ACIDS, BASES AND SALTS

Acid: is a compound which when dissolved in water produces hydronium ion as the cation.

Classification of acids:

Based on strength

STRONG ACID	WEAK ACID
• An acid which dissociates **almost completely** in aqueous solution to produce a **high** concentration of hydronium ions is called **STRONG ACID** • A solution of strong acid contains almost **only** ions • A solution of strong acid is a good conductor of electricity Ex: dil. HCl, dil. HNO_3, Dil. H_2SO_4	• An acid which dissociates **partially** in aqueous solution to produce a **low** concentration of hydronium ions is called **WEAK ACID** • A solution of weak acid contains ions and molecules. • A solution of weak acid is poor of electricity EX: CH_3COOH, H_2CO_3

Based on Basicity:

Basicity of an acid: The number of $[H_3O]^+$ /H^+ produced per molecule of an acid on dissociation in aqueous solution.

Monobasic acid: is an acid which produces **one** $[H_3O]^+$ /H^+ produced per molecule of an acid on dissociation in aqueous solution.

EX: hydrochloric acid, nitric acid, acetic acid

$HCl_{(aq)} \longleftrightarrow [H_3O]^+ + Cl^-$

$HNO_3 + H2O \longleftrightarrow [H_3O]^+ + NO_3^-$

Dibasic acid: is an acid which produces **two** $[H_3O]^+ / H^+$ per molecule of an acid on dissociation in aqueous solution.

EX: sulphuric acid, carbonic acid

$H_2SO_4 + H_2O \longleftrightarrow [H_3O]^+ + HSO_4^-$

$HSO_4^- + H_2O \longleftrightarrow [H_3O]^+ + SO_4^{-2}$

$H_2SO_4 + 2\,H_2O \rightarrow 2[H_3O]^+ + SO_4^{-2}$

Tribasic acid: is an acid which produces **three** $[H_3O]^+ / H^+$ per molecule of an acid on dissociation in aqueous solution/contains 3 replaceable hydrogen ions.

Ex: phosphoric acid $[H_3PO_4]$

Physical properties of acids:

- Sour to taste
- Strong acids are highly corrosive
- Action on indicators- Blue litmus turns red
  Red litmus paper remains red
  Orange methyl orange turns red/pink

Chemical properties of dilute acids:

1. **Reaction with active metals to liberate H_2**

$Zn + 2$ dil. $HCl \rightarrow ZnCl_2 + \mathbf{H_2}\uparrow$

Fe + dil. $H_2SO_4 \rightarrow FeSO_4 + \mathbf{H_2}\uparrow$

2. Reaction with base to form salt and water:

$NaOH + HCl \rightarrow NaCl + H_2O$

3. Reaction with metallic carbonates/bicarbonates to liberate CO_2:

$CaCO_3 + 2$ dil. $HCl \rightarrow CaCl2 + H2O + \mathbf{CO_2}$

$NaHCO_3 +$ dil. $HNO_3 \rightarrow NaNO_3 + H2O + \mathbf{CO_2}$

4. Reaction with metallic sulphites to liberate SO_2:

$Na_2SO_3 + 2$Dil $HCl \rightarrow 2NaCl + H_2O + \mathbf{SO_2}$

5. Reaction with metallic sulphides to liberate H_2S:

$Na_2S + 2$dil.$HCl \rightarrow 2NaCl + \mathbf{H_2S}$

TYPICAL ACID PROPERTIES:

Reactants	Products	**Gas liberated**	**Colour of the gas liberated**	**Odour of the gas liberated**
Metal + dil. acid	Salt + H_2	**H_2**	**colourless**	**odourless**
Acid + Base	Salt + water	**-**	**-**	**-**
Metallic carbonates/ bicarbonates + acid	Salt + water + CO_2	**CO_2**	**Colourless**	**Odourless**
Metallic sulphites + acid	Salt + water + SO_2	**SO_2**	**Colourless**	**Pungent choking odour**
Metallic sulphides + acid	Salt + H_2S	**H_2S**	**Colourless**	**Rotten egg odour**

Complete the following equations:

1. NaHCO3 + HCl →
2. FeS + dil. HCl →
3. K_2SO_3 + H_2SO_4 →
4. Al + dil. HCl →
5. HNO_3 + NaOH →
6. Fe + dil. H_2SO_4 →

To differentiate between CO_2 and SO_2

Reagent used	**CO_2**	**SO_2**
Moist blue litmus paper	Moist blue litmus paper turns red	Moist blue litmus paper turns red
Pass the gas through lime water	Lime water turns milky $Ca(OH)_2$ + CO_2→ $CaCO_3$ + H2O	Lime water turns milky $Ca(OH)_2$ + SO_2→ $CaSO_3$ + H_2O
Pink $KMnO_4$ solution	Pink $KMnO_4$ soln remains pink	Pink $KMnO_4$ soln turns colourless
Orange acidified $K_2Cr_2O_7$ paper	Orange acidified $K_2Cr_2O_7$ paper remains orange	Orange acidified $K_2Cr_2O_7$ paper turns green

Identification of H_2S gas:

1. H_2S is colourless gas with pungent odour of rotten egg.
2. When white lead nitrate paper is brought near the mouth of test tube containing H_2S gas, white lead nitrate paper turns **silvery black.**

   $Pb(NO_3)_2$ + H_2S → PbS ↓ + $2HNO_3$

Silvery black

3. When white lead acetate paper is brought near the mouth of test tube containing H_2S gas, white lead acetate paper turns silvery black.

$$Pb(CH_3COO)_2 + H_2S \rightarrow \underset{\text{Silvery black}}{\downarrow PbS} + 2CH_3COOH$$

Base: A compound which reacts with hydronium ion of an acid to form salt and water is called **Base.**

All oxides and hydroxides of metals including ammonium hydroxide are called Bases.

Ex: NaOH, KOH, $Ca(OH)_2$, $Fe(OH)_2$, Al_2O_3, $Pb(OH)_2$ CaO

Alkali: Bases which are soluble in water are called **Alkali**

EX: NaOH, KOH, $Ca(OH)_2$, NH_4OH LiOH

Classification of alkali based on strength

STRONG ALKALI	**WEAK ALKALI**
An alkali which dissociates almost completely in aqueous solution to produce a high concentration of hydroxyl/hydroxide ions. A solution of strong alkali contains almost only ions and hence is a good conductor of electricity Ex: NaOH, KOH, LiOH, Na_2O, K_2O	An alkali which dissociates partially in aqueous solution to produce a low concentration of hydroxyl/ hydroxide ions. A solution of weak alkali contains ions and molecules and hence is a poor conductor of electricity. Ex: NH_4OH, $Ca(OH)_2$

Acidity of Base: The number of hydroxyl ion produced per molecule of a base on dissociation in aqueous solution.

Monoacidic base – NaOH, KOH

Diacidic base – $Ca(OH)_2$,

Triacidic base – $Al(OH)_3$

Physical properties of bases:

1. Bases are bitter to taste
2. Solution of alkali is soapy to touch
3. Action on indicators-

   Turns red litmus blue

   Blue litmus remains blue

   Orange methyl orange yellow

   Colourless phenolphthalein turns pink
4. A solution of strong alkali is corrosive

   Ex : NaOH (caustic soda), KOH (caustic potash)

Chemical properties of bases:

1. Reaction with acids to form salt and water

   $CaO + 2dil.\ HCl \rightarrow CaCl_2 + H_2O$

   $Cu(OH)_2 + dil.\ H_2SO_4 \rightarrow CuSO_4 + 2H_2O$

2. Reaction of alkali with salts of heavy metals:

   $FeSO_4 + 2NaOH \rightarrow Fe(OH)_2\downarrow + Na_2SO_4$

   dirty green ppt

   $FeCl_3 + 3NH_4OH \rightarrow Fe(OH)_3\downarrow + 3NH_4Cl$

   reddish brown ppt

   $Pb(NO_3)_2 + NaOH \rightarrow Pb(OH)_2\downarrow + NaNO_3$

   chalky white ppt

3. Reaction of alkali with ammonium salts to liberate ammonia:

$NH_4Cl + NaOH \rightarrow NaCl + H_2O + NH_3$

SALTS : A compound formed by partial or complete replacement of replaceable hydrogen ion of an acid by a basic radical(metallic ion/ammonium ion) is called Salt.

$NaOH + HCl \rightarrow NaCl + H_2O$

Classification of salts:

1. Normal salt – A salt formed by complete replacement of replaceable hydronium ion of an acid by basic radical.

   $NaOH + HCl \rightarrow \underline{NaCl} + H_2O$

   EX; KNO_3, $FeCl_3$, $CaSO_4$, $MgCO_3$

2. Acid salt – A salt formed by partial replacement of replaceable hydrogen ion of an acid by basic radical.
   Ex; $NaHCO_3$ $KHSO_3$ $Ca(HCO_3)_2$

3. Basic salt - A salt formed by partial replacement of replaceable hydroxyl ion of diacidic or triacidic base by an acid radical
   Ex; Cu(OH)Cl

SOLUBILITY OF SALTS IN WATER:

1. All sodium, potassium and ammonium salts are soluble in water.
2. All nitrates are soluble in water.
3. All chlorides are soluble in water **except $PbCl_2$, AgCl**

4. All sulphates are soluble in water **except $BaSO_4$, $PbSO_4$, $CaSO_4$**
5. All carbonates are insoluble in water except Na_2CO_3, K_2CO_3
6. All hydroxides, oxides, sulphides are insoluble in water.

Action of acid/alkali on indicators:

Indicator	Acid	Alkali
Blue litmus	Blue litmus turns red	Blue litmus remains blue
Red litmus	Red litmus remains red	Red litmus turns blue
Orange methyl orange	Orange methyl orange turns red/pink	Orange methyl orange turns yellow
Phenolphthalein	Colourless phenolphthalein remains colourless	Colourless phenolphthalein turns pink

2. Universal Indicators- not only indicate if a given solution is acidic or alkaline but also indicate the strength of acid or alkali.

Salt: A compound formed by partial or complete replacement of replaceable hydrogen ion of an acid by a basic radical is called Salt

Example: NaOH + HCl NaCl + H2O

Other examples are: NaHCO3, KNO3, CaSO4, MgCl2 etc.

Types of salts :

1. Normal salt : A salt formed by complete replacement of replaceable hydrogen ion of an acid by a basic radical.

Example: NaCl, KNO3, CaCO3

2. Acid salt: A salt formed by partial replacement of replaceable hydrogen ion of an acid by basic radical.

Example: NaHCO3, NaHSO3, KHSO4

3. Basic salt: A salt formed by partial replacement of replaceable hydroxyl ion of a diacidic or triacidic base by a acid radical.

Example: Cu(OH)Cl.

Definitions to remember:

1. Deliquescence: Certain water soluble salts on exposure to the atmosphere absorb moisture, dissolve in it and forms a solution. Such salts are called Deliquescent salts. The phenomenon is called Deliquescence.

Example: $MgCl_2$, $ZnCl_2$ $FeCl_3$,
(NaOH and KOH are also deliquescent)

2. Efflorescence: Certain crystalline hydrated salts on exposure to the atmosphere lose their water of crystallization and turn in powder form or amorphous form. Such salts are called Efflorescent salts. The phenomenon is called Efflorescence.

Example: Blue vitriol (CuSO4 .5H2O), Washing soda(Na2CO3 .10H2O)

3. Hygroscopy : The property of certain substances to absorb moisture from atmosphere/other substances without dissolving in it. These substances are also used as drying agents.

Example: CaO, silica gel, fused $CaCl_2$, Conc. H_2SO_4

4. Drying agents: These are substances that remove physically combined moisture from other substances.

Example: Conc. H_2SO_4, CaO, P_2O_5, silica gel

5. Dehydrating agents: These are substances that remove chemically combined elements of water i.e., H and O in the ratio 2:1.

Example: Conc. H_2SO_4

CHEMICAL BONDING

The force that holds the atoms together in a molecule is called **Chemical bond.**

Atoms of elements tend to gain electrons or lose electrons or share electrons to attain stable octet/duplet configuration.

Types of chemical bonds:

1. Ionic/electrovalent bond
2. Covalent bond

IONIC BOND:

- The type of bond formed by transfer of electrons from one atom to another is called **Ionic or electrovalent bond.**
- Ionic bond occurs between a **metal and a non-metal.**

COVALENT BOND:

- The type of bond formed by sharing of electrons between the combining atoms is called **covalent bond.**
- Bonding occurs between atoms of same element or atoms of different elements with a small difference in electronegativity.
- Covalent bond occurs between nonmetals.

Differences between Ionic compounds and Covalent compounds

Ionic compounds	Covalent compounds
• Generally crystalline solids at room temperature	• Solids or liquids or gases at room temperature

• Ionic compounds have high melting and boiling point • Ionic compounds are generally soluble in water • Conduct electricity in molten state or in aqueous solution	• Covalent compounds have low melting and boiling point • Covalent compounds are insoluble in water • Do not conduct electricity

Give reasons:

1. Ionic compounds have a high melting point/boiling point.
Ionic compounds are made of oppositely charged ions which are held together by strong electrostatic force of attraction. So a lot of energy is required to break the bond and change the state.

2. Covalent compounds have low melting and boiling point.
Covalent compounds are made of molecules and between the molecules there is weak force of attraction. So less energy is required to change the state.

Differences between Polar covalent compounds and Non polar covalent compounds

Polar covalent compounds	Non polar covalent compounds

1. Bonding occurs between atoms of different elements with a large difference in electronegativity	1. bonding occurs between atoms of same element or atoms of different elements with a small difference in electronegativity.
2. Shared pair of electrons are unequally distributed between the combining atoms.	2. Shared pair of electrons are equally distributed.
3. Charge separation takes place.	3. No charge separation occurs.
4. Soluble in water	4. Insoluble in water

Coordinate covalent bond- The type of covalent bond formed by sharing of electrons with both the electrons coming from the same atom.

Ammonium ion $(NH_4)^+$, Hydronium ion $(H_3O)^+$

TRENDS IN PROPERTIES OF ELEMENTS

The elements of one short period of the Periodic Table are given below in order from left to right:-

Li Be B C O F Ne

(i) To which period do these elements belong?
(ii) One element of this period is missing. Which is the missing element and where should it be placed?
(iii) Which one of the elements in this period shows the property of catenation?
(iv) Place the three elements fluorine, beryllium and nitrogen in the order of increasing electronegativity.
(v) Which one of the above elements belongs to the halogen series?

Complete the following sentences choosing the correct word or words from those given in brackets at the end of each sentence-

1. The properties of the elements are a periodic function of their ..... (atomic number, mass number, relative atomic mass)

2. Moving across a ..... of the Periodic Table the elements show increasing ..... character (group, period, metallic, non-metallic)

3. The element at the bottom of a group would be expected to show ..... metallic character than the element at the top (less, more)

4. The similarities in the properties of a group of elements is because they have the same ..... (electronic configurations, number of outer electrons, atomic numbers

5. The atomic size ..... as we move from left to right across the period, because the .....increases but the ..... remains the same.

6. The element below sodium in the same group would be expected to have a ..... (lower/higher) electronegativity than sodium and the Y element above chlorine would be expected to have a ..... (lower/higher) ionization potential than chlorine.

7. On moving from left to right in a given period, the number of shells _____ (remains the same/increases/decreases).

8. On moving down a group, the number of valence electrons _____(remains the same/increases/decreases).

9. If an element has a low ionization energy then it likely to be _____

(metallic/non metallic).

10. If an element has seven electrons in its outermost shell then it is likely to have the _____(largest/smallest) atomic size among all the elements in the same period

11. Metals have ------ ionisation potential. (low/ high)

12. Group 18 elements have ------ valence electrons (4 / 8) with the exception of ----

(He / Ne) with -------- electrons (2 / 8) in valence shell.

13. Group 2 elements are called ----- metals (alkali / alkaline earth).

14. Across a period, the ionization potential _____ [decreases/ increases/ remains the same]

15. Down the group, electron affinity _____ [increases/ decreases/ remains the same]

16. In the periodic table alkali metals are placed in the group _____ [1/11/17/18]

17. Which of the following properties do not match with elements of the halogen family? _____ [they have seven electrons in their valence shell/ they are highly reactive chemically/ they are metallic in nature/ they are diatomic in their molecular form]

18. The group no. and the period no. of the element having three shells and three valence electrons is _____ [3, 3/3, 13/ 3, 15]

What is meant by a Group in the Periodic Table?
Within a Group where would you expect to find the element with:
1. The greatest metallic character?
2. The largest atomic size?
3. State whether the ionization potential increases or decreases on going down a Group.
4. How many elements are there in Period 2?
5. Write the formula of the sulphate of the element with number 13.
6. What type of bonding will be present in the oxide of the element with atomic number 13.
7. Name the element which has the highest ionization potential.
8. How many electrons are present in the valency shell of the element with the atomic number 18?

9. What is the name given to the energy released when an atom in its isolated gaseous state accepts an electron to form an anion?
10. What is the electronic configuration of the element in the third period which gains one electron to change into an anion?

The electronegativities (according to Pauling) of the elements in period 3 of the Periodic Table are as follows with the elements arranged in alphabetical order:

Al	Cl	Mg	Na	P	S	Si
1.5	3.0	1.2	0.9	2.1	2.5	1.8

Arrange the elements in the order in which they occur in the Periodic Table from left to right.
(The group 1 element first, followed by the group 2 element and so on, up to group 7.)

A group of elements in the Periodic Table are given below (Boron is the first member of the group and Thallium is the last.)
Boron
Aluminium
Gallium
Indium
Thallium
Answer the following questions in relation to the above group of elements:-
(i) Which element has the most metallic character?
(ii) Which element would be expected to have the highest electro-negativity?
(iii) If the electronic configuration of Aluminium is 2, 8, 3, how many electrons are there in the outer shell of Thallium?
(iv) The atomic number of Boron is 5. Write the chemical formula of the compound formed when Boron reacts with Chlorine.
(v) Will the elements in the group to the right of this Boron group be more metallic or less metallic in character? Justify your answer.
Atomic size decreases, nuclear charge increases, nuclear attraction on the outermost shell increases, so the atom loses electron less readily.

The following questions refer to the Periodic Table.
(i) Name the first and last element in period 2.
(ii) What happens to the atomic size of elements moving from top to bottom of a group?
(iii) Which of the elements the has greatest electron affinity among the halogens?
(iv) What is the common feature of the electronic configurations of the elements in group 17?
(v) The metals of Group 2 from top to bottom are: Be, Mg, Ca, Sr, Ba. Which of these metals will form ions most readily and why?

Barium forms ion most readily. Atomic size increases and nuclear attraction on the outermost shell is overcome by increased atomic size. So the atom loses electron more readily.

(vi) What property of an element is measured by electronegativity?

The tendency of an atom to attract _____towards itself when combined in a molecule

Choose the correct option:

1.Among the elements of Period 2, the element which has high electron affinity is
a. Lithium b. Carbon c. Chlorine d. Fluorine

2. The element with the highest ionization potential in the periodic table is:
A He B Ne C Ar D Xe

3.The amount of energy liberated when a neutral gaseous atom gain one electron is called
(a)Ionisation energy (b) electron affinity (c) ionization potential
(d) bond energy

4. The energy required to remove an electron from an isolated gaseous atom is
(a) electron affinity (b)ionization energy (c) ionization potential
(d) bond energy.

5. How does metallic character changes in period from left to right?
(a)increases (b) decreases (c) increases and then decreases
(d) no effect

6.The element having similar properties are placed in same
(a)period (b) group (c) both (d) none of these

7. Size of sodium ion is _____ than sodium atom
(a) smaller (b) equal (c) greater (d)none of these

8. Group II element are known as
(a) halogen (b) inert gas (c) alkalies (d)alkaline earth metal

9. An element X belongs to the 2^{nd} group of periodic table . What is formula of its chlorides?
(a)X_2Cl (b) XCl_2 (c) X_2Cl_2 (d) XCl

10. What is valence electron of last element in 3rd period?
(a) 1 (b) 5 (c) 8 (d) 0

11.What happen to atomic size in group from top to bottom?
(a) decreases (b) increases (c) remans same (d) none of these

12. In F ,Cl, Br ,I, Which one is most reactive?
(a) Br (b) Cl (c) F (d) I

The following questions refer to the periodic table:
(i) Name the second last element of the period
(ii) How many elements are in the second period?
(iii) Name the element which has the highest electron affinity.
(iv) Name the element which has the highest electro negativity.
(v) Name the element which may be placed In group 1 but is not a metal.
(vi) Name the noble gas in period 4**.**

Answer on basis of given periodic table

1	2	13	14	15	16	17	18
Lithium			Carbon		Oxygen		Neon
X			S		G		Q
Y							R
Z							T

1. Which is the most reactive metal?
2. Which is the most reactive non metal 3. Name the family Q,R,T
4. Name one element of **group 2, 13 and 15 -**

Two elements X and Y belongs to group 1 and 2 in same period. Compare them with respect to

(a) valence electron (b) valency © metallic character (d)size of atom
(e) Formula of their oxide

Characteristic	**X**	**Y**
valence electron		
valency		
metallic character		
size of atom		
Formula of their oxide		

The atomic no. of an element is 16 . predict its

(a) valency -**2** (b) group no.- © is it metal or non metal
(d) name the element - S

Define ionization energy – remove the electron
Ionisation energy of an element is 500kj/ mole an of another element is 375kj/mole. Comment about their relative position in Period - as well as Group -

Element X with atomic no. 11 and element Y with atomic no. 16 reacts with hydrogen to form hydrides .
1. Write formula of their hydrides .
2. Which of them will have high melting point and why?

Identify the following:
(a) An element with 4 electrons in its M shell (b) element with half as many electrons in 3rd shell as compared to 2nd shell. ©An alkali metal. (d) An alkaline earth metal.
An element belongs to 4th period and 17th group. Find out
(a) valence electron- (b) valency (c) Name of element
(d) formula of this element with H

Among the following element of 2nd period
Li, Be, B, C , N, O, F , Ne

1. Which has largest atomic size?
2. Which element has the smallest atomic size?
3. Which element has 5 valence electrons?
4. Which element is most electronegative**?**
5. Which element is most metallic?

Give below is a part of periodic table:

Group Period	1	2	3 to 12	13	14	15	16	17	18
1	G								H

2	A			I			B		C
3		D			E				F

Answer on basis of given periodic table

(a)Which element will form only co-valent compound?
(b)Non metal with valency 2 (c) Metal with valency 2 (d)Out of H, C ,F which has largest atomic size?
(e) Give name of family to which H, C , and F belong

Give reasons.

i. Inert gases do not form ions.
ii. Alkali metals are good reducing agents.

In Period 3 of the Periodic table, element 'B' is placed to the left of element 'A'. on the basis of this information, choose the correct word from the brackets to complete the following statements.

i. The element B would have (lower/higher) metallic character than A.
ii. The element A would probably have (lesser/higher) electron affinity than B.
iii. The element A would have (greater/smaller) atomic size than B.

Match the atomic number 2, 4, 8, 15 and 19 with each of the following.

i. A solid non metal belonging to Period 3.
ii. A metal with valency 1.
iii. A gaseous element with valency 2**.**
iv. An element belonging to Group 2**.**
v. A rare gas.

Arrange the following as per the instruction given in the brackets.

i. He, Ar, Ne (increasing order of the number of electron shells)
ii. Na, Li, K (increasing ionization energy)

iii. Na, K, Li (increasing atomic size)

GENETICS

1. Genetics - a branch of biology that deals with the heredity and variation of organisms.

2. Heredity - passing of genetic factors from parents to offspring or from one generation to the next.

3. Variation - small differences among the individual of the same species.

4. Character - heritable feature that varies among individuals.
An example would be flower color, height of the plant

5. Trait a variant for character, such as white or purple colors for flowers.

6. Locus is the specific physical location of a gene on a chromosome.

7. Gene/Factor -A gene is the fundamental, physical, and functional unit of heredity present on a specific location on a chromosome. The genes are made up of a sequence of nucleotides.

8. Allele/Allelomorph - are variants of the same gene that occur at the same place on homologous chromosomes or alleles are pair of genes on
Homologous chromosome that determine the hereditary characteristics.

9. Homozygous condition/Pure breeding - A condition in which factors or genes controlling the character are similar.

10. Heterozygous condition/Hybrid: A condition in which the factors or genes controlling the character are dissimilar.

11. Phenotype: Physical expression of character due to genetic constitution.

12. Genotype : Genetic constitution of an organism.

13. Dominant gene/allele: Factor or gene which expresses itself phenotypically in heterozygous condition.

14. Recessive gene/allele: Factor or gene which remains unexpressed in
heterozygous condition.

15.Monohybrid cross: A cross between two pure breeding individuals with a pair of contrasting traits resulting in a generation that is hybrid for that character.

16. Dihybrid cross: A cross between two pure breeding individuals with two pairs of contrasting traits resulting in a generation that is hybrid for those characters.

17. F-1 generation(First Filial generation) : The hybrid generation formed in monohybrid and dihybrid cross.

18. F-2 generation (Second filial generation) : The generation formed on self pollinating F-1 generation.

19. Mutation: Sudden spontaneous change genetic constitution of an organism which may or may not be inherited.

Ex: **Sickle cell anemia**- is a genetic disease of the RBCs which are disc
shaped (which gives them the flexibility to travel through even the smallest blood vessels) become crescent shape resembling a sickle due to which they get trapped in small vessels. This blocks blood from reaching different parts of the body which causes pain and tissue damage.

Thalassemia is an inherited blood disorder that causes the body to have

less hemoglobin than normal causing anemia, leaving the person fatigued.

Gregor Mendel is called ‘Father of Genetics’

Mendel used garden pea plants [Pisum sativum] to perform expts on genetics.

Reason for using pea plants:

- Annual plants
- Flowers are large and bisexual
- Plants exhibited contrasting traits
- He could carry on artificial pollination

Law of Unit character:

Every character in an individual is controlled a pair of genes/factors, one of which is shared by male parent and the other by female parent.

Law of Dominance:

In a heterozygous condition, the factor/gene which expresses itself phenotypically is called Dominant and the other which remains unexpressed is called Recessive.

For ex: When a pure breeding tall plant is crossed with a pure breeding dwarf plant

Law of Segregation/ I Law of Inheritance:

The factors or genes controlling a character segregate or separate without influencing each other during the formation of gametes in such a way that each gamete gets one gene for that character.

Law of Independent Assortment/II Law of Inheritance:

The factors/genes controlling different characters assort themselves independently without influencing each other during the formation of gametes.

Ex:

Character	Dominant trait	Recessive trait
Colour of the seed	**Yellow colour (YY)**	**Green colour (yy)**
Shape of the seed	**Round (RR)**	**Wrinkled (rr)**

Sex linked diseases

In case of humans, females have similar sex chromosomes- XX whereas the males have two different sex chromosomes -XY.

X chromosome is longer than Y chromosome. A part of the X chromosome has corresponding allele on Y chromosome. That part of X chromosome is called HOMOLOGOUS **region of X chromosome.** The remaining part of X chromosome is called **NON-HOMOLOGOUS region of X chromosome.**

In the **non-homologous region of X chromosome**, if a **defective(recessive) gene** is present, it expresses itself, especially in males due to the absence of corresponding allele on Y chromosome. This is called **Hemizygous condition**

Hemizygous condition is a condition, **especially seen in males**, where certain characters are controlled by a single gene in the absence of its allele. Ex: Hemophilia, Color blindness

Haemophilia: is a condition in which the blood fails to clot normally even if there is a minor wound.
Reason: Gene for clotting of blood is present in the **non -homologous region of X chromosome.**

Gene for normal clotting of blood is a **dominant allele**

Gene for haemophilia is a **recessive allele**.

Therefore, this condition is seen more often in males than in females.

Colour blindness: is a condition in which the person is not able to distinguish primary colours.

Reason: Gene for vision is present in the **non-homologous region of X chromosome.**

Gene for normal vision is a **dominant allele**

Gene for colour blindness is a **recessive allele.**

Therefore, this condition is seen more often in males than in females.

Holandric genes - Genes present on **Y chromosome** and are passed on from father to son. Ex: Hypertrichosis – hair on pinna