactive → most reactive			
A	P	S	Q	R
B	P	Q	S	R
C	R	S	Q	P
D	R	Q	S	P

9. June/2022/Paper_12/No.26

Iron is extracted from hematite in the blast furnace at a temperature of about 1550 °C.

Which equation shows the main reaction that increases the temperature in the furnace?

A $CaCO_3 \rightarrow CaO + CO_2$

B $C + O_2 \rightarrow CO_2$

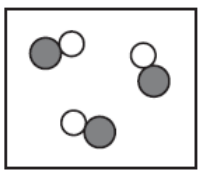
C $CO_2 + C \rightarrow 2CO$

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

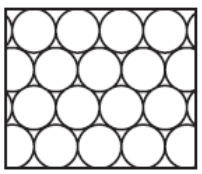
10. June/2022/Paper_12/No.27

Which diagram represents the arrangement of atoms in an alloy?

A



B



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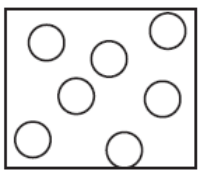
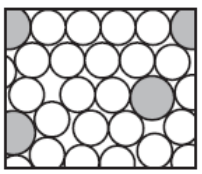


D



11. June/2022/Paper_12/No.28

Which uses of the metals shown are correct?

	aluminium	stainless steel
A	aircraft bodies	car bodies
B	car bodies	aircraft bodies
C	chemical plant	food containers
D	food containers	cutlery

12. June/2022/Paper_13/No.13

Metal M reacts with steam and produces gas G.

Which row identifies gas G and the type of reaction when metal M reacts with steam?

	gas G	type of reaction
A	hydrogen	redox
B	hydrogen	neutralisation
C	oxygen	redox
D	oxygen	neutralisation

13. June/2022/Paper_13/No.26

Some properties of four elements, P, Q, R and S, are shown.

Solid P reacts with dilute hydrochloric acid to give hydrogen.

Solid Q does not conduct electricity.

Solid R is used to make saucepans because it is a good conductor of heat.

Solid S reacts with oxygen to form a compound where atoms of S share electrons with atoms of oxygen.

Which elements are metals?

A P and R **B** P and S **C** Q and R **D** Q and S

14. June/2022/Paper_13/No.27

Three metals, X, Y and Z, are added separately to dilute hydrochloric acid.

The oxides of each metal are heated with carbon.

The results of the reactions are shown.

	dilute aqueous hydrochloric acid	metal oxide with carbon
X	no reaction	brown solid forms
Y	fast fizzing	no change
Z	slow fizzing	silver coloured solid forms

What are X, Y and Z?

	X	Y	Z
A	copper	calcium	zinc
B	copper	zinc	magnesium
C	iron	calcium	zinc
D	iron	zinc	magnesium

15. June/2022/Paper_13/No.28

Which uses of the metals shown are correct?

	aluminium	stainless steel
A	aircraft bodies	car bodies
B	car bodies	aircraft bodies
C	chemical plant	food containers
D	food containers	cutlery

16. June/2022/Paper_21/No.23

In the extraction of aluminium by electrolysis, cryolite is added to the bauxite ore.

Which row describes the role of cryolite and gives the ionic half-equation at the cathode?

	role of cryolite	ionic half-equation at the cathode
A	catalyst	$Al^{3+} + 3e^- \rightarrow Al$
B	catalyst	$Al^{3+} + 3e^- \rightarrow 3Al$
C	lowers melting point of electrolyte	$Al^{3+} + 3e^- \rightarrow Al$
D	lowers melting point of electrolyte	$Al^{3+} + 3e^- \rightarrow 3Al$

17. June/2022/Paper_21/No.24

Mild steel is galvanised to prevent corrosion of the iron.

Which statements about galvanising are correct?

1 Galvanising prevents corrosion because the zinc forms an alloy.

2 If the coating is damaged, water and oxygen do not corrode the iron.

3 Zinc is a sacrificial metal and corrodes in preference to iron.

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

18. June/2022/Paper_21/No.26

Which statements about the general properties of metals are correct?

1 They are good conductors of heat and electricity.

2 They have low melting points.

3 They react with dilute acids to form a salt and water.

4 They react with oxygen to form basic oxides.

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

19. June/2022/Paper_21/No.27

Reactions of three metals and their oxides are shown.

metal	add dilute hydrochloric acid to metal	heat metal oxide with carbon
1	✓	✓
2	✓	✗
3	✗	✓

key

✓ = reacts

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What is the order of reactivity of these metals, from most reactive to least reactive?

A $1 \rightarrow 2 \rightarrow 3$ **B** $1 \rightarrow 3 \rightarrow 2$ **C** $2 \rightarrow 1 \rightarrow 3$ **D** $2 \rightarrow 3 \rightarrow 1$

20. June/2022/Paper_21/No.28

Three metal compounds, J, K and L, are heated using a Bunsen burner.

The results are shown.

J colourless gas produced, which relights a glowing splint

K colourless gas produced, which turns limewater milky

L no reaction

Which row identifies J, K and L?

	J	K	L
A	magnesium carbonate	potassium carbonate	potassium nitrate
B	magnesium carbonate	potassium nitrate	potassium carbonate
C	potassium nitrate	magnesium carbonate	potassium carbonate
D	potassium nitrate	potassium carbonate	magnesium carbonate

21. June/2022/Paper_22/No.25

The reactions of metals P, Q, R and S are shown.

metal	reaction with water	reaction with hydrochloric acid	reduction of the metal oxide with carbon
P	no reaction	no reaction	reduced
Q	slow	vigorous	no reaction
R	vigorous	vigorous	no reaction
S	very slow	vigorous	reduced

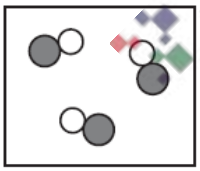
What is the order of reactivity of the metals?

	least reactive →			most reactive
A	P	S	Q	R
B	P	Q	S	R
C	R	S	Q	P
D	R	Q	S	P

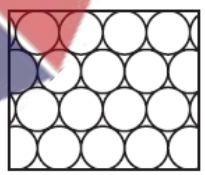
22. June/2022/Paper_22/No.27

Which diagram represents the arrangement of atoms in an alloy?

A



B



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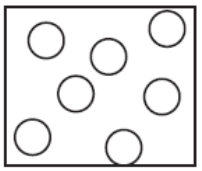
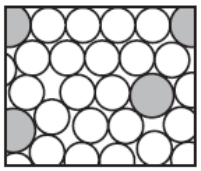


D



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C	potassium nitrate	magnesium carbonate	potassium carbonate
D	potassium nitrate	potassium carbonate	magnesium carbonate

24. June/2022/Paper_22/No.29

Processes involved in the extraction of zinc are listed.

1 Heat zinc oxide with carbon.

2 Condense zinc vapour.

3 Vaporise the zinc.

4 Roast zinc ore in air.

In which order are the processes carried out?

A $1 \rightarrow 2 \rightarrow 3 \rightarrow 4$

B $4 \rightarrow 3 \rightarrow 1 \rightarrow 2$

C $4 \rightarrow 1 \rightarrow 3 \rightarrow 2$

D $1 \rightarrow 4 \rightarrow 3 \rightarrow 2$

25. June/2022/Paper_22/No.30

Which process uses sacrificial protection to prevent steel from rusting?

A galvanising

B oiling

C copper plating

D painting

26. June/2022/Paper_23/No.13

Metal M reacts with steam and produces gas G.

Which row identifies gas G and the type of reaction when metal M reacts with steam?

	gas G	type of reaction
A	hydrogen	redox
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27. June/2022/Paper_23/No.26

Some properties of four elements, P, Q, R and S, are shown.

Solid P reacts with dilute hydrochloric acid to give hydrogen.

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Solid R is used to make saucepans because it is a good conductor of heat.

Solid S reacts with oxygen to form a compound where atoms of S share electrons with atoms of oxygen.

Which elements are metals?

A P and R **B** P and S **C** Q and R **D** Q and S

28. June/2022/Paper_23/No.27

Which substance is used to reduce zinc oxide in the manufacture of zinc?

A carbon

B carbon dioxide

C hydrogen

D sulfur dioxide

29. June/2022/Paper_23/No.28

Three metal compounds, J, K and L, are heated using a Bunsen burner.

The results are shown.

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Which row identifies J, K and L?

	J	K	L
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B	magnesium carbonate	potassium nitrate	potassium carbonate
C	potassium nitrate	magnesium carbonate	potassium carbonate
D	potassium nitrate	potassium carbonate	magnesium carbonate

30. June/2022/Paper_23/No.30

A magnesium block is attached to iron to prevent it from rusting.

Which statement about this method of rust prevention is correct?

A Magnesium corrodes instead of iron because it is more reactive.

B Magnesium prevents oxygen from reaching the iron.

C The iron does not rust because it has a greater tendency to form ions than magnesium.

D This method of rust prevention is called galvanising.

31. June/2022/Paper_31/No.5(c, d)

(c) Lead is extracted from lead(II) oxide by heating with carbon.

$$PbO + C \rightarrow Pb + CO$$

Describe how this equation shows that lead(II) oxide is reduced.

.....

..... [1]

(d) Lead is a pollutant of the air.

(i) State **one** source of lead in the air.

..... [1]

(ii) State **one** adverse effect of lead on health.

..... [1]

32. June/2022/Paper_32/No.5(c, _f)

(c) Aluminium ore contains aluminium oxide.

(i) Name the main ore of aluminium.

..... [1]

(ii) Aluminium is extracted from aluminium oxide by electrolysis.

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

.....

..... [1]

(d) Aluminium can be used to reduce iron(III) oxide to iron.

$$Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3$$

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

..... [1]

(e) Aluminium is used for electric cables.

State one **other** use of aluminium.
Give a reason for this use in terms of the properties of aluminium.

use of aluminium .....

reason for this use .....

.....
[2]

(f) Deduce the electronic structure of aluminium.

Use the Periodic Table to help you.

..... [1]

33. June/2022/Paper_32/No.7(a, _b)

This question is about sodium and compounds of sodium.

(a) Sodium is a metal in Group I of the Periodic Table.

(i) Give **two** physical properties of all metals.

1 .....

2 .....

[2]

(ii) Give **one** physical property of Group I metals that is different from most other metals and state how it is different.

.....

..... [1]

(b) Sodium reacts with oxygen to form sodium oxide, Na_2O.

Complete the chemical equation for this reaction.

.....Na + O_2 → .....Na_2O [2]

34. June/2022/Paper_41/No.6(**a**)

This question is about zinc and its compounds.

(a) Zinc is extracted from its ore which is mainly zinc sulfide, ZnS.

The steps for this extraction are shown.

step 1 Zinc sulfide is converted into zinc oxide.

step 2 The zinc oxide is then reduced to zinc in a furnace. The zinc formed becomes a gas.

step 3 The zinc gas is cooled to form molten zinc.

(i) Name the ore of zinc, which is mainly zinc sulfide.

..... [1]

(ii) Describe how zinc sulfide is converted into zinc oxide in **step 1**.

.....

..... [1]

(iii) Name the reducing agent used in **step 2**.

..... [1]

(iv) Explain why the zinc forms a gas in **step 2** inside the furnace.

..... [1]

(v) State the name of the physical change occurring when zinc gas is converted into molten zinc.

..... [1]

35. June/2022/Paper_43/No.5

This question is about copper and its compounds.

(a) Describe the bonding in a metallic element such as copper.

You may include a diagram as part of your answer.

.....

.....

..... [3]

(b) A metal spoon is electroplated with copper.

State what is used as:

the positive electrode (anode) .....

the negative electrode (cathode) .....

the electrolyte. .....

[3]

(c) The formula for crystals of hydrated copper(II) sulfate is $CuSO_4 \cdot 5H_2O$.

Hydrated copper(II) sulfate is made by reacting copper(II) oxide with dilute sulfuric acid.

The overall equation is shown.

$$CuO + H_2SO_4 + 4H_2O \rightarrow CuSO_4 \cdot 5H_2O$$

The crystals are made using the following steps:

step 1 50.0 cm^3 of 0.200 mol/dm^3 dilute sulfuric acid is heated in a beaker. Powdered copper(II) oxide is added until the copper(II) oxide is in excess. Aqueous copper(II) sulfate is formed.

step 2 The excess copper(II) oxide is separated from the aqueous copper(II) sulfate.

step 3 The aqueous copper(II) sulfate is heated until a saturated solution is formed.

step 4 The saturated solution is allowed to cool and crystallise.

step 5 The crystals are removed and dried.

Calculate the maximum mass of copper(II) sulfate crystals, $CuSO_4 \cdot 5H_2O$, that can form using the following steps.

- Calculate the number of moles of H_2SO_4 in 50.0 cm^3 of 0.200 mol/dm^3 H_2SO_4.

..... mol

- Deduce the number of moles of $CuSO_4 \cdot 5H_2O$ that can form.

..... mol

- The M_r of $CuSO_4 \cdot 5H_2O$ is 250.

  Calculate the maximum mass of $CuSO_4 \cdot 5H_2O$ that can form.

..... g
[3]

(d) State **one** observation that indicates the copper(II) oxide is in excess in **step 1**.

..... [1]

(e) **Step 1** is repeated without heating the dilute sulfuric acid.

All other conditions are kept the same.

The rate of reaction decreases.

Give a reason why the rate of reaction decreases. Explain your answer in terms of particles.

.....

.....

.....

.....

..... [3]

(f) Name a substance, other than copper(II) oxide, that can be added to dilute sulfuric acid to produce copper(II) sulfate in **step 1**.

..... [1]

(g) Name the process used to separate excess copper(II) oxide from aqueous copper(II) sulfate in **step 2**.

..... [1]

(h) Suggest what is meant by the term *saturated solution* in **step 3**.

.....

.....

..... [2]

(i) The phrase 'heating to dryness' means heating until no more water is given off.

Explain why aqueous copper(II) sulfate is **not** heated to dryness in **step 3**.

.....

..... [1]

[Total: 18]

36. March/2022/Paper_12/No.26

Which process is used to obtain the metal calcium from its ore?

A electrolysis

B oxidation with carbon

C reduction with carbon

D thermal decomposition

37. March/2022/Paper_12/No.27

Which row links the property of a metal to its use?

	property	use
A	high density	aircraft bodies
B	high reactivity	food containers
C	good electrical conductor	cooking pans
D	ductile	electrical wiring

38. March/2022/Paper_12/No.28

The table gives some properties of an element.

melting point in °C	3422
appearance of the element	grey
appearance of the chloride of the element	dark blue
density in g / cm^3	19.2
electrical conductivity when solid	good

Which other property does this element have?

A acts as a catalyst

B brittle

C forms an acidic oxide

D highly reactive with water

39. March/2022/Paper_12/No.29

A metal reacts vigorously with cold water.

Which statement about the metal is correct?

A It is above hydrogen in the reactivity series.

B It is below magnesium in the reactivity series.

C Its oxide can be reduced with carbon.

D It does not react with dilute acids.

40. March/2022/Paper_22/No.26

Which statement about the extraction of aluminium is correct?

A Aluminium is formed at the cathode during the electrolysis of aluminium oxide.

B Hematite is mainly aluminium oxide.

C Molten cryolite is used to raise the melting point of the aluminium oxide.

D Oxygen gains electrons at the anode during the electrolysis of aluminium oxide.

41. March/2022/Paper_22/No.27

Metal M is mixed with copper to produce brass.

What is M?

A chromium

B nickel

C vanadium

D zinc

42. March/2022/Paper_22/No.28

The table gives some properties of an element.

melting point in °C	3422
appearance of the element	grey
appearance of the chloride of the element	dark blue
density in g / cm^3	19.2
electrical conductivity when solid	good

Which other property does this element have?

A acts as a catalyst

B brittle

C forms an acidic oxide

D highly reactive with water

43. March/2022/Paper_32/No.3(a _ c)

This question is about metals.

(a) State **three** general physical properties common to most metals.

1 .....

2 .....

3 .....

[3]

(b) Metals are often used in the form of alloys.

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

.....

..... [1]

(ii) Explain in terms of their properties why alloys are used instead of pure metals.

..... [1]

(iii) Stainless steel is an alloy.

Give **one** use of stainless steel.

..... [1]

(c) Place these metals in order of their reactivity with oxygen.

copper
magnesium
potassium
zinc

Put the least reactive metal first.

least reactive → most reactive

[2]