Metals – 2021 O Level

1. Nov/2021/Paper_11/No.31

Different metals react with water in different ways.

Which statement is correct?

A Calcium does not react with cold water.

B Iron reacts slowly with steam to produce an oxide of iron and hydrogen.

C Magnesium reacts with steam to produce magnesium hydroxide and oxygen.

D Sodium reacts with cold water to produce aqueous sodium oxide and hydrogen.

2. Nov/2021/Paper_11/No.32

Metal X is more reactive than zinc but less reactive than sodium.

What would be the best method for obtaining metal X from its ore?

A electrolysis of an aqueous solution of a salt of X

B electrolysis of the molten oxide of X

C heating the oxide of X in hydrogen

D heating the oxide of X with powdered carbon

3. Nov/2021/Paper_11/No.33

Steel is often galvanised.

Which statements about galvanising are correct?

1 Galvanising makes a steel alloy.

2 Galvanising provides a sacrificial protection against rusting.

3 Galvanising coats a layer of zinc onto steel.

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

4. Nov/2021/Paper_11/No.34

In the extraction of aluminium from aluminium oxide, the following three reactions take place.

1 $Al^{3+} + 3e^- \rightarrow Al$

2 $2O^{2-} \rightarrow O_2 + 4e^-$

3 $C + O_2 \rightarrow CO_2$

Which reactions take place at the positive electrode?

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

5. Nov/2021/Paper_12/No.31

The table gives properties of four metals, P, Q, R and S.

	method of extraction	reaction with water	reaction with acid
P	electrolysis only	no reaction	reacts slowly
Q	heating oxide with carbon	reacts slowly with steam	reacts slowly
R	electrolysis only	reacts rapidly with steam	reacts rapidly
S	heating oxide with carbon	no reaction	no reaction

Which statement is correct?

A P is the least reactive.

B Q would displace R from a solution of its salt.

C R could be zinc.

D S could be copper.

6. Nov/2021/Paper_12/No.32

Which statements about extracting metals from their ores are correct?

1 Aluminium is extracted by the electrolysis of aluminium oxide dissolved in cryolite.

2 Silver is difficult to extract from its ores because of its low reactivity.

3 Iron is extracted from haematite by reduction in the blast furnace.

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

7. Nov/2021/Paper_12/No.33

Which statements about the corrosion of iron are correct?

1 Corrosion can be prevented by coating the iron with zinc.

2 Corrosion only occurs in the presence of both air and water.

3 Rust is an alloy of iron and oxygen.

4 Sacrificial protection occurs when iron is connected to a less reactive metal.

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

8. Nov/2021/Paper_12/No.34

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Which reactions take place at the positive electrode?

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

9. Nov/2021/Paper_21/No.7

This question is about metals and metal compounds.

(a) Silver is a transition element. Potassium is a metal in Group I of the Periodic Table.

State two differences in the physical properties of silver and potassium.

1 .....

2 .....

[2]

(b) An ion of silver has the symbol

$$^{109}_{47}Ag^{+}$$

Deduce the number of protons, neutrons and electrons in this ion.

number of protons .....

number of neutrons .....

number of electrons .....

[3]

(c) Potassium reacts with water to form a gas which 'pops' with a lighted splint.

Complete the equation for this reaction.

..... K + ...H_2O $\rightarrow$ 2KOH + ... [1]

(d) When zinc carbonate is warmed in a closed container, an equilibrium mixture is formed.

$$ZnCO_3(s) \rightleftharpoons ZnO(s) + CO_2(g)$$

The forward reaction is endothermic.

(i) Describe and explain the effect, if any, on the position of equilibrium when the temperature is decreased.

.....

.....

..... [2]

(ii) Describe and explain the effect, if any, on the position of equilibrium when the concentration of carbon dioxide is increased.

.....

.....

..... [2]

[Total: 10]

10. Jun/2021/Paper_11/No.26

Some properties which indicate the differences in elements are listed.

1 metallic character

2 number of electron shells in an atom

3 number of protons in an atom

4 total number of electrons in an atom

Which two properties increase across a period of the Periodic Table?

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

11. Jun/2021/Paper_11/No.29

The properties of four substances are shown.

Which substance is a metal?

A It conducts electricity when dissolved in water but not when solid.

B It has a high melting point and conducts heat when solid.

C It has a low melting point and is brittle.

D It has a giant covalent structure with a high melting point.

12. Jun/2021/Paper_11/No.31

Tin is more reactive than lead but less reactive than iron.

Which method would be most suitable for extracting tin from its ore?

A electrolysis

B heating alone

C heating with carbon

D reacting with hydrogen

13. Jun/2021/Paper_11/No.32

Attaching pieces of magnesium to underground iron pipes can protect the iron from corrosion.

Which reaction protects the iron from corrosion?

A $Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$

B $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

C $Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$

D $Mg(s) \rightarrow Mg^{2+}(aq) + 2e^-$

14. Jun/2021/Paper_11/No.33

Which reactions take place during the extraction of aluminium from aluminium oxide using carbon electrodes?

1 $2O^{2-} \rightarrow O_2 + 4e^-$

2 $C + O_2 \rightarrow CO_2$

3 $Al^{3+} + 2e^- \rightarrow Al$

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

15. Jun/2021/Paper_12/No.27

Germanium is in Group IV of the Periodic Table. It has a proton number of 32.

Selenium is in Group VI of the Periodic Table. It has a proton number of 34.

Which prediction can be made, based on the positions of germanium and selenium in the Periodic Table?

A A germanium atom has two more valence electrons than a selenium atom.

B Germanium forms a Ge^{3+} ion and selenium forms an Se^{3-} ion.

C Germanium has more metallic character than selenium.

D Germanium has similar properties to tellurium, and selenium has similar properties to tin.

16. Jun/2021/Paper_12/No.31

Three correct statements about aluminium are listed.

1 Aluminium is the most common metal in the Earth's crust.

2 It is costly to extract aluminium from its ore, bauxite.

3 The world's supply of bauxite is limited.

Which statements explain why aluminium should be recycled?

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

17. Jun/2021/Paper_12/No.32

Attaching pieces of magnesium to underground iron pipes can protect the iron from corrosion.

Which reaction protects the iron from corrosion?

A $Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$

B $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

C $Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$

D $Mg(s) \rightarrow Mg^{2+}(aq) + 2e^-$

18. Jun/2021/Paper_12/No.33

Iron is extracted from its ore, haematite, in a blast furnace.

Which statement about this extraction process is correct?

A Air is blown into the blast furnace to react with carbon.

B At the bottom of a blast furnace a layer of molten iron floats on top of a layer of molten slag.

C Limestone is decomposed in the blast furnace to produce carbon monoxide.

D Silicon dioxide, an impurity in the ore, is a basic oxide.

19. Jun/2021/Paper_12/No.34

Which statement about the preparation and properties of aluminium is correct?

A Aluminium is obtained by heating aluminium oxide with carbon.

B Aluminium is produced at the anode by electrolysis of aluminium oxide dissolved in molten cryolite.

C Aluminium is unreactive as it forms an oxide coating.

D Aluminium is used in overhead electricity cables as it is a good conductor of electricity and has a high density.

20. Jun/2021/Paper_21/No.4

Copper(II) chloride, copper(II) iodide and copper(II) carbonate are ionic compounds.

(a) Predict two physical properties, other than electrical conductivity, of copper(II) chloride.

1. .....

2. .....

[2]

(b) Copper is a transition element.

Suggest **one** property of copper(II) chloride that is characteristic of a compound of a transition element.

..... [1]

(c) Copper reacts with chlorine to make copper(II) chloride.

$$Cu + Cl_2 \rightarrow CuCl_2$$

Copper(II) chloride contains Cu^{2+} and Cl^- ions.

Explain, in terms of the movement of electrons, how $CuCl_2$ is formed from copper atoms and chlorine molecules.

.....

.....

..... [2]

(d) Copper(II) iodide decomposes to make iodine and copper(I) iodide.

The ionic equation for this reaction is shown.

$$2Cu^{2+} + 4I^- \rightarrow 2CuI + I_2$$

(i) Use the information to explain that oxidation takes place.

.....

..... [1]

(ii) Use the information to explain that reduction takes place.

.....

..... [1]

(e) A sample of copper(II) carbonate is heated strongly.

Name the products of this reaction.

..... [1]

[Total: 8]

21. Jun/2021/Paper_21/No.5

Iron pyrite, FeS_2, is an ore of iron.

When heated in air, FeS_2 produces both iron(III) oxide and sulfur dioxide.

(a) Balance the equation shown.

..... FeS_2 + ... O_2 → ..... Fe_2O_3 + ... SO_2 [1]

(b) Describe one environmental problem caused by sulfur dioxide in the air.

..... [1]

(c) Describe how sulfur dioxide is converted into sulfuric acid in the contact process.

.....

.....

.....

.....

..... [3]

(d) State one **other** use of sulfur dioxide.

..... [1]

(e) Iron(III) oxide, coke, limestone and hot air are heated together in a blast furnace to make molten iron.

Describe the function in the blast furnace of:

(i) coke

.....

..... [1]

(ii) limestone

.....

..... [1]

(iii) hot air.

.....

..... [1]

[Total: 9]