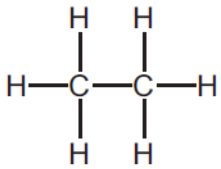
Metals – 2020 O Level

1. Nov/2021/Paper_11/No.12

The diagram shows the covalent bonds in an organic compound.



The total number of electrons in one molecule of this compound is .....X..... .

The total number of electrons in the bonds in one molecule of this compound is .....Y..... .

Which numbers correctly complete gaps X and Y?

	X	Y
A	14	12
B	14	14
C	18	12
D	18	14

2. Nov/2021/Paper_11/No.28

Metals are elements that have many similar properties because of their structure.

Which statement about metals is correct?

A Metals are malleable because the layers of atoms can slide over each other.

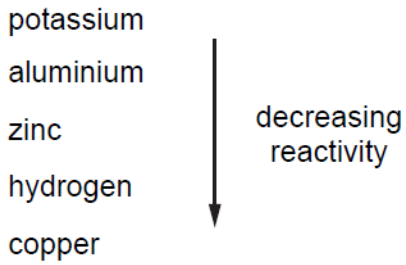
B Metals conduct electricity because their ions vibrate and pass on energy to each other.

C The melting point of metals depends on the strength of the intermolecular forces in the lattice.

D To form an alloy of two metals, the metals must have very similar ionic radii.

3. Nov/2021/Paper_11/No.30

Four metals and hydrogen are arranged in order of decreasing reactivity.



Which statement about these elements is correct?

A Aluminium is formed when aluminium oxide is heated with hydrogen.

B Copper displaces zinc from aqueous zinc sulfate.

C Copper is formed when copper(II) oxide is heated with hydrogen.

D When added to water, aluminium forms positive ions more readily than potassium forms positive ions.

4. Nov/2021/Paper_11/No.31

Iron is extracted from haematite in a blast furnace. Coke and limestone are added to the blast furnace.

What is the function of the limestone?

A It decomposes and neutralises acidic impurities.

B It is a fuel which heats the furnace.

C It oxidises the iron in haematite.

D It releases oxygen allowing the coke to burn.

5. Nov/2021/Paper_12/No.13

Magnesium will react with aqueous copper(II) sulfate to form copper and aqueous magnesium sulfate.

What is the correct equation for this reaction?

A $Mg + CuSO_4 \rightarrow Cu + MgSO_4$

B $Mg + Cu_2SO_4 \rightarrow 2Cu + MgSO_4$

C $2Mg + CuSO_4 \rightarrow Cu + Mg_2SO_4$

D $2Mg + Cu_2SO_4 \rightarrow 2Cu + Mg_2SO_4$

6. Nov/2021/Paper_12/No.23

Which salts could be prepared by precipitation?

1 barium sulfate

2 lead chloride

3 copper(II) chloride

4 zinc sulfate

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

7. Nov/2021/Paper_12/No.24

Silver is below hydrogen in the reactivity series.

Which row describes the chemicals used and the method of separation used to prepare a pure sample of silver chloride?

	chemicals used	method of separation of product
A	silver and hydrochloric acid	crystallisation
B	silver and hydrochloric acid	filtration
C	silver nitrate and hydrochloric acid	crystallisation
D	silver nitrate and hydrochloric acid	filtration

8. Nov/2021/Paper_12/No.28

Metals have high melting points.

What is the reason for this?

A Their atoms are joined by strong covalent bonds in a giant lattice.

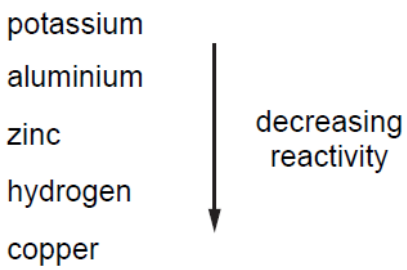
B They have strong forces of attraction between negative ions and delocalised electrons.

C They have strong forces of attraction between negative ions and positive ions.

D They have strong forces of attraction between positive ions and delocalised electrons.

9. Nov/2021/Paper_12/No.30

Four metals and hydrogen are arranged in order of decreasing reactivity.



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B Copper displaces zinc from aqueous zinc sulfate.

C Copper is formed when copper(II) oxide is heated with hydrogen.

D When added to water, aluminium forms positive ions more readily than potassium forms positive ions.

10. Nov/2021/Paper_12/No.31

Aluminium is extracted from its ore using electrolysis.

Which statement about the electrodes used is correct?

A The anode is made of graphite.

B The anode is made of steel.

C The cathode is made of bauxite.

D The cathode is made of cryolite.

11. Nov/2021/Paper_21/No.3

This question is about copper and copper compounds.

(a) Copper is a metal.

Explain why copper conducts electricity.

..... [1]

(b) Describe a test for copper(II) ions.

test .....

observations .....

[2]

(c) Aqueous copper(II) sulfate is electrolysed using graphite electrodes.

(i) Describe what is observed during this electrolysis:

- at the positive electrode

.....

- at the negative electrode

.....

- in the electrolyte.

.....

[3]

(ii) Graphite conducts electricity.

Give one other reason why graphite electrodes are used in electrolysis.

..... [1]

(d) Aqueous copper(II) sulfate reacts with magnesium.

$$CuSO_4 + Mg \rightarrow Cu + MgSO_4$$

Construct the ionic equation, including state symbols, for this reaction.

..... [2]

(e) A 2.25 g sample of an oxide of copper contains 0.250 g of oxygen.

Deduce the empirical formula of this oxide of copper.

[3]

(f) There are several commonly used alloys of copper.

What is the meaning of the term *alloy*?

.....

..... [1]

[Total: 13]

12. Nov/2021/Paper_21/No.7

Aluminium is extracted by the electrolysis of molten aluminium oxide.

(a) (i) Explain why aluminium is extracted by electrolysis and not by reduction with carbon.

..... [1]

(ii) The electrolyte is a mixture of aluminium oxide and cryolite.

Explain the purpose of the cryolite.

.....

..... [1]

(iii) At the positive electrode (anode) oxide ions are converted to oxygen.

Construct the equation for this reaction.

..... [1]

(b) Aluminium can also be produced on a small scale by reacting aluminium oxide with magnesium.

$$Al_2O_3 + 3Mg \rightarrow 2Al + 3MgO$$

(i) Use this equation to explain why the Al_2O_3 is reduced.

.....

..... [1]

(ii) Calculate the maximum mass of aluminium formed when 25.5 g of aluminium oxide reacts with excess magnesium.

mass of aluminium = ... g [2]

(c) Aluminium is a metal.

Use your knowledge of the structure of metals to explain why aluminium is malleable.

.....

.....

..... [2]

(d) When aluminium is heated in chlorine, aluminium chloride is formed.

The reaction is exothermic.

Explain, in terms of bond making and bond breaking, why this reaction is exothermic.

.....

.....

..... [2]

[Total: 10]

13. Nov/2021/Paper_22/No.7

Iron is extracted from iron ore in a blast furnace using limestone and coke (carbon).

(a) Name a common ore of iron.

..... [1]

(b) The coke burns to form carbon dioxide.

This reaction is exothermic.

Explain, in terms of bond making and bond breaking, why this reaction is exothermic.

.....

.....

..... [2]

(c) Carbon dioxide reacts with hot coke to form carbon monoxide.

The carbon monoxide reduces the iron(III) oxide in the iron ore.

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

(i) Use this equation to explain why the Fe_2O_3 is reduced.

.....

..... [1]

(ii) Calculate the maximum mass of iron formed when 12.5 g of iron(III) oxide react with excess carbon monoxide.

mass of iron ..... g
[2]

(d) Silicon dioxide is an impurity in the iron ore.

Explain how the addition of limestone helps remove silicon dioxide from the blast furnace.

.....

.....

.....

..... [2]

(e) Iron is a metal.

Describe metallic bonding.

.....

.....

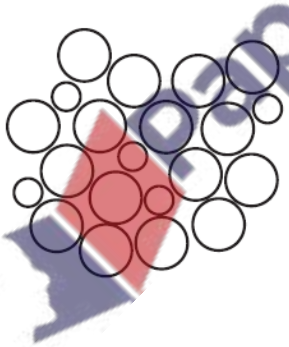
..... [2]

[Total: 10]

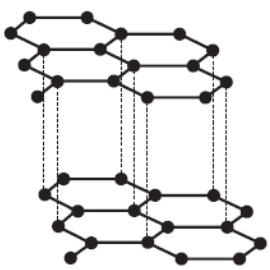
14. Jun/2020/Paper_11/No.26

Which diagram shows the structure of an alloy?

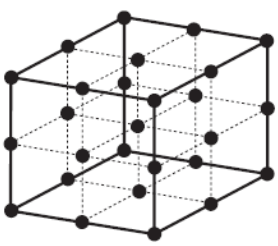
A



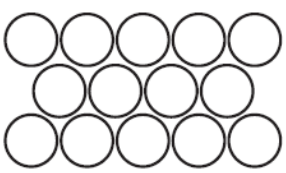
B



C



D



15. Jun/2020/Paper_11/No.27

Which element can only be extracted from its ore using electrolysis?

A calcium

B copper

C lead

D silver

16. Jun/2020/Paper_11/No.28

The equations show reactions taking place in the blast furnace.

In which reaction is an acidic impurity, present in iron ore, removed?

A $C + O_2 \rightarrow CO_2$

B $C + CO_2 \rightarrow 2CO$

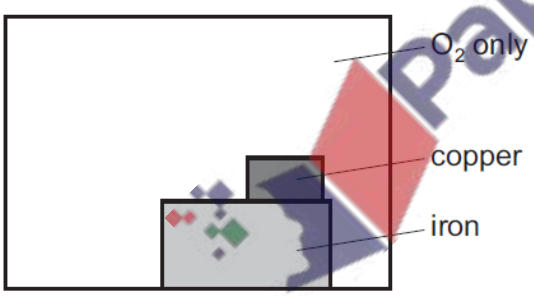
C $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

D $CaCO_3 + SiO_2 \rightarrow CaSiO_3 + CO_2$

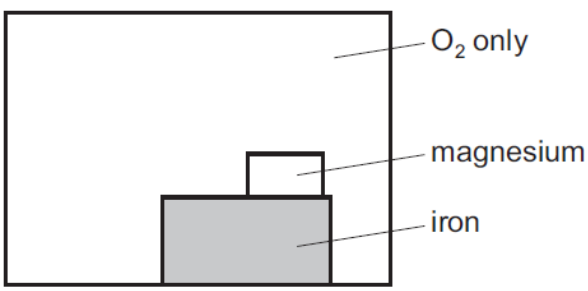
17. Jun/2020/Paper_11/No.29

Which diagram correctly shows the conditions necessary for the rusting of iron and also the metal that can be used to prevent rusting by sacrificial protection?

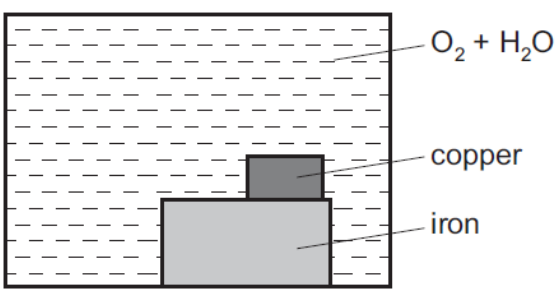
A



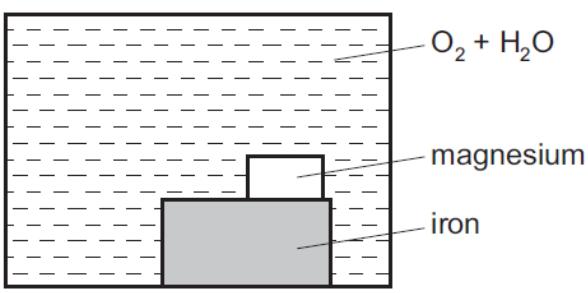
B



C



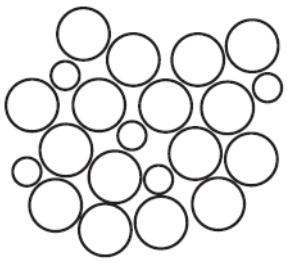
D



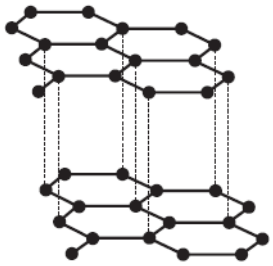
18. Jun/2020/Paper_12/No.26

Which diagram shows the structure of an alloy?

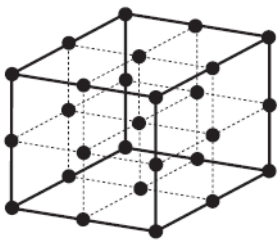
A



B



C



D

19. Jun/2020/Paper_12/No.27

Which element can only be extracted from its ore using electrolysis?

A calcium

B copper

C lead

D silver

20. Jun/2020/Paper_12/No.28

Which equation shows a thermal decomposition that occurs in the blast furnace?

A $C + O_2 \rightarrow CO_2$

B $CO_2 + C \rightarrow 2CO$

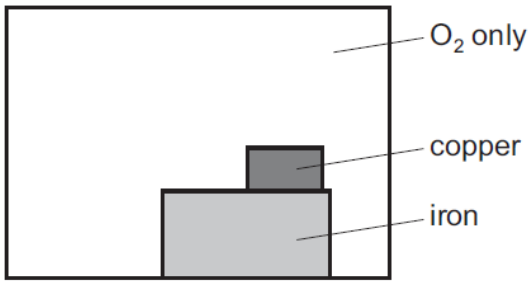
C $CaCO_3 \rightarrow CaO + CO_2$

D $CaO + SiO_2 \rightarrow CaSiO_3$

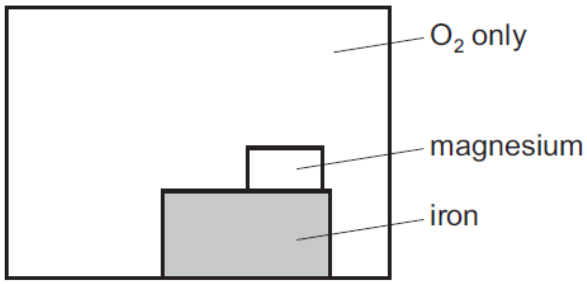
21. Jun/2020/Paper_12/No.29

Which diagram correctly shows the conditions necessary for the rusting of iron and also the metal that can be used to prevent rusting by sacrificial protection?

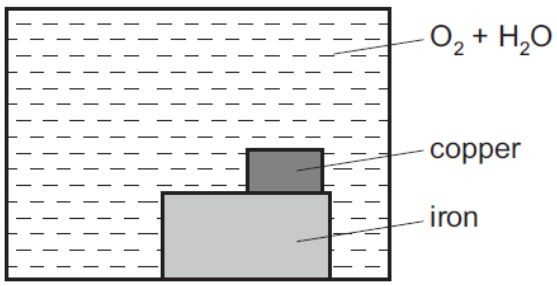
A



B



C



D

22. Jun/2020/Paper_12/No.30

Aluminium is produced by the electrolysis of pure aluminium oxide. One of the electrodes in the process has to be replaced often.

Which statement is correct?

A The product at the anode reacts with the anode.

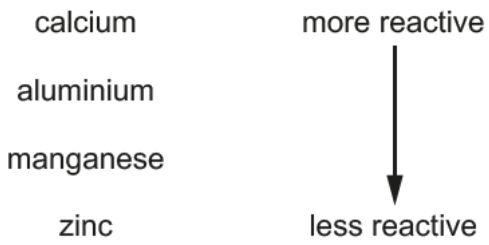
B The product at the anode reacts with the cathode.

C The product at the cathode reacts with the anode.

D The product at the cathode reacts with the cathode.

23. Jun/2020/Paper_21/No.2

Part of the reactivity series is shown.



(a) Predict the names of the products formed when manganese reacts with dilute hydrochloric acid.

.....

..... [1]

(b) A sample of manganese(II) carbonate, $MnCO_3$, is heated strongly.

Construct the equation for this reaction.

..... [1]

(c) Powdered manganese is added to aqueous zinc sulfate to form aqueous manganese(II) sulfate, $MnSO_4$.

Construct an ionic equation, with state symbols, for this reaction.

..... [2]

(d) Zinc powder, a reducing agent, is added to acidified aqueous potassium manganate(VII).

Describe the colour change during this reaction.

..... [1]

(e) Aluminium is extracted by the electrolysis of aluminium oxide dissolved in molten cryolite.

(i) Write the electrode equation for the formation of aluminium atoms at the cathode.

..... [1]

(ii) Write the electrode equation for the formation of oxygen molecules at the anode.

..... [1]

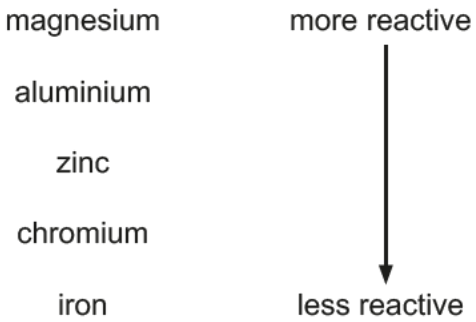
(f) State one advantage of recycling aluminium.

..... [1]

[Total: 8]

24. Jun/2020/Paper_22/No.4

Part of the reactivity series is shown.



(a) Predict the names of the products formed when chromium reacts with dilute hydrochloric acid.

.....

..... [1]

(b) Powdered zinc is added to aqueous chromium(III) ions, $Cr^{3+}(aq)$.

Construct an ionic equation, with state symbols, for this reaction.

..... [2]

(c) Explain why aluminium does **not** react with water.

.....

.....

..... [2]

(d) Hydrogen peroxide, an oxidising agent, is added to aqueous potassium iodide in a test-tube.

Describe the colour change seen in the test-tube.

..... [1]

(e) Chromium is extracted by the reaction of aluminium with chromium(III) oxide, Cr_2O_3.

(i) Write the equation for this reaction.

..... [1]

(ii) Suggest a **compound** that can reduce chromium(III) oxide to chromium metal.

..... [1]

(f) State one advantage of recycling metals.

..... [1]

[Total: 9]