Extraction of metals

Question Paper 1

Level	IGCSE
Subject	Chemistry (0620/0971)
Exam Board	Cambridge International Examinations (CIE)
Topic	Metals
Sub-Topic	Extraction of metals
Booklet	Question Paper 1

Time Allowed: **48 minutes**

Score: **/40**

Percentage: **/100**

Grade Boundaries:

9	8	7	6	5	4	3	2	1
>85%	75%	68%	60%	53%	48%	40%	33%	<25%

1. In a blast furnace, iron(III) oxide is converted to iron and carbon monoxide is converted to carbon dioxide.

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

What happens to each of these reactants?

A Both iron(III) oxide and carbon monoxide are oxidised.

B Both iron(III) oxide and carbon monoxide are reduced.

C Iron(III) oxide is oxidised and carbon monoxide is reduced.

D Iron(III) oxide is reduced and carbon monoxide is oxidised.

2. Some metals react readily with dilute hydrochloric acid.

Some metals can be extracted by heating their oxides with carbon.

For which metal are **both** statements correct?

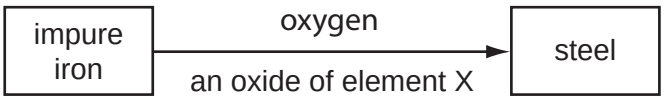
A calcium

B copper

C iron

D magnesium

3. The diagram shows the materials used in the production of steel from impure iron.



What could element X be?

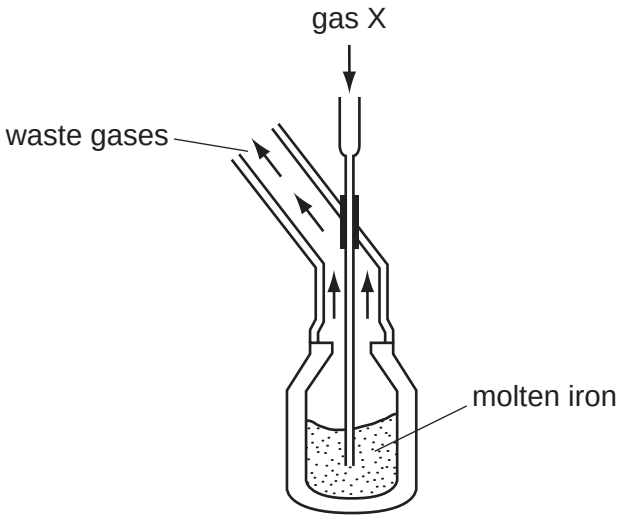
A calcium

B carbon

C nitrogen

D sulfur

4. The diagram shows the manufacture of steel.



What is gas X?

A carbon dioxide

B chlorine

C hydrogen

D oxygen

5. A metal is extracted from hematite, its oxide ore.

What is the metal and how is the oxide reduced?

	metal	method of reduction
A	Al	electrolysis
B	Al	heating with carbon
C	Fe	electrolysis
D	Fe	heating with carbon

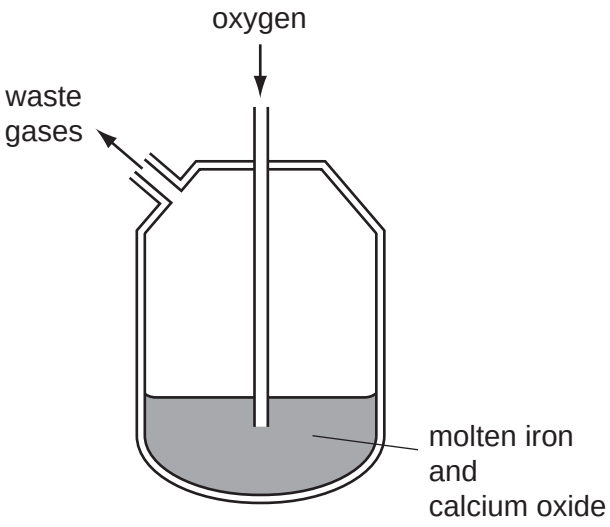
6. Which row describes the conditions used to make steel from the iron produced by a blast furnace?

	calcium oxide (lime)	oxygen	heat
A	✓	✓	✓
B	✓	✓	✗
C	✗	✓	✓
D	✗	✓	✗

7. The Basic Oxygen Process converts iron into steel.

In step 1, oxygen is blown into impure molten iron.

In step 2, oxides are removed by reaction with calcium oxide.



Which chemical reaction takes place in step 1 and which type of oxides are removed in step 2?

	chemical reaction in step 1	type of oxides removed in step 2
A	carbon is converted to carbon dioxide	acidic
B	carbon is converted to carbon dioxide	basic
C	iron is converted to iron(III) oxide	acidic
D	iron is converted to iron(III) oxide	basic

8. Iron is extracted from its ore in a Blast Furnace.

Hematite, coke, limestone and hot air are added to the furnace.

Which explanation is **not** correct?

A Coke burns and produces a high temperature.

B Hematite is the ore containing the iron as iron oxide.

C Hot air provides the oxygen for the burning.

D Limestone reduces the iron oxide to iron.

9. Which statement about the extraction of iron from its ore is correct?

A Iron is more difficult to extract than zinc.

B Iron is more difficult to extract than copper.

C Iron is easy to extract because it is a transition metal.

D Iron cannot be extracted by reduction with carbon.

10. Many metals are extracted from their ores by heating the metal oxide with carbon.

Which metal **cannot** be extracted using this method?

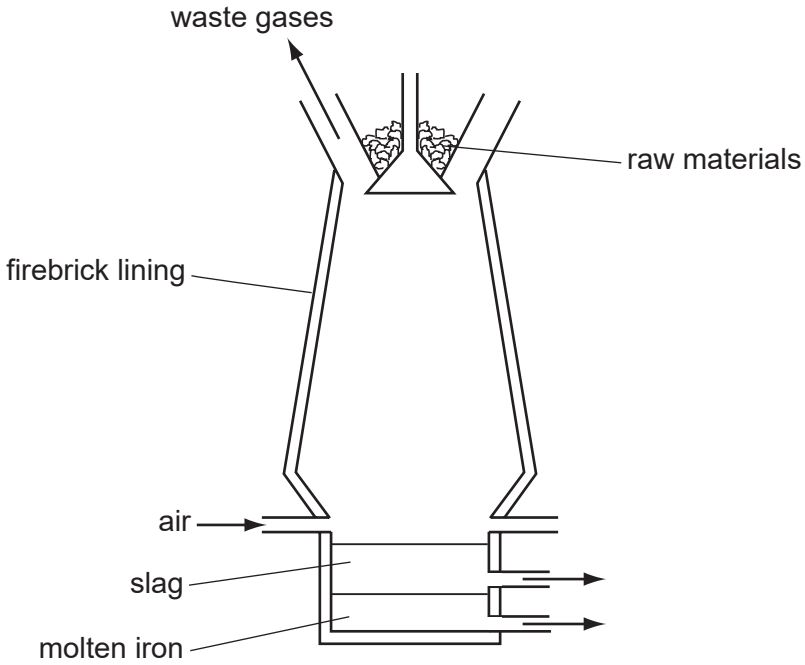
A aluminium

B copper

C iron

D zinc

11 Iron is extracted from hematite in the Blast Furnace.



The hematite contains silica as an impurity.

What reacts with this impurity to remove it?

A calcium oxide

B carbon

C carbon dioxide

D oxygen

12. Which substance is **not** involved in the extraction of iron from hematite?

A carbon

B carbon monoxide

C calcium carbonate

D nitrogen

13. Which statement is incorrect?

A Carbon dioxide is a waste product in the extraction of iron.

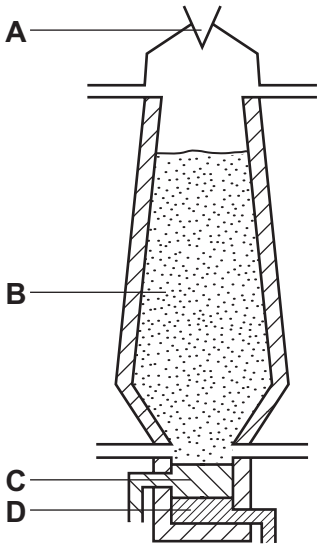
B Carbon monoxide is a reducing agent.

C The extraction of iron from hematite involves reduction.

D When iron is converted into steel, oxygen is used to oxidise the iron.

14. The diagram shows a blast furnace.

In which part is iron ore changed to iron?



15. Four reactions that take place in the blast furnace to produce iron are shown.

Which reaction is used to keep the furnace hot?

A $C + O_2 \rightarrow CO_2$

B $CO_2 + C \rightarrow 2CO$

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

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

16. Iron is extracted from its ore (hematite) in the blast furnace.

Which gas is produced as a waste product?

A carbon dioxide

B hydrogen

C nitrogen

D oxygen

17. Iron is extracted from hematite in a blast furnace.

Which reaction increases the temperature in the blast furnace to over 1500 °C?

A calcium carbonate → calcium oxide + carbon dioxide

B calcium oxide + silicon dioxide → calcium silicate

C carbon + oxygen → carbon dioxide

D carbon dioxide + carbon → carbon monoxide

18. Which row describes the conditions used to make steel from the iron produced by a blast furnace?

	calcium oxide (lime)	oxygen	heat
A	✓	✓	✓
B	✓	✓	✗
C	✗	✓	✓
D	✗	✓	✗

19. Molten iron from the blast furnace contains impurities.

The process of turning the impure iron into steel involves blowing oxygen into the molten iron and adding calcium oxide.

What are the reasons for blowing in oxygen and adding calcium oxide?

	blowing in oxygen	adding calcium oxide
A	carbon is removed by reacting with oxygen	reacts with acidic impurities making slag
B	carbon is removed by reacting with oxygen	reacts with slag and so removes it
C	iron reacts with the oxygen	reacts with acidic impurities making slag
D	iron reacts with the oxygen	reacts with slag and so removes it

20. Iron from a blast furnace is treated with oxygen and with calcium oxide to make steel.

Which substances in the iron are removed?

	oxygen removes	calcium oxide removes
A	carbon	acidic oxides
B	carbon	basic oxides
C	iron	acidic oxides
D	iron	basic oxides

21. Iron is obtained from its ore in a blast furnace and is used to make steel.

Iron obtained from the blast furnace is contaminated with .....1..... .

In order to remove this substance, ...2..... is passed through the molten iron.

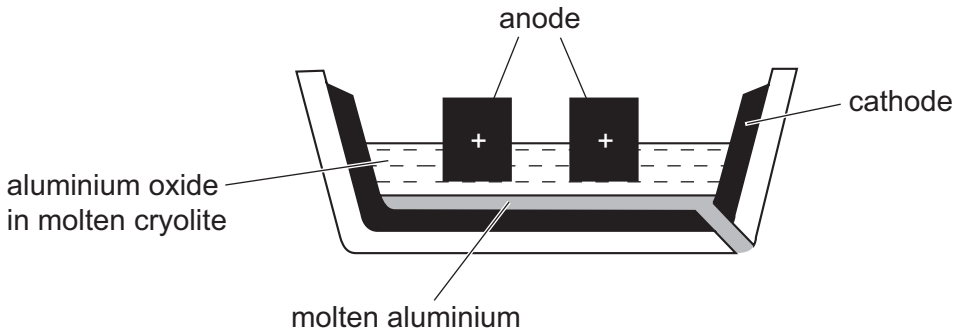
.....3..... is also added to remove oxides of phosphorus and silicon which are .....4..... .

Which words complete the sentences about the conversion of iron to steel?

	1	2	3	4
A	carbon	nitrogen	calcium carbonate	acidic
B	carbon	oxygen	calcium oxide	acidic
C	carbon	oxygen	calcium oxide	basic
D	sand	oxygen	calcium oxide	basic

22. Aluminium is manufactured by electrolysis of aluminium oxide.

The diagram shows the electrolysis cell.



Which statement about the process is **not** correct?

A Aluminium ions gain electrons during the electrolysis and are reduced.

B Cryolite is added to reduce the melting point of the aluminium oxide.

C The anode and cathode are made of graphite.

D The cathode has to be replaced regularly because it is burnt away.

23. Why is cryolite used during the extraction of aluminium by electrolysis?

A It is a catalyst for the reaction.

B It lowers the melting point of the electrolyte.

C It protects the anodes.

D It separates the aluminium from the electrolyte.

24. Aluminium is extracted by electrolysis of a mixture of aluminium oxide and cryolite.

Which statement is **not** correct?

A The electrodes are made from graphite.

B The formula for aluminium oxide is Al_2O_3.

C The purpose of the cryolite is to lower the melting point of the mixture.

D The reaction taking place at the anode is $Al^{3+} + 3e^- \rightarrow Al$.

25. Iron is extracted from hematite in the blast furnace.

The hematite contains silicon(IV) oxide (sand) as an impurity.

What reacts with this impurity to remove it?

A calcium oxide

B carbon

C carbon dioxide

D slag

26. Brass is an alloy of two metals.

Which row gives a correct use for the two metals from which brass is made?

	metal 1	metal 2
A	used for electrical wiring	used for galvanising steel
B	used for galvanising steel	used for making aircraft
C	used for making aircraft	used for making cutlery
D	used for making cooking pans	used for electrical wiring

27 Zinc is extracted from zinc blende. Zinc blende is an ore of zinc and consists mainly of zinc sulfide.

One of the steps in the process involves zinc sulfide reacting with oxygen from the air.

What is the equation for this reaction?

A $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

B $2ZnS + O_2 \rightarrow 2Zn + SO_2$

C $2ZnS + O_2 \rightarrow 2ZnO + S$

D $ZnS + 2O_2 \rightarrow ZnSO_4$

28 Which material is **not** involved in the large-scale extraction of iron from iron ore?

A bauxite

B calcium carbonate (limestone)

C carbon (coke)

D hematite

29 Which process is used to extract iron from hematite in the blast furnace?

A electrolysis

B reduction with carbon monoxide

C reduction with lime

D thermal decomposition

30 What is the reducing agent in the large-scale extraction of iron from iron ore?

A air

B carbon monoxide

C hematite

D limestone

31 Aluminium is extracted by the electrolysis of aluminium oxide.

Which statement is **not** correct?

A Aluminium ions are oxidised at the cathode.

B Carbon dioxide is made at the anode.

C Cryolite is added to lower the melting point of the aluminium oxide.

D The electrodes are made from graphite.

32 Aluminium is extracted from bauxite by electrolysis.

Which row shows the anode material and the anode reaction?

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

33 Aluminium is obtained by the electrolysis of a mixture of aluminium oxide and cryolite.

Why is cryolite used?

A as a catalyst to speed up the process

B as a coolant to prevent the process getting too hot

C as a solvent for aluminium oxide

D as the main source of aluminium ions

34 Which statement about the extraction of iron in a blast furnace is **not** correct?

A Calcium oxide reacts with acidic impurities.

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

C Molten iron is formed at the base of the blast furnace.

D The raw materials are hematite, limestone and coke.

35 Steel is manufactured from the iron produced in a blast furnace.

Which statement about the manufacture of iron and steel is **not** correct?

A In a blast furnace, acidic impurities are removed by adding a basic oxide.

B In a blast furnace, calcium oxide is added to remove basic impurities.

C Oxygen is passed into the molten iron from a blast furnace to remove carbon impurities.

D The molten iron from a blast furnace contains traces of other elements such as phosphorus.

36 Which statement about the extraction of iron from hematite is correct?

A Air is blown into the blast furnace to oxidise the molten iron.

B Carbon dioxide is reduced by coke to carbon monoxide.

C Hematite is oxidised by carbon to molten iron.

D The slag produced is denser than molten iron.

37 Zinc metal is extracted from its ore zinc blende in a similar method to that used to extract iron from hematite.

In which way is zinc extraction different from iron extraction?

A Carbon and carbon monoxide are the main reducing agents.

B Hot air at the base of the furnace reacts with coke to keep the furnace hot.

C The metal is removed as a vapour at the top of the furnace.

D The metal oxide is added into the top of the furnace.

38 Which process is involved in the extraction of zinc from zinc blende?

A Cryolite is added to lower the melting point of zinc blende.

B Molten zinc blende is electrolysed.

C Zinc blende is heated with carbon.

D Zinc blende is roasted in air.

39 Which equation from the zinc extraction process shows the metal being produced by reduction?

A $ZnO + C \rightarrow Zn + CO$

B $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

C $Zn(g) \rightarrow Zn(l)$

D $Zn(l) \rightarrow Zn(s)$

40 Two industrial processes that involve heating are

- extracting iron from its ore using a blast furnace,
- making lime.

In which of these processes is calcium carbonate used?

	extracting iron	making lime
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗