

Reactivity Series

Question Paper

Level	O Level
Subject	Chemistry
Exam Board	Cambridge International Examinations
Topic	Metals
Sub-Topic	Reactivity Series
Booklet	Question Paper

Time Allowed: 47 minutes

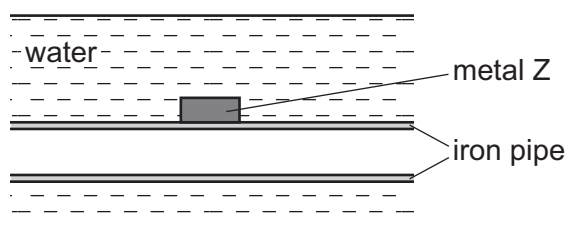
Score: /39

Percentage: /100

1 Which metal oxide will be reduced by heating with iron?

- A calcium oxide
- B lead oxide
- C magnesium oxide
- D zinc oxide

2 The diagram shows how an underwater iron pipe can be protected from rusting.



Metal Z can be1..... because it is2..... reactive than iron.

Which words correctly complete gaps 1 and 2?

	1	2
A	copper	less
B	copper	more
C	magnesium	less
D	magnesium	more

3 Iron(III) oxide can be reduced to iron by carbon.

Which other element can reduce iron(III) oxide to iron?

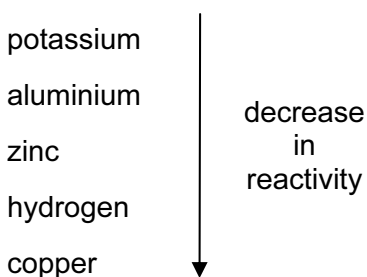
- A copper
- B lead
- C magnesium
- D silver

- 4 Metal X oxidises in air. The formula of the oxide is XO . X displaces zinc from aqueous zinc nitrate.

Which could be X?

- A aluminium
- B lead
- C magnesium
- D sodium

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



Which statement about these elements is correct?

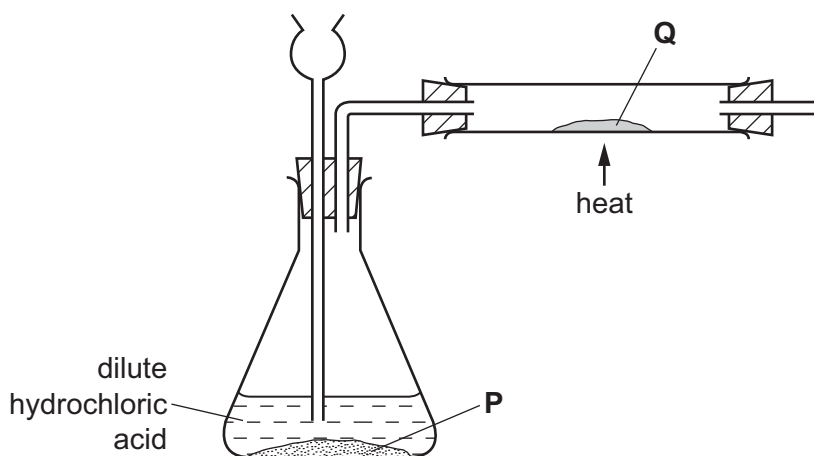
- A Aluminium is formed when aluminium oxide is heated with hydrogen.
- B Copper displaces zinc from zinc sulfate solution.
- C Copper is formed when copper(II) oxide is heated with hydrogen.
- D When added to water, aluminium forms positive ions more readily than potassium.

- 6 An element is burned in an excess of oxygen.

Which statement about the oxide formed is always correct?

- A The mass of oxide formed is greater than the mass of element burned.
- B The oxide formed is a crystalline solid.
- C The oxide formed is soluble in water.
- D The oxide formed is white in colour.

- 7 Which metal can react rapidly with steam but reacts only **very slowly** with cold water?
- A calcium
 - B copper
 - C iron
 - D potassium
- 8 Which metal can react with water at r.t.p.?
- A calcium
 - B copper
 - C lead
 - D zinc
- 9 Substance **P** reacts with dilute hydrochloric acid to produce a gas. This gas reduces substance **Q**.



What are substances **P** and **Q**?

	P	Q
A	copper	copper(II) oxide
B	lead	lead(II) oxide
C	magnesium	zinc oxide
D	zinc	copper(II) oxide

- 10 A powdered mixture of metals contains aluminium, calcium, silver and iron. Excess hydrochloric acid is added until no more mixture dissolves.

What is the undissolved residue?

- A aluminium
- B calcium
- C iron
- D silver

- 11 A metal *M* forms a chloride which dissolves in cold water and has an oxide which dissolves in both strong acids and strong alkalis.

What is *M*?

- A iron
- B lead
- C sodium
- D zinc

- 12 Which gas could be used to convert copper(II) oxide to copper?

- A carbon dioxide
- B hydrogen
- C nitrogen
- D oxygen

- 13 An alloy of copper and zinc is added to an excess of dilute hydrochloric acid. The resulting mixture is then filtered.

Which observations are correct?

	filtrate	residue
A	colourless solution	none
B	colourless solution	red-brown
C	blue solution	grey
D	blue solution	none

14 The results of two tests on a solution **X** are shown.

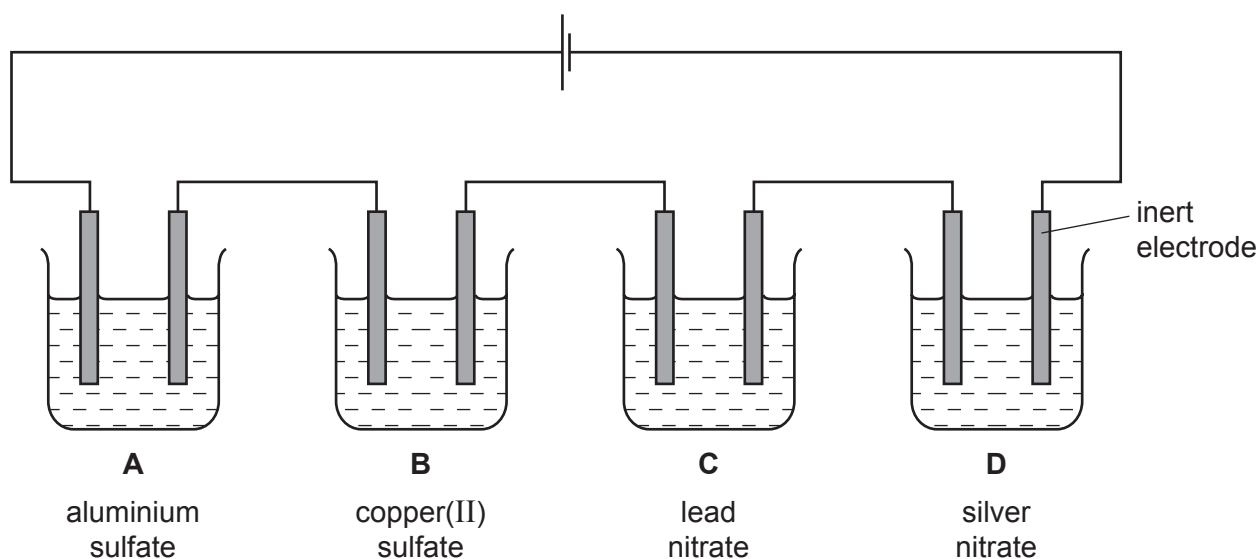
reagent added	few drops	an excess
aqueous sodium hydroxide	white precipitate	precipitate dissolves
aqueous ammonia	white precipitate	precipitate remains

Which ion is present in solution **X**?

- A** Al^{3+} **B** Ca^{2+} **C** Cu^{2+} **D** Zn^{2+}

15 When electrolysed using inert electrodes, which dilute solution would produce the greatest increase in mass of the cathode?

[A_r : Al, 27; Cu, 64; Pb, 207; Ag, 108]

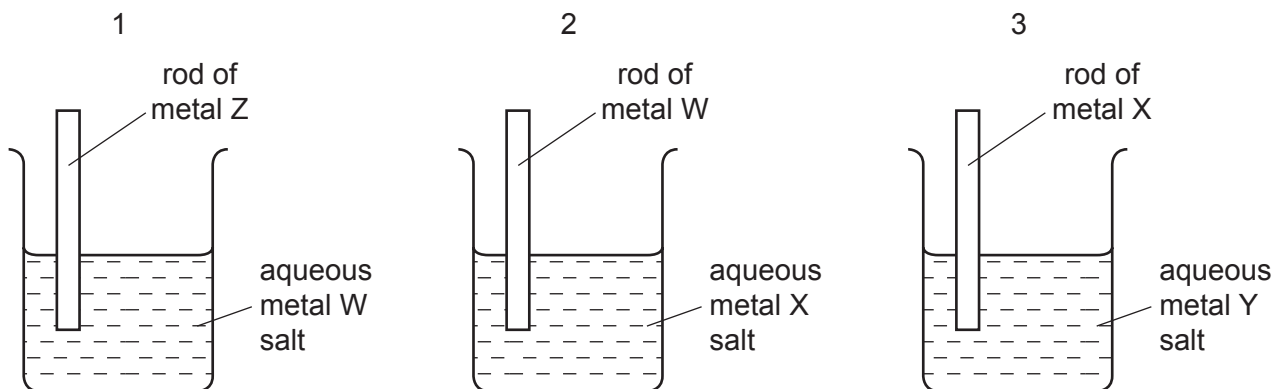


16 The metals iron, lead and zinc can be manufactured by the reduction of their oxides with coke.

What is the correct order of the ease of reduction of the metal oxides?

	oxides become more difficult to reduce →
A	iron → lead → zinc
B	iron → zinc → lead
C	lead → iron → zinc
D	zinc → iron → lead

17 Three different beakers are set up as shown.



In beaker 1 metal W is displaced from solution.

In beaker 2 metal X is displaced from solution.

In beaker 3 metal Y is displaced from solution.

What is the order of **decreasing** reactivity of the four metals?

	most reactive	→			least reactive
A	W	X	Y	Z	
B	X	Y	W	Z	
C	Z	W	X	Y	
D	Z	X	W	Y	

- 18 A metal, X, has a low melting point, reacts with water, forms only one oxide and is extracted from its ore by electrolysis.

What is the identity of X?

- A aluminium
 - B copper
 - C iron
 - D sodium
- 19 Iron pipes corrode rapidly when exposed to sea water.
- Which metal, when attached to the iron, would **not** offer protection against corrosion?
- A aluminium
 - B copper
 - C magnesium
 - D zinc
- 20 Metal **M** will displace copper from aqueous copper(II) sulfate solution, but will not displace iron from aqueous iron(II) sulfate solution. **M** is extracted from its oxide by heating the oxide with carbon.

What is the order of reactivity of these four metals?

	least reactive	→	most reactive	
A	sodium	metal M	iron	copper
B	sodium	iron	metal M	copper
C	copper	iron	metal M	sodium
D	copper	metal M	iron	sodium

21 Which carbonate decomposes on heating to give a black solid and a colourless gas?

- A calcium carbonate
- B copper(II) carbonate
- C sodium carbonate
- D zinc carbonate

22 Which row shows the three metals in the correct order of decreasing reactivity?

	most active	→	least active
A	copper		zinc iron
B	iron		copper zinc
C	iron		zinc copper
D	zinc		iron copper

23 From your knowledge of the manufacture of both aluminium and iron, what is the order of chemical reactivity of aluminium, carbon and iron towards oxygen?

	most reactive	→	least reactive
A	aluminium		carbon iron
B	aluminium		iron carbon
C	carbon		aluminium iron
D	carbon		iron aluminium

24 A dark, shiny solid, X, conducts electricity.

Oxygen combines with X to form a gaseous oxide.

What is X?

- A graphite
- B iodine
- C iron
- D lead

25 The tests below were carried out on a solution containing ions of the metal X.

test	observation
add sodium chloride solution	no change
add sodium sulfate solution	no change
add sodium hydroxide solution	a precipitate was formed, soluble in excess of the hydroxide

What is metal X?

- A calcium
- B iron
- C lead
- D zinc

26 When zinc is added to a solution of a metal sulfate, the metal is deposited and zinc ions are produced in solution.

Which metal is deposited?

- A calcium
- B copper
- C magnesium
- D potassium

27 Which oxide is **most** readily reduced to the metal by heating in a stream of hydrogen?

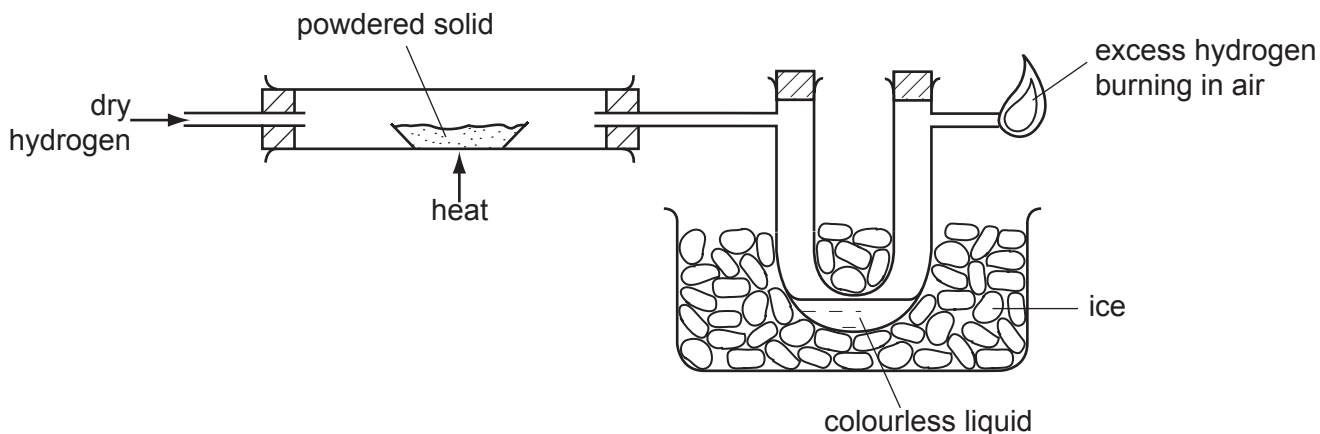
- A calcium oxide
- B lead(II) oxide
- C sodium oxide
- D zinc oxide

28 The element chromium liberates hydrogen from dilute hydrochloric acid although it does not react with cold water. When a piece of chromium is placed in lead(II) nitrate solution, crystals of lead appear.

What is the order of **decreasing** reactivity of the metals lead, calcium and chromium?

- A calcium, chromium, lead
- B calcium, lead, chromium
- C chromium, calcium, lead
- D lead, chromium, calcium

29 Dry hydrogen gas is passed over a powdered solid and then through a cooled U-tube before the excess of hydrogen is burned in air.

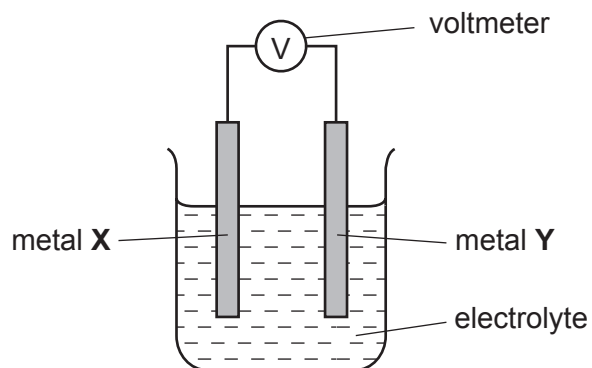


A colourless liquid collects in the U-tube.

What could the powdered solid be?

- A calcium oxide
- B copper(II) oxide
- C magnesium
- D zinc oxide

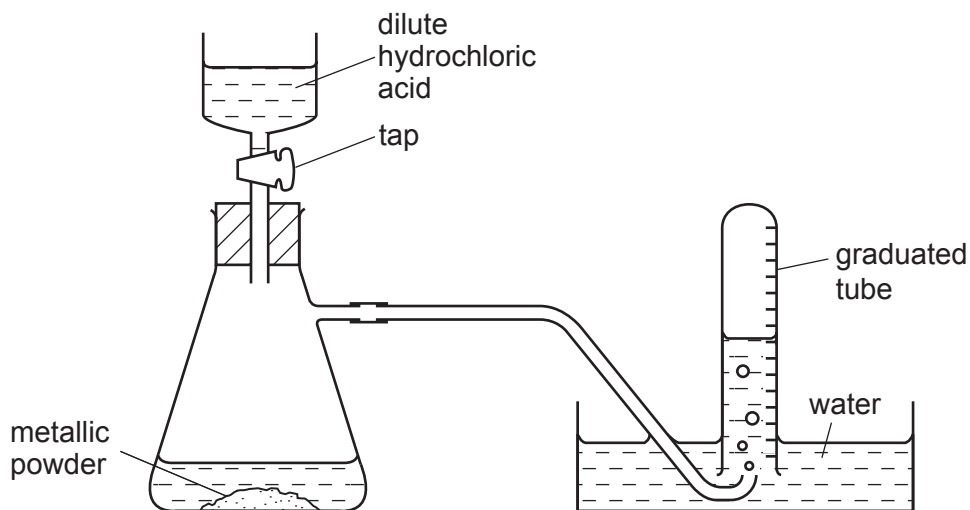
30 The diagram shows a simple cell.



Which two metals produce the highest reading on the voltmeter?

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

31 The diagram shows apparatus for measuring the volume of hydrogen given off when an excess of dilute hydrochloric acid is added to powdered metal. The volume of gas is measured at room temperature and pressure.



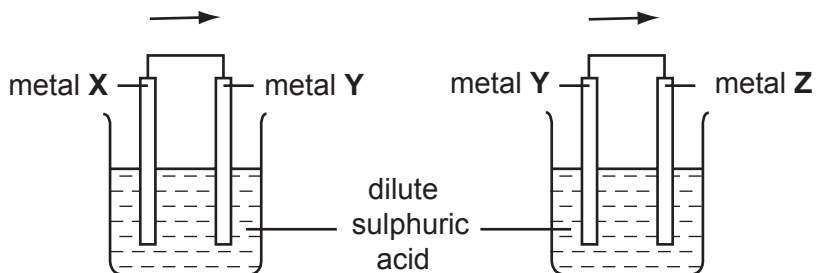
The experiment is carried out three times, using the same mass of powder each time but with different powders:

- pure magnesium
- pure zinc
- a mixture of magnesium and zinc

Which powder gives the greatest volume of hydrogen and which the least volume?

	greatest volume of H ₂	least volume of H ₂
A	magnesium	zinc
B	magnesium	the mixture
C	zinc	magnesium
D	zinc	the mixture

- 32 Two cells were set up as shown in the diagram. The arrows show the direction of electron flow in the external circuits.



Which set of metals would give the electron flows in the directions shown?

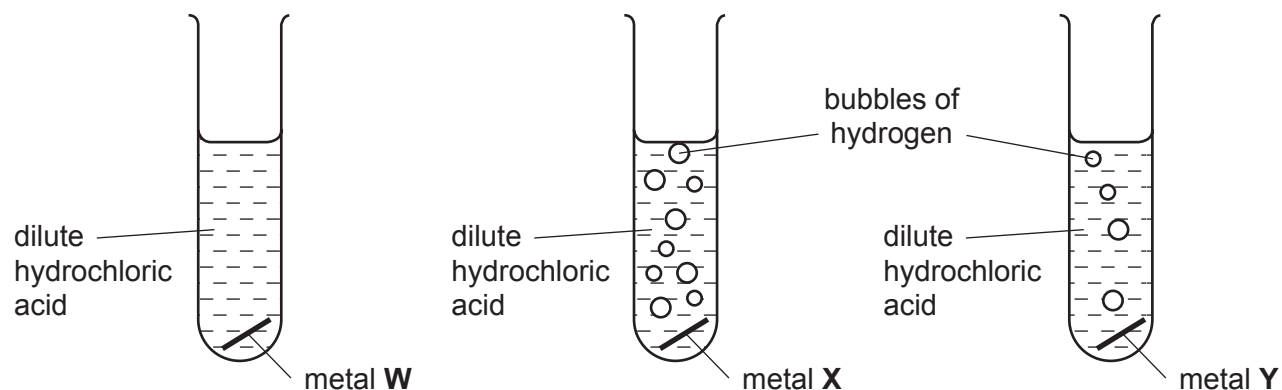
	metal X	metal Y	metal Z
A	Ag	Cu	Zn
B	Ag	Zn	Cu
C	Cu	Zn	Ag
D	Zn	Cu	Ag

- 33 Metal carbonates decompose when heated.

Which carbonate is **most** stable to heat?

- A** calcium carbonate
 - B** copper(II) carbonate
 - C** lead(II) carbonate
 - D** zinc carbonate
- 34 Which metal will displace hydrogen from aqueous solutions of acids but not from cold water?
- A** calcium
 - B** copper
 - C** sodium
 - D** zinc

35 The diagrams show the reactions of three different metals with dilute hydrochloric acid.



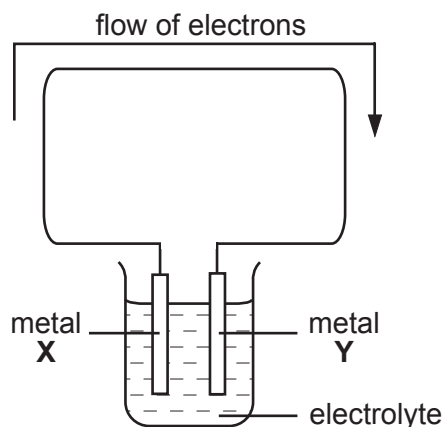
What are metals **W**, **X** and **Y**?

	W	X	Y
A	copper	magnesium	zinc
B	copper	zinc	magnesium
C	magnesium	zinc	copper
D	zinc	magnesium	copper

36 Which oxide can be reduced to the metal by hydrogen?

- A** calcium oxide
- B** copper(II) oxide
- C** magnesium oxide
- D** sodium oxide

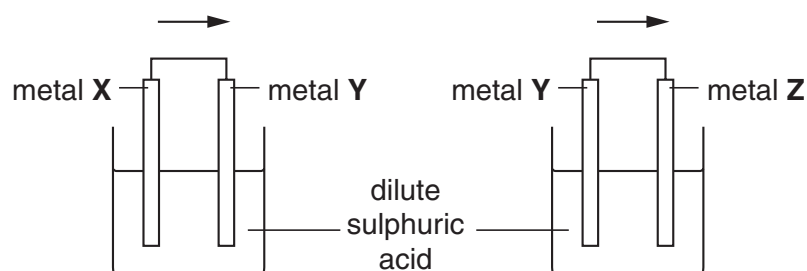
37 Apparatus was set up as shown.



For which pair of metals would electrons flow in the direction shown?

	metal X	metal Y
A	copper	zinc
B	iron	aluminium
C	iron	magnesium
D	zinc	silver

38 Two cells were set up as shown in the diagram. The arrow shows the direction of electron flow in the external circuit.



Which set of metals would give the electron flows in the direction shown?

	metal X	metal Y	metal Z
A	Ag	Cu	Zn
B	Ag	Zn	Cu
C	Cu	Zn	Ag
D	Zn	Cu	Ag

39 An experiment is carried out to find the order of reactivity of some metals.

Three metals are placed in solutions containing aqueous metal ions.

The results are shown.

metal	aqueous metal ions			
	Mg ²⁺	Al ³⁺	Fe ²⁺	Zn ²⁺
Mg		✓	✓	✓
Fe	x	x		x
Zn	x	x	✓	

key
✓ = reaction observed
x = no reaction observed

What is the order of reactivity (most reactive first)?

- A** Mg Zn Fe Al
- B** Fe Zn Al Mg
- C** Mg Al Zn Fe
- D** Mg Al Fe Zn