
CHEMISTRY FOR JUNIOR SECONDARY SCHOOLS 1
JC BEST INTERNATIONAL SCHOOLS

JSS1 3RD TERM SCHEME OF WORK

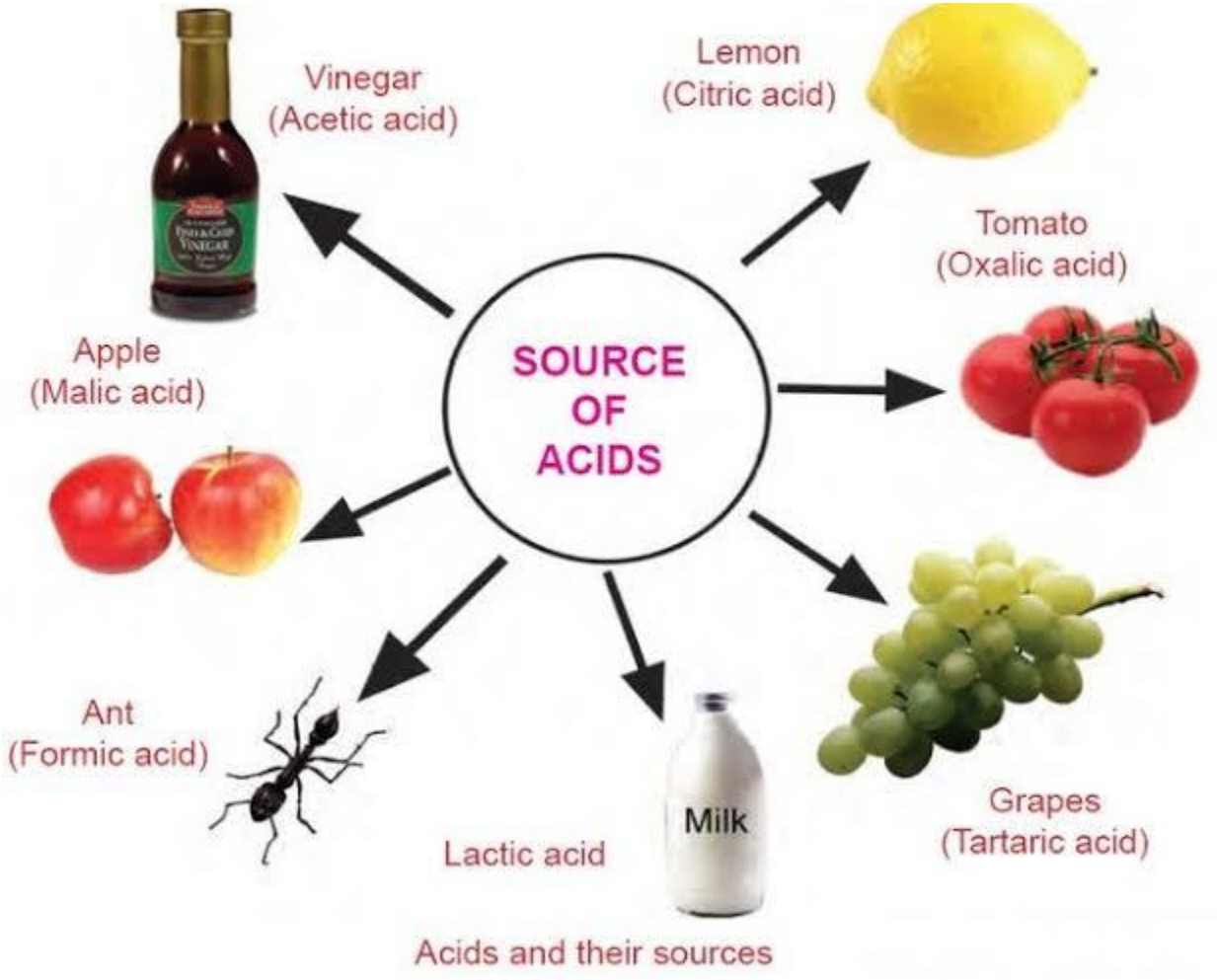
WEEK	TOPIC	CONTENTS
1	ACIDS, BASES AND SALTS	-Definition of acids -Strong and weak acids -Concentrated and dilute acids
2	ACIDS, BASES AND SALTS	-Basicity of an acid -Physical properties of acid -Chemical properties of acids -Uses of acids
3	ACIDS, BASES AND SALTS	-Bases and alkalis -Neutralization reaction
4	ACIDS, BASES AND SALTS	-Physical properties of alkalis -Chemical properties of alkalis -Uses of alkalis
5	ACIDS, BASES AND SALTS	-pH scale -Importance of pH -Indicators
6	ACIDS, BASES AND SALTS	-Definition of salts -Types of salts
7	ACIDS, BASES AND SALTS	-Types of salts -Uses of salts
8	WATER	-Water: water as a universal solvent -physical and chemical properties
9	WATER	-Hardness of water -Types of hardness -Removal of hardness -Advantages and disadvantages of hardness
10	REVISION	
11	EXAMINATION	

WEEK 1-7

ACIDS, BASES AND SALTS

Acids

According to Arrhenius, an acid is a substance that will produce hydrogen ion as the only positive ion when dissolved in water.



Acids and their sources

Classification of acids

1. Organic and inorganic
2. Strong and weak
3. Dilute and concentrated

Organic and inorganic

Organic acids are acids that occur as natural products in plant and animal materials

Organic acid	Source
Ethanoic acid	Vinegar
Lactic acid	Milk
Citric acid	Lime, lemon
Amino acid	Proteins
Fatty acid	Fats and oils
Ascorbic acid	Oranges

Inorganic acids also known as mineral acids can be prepared from mineral elements or inorganic matter

Inorganic acid	Formula
Hydrochloric acid	HCl
Sulphuric acid	H_2SO_4
Nitric acid	HNO_3

Strong and weak acids

A strong acid is one which ionise completely in water. Eg HCl, H_2SO_4 and HNO_3

$$HNO_3 \rightarrow H^+ + NO_3^-$$

Weak acids only partially ionise in water e.g ethanoic acid, CH_3COOH, carbonic acid, H_2CO_3

$$CH_3COOH \rightarrow CH_3COO^- + H^+$$

Dilute and Concentrated Acids

A concentrated acid is one that has been dissolved in a little quantity of water whereas a dilute one has been dissolved in a large quantity of water

ASSIGNMENT

Differentiate between

1. Organic and inorganic acids
2. Strong and weak acids
3. Concentrated and dilute acids

WEEK 2

Basicity of an Acid

This is the number of replaceable hydrogen ion in one molecule of an acid

Acid	Ions produced	Basicity
HCl	H^+, Cl^-	1 or monobasic
CH_3COOH	H^+, CH_3COO^-	1 or monobasic
H_2SO_4	$2H^+, SO_4^-$	2 or dibasic
H_3PO_4	$3H^+, PO_4$	3 or tribasic

Physical properties of acids

1. Dilute acid has a sour taste
2. **Acid** turns litmus red
3. Concentrated forms of strong acids are corrosive

Chemical properties of acids

1. Acids reacts with some metals like Zn, Fe, and Mg to liberate hydrogen gas

   Acid + Metal → salt + hydrogen gas

   $2HCl + Zn \rightarrow ZnCl_2 + H_2$
2. They react with bases to form a corresponding salt and water (neutralization reaction)

   Acid + Base → salt + water

   $H_2SO_4 + 2KOH \rightarrow K_2SO_4 + H_2O$
3. acids react with trioxocarbonates to liberate carbon dioxide, CO_2

   Acid + trioxocarbonates → salt + water + carbon dioxide

   $HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$

Uses of Acids

Acids are used

1. in storage batteries (H_2SO_4)
2. as food preservatives (acetic acid)
3. in the preparation of baking powder (tartaric acid)
4. in manufacture of fertilizers (nitic acid)
5. in making Poly Vinyl Chloride, PVC (HCl)

ASSIGNMENT

State two general methods for the preparation of acids

WEEK 3

Bases and Alkalis

A base is a substance that will neutralize an acid to yield salt and water. Most oxides and hydroxides of metals are bases e.g. CaO, NaOH, MgO, $Mg(OH)_2$ etc

An alkali is a basic hydroxide which is soluble in water. Examples include sodium, potassium and calcium hydroxides.

Neutralization

This is a process in which an acid reacts completely with an appropriate amount of an alkali (or any base) to produce a salt and water.

Acid + Base → salt + water

$HCl + NaOH \rightarrow NaCl + H_2O$

ASSIGNMENT

Differentiate between soluble and insoluble base with examples

WEEK 4

Physical properties of Alkalis

1. alkalis have a bitter taste
2. they are soapy to the touch
3. they turn red litmus blue
4. concentrated form of the two caustic alkalis, sodium hydroxide and potassium hydroxide are corrosive

Chemical Properties of Bases and Alkalis

1. all bases react with acids to form salt and water only.
base + acid → salt + water
$NaOH + HCl \rightarrow NaCl + H_2O$

2. alkalis react with ammonium salts, in the presence of heat, to generate ammonia gas. This reaction can be used as a test for alkalis
base + ammonium salts → salt + water + ammonia
$NaOH + NH_4Cl \rightarrow NaCl + H_2O + NH_3$

Uses of Alkalis

Alkalis are used

1. in the manufacture of soap sodium salts and plastics (sodium hydroxide)
2. in the manufacture of mortar, cement and plaster (calcium hydroxide)
3. in the manufacture of toothpaste (magnesium hydroxide)
4. as a detergent (aqueous ammonia)

ASSIGNMENT

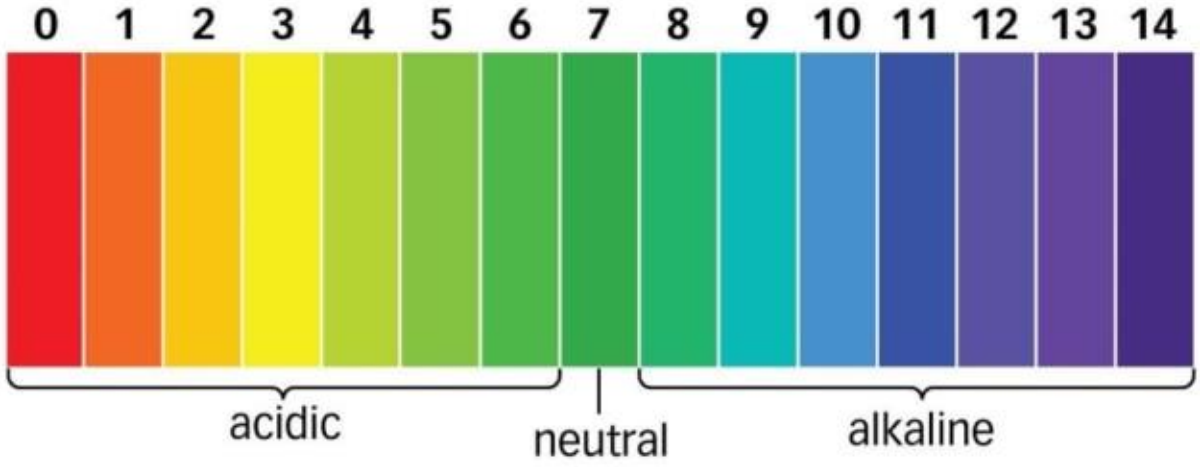
State the uses of the following alkalis

1. sodium hydroxide
2. potassium hydroxide
3. calcium hydroxide
4. magnesium hydroxide
5. aqueous ammonia

WEEK 5

pH Scale

The pH scale is a numbered scale from 0 to 14 used to measure the degree of acidity or alkalinity of a solution.



Importance of pH

1. it is required for digestion of food in our body
2. it is used to control the acidity and/or alkalinity of the soil
3. pH values are also important in pharmacy, medicine, water purification, sewage treatment and several other industrial processes.

Indicators

Indicators are dyes which change colour in solution as the pH of the solution changes. They are weak organic acids or bases which will produce different colours in solution according to the hydrogen ion, H^+ concentration in that solution.

Some common indicators are

1. Methyl orange
2. Phenolphthalein
3. Methyl red
4. Litmus

Types of pH Indicators

Indicator	Colour in acid (pH < 7)	Colour at pH = 7	Colour in base (pH > 7)
Red cabbage water	red, pink	purple	blue, green, yellow
Red onion water	red	violet	green
Turmeric water	yellow	yellow	red
Phenolphthalein	colourless	colourless	pink, red
Bromothymol blue	yellow	green	blue
Red litmus	red	red	blue
Blue litmus	red	blue	blue
Universal indicator	red, orange, yellow	green	Blue, violet, purple

ASSIGNMENT

Which of the following pH values are/is acidic, basic or neutral

1. 1
2. 4
3. 7
4. 8
5. 10

WEEK 6

Salts

A salt is a compound formed when part or all of the ionisable hydrogen of an acid is replaced by a metallic or ammonium ion.

Types of Salts

1. normal salts
2. acid salts
3. basic salts
4. double salts and
5. complex salts.

ASSIGNMENT

Give three examples each of the different type of salts mentioned above

WEEK 7

Types of Salts

1. normal salts
2. acid salts
3. basic salts
4. double salts and
5. complex salts.

Normal salts; are formed when all the ionizable hydrogen has been completely replaced e.g NaCl, Na_2SO_4, K_2CO_3

Acid salts; these salts are formed when part of the ionizable hydrogen ion of an acid has been replaced e.g $NaHCO_3$, $KHSO_4$

Basic Salts; basic salts contain the hydroxide ion, OH^-. They are formed when there is an insufficient supply of oxygen which is needed for the complete neutralization of the base. E.g Ca(OH)Cl, Zn(OH)Cl

Double salts; these salts ionize to produce three different ions in solution. Usually, two of these are positively charged while the other is negatively charged e.g. $(NH_4)_2Fe(SO_4)_2$, $KMgCl_3$

Complex salts: these salts contain a central metal ion bonded to one or more ligands by co-ordinate bonds formed from the ligands to the metal. Examples; potassium hexafluoroaluminate (III), $K_3[AlF_6]$ and tetraamminecopper (II) tetraoxosulphate (VI), $[Cu(NH_4)_4]SO_4$.

Uses of Salts

Salts are used

1. In the manufacture of many industrial, agricultural and consumer substances like chlorine gas, fertilizers and laxatives.
2. As food preservatives, drying agents and antifreeze.
3. For making gunpowder and matches

ASSIGNMENT

State three (3) laboratory preparation of Salts

WEEK 8 AND 9

WATER

Water

Water is one of the most common substances known. It is a good solvent for many substances and rarely occurs in its pure form in nature.

Physical properties

Pure water is clear, colourless, tasteless, and odourless liquid with the following properties.

1. A boiling point of 100 ^{0}C
2. A freezing point of 0 ^{0}C
3. Maximum density of 1 g/cm^3 at 4 ^{0}C
4. Neutral to litmus

Chemical properties

1. Water reacts with metals depending on the degree of reactivity to i.e position in the electrochemical series to liberate hydrogen gas
   a. Na, K, and Ca react with Coldwater
   $2Na + 2H_2O \rightarrow 2NaOH + H_2$
   b. Mg reacts with hot water to form magnesium hydroxide or with steam to form its oxide and liberates hydrogen gas in each case.
   $Mg + H_2O(g) \rightarrow MgO(s) + H_{2(g)}$
   c. Al, Zn, and Fe react only with steam. Fe reacts at red heat
   $3Fe + 4H_2O(g) \rightarrow Fe_3O_{4(s)} + 4H_2(g)$
   d. Cu, Au, Ag, and Hg do not react with water in any form

2. Non-metals like chlorine, oxygen, and silicon also reacts with water
3. Oxides of alkaline metals readily form strong alkalis or hydroxides with water. E.g slaking of lime
   $CaO\ (s) + H_2O\ (l) \rightarrow Ca(OH)_2(aq)$
4. Certain non-metallic oxides (acid anhydrides) react with water to form their corresponding acid. Eg. CO_2, SO_2, SO_3, NO_2 e.t.c
5. Water reacts with organic and inorganic compounds. Such reactions are generally described as hydrolysis. For example
   $Al_2S_3\ (s) + 6H_2O(l) \rightarrow 2Al(OH)_3(s) + 3H_2S\ (g)$
   $(C_6H_{10}O_5)n$ *(starch)* + $nH_2O \rightarrow nC_6H_{12}O_6$ *(glucose)*

ASSIGNMENT

Briefly explain steps in Purification of water for municipal supply

WEEK 9

Hardness of Water

Hard water is one that does not form lather readily with soap. It contains a number of dissolved salts. Hardness is caused by the presence of calcium and magnesium compounds/ions in water.

Water may acquire hardness when it dissolves gypsum $CaSO_4.2H_2O$, or limestone, $CaCO_3$, from soil over which it flows.

Types of hardness

1. Temporary hardness
2. Permanent hardness

Temporary Hardness; this hardness can easily be removed by boiling. It is caused by calcium hydrogen trioxocarbonate (IV), $Ca(HCO_3)_2$

Removal

1. By boiling
   $Ca(HCO_3)_2\,(aq) \rightarrow CaCO_3\,(s) + H_2O\,(l) + CO_2\,(g)$
2. By adding calculated amount of slaked lime $Ca(OH)_2$
   $Ca(HCO_3)_2\,(aq) + Ca(OH)_2(aq) \rightarrow 2CaCO_3(s) + 2H_2O\,(l)$

Effects of temporary hardness

1. Furring of kettles
2. Formation of stalactite and stalagmites

Permanent Hardness: this is one that cannot be removed by boiling. They are usually caused by chlorides or sulphates of calcium or magnesium.

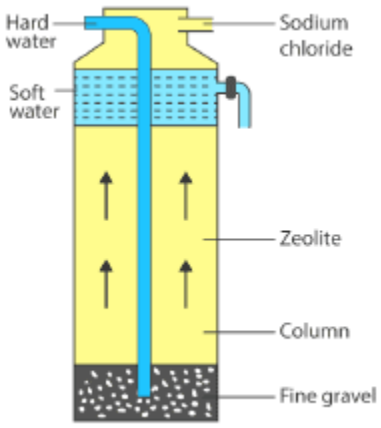
Removal

1. Addition of washing soda, Na_2CO_3
   $Na_2CO_3\,(aq) + CaSO_4\,(aq) \rightarrow CaCO_3(s) + Na_2SO_4\,(aq)$

2. Addition of caustic soda

   $NaOH(aq) + CaSO_4(aq) \rightarrow Ca(OH)_2(s) + Na_2SO_4(aq)$

3. Ion exchange using permutit or zeolite



ASSIGNMENT

State 3 advantages and disadvantages each of hard water