ACIDS, BASES AND SALTS

Chemical substances
↓
Source
- Animal and plants → Organic Compounds
- Minerals and rocks → Inorganic Compounds

classification of compounds (inorganic, organic)
↓
Based on taste
- Acid
- Base
- Salt

Acid: Derived from Latin word, 'acidus', which means sour

Ex. lemon juice, tomatoes, vinegar, HCl, H_2SO_4 etc.

Base: Bitter taste

Ex. Washing soda, baking soda

Salt: formed from acids and bases.

Ex. Sodium Chloride, Copper sulphate, silver nitrate, Calcium Carbonate,

Note: Some salts are unpleasant, taste and even may be poisonous. Hence, it is very dangerous to taste any chemical substance. Therefore, advised never to taste any chemical substance.

↓

Q) How to test that the given substance is an acid or a base without tasting it?

↓

Acid-Base Indicator

Indicators showing different colours in acidic and basic medium.

→ Most commonly used

→ Litmus, Phenolaphthalein, Methyl orange, Turmeric, red Cabbage leaves, Petals of flowers like: Petunia, Hydrangea, Geranium.

i) Onion
ii) Vanilla essence
iii) clove oil

Indicators giving different odours in acidic and basic medium.

(OLFACTORY INDICATORS)

Q) Litmus?

Found in nature. Litmus soln. is a **purple** coloured dye extracted from the lichen plants (division Thallophyta).

In the neutral soln., it has **purple colour**

Acidic soln. : Red

Basic soln. : Blue

Instead of using litmus soln. as such, two types of litmus soln. are used called Blue litmus soln. and red litmus soln.

Red litmus soln. : Acidifying the purple litmus extract

Blue litmus soln. : Making the purple litmus extract alkaline.

Acid

Vinegar

Lemon juice

Orange juice

juice of unripe mangoes

Tamarind juice

Base

Baking soda soln.

Washing soda soln.

neem extract

bitter gourd extract

Cucumber extract

(1)

NATURAL INDICATORS

Indicator	Color in neutral soln.	Color in acidic soln.	Color in basic soln.
Litmus	Purple	Red	Blue
Red Cabbage leaves extract	Red	Red (No change in Colour)	Green
Petals of Hydrangea plant	Blue	Blue (No change)	Pink.
Turmeric	Yellow	Y (No change)	Reddish Brown or Brown.
China Rose	—	Magenta (Deep pink)	Green

Synthetic Indicators

Indicator	Color in neutral soln.	Color in acidic soln.	Color in Basic soln.
Phenolphthalein	Colourless	Colourless (No change)	Pink
Methyl orange	Orange	Red	Yellow.

(2)

OLFACTORY INDICATORS

i) Onion odoured cloth strips

Acidic medium → characteristic smell

Basic medium → loose the characteristic smell

ii) Vanilla essence

Acidic medium → Retain smell

Basic medium → loose the characteristic smell

iii) clove oil

Acid medium → Smell$_1$ ≠ Basic medium → Smell$_2$

PROPERTIES

① Taste : Sour ✓

② Action :

litmus paper : Blue litmus soln. — Red ✓

methyl orange : Orange — Red ✓

③ Corrosive nature

Most of acids are corrosive. They produce a burning sensation on skin and holes in the clothes on which they fall.

Qy Why acids are never stored in metal containers? Or Qy Why stored in glass/ ceramics.

They attack metal structure and stone work.

④ Reaction :

a) Metals

$Zn(s) + dil.\ H_2SO_4(aq) \longrightarrow ZnSO_4(aq) + H_2(g)$

$Zn(s) + 2HCl(aq) \longrightarrow ZnCl_2(aq) + H_2(g)$

Metal + Acid ⟶ Metal salt + Hydrogen gas

Qy What happens when dil. H_2SO_4/ HCl is added to a test tube containing copper strips?

Note: All metals do not react with the same acid with the same vigour.

By Metal Carbonates, Metal hydrogen Carbonates

Metal and

Acids react with metal carbonates and bicarbonates to give out carbon dioxide with effervescence and forming the corresponding salt and water.

$$Na_2CO_3 + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O + CO_2$$

$$NaHCO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$$

limestone / chalk / marble / egg shell

$$CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$$

Metal Carbonates / Hydrogen Carbonate + Acid → Salt + CO_2 + H_2O

Q) What happens when egg shells are dipped in a tube containing dil. HCl / H_2SO_4.

OR

Dil. H_2SO_4 falls on egg shell.

Q) Give one useful example of reaction between metal bicarbonate and acid?

$$HCl + NaHCO_3 \longrightarrow NaCl + H_2O + CO_2$$

Baking soda

Q) What happens when carbon dioxide gas is passed through lime water.

$Ca(OH)_2(aq) + CO_2(g) \longrightarrow CaCO_3(s) + H_2O(l)$

lime water — milky suspension.

$CaCO_3(s) + H_2O(l) + CO_2(g) \longrightarrow Ca(HCO_3)_2(aq)$

Calcium bicarbonate

Milkiness disappears and solution becomes clear due to the formation of soluble calcium bicarbonate.

c) Bases :

$HCl + NaOH \longrightarrow NaCl + H_2O$

Caustic soda

Acid + Base → Salt + Water ...

d) Metallic Oxide :

$CaO(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + H_2O$

Quick lime

$CuO(s) + 2HCl(aq) \longrightarrow CuCl_2 + H_2O$

(Black) (Bluish green)

Metal oxide + Acid → Salt + Water ...

Neutralisation reaction.

Ex Metal hydroxide:

$$Mg(OH)_2 + 2HCl \longrightarrow MgCl_2 + 2H_2O$$

(Milk of Magnesia)

↓

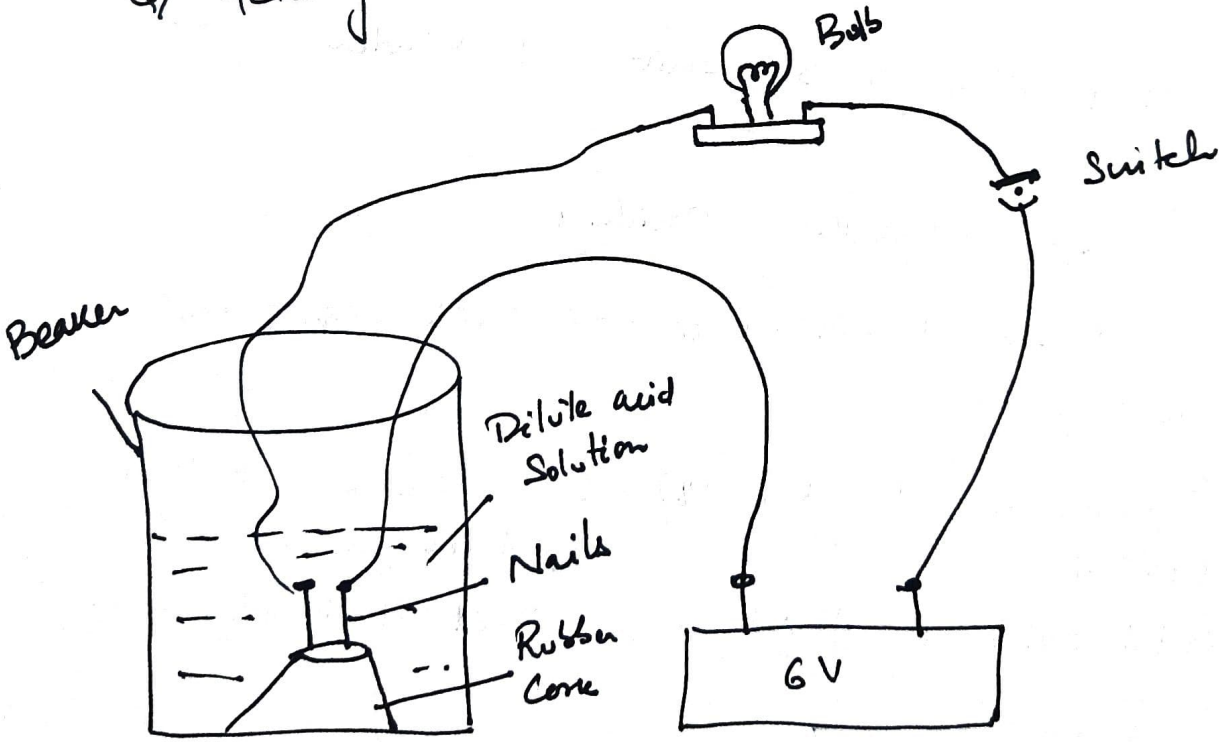
given as "Antacid"

Q/ A shiny brown colored element 'x' on heating in air becomes black in colour and form Y. Y react with muriatic acid to form bluish green compound Z. Name x, Y, Z and give the accompanying reactions.

(5) Conduction of Electricity:

Soln. of acid in water conducts electricity.

Q/ Activity to demostrate conduction of electricity.



Naturally occuring acids

Source	Acid
Orange, lemons	Citric acids
Apples	Malic acid
Tomatoes	Oxalic acid
Tamarind, Grapes, Apples*	Tartaric acid
Sour milk/ Curd	Lactic acid
Vinegar	Acetic acid
Proteins	Amino acids
Rancid Butter	Butyric acid
Gastric juice	Hydrochloric acid
Sting of bees and ants	Formic acid
Olive oil	Oleic acid
Fats	Stearic acid
Tea	Tannic acid
Urine	Uric acid.
Nitamin B5	Pantothenic acid

* Naturally occuring acids are generally weak acids.

* Mineral acids

Strong	Weak
HCl	Carbonic acid
HNO_3	Phosphoric acid
H_2SO_4	

Use:

Acetic acid : preservative

Tartaric acid : Ingredient of baking powder

Carbonic acid : Soft drinks, soda water

Q) Why copper, brass vessels have to be coated with a thin layer of tin (Kalai) from time to time?

When sour food stuffs such as curd or other substances which are acidic in nature are kept in these vessels, they react to form toxic compounds and make the food stuff unfit for consumption.

CHEMICAL NATURE OF ACIDS – What do all acids have in common

[ACID – H^+ ion]

Defn Acids are substances which contain hydrogen and which when dissolved in water give hydrogen ion (H^+) in the soln.

↳ Arrhenius Defn. (1884)

Q) Does all hydrogen containing compounds are acidic?

No, ethyl alcohol : C_2H_5OH, glucose : $C_6H_{12}O_6$

soln. do not conduct electricity.

Q) Why rain water conducts electricity but distilled water doesn't?

OR

Q) Two samples of water collected in test tube A, B. A has rain water and B contain distilled water. Which will conduct electricity? Why?

Rain water contains dissolved gases of the air like CO_2, SO_2, NO_2 etc. These gases dissolve in water to form acids, eg:

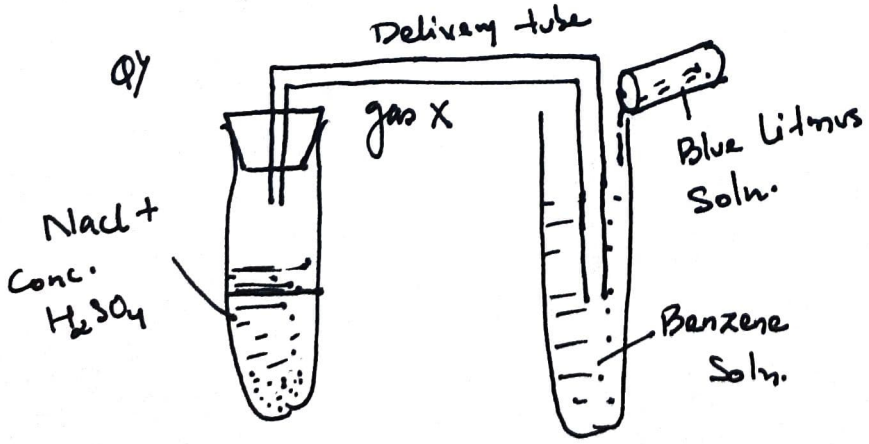
$$CO_2 + H_2O \rightarrow H_2CO_3$$

Q) Role of water in the Dissociation of an Acid:

Acid → Dissociate to give H^+ only in the presence of water. Hence, they act as acid only in the presence of water.

Q) Activity to show that dry HCl gas is not acidic but it becomes acidic in presence of water.

Q)



What will happen to blue litmus soln.

a) turn black b) turn purple

c) turn red d) No change.