Paper 1

Questions are applicable for both core and extended candidates

1 Which metal is most easily obtained from its ore?

A aluminium

B copper

C calcium

D iron

2 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

3 Which statement about the extraction of iron in a blast furnace is correct?

A Calcium oxide reacts with basic impurities.

B Carbon is burnt to provide heat.

C Iron(III) oxide is reduced to iron by carbon dioxide.

D The raw materials are bauxite, limestone and coke.

4 Which process is used to convert calcium carbonate into calcium oxide?

A electrolysis

B fractional distillation

C incomplete combustion

D thermal decomposition

5 Limestone fizzes and dissolves in dilute hydrochloric acid.

What is the word equation for this reaction?

A calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide

B calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide

C calcium hydroxide + hydrochloric acid → calcium chloride + hydrogen

D calcium oxide + hydrochloric acid → calcium chloride + water

6 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

7 Which statements about lime are correct?

1 Lime is made by heating calcium carbonate (limestone).

2 Lime is used to desulfurise flue gases.

3 Lime is used to treat alkaline soil.

4 The chemical name for lime is calcium oxide.

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

8 Which equation for the decomposition of calcium nitrate is correct?

A $Ca(NO_3)_2 \rightarrow CaO + NO_2 + O_2$

B $Ca(NO_3)_2 \rightarrow CaO + 2NO_2 + O_2$

C $2Ca(NO_3)_2 \rightarrow 2CaO + 2NO_2 + O_2$

D $2Ca(NO_3)_2 \rightarrow 2CaO + 4NO_2 + O_2$

9 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.

10 What are the products when limestone (calcium carbonate) is heated strongly?

A calcium hydroxide and carbon dioxide

B calcium hydroxide and carbon monoxide

C calcium oxide and carbon dioxide

D calcium oxide and carbon monoxide

11 Iron from a blast furnace can be converted to steel.

Which statements about steel are correct?

1 Steel contains more carbon than the iron obtained from the blast furnace.

2 Steel is produced by blowing oxygen through the iron.

3 Calcium oxide is added to molten iron to remove basic oxides.

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

12 Which substance gives off carbon dioxide on heating?

A lime

B limestone

C limewater

D slaked lime

Paper 2

Questions are applicable for both core and extended candidates unless indicated in the question

13 In the blast furnace, the impurity silicon(IV) oxide is removed by the formation of slag.

Which equation represents the formation of the substance which reacts with silicon(IV) oxide to form slag? **(extended only)**

A $C + O_2 \rightarrow CO_2$

B $C + CO_2 \rightarrow 2CO$

C $CaCO_3 \rightarrow CaO + CO_2$

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

14 Aluminium is extracted from bauxite by electrolysis.

Which statement is correct? **(extended only)**

A Aluminium ions are oxidised to form aluminium.

B The cathode has to be replaced regularly because it reacts with the oxygen which is formed.

C Carbon dioxide is produced at the anode.

D Cryolite is added to remove impurities.

15 Four substances present in the blast furnace during iron extraction are listed.

1 calcium carbonate

2 carbon dioxide

3 carbon monoxide

4 iron(III) oxide

Which substances are both a reactant and a product during the reactions occurring in the blast furnace?

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

16 Aluminium is extracted from purified bauxite by electrolysis.

Which row shows the ionic half-equations for the reaction at each electrode? **(extended only)**

	anode	cathode
A	$Al \rightarrow Al^{3+} + 3e^-$	$2O^{2-} + 4e^- \rightarrow O_2$
B	$Al^{3+} + 3e^- \rightarrow Al$	$2O^{2-} \rightarrow O_2 + 4e^-$
C	$2O^{2-} + 4e^- \rightarrow O_2$	$Al \rightarrow Al^{3+} + 3e^-$
D	$2O^{2-} \rightarrow O_2 + 4e^-$	$Al^{3+} + 3e^- \rightarrow Al$

17 Bauxite contains aluminium oxide.

Aluminium is extracted from aluminium oxide by electrolysis.

Which statement is a reason for why cryolite is added to the electrolytic cell used to extract aluminium? **(extended only)**

A Cryolite decreases the rate at which aluminium ions are discharged.

B Cryolite lowers the melting point of the electrolyte mixture.

C Cryolite prevents the carbon anodes being burned away.

D Cryolite removes impurities from the bauxite.

18 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.

19 In the extraction of aluminium by electrolysis, cryolite is added to the bauxite ore. **(extended only)**

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

20 Which statement about the extraction of aluminium by electrolysis is correct? **(extended only)**

A Aluminium is extracted from its ore, cryolite.

B Aluminium is formed at the positive electrode.

C Bauxite is used to lower the temperature of the extraction process.

D Graphite is used for both the positive and negative electrodes.