Unit 14A. Acids

HKDSE Syllabus

a. Introduction to acids and alkalis

Students should learn

- common acids and alkalis in daily life and in the laboratory
- characteristics and chemical reactions of acids as illustrated by dilute hydrochloric acid and dilute sulphuric acid
- acidic properties and hydrogen ions ($H^+(aq)$)
- role of water in exhibiting properties of acid
- basicity of acid
- characteristics and chemical reactions of alkalis as illustrated by sodium hydroxide and aqueous ammonia
- alkaline properties and hydroxide ions ($OH^-(aq)$)
- corrosive nature of concentrated acids and concentrated alkalis

Students should be able to

- recognise that some household substances are acidic
- state the common acids found in laboratory
- describe the characteristics of acids and their typical reactions
- write chemical and ionic equations for the reactions of acids
- relate acidic properties to the presence of hydrogen ions ($H^+(aq)$)
- describe the role of water for acids to exhibit their properties
- state the basicity of different acids such as HCl, H_2SO_4, H_3PO_4, CH_3COOH
- define bases and alkalis in terms of their reactions with acids
- recognise that some household substances are alkaline
- state the common alkalis found in the laboratory
- describe the characteristics of alkalis and their typical reactions
- write chemical and ionic equations for the reactions of alkalis
- relate alkaline properties to the presence of hydroxide ions ($OH^-(aq)$)
- describe the corrosive nature of acids and alkalis and the safety precautions in handling them

A. Domestic Acids and Alkalis

- _____ is used to test the **acidic** and **alkaline** nature of substances.
  1. **Acidic** substances turns _____ litmus paper from _____to _____
  2. **Alkaline** substances turns _____litmus paper from _____to _____
  3. _____ substances neither change the colour of **red** nor **blue** litmus paper.

Substances	Nature	Ingredients
Lemon / orange juice	Acidic / Alkaline / Neutral	
Coca-Cola / Pepsi	Acidic / Alkaline / Neutral	
Sprite / Cream soda	Acidic / Alkaline / Neutral	
Milk of magnesia	Acidic / Alkaline / Neutral	
Washing soda	Acidic / Alkaline / Neutral	
Sugar solution	Acidic / Alkaline / Neutral	
Limewater	Acidic / Alkaline / Neutral	
Vinegar	Acidic / Alkaline / Neutral	
Yogurt	Acidic / Alkaline / Neutral	
Window cleaner	Acidic / Alkaline / Neutral	
Vitamin C	Acidic / Alkaline / Neutral	
Alcohol	Acidic / Alkaline / Neutral	
Blood	Acidic / Alkaline / Neutral	
'Harpic' solution	Acidic / Alkaline / Neutral	
Tea	Acidic / Alkaline / Neutral	
Baking soda	Acidic / Alkaline / Neutral	

B. Characteristics of Acids

Organic Acids

- Acids containing _____.
- Despite carbon, it also contains the element **hydrogen** and **oxygen**.
- Examples: *citric acid ($C_6H_8O_7$), ethanoic acid (CH_3COOH)*…etc.

Inorganic Acids

- Acids that do **NOT** contain carbon.
- Examples :

  (1) Hydrochloric acid ( )

  (2) Sulphuric acid ( ) &

  (3)Nitric acid ( )
- They are also called _____ acids.

  ∵ they are derived from **minerals** in the past.

ALL pure acids are ionic / covalent compounds as they are made up of non-metal elements

∴ the basic units of pure acids are atoms / ions / molecules.

At room conditions, pure acids can be found in the **THREE** states :

1. Gas : _____
2. Liquid : _____
3. Solid : _____

In order to show acidic properties, _____ should be added to the pure acids.

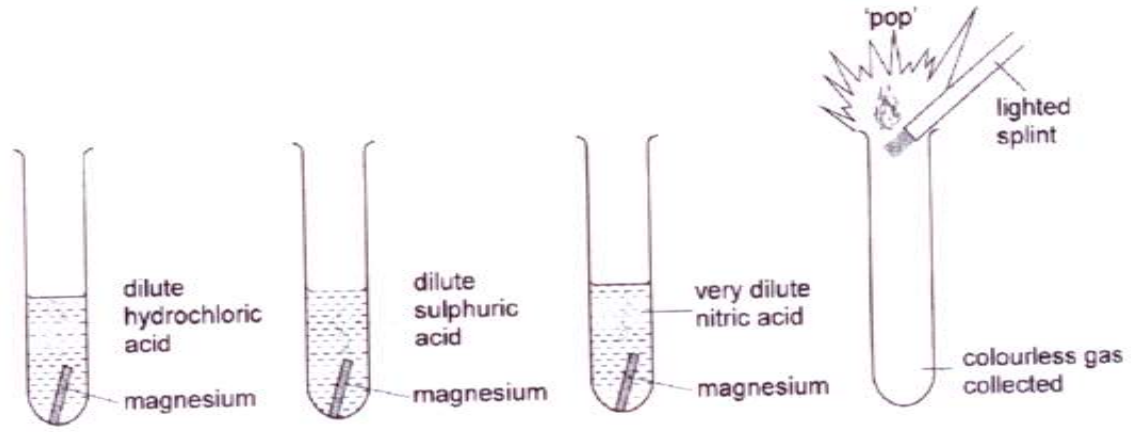
Concentration of acid :

_____ acid : small amount of pure acid + large amount of water

_____ acid : large amount of pure acid + small amount of water

(I) Reaction of Dilute Acids

(1) Metals



(a) Magnesium reacts with dilute hydrochloric acid(_____) :

Chemical equation : _____

Ionic equation : _____

(b) Magnesium reacts with dilute sulphuric acid(_____) :

Chemical equation : _____

Ionic equation : _____

(c) Magnesium reacts with VERY dilute nitric acid (_____):

Chemical equation : _____

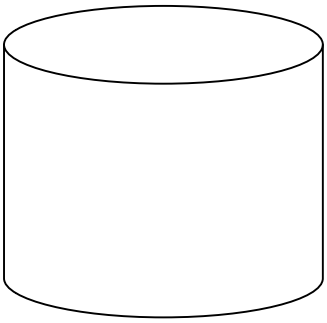
Ionic equation : _____

Observations :

1. _____
2. _____
3. _____

ALL dilute acids contain _____.

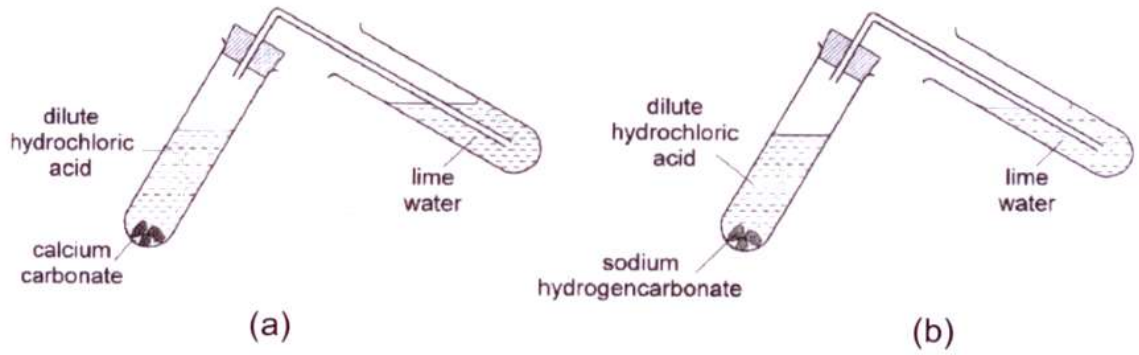
* If calcium or lead reacts with dilute sulphuric acid, the reaction stops quickly due to the formation of _____ **calcium / lead (II) sulphate**.



(2) Carbonates and Hydrogencarbonates

Acid + Carbonates →

Acid + Hydrogencarbonates →



(a) Calcium carbonate reacts with dilute hydrochloric acid :

Chemical equation : _____

Ionic equation : _____

(b) Sodium hydrogencarbonate reacts with dilute hydrochloric acid :

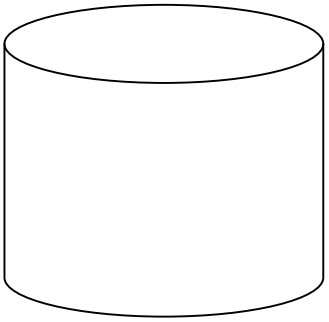
Chemical equation : _____

Ionic equation : _____

Observations :

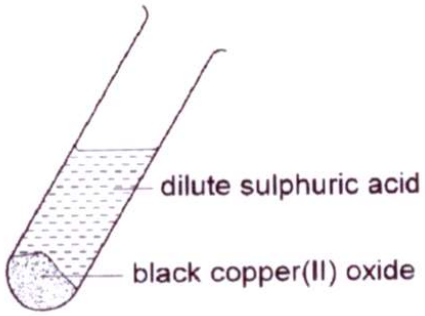
1. _____
2. _____
3. _____

Question : What happens if calcium carbonate is added to dilute sulphuric acid?



(3) Metal oxides

Acid + Metal oxides →



Chemical equation : _____

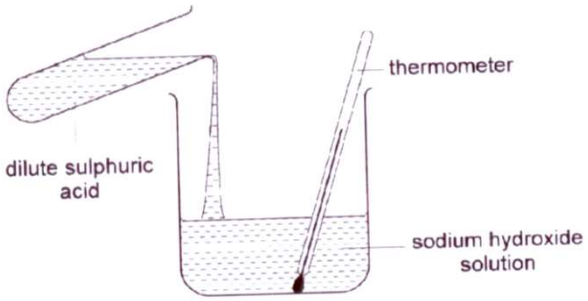
Ionic equation : _____

Observations :

1. _____
2. _____

(4) Metal hydroxides

Acid + Metal hydroxides →



Chemical equation : _____

Ionic equation : _____

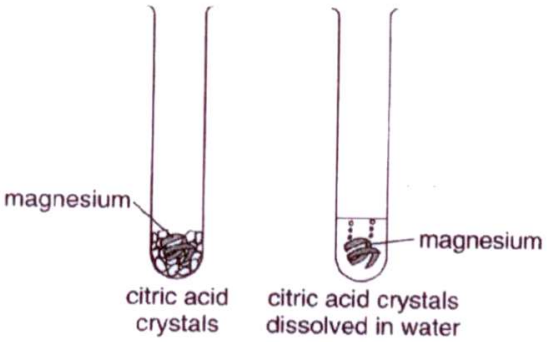
Observations :

1. _____

The above reactions (3)&(4) are called _____.

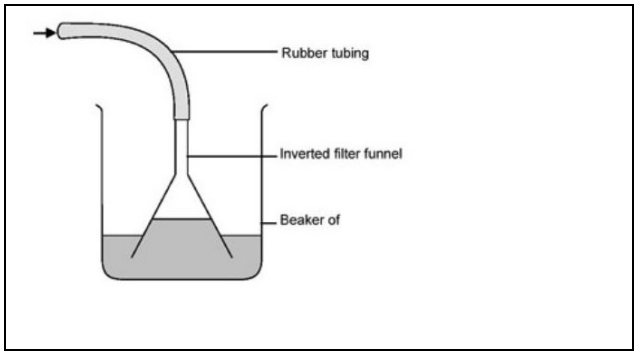
C. The Role of Water in Acids

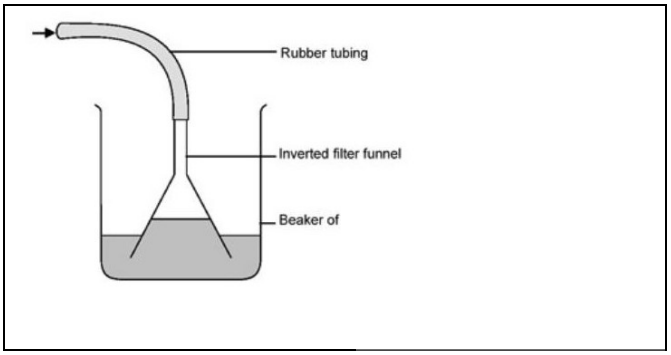
Experiment 1



Experiment 2

When hydrogen chloride gas dissolves in (i) water , and (ii) methylbenzene





Equations : $HCl(g)$ + water → $H^+_{(aq)} + Cl^-_{(aq)}$

$HNO_{3(l)}$ + water →

$H_2SO_{4(l)}$ + water →

- There is a change in bonding : _____ → _____
- This process is called _____ : formation of **IONS** from _____
- H^+ in aqueous solutions :

Questions :

1. Suggest how to distinguish between HCl (g) in water and in methylbenzene.
   (i) Test them for _____.
   (ii) Add _____.
   (iii) Test them with dry / moist _____ paper.
   (iv) Add solid / aqueous _____.

2. Explain why an inverted funnel is used.

∵ HCl(g) is very soluble / insoluble in water, the funnel provides a large _____ _____ for the gas to dissolve. (Sucking back can be prevented. Will be discussed in 2012 DSE)

D. Basicity = the number of _____ hydrogen atoms in an acid molecules

Basicity	Example
1	_____ acid : _____ acid : _____ acid : _____ acid :
	They are called _____ acids
2	_____ acid : _____ acid : _____ acid :
	They are called _____ acids
3	_____ acid :
	It is called _____ acid.

* Acids with 2 or more ionizable **H** atoms are called _____acids.

An ACID is a _____-containing compound that gives hydrogen ions ( )
as the ONLY positive ion when dissolved in water.