

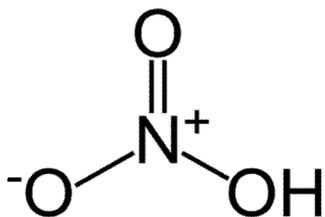
## Ex 3

# Reaction of metals with nitric acid

### Background

Nitric acid is a strong oxidising agent, even when dilute. It can be reduced to nitrogen dioxide ( $\text{NO}_2$ ), nitric oxide ( $\text{NO}$ ), nitrous oxide ( $\text{N}_2\text{O}$ ), nitrogen ( $\text{N}_2$ ), or the ammonium ion ( $\text{NH}_4^+$ ). In its reaction with metals it is usually reduced to the colourless gas  $\text{NO}$  or the brown gas  $\text{NO}_2$ .

The purpose of this experiment is to observe the reaction of dilute and concentrated nitric acid with selected metals. Because of the toxic nature of the gases evolved the experiment should be carried out in the fumehood.



### Equipment required

Test tubes (four)

Emery paper

Test tube rack

Test tube holder

Wax taper

Bunsen

Small pieces of the following metals:

Aluminium [Al] Magnesium [Mg] Copper [Cu]

Zinc [Zn]

Nitric acid [ $\text{HNO}_3$ ] 2 mol L<sup>-1</sup> (20 mL)

Concentrated nitric acid [ $\text{HNO}_3$ ] (15 mL)

**Procedure**  
**(For safety reasons your teacher will conduct this experiment as a demonstration.)**



### A Reactions of Dilute Nitric Acid

**#1** Place 2-3 cm of clean magnesium ribbon in a test tube and add about 3 mL of 2 mol L<sup>-1</sup>  $\text{HNO}_3$ . Observe the reaction carefully

**#2** Test for the evolution of hydrogen by collecting the liberated gas in an inverted test tube and placing a lighted taper into it.

Record your observations.

**#3** Repeat the first step using small samples of aluminium, copper and zinc instead of magnesium. If no reaction occurs, heat the test tube gently and observe again.

# Reactions of Concentrated Nitric Acid



## Safety Note

Concentrated nitric acid is very corrosive and must be handled with extreme care.

- If any concentrated  $\text{HNO}_3$  comes in contact with your skin immediately wash it off with copious quantities of water.
- Make sure only small samples of the metals are used and that the experiment is carried out in a fumehood as the nitrogen dioxide gas given off is poisonous.

**#1** Place very small samples of aluminium, zinc and copper into separate test tubes. Add about 3 mL of concentrated  $\text{HNO}_3$  to each and record your observations

## Processing of results, and questions

- 1** What gas do you think was evolved in the reaction of magnesium with dilute  $\text{HNO}_3$ ?
- 2** Write equations for the observed reactions of dilute and concentrated  $\text{HNO}_3$  with the metals tested.
- 3** Magnesium reacts with dilute sulfuric acid to liberate hydrogen and concentrated sulfuric acid to form sulfur dioxide. Write equations for these two reactions