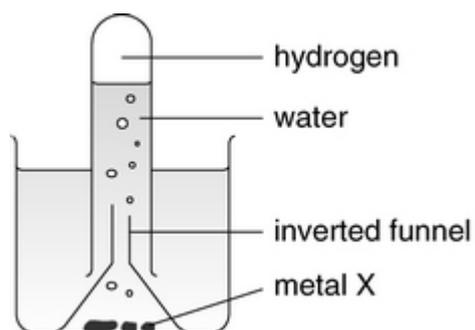


## 11. Metal Reactivity

- The oxide of a metal is orange when it is hot but yellow when it is cold. The metal is
  - calcium.
  - lead.
  - potassium.
  - zinc.
- Hydrogen is produced when metal X reacts with water in the set-up shown below:

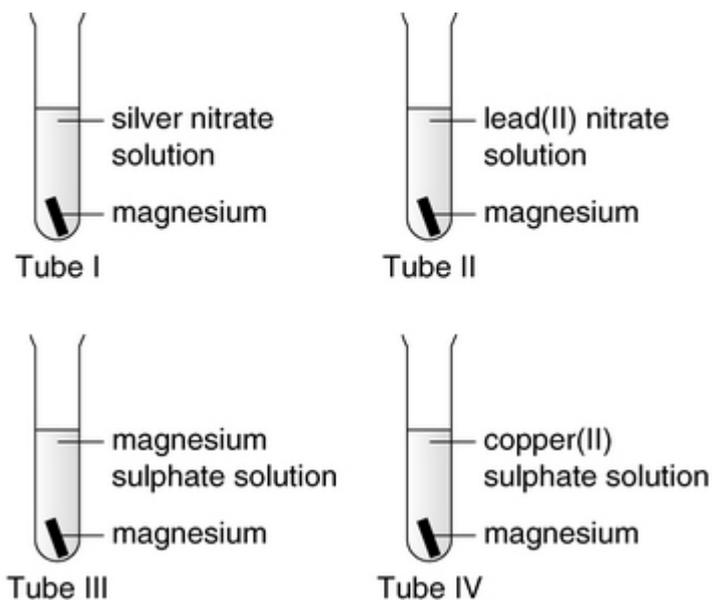


X could be

- lead.
  - magnesium.
  - potassium.
  - strontium.
- Which of the following word equations is correct?
    - calcium + water  $\rightarrow$  calcium oxide + hydrogen
    - iron + water  $\rightarrow$  iron(II) hydroxide + hydrogen
    - lead + steam  $\rightarrow$  lead(II) hydroxide + hydrogen
    - magnesium + steam  $\rightarrow$  magnesium oxide + hydrogen
  - Which of the following pairs of chemicals do NOT give hydrogen when mixed?
    - Aluminium and steam
    - Calcium and water
    - Silver and dilute hydrochloric acid
    - Zinc and dilute sulphuric acid

5. Which of the following metals would form an oxide with different colours at different temperatures?
- (1) Iron
  - (2) Lead
  - (3) Zinc
- A (1) and (2) only  
B (1) and (3) only  
C (2) and (3) only  
D (1), (2) and (3)
6. A small piece of potassium is dropped into a trough of water containing litmus solution. Which of the following observations are correct?
- (1) The potassium moves about on the water surface with a hissing sound.
  - (2) The potassium dissolves in water and the solution turns blue.
  - (3) The potassium burns with a lilac flame.
- A (1) and (2) only  
B (1) and (3) only  
C (2) and (3) only  
D (1), (2) and (3)
7. Potassium is more reactive than calcium because
- A potassium loses electrons more readily than calcium does.
  - B potassium has a lower melting point than calcium.
  - C potassium has a lower density than calcium.
  - D calcium ions are more stable than potassium ions.
8. Which of the following ions can be displaced by lead?
- A  $\text{Fe}^{2+}(\text{aq})$
  - B  $\text{Cu}^{2+}(\text{aq})$
  - C  $\text{Mg}^{2+}(\text{aq})$
  - D  $\text{Al}^{3+}(\text{aq})$
9. Which of the following will NOT react with each other?
- A Heated zinc and steam
  - B Barium and dilute hydrochloric acid
  - C Silver and copper(II) sulphate solution
  - D Heated lead and oxygen

10. Into each of the four solutions shown below, a strip of magnesium is added.



Which of the following observations is correct?

	<u>Tube</u>	<u>Observation</u>
A	I	a grey coating on magnesium
B	II	a brown coating on magnesium
C	III	gas bubbles are given off
D	IV	a grey coating on magnesium

11. Iron(II) nitrate solution should NOT be stored in

- (1) a zinc container.
- (2) a plastic container.
- (3) a lead container.

- A (1) only  
B (2) only  
C (1) and (3) only  
D (2) and (3) only

12. Which of the following metal oxides is the most difficult to be reduced?

- A MgO  
B CuO  
C ZnO  
D FeO

13. Nickel is in between iron and lead in the reactivity series. Which of the following statements concerning nickel is / are probably correct?

- (1) Its oxide can be reduced by heating in air.
- (2) It can displace silver from silver nitrate solution.
- (3) It reacts with cold water to give hydrogen.

- A (1) only
- B (2) only
- C (1) and (3) only
- D (2) and (3) only

14. X, Y and Z are different metals. Y and Z have no reaction with steam while X reacts with water to liberate hydrogen. Only Y exists as a free element in the Earth's crust. The order of increasing reactivity of the three metals is

- A X, Y, Z.
- B X, Z, Y.
- C Y, X, Z.
- D Y, Z, X.

15. Directions: Questions 15 and 16 refer to three different metals X, Y and Z. The table below shows the observations when each of them is put into iron(II) sulphate solution:

Metal	Observation
X	grey solid formed
Y	grey solid formed and colourless gas evolved
Z	no observable change

The order of increasing reactivity of the three metals should be

- A  $Y < X < Z$ .
- B  $X < Z < Y$ .
- C  $Z < Y < X$ .
- D  $Z < X < Y$ .

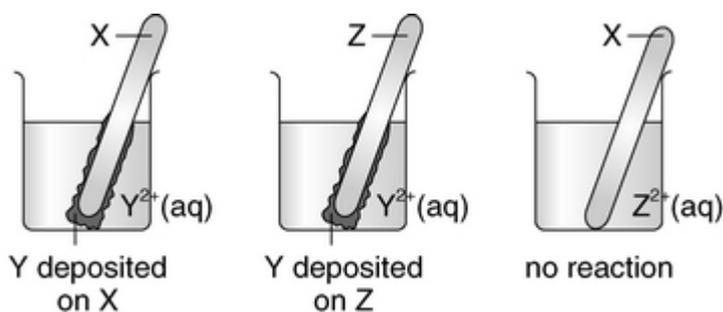
16. Directions: Questions 15 and 16 refer to three different metals X, Y and Z. The table below shows the observations when each of them is put into iron(II) sulphate solution:

Metal	Observation
X	grey solid formed
Y	grey solid formed and colourless gas evolved
Z	no observable change

Y could be

- A copper.
- B magnesium.
- C sodium.
- D zinc.

17. A student performed tests to investigate the reactivity of three metals. In each test, a metal strip was placed in a solution containing ions of a different metal. The results are shown in the diagrams.



What is the order of reactivity of the metals, based on these results?

- A  $X > Z > Y$
- B  $Y > X > Z$
- C  $Z > Y > X$
- D  $Z > X > Y$

18. From which of the following processes can lead be obtained?

- (1) Adding zinc to lead(II) nitrate solution
- (2) Mixing lead(II) oxide with carbon
- (3) Heating magnesium with lead(II) oxide

- A (1) and (2) only
- B (1) and (3) only
- C (2) and (3) only
- D (1), (2) and (3)

### Structured questions

1. a) For each of the following experiments, state ONE observable change and write a chemical equation for the reaction involved.

i) Iron is put into dilute hydrochloric acid. (2 marks)

ii) Potassium is heated in a Bunsen flame. (2 marks)

iii) Lead(II) oxide is heated with carbon powder. (2 marks)

iv) Copper is put into silver nitrate solution. (2 marks)

b) Explain why there is NO reaction in the following experiments.

i) Lead is put into dilute sulphuric acid. (2 marks)

ii) Calcium oxide is heated with carbon powder. (2 marks)

iii) Zinc is put into magnesium nitrate solution. (2 marks)

2. X, Y and Z are three different metals. The table below lists the results of three experiments carried out using the metals or their oxides.

Experiment	X	Y	Z
Adding metal to cold water	no observable change	no observable change	formation of a colourless gas
Adding metal to silver nitrate solution	formation of a grey solid	no observable change	formation of a colourless gas and a grey solid
Heating the metal oxide	no observable change	formation of a solid with metallic lustre	no observable change

- a) What is the colourless gas formed when Z is added to cold water? Suggest a test for the gas. (2 marks)
- b) Arrange the three metals in order of increasing reactivity. Explain your answer. (3 marks)
- c) Why is a colourless gas formed when Z is added to silver nitrate solution? (1 mark)
- d) X burns in air with a very bright light. A white powder is formed.
- i) Suggest what X might be. (1 mark)
- ii) Write an ionic equation for the reaction between X and silver nitrate solution. (1 mark)
- iii) Suggest how X can be extracted from its ore. (1 mark)

### Multiple choice questions

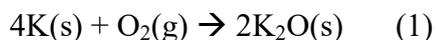
- |    |                  |    |                  |    |                  |    |                  |    |                  |
|----|------------------|----|------------------|----|------------------|----|------------------|----|------------------|
| 1  | <u>    B    </u> | 2  | <u>    D    </u> | 3  | <u>    D    </u> | 4  | <u>    C    </u> | 5  | <u>    C    </u> |
| 6  | <u>    D    </u> | 7  | <u>    A    </u> | 8  | <u>    B    </u> | 9  | <u>    C    </u> | 10 | <u>    A    </u> |
| 11 | <u>    A    </u> | 12 | <u>    A    </u> | 13 | <u>    B    </u> | 14 | <u>    D    </u> | 15 | <u>    D    </u> |
| 16 | <u>    C    </u> | 17 | <u>    D    </u> | 18 | <u>    B    </u> |    |                  |    |                  |

## Structured questions

1. Iron dissolves. / Gas bubbles are given off. (1)



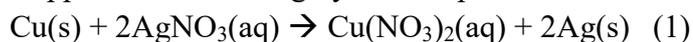
A lilac flame is observed. / A white smoke is formed. (1)



The yellow solid turns orange. / A solid with metallic lustre is formed. (1)



Copper dissolves. / A grey solid deposits. / The solution becomes blue gradually. (1)



Insoluble lead(II) sulphate is formed on the surface of lead. (1)

It prevents further reaction. (1)

Calcium oxide is very stable. (1)

It cannot be reduced by carbon. (1)

Zinc is less reactive than magnesium. (1)

Zinc cannot displace magnesium from the solution of a magnesium compound. (1)

2.

Hydrogen(1)

It gives a 'pop' sound when tested with a burning splint. (1)

$Y < X < Z$  (1)

X is more reactive than Y as it can displace silver from silver nitrate solution but Y cannot. (1)

Z is more reactive than X as it can react with cold water but X cannot. (1)

Z reacts with water in the silver nitrate solution and a colourless gas (hydrogen) is formed. (1)

Magnesium (1)



By electrolysis(1)