Most IMP Topics

SSC
Class 10

CHEMISTRY

Science - 1

Board Exam 2022

Chapter	Marks	With option
1. Gravitation	3	5
2. Periodic classification of elements	4	6
3. Chemical reaction and equations	4	6
4. Effects of electric current	5	7
5. Heat	3	5
6. Refraction of light	5	7
7. Lenses	4	6
8. Metallurgy	4	6
9. Carbon compounds	5	7
10. Space missions	3	5
Total	40	60

2. Periodic Classification of Elements

Dobereiner's Triads Page - 16

In the year 1817 a German scientist Dobereiner suggested that properties of elements are related to their atomic masses. He made groups of three elements each, having similar chemical properties and called them triads. He arranged the three elements in a triad in an increasing order of atomic mass and showed that the atomic mass of the middle element was approximately equal to the mean of the atomic masses of the other two elements.

Newlands' Law of Octaves Page - 17

In the year 1866 Newlands arranged the elements known at that time in an increasing order of their atomic masses. It started with the lightest element hydrogen and ended up with thorium. Newlands' Law of Octaves states that "When the elements are arranged in an increasing order of their atomic masses, the properties of every eighth element are similar to those of the first."

Dobereiner's Triads Page - 16

In the year _____ a German scientist _____ suggested that _____ of elements are related to their atomic _____. He made groups of _____each, having similar _____ properties and called them _____. He arranged the ____ elements in a triad in an _____ order of atomic ____ and showed that the atomic mass of the _____ element was approximately _____ to the ____ of the atomic masses of the other _____.

Newlands' Law of Octaves Page - 17

In the year ___, _____ arranged the elements known at that time in an _____ order of their atomic _____. It started with the _____ element _____ and ended up with _____. Newlands' Law of _____ states that "When the _____ are arranged in an _____ order of their atomic _____, the properties of every _____ element are _____ to those of the ____."

Mendeleev's Periodic table Page - 18

Mendeleev's Periodic law states that "properties of elements are periodic function of their atomic masses."

Merits of Mendeleev's periodic table Page - 19

- Atomic masses of some elements were revised so as to give them proper place in the periodic table in accordance with their properties. For example, the previously determined atomic mass of beryllium, 14.09, was changed to the correct value 9.4, and beryllium was placed before boron.
- Mendeleev kept vacant places in the periodic table for elements not discovered till then. Three of these unknown elements were given the names eka-boron, eka-aluminium and eka-silicon from the known neighbours and their atomic masses were indicated as 44, 68 and 72, respectively. Not only this but their properties were also predicted. Later on these elements

were discovered and named as scandium (Sc), gallium (Ga) and germanium (Ge) respectively. The properties of these elements matched well with those predicted by Mendeleev.

- There was no place reserved for noble gases in Mendeleev's original periodic table. However, when noble gases such as helium, neon and argon were discovered towards the end of nineteenth century, Mendeleev created the ' zero' group without disturbing the original periodic table in which the noble gases were fitted very well.

Mendeleev's Periodic table Page - 18

Mendeleev's Periodic law states that "_____ of elements are _____ function of their atomic _____."

Merits of Mendeleev's periodic table Page - 19

- Atomic _____ of some elements were _____ so as to give them _____ in the periodic table in _____ with their _____. For example, the previously determined atomic mass of _____, _____, was changed to the correct value _____, and _____ was placed before _____.
- Mendeleev kept _____ places in the periodic table for elements _____ till then. Three of these _____ elements were given the names eka-_____, eka-_____ and eka-_____ from the known _____ and their atomic masses were indicated as __, __ and __, respectively. Not only this but their _____ were also predicted. Later on these elements

were discovered and named as _____ ,_____and _____.
respectively. The _____ of these elements matched well with those predicted by _____.

- There was no _____ reserved for _____ gases in Mendeleev's original periodic table. However, when _____ gases such as _____, _____ and _____ were discovered towards the end of _____ century, Mendeleev created the ' _____' group without _____ the original periodic table in which the _____ gases were fitted very well.

Demerits of Mendeleev's periodic table Page - 20

- The whole number atomic mass of the elements cobalt (Co) and nickel (Ni) is the same. Therefore there was an ambiguity regarding their sequence in Mendeleev's periodic table.
- Isotopes were discovered long time after Mendeleev put forth the periodic table. As isotopes have the same chemical properties but different atomic masses, a challenge was posed in placing them in Mendeleev's periodic table.
- When elements are arranged in an increasing order of atomic masses, the rise in atomic mass does not appear to be uniform. It was not possible, therefore, to predict how many elements could be discovered between two heavy elements.
- Position of hydrogen : Hydrogen shows similarity with halogens (group VII). For example, the molecular formula of hydrogen is H2 while the molecular formulae of fluorine and chlorine are F2 and Cl2, respectively. In the same way, there is a similarity in the chemical

properties of hydrogen and alkali metals (group I). There is a similarity in the molecular formulae of the compounds of hydrogen and alkali metals (Na, K, etc.) formed with chlorine and oxygen. On considering the above properties it can not be decided whether the correct position of hydrogen is in the group of alkali metals (group I) or in the group of halogens (group VII).

Demerits of Mendeleev's periodic table Page - 20

- The _____ number atomic ____ of the elements _____ (__) and _____ (____) is the same. Therefore there was an _____ regarding their _____ in Mendeleev's periodic table.
- _____ were discovered _____ time after Mendeleev put forth the periodic table. As _____ have the same _____ properties but different _____, a _____ was posed in _____ them in Mendeleev's periodic table.
- When _____ are arranged in an _____ order of atomic _____, the ____ in atomic mass does not appear to be _____. It was not possible, therefore, to _____ how many _____ could be _____ between two _____ elements.
- Position of _____ : _____ shows similarity with _____ (group ___). For example, the molecular formula of _____ is ___ while the molecular formulae of _____ and _____ are ___ and ___, respectively. In the same way, there is a similarity in the _____

properties of _____ and _____ metals (group __). There is a similarity in the _____ formulae of the compounds of _____ and _____ metals (_____, etc.) formed with _____ and _____. On considering the above properties it can not be decided whether the _____ position of _____ is in the group of _____ metals (group ___) or in the group of _____ (group ____).

Modern Periodic Law Page - 20

Modern Periodic law states that “properties of elements are periodic function of their atomic numbers.”

Modern periodic table : long form of the periodic table Page - 21

- The modern periodic table contains seven horizontal rows called the periods 1 to 7. Similarly, the eighteen vertical columns in this table are the groups 1 to 18.
- The arrangement of the periods and groups results into formation of boxes. Atomic numbers are serially indicated in the upper part of these boxes. Each box corresponds to the place for one element.
- Apart from these seven rows, two rows are shown separately at the bottom of the periodic table. These are called lanthanide series and actinide series, respectively.
- There are 118 boxes in the periodic table including the two series. It means that there are 118 places for elements in the modern periodic table.

- The entire periodic table is divided into four blocks, viz, s-block, p-block, d-block and f-block.
- The s-block contains the groups 1 and 2. The groups 13 to 18 constitute the p-block. The groups 3 to 12 constitute the d-block, while the lanthanide and actinide series at the bottom form the f-block. The d-block elements are called transition elements.
- A zig-zag line can be drawn in the p-block of the periodic table. The three traditional types of elements can be clearly shown in the modern periodic table with the help of this zig-zag line.
- The metalloid elements lie along the border of this zig-zag line. All the metals lie on the left side of the zig-zag line while all the nonmetals lie on the right side.

Modern Periodic Law Page - 20

_____ Periodic law states that "_____ of elements are _____ function of their atomic _____."

Modern periodic table : long form of the periodic table Page - 21

- The modern periodic table contains _____ _____ rows called the _____ 1 to ___. Similarly, the _____ _____ columns in this table are the _____ 1 to ___.
- The arrangement of the _____ and _____ results into formation of _____. Atomic _____ are _____ indicated in the _____ part of these boxes. Each box corresponds to the _____ for ____ element.
- Apart from these _____ rows, ____ rows are shown separately at the _____ of the periodic table. These are called _____ series and _____ series, respectively.
- There are _____ boxes in the periodic table including the ____ series. It means that there are _____ places for _____ in the modern periodic table.

- The entire periodic table is divided into ____ blocks, viz, _____, _____, _____ and _____.
- The __-block contains the groups 1 and ___. The groups ___ to 18 constitute the ___-block. The groups 3 to ____ constitute the ___-block, while the _____ and _____ series at the bottom form the __-block. The __-block elements are called _____ elements.
- A _____ line can be drawn in the __-block of the periodic table. The three _____ types of _____ can be _____ shown in the modern periodic table with the help of this _____ line.
- The _____ elements lie along the _____ of this _____ line. All the _____ lie on the _____ side of the _____ line while all the _____ lie on the right side.

In the modern periodic table..... Page - 22

1. Elements are arranged in an increasing order of their atomic numbers.
2. Vertical columns are called groups. There are 18 groups. The chemical properties of the elements in the same group show similarity and gradation.
3. Horizontal rows are called periods. There are in all 7 periods. The properties of elements change slowly from one end to the other in a period.

Periodic trends in the modern periodic table Page - 24

Valency

- Valency is the number of electrons donated, accepted or shared by the atoms of an element so as to complete the octet in the outermost shell.
- Valency is dependent upon the number of valence electrons present in the outermost shell of an atom called valence electrons.

- Elements in the same group have same number of valence electrons, irrespective of the number of shells. Hence, elements in the same group have the same valency

Atomic size Page - 25

- The size of an atom is indicated by its radius. Atomic radius is the distance between the nucleus of the atom and its outermost shell. Atomic radius is expressed in the unit picometer (pm) which is smaller than nanometer (1 pm = 10^{-12} m).
- We find that atomic radius goes on decreasing while going from left to right within a period. The reason behind this is as follows.
- While going from left to right within a period, the atomic number increases one by one, meaning the positive charge on the nucleus increases by one unit at a time. However, the additional electron gets added to the same outermost shell.

- Due to the increased nuclear charge the electrons are pulled towards the nucleus to a greater extent and thereby the size of the atom decreases.
- We find that while going down a group the atomic size goes on increasing. This is because while going down a group a new shell is added. Therefore the distance between the outermost electron and the nucleus goes on increasing. As a result of this the atomic size increases in spite of the increased nuclear charge.

In the modern periodic table..... Page - 22

1. _____ are arranged in an _____ order of their atomic _____.
2. _____ columns are called _____. There are ___ groups. The _____ properties of the _____ in the same group show _____ and _____.
3. _____ rows are called _____. There are in all ___ periods. The _____ of elements _____ slowly from _____ to the _____ in a period.

Periodic trends in the modern periodic table Page - 24

Valency

- Valency is the _____ of electrons _____, _____ or _____ by the atoms of an element so as to complete the _____ in the _____ shell.
- Valency is _____ upon the number of _____ electrons present in the _____ shell of an atom called _____ electrons.

- Elements in the _____ group have same _____ of _____ electrons, irrespective of the number of _____. Hence, elements in the _____ group have the same _____.

Atomic size Page - 25

- The ____ of an atom is indicated by its _____. Atomic _____ is the _____ between the _____ of the atom and its outermost _____. Atomic _____ is expressed in the unit _____ (pm) which is smaller than _____ (1 pm = 10— m).
- We find that atomic ____ goes on _____ while going from left to _____ within a _____. The reason behind this is as follows.
- While going from _____ to right within a _____, the atomic number _____ one by one, meaning the _____ charge on the _____ increases by one ____ at a ___. However, the additional _____ gets added to the same _____.

- Due to the increased _____ charge the _____ are _____ towards the nucleus to a _____ extent and thereby the _____ of the atom _____.
- We find that while going _____ a group the atomic size goes on _____. This is because while going _____ a group a new _____ is _____. Therefore the _____ between the outermost _____ and the _____ goes on increasing. As a result of this the atomic size _____ in spite of the _____ _____ charge.

Metallic- Nonmetallic Character Page – 26,27

- All the electrons in any atom are held by the attractive force exerted on them by the positively charged nucleus.
- Electrons in the inner shells lie in between the valence shell and the nucleus. Because of their presence the effective nuclear charge exerting an attractive force on the valence electrons is somewhat less than the actual nuclear charge.

- The number of valence electrons in metals is small (1 to 3). Also the effective nuclear charge exerting attractive force on the valence electrons is small.
- As a combined effect of these two factors metals have a tendency to lose the valence electrons to form cations having a stable noble gas configuration. This tendency of an element called electropositivity is the metallic character of that element
- While going down a group a new shell gets added, resulting in an increase in the distance between the nucleus and the valence electrons. This results in lowering the effective nuclear charge and thereby lowering the attractive force on the valence electrons.
- As a result of this the tendency of the atom to lose electrons increases. Also the penultimate shell becomes the outermost shell on losing valence electrons.
- The penultimate shell is a complete octet. Therefore, the resulting cation has a special stability.

- Due to this, the tendency of the atom to lose electrons increases further. The metallic character of an atom is its tendency to lose electrons.
- Therefore, the following trend is observed : The metallic character of elements increases while going down the group.

- While going from left to right within a period the outermost shell remains the same.
- However, the positive charge on the nucleus goes on increasing while the atomic radius goes on decreasing and thus the effective nuclear charge goes on increasing.
- As a result of this the tendency of atom to lose valence electrons decreases within a period from left to right.

- The valence electrons are held with greater and greater attractive force. This is called electronegativity of an atom.

- Due to increasing electronegativity from left to right within a period, the ability of an atom to become anion by accepting outside electrons goes on increasing.
- The tendency of an element to form anion is the nonmetallic character of an element.

Metallic- Nonmetallic Character Page – 26,27

- All the _____ in any atom are held by the _____ force exerted on them by the _____ charged _____.
- Electrons in the inner _____ lie in _____ the _____ shell and the _____. Because of their presence the _____ nuclear charge exerting an _____ force on the _____ electrons is somewhat _____ than the _____ nuclear charge.

- The number of _____ electrons in metals is _____ (__ to __). Also the _____ nuclear charge exerting _____ force on the _____ electrons is _____.
- As a combined _____ of these two _____ metals have a _____ to ____ the _____ electrons to form _____ having a stable _____ gas _____. This tendency of an element called _____ is the _____ character of that element
- While going _____ a group a new ____ gets added, resulting in an _____ in the _____ between the _____ and the _____ electrons. This results in _____ the _____ nuclear charge and thereby _____ the _____ force on the _____ electrons.
- As a result of this the _____ of the atom to _____ electrons _____. Also the _____ shell becomes the _____ shell on _____ valence electrons.
- The penultimate shell is a complete _____. Therefore, the resulting _____ has a special _____.

- Due to this, the _____ of the atom to ____ electrons _____ further. The _____ character of an atom is its _____ to ____ electrons.
- Therefore, the following _____ is observed : The _____ character of elements _____ while going _____ the group.
- While going from _____ to right within a _____ the outermost _____ remains the _____.
- However, the _____ charge on the nucleus goes on _____ while the atomic _____ goes on _____ and thus the _____ nuclear charge goes on _____.
- As a result of this the _____ of atom to lose _____ electrons _____ within a period from ____ to _____.
- The _____ electrons are held with _____ and greater _____ force. This is called _____ of an atom.

- Due to increasing _____ from left to right within a _____, the ability of an atom to become _____ by accepting outside _____ goes on _____.
- The _____ of an element to form _____ is the _____ character of an element.

3. Chemical Reactions and Equations

Combination reaction. Page – 35

When two or more reactants combine in a reaction to form a single product, it is a combination reaction.

- Due to heating HCl vapours started coming out from the test tube, and NH_3 gas came out from the solution on the glass rod. The ammonia gas and hydrogen chloride gas reacted to form the salt ammonium chloride in gaseous state first, but immediately due to the condensation process at room temperature it got transformed into the solid state. As a result white smoke was formed.
- On burning magnesium strip in air a white powder of magnesium oxide is formed.
- Add a few pieces of slaked lime (calcium oxide, CaO) to water. Calcium hydroxide ($Ca(OH)_2$) is formed by combination of calcium oxide and water with generation of large amount of heat.

Combination reaction. Page – 35

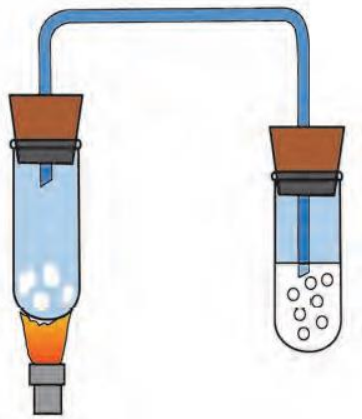
When ____ or ____ reactants _____ in a reaction to form a _____ product, it is a _____ reaction.

- Due to heating HCl, _____ started coming out from the _____, and ____ gas came out from the _____ on the glass ___. The _____ gas and _____ chloride gas reacted to form the salt _____ chloride in _____ state first, but immediately due to the _____ process at _____ temperature it got transformed into the _____ state. As a result _____ was formed.
- On burning _____ strip in ____ a _____ powder of _____ oxide is formed.
- Add a few pieces of _____ lime (_____, CaO) to water. _____ ($Ca(\_\_\_\_)_2$) is formed by _____ of _____ oxide and ____ with _____ of large amount of _____.

Decomposition reaction Page – 36

The chemical reaction in which two or more products are formed from a single reactant is a "Decomposition reaction".

- Calcium carbonate undergoes decomposition reaction and the carbon dioxide gas formed turns the lime water milky. The second product of the reaction, the calcium oxide powder, remains behind in the first test tube.



- Hydrogen peroxide naturally undergoes slow decomposition into water and oxygen.

- Water decomposes into hydrogen and oxygen gases on passing electric current through acidulated water. This decomposition takes place by means of electrical energy. Therefore it is called electrolysis.

Displacement reaction Page – 38

The reaction in which the place of the ion of a less reactive element in a compound is taken by another more reactive element by formation of its own ions, is called displacement reaction.

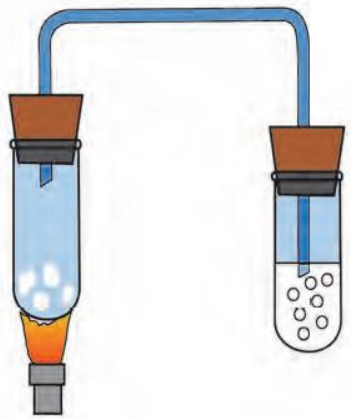
Double displacement reaction Page – 38

The reaction in which the ions in the reactants are exchanged to form a precipitate is a double displacement reaction.

Decomposition reaction Page – 36

The chemical _____ in which ____ or more _____ are formed from a _____ reactant is a "_____ reaction".

- Calcium _____ undergoes _____ reaction and the car___ _____ gas formed turns the _____ water _____. The second _____ of the reaction, the _____ oxide powder, remains behind in the first _____.



- Hyd_____ naturally undergoes slow _____ into water and _____.

- _____ decomposes into hydrogen and _____ gases on passing _____ through _____ water. This decomposition takes place by means of _____ energy. Therefore it is called _____.

Displacement reaction Page – 38

The reaction in which the _____ of the ion of a _____ _____ element in a _____ is taken by another ____ _____ element by formation of its own _____, is called _____ reaction.

Double displacement reaction Page – 38

The reaction in which the _____ in the _____ are _____ to form a _____ is a double _____ reaction.

Endothermic and Exothermic Processes and Reaction : Page – 38

Heat is absorbed and given away in various processes and reactions. Accordingly processes and reactions are classified as 'Endothermic or Exothermic'.

Endothermic and Exothermic Processes

- Heat from outside is absorbed during some physical changes. For example, (i) melting of ice (ii) dissolution of potassium nitrate in water. Therefore, these are **'Endothermic processes.'**
- On the other hand, heat is given away during some physical changes. For example, (i) formation of ice from water, (ii) dissolution of sodium hydroxide in water. Therefore these are **'Exothermic processes.'**
- In the process of dilution of concentrated sulphuric acid with water, very large amount of heat is liberated. As a result, water gets evaporated instantaneously, if it is poured in to the concentrated sulphuric acid, it may cause an accident.

- To avoid this, required amount of water is taken in a glass container and small quantity of concentrated sulphuric acid at a time is added with stirring. Therefore, only a small amount of heat is liberated at a time.

Endothermic and Exothermic Reactions Page – 39

- There is an exchange of heat in chemical reactions as well.
- Accordingly some chemical reactions are exothermic while some other are endothermic.
- During exothermic chemical reactions heat is given away when reactants are transformed into the products, while during endothermic chemical reactions heat is either absorbed from the surroundings or has to be supplied continuously from outside.

Endothermic and Exothermic Processes and Reaction : Page – 38

_____ is absorbed and given ____ in various _____ and _____. Accordingly processes and reactions are classified as '_____ or _____'.

Endothermic and Exothermic Processes

- Heat from _____ is _____ during some _____ changes. For example, (i) _____ of ice (ii) dissolution of _____ nitrate in water. Therefore, these are '_____ **processes.'**
- On the other hand, heat is _____ during some _____ changes. For example, (i) _____ of ice from _____, (ii) dissolution of _____ in water. Therefore these are '_____ **processes.'**
- In the process of _____ of concentrated _____ acid with water, very _____ amount of _____ is liberated. As a result, water gets _____ instantaneously, if it is poured in to the _____ _____ acid, it may cause an _____.

- To avoid this, required amount of _____ is taken in a _____ container and _____ quantity of _____ _____ acid at a time is _____ with _____. Therefore, only a small amount of ____ is _____ at a time.

Endothermic and Exothermic Reactions Page – 39

- There is an _____ of _____ in chemical reactions as well.
- Accordingly some chemical reactions are _____ while some other are _____.
- During _____ chemical reactions heat is _____ when _____ are transformed into the products, while during _____ chemical reactions heat is either _____ from the _____ or has to be _____ continuously from _____.

Factors affecting the rate of a chemical reaction

a. Nature of the Reactants

- On reaction of both Al and Zn with dilute hydrochloric acid, H_2 gas is liberated and water soluble salts of these metals are formed.
- However, the reaction of aluminium metal takes place faster as compared to zinc metal.
- The nature of the metal is responsible for this difference. Al is more reactive than Zn.
- Therefore the rate of reaction of Al with hydrochloric acid is higher than that of Zn. Nature or reactivity of reactants influences the rate of a chemical reaction.

b. Size of the Particles of Reactants

- The CO_2 effervescence is formed slowly with the pieces of Shahabad tile while at a faster speed with the powder.

- The above observation indicates that the rate of a reaction depends upon the size of the particles of the reactants taking part in the reaction.
- Smaller the size of the reactant particles, higher is the rate of the reaction.

c. Concentration of the reactants

- Dilute HCl reacts slowly with $CaCO_3$ and thereby $CaCO_3$ disappears slowly and CO_2 also liberates slowly.
- On the other hand the reaction with concentrated HCl takes place rapidly and $CaCO_3$ disappears fast.
- Concentrated acid reacts faster than dilute acid, which means that rate of a reaction is proportional to the concentration of reactants.

d. Temperature of the Reaction

- While studying decomposition reaction of lime stone, the lime water does not turn milky before heating the lime stone; because of the zero rate of reaction.
- From this it is learnt that the rate of a reaction increases on increasing the temperature.

e. Catalyst

- On heating potassium chlorate ($KClO_3$) decomposes slowly.
- The rate of the above reaction neither increases by reducing the particle size nor by increasing the reaction temperature.
- However, $KClO_3$ decomposes rapidly in presence of manganese dioxide (MnO_2) to liberate O_2 gas. No chemical change takes place in MnO_2 in this reaction.
- The substance in whose presence the rate of a chemical reaction increases, without causing any chemical change to it, is called a catalyst.

- The decomposition of hydrogen peroxide into water and oxygen takes place slowly at room temperature. However, the same reaction occurs at a faster rate on adding manganese dioxide (MnO_2) powder in it.

Factors affecting the rate of a chemical reaction

a. Nature of the Reactants

- On reaction of both ____ and ____ with dilute _____ acid, H_2 gas is _____ and water soluble _____ of these metals are formed.
- However, the reaction of _____ metal takes place _____ as compared to _____ metal.
- The _____ of the metal is responsible for this _____. ___ is more _____ than ____.
- Therefore the _____ of reaction of ___ with _____ acid is _____ than that of Zn. Nature or _____ of reactants influences the _____ of a chemical reaction.

b. Size of the Particles of Reactants

- The CO_2 _____ is formed _____ with the ___ of _____ tile while at a _____ speed with the _____.

- The above _____ indicates that the ____ of a reaction depends upon the _____ of the _____ of the _____ taking part in the reaction.
- _____ the size of the _____ particles, _____ is the _____ of the reaction.

c. Concentration of the reactants

- Dilute _____ reacts _____ with _____ and thereby $CaCO_3$ disappears _____ and CO_2 also liberates _____.
- On the other hand the reaction with _____ HCl takes place _____ and $CaCO_3$ disappears _____.
- _____ acid reacts _____ than _____ acid, which means that ____ of a reaction is _____ to the _____ of reactants.

d. Temperature of the Reaction

- While studying _____ reaction of _____ stone, the ____ water does not turn _____ before _____ the ____ stone; because of the _____ _____ of reaction.
- From this it is learnt that the _____ of a reaction _____ on increasing the _____.

e. Catalyst

- On heating _____ chlorate ($KClO_3$) _____ slowly.
- The _____ of the above reaction neither _____ by _____ the particle ____ nor by _____ the reaction _____.
- However, $KClO_3$ decomposes _____ in presence of _____ (MnO_2) to liberate _____ gas. No _____ change takes place in _____ in this reaction.
- The _____ in whose presence the _____ of a chemical reaction _____, without causing any _____ change to it, is called a _____.

- The _____ of _____ peroxide into _____ and _____ takes place _____ at room temperature. However, the same reaction occurs at a _____ rate on adding _____ (MnO_2) powder in it.

Oxidation and Reduction Page – 41,42,43

- The chemical reaction in which a reactant combines with oxygen or loses hydrogen to form the product is called oxidation reaction.
- Chemical substances which bring about an oxidation reaction by making oxygen available are called oxidants or oxidizing agents.
- The chemical reactions in which reactants gain hydrogen are called ‘reduction’ reactions. Similarly, the reaction in which a reactant loses oxygen to form the product is also called reduction reaction.
- The substance that brings about reduction is called a reductant, or a reducing agent.

- When hydrogen gas is passed over black copper oxide a reddish coloured layer of copper is formed.

$$CuO + H_2 \longrightarrow Cu + H_2O$$

- In this reaction an oxygen atom goes away from CuO (copper oxide), which means that reduction of copper oxide takes place, whereas hydrogen molecule takes up oxygen atom and water (H_2O) is formed meaning, oxidation of hydrogen takes place.
- Thus oxidation and reduction reactions occur simultaneously. The reductant is oxidized by the oxidant and the oxidant is reduced by the reductant.
- Due to this characteristics of the reduction and oxidation reactions, a single term ‘redox reaction’ is used in place of the two terms.

Redox Reaction = Reduction + Oxidation

Oxidation and Reduction Page – 41,42,43

- The chemical reaction in which a _____ combines with _____ or loses _____ to form the _____ is called _____ reaction.
- Chemical _____ which bring about an _____ reaction by making _____ available are called _____ or _____ agents.
- The chemical reactions in which _____ gain _____ are called '_____' reactions. Similarly, the reaction in which a _____ loses _____ to form the product is also called _____ reaction.
- The substance that brings about _____ is called a _____, or a _____ agent.

- When _____ gas is passed over black _____ oxide a _____ coloured layer of _____ is formed. $CuO + \longrightarrow + H_2O$
- In this reaction an _____ atom goes away from _____ (_____ oxide), which means that _____ of _____ oxide takes place, whereas _____ molecule takes up _____ atom and ____ (_____) is formed meaning, _____ of hydrogen takes place.
- Thus _____ and _____ reactions occur simultaneously. The _____ is oxidized by the _____ and the _____ is reduced by the _____.
- Due to this characteristics of the _____ and _____ reactions, a single term '_____ reaction' is used in place of the two terms.

_____ Reaction = Reduction + Oxidation

Corrosion Page – 44

- A certain type of reddish coloured solid layer collects on metallic surface. This layer is called 'rust'. Its chemical formula is $Fe_2O_3 . XH_2O$.
- The rust is formed by an electrochemical reaction. Different regions on the surface of iron become anode and cathode.
- Fe is oxidised to Fe^{2+} in the anode region.

  $Fe_{(s)} \rightarrow Fe^{2+}_{(aq)} + 2e^-$
- O_2 is reduced to form water in the cathode region.

  $O_{2\,(g)} + 4H^+_{(aq)} + 4e^- \rightarrow 2H_2O_{(l)}$
- When Fe^{2+} ions migrate from the anode region they react with water and further get oxidised to form Fe^{3+} ions.

- A reddish coloured hydrated oxide is formed from Fe^{3+} ions. It is called rust. It collects on the surface.

$$2Fe^{3+}_{(aq)} + 4H_2O_{(l)} \rightarrow Fe_2O_3.H_2O_{(s)} + 6H^+_{(aq)}$$

- Due to various components of atmosphere, oxidation of metals takes place, consequently resulting in their damage.
- This is called ‘corrosion’. Iron rusts and a reddish coloured layer is collected on it. This is corrosion of iron.

Corrosion Page – 44

- A certain type of _____ coloured _____ layer collects on _____ surface. This layer is called '_____'. Its chemical formula is _____. XH_2O.
- The rust is formed by an _____ reaction. Different regions on the _____ of _____ become _____ and _____.
- Fe is _____ to _____ in the anode region.

  $Fe_{(s)} \rightarrow$ ____$_{(aq)}$ + ____
- ____ is reduced to form _____ in the cathode region.

  ____$_{(g)}$ + $4H^+_{(aq)}$ + _____ $\rightarrow$ _____$_{(l)}$
- When Fe^{2+} ions _____ from the anode region they react with _____ and further get _____ to form ____ ions.

- A _____ coloured _____ oxide is formed from _____ ions. It is called ____. It collects on the surface.

$$2Fe^{3+}_{(aq)} + 4\_\_\_\_{}_{(l)} \rightarrow \_\_\_\_\_. H_2O_{(s)} + \_\_\_\_\_{}_{(aq)}$$

- Due to various components of _____, _____ of metals takes place, consequently resulting in their _____.
- This is called '_____'. Iron _____ and a _____ coloured layer is collected on it. This is _____ of iron.

Rancidity Page – 45

- When we use old, left over cooking oil for making food stuff, it is found to have foul odour called rancidity. If food is cooked in such oil, its taste also changes.
- When oil or ghee is left aside for a long time or fried food is left aside for a long time it undergoes air oxidation and becomes rancid.
- Rancidity in the food stuff cooked in oil or ghee is prevented by using antioxidants.
- The process of oxidation reaction of food stuff can also be slowed down by storing it in air tight container.

Rancidity Page – 45

- When we use ____, left over cooking _____ for making _____ stuff, it is found to have _____ odour called _____. If food is _____ in such oil, its _____ also changes.
- When ____ or _____ is left aside for a long _____ or _____ food is left _____ for a long time it undergoes _____ and becomes _____.
- _____ in the food stuff cooked in ____ or ____ is prevented by using _____.
- The process of _____ reaction of food stuff can also be _____ down by storing it in _____ container.

Chemical Reactions and equations

Combination Reaction

$$\text{Vegetable oil (l)} + H_2(g) \xrightarrow[\text{Ni Catalyst}]{60^0\,C}$$

$$NH_3\,(g) + HCl\,(g) \longrightarrow$$

$$Mg + O_2 \longrightarrow$$

$$CaO + H_2O \longrightarrow$$

$$H_2O(l) + CO_2(g)$$

Decomposition Reaction

$$CaCO_3(s) \xrightarrow{\Delta}$$

$$\underset{\text{Sugar}}{C_{12}H_{22}O_{11}} \xrightarrow{\text{Heat}}$$

$$H_2O(l) \xrightarrow{\text{Electrical Energy}}$$

$$KClO_3 \xrightarrow{\Delta}$$

$$AgCl(s) \longrightarrow$$

Displacement Reaction

$$CuSO_4\ (aq) + Zn\ (s) \longrightarrow$$

$$CuSO_4(aq) + Fe\ (s) \longrightarrow$$

$$CuSO_4(aq) + Pb(s) \longrightarrow$$

Double displacement Reaction

$$AgNO_3(aq) + NaCl(aq) \longrightarrow$$

$$BaCl_2(aq) + ZnSO_4(aq)$$

Oxidation

$Mg + O_2 \longrightarrow$

$C + O_2 \longrightarrow$

$MgH_2 \longrightarrow$

$CH_3\text{-}CH_3 \longrightarrow$

$CH_3\text{-}CH_2\text{-}OH \xrightarrow[K_2Cr_2O_7/H_2SO_4]{[O]}$

Ethyl alcohol

$KMnO_4 + FeSO_4 + H_2SO_4 \longrightarrow$

Reduction

$$CuO + H_2 \longrightarrow$$

Redox

$$H_2S + SO_2 \longrightarrow$$

$$MnO_2 + 4\,HCl \longrightarrow$$

8. Metallurgy

Reactions of Metals: Page – 94

a. Reaction of metals with oxygen

- Metals combine with oxygen on heating in air and metal oxides are formed.
- Sodium and potassium are very reactive metals. Sodium metal combines with oxygen in the air even at room temperature and forms sodium oxide.
- On exposure to air sodium readily catches fire. Therefore, to prevent accident in the laboratory or elsewhere it is kept in kerosene.
- Oxides of some metals are soluble in water. They react with water to form alkali.
- We know that magnesium oxide is formed on burning magnesium ribbon in the air. Magnesium oxide reacts with water to form an alkali, called magnesium hydroxide.

Reactions of Metals: Page – 94

a. Reaction of metals with oxygen

- _____ combine with oxygen on _____ in air and _____are formed.
- _____ and _____ are very _____ metals. Sodium metal combines with _____ in the ____ even at _____ temperature and forms _____ oxide.
- On exposure to ____ sodium readily catches _____. Therefore, to prevent _____ in the _____ or elsewhere it is kept in _____.
- _____ of some metals are _____ in water. They react with _____ to form _____.
- We know that _____ oxide is formed on burning _____ ribbon in the air. _____ oxide reacts with _____ to form an _____, called _____ hydroxide.

b. Reaction of metals with water Page – 94,95

- Sodium and potassium metal react rapidly and vigorously with water and liberates hydrogen gas.
- On the other hand, calcium reacts with water slowly and less vigorously. The hydrogen gas released in this reaction collects on the surface of the metal in the form of bubbles and the metal floats on water.
- The metals; aluminium, iron and zinc do not react with cold or hot water, but they react with steam to form their oxides. Hydrogen gas is released in this reaction.

c. Reaction of metals with acids Page – 95

- When samples of aluminium, magnesium, iron or zinc are treated with dilute sulphuric or hydrochloric acid, sulphate or chloride salts of metals are formed.

- Hydrogen gas is liberated in this reaction. The reactivity of these metals can be indicated by the following sequence - Mg > Al > Zn > Fe

d. Reaction of metals with nitric acid Page – 96

- Nitrate salts of metals are formed on reaction of metals with nitric acid.
- Various oxides of nitrogen (N_2O, NO, NO_2) are also formed in accordance with the concentration of nitric acid.

Aqua Regia:

- Aqua regia is a highly corrosive and fuming liquid. It is one of the few reagents which can dissolve the noble metals like gold and platinum.
- Aqua regia is freshly prepared by mixing concentrated hydrochloric acid and concentrated nitric acid in the ratio 3:1.

b. Reaction of metals with water

Page – 94,95

- _____ and potassium metal react _____ and _____ with _____ and liberates _____ gas.
- On the other hand, _____ reacts with water _____ and less _____. The _____ gas released in this reaction _____ on the _____ of the metal in the form of _____ and the metal _____ on water.
- The metals; _____, _____ and _____ do not react with ____ or _____ water, but they react with _____ to form their oxides. _____ gas is released in this reaction.

c. Reaction of metals with acids

Page – 95

- When samples of _____, _____, iron or _____ are treated with dilute _____ or _____ acid, _____ or chloride _____ of metals are formed.

- _____ gas is liberated in this reaction. The _____ of these metals can be indicated by the following sequence - ___ > Al > __ > Fe

d. Reaction of metals with nitric acid Page – 96

- _____ salts of metals are formed on reaction of _____ with _____ acid.
- Various oxides of _____ (__O, __O, N__) are also formed in _____ with the _____ of nitric acid.

Aqua Regia:

- Aqua regia is a highly _____ and _____ liquid. It is one of the few _____ which can _____ the _____ metals like gold and _____.
- Aqua regia is _____ prepared by mixing concentrated _____ acid and concentrated _____ acid in the ratio _____.

General properties of ionic compounds

Page – 99

- The _____ force between the _____ and _____ charged ions is strong. Therefore, the ionic compounds exist in _____ state and are _____.
- The ionic compounds are _____ and can be _____by applying _____.
- The _____ force of _____ is _____ in ionic compounds and, _____ energy is required to _____ it. Therefore, the _____ and _____ points of ionic compounds are _____.
- Ionic compounds are _____. This is because the _____ molecules _____ around the _____ separated by _____ process. As a result of this a new _____ is established between the _____ and the surrounding _____ molecules, replacing the original _____; and _____ solutions of ionic compounds are formed.

- Ionic compounds are however, _____ in solvents like _____ and _____. This is because _____ water a _____ can not be established in these solvents.
- The ionic compounds cannot _____ when in solid state. In this state the ions cannot _____. However, in the _____ state they can conduct _____, as in this state the ions are _____.
- The _____ solutions of ionic compounds conduct _____ as they contain the _____ ions. On passing _____ through the solution the ions move to the _____. Due to the _____ in _____ and _____ state the ionic compounds are called _____.

Metallurgy Page – 99,100

- Most metals being _____ do not occur in nature in _____ state but are found in _____ state as their _____ such as _____, _____, sulphides and _____.
- However, the most _____ metals that are not affected by ____, _____ and other natural factors like _____, gold, _____, generally occur in _____ state.
- The _____ of metals that occur in _____ along with the _____ are called _____.
- The _____ from which the _____ can be separated _____ are called _____.
- _____ contain many types of _____ such as _____, _____ and _____ substances along with the _____ compounds.
- These _____ are called _____.

- **Wilfley table method** Page – 100
- The Wilfley table is made by _____ and _____ wooden _____ on _____ surface.
- The table is kept _____ continuously. _____ obtained from _____ of the ore using _____ is poured on the table and a _____ is also released from the upper side.
- As a result, the _____ particles are _____ along with the _____ .
- The _____ in which proportion of _____ is more and proportion of _____ is less, are _____ by the wooden riffles and get _____ on the _____ between them.

- **Hydraulic separation method** Page – 100,101
- The hydraulic separation method is based on the _____. There is a _____ vessel similar to that used in a _____.
- It opens in a _____ container that is _____ on the lower side. The tank has an _____ on the upper side and a _____on the lower side.
- _____ ore is released in the tank. A _____is introduced in the tank from the _____.
- _____ particles are _____ and therefore they _____ along with the _____ from the _____ on the upper side of the tank and get _____.
- At the same time the _____of the ____ are collected at the _____ from the lower side of the tank.
- In short, this method is based on the law of _____, wherein particles of the _____ are separated by their _____ with the help of _____.

- **Magnetic separation Method** Page –101
- This method requires an _____ machine.
- The main parts of this machine are _____ of _____ and the _____ moving _____ around them. One of the _____ is _____ while the other is _____.
- The _____ belt moving around the _____ is made up of _____ or _____.
- The _____ is poured on the conveyor belt near the _____ roller. Two _____ are placed below the _____.
- The particles of the _____ in the ore are _____towards the _____ roller.
- Therefore, they are _____ along the belt and _____ in the _____ placed away from the _____ .
- At the same time the particles of the _____ of the ore stick to the _____ and therefore fall in the _____ vessel near the _____ roller.

- **Froth floatation method** Page –101,102
- The froth floatation method is based on the _____ properties, _____ and _____, of the particles.
- Here the particles of the _____, due to their _____ property, get wetted _____ , while due to the _____ property the _____ get wetted with _____ .
- In this method the _____ is put into a big tank containing _____.
- Certain _____ such as _____, is added in the _____ for the formation of _____. _____ air is blown through the water.
- There is an _____ rotating around its _____ in the centre of the floatation tank. _____ are formed due to the _____. Due to _____ a foam is formed from _____ together.

- This _____ rises to the _____ and floats.
- Particles of certain _____ float with the _____ on water as they preferentially get _____ .
- For example, this method is used for the concentration of _____ and _____ .

- **Leaching** Page –102

- The first step in the extraction of the metals _____, _____ and _____ from their ores is the method of _____.
- In this method the ore is _____ in a _____for a long time. The ore _____ in that _____ due to a _____.
- The _____, however, does not _____ and therefore _____ in that solution. So it can be _____.
- For example, concentration of _____, the aluminium ore, is done by leaching method. Here _____ is soaked in aqueous _____ or aqueous _____ which dissolves the main ingredient _____ in it.

Extraction of Aluminium Page –103

- Aluminium being reactive metal does not occur in nature in free state. Aluminium is the third highly abundant element in the earth crust after oxygen and silicon.
- Aluminium is extracted from its ore bauxite ($Al_2O_3.nH_2O$).
- Bauxite contains 30% to 70% of Al_2O_3 and remaining part is gangue. It is made up of sand, silica, iron oxide etc. There are two steps in the extraction of aluminium.

i. Concentration of bauxite ore:

- Bauxite is the main ore of aluminium. Silica (SiO_2), ferric oxide (Fe_2O_3) and titanium oxide (TiO_2) are the impurities present in bauxite.
- Separation of these impurities is done by leaching process using either Bayer's method or Hall's method. In both these methods finally the concentrated alumina is obtained by calcination.

- In the Bayer’s process the ore is first ground in a ball mill. Then it is leached by heating with concentrated solution of caustic soda (NaOH) at 140 to 150 ^{0}C under high pressure for 2 to 8 hours in a digester.
- Aluminium oxide being amphoteric in nature, it reacts with the aqueous solution of sodium hydroxide to form water soluble sodium aluminate. This means that bauxite is leached by sodium hydroxide solution.
- The iron oxide in the gangue does not dissolve in aqueous sodium hydroxide. It is separated by filtration.
- However, silica in the gangue dissolves in aqueous sodium hydroxide to form water soluble sodium silicate.
- Aqueous sodium aluminate is diluted by putting in water and is cooled to 50 ^{0}C. This results in precipitation of aluminium hydroxide.

- In the Hall’s process the ore is powdered and then leached by heating with aqueous sodium carbonate in the digester to form water soluble sodium aluminate.
- Then the insoluble impurities are filtered out. The filtrate is warmed and neutralised by passing carbon dioxide gas through it. This results in the precipitation of aluminium hydroxide.
- The precipitate of $Al(OH)_3$ obtained in both, Bayer’s and Hall’s processes is filtered, washed, dried and then calcined by heating at 1000 ^0C to obtain alumina.

Extraction of Aluminium Page –103

- Aluminium being _____ metal does not occur in _____ in _____ state. Aluminium is the _____ highly _____ element in the earth crust after _____ and silicon.
- Aluminium is extracted from its ore _____ (_____.nH_2O).
- Bauxite contains _____ to _____ of _____ and remaining part is _____. It is made up of _____, _____, _____ oxide etc. There are ___ steps in the _____ of aluminium.

i. Concentration of bauxite ore:

- Bauxite is the main ___ of aluminium. _____ (SiO_2), _____ oxide (Fe_2O_3) and _____ oxide (TiO_2) are the _____ present in bauxite.
- _____ of these impurities is done by _____ process using either _____ method or _____ method. In both these methods finally the concentrated _____ is obtained by _____.

- In the _____ process the ore is first _____ in a _____ mill. Then it is _____ by heating with _____ solution of _____ soda (_____) at ____ to 150 ^{0}C under high ____ for __ to ___ hours in a _____.
- _____ oxide being _____ in nature, it reacts with the _____ solution of _____ to form water soluble _____. This means that bauxite is _____ by _____solution.
- The _____ oxide in the gangue does not _____ in aqueous sodium _____. It is separated by _____.
- However, _____ in the gangue dissolves in _____ sodium _____ to form water _____ sodium _____.
- Aqueous sodium _____ is _____ by putting in water and is _____ to ____ ^{0}C. This results in _____ of aluminium _____.

- In the _____ process the ore is _____ and then leached by _____ with aqueous sodium _____ in the digester to form water _____ sodium _____.
- Then the _____ impurities are _____ out. The filtrate is _____ and _____ by passing _____ gas through it. This results in the _____ of aluminium _____.
- The precipitate of _____ obtained in both, _____ and _____ processes is _____, _____, _____ and then _____ by heating at _____ ^{0}C to obtain _____.

ii. Electrolytic reduction of alumina

Page –104

- In this method electrolysis of molten mixture of alumina (melting point > 2000 ^{0}C) is done in a steel tank.
- The tank has graphite lining on the inner side. This lining does the work of a cathode. A set of graphite rods dipped in the molten electrolyte works as anode.
- Cryolite (Na_3AlF_6) and fluorspar (CaF_2) are added in the mixture to lower its melting point up to 1000 ^{0}C.
- Aluminium is deposited on the cathode on passing electric current.
- Molten aluminium being heavier than the electrolyte, is collected at the bottom of the tank.
- It is taken out from there from time to time, Oxygen gas is liberated at the anode.
- The liberated oxygen reacts with the anodes to form carbon dioxide gas. The anodes have to be changed from time to time as they get oxidised during the electrolysis of alumina.

ii. Electrolytic reduction of alumina Page –104

- In this method _____ of molten mixture of _____ (melting point > _____ ^{0}C) is done in a _____ tank.
- The tank has _____ lining on the _____ side. This lining does the work of a _____. A set of _____ rods dipped in the molten _____ works as _____.
- _____ (_____) and fluorspar (_____) are added in the mixture to _____ its _____ point up to _____ ^{0}C.
- _____ is deposited on the _____ on passing _____ current.
- Molten aluminium being _____ than the _____, is collected at the _____ of the tank.
- It is taken out from there from _____ to ____, _____ gas is liberated at the _____.
- The liberated _____ reacts with the _____ to form _____ gas. The anodes have to be _____ from time to time as they get _____ during the _____ of alumina.

Extraction of moderately reactive metals Page –104

The sulphide ores are strongly heated in air to transform them into oxides. This process is called **roasting**. Carbonate ores are strongly heated in a limited supply of air to transform them into oxides. This process is called **calcination**.

Corrosion of metals Page –106

- Iron reacts with moist air and a deposit of reddish substance (Fe_2O_3 H_2O) is formed on it. This substance is called rust.
- Carbon dioxide in moist air reacts with the surface of copper vessel. Copper loses its luster due to formation of greenish layer of copper carbonate ($CuCO_3$) on its surface. This is called patination of copper.
- On exposure to air, silver articles turn blackish after some time. This is because of the layer of silver sulphide (Ag_2S) formed by the reaction of silver with hydrogen sulphide in air.

- By oxidation of aluminium, a thin layer of aluminium oxide forms on it.

Corrosion can be prevented by putting a layer of noncorrodible metal on a corrodible metal. This can be done in many ways.

1. Galvanizing Page –107

- In this method a thin layer of zinc is applied to prevent corrosion of iron or steel. For example, shining iron nails, pins, etc.
- In this method corrosion of zinc occurs first because zinc is more electropositive than iron.
- After a few rainy seasons the zinc layer goes away and the inner iron gets exposed. Then iron starts rusting.

Extraction of moderately reactive metals Page –104

The _____ ores are strongly _____ in ____ to transform them into _____. This process is called _____. _____ ores are strongly _____ in a limited supply of _____ to transform them into _____. This process is called _____.

Corrosion of metals Page –106

- _____ reacts with moist ____ and a deposit of _____ substance (_____ H_2O) is formed on it. This substance is called _____.
- _____ in moist air reacts with the surface of _____ vessel. Copper loses its _____ due to formation of _____ layer of _____ ($CuCO_3$) on its surface. This is called _____ of _____.
- On _____ to air, ____ articles turn _____ after some time. This is because of the layer of _____ (Ag_2S) formed by the reaction of _____ with _____ sulphide in air.

- By _____ of aluminium, a thin layer of _____forms on it.

_____ can be prevented by putting a layer of _____ metal on a _____ metal. This can be done in many ways.

1. Galvanizing Page –107

- In this method a thin layer of _____ is applied to prevent _____ of ____ or _____. For example, _____ iron ____, pins, etc.
- In this method _____ of _____ occurs first because _____ is more _____ than iron.
- After a few _____ seasons the _____ layer goes _____ and the inner _____ gets exposed. Then _____ starts _____.

2. Tinning

- In this method a layer of molten tin is deposited on metals. We call this as ‘kalhaee’.
- A greenish layer forms on the surface of a copper or brass vessel. This greenish layer is poisonous. If buttermilk or curry is placed in such a vessel it gets spoiled.
- Tinning is done to prevent all such damages.

3. Anodization

- In this method metals like copper, aluminium are coated with a thin and strong layer of their oxides by means of electrolysis. For this the copper or aluminium article is used as anode.
- As this oxide layer is strong and uniform all over the surface, it is useful for prevention of the corrosion of the metal.
- when aluminium is anodised, the thin layer of aluminium oxide is formed. It obstructs the contact of the aluminium with oxygen and water. This prevents further oxidation.

- This protection can be further increased by making the oxide layer thicker during the anodization

4. Electroplating Page –108

In this method a less reactive metal is coated on a more reactive metal by electrolysis. Silver plated spoons, gold plated ornaments are the examples of electroplating.

5. Alloying

- Majority of the metallic substances used presently are in the form of alloys.
- The main intention behind this is to decrease the intensity of corrosion of metals.
- The homogenous mixture formed by mixing a metal with other metals or nonmetals in certain proportion is called an alloy.
- For example, bronze is an alloy formed from 90% copper and 10 % tin. Bronze statues do not get affected by sun and rain.

- Stainless steel does not get stains with air or water and also does not rust. It is an alloy made from 74% iron, 18% chromium and 8% carbon.
- In recent times various types of alloys are used for minting coins.

2. Tinning

- In this method a layer of _____ is deposited on _____ . We call this as '_____'.
- A _____ layer forms on the surface of a _____ or _____ vessel. This _____ layer is _____. If _____ or _____ is placed in such a vessel it gets _____.
- _____ is done to prevent all such _____.

3. Anodization

- In this method metals like _____, _____ are coated with a ____ and _____ layer of their _____ by means of _____. For this the copper or _____ article is used as _____.
- As this _____ layer is _____ and _____ all over the surface, it is useful for _____ of the _____ of the metal.
- When aluminium is _____, the thin layer of _____is formed. It _____ the contact of the _____ with _____ and water. This prevents further _____.

- This protection can be further _____ by making the _____ layer _____ during the _____.

4. Electroplating Page –108

In this method a _____ reactive metal is _____ on a _____ reactive metal by _____. _____ plated spoons, _____ plated ornaments are the examples of _____.

5. Alloying

- Majority of the metallic substances used presently are in the form of alloys.
- The main intention behind this is to decrease the intensity of corrosion of metals.
- The homogenous mixture formed by mixing a metal with other metals or nonmetals in certain proportion is called an alloy.
- For example, bronze is an alloy formed from 90% copper and 10 % tin. Bronze statues do not get affected by sun and rain.

- _____ steel does not get _____ with ____ or _____ and also does not ____. It is an alloy made from _____ iron, 18% _____ and _____ carbon.
- In recent times various types of alloys are used for _____ .

Metallurgy

Reaction with oxygen

$$Na(s) + O_2(g) \longrightarrow$$

$$Na_2O(s) + H_2O(l) \longrightarrow$$

$$Mg(s) + O_2(g) \longrightarrow$$

$$MgO + H_2O \longrightarrow$$

Reaction with water:

$Na\ (s) + H_2O\ (l) \longrightarrow$

$K(s) + H_2O\ (l) \longrightarrow$

$Ca(s) + H_2O\ (l) \longrightarrow$

$Al(s) + H_2O(g) \longrightarrow$

$Fe(s) + H_2O(g) \longrightarrow$

$Zn(s) + H_2O(g) \longrightarrow$

Reaction with acid:

$Mg(s) + HCl(aq) \longrightarrow$

$Al(s) + HCl(aq) \longrightarrow$

$Fe(s) + HCl(aq) \longrightarrow$

$Zn(s) + HCl(aq) \longrightarrow$

$Cu(s) + HNO_3(aq) \longrightarrow$ (Concentrated)

$Cu(s) + HNO_3(aq) \longrightarrow$ (dilute)

Reactions of nonmetals:

$$C + O_2 \xrightarrow{\text{Complete combustion}}$$

$$C + O_2 \xrightarrow{\text{Partial Combustion}}$$

$$S + O_2 \xrightarrow{\text{Combustion}}$$

$$Cl_2(g) + H_2O(l) \longrightarrow$$

$$Cl_2(g) + HBr(aq) \longrightarrow$$

$$S + H_2 \longrightarrow$$

$$N_2 + H_2 \longrightarrow$$

Extraction of aluminium:

$$Al_2O_3 \cdot 2H_2O\ (s) + \quad NaOH\ (aq) \longrightarrow$$

$$NaAlO_2 + \quad H_2O \longrightarrow$$

$$Al_2O_3 \cdot 2H_2O\ (s) + Na_2CO_3(aq) \longrightarrow$$

$$NaAlO_2(aq) + \quad H_2O + CO_2(g) \longrightarrow$$

$$Al(OH)_3 \longrightarrow$$

Extraction of metals:

$ZnS + O_2 \longrightarrow$

$ZnCO_3 \longrightarrow$

$ZnO + C \longrightarrow$

$MnO_2 + Al \longrightarrow$

$Fe_2O_3 + Al \longrightarrow$

$Cu_2S + O_2 \longrightarrow$

$Cu_2O + Cu_2S \longrightarrow$

9. Carbon Compounds

Exercise

1. Match the pairs.

Group 'A'	Group 'B'
a. C_2H_6	1. Unsaturated hydrocarbon
b. C_2H_2	2. Molecular formula of an alcohol
c. CH_4O	3. Saturated hydrocarbon
d. C_3H_6	4. Triple bond

2. Draw an electron dot structure of the following molecules. (Without showing the circles)

a. Methane b. Ethene

c. Methanol d. Water

3. Draw all possible structural formulae of compounds from their molecular formula given below.

a. C_3H_8 b. C_4H_{10} c . C_3H_4

4. Explain the following terms with example.

a. Structural isomerism
b. Covalent bond
c. Hetero atom in a carbon compound
d. Functional group
e. Alkane
f. Unsaturated hydrocarbon
g. Homopolymer
h. Monomer
i. Reduction
j. Oxidant

5. Write the IUPAC names of the following structural formulae.

a. CH_3-CH_2-CH_2-CH_3 b. CH_3-CHOH-CH_3
c. CH_3-CH_2-COOH d. CH_3-CH_2-NH_2
e. CH_3-CHO f. CH_3-CO-CH_2-CH_3

6. Identify the type of the following reaction of carbon compounds.

a. CH_3-CH_2-CH_2-OH $\longrightarrow$ CH_3-CH_2-COOH
b. CH_3-CH_2-CH_3 $\longrightarrow$ $3\,CO_2 + 4\,H_2O$
c. CH_3-CH= CH -CH_3 + Br_2 $\longrightarrow$ CH_3-CHBr - CHBr -CH_3
d. CH_3-CH_3 + Cl_2 $\longrightarrow$ CH_3-CH_2-Cl + HCl
e. CH_3-CH_2-CH_2-CH_2-OH $\longrightarrow$ CH_3-CH_2-CH=CH_2 + H_2O
f. CH_3-CH_2-COOH + NaOH $\longrightarrow$ CH_3-CH_2-COO^-Na^+ + H_2O
g. CH_3-COOH + CH_3-OH $\longrightarrow$ CH_3-COO- CH_3 + H_2O

7. Write structural formulae for the following IUPAC names.

a. pentan -2-one b. 2- chlorobutane
c. propan - 2- ol d. methanal
e. butanoic acid f. 1- bromopropane
g. ethanamine h. butanone

8. Write answers as directed.

a. What causes the existance of very large number of carbon compound ?
b. Saturated hydrocarbons are classified into three types. Write these names giving one example each.
c. Give any four functional groups containing oxygen as the heteroatom in it. Write name and structural formula of one example each.
d. Give names of three functional groups containing three different hetero atoms. Write name and structural formula of one example each.
e. Give names of three natural polymers. Write the place of their occurrance and names of monomers from which they are formed.
f. What is meant by vinegar and gasohol? What are their uses ?
g. What is a catalyst ? Write any one reaction which is brought about by use of catalyst ?

Hydrocarbons : Saturated and Unsaturated

Page –114

- The compounds which contain carbon and hydrogen as the only two elements are called hydrocarbons.
- Hydrocarbons are the simplest and the fundamental organic compounds.
- Hydrocarbons in which all four valencies of carbon atoms are satisfied by single bonds are called as SATURATED HYDROCARBONS. Saturated hydrocarbons are also called ‘Alkanes’.
- Hydrocarbons having a double bond or triple bond between two carbon atoms are called UNSATURATED HYDROCARBONS.
- The unsaturated hydrocarbons containing a carbon-carbon double bond are called ‘Alkenes’.

- The unsaturated hydrocarbons whose structures contain a carbon-carbon triple bond are called ‘Alkynes’.
- Generally the unsaturated compounds are more reactive than the saturated compounds.

Hydrocarbons : Saturated and Unsaturated

Page –114

- The compounds which contain _____ and _____ as the only two _____ are called _____.
- Hydrocarbons are the _____ and the _____ organic compounds.
- Hydrocarbons in which all _____ valencies of _____ atoms are satisfied by _____ bonds are called as _____ HYDROCARBONS. _____ hydrocarbons are also called '_____'.
- Hydrocarbons having a _____ bond or _____ bond between two _____ atoms are called _____ HYDROCARBONS.
- The _____ hydrocarbons containing a carbon-carbon _____ bond are called '_____'.

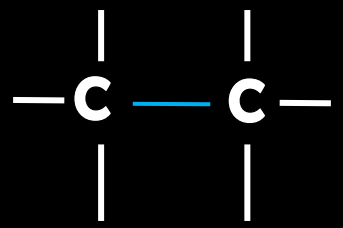
- The _____ hydrocarbons whose structures contain a carbon-carbon _____ bond are called '_____'.
- Generally the _____ compounds are more _____ than the _____ compounds.

HYDROCARBONS

Open chain hydrocarbon

SATURATED

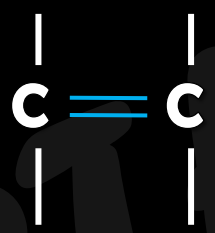
Alkane



C_nH_{2n+2}

UNSATURATED

Alkene

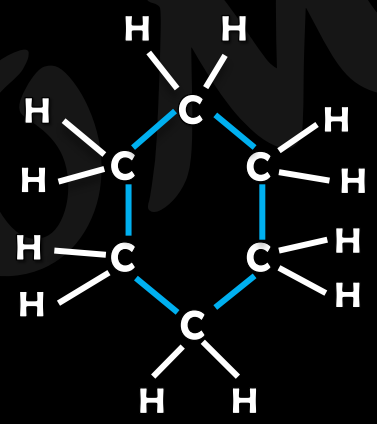


C_nH_{2n}

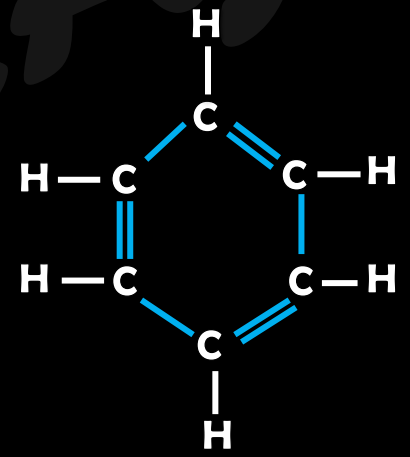
Alkyne

C_nH_{2n-2}

Closed-chain/ring/ cyclic hydrocarbon



Cyclohexane



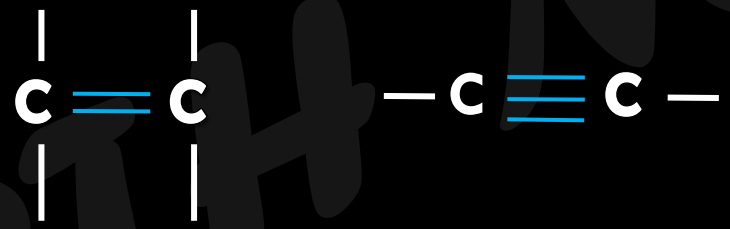
Benzene

HYDROCARBONS

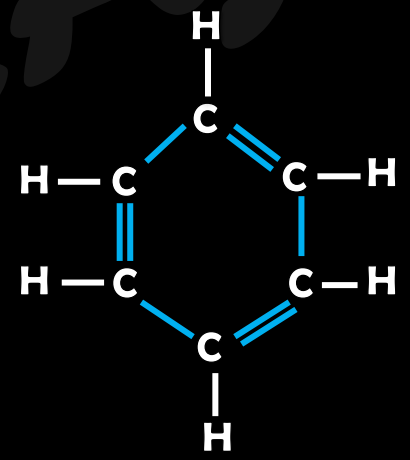
Open chain hydrocarbon

Alkane

UNSATURATED



Cyclohexane

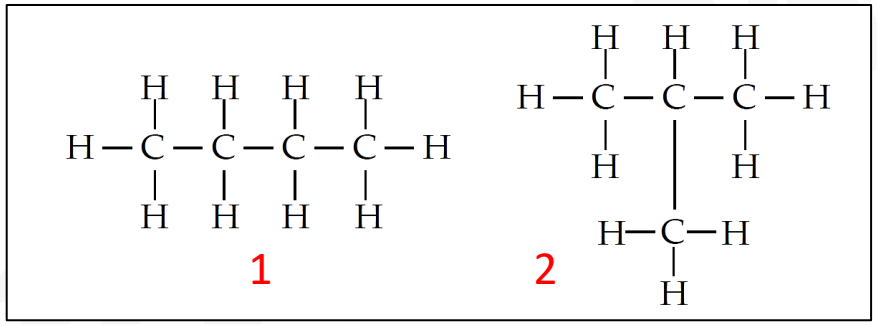


C_nH___

C_nH___

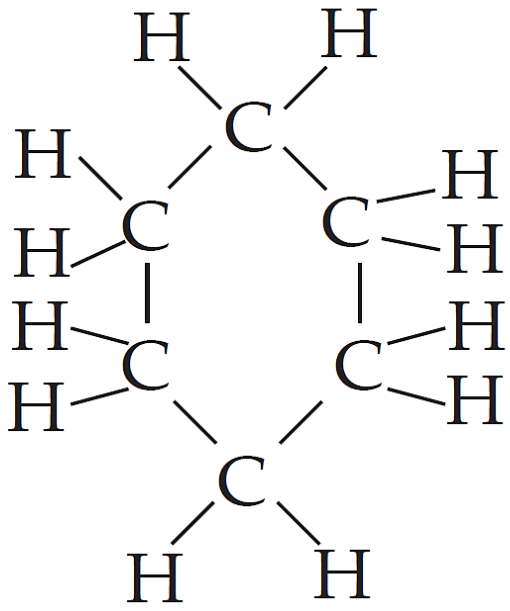
Structural isomerism Page –116

- The phenomenon in which compounds have different structural formulae but have the same molecular formula is called structural isomerism. e.g. Structural formula of compound C_4H_{10}
- The carbon chain in the figure 1 is a straight chain of carbon atoms, whereas the carbon chain in figure 2 is a branched chain of carbon atoms.

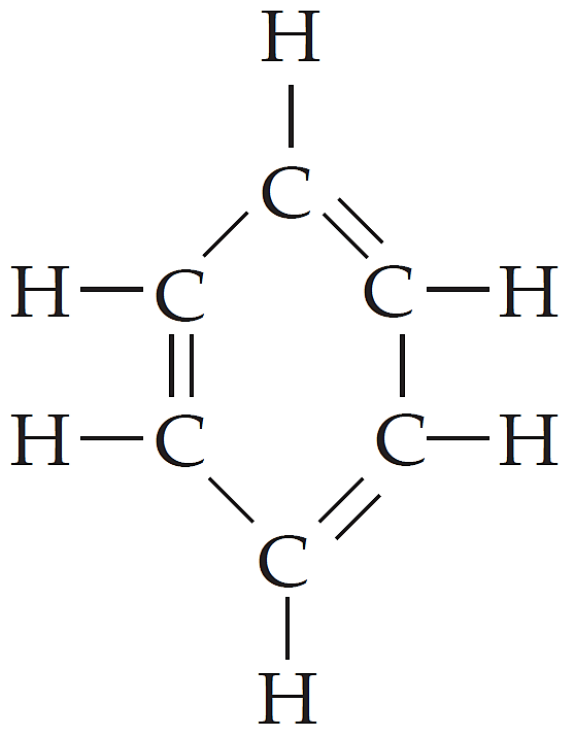


- Apart from the straight chains and branched chains, closed chains of carbon atoms are present in some carbon compounds. Where in rings of carbon atoms form.

- For example, the molecular formula of cyclohexane is C_6H_{12} and its structural formula contains a ring of six carbon atoms.
- Benzene is a cyclic unsaturated hydrocarbon. There are three alternate double bonds in the six membered ring structure of benzene. The compounds having this characteristic unit in their structure are called aromatic compounds.



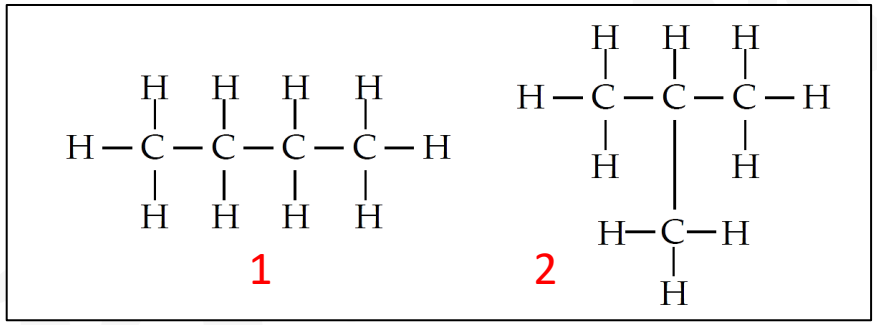
Cyclohexane



benzene

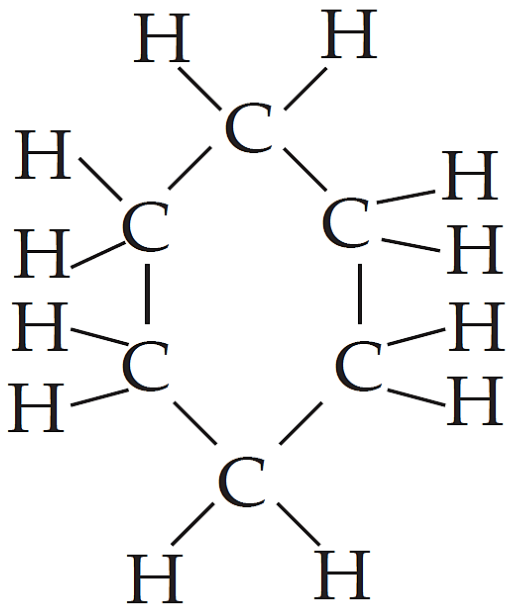
Structural isomerism Page –116

- The _____ in which compounds have different _____ formulae but have the same _____ formula is called _____. e.g. Structural formula of compound _____
- The carbon chain in the figure 1 is a _____ chain of carbon atoms, whereas the carbon chain in figure 2 is a _____ chain of carbon atoms.

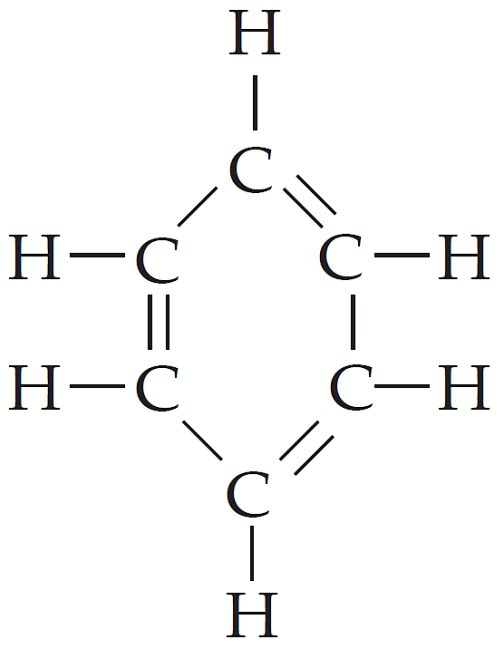


- Apart from the _____ chains and _____ chains, _____ chains of carbon atoms are present in some carbon compounds. Where in _____ of carbon atoms form.

- For example, the _____ formula of _____ is C_6H_{12} and its _____ formula contains a _____ of six _____ atoms.
- _____ is a _____ unsaturated hydrocarbon. There are _____ alternate _____ bonds in the ____ membered ____ structure of _____. The compounds having this _____ unit in their structure are called _____ compounds.



Cyclohexane



benzene

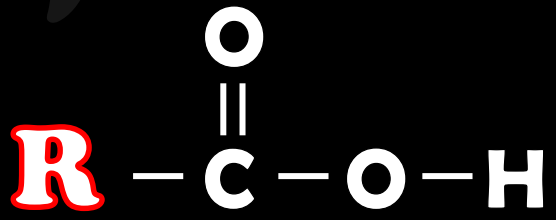
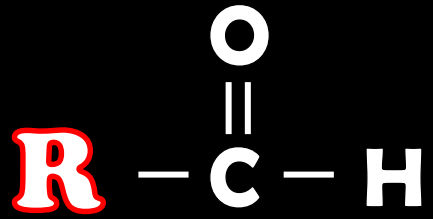
Functional Groups in Carbon Compounds

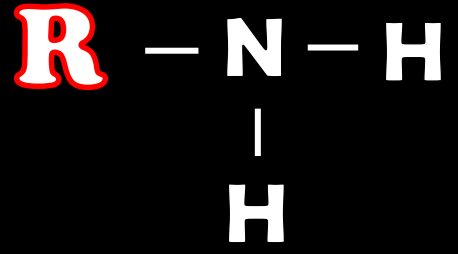
Page –117

- Many types of carbon compounds are formed by formation of bonds of carbon with other elements such as halogens, oxygen, nitrogen, sulphur.
- The atoms of these elements substitute one or more hydrogen atoms in the hydrocarbon chain and thereby the tetravalency of carbon is satisfied.
- The atom of the element which is substitute for hydrogen is referred to as a hetero atom.
- Sometimes hetero atoms are not alone but exist in the form of certain groups of atoms.
- The compound acquire specific chemical properties due to these hetero atoms or the groups of atoms that contain heteroatoms, irrespective of the length and nature of the carbon chain in that compound. Therefore these hetero atoms or the groups of atoms containing hetero atoms are called functional groups.
- The **carbon- carbon double and triple bonds** are also recognised as functional groups as the respective compounds get specific chemical properties due to them.

Functional Groups in Carbon Compounds Page –117

- Many types of _____ compounds are formed by _____ of bonds of _____ with other _____ such as _____, _____, nitrogen, _____.
- The _____ of these elements _____ one or more _____ atoms in the _____ chain and thereby the _____ of carbon is _____.
- The _____ of the element which is _____ for _____ is referred to as a _____ atom.
- Sometimes _____ atoms are not _____ but exist in the form of certain _____ of atoms.
- The _____ acquire specific _____ properties due to these _____ atoms or the _____ of atoms that contain _____, irrespective of the _____ and _____ of the carbon chain in that compound. Therefore these _____ atoms or the _____ of atoms containing _____ atoms are called _____ groups.
- The **carbon- carbon _____ and _____ bonds** are also recognised as _____ groups as the respective compounds get _____ properties due to them.

Hetero atom	Functional group		
	Name	General formula	Condensed General formula
Halogen F, Cl, Br, I	Halo Chloro, Bromo, Fluoro, Iodo	 - Cl, - Br, - F, - I	
Oxygen	1) Alcohol		
	2) Carboxylic acid		
	3) Aldehyde		

Hetero atom	Functional group		
	Name	General formula	Condensed General formula
Oxygen	4) Ketone		$R-CO-R'$
	5) Ether	$R-O-R'$	$R-O-R'$
	6) Ester		$R-COO-R'$
Nitrogen	Amine		$R-NH_2$

Homologous series Page –118

- We have seen that chains of different length are formed by joining the carbon atoms to each other.
- Moreover we have also seen that a functional group can take place of a hydrogen atom on these chains.
- As a result of this, large number of compounds are formed having the same functional groups but different length of carbon chain.
- For example, there are many compounds such as CH_3-OH, CH_3-CH_2-OH, CH_3-CH_2-CH_2-OH, CH_3-CH_2-CH_2-CH_2-OH which contain alcohol as the functional group.
- Though the length of the carbon chains in them is different, their chemical properties are very much similar due to the presence of the same functional group in them.

- The series of compounds formed by joining the same functional group in the place of a particular hydrogen atom on the chains having sequentially increasing length is called homologous series. All the members of the homologous series are homologues of each other.
- While going from one member to the next in a homologous series.

a. One methylene (-CH_2-) unit gets added.

b. molecular mass increases by 14 u.

c. number of carbon atoms increases by one.

- Chemical properties of members of a homologous series show similarity.
- While going in an increasing order in any homologous series the physical properties show variation in one direction, that is, a gradation is observed in the physical properties.
- All the members of a homologous series can be represented by the same general molecular formula.

Homologous series Page –118

- We have seen that _____ of different _____ are formed by joining the _____ atoms to each other.
- Moreover we have also seen that a _____ group can take place of a _____ atom on these _____.
- As a result of this, _____ number of _____ are formed having the same _____ groups but _____ length of _____.
- For example, there are many compounds such as _____, CH_3-CH_2-OH, _____, CH_3-CH_2-CH_2-CH_2-OH which contain _____ as the _____ group.
- Though the _____ of the carbon chains in them is _____, their _____ properties are very much _____ due to the presence of the same _____ group in them.

- The _____ of compounds formed by _____ the same _____ group in the place of a particular _____ atom on the chains having _____ increasing _____ is called _____ series. All the _____ of the _____ series are _____ of each other.
- While going from one _____ to the _____ in a homologous series.

a. One _____ ($-CH_2-$) unit gets _____.

b. _____ mass increases by ____ u.

c. number of _____ atoms _____ by _____.

- _____ properties of members of a _____ series show _____.
- While going in an _____ order in any _____ series the _____ properties show _____ in one direction, that is, a _____ is observed in the _____ properties.
- All the members of a _____ series can be represented by the same _____ formula.

Chemical Properties of Carbon Compounds Page –123

1. Combustion : Hydrocarbons as well as most of the carbon compounds under goes combustion in presence of oxygen to emit heat and light and form carbon dioxide and water as the common products.

- Ethanol (C_2H_5OH) is a saturated carbon compound, while naphthalene ($C_{10}H_8$) is an unsaturated compound.
- Generally saturated carbon compounds burn with a clean blue flame while unsaturated carbon compounds burn with a yellow flame and release black smoke.
- Comparison of the molecular formulae indicates that the proportion of carbon is larger in unsaturated compounds than in saturated compounds. As a result, some unburnt carbon particles are also formed during combustion of unsaturated compounds.

- While in the flame, these hot carbon particles emit yellow light and therefore the flame appears yellow.

2. Oxidation Page –124

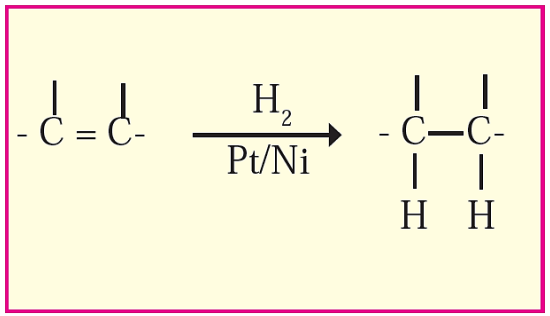
- Substances that can give oxygen to other substances are called oxidants or oxidizing agents.
- Potassium permanganate or potassium dichromate are commonly used as oxidizing agents.
- Ethanol gets oxidised by alkaline potassium permanganate to form ethanoic acid.
- On adding the pink coloured solution of potassium permanganate to ethanol, the pink colour disappears in the beginning.
- This is because potassium permanganate is used up in the oxidation reaction. At a certain point of the addition, oxidation of all the quantity of ethanol in the test tube is complete.
- If the addition of potassium permanganate is continued beyond this point, it is not used up and becomes excess.

- The pink colour of this excess potassium permanganate does not vanish but stays as it is.

3. Addition Reaction Page –125

- When a carbon compound combines with another compound to form a product that contain all the atoms in both the reactants, it is called an addition reaction.
- Unsaturated compounds contains a multiple bond as their functional group. They undergo addition reaction to form a saturated compound as the product.
- The addition reaction of an unsaturated compound with iodine or bromine takes place instantaneously at room temperature. Moreover the colour change can be felt by eyes.
- Therefore this reaction is used as a test for detection of a multiple bond in a carbon compound.
- The colour of iodine disappears in the reaction between an oil and iodine, however, there is no colour change with Vanaspati ghee.

- The unsaturated compound can also undergo addition reaction with hydrogen to form a saturated compound.
- However, it is necessary to use a catalyst like platinum or nickel for this reaction. We have already seen that catalyst is such a substance due to presence of which rate of reaction changes without causing any disturbance to it.



- This reaction is used for hydrogenation of vegetable oils in presence of nickel catalyst.
- We have seen that iodine test indicates presence of multiple bonds (double bond in particular) in the molecules of oils while Vanaspati ghee is found to be saturated.
- The molecules of vegetable oil contain long and unsaturated carbon chains. Hydrogenation transforms them into saturated chains and thereby Vanaspati ghee is formed.

- Unsaturated fats containing double bonds are healthy while saturated fats are harmful to health.

4. Substitution reaction Page –126

- As the single bonds C-H and C-C are very strong, the saturated hydrocarbons are not reactive, and therefore they remain inert in presence of most reagents.
- However, saturated hydrocarbons, in presence of sunlight react rapidly with chlorine.
- In this reaction chlorine atoms replace, one by one, all the hydrogen atoms in the saturated hydrocarbon.
- The reaction in which the place of one type of atom / group in a reactant is taken by another atom / group of atoms, is called substitution reaction.
- Chlorination of methane, is a substitution reaction which gives four products.

Chemical Properties of Carbon Compounds Page –123

1. Combustion : _____ as well as most of the _____ compounds under goes _____ in presence of _____ to emit _____ and light and form _____ dioxide and _____ as the common products.

- _____ (C_2H_5OH) is a _____ carbon compound, while _____ ($C_{10}H_8$) is an _____ compound.
- Generally _____ carbon compounds _____ with a clean ____ flame while _____ carbon compounds _____ with a _____ flame and release _____ smoke.
- Comparison of the _____ formulae indicates that the _____ of carbon is _____ in _____ compounds than in _____ compounds. As a result, some _____ carbon particles are also formed during _____ of _____ compounds.

- While in the flame, these _____ carbon particles _____ yellow _____ and therefore the _____ appears _____.

2. Oxidation Page –124

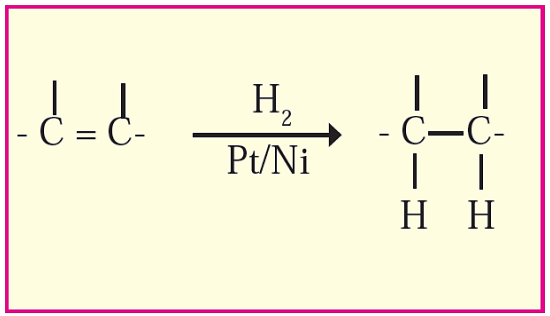
- _____ that can give _____ to other substances are called _____ or _____ agents.
- _____ or potassium _____ are commonly used as _____ agents.
- _____ gets oxidised by _____ potassium _____ to form _____ acid.
- On adding the _____ coloured solution of potassium _____ to _____, the pink colour _____ in the _____.
- This is because potassium _____ is _____ up in the _____ reaction. At a certain point of the _____, _____ of all the quantity of _____ in the test tube is _____.
- If the _____ of potassium _____ is _____ beyond this point, it is not _____ up and becomes _____.

- The _____ colour of this ____ potassium _____ does not _____ but ____ as it is.

3. Addition Reaction Page –125

- When a _____ compound _____ with another _____ to form a _____ that contain all the _____ in both the _____, it is called an _____ reaction.
- _____ compounds contain a _____ bond as their _____ group. They undergo _____ reaction to form a _____ compound as the _____.
- The _____ reaction of an unsaturated compound with _____ or _____ takes place _____ at room temperature. Moreover the _____ change can be ____ by ____.
- Therefore this reaction is used as a _____ for _____ of a _____ bond in a carbon compound.
- The colour of _____ disappears in the reaction between an _____ and _____, however, there is no _____ change with _____.

- The _____ compound can also undergo _____ reaction with _____ to form a _____ compound.
- However, it is necessary to use a _____ like _____ or nickel for this reaction. We have already seen that _____ is such a substance due to _____ of which _____ of reaction _____ without causing any _____ to it.



- This reaction is used for _____ of _____ oils in presence of _____ catalyst.
- We have seen that _____ test indicates presence of _____ bonds (____ bond in particular) in the _____ of _____ while _____ ghee is found to be _____.
- The molecules of _____ oil contain _____ and _____ carbon chains. _____ transforms them into _____ chains and thereby Vanaspati _____ is formed.

- _____ fats containing _____ bonds are healthy while _____ fats are harmful to _____.

4. Substitution reaction Page –126

- As the single bonds _____ and _____ are very strong, the _____ hydrocarbons are not _____, and therefore they remain _____ in presence of most _____.
- However, _____ hydrocarbons, in presence of _____ react rapidly with _____.
- In this reaction _____ atoms replace, ____ by ____, all the _____ atoms in the saturated hydrocarbon.
- The reaction in which the _____ of one type of _____ / group in a _____ is taken by another _____ / ____ of atoms, is called _____ reaction.
- _____ of methane, is a _____ reaction which gives _____ products.

Important carbon compounds : Ethanol and Ethanoic Acid

- At room temperature colourless ethanol is a liquid and its boiling point is 78 ^{0}C.
- Generally ethanol is called alcohol or spirit. Ethanol is soluble in water in all proportions.
- When aqueous solution of ethanol is tested with litmus paper it is found to be neutral.
- Consumption of small quantity of dilute ethanol shows its effect, even though is condemned still it has remained socially widespread practice.
- Consumption of alcohol harms health in a number of ways. It adversely affects the physiological processes and the central nervous system.
- Consumption of even a small quantity of pure ethanol (called absolute alcohol) can be lethal.
- Ethanol being good solvent, it is used in medicines such as tincture iodine (solution of iodine and ethanol), cough mixture and also in many tonics.

Chemical properties of ethanol

(i) Reaction with sodium

All the alcohols react with sodium metal to liberate hydrogen gas and form sodium alkoxide salts. In the reaction of ethanol with sodium metal, hydrogen gas and sodium ethoxide are formed as products.

(ii) Dehydration reaction : When ethanol is heated at the temperature 170 ^{0}C with excess amount of concentrated sulphuric acid, one molecule of water is removed from its molecule to form ethene, an unsaturated compound. Here, concentrated sulphuric acid acts as a dehydrating agent.

Important carbon compounds : Ethanol and Ethanoic Acid

Page –127

- At room _____ colourless _____ is a _____ and its _____ point is ___ ^{0}C.
- Generally _____ is called _____ or _____. Ethanol is _____ in water in all _____.
- When _____ solution of _____ is tested with _____ paper it is found to be _____.
- Consumption of _____ quantity of dilute _____ shows its effect, even though is _____, still it has remained _____ widespread practice.
- Consumption of _____ harms _____ in a number of ways. It _____ affects the _____ processes and the _____ nervous system.
- Consumption of even a ____ quantity of ___ ethanol (called _____ alcohol) can be _____.
- Ethanol being good _____, it is used in _____ such as _____ (solution of iodine and ethanol), _____ mixture and also in many _____.

Chemical properties of ethanol

(i) Reaction with sodium

All the _____ react with sodium metal to liberate _____ gas and form _____salts. In the reaction of _____ with _____ metal, _____ gas and _____are formed as products.

(ii) Dehydration reaction : When _____ is heated at the temperature _____ ^{0}C with excess amount of _____ _____ acid, one molecule of _____ is removed from its molecule to form _____, an _____ compound. Here, concentrated _____ acid acts as a _____ agent.

Chemical Properties of ethanoic Acid Page –129

Ethanoic acid contain carboxylic acid as its functional group. The chemical reaction of ethanoic acid are mainly due to this functional group.

i. Reaction with base

a. A reaction with strong base

Ethanoic acid gives neutralization reaction with a strong base sodium hydroxide to form a salt and water.

b. Reaction with carbonate and bicarbonate

Ethanoic acid reacts with basic salts, namely, Sodium carbonate and Sodium bicarbonate to form a salt , named sodium ethanoate, water and carbon dioxide gas.

ii. Esterification Reaction : Page –130

- Substances having ester as the functional group are formed by reaction between a carboxylic acid and an alcohol. Ethanoic acid reacts with ethanol in presence of an acid catalyst and ester, ethyl ethanoate is formed.
- Esters have sweet odour. Majority of fruits owe their odour to a particular ester present in them.
- Esters are used for making fragrances and flavouring agents.
- When an ester is reacted with the alkali sodium hydroxide, the corresponding alcohol and carboxylic acid (in the form of its sodium salt) are obtained back. T
- his reaction is called saponification reaction, as it is used for preparation of soap from fats.

$$\text{Ester} + \text{Sodium hydroxide} \longrightarrow \text{Sodium Carboxylate} + \text{Alcohol}$$

Chemical Properties of ethanoic Acid Page –129

Ethanoic acid contain _____ acid as its _____ group. The chemical reaction of ethanoic acid are mainly due to this _____ group.

i. Reaction with base

a. A reaction with strong base

Ethanoic acid gives _____ reaction with a strong _____ sodium _____ to form a _____ and _____.

b. Reaction with carbonate and bicarbonate

Ethanoic acid reacts with _____ salts, namely, Sodium _____ and Sodium _____ to form a _____ , named sodium _____, _____ and _____ gas.

ii. Esterification Reaction : Page –130

- Substances having _____ as the _____ group are formed by reaction between a _____ acid and an _____. _____ acid reacts with _____ in presence of an acid _____ and ester, _____ is formed.
- Esters have _____ odour. Majority of _____ owe their _____ to a particular ester present in them.
- Esters are used for making _____ and _____ agents.
- When an ester is reacted with the _____ sodium _____, the corresponding _____ and _____ acid (in the form of its _____ salt) are obtained back.
- This reaction is called _____ reaction, as it is used for preparation of _____ from _____.

$$\text{Ester} + \text{Sodium hydroxide} \longrightarrow \text{Sodium Carboxylate} + \text{Alcohol}$$

Carbon Compounds

$C + O_2 \rightarrow$

(Carbon)

$CH_4 + O_2 \rightarrow$

(methane)

$CH_3\text{-}CH_2\text{-}OH + O_2 \rightarrow$

(Ethanol)

$$CH_3 - CH_2 - OH \xrightarrow[\text{alkaline } KMnO_4]{(O)}$$

(ethanol)

$$-\overset{|}{C} = \overset{|}{C}- \xrightarrow[Pt/Ni]{H_2}$$

$$CH_4 + Cl_2 \xrightarrow{\text{Sunlight}}$$

$$CH_3Cl + Cl_2 \xrightarrow{\text{Sunlight}}$$

$$CH_2Cl_2 + Cl_2 \xrightarrow{\text{Sunlight}}$$

$$CHCl_3 + Cl_2 \xrightarrow{\text{Sunlight}}$$

Ethanol:

$$Na + \quad CH_3\text{-}CH_2\text{-}OH \longrightarrow$$

$$CH_3\text{-}CH_2\text{-}OH \xrightarrow[\text{conc. } H_2SO_4]{170^0C}$$

Ethanoic acid:

$$CH_3\text{-}COOH + NaOH \rightarrow$$

(Acid) (Base)

$$CH_3COOH\ (aq) + Na_2CO_3\ (g) \rightarrow$$

$$CH_3COOH + NaHCO_3 \rightarrow$$

$$\underset{\text{(Ethanoic acid)}}{CH_3\text{-}COOH} + \underset{\text{(Ethanol)}}{CH_3\text{-}CH_2\text{-}OH} \xrightarrow[\text{Catalyst}]{\text{Acid}}$$