GREENWOOD PUBLIC SCHOOL
CLASS 10th (PHYSICS) ELECTRICITY

INTRODUCTION:-Electricity has an important role in modern society. In a span of more than 100 years, electricity has indeed, developed from a mere experimental activity in the laboratory into one of the most convenient and widely used forms a energy in the world. One of the practical advantage of electricity as a from of energy, is that it can readily transmitted over considerable distance with relatively small loss in energy. This makes it possible to supply electricity from a central generating plant to any location.

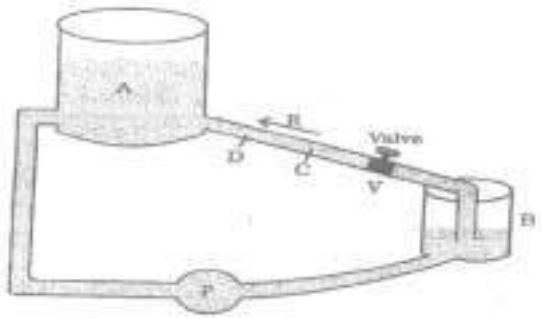
6.1 ELECTRIC CHARGE : When we run our shoed across a carpet and reach for a metal doorknob, we can be zapped by an agoing spark of electricity. The answers to this lie in the branch of Physics called Electrostatics. The word electricity comes from the Greek word electron, which means "amber." Amber is petrified tree resin and it was well known to the ancients that if we rub an amber rod with a piece of cloth, the amber attracts small pieces of dry leaves or paper. A piece of hard rubber, a glass rod or a plastic comb rubbed with cloth also display this "amber effect" or static electricity or frictional electricity as we call it today.

Experiments show that there are exactly two kinds of electric charges :(i) Negative charge(ii) Positive charge This also shows that unlike charges attract each other while like charges repel each other.The S.I. unit of electric charge is coulomb. It is denoted by symbol **C**

6.1 (a) Conductors and Insulators : In some substances, the electric charges can flow easily while in other they cannot. S, all the substances can be divided mainly into two electrical categories: Conductors and insulators.**(i) Conductors :** Those substances through which electric charges can flow, are called conductors. But the flow of electric charges is called electricity. All the metals like silver copper and aluminum etc., are conductors. Carbon, in the form of graphite, is a conductors an the aqueous solution (water solution) of salts are also conductors. The human body is a fairly good conductor. All the conductors (like metals) have some electrons which are loosely held by the nucleus of their atoms. These electrons are called "free electrons" and can move from one atom to another atom throughout the conductor. The presence of "free electrons" in a substance makes it a conductor of electricity.

(ii) Insulators : Those substances through which electric charges cannot flow, are called insulators. In other words, those substances through which electricity cannot flow are called insulators. Glass, ebonite, rubber, most of the plastics, paper, dry wood, cotton, mica, bakelite, and dry air, are all insulators because they do not allow electric charges (or electricity) to flow through them. In the case of charged insulators like glass, ebonite etc., the electric charges remain bound to them and do not move away.The electrons present in insulators are strongly held by the nuclei of their atoms. Since there are "no free electron" in an insulator which can move from one atom to another, so insulator does not allow electric charges (or electricity) to flow through it.**NOTE :** Those substance whose conductivity lies in between the conductors and insulators are called semi-conductors.**For e.g. :** Silicon, germanium are semi - conductors.

6.2 ELECTRIC FIELD AND ELECTRIC POTENTIAL : The flow of electricity in a circuit can be regarded very mush similar to the flow of water in a pipe. The water pipe is analogous to the electric conductor, while the amount of water flowing through a given point per second corresponds to electric current. Figure below show how the pump (P) builds up and maintains pressure by lifting water from a tank (B) to the reservoir (A) through the pipe (R).Note that along the pipe, different points are at different pressure. Water in the pipe flow from say, a



point C to D only when the pressure at C is greater than that at D. Thus, when the value (V) is open, water start flowing into the reservoir.

In the same manner electrons will move along a wire only if there is a difference of electric pressure called potential difference along the conductor. This difference of potential produced by the cell or a battery, which acts like a water pump in the circuit.

The chemical action within the cell generates the difference in potential between the electrodes, which sets the electrons in motion and produces the current We define the electric potential difference between the two points, A and B, on a conductors carrying current, as the work done to move a unit charge from A to B. Potential difference (V) between the points A and B = work done (**W)**/charge (**Q**). The unit of potential is volt, named after a scientist Alessandra (1745 - 1827).One volt is the potential difference when 1 joule of work is done to move a charge of 1C.

6.2 (a) Electric Field : Electric field due to a given charge is defined as the space around the charge in which electrostatic force of attraction or repulsion due to charge can be experienced by any other charge. If a test charge experiences no force at a point, the electric field at that point must be zero.Electric field intensity at any point is the strength of electric field at that point/ It is defined as the force experienced by unit positive charge placed at that point.

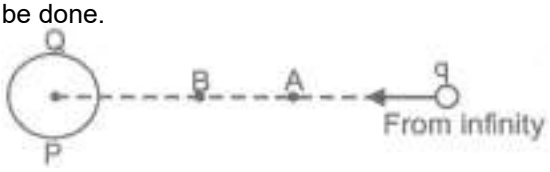
If $\vec{F}$ is the force acting on a test charge **+q**$_0$ at any point **r**, then electric field intensity at this point is given by $\vec{E}(r) = \frac{\vec{F}}{q_0}$, Electric field is a vector quantity and its S.I. unit is Newton per coulomb or N/C.

6.2 (b) Electric Potential : The electric potential at a point in an electric field is defined as the amount of work done in moving a unit +ve charge from infinity to that point, without acceleration or without a change in K.E., against the electric force due to the electric field. $V = \frac{W}{q}$ Since work is measured in joule and charge in coulomb, therefore electric potential is measured in joule per coulomb (**J/C**). This unit occurs so often in our study of electricity, so it has been named as volt, in honour of the scientist Alessandra Volta (the inventor of the voltaic cell). $1\,\text{Volt} = \frac{1\,\text{joule}}{1\,\text{coulomb}}$,Potential is a scalar quantity, therefore it is added algebraically. For a positively charged body potential is positive and for a negatively charged body potential is negative.

6.2 (c) Electric Potential Difference : Consider a charge Q placed at a point P. Let A and B be two other point (B being closer to A) as shown

If a charge q is brought from infinity to A, a work W_A will be done.

The potential at A will then be, $V_A = \frac{W_A}{q}$



If charge q is brought from infinity to B, the work done will be W_B.

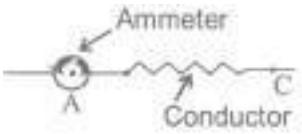
The potential at B will the be, $V_B = \frac{W_B}{q}$, The quantity V_B - V_A is called the potential difference between points A and B in the electric field of charge Q.Mathematically we have, $V_B - V_A = \frac{W_B}{q} - \frac{W_A}{q}$, Electric potential difference is also measured in volt.

6.3 ELECTRIC CURRENT : The electric current is a flow of electric charges (called electrons) in a conductor. The magnitude of electric current in a conductor is the amount of electric charge passing through a given point of the conductor in one second. If a charge of **Q** coulombs flow through a conductor in time **t** seconds, then the magnitude of the electric current **I** flowing through it is given by : $I = \frac{Q}{t}$ **,** The unit of charge, in S.I. system is coulomb, which is equivalent to the charge of nearly 6.25×10^{18} electrons.

If charge is measured in coulomb, then the flow of 1 coulomb/second gives us the unit of current, which is called ampere named in the honour French scientist, Andre - Marie Ampere (1775 - 1836).

Definition of ampere : When 1 coulomb of charge flows through any cross - section of a conductor 1 second, the electric current flowing through it, is said to be 1 ampere.1 mA = $\frac{1}{1000}$ A

Current is measured by an instrument called ammeter. The ammeter is connected in series with the circuit through which the current is to be measured. An ammeter should have very low resistance.

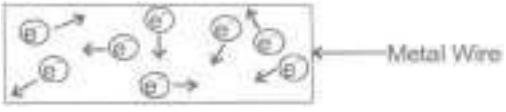


6.3 (a) Direction of Electric Current :

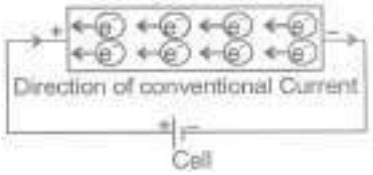
When electricity was invented a long time back, it was known that there are two types of charges : positive charges and negative charges, but the electron had not been discovered at that time. So, electric current was considered to be a flow of positive charges and the direction of flow of the positive charges was taken to be the direction of electric current. Thus, the conventional direction of electric current is from positive terminal of a cell (or battery) to the negative terminal through the circuit.

6.3 (b) How the Current Flows in a Wire :

As electric current is the flow of electrons in a metal wire (or conductor) when a cell or battery is connected across its ends. A metal wire has plenty of free electrons in it. When the metal wire has not been connected to a source of electricity like a cell or a battery, then the electrons present in it move at random in all the directions between the atoms of the metal wire as shown in figure below.



When a source of electricity like a cell or a battery is connected between the ends of the metal wire, then and electric force acts on the electrons present in the wire. Since the electrons are negatively charged, they start moving from negative end to the positive and of the wire and this flow of electrons constitutes the electric current in the wire.**6.3 (c) How to get a Continuous flow of Electric Current :**



It is due to the potential difference two points that an electric current flows between them. The simplest way to maintain a potential difference between the two ends of a conductor so as to get a continuous flow of current is to connect the conductor between the terminals of a cell or a battery. Due to the chemical reactions going on inside the cell or battery, a potential difference is maintained between its terminals and this potential difference drives the current in a circuit.

6.4 ELECTRICAL SYMBOLS : The various electrical symbols used in electric circuits are given below :

(i) Cell

(ii) Battery

(iii) Connecting wire

(vi) A wire joint

(v) Wire crossing without contact

(vi) Fixed resistance (or Resistor)

(vii) Variable resistance (or Rheostat)

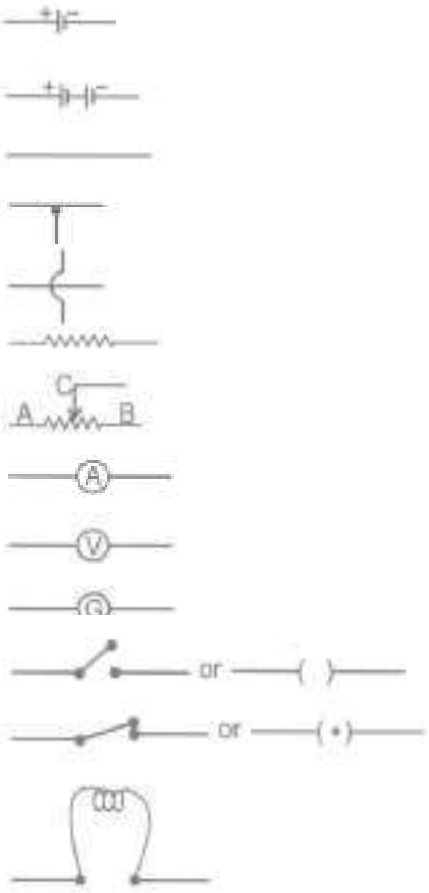
(viii) Ammeter

(ix) Voltmeter

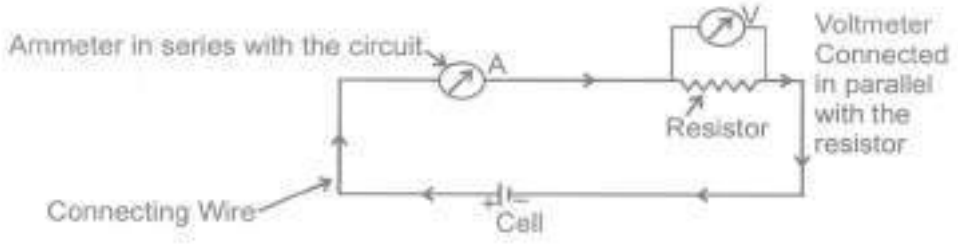
(x) Galvanometer

(xi) An open switch (An open plug key)

(xii) A closed switch (A closed plug key) (xiii) Electric bulb



6.4 ELECTRICAL CIRCUITS :A continuous path consisting of conducting wires and other resistances (like lamps, bulbs etc.) between the terminal of a battery, along which an electric current flows, is called a circuit.



6.4 (a) Open Electric Circuit :

An electric circuit through which no electric current flows is known as open electric circuit. The electric circuit will be open circuit if the plug of the key is taken out or if the connecting wire break from any point.

6.4 (b) Closed Circuit : An electric circuit through which electric current flows continuously is known as closed circuit.

DAILY PRACTIVE PROBLEMS # 6

OBJECTIVE DPP - 6.1

1. How many electrons constitute a current of

(A) 6.25×10^{18} (B) 6.25×10^{12} (C) 6.25×10^{11} (D) 6.25

2. 1 Coulomb is equal to :

(A) 1 amp × 1 sec (B) 1 amp / 1 sec (C) 1 joule × 1 amp (D) 1 joule / 1 sec

3. When a body is negatively charged by fraction, it means :

(A) the body has acquired excess of electrons (B) the body has acquired excess of protons

(C) must be zero (D) many be negative or positive or zero

4. If a charged body attracts another body, the charge on the other body :

(A) must be negative (B) must be positive

(C) must be zero (D) may negative or positive or zero

5. A suitable unit for expressing the strength of electric field is :

(A) V/C (B) C/m (C) N/C (D) C/N

6. One ampere equal :

(A) 10^6 μ A (B) 10^{-6} μ A (C) 10_{-3} μ A (D) 10 mA

7. What constituted current in a metal wire ?

(A) Electrons (B) Protons (C) Atoms (D) Molecules

8. If **I** is the current through a wire and e is the charge of electron, then the number of electrons in **t** seconds will be given by-

(A) $\frac{Ie}{t}$ (B) e/It (C) It/e (D) Ite

9. Conventionally, the direction of the current is taken as -

(A) the direction of flow of negative charges (B) the direction of flow of atoms

(C) the direction of flow of positive charges (D) the direction of flow of molecules

10. Figure shows, current in a part of electrical circuit, then the value of current is -

(A) 1.7 A (B) 3.7 A (C) 13 A (D) 1.0 A

SUBJECTIVE DPP - 6.2

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1. What is conventional current ?

2. A wire is carrying current. is it charged ? If yes then, why ?

3. One coulomb of charge flows through any cross section of a conductor in 1 second. What is the current flowing through the conductor ?

4. Which of the two is connected in series, ammeter or voltmeter ?

5. What is the potential difference between the terminals of battery is 250 joules of work is required to tran 20 coulombs of charge from one terminal of the battery to the other ?

PL - 7

7.1 ELECTRICAL RESISTANCE :

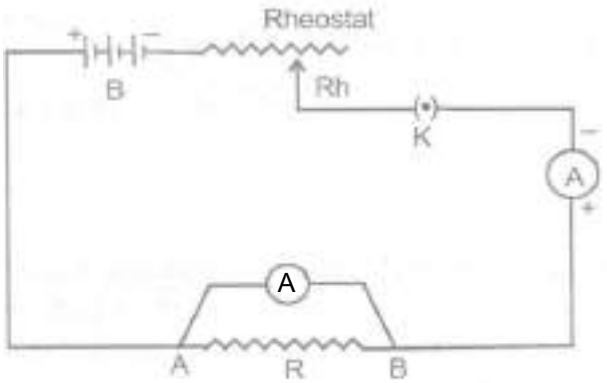
7.1 (a) Ohm's Law : It states that the current passing through a conductor is directly proportional to the potential difference across its ends, provided the temperature and other physical conditions (mechanical stain etc.), remain unchanged i.e.,

Where R is a content called resistance of the conductor.

The relation R = V/I is referred to an Ohm's law, after the German physicist George Simon Ohm (1789 - 1854), who discovered it.It is quite clear from the above equation that **(i)** The current **I** is proportional to the potential difference **V** between the ends of the resistor. **(ii)** Current **I** is inversely proportional to the resistance.

Experimental verification of ohm's law : Set up a circuit as shown in the figure below consisting of a wire AB, a current measuring instrument called ammeter, an instrument measuring the potential difference called voltmeter and a number of cells, each of which provided some constant potential difference across the two point of a conductor. First, use one cell and note the current in the circuit and the potential difference across the wire AB. Suppose potential difference due to the cell produces a current **I** in the circuit and a potential difference

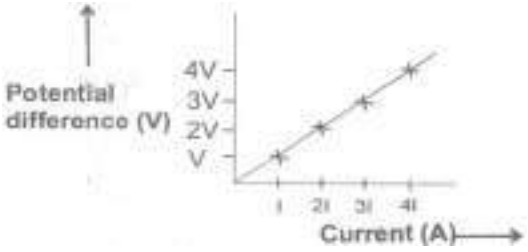
(**V**) across the wire AB. Repeat this experiment with two cells, three cells and four cells.



Note the successive readings in the ammeter and the voltmeter. WE will find that with two cells in the

circuit, the current would be **2I** and the potential difference **2v.** Similarly, with three cells the current is **3I** and potential difference **3v** and so on. [The important precaution to observe here is not allow the current of flow in the wire continuously. This can be done by taking off the plug key and closing it only when the current is to be drawn.]

Now, plot a graph between the current and the potential difference. we will be a straight line graph.



7.1 (b) Resistance of a Conductor : The electric current is a flow of electrons through a conductor. When the electrons move from one part of the conductor to the other part, they collide with other electrons and with the atoms and ions present in the body of the conductor. Due to these collisions, there is some obstruction or opposition to the flow of electrons through the conductor.

The property of a conductor due to which it opposes the flow of current through it, is called resistance. The resistance of conductor is numerically equal to the ratio of potential difference across its ends to the current following through it. $\Rightarrow$ Resistance = $\frac{\text{Potential difference}}{\text{Current}}$

Or $R = \frac{V}{I}$

7.1 (c) Unit of Resistance :

The S.I. unit of resistance is **ohm**, which is denoted by the symbol Ω.

When a potential difference of 1 volt is applied to its ends and a current of 1 ampere flows through it, then resistance f the conductor will be 1 ohm.

7.1 (d) Conductors, Resistors and Insulators : On the basis of their electrical resistance, all the substances can be divided into three groups: conductors, resistors and insulators.

(i) Conductors : Those substances which have very low electrical resistance are called conductors. A conductor allows the electricity to flow through it easily. Silver metal is the best conductor of electricity. Copper and aluminum metals are also conductors. Electric wires are made of copper or aluminum because they have very low electrical resistance.

(ii) Resistor : Those substances which have comparatively high electrical resistance, are called resistors. The alloys like nichrome, manganin and constantan (or ureka), all have quite high resistances, so they are used to make those electrical devices where high resistance is required. A resistor reduces the current in the circuit.

(iii) Insulators : Those substances which have infinitely high electrical resistance are called insulators. An insulator does to allow electricity to flow through it. Rubber is an excellent insulator. Electrician wear rubber hundgloves while working with electricity because rubber in an insulator and protects them from electric shocks. Wood is also a good insulator.

7.1 (e) Factors affecting the Resistance of a Conductor : Resistance depends upon the following factors :**(i)** length of the conductor.**(ii)** Area of cross - section of the conductor (or thickness of the conductor).**(iii)** Nature of the material of the conductor.**(iv)** Temperature of the conductor,**Mathematically :** it has been found by experiments that :**(i)** The resistance of a given conductor is directly proportional to its length i.e. $R \propto \ell$ …….(i)

(ii) The resistance of a given conductor is inversely proportional to its area of cross-section i.e.

$R \propto \frac{\ell}{A}$ ……..(ii)

From (i) and (ii) $R \propto \frac{\ell}{A}$, $R = \frac{\rho \times \ell}{A}$ ……..(iii)

Where ρ (rho) is a constant known as resistively of the material of the conductor. Resistivity is also known

as specific resistance.

Dependency of resistance on temperature :

If R_0 is the resistance of the conductor at 0^0C and R_t is the resistance of the conductor at t^0C then the relation between R_0 and R_t is given by.

$R_t = T_0 (1+ \alpha \Delta T)$ [Here $\Delta t = t - 0 = t$]

or $\alpha = \frac{R_t R_0}{R_0 t}$

Here, α = Coefficient of Resistivity, t= temperature in ^0C

7.1 (r) Resistivity :

Resistivity, $\rho = \frac{R \times A}{\ell}$ .....(iv)

By using this formula, we will now obtain the definition of resistivity. Let us take a conductor having a unit area of cross - section of 1 m^2 and a unit length of 1 m. So, putting A = 1 and ℓ = 1 in equation (iv), we get:

Resistivity, ρ = R

The resistivity of a substance is numerically equal to the resistance of a rod of the substance which is 1 metre long and 1 metre square in cross - section.

$$'\rho' = \frac{\text{ohm} \times (\text{metre})^2}{\text{metre}} = \text{ohm - metre}$$

The S.I. unit of resistivity is ohm-metre which is written in symbols as Ω-m.

Resistivity of a substance does not depend on its length or thickness. It depends only on the nature of the substance. The resistivity of a substance is its characteristic property. So, we can use the resistivity values to compare the resistances of two or more substances.

(i) Importance of resistivity :A good conductor of electricity should have a low resistivity and a poor conductor of electricity should have a high resistivity. The resistivities of alloys are much more higher than those of the pure metals. It is due to their high resistivities that manganin and constantan alloys are used to make resistance wires used in electronic appliances to reduced the current in an electrical circuit.

Nichrome alloy is used for making the heating elements of electrical appliances like electric irons, room-heaters, water-heaters and toasters etc. because it has very high resistivity and it does not undergo oxidation (or burn) even when red-hot.

(ii) Effect of temperature of resistivity : The resistivity of conductors (like metals) is very low. The resistivity of most of the metals increases with temperature. On the other hand, the resistivity of insulators like ebonite, glass and diamond is very high and does to changes with temperature. The resistivity of semi-conductors like silicon and germanium is in between those of conductors and insulators and decreases on increasing the temperature. Semi-conductors are proving to be of great practical importance because of their marked change in conducting properties with temperature and impurity concentration.**Que.:** Why alloys do not oxidize (burn) readily at high temperature ?

Ans. Because with the change in temperature their resistivity changes less rapidly.

7.1 (g) Combination of Resistances (or Resistors): Apart from potential difference, current in circuit depend or resistance of the circuit. So, in the electrical circuits of radio, television and other similar things, it is usually necessary to combine two or more resistances to get the required current in the circuit. We can combine the resistances lengthwise (called series) or we can put the resistances parallel to one another. Thus, the resistances can be combined in two ways : (i) series combination (ii) parallel combination

(i) Series combination of resistors : Consider three resistors of resistances R_1, R_2 and R_3 connected in series to cell of potential difference V as shown in figure. Since the three resistors are connected in series therefore the current I through each of them is same.

Then by Ohm's law the potential drop across each resistor is given by $V_1 = IR_1$, V_2 and $V_3 = IR_3$.

Since V is the total potential in the circuit therefore by conservation of energy we have

$$V = V_1 + V_2 + V_3$$

Substituting for V_1, V_2 and V_3 in above equation we have,

$$V = IR_1 + IR_2 + IR_3 \quad \text{..... (i)}$$

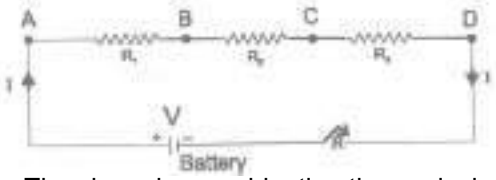
If R_S is the equivalent resistance of the series combination, then by Ohm's law we have

$$V = IR_s \quad \text{..... (ii)}$$

Therefore from equations (i) and (ii) we have

$$IR_s = IR_1 + IR_2 + IR_3$$

Hence $$R_s = R_1 + R_2 + R_3$$



Series comination of resistances Thus in series combination the equivalent resistance is the sum of the individual resistances. For more resistors, the above expression would have been-

$R_s = R_1 + R_2 + R_3$ + ...

NOTE : In a circuit, if the resistors are connected in series :**(A)** The current is same in each resistor of the circuit :**(B)** The resistance of the combination of resistors is equal to sum of the individual resistors.**(C)** The total voltage across the combination is equal to the sum of the voltage drop across the individual resistors.**(D)** The equivalent resistance is greater than that of any individual resistance in the series combination.

(ii) Parallel combination of resistors :

Consider two resistors R_1 and R_2 connected in parallel as shown in figure. When the current I reached point 'a', it splits into two parts I_1 going through R_1 and I_2 going through R_2. If R_1 is greater than R_2, then I_1 will be less than I_1 i.e. the current will tend to take the path of least resistance.Since charge must be conserved, therefore the current I that enters point 'a' must be equal to the current that leaves that point. Therefore we have

$$I = I_1 + I_2 \qquad \text{.....(i)}$$

Since the resistors are connected in parallel therefore the potential across each must be same, hence by Ohm's law we have

$I_1 = \frac{V}{R_1}$ and $I_2 = \frac{V}{R_2}$ substituting in equation (i) we have,

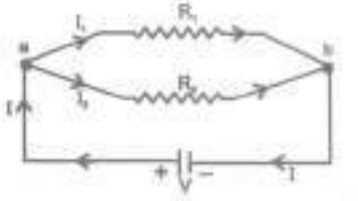
$$I = \frac{V}{R_1 + \frac{V}{R_2}} \qquad \text{.....(ii)}$$

Let R_P be the equivalent resistance of the parallel combination, they by Ohm's law we have,

$$I = \frac{V}{R_P} \qquad \text{.....(iii)}$$

Hence from equations (ii) and (iii) we have,

$$\frac{V}{R_P} = \frac{V}{R_1} + \frac{V}{R_2} \quad \text{or} \quad \frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$$



An extension of this analysis to three or more resistors in parallel gives the following general expression

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \text{.....}$$

NOTE : (A) The sum of the reciprocals of the individual resistance is equal to the reciprocal of equivalent resistance, R_P.

(B) The currents in various resistors are inversely proportional to the resistances, higher the resistance of a branch, the lower will be the current through it. The total current is the sum of the currents flowing in the different branches.

(C) The voltage across each resistor of a parallel combination is the same and is also equal to the voltage across the whole group considered as unit. **NOTE :** For n equal residences $\frac{R_s}{R_p} = n^2$

DIALY PRACTIVE PROBLEMS # 7

OBJECTVIE DPP - 7.1

1. When the temperature of metallic conductor is increased its resistance :
(A) always decrease (B) always increase
(C) may increase or decease (D) remain the same

2. Specific residence of a wire depends upon :
(A) its length (B) its cross - sectional area
(C) its dimensions (D) its material

3. The unit of resistivity is :
(A) ohm (B) ohm meter (C) ohm metre^{-1} (D) mho metre^{-1}

4.A wire of resistance R is cut into n equal parts. These parts are then connected in parallel. The equivalent resistance of combination will be :(A) nR (B) R/n (C) n/R (D) R/n^2

5.A piece of wire of resistance $4\,\Omega$ is bent through 180^0 at its mid point and the two halves are twisted together, then resistance is :

(A) $1\,\Omega$ (B) $2\,\Omega$ (C) $5\,\Omega$ (D) $8\,\Omega$

6.Three resistance each of $8\,\Omega$ are connected to a triangle. The resistance between any two terminal will be:(A) $12\,\Omega$ (B) $2\,\Omega$ (C) $6\,\Omega$ (C) $\frac{16}{3}\,\Omega$

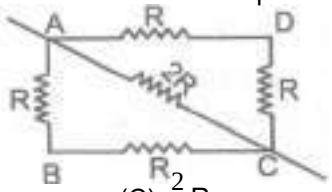
7.In how many parts(equal) a wire of $100\,\Omega$ be cut so that a resistance of $1\,\Omega$ is obtained by connecting them in parallel ?(A) 10 (B) 5 (C) 100 (D) 50

8.The filament of an electric bulb is made of tungsten because :(A) its resistance is negligible
(B) it is cheaper (C) its melting point is high (D) its filament is easily made

9. If a wire of resistance $1\,\Omega$ is stretched to double its length, then the resistance will become :

(A) $\frac{1}{2}\,\Omega$ (B) $2\,\Omega$ (C) $\frac{1}{4}\,\Omega$ (D) $4\,\Omega$

10. In the given circuit, the effective resistance between points A and C will be :



(A) $\frac{3}{2}$R (B)6R (C) $\frac{2}{3}$R (D) 3R

SUBJECTIVE DPP - 7.2

1.Does the value of resistance of a conductor depend upon the potential difference applied across it or the current passed through it ?

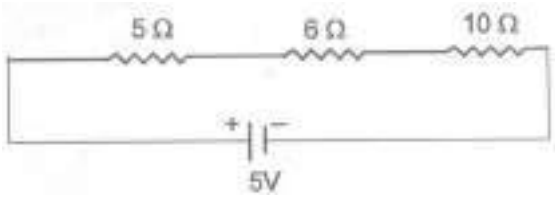
2.A wire of resistivity ρ is stretched to double its length. What will be its new resistivity ?

3.Two wires A and B of same metal have the same area of cross-section and have their lengths in the ratio 2 : 1. What will be the ratio of currents flowing through them, when the same potential difference is applied across length of each of them ?

4.Compare the resistance of two wires of same material. Their lengths are in the ratio 2 : 3 and their diameters are in the ratio 1 : 2.

5.If the current supplied to a variable resistor is constant, draw a graph between voltage and resistance.

6.Calculate the potential difference across each resistor in the circuit shown in figure below.



8.1 HEATING EFECT OF CURRENT : When the ends of a conductor are connected to a battery, then free electrons move with drift velocity and electric current flows through the wire. These electrons collide continuously with the positive ions of the wire an thus the energy taken from the battery is dissipated. To maintain the electric current in the wire, energy is taken continuously from the battery. This energy is transferred to the ions of the wire by the electrons. This increases the thermal motion of the ions, as a result the temperature of the wire rises. The effect of electric current due to which heat is produced in a wire when current is passed through it is called heating effect of current or Joule heating. In 1841 Joule found that when current is passed through a conductor the heat produced across it is :

(i) Directly proportional to the squire of the current through the conductor i.e. $H \propto I^2$

(ii) Directly proportional to the resistance of the conductor i.e. $H \propto R$

(iii) Directly proportional to the time for which the current is passed i.e. $H \propto t$

Combining the above three equations we have $H \propto I^2Rt$

or $H = \frac{I^2Rt}{J}$ Where J is called Joule's mechanical equivalent of heat and has a value of J = 4.18 cal^{-1}. The above equation is called Joule's law of heating.

In some cases, heating is desirable, while in many cases, much as electric motors, generators or transformers, it is highly undesirable. Some of the devices in which heating effect of an electric current is desirable, are incandescent lamps, toasters, electric irons and stoves. The tungsten filament of an incandescent lamp operates at a temperature of 2700^0 c. Here, we see electrical energy being converted into both heat and light energy.

8.1 (a) Electric Energy : The fact that conductors offer resistance to the flow of current, means that work must be continuously done to maintain the current. The role of resistance in electrical circuits in analogous to that of friction in mechanics. To calculate the amount of work done by a current I, flowing through a wire of resistance R, during the time t, the amount of work done is given by- $W = QV$

but as $Q = I \times t$ therefore, the amount of work done, W is

$W = V \times I \times t$

By substituting the expression for V from Ohm's law,

$$V = IR$$

we finally get $W = I^2 Rt$

This shows that the electrical energy dissipated or consumes depends on the product of the square of the current I. flowing through the resistance R and the time t.

(i) **Commercial unit of electrical energy (Kilowatt - hour) :**The S.I. unit of electrical energy is joule and we know that for commercial purposes we use a bigger unit of electrical energy which is called **"kilowatt - hour".** One kilowatt - hour is the amount of electrical energy consumed when an electrical appliance having a power rating of 1 kilowatt and is used for 1 hour.

Relation between kilowatt hour and Joule : Kilowatt-hour is the energy supplied by a rate of working of 1000 watts for 1 hour.

1 kilowatt-hour = 3600000 joules

$\Rightarrow$ 1 kWh = 3.3×10^6 J

8.1 (b) Electric Power : The rate at which electric energy is dissipated or consumed, is termed as electric power. The power P is given by,

$$P = W/t = I^2 R$$

The unit of electric power is watt, which is the power consumed when 1 A of current flows at a potential difference of 1 V.

(i) Unit of power : The S.I. unit of electric power **'watt'** which is denoted by the letter W. The power of 1

watt is a rate of working of 1 joule per second.

A bigger unit of electric power is kilowatt.

1 kilowatt (kW) = 1000 watt.

Power of an agent is also expressed in horse power (hp).

1 hp = 746 watt.

(ii) Formula for calculating electric power : We know, Power, $P = \frac{\text{Work}}{\text{Time}}$

and Work, $W = V \times I \times t$ joules

$\therefore$ $P = \frac{V \times I \times t}{t}$

$$P = V \times I$$

$$P = V \times I$$

Power P in timers of I and R :

Now from Ohm's law we have $\frac{V}{I} = R$

$$V = I \times R$$

$$P = I \times R \times I$$

$$\therefore \quad P = I^2 \times R$$

Power P in terms of V and R :

We know, $P = V \times I$

From Ohm's low $I = \frac{V}{R}$

$$P = V \times \frac{V}{R}$$

$$P = \frac{V^2}{R}$$

8.1 (c) Power - Voltage Rating of Electrical Appliances : Every electrical appliance like an electric bulb, radio or fan has a label or engraved plate on it which tells us the voltage (to be applied) and the electrical power consumed by it. For example, if we look at a particular bulb in our home it may have the figures **220 V, 100W** written on it. Now **220 V** means that this bulb is to be used on a voltage of **220 volts** and **100 W** Which means it has a power consumption of 100 watts or 100 joules per second.

8.1 (d) Application of Heating Effect of Current : Domestic electric appliances such as electric bulb, electric iron geyser, room heater etc work on heating effect of current and are rated in terms of voltage and wattage. The coils of these devices are made of a material of a very high resistance, (for instance, nichrome or tungsten) such that when a current passes through the coil, heat is generated. Generally the potential difference applied to the electrical appliance is the same as the of the mains i.e. **220-230 V** in India an d**110 V** is U.S.A. Canada etc.

8.1 (e) Electric Fuse : An electric fuse in an easily fusible wire of short length put into an electric circuit for protection purpose. It is arranged to melt ("blow") at a definite current. It is an alloy of lead and tin (**37% lead + 63% tin**). It has a low resistivity and low melting point. As soon as the safe limit of current exceeds, the fuse "blows" and the electric circuit is cut off.

Consider a wire of length **L**, radius r and resistivity **p.** Let I be the current flowing through the wire. Now rate at which heat is produced in the wirem.

$$P = I^2 R = \frac{I^2 \rho L}{\pi r^2} \qquad \left[\therefore \frac{\rho L}{A} = \frac{\rho :}{\pi r^2}\right]$$

This heat increases the temperature of the wire. Due to radiation some heat is lost. The temperature of the fuse becomes constant when the heat lost due to the radiation becomes equal to the heat produced due to the passage of current. This given the value of current which can safely pass through the fuse. In other words we have,

$$I \propto r^{3/2}$$

Illustration :1. 15 bulbs of 60W each, run for 6 hours daily and a refrigerator of 300 W runs for 5 hours daily. Work out per day bill at 3 rupees per unit.

Sol. Total wattage of 15 bulbs = 15 ” 60 W = 900 W

$\therefore$ Electrical energy consumed by bulbs per day = P × t = 900 × 6 = 5400 Wh

And electrical energy consumed by refrigerator per day = 300 × 5 = 1500 Wh

Total electrical energy consumed per day = (5400 + 1500) Wh = 6900 Wh

$\therefore$ Electrical energy consumed per day = $\frac{6900}{1000}$ KWh $= 6.9$KWh

Here, per day bill = Rs. 6.9 × 3 = Rs. 20.7

2. Two lamps, one rated 100 W at 220 V and other 60 W at 220 V are connected in parallel to a 220 V supply. What is current drawn from the supply line ?

Sol. Given that

V = 220 V , P_1 = 100W and P_2 = 60 W

$\therefore$ Current $I_1 = \frac{P_1}{V} = \frac{100}{220} = \frac{5}{11}$ A

Similarly, Current $I_2 = \frac{P_2}{V} = \frac{60}{220} = \frac{3}{11}$ A Hence, total current drawn from the supply line = $\frac{5}{11} + \frac{3}{11} = \frac{8}{11}$ A $= 0.727$ A.

DAILY PRACTIVE PROBLEMS # 8

OBJECTVIE DPP - 8.1

1. Rate of heat generated by electrical current in a resistive circuit is expressed in :

(A) IR (B) IR^2 (C) I^2R (D) $\sqrt{IR}$

2. Two heater wires of equal length are first connected in series and then in parallel with a battery. They ratio of heat produced in the two cases in :

(A) 2 : 1 (B) 1 : 2 (C) 4 : 1 (D) 1 : 4

3. How much electrical energy in kilowatt hour is consumed in operating ten, 50 watt bulbs for 10 hours per day in a month of 30 days ?

(A) 15 (B) 150 (C) 1500 (D) 15000

4. An electric iron draws a current of 4A when connected to a 220 V mains. Its resistance must be :

(A) $40\,\Omega$ (B) $55\,\Omega$ (C) $100\,\Omega$ (C) None of these

5. The resistance of a conductors is reduced to half its initial value. In during so the heating effects in the conductor will become :

(A) half (B) one-fourth (C) four times (D) double

6. Laws of heating are given by :

(A) Faraday (B) Joule (C) Ohm (D) Maxwell

7. An electric iron is based upon the principle of :
(A) magnetic effect of current (B) heating effect of current
(C) chemical effect of current (D) none of these

8. A fuse wire is always connected to the :
(A) neutral wire (B) earth wire (C) live wire (D) none of these

9. Heating effete of a current conductor is due to :
(A) Loss of kinetic energy of moving atoms (B) Loss of kinetic energy of moving electrons
(C) Attraction between electrons and atoms (D) Repulsion between electrons and atoms

10. The correct relation between heat produce (H) and electric current following is :

(A) $H \propto I$ (B) $H \propto \frac{1}{I}$ (C) $H \propto I^2$ (D) $H \propto \frac{1}{I^2}$

SUBJECTIVE DPP - 8.2

1. An electric kettle is rated 500 W, 220 V. It is used to heat 400 g of water for 30 seconds. Assuming the voltage to be 220 V, calculate the rise in the temperature of the water. Specific heat capacity of water = 4200 J/kj^{0}C.

2. Three identical are connected in parallel with a battery. The current drawn from the battery is 6 A. If one of the bulbs gets fused, what will be the total current drawn from the battery ?

3. When two resistor are joined in series, the equivalent resistance is $90\,\Omega$. When the same resistors are joined in parallel, the equivalent resistance is $20\,\Omega$. Calculate the resistances of the two resistors.

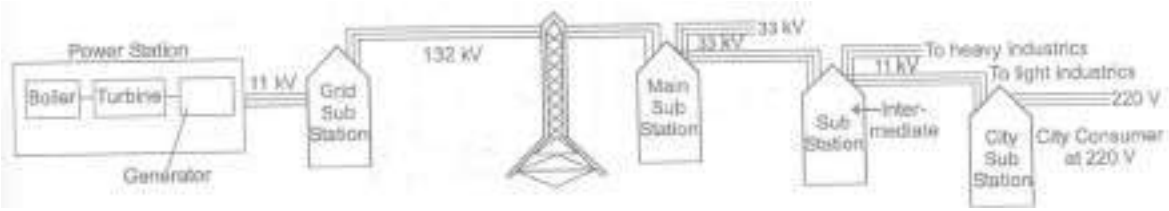
4. Name of few practical applications of heating effect of current.

5. Out of the following bulbs rated 40 W, 220 V, 60 W, 220 V and 100 W, 220 V which one will glow the brightest when connected in series in series to a supply of 220 V ?

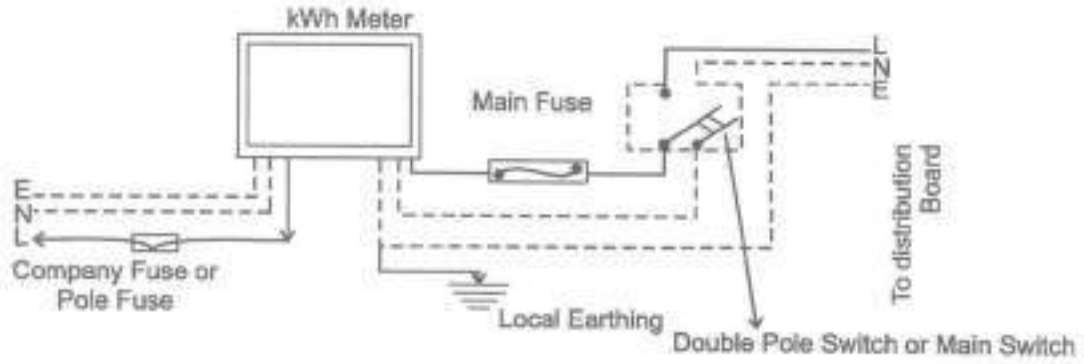
9.1 HOUSE - HOLD ELECTRICAL CIRCUIT :

Electric power is usually generated at placed which are very far from the placed where it is consumed. At the generating station, the electric power is generated at 11.000 volt (because voltage higher than this causes insulation difficulties, while the voltage lower than this involves high current). This voltage is alternating of frequency 50 Hz (i.e. changing its polarity 50 times in a second). The power is transmitted over long distances at high voltage to minimize the loss of energy in the transmission line wires. For a given electric power, the current becomes low at a high voltage and therefore the loss of energy due to heating ($=I^2$ Rt) becomes less. Thus, the alternating voltage is stepped up from 11 kV to 132 kV at the generating station (or called grid sub - station). It is then transmitted to the main sub-station. At the main sub-station, this voltage is stepped down to 33 kV and is transmitted to the switching transformer station or the city sub-station. At the city sub-station, it is further stepped down to 220 V for supply to the consumer as shown in figure.

To supply power to a house either the overhead wires on poles are used or an underground cable is used. Before the electric line is connected to the meter in a house, a fuse of high rating (≈ 50 A) is connected at the pole or before the meter. This is called the company fuse. The cable used for connection has three wire : (i) live (or phase) wire, (ii) neutral wire and (iii) wire. The neutral and the earth wire are connected together at the local sub-station, so the neutral wire is at the earth potential. After the company fuse, the cable is connected to a kWh meter. From the meter, connections are made to the distribution board through a main fuse and a main switch.



The main switch is a double pole switch. it has iron covering. The covering is earthed. This switch is used to cut the connections of the live as well as the neutral wires simultaneously. The main switch and the meter and locally earthed (in the compound of house). From the distribution board, the wires go to the different parts of the house.



Disadvantages :(i) It requires plugs and sockets of different sizes for different current carrying capacities.**(ii)** When the fuse in one distribution line blows, it disconnects all the appliances in the distribution line.**(iii)** This wiring is expensive.**(iv)** If a new appliance is to be installed requiring higher current say 15 A, white the original circuit in the room is for 5 A rating, then it is necessary to put new leads upto the distribution box. This could be quite expensive and inconveni

9.1 (c) Domestic Heating Applications : Electric appliances like iron, heater radiator etc. depend on the fact that when a current is sent through a wire, the wire is heated up and it begins to radiate energy.

The most widely used material for making the heater wire is nichrome. It is an alloy of nickel and chromium in the ratio of 4 : 1. It is chosen because of the following reasons :

(i) It has high resistivity. A nichrome wire of ordinary length shows sufficient resistance.

(ii) It can withstand high temperature without oxidation.

(iii) Its melting point is very high.

9.1 (d) Hazards of Electricity: We have seen earlier that touching a bare electricity wire with current flowing through it can give a dangerous electric shock. This is because electricity then flows through the body and damages the cells. The among of damage caused depends on the magnitude of current and the duration for which it flows is the body. The magnitude of current increases if the body is wet. That is why we are always advised not to touch any electrical appliances or a switch with wet hands.

A severe electric shock affects the muscles. Sometimes the shock may be so severe than the person may not be able to use his muscle to pull his hand away from the wire. In extreme cases, the heart muscles may get affected and may even lead to death

9.2 EARTHING : Earthling means to connect the metal case of electrical appliance to the earth (at zero potential) by means of a metal wire called “earth wire”. In household circuits, we have three wires, the live wire, the neutral wire and the earth wire. In household circuits. we have three wires, the live wire, the neutral wire an the earth wire. One and of the earth wire is buried the earth. We connect the earth wire to the metal case of the electrical appliance by using a three-pin plug. The mental casing of the appliance will now always remain at the zero potential of the earth. We say that the appliance has been earthed or grounded.

If, by chance, the live wire touches the metal cause of the electric iron (or any other appliance) which has been earthed, then the current passed directly to the earth through the earth wire. It does not need our body to pass the current and therefore, we do not get an electric shock. Actually, a very heavy current flows through the earth wire and the fuse of household wiring blows out or melts. And it cuts off the power supply. In this way, earthing also saves the electrical appliance from damage due to excessive current.

9.3 COLOUR CODING OF WIRES : An electric appliance is provided with a three-core flexible cable. The insulation on the three wires is of different colours. The old convention is red for live, black for neutral and green for earth. The new international convention is brown for live, light blue for neutral and green (or yellow) for earth.

9.4 GALVANOMETER :A galvanometer is an instrument that can detect the presence of a current is a circuit. The pointer remain at zero (the centre of the scale) for zero current flowing through it. It can deflect either to the left or to the right of the zero mark depending on the direction of current.

(i) Moving coil galvanometer (ii) Moving magnet galvanometer

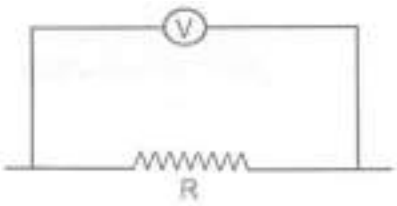
it is used to make ammeter and voltmeter as follows :

9.4 (a) Ammeter : Ammeter is an electrical instrument which measures the strength of current in 'ampere' in a circuit which is always connected in series in circuit so that total current (to be measured) may pass through it. The resistance of an ideal ammeter is zero 9practically it should be minimum).

9.4 (b) Voltmeter :it is an electrical instrument which measures the potential difference is 'volt' between two points of electric circuit. The only difference between ammeter and coltmeter is that ammeter has its negligible (approximately zero) resistance so that it may measure current of circuit passing through it more accurately giving the deflection accordingly, while the voltmeter passes negligible current through itself so that potential difference developed due to maximum current passing through circuit may be measured.

Voltmeter has very high resistance and the resistance of an ideal voltmeter is infinite.

A voltmeter is always connected in parallel.



DAILY PRATICE PROBLEMS # 9

OBJECTIVE DPP-9.1

1. The wire having a red plastic covering is a :
(A) live wire (B) neutral wire (C) earth wire (D) none of these

2. A switch is always connected to the
(A) earth wire (B) neutral wire (C) live wire (D) none of these

3. The wire having a black plastic covering is a
(A) live wire (B) neutral wire (C) earth wire (D) none of these

4. The wire having a green plastic covering is a
(A) live wire (B) neutral wire (C) earth wire (D) none of these

5. In three pin socket (shoe) the bigger hole is connected to :
(A) any wire (B) live wire (C) neutral wire (D) earth wire

6. Coming of live wire and neutral wire in direct contact cause :
(A) short-circuiting (B) over loading
(C) no damage (D) unknown effect

7. In electric fitting in a house :
(A) the live wire goes through the switch (B) the neutral wire goes through the switch
(C) the earth wire goes through the switch (D) no wire goes through the switch

8. High power electrical appliances are earthed to
(A) avoid shock
(B) avoid wastage
(C) Make the appliance look beautiful
(D) reduce the bill

SUBJECTIVE DPP - 9.2

1. Name two types of wiring system done for domestic wirings.

2. Why is earthing important for electrical appliance ?

3. Which colour wire used for earthing or grounding ?

4. Explain earthing.

Chemical Reactions and Equations

Important points.

1. Processes in which no new chemical substances are formed called physical change
Eg- Melting of ice, Tearing of paper.

2. Process in which the original substance lose their nature and identity and form new chemical substances with different properties are called Chemical changes.

3. The processes involving in a chemical change is called a chemical reactions.
Eg- Rusting of Iron, Curdling of milk
Photosynthesis, Digestion, Respiration.

4. In a chemical reaction, reactants react with each other under favourable conditions and new products are formed

5. The chemical substances those take part in a chemical reaction are called reactants where as the substances formed after the reaction are called products.

6. The properties of reactants and products are entirely different from each other.

7. In a chemical reaction only rearrangement of molecules takes place.

8 Reactants are always written in left side and products are written on Right side.

Characteristics of a Chemical Reaction:-
When a chemical reaction takes place some changes are observed.

1. Evolution gas.
2. Formation of Precipitate
3. Change of State
4. Change of temperature
5. Change of colour.

Chemical Reaction:- The process in which the original substance lose their nature and identity and forms a new chemical substance with different properties, are called Chemical changes. The process involving in a Chemical Change is called chemical reaction

Eg- Respiration
Digestion of food.
Rusting of iron
Burning of fuels.

Chemical Equations :- The shorthand method of representing a chemical reaction in terms of symbols and formulae of different reatants and products is called a chemical equation.

Example - The Reaction of burning of methane gas can be written as

$$CH_4 + 2O_2 \xrightarrow{\Delta} CO_2 + 2H_2O$$

When quick lime react with water it produced a suspension of calcium Hydroxide (Slaked lime) and heat energy

$$\underset{\text{Quick lime}}{CaO} + H_2O \longrightarrow \underset{\substack{\text{Slaked} \\ \text{lime.}}}{Ca(OH)_2} + \text{Heat}$$

Writing of a Chemical Equation :.

While writing a chemical equations. the following point should be noted -

1. Reactants are written on the left hand side with '+ sign' between them.

2. The products are written on the right hand side with '+sign' between them.

3) $2Mg + CO_2 \xrightarrow{\Delta} 2MgO + C$

4) $4NH_3 + 3O_2 \longrightarrow 2N_2 + 6H_2O$

5) $2H_2S + 3O_2 \longrightarrow 2SO_2 + 2H_2O$

6) $2Al[OH]_3 \longrightarrow Al_2O_3 + 3H_2O$

7) $3BaCl_2 + Al_2(SO_4)_3 \longrightarrow 2AlCl_3 + 3BaSO_4 \downarrow$

Advantages of Chemical equation.

1. It save time and space in writing.
2. The exact amount of reactants to get a definite amount of product can be calculated.
3. From a balanced chemical equation, the effect of change of concentration or pressure of reactants can be predicted.

Types of Chemical Reactions.

1. Combination Reactions:- A reaction in which two or more elements or compounds combined together to form a single product or compound are called combination reaction.

Ex- $2Mg + O_2 \rightarrow 2MgO$

$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$$

Types of Combination reactions.

a) Combination between two elements.
b) Combination between two compounds.
c) Combination between an element and a compound.

I) Combination Reaction between elements.

$$C + O_2 \longrightarrow CO_2$$
$$2H_2 + O_2 \longrightarrow 2H_2O$$
$$S + O_2 \longrightarrow SO_2$$

II) Combination between two compounds.

$$NH_3 + HCl \longrightarrow NH_4Cl$$
$$CaO + CO_2 \longrightarrow CaCO_3$$

III) Combination between an element or compounds.

$$CO + O \longrightarrow CO_2$$
$$SO_2 + O_2 \longrightarrow SO_3$$ [Sulphur trioxide]

2. Decomposition Reaction :- Those reactions in which a single compound breaks down to give two or more simpler substances are called decomposition reactions.

* These reactions are just opposite of combination reactions.

* These reactions are always endothermic in nature because these takes place only when the energy is given to the compound in the form of heat, electricity or light.

There are three types of decomposition reaction

A) Thermal Decomposition Reactions:- Decomposition reactions which takes place in the presence of heat are called thermal decomposition reactions.

Eg- $CaCO_3[s] \xrightarrow{\Delta} CaO^{(s)} + CO_2(g)$
limestone [Quick] lime

$ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

B] Electrolytic [Electrolysis] Decomposition Reaction:-

Reactions which takes place when electric current is supplied through compound in molten state or in aqueous solution.

Electrolysis of NaCl:- When electric current is passed through molten NaCl, it decomposes and give sodium metal and Chlorine gas. In this Reaction, Sodium is produced on large scale and chlorine gas is obtained in small amount.

* Element involved may be metals and non-metals.

* One element displace another element according to the position of element in the reactivity series.

There reactions are of two types.

1. Single Displacement reaction :- A reaction in which more reactive element displaces a less reactive element from the solution of its compound is called single displacement reaction.

Ex -

$$Zn + CuSO_4 \longrightarrow ZnSO_4 + Cu$$

$CuSO_4$: Copper sulphate; $ZnSO_4$: Zinc Sulphate

$$Mg + ZnSO_4 \longrightarrow MgSO_4 + Zn$$

Thermite reaction [Aluminothermy process]

$$Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + Fe$$

Fe_2O_3 : [ferric oxide]; Al_2O_3 : [Aluminium oxide]; Fe : molten state

In this reaction ferric oxide heated with aluminium powder, aluminium is more reactive than iron, so it displaces Fe from Fe_2O_3 and produces

Al_2O_3. This reaction is highly exothermic. So iron is obtained in the molten state. This reaction is used for joining the broken railway tracks and machine parts this reaction is called Aluminothermy or thermite reaction. ~~The~~ mixture ~~of~~ Fe_2O_3 and Aluminium po

* All displacement reaction are exothermic reactions.

* When only one element has been displaced by another element from its compound this is called single displacement reaction.

Double-Displacement Reactions:-

Those reaction in which two different atoms or group of atoms are exchanged are called double displacement reactions.

These reactions generally take placebitwo ionic compounds. Hence, they can also be defined as, Those reactionin which two ionic compounds in the solution react by exchange of their ions to form a new compound is called double displacement reactions.

=> The ionic compounds are soluble in water. However, one of the product is either insoluble and separate out as a solid called precipitate or it is a gas.

Ex-

$$AgNO_3 + NaCl \longrightarrow AgCl + NaNO_3$$

[Silver Chloride white ppt]

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

In this reaction, acid react with a base and form salt and water. this reaction is called neutralization reaction

Ques. What do you mean by precipitation reaction Explain by giving example.

Ans- The reaction which is accompained by the formation of an insoluble solid mass [precipitate] is known as Precipitation reaction

Ex - Na_2SO_4 (aq) + $BaCl_2$ (aq) $\longrightarrow$ $BaSO_4$ (White solid ppt) + 2NaCl

Oxidation Reaction-

Oxidation is defined as a process which involves

i) Gain of oxygen
ii) Lose of Hydrogen or electron

Oxidising agent :- A substance which help in the oxidation of another substance is called a oxidising agent. It either gives oxygen removes hydrogen, accepts electron from the substance to be oxidised.

Reducing agent :- A substance which help in the reduction of another substance is called reducing agent. It either remove oxygen. Gives hydrogen, or donate electrons to the substance that is to be reduced.

Corrosion :- The process of slowly eating up of the metals due to attack of atmospheric gases - oxygen Carbon, Hydrogen, Sulphur, water vapour etc. on the surface of the metals so as to converts the metals into oxide.

Metals into oxide, Carbonate, Sulphide etc. is known as corrosion.

Iron articles are shiny when new, but get coated with a reddish brown powder when left for sometime this process is commonly known as rusting of iron

The black coating of Silver and the green coating of copper are other example of corrosion.

Methods of Preventing rusting

I) By Painting - The iron articles such as window grills, iron gate, steel furniture, railway coaches bodies of cars, buses etc.

II) By Greasing and Oiling - The iron articles such as mechanical tools, machine parts etc.

III) By Galvanisation :- Coating the surface of iron objects with a thin layer of Zinc

IV) By alloying

Rancidity :- The oxidation of oils or fats in a food resulting into a bad smell and bad taste is called rancidity.

Methods to prevent rancidity.

1. Refrigeration of the food stuffs.
2. Replacing air by nitrogen.

3. Avoid keeping the cooked food and food material in direct sunlight

4. By adding antioxidants.

Eg - BHA Bytylated Hydroanisole
BHT - Butylated Hydrooxy toluene.

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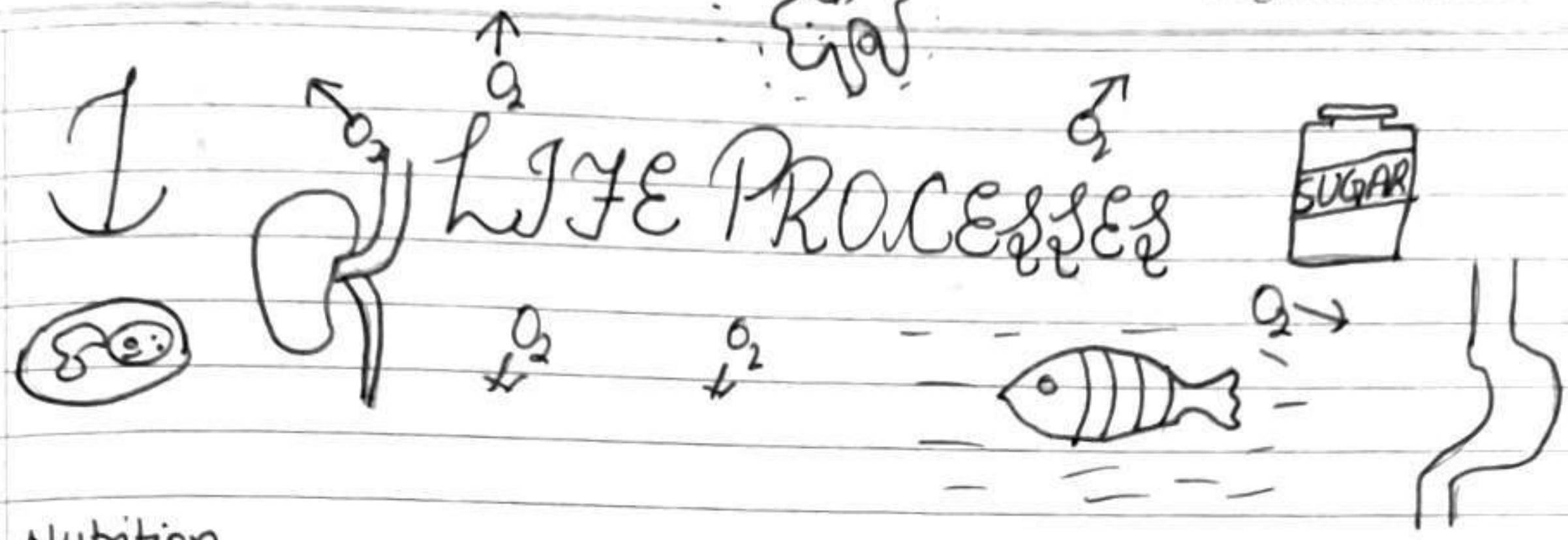


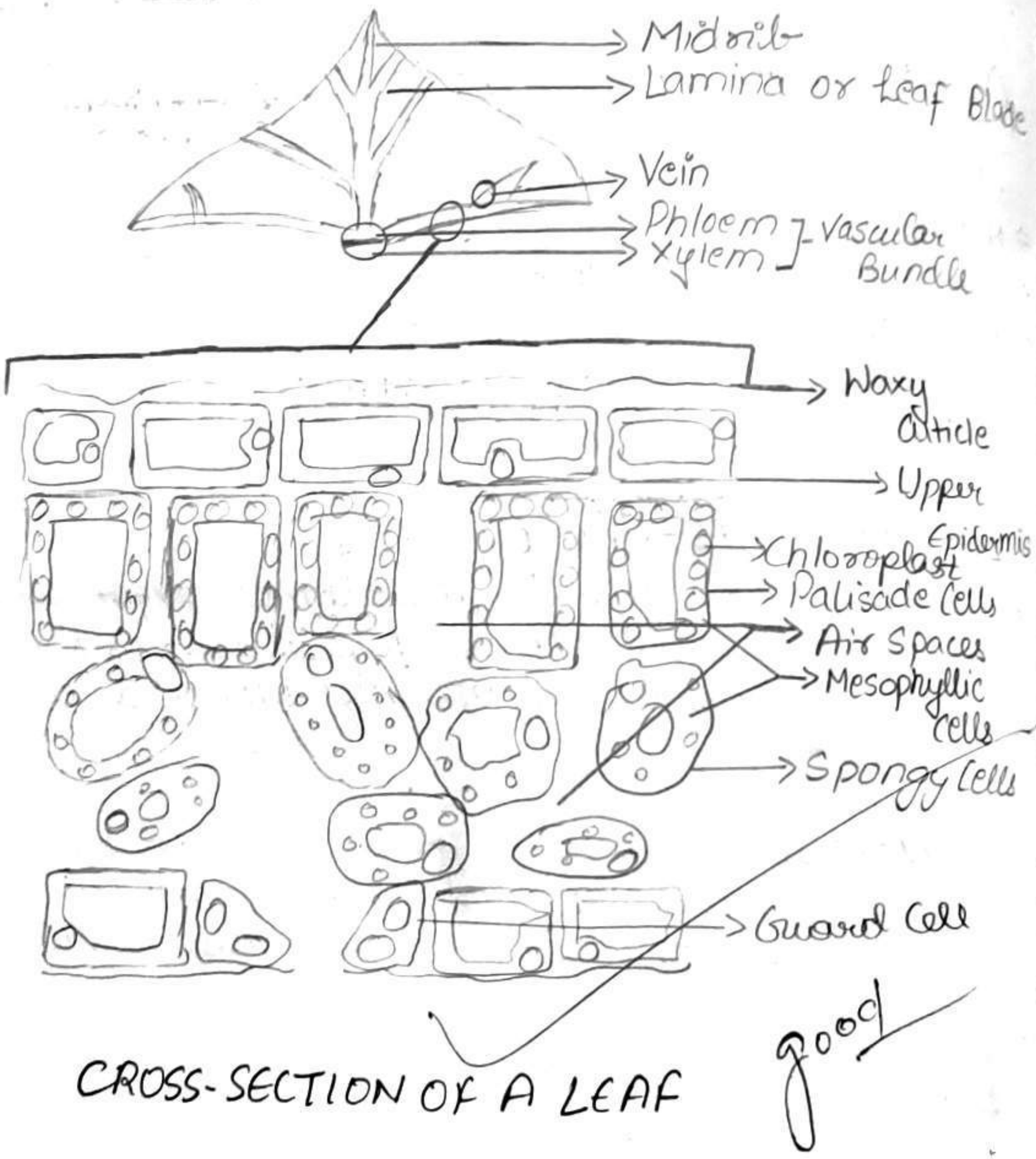
⇒ Nutrition
⇒ Human digestive system
⇒ Respiration
⇒ Transportation
⇒ Excretion

LIFE PROCESSES - The processes required to maintain life in the living organisms are known as life processes. Ex-Respiration, digestion, transportation and excretion.

Nutrition - The process of obtaining food from outside (environment) to fulfill the energy requirement of the body is called Nutrition.

→ Nutrition serves two purpose-
1.) It provide energy for performing various life activites.
2.) Provides material required for growth and developement of body.

Teacher's Signature .....



CROSS-SECTION OF A LEAF

good

Expt. No. .....

Page No. .....

Q. Write difference between autotrophic and heterotrophic nutrition?

AUTOTROPIC NUTRITION	HETEROTROPIC NUTRITION
⇒ Organisms can prepare their own food.	⇒ Organisms can't prepare their own food.
⇒ They are self dependent for food.	⇒ They depends on plants and plant's products to obtain food.
⇒ They can do photosynthesis.	⇒ They can't do photosynthesis.
⇒ They have chlorophyll present in them.	They do not have chlorophyll.
⇒ Ex- All green plants, blue-green algae, etc.	Ex- Animals, fungi, etc. (Except Euglena).

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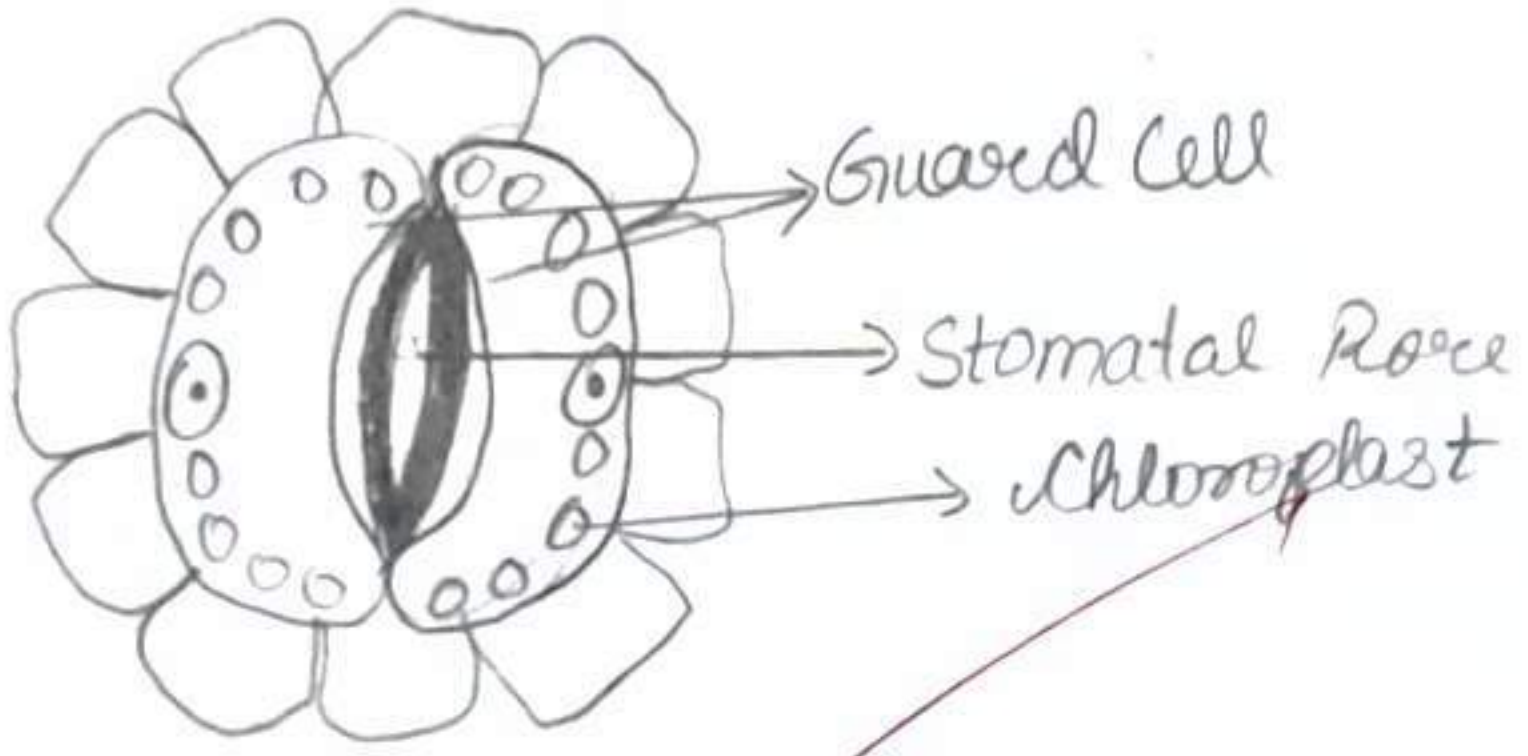
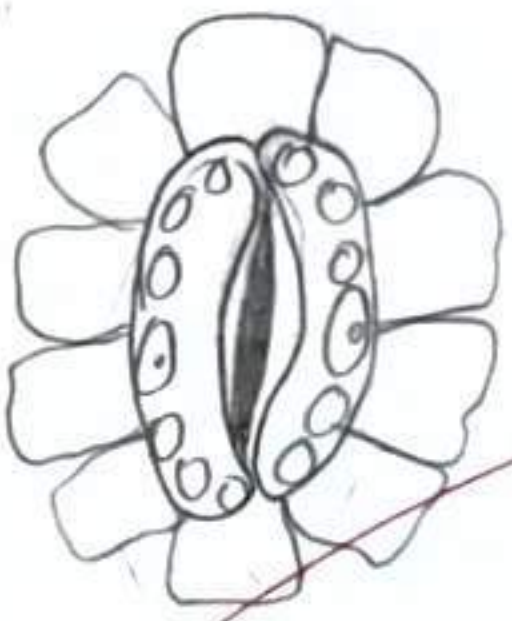


(a) Opening of Stomata



(b) Closing of Stomata.

Expt. No. ..... Page No. .....

AUTOTROPIC NUTRITION ~ It is the mode of nutrition by which green plants (autotrophs) are able to make their own food by using inorganic raw materials like as CO_2 & H_2O in presence of sunlight and chlorophyll.

→ Green plants have chlorophyll. Hence, they can make their own food.

PHOTOSYNTHESIS ~ The process of converting carbon-di-oxide and water in carbohydrate (Glucose) in presence of sunlight and chlorophyll is called photosynthesis.

Equation of Photosynthesis -

$$6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2$$

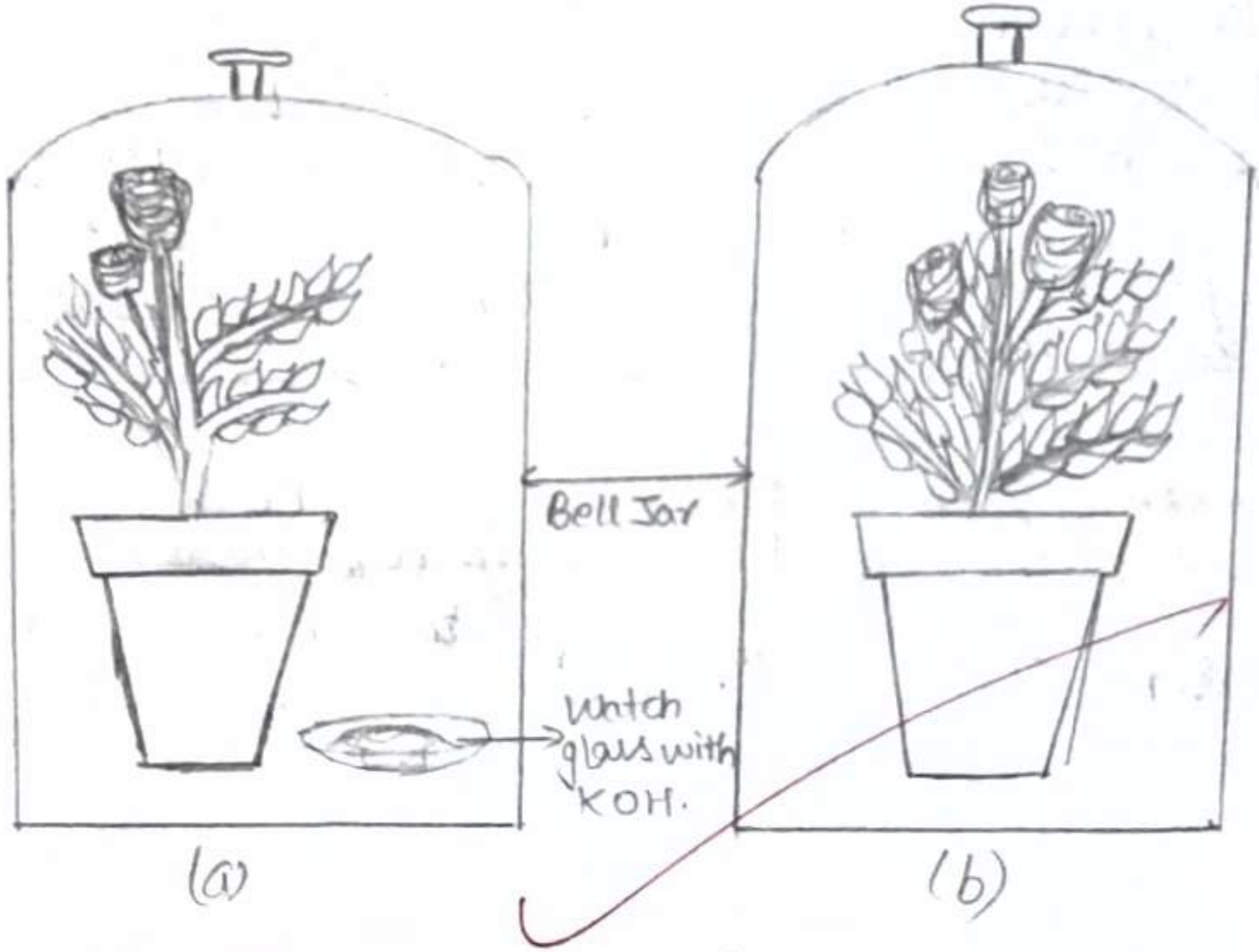
Carbon di oxide + Water → Glucose + Oxygen.

Carbohydrates are utilised for providing energy to the plant.

→ Some amount of Carbohydrates which are not used immediately are stored in the form of starch.

→ It serves as reserve food material for internal energy, which is used as per requirement.

Teacher's Signature _____



Experimental set up - (a) with Potassium Hydroxide (b) without Potassium Hydroxide.

Raw Materials Required for Photosynthesis :-

1) Sunlight → Absorbed by Chlorophyll molecule.

2) Water → Taken by roots from soil.

3) Chlorophyll → Present in chloroplast in leaves.

4) Carbon-di-oxide → Enters leaves through Stomata present on the leaf's surface.

⇒ Photosynthesis is an essential process as it provide food and oxygen for all the living beings (directly or indirectly)

→

HETEROTROPHIC NUTRITION - It is a mode of nutrition in which the organisms cannot prepare their own food and they depend on plants and plant products to obtain energy (directly or indirectly).

All animals and non-green plants perform this.

It is further divided into three types :-

→ Holozoic Nutrition
→ Saprophytic Nutrition
→ Parasitic Nutrition

Teacher's Signature

HOLOZOIC NUTRITION - It is the type of nutrition in which complex food material is ingested, digested, absorbed, and utilised in the body. Ex - human beings, cow, dog, Amoeba, etc.

HETEROTROPIC (HOLOZOIC) NUTRITION IN AMOEBA - OR

→ It is a unicellular animal found in freshwater ponds.
→ Whenever it comes in contact with food particle, Amoeba form a cup-like structure around the food with the help of pseudopodia (false feet).
→ Ingestion of food take place in the form of food vacuole.

SAPROPHYTIC NUTRITION:- In this mode of nutrition, the organism obtain energy from dead and decaying organic matter. Ex - fungi, some Bacterias, etc.

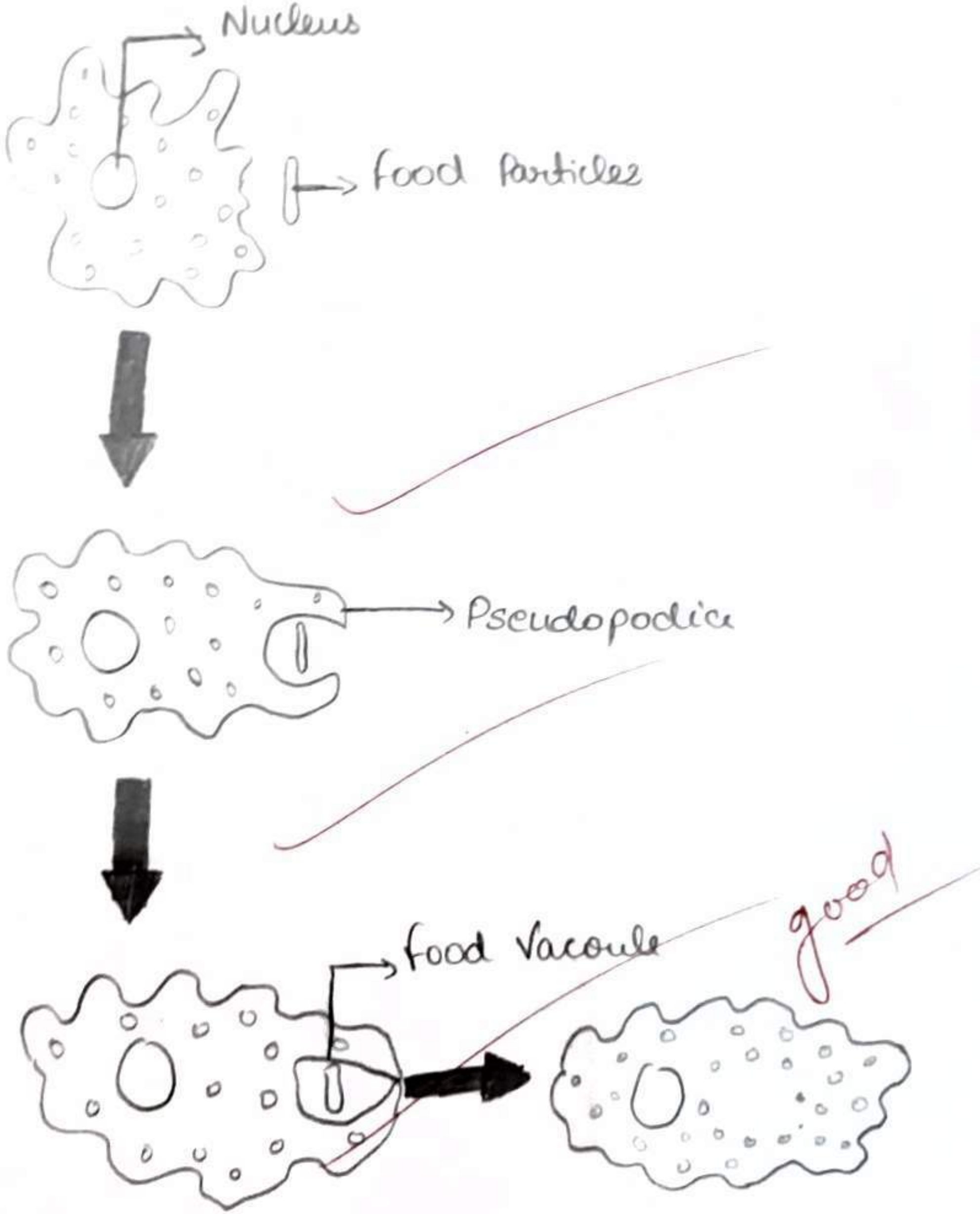
Saprophytes release digestive enzymes on the dead bodies and then absorb the nutrients from them.

PARASYTIC NUTRITION:- It is the type of nutrition in which one organism obtain nutrient from the body of other organism.

The organism which takes nutrients is known as parasite.

Teacher's Signature : _____

NUTRIJION IN AMOEBA



while the organism from which the food has been taken is known as <u>host</u>.

It is of two types :-

1.) <u>Ectoparasite</u> ;→ The parasite lives on the body of host. Ex - Leech, lice, mosquito.

2.) <u>Endoparasite</u> ;→ The parasite lives inside the body of the host. Ex - Tapeworm, Ascaris €, etc.

HUMAN DIGESTIVE SYSTEM -

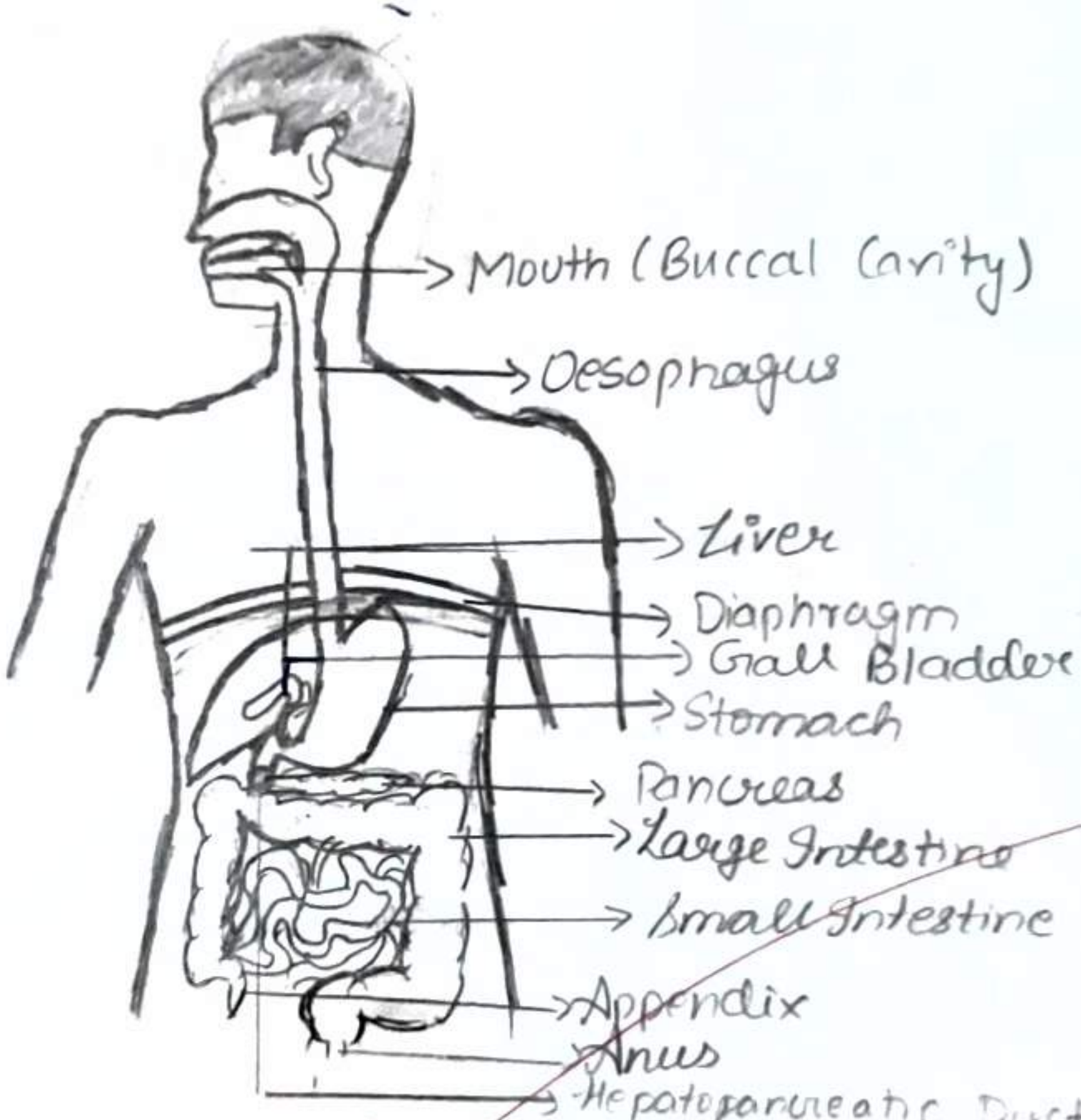
The organs that are responsible for ingestion, digestion, absorbtion, assimilation and egestion constitute the digestive system.

The human digestive system has two main parts -

1.) Alimentary Canal
2.) Digestive Glands → Salivary glands
→ Pancreas
→ Liver.

Teacher's Signature : _____

HUMAN DIGESTIVE SYSTEM



(I) ALIMENTARY CANAL - It is about 9 mtre long tube consisting of following parts.

→ Mouth → It is the opening of alimentary canal and is guarded by a pair of lips. It opens into Buccal cavity.

→ Buccal Cavity → It is the cavity present in mouth. It consist of muscular tongue and 32 teeths.

Teeth → There are four types of teeth present in our Buccal cavity.

→ Incisors - Cutting teeth
→ Canines - Tearing teeth
→ Premolars } Grinding teeth
→ Molars }

Dental formula of an Adult ⇒ $\frac{\text{ICPM}}{2123}$ (Upper Jaw) = $\frac{16}{16}$ = 32
2123 (Lower Jaw)

→ Pharynx → It is the short conical region that lies after buccal cavity.
It has three parts namely
→ Oropharynx (Opening of Oesophagus)
→ Nasopharynx (Opening of Trachea)
→ Laropharynx (Larynx) (Voicebox)

Teacher's Signature :

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Teacher's Signature :

Oesophagus → It is a long narrow muscular tube-like structure which opens into stomach. It is a flexible tube which help in swallowing of the food

Stomach → It lies below the diaphragm on the left side of the abdominal cavity. It is a 'J' shaped or inverted 'L' shaped structure. The food stores into stomach for two to six hours. Most of the digestion of food takes place within the stomach with the help of various digestive enzymes.

Small Intestine → It is a highly coiled tube of about 6 - 7.5m long tube and has three parts namely as:

→ Duodenum
→ Jejunum
→ Ileum

Large Intestine → It is a shorter, wider part of alimentary canal and has three parts

→ Caecum
→ Colon
→ Rectum

⇒ Rectum opens outside through anus.

2m
Imp → Functions of HCl →
→ HCl makes the medium acidic.
→ It kills the germs present in food.
→ It also help to convert pro enzyme 'pepsinogen' into 'pepsin'.

Pepsinogen $\xrightarrow{HCl}$ Pepsin
→ Now pepsin breakdown protiens into proteoses and peptones.

Proteoses $\xrightarrow[ins]{Pepsin}$ Proteoses + Peptones

→ The partially digested food moves towards duodenum which recieves bile juice (liver) and pancreatic juice (pancreas) through a common duct known as hepato-pancreatic duct.

2m
Imp Functions of Bile Juice →
→ It makes the medium alkaline (basic) in duodenum (pH-8.8)
→ It also activates the enzyme lipase.
→ Bile juice help in emulsification of the fat.

2m
Imp Emulsification: It is defined as the process of breakdown of fats into fatty acids and glycerol.

with the help of lipase in presence of bile juice

(A)
Lipase (bile juice)
Fats ⟶ Fatty Acids + Glycerol

→ $C_{17}H_{35}COOH$ (Stearic Acid)

Tri-hydroxy Propane

CH_2OH
|
$CHOH$
|
CH_2OH

Glycerine

02/08/19 ~

(II) DIGESTIVE GLANDS:→

Salivary glands:→ There are three pairs of salivary glands in our body namely

1.) Sublingual glands (1 pair)
2.) Submaxillary glands (1 pair)
3.) Parotid (1 pair)

Salivary glands secrete salivary that contains water, electrolytes, several enzymes like salivary amylase (ptyalin) and lysozymes (anti-bacterial enzyme)

Liver: It is the biggest gland present in human body. It is present on to the right side of abdomenal cavity. Liver cells produce bile juice. Bile juice stores into gall bladder

Pancreas: It is the soft lobulated gland present between duodenum and stomach. It secrete pancreatic juice which contains three enzymes → trypsin, pancreatic amylase, lipase.

Gastric Glands:- They are present in the walls of stomach. They produce mucus, HCl and pepsinogen.

Teacher's Signature : _____

PROCESS OF NUTRITION ~ (III)

Ingestion - It is the process of taking food inside the mouth (buccal cavity).

Digestion - It is the catabolic process which involves to breakdown of large, complex food particles into small, simple and soluble food particles with the help of enzymes present in the digestive juices.

→ In the mouth, the food is chewed and grinded with the help of teeth.

→ The salivary amylase (ptylin) present in saliva breakdown starch into maltose.

$$\text{Starch} \xrightarrow{\text{Sal. Amylase}} \text{Maltose}.$$

→ After this, the food is swallowed in the form of bolus through oesophagus by the peristaltic movement of oesophageal wall.

Peristalsis → It is defined as the wavy movement of oesophageal valve which help in forward movement of food in alimentary canal.

→ Now the food enters into the stomach and stores here for 2-6 hours.

→ The gastric glands present in stomach produce HCl.

Pancreatic juice produced by pancreas contains three enzymes and works on following substances →

1.) Trypsin → help to digest protien
2.) Pancreatic Amylase → Works on carbohydrate
3.) Lipase - help to digest fats.

→ Finally digestion completes in small intestine with the help of intestinal juices which contain several enzymes

~~Carbohydrates~~

Polymer	Monomer
Carbohydrates	Glucose
Protien	Amino Acid
Fats → diglycerides → monoglycerides →	fatty acids + glycerol.

Absorbtion →

Q Why is finger-like projections called villi are present in small intestine?
The small intestine has many finger-like projections called villi which help in absorbtion of nutrients from the digested food material. There villi contain fine network

Teacher's Signature :

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II RESPIRATION

Respiration → Respiration is a very important process taking place in both plants and animals. The respiration is a complex process that takes place in following steps →

1.) Breathing → It is the process of taking in O_2 rich air and releasing CO_2 rich air from the body. It is further divided into two types.

Inhalation → Taking O_2 rich air.

Exhalation - Releasing CO_2 rich air.

2.) Gaseous Exchange in Lungs.
3.) Transport of gases by blood
4.) Gaseous Exchange in Tissue
5.) Cellular Respiration

Respiration in Animals → In animals, it takes place by the various organs.

1.) In unicellular organisms, it takes place by diffusion through plasma membrane.
.) On earthworm, it takes place through skin (cutaneous respiration)
.) Aquatic Animals resp respire through gills (ctenidial respi
.) Insects have air tube (spiracles) for respiration (tracheal respiration)

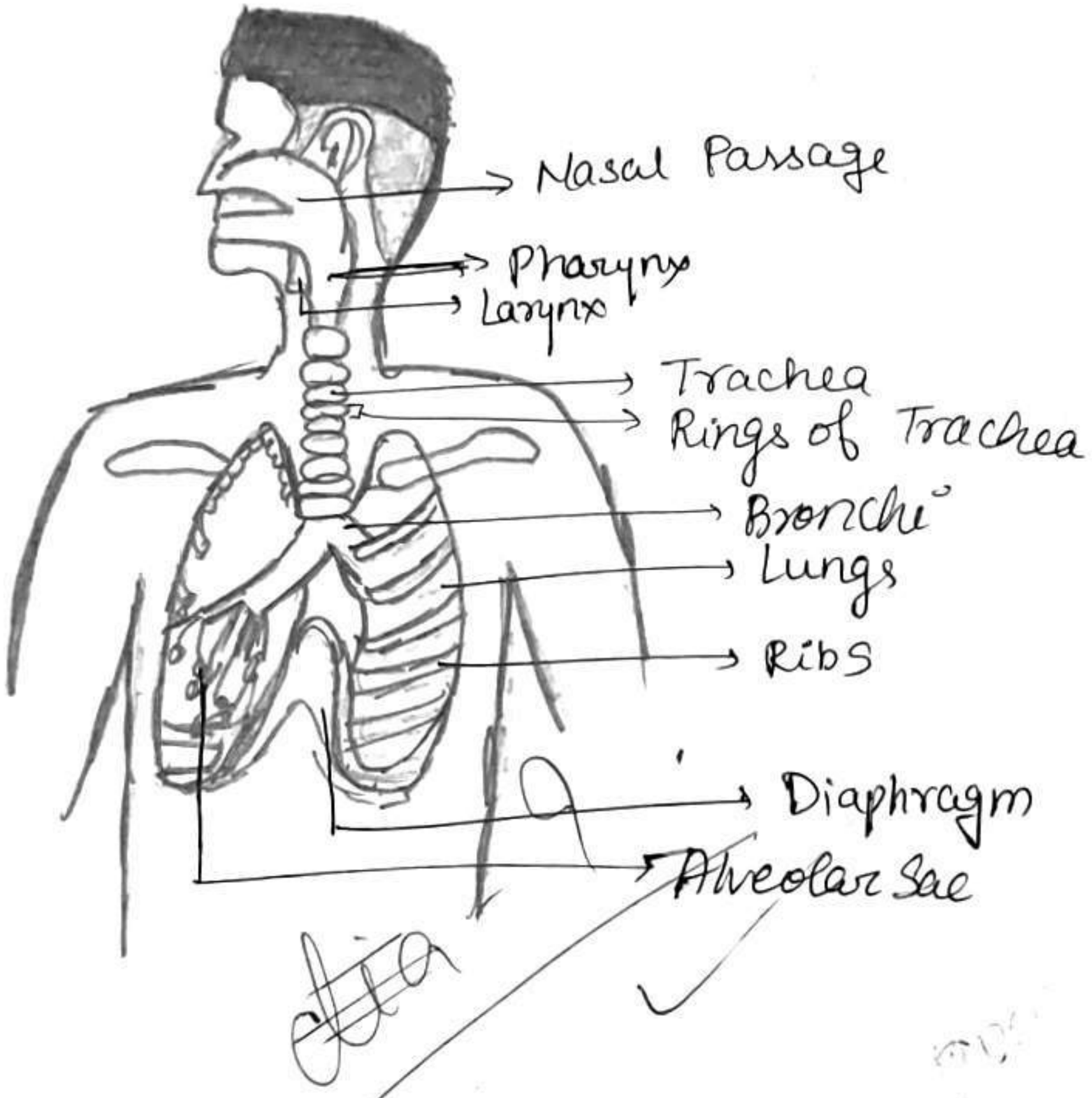
Teacher's Signature :

of blood vessels. It increases the area of absorbtion of digested food.

ASSIMILATION: It is the procers of utilization of absorbed nutrients in the body for various function.

⇒ Carbohydrates ⇒ Energy-giving food
⇒ Protien ⇒ Body-building food
⇒ fats ⇒ Energy-giving
⇒ Minerals and salt ⇒ Conductivity
⇒ Vitamins ⇒ Protective food.

EGESTION: It is the procers of removal of undigested food from the body taking place through anus.



HUMAN RESPIRATORY SYSTEM

Date .....

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5.) Reptiles, birds and humans have lungs for respiration (pulmonary respiration)

HUMAN RESPIRATORY SYSTEM :

It consists of following parts :-

→ The respiratory organs → Pair of lungs in the chest cavity

→ The respiratory tract → It has various parts namely as nose, nostril, nasal cavity, nasopharynx, trachea, bronchi, bronchioles and alveoli.

Trachea → It is also known as wind pipe. It is supported by 'C' shaped cartilagenous rings. These rings make the trachea tough and prevent it from collapsing when there is no air in it.

Alveoli → Each bronchiole opens into many thin walled small balloon-like structures called alveoli. It is provided with fine network of blood vessels which provide surface area for gaseous exchange.

Cellular Respiration → It is defined as the oxidation of glucose that takes place either in presence of oxygen or air with release of energy.

Teacher's Signature : _____

Cellular respiration takes place in two steps →

Glycolysis → It takes place in cell cytoplasm. During the process one molecule of glucose breaks to form two molecules of pyruvic acid.

Glucose → $CH_3COCOOH$

$$C_6H_{12}O_6 \xrightarrow[\text{Cytoplasm}]{} 2\ \text{mol. pyruvic acid}$$

Krebs Cycle → It takes place in mitochondria. During the process pyruvic acid breaks down in presence of oxygen to form CO_2, H_2O, and large amount of ATP.

$$2\ \text{mol.}\ CH_3COCOOH \xrightarrow[\text{Oxygen}]{\text{Mitochondria}} 6CO_2 + 6H_2O + 36ATP$$

Pyruvic Acid

Difference b/w Aerobic and Anaerobic Respiration.

Aerobic Respiration	Anaerobic Respiration
→ The oxidation takes place in presence of O_2.	→ It takes place in absence of O_2.
→ It produces large amount of energy (36ATP).	→ It produces less amount of energy (2ATP).
→ It takes place in two steps Glycosis, Krebs Cycle	→ It takes place in one step
→ Mitochondria is involved	→ Mitochondria isn't involve
→ Ex - All plant and animal cells,	→ Ex - Yeast, Muscle cells, etc

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Alcoholic fermentation → It is anaerobic respiration taking place in yeast. During the process one molecule of $C_6H_{12}O_6$ breakdown to form 2 molecules of Ethanol, CO_2 and 2ATP.

$$C_6H_{12}O_6 \xrightarrow[\text{Yeast}]{\text{Anaerobic}} 2C_2H_5OH + 2CO_2 + 2ATP$$

Glucose — Ethanol — Carbon di-oxide — Energy

Applications →

→ It is the base of bakery industry. The CO_2 makes the food soft and fluffy.
→ It is also the base of beverage industry. Alcohol is used to make various drinks like whisky, beer, wine, etc.

Lactic Acid fermentation → It is anaerobic respiration taking place in muscles. In case of heavy exercise. During the process glucose breakdown into lactic acid and 2ATP molecules.

$$C_6H_{12}O_6 \xrightarrow{\text{Muscle cell}} CH_3CHOHCOOH + 2ATP$$

Glucose — Lactic Acid — Energy

Teacher's Signature :

BLOOD PLASMA → It is fluid matrix. 55% of blood volum is plasma. 90% of plasma is water. It also contain dissolved minerals, glucose, amino acids, hormones and plasma protiens namely as albumin, globulin and fibrinogen.

⇒ Fibrinogen is the protien which help in blood clotting.

Plasma - Fibrinogen = Serum

Cellular Components →

RBCs ⇒ Red Blood Corpuscles (Erythrocytes)
- → They are also known as Erythrocytes.
- → They are biconcave in shape and are non-nucleated cells.
- → There no. is 4-5 million - 5.5 million /ml of blood.
- → Site of production of RBCs is Bone marrow of Ribs, Sternum and vertebrae, femur, etc.
- → The life span of RBCs is 120 days

Clotting →.

WBCs ⇒ White Blood Corpuscles (Leucocytes)
- → They are nucleated cells of shapes and sizes
- → These cells constitute the immune system of the body i.e protect us from various infections
- → They no. 6000-8000/ml of blood.

TRANSPORTATION

TRANSPORTATION IN HUMAN BEINGS:

Transportation of various substances within the human body is the function of blood circulatory system.

Components of Blood Circulatory system →

1) Blood
2) Heart
3) Blood vessels.

BLOOD → Blood is fluid connective tissue consisting of
- → Blood Plasma
- → Blood Cells

Human beings have closed type of blood circulatory system. It means the blood flows in blood vessels

COMPOSITION OF BLOOD

ACELLULAR COMPONENT	CELLULAR COMPONENT.
→ Plasma (55%)	→ Red Blood Cells (RBC)
→ 90% H_2O	→ White Blood Cells (WBC)
→ 10% Plasma Protiens	→ Platelets.
☆ Albumin	
☆ Globulin	
☆ Fibrinogen	
→ Nutrients, Hormones, etc.	

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HUMAN HEART

⇒ It is a muscular organ to pump the blood in the body. It is made up of cardiac muscles (myogenic). Rate of

⇒ Weight of heart in adult human male is
300 - 350 gm
for women
250 - 300 gm

⇒ Heart is situated in upper chest region, to the little left side of the body.

⇒ Study of heart is called Cardiology.

⇒ Human heart has four chambers ↴
1.) Right Auncle
2.) Right Ventricle
3.) Left Ventricle
4.) Left Ventricle

⇒ Blood vessels entering in heart are -
Superior Vena Cava
Inferior Vena Cava
Pulmonary Vein

⇒ Blood vessels leaving heart are -
1.) Aorta
2.) Pulmonary Artery

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WBCs

Granulocytes	Agranulocytes
1. Eosinophills Life Span - 3 to 5 days Produce allergic responses	1. Monocytes Also called Macrophages Phagocytotic in nature
2. Basophils Life Span - 9 to 18 days Produce allergic reactions	2. Lymphocytes Life span - 100 to 200 days Produce antibodies
3. Neutrophils (65% of WBC Count) Life Span - 12 hrs to 3 days Phagocytotic in nature	→ T - Lymphocytes → B - Lymphocytes

Platelets → Also known as Thrombocytes
→ They are non-nucleated
→ Help in blood clotting and prevent loss of blood from body

Functions of Blood →
→ Transportation of gases like O_2 & CO_2.
→ Transport nutrients like glucose and amino acids.
→ Transport hormones
→ Transport waste like Urea & Uric Acid.
→ Maintaining Body pH
→ Maintaining body temperature.

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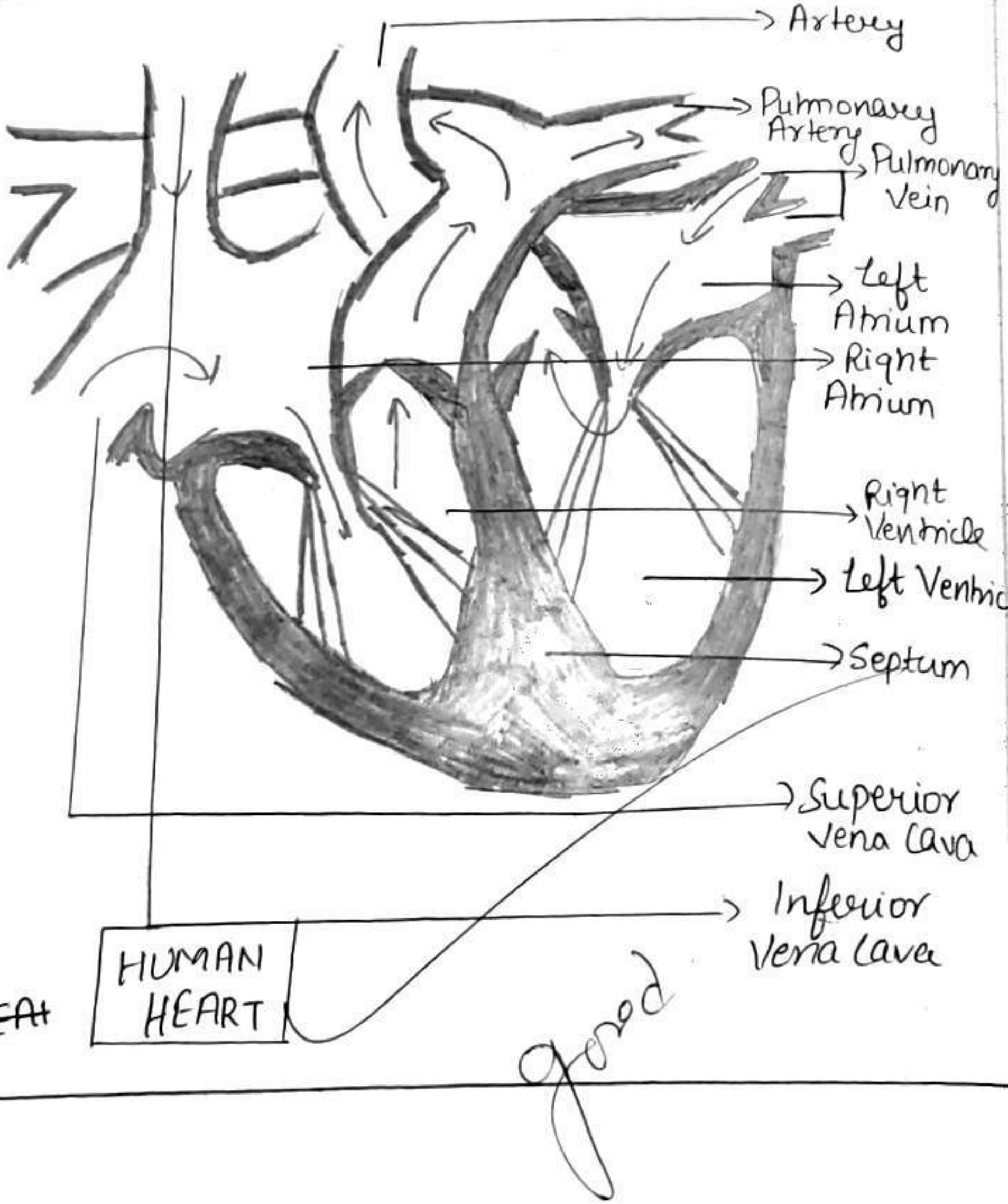
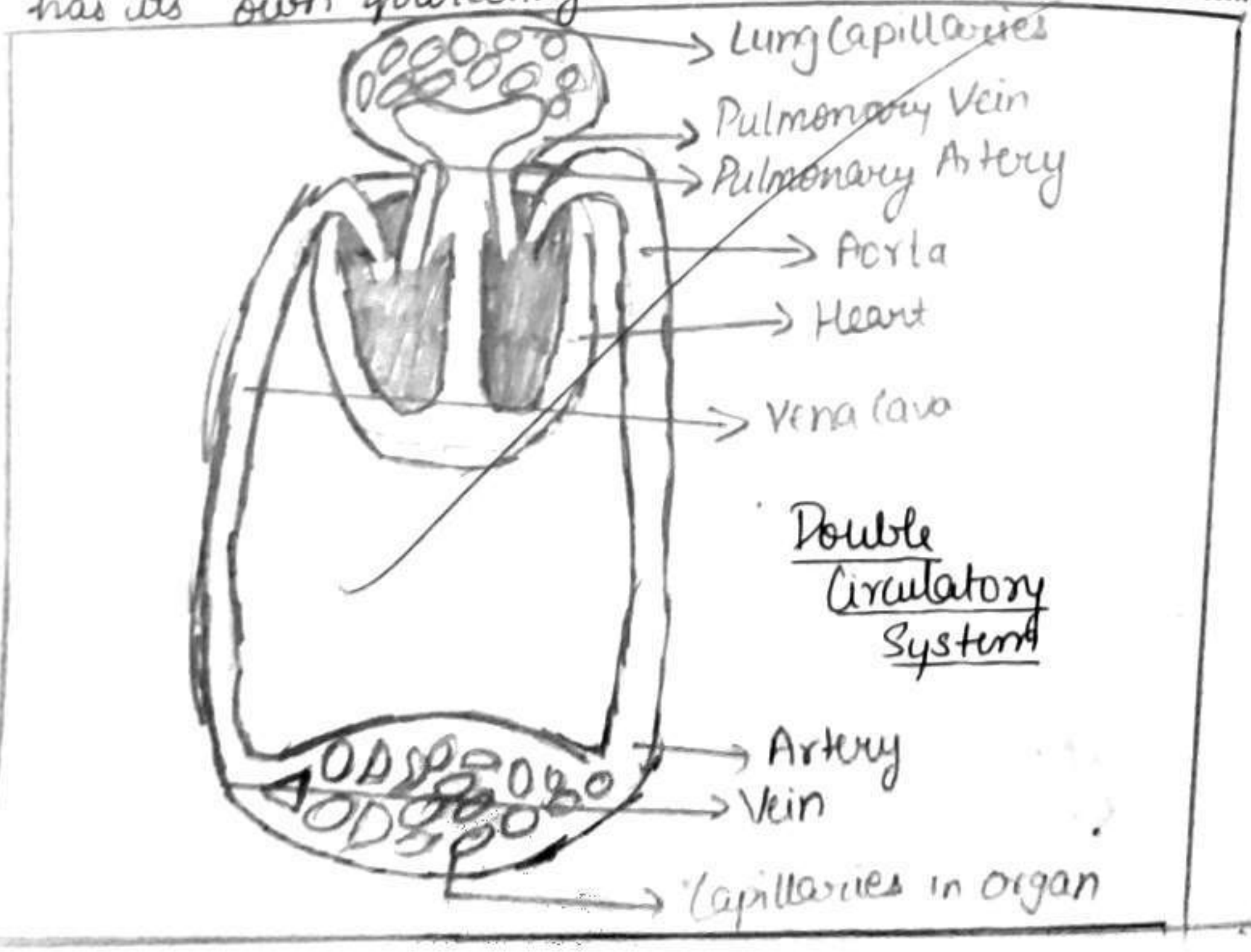

Artery
Pulmonary Artery
Pulmonary Vein
Left Atrium
Right Atrium
Right Ventricle
Left Ventric
Septum
Superior Vena Cava
Inferior Vena Cava
HUMAN HEART
HEAT
good

→ Valves in the heart are
- Tricuspid Valve
- → Bicuspid Valves Mitreal Valve)
- → Semilunar Valves

→ Nervous Tissue of heart are → (Neurogenic)
- → Sino Auricular Node (SAN) (Pacemaker of Heart) ☆
- → Auriculo-Ventricular Node (AVN)
- → Bundles of His
- → Purkinje fibres

☆ SAN generates electrical impulses for functioning of heart.

Heart has its own protecting membrane called Pericardium.



② Pulmonary Circulation → During this circulation deoxygenated blood is carried through the pulmonary artery to the lungs while the oxygenated blood comes to heart through pulmonary vein.

BLOOD PRESSURE → The pressure exerted by blood on the walls of arteries is called blood pressure. It can be measured with an instrument called sphygmomanometer.
Normal blood pressure ⇒ $\frac{120}{80}$ mm Hg (Systolic) / (Diastolic)

High blood pressure is equal to hypertension ⇒ $>\frac{140}{100}$

Low Blood Pressure is equal to hypotension ⇒ $<\frac{90}{60}$

Blood Vessels → Human beings have closed type of blood circulatory system. The blood flows in proper tubes called blood vessels. They are of three types ⇒

(i) Arteries
(ii) Veins
(iii) Capillaries

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WORKING OF HUMAN HEART→

The oxygenated blood comes into left auricle by the means of pulmonary vein. The at the same time right auricle also recieves deoxygenated blood from superior vena cava and inferior vena cava.

SAN generates electrical impulses and causes contraction of auricles (systole).
The deoxygenated blood comes into right auricle through tricuspid valve and the oxygenated blood comes into left ventricle through bicuspid valve.

AVN generate electrical impulses and causes contraction of ventricles. Now the O_2 blood goes to all body parts by the means of aorta and deoxygenated blood goes to lungs through pulmonary artery.

Q. What do you mean by Double Circulatory system?
In human beings the blood passes through heart twice in one cardiac cycle, it is called double circulation. It has following two steps→

① Body or Systemic circulation→ During this, the O_2 ed blood goes to all body parts through aorta and deoxygenated blood come back to heart through superior vena cava and inferior vena cava.

Teacher's Signature

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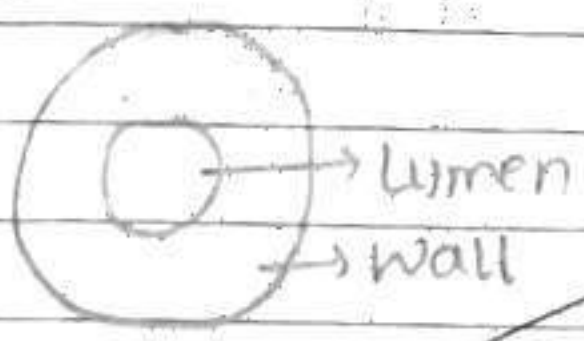
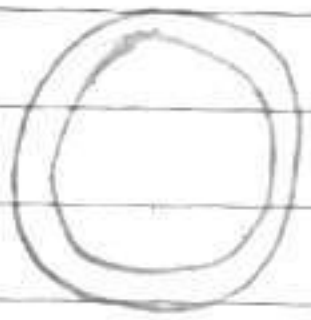
Imp 8. Write difference between arteries and veins?

Arteries	Veins
Carry blood from heart to organs	Carry blood from organ to heart.
Carry oxygenated blood except pulmonary vein	Carry oxygenated blood except pulmonary vein.
Pressure is more	Pressure is less.
Arteries have narrow lumen, thick wall. 	Veins have broader lumen, thin wall 
Arteries are deep in position	Superficial (near to skin) in position.
Valves are absent.	Valves are present to prevent back flow of blood.

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TRANSPORTATION IN PLANTS

In plants transportation of water and minerals takes place through xylem tissue.

XYLEM → It is a complex permanent tissue that transport water and minerals from roots to all upper parts of the plants.

Xylem consist of following four tissues :
→ Tracheids
→ Xylem Vessels
→ Xylem Parenchyma
→ Xylem fibres

Mechanism of conduction of water and minerals. (Ascent of Sap) →

The cells of roots are in contact of soil water. This water enters into the root by the process of osmosis. Thus the slow movement of water into root xylem from soil creats a column of water that is pulled upward.

Evaporation of water from aerial parts of plants (Transpiration) creates a pulling pressure in the upward direction which help in upward movement of water

Teacher's Signature :

Blood Capillaries - These are the smallest vessels they have single layered wall Exchange of materials such as gases, nutrients and hormones, etc take place between blood and surrounding tissues through blood capillaries.

LYMPHATIC SYSTEM

Human being have another type of fluid transport system It is called lymphatic system.

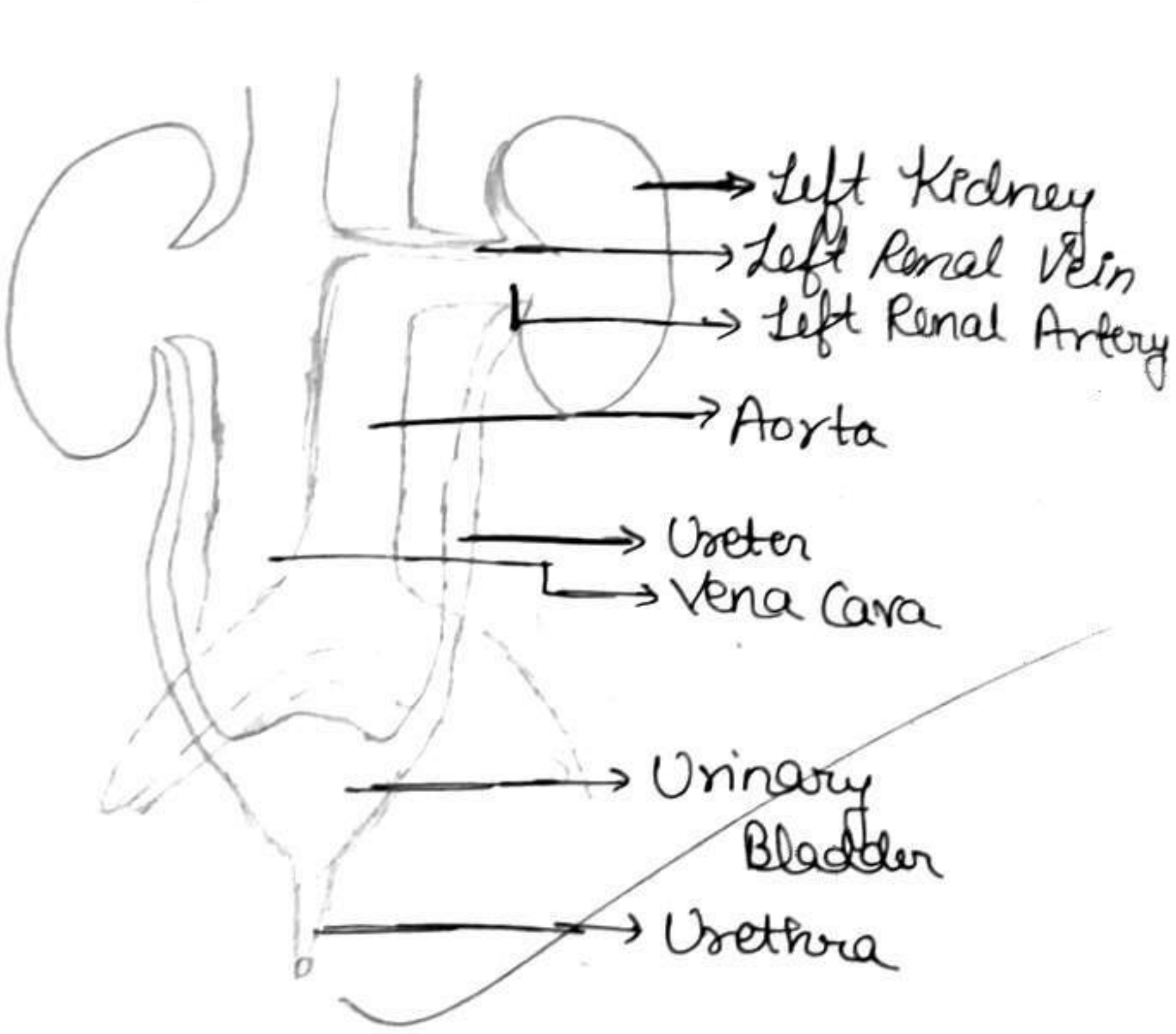
The blood is filtered out in between of the tissues from the blood capillaries and forms the lymph.

Lymph consist of plasma, protien, nutrients, hormones and lymphocytes. It is pale yellow in colour and is also known as tissue fluid.

Lymphatic System consists of :
(i) Lymph
(ii) Lymph Capillaries
(iii) Lymph vessels
(iv) Lymph nodes.

FUNCTIONS OF LYMPH :
- It provide nutrition to the tissues and cells.
- Provide protection to the tissues against microorganisms.
- Absorption and transport of digested fat from intestines
- Drainage of excess fluid in the blood (Body fluid volume)

HUMAN EXCRETORY SYSTEM



and minerals in the stem xylem and then other parts of plants. Thus, root pressure, transpiration pull and property of water molecule help in rising up of water and minerals in plants.

CONDUCTION OF FOOD IN PLANTS:

PHLOEM → It is the vascular tissue that conducts food material in plant body from leaves to other parts of plant (bi-directional).

It consist of four elements:-
- → Sieve tubes
- → Companion cell
- → Phloem Parenchyma
- → Phloem fibres.

Mechanism of Transport of food (Translocation):

Translocation of food and other substance is bi-directional means, it take place both in upward as well as downward direction. The food entering in the phloem tube is transported to all others part of plant by network of phloem tubes.

The process of Translocation take place through Massflow Hypothesis.

The translocation of food is necessary as each and every part of plant requires energy.

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EXCRETION

Excretion → The process of removal of harmful nitrogenous waste (NH_3, Urea, and Uric Acid) from the body of an organism is known as excretion.

Primary organs for Excretion :-

Lungs → Expulsion of CO_2 by respiration

Skin → Removal of salt by sweat

Kidney → Elimination of nitrogenous waste like urea, uric acid and NH_3.

Unicellular organism remove their waste by diffusion.

Multicellular organism have specialised organ for respiration.

Ex → Earthworm → Nephridia
Cockroach → Malphigian tubules
Prawn → Green Glands
Human → Pair of Kidney.

HUMAN EXCRETORY SYSTEM :-

The excretory system in human consist of :-
→ A pair of kidney → Urinary bladder
→ A pair of ureters → Urethra

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KIDNEY → They are the main excretory organ in human
They are bean shaped and reddish brown in colour
in and are located in the lower abdominal cavity, one
each side of the vertebral column. The left one is plac
a little higher than the right one. Because the right
side has liver.

The renal arteries bring the uncleaned blood into the kidn
for filtration. The Renal veins carries away the unclean
blood from the kidney.

NEPHRON → It is the structural and functional unit of ea
kidney. Each kidney consist of 1 million neph

Nephron has the two parts.

1. Bowmann's Capsule → It is a cup like structure which contain network of blood capillaries known as glomerula

2. Renal Tubules → It is a coiled tube which consist of three parts.
PCT → Proximal Convulated Tubule
Loop of Henle
DCT → Distal Convulated Tubule

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The Afferent Renal Arteriole supplies unclean blood to the glomerulas. Filtration of blood takes place in glomerulas. Efferent Renal Arteriole take away the filtered blood.

Urine formation :-

It takes place in three steps

1. Ultra Filtration / Glomerular filtration
2. Selective Reabsorption
3. Tubular Secretion

Ultrafiltration → The blood enters into glomerulus by the renal arteriole. In Glomerulus, the filtration of blood takes place because walls of glomerulus capillary and Bowman's capsule are very thin and selectively permeable.

The Glomerular pressure (75 mm Hg) and capillary Hydrostatic Pressure (20mm Hg) helps in filtration of blood.

Once the waste is filtered out, the blood goes in the efferent renal arteriole.

The fluid containing waste material filtered out from glomerulus is called glomerular filtrate (GF).

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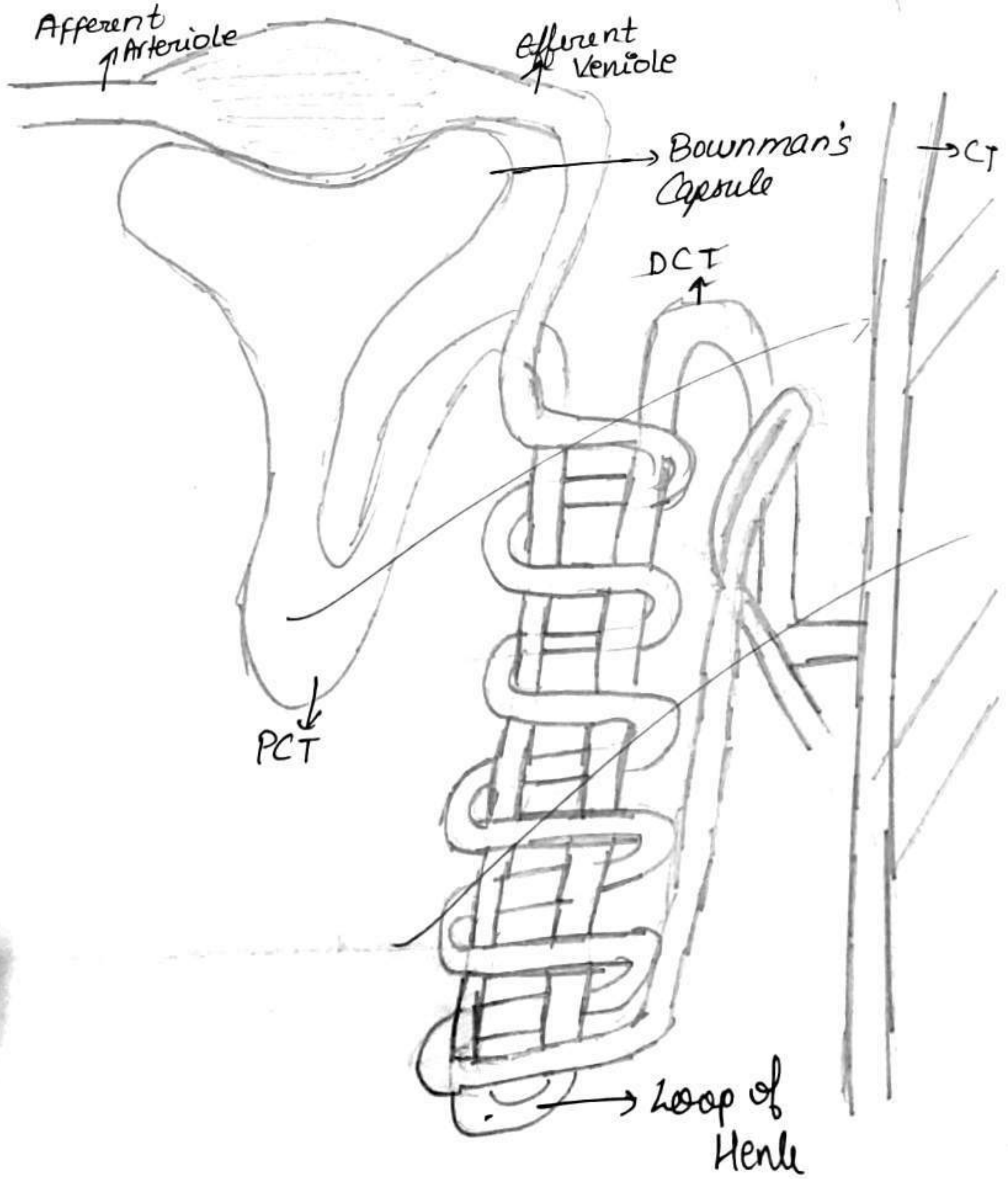
STRUCTURE OF NEPHRON



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OSMOREGULATION:

It is the process of maintaining amount of body fluid, water and ions (salts) in the body. In our body, kidney perform the function of osmoregulation.

RENAL FAILURE AND TECHNOLOGY

OF SURVIVAL:

Kidneys are the most vital organ for survival. Due to some disease or injury or restricted blood flow. The kidney may become functionless.

Artificial Kidney Machine:

It is a device used to filter the blood whose both the kidneys are out of order. The machine consist of cellophane tubes suspended in a dialysing soln. The fluid has same osmotic pressure as blood. Waste products from the blood pass in the dialysing fluid by diffusion.

Haemodialysis → A method of cleaning blood by removing waste product such as urea and water from it.

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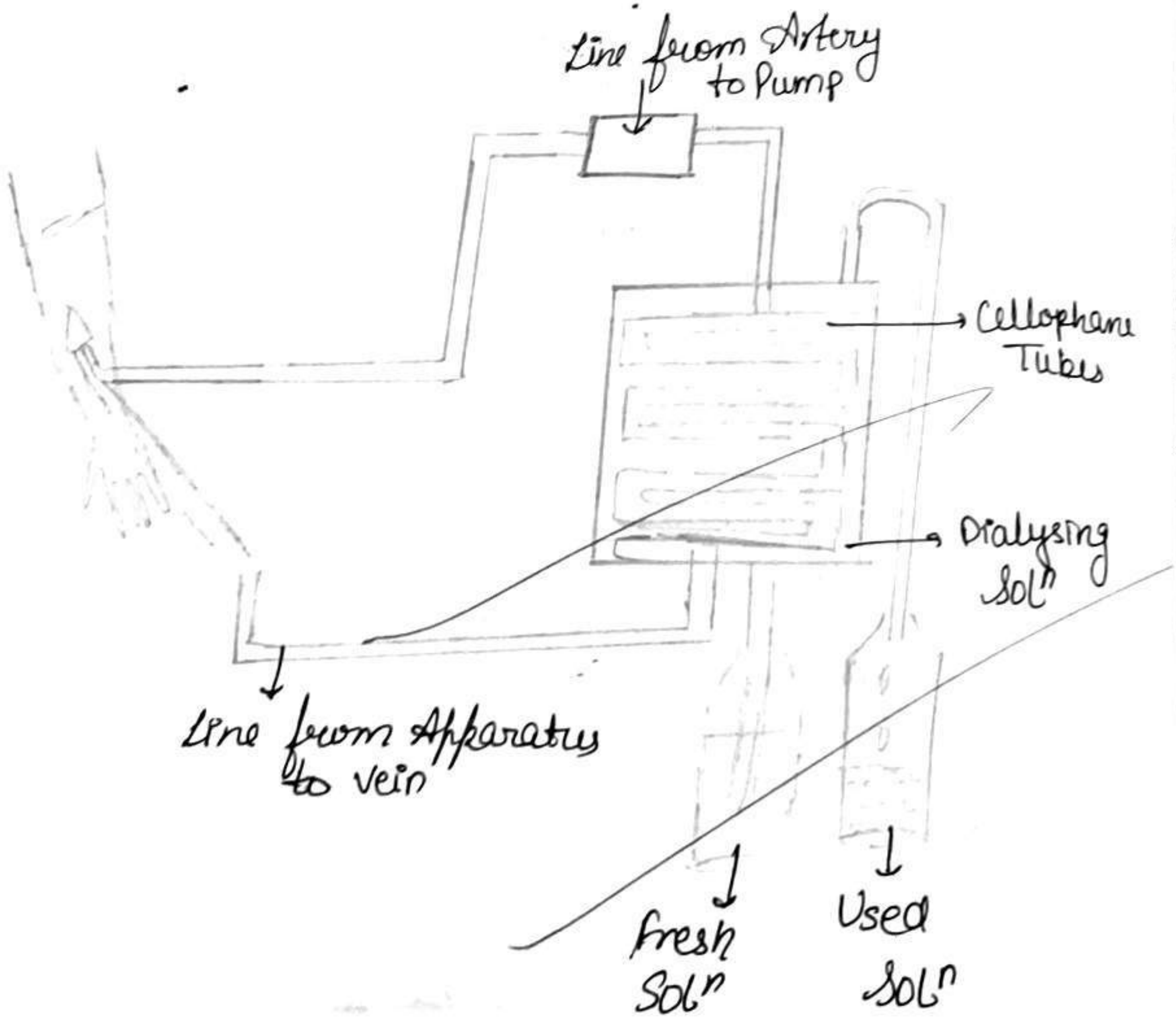
ARTIFICIAL KIDNEY (HAEMODIALYSIS)



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The filtrate contains some important things like glucose, amino acid, vitamin, salts and water along with waste like urea and uric acid.

SELECTIVE REABSORBTION →

After filtration, the GF moves from renal tubule, here the process of reabsorbtion takes place in various parts About 60% reabsorbtion take place in PCT.

TUBULAR SECRETION →

To make the proper conc. of urine, the secretion of urea, uric acid, NH_3 and excess of water take place from body fluid into PCT part of Renal tubule.

finally the conc. urine is formed and is collected into urinary bladder for excretion through urethra.

URINE ↓

Urine is a pale-yellowish fluid which contain 95% wate and 5% urea and uric acid. The yellow colour of uri is due to the presence of pigment urochrome and the s is because of ammonia.

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CHAPTER-2

CONTROL AND COORDINATION

INTRODUCTION:

Control and coordination are need to be maintained between actions performed by organisms in response to stimuli recieved from the immediate environment.

STIMULUS:
Changes around organisms that affect and compel them to react. Ex-sound, temperature, light, gravity, etc.

RESPONSE:
Movements or actions done by a living organism in reaction to stimuli. Ex-walking, running, salivation in mouth, etc

Human beings have two systems for control and coordination.
- Nervous System.
- Endocrine System

Nervous System :

Every coordinated movement or work performed by the body involves

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the integration of the specialised cells of nervous system known as neurons.

STRUCTURE OF NEURON:

- Neuron consist of following parts;
  - → Cell Body / Cyton: Transfer stimulus from dendrites to axon.
  - → Dendrites: Recreves stimulus.
  - → Axon: Transmits information further in the form of electrical impulses.
- Neuron is the structural and functional unit of nervous system.

TYPES OF NEURONS: &

- Sensory or Afferent Neuron: Carry nerve impulses from the sense organs of the body to brain and spinal cord (Central Nervous System).
- Motor or Efferent Neurons: Carry nerve impulses from CNS to various organs of the body to produce proper response.

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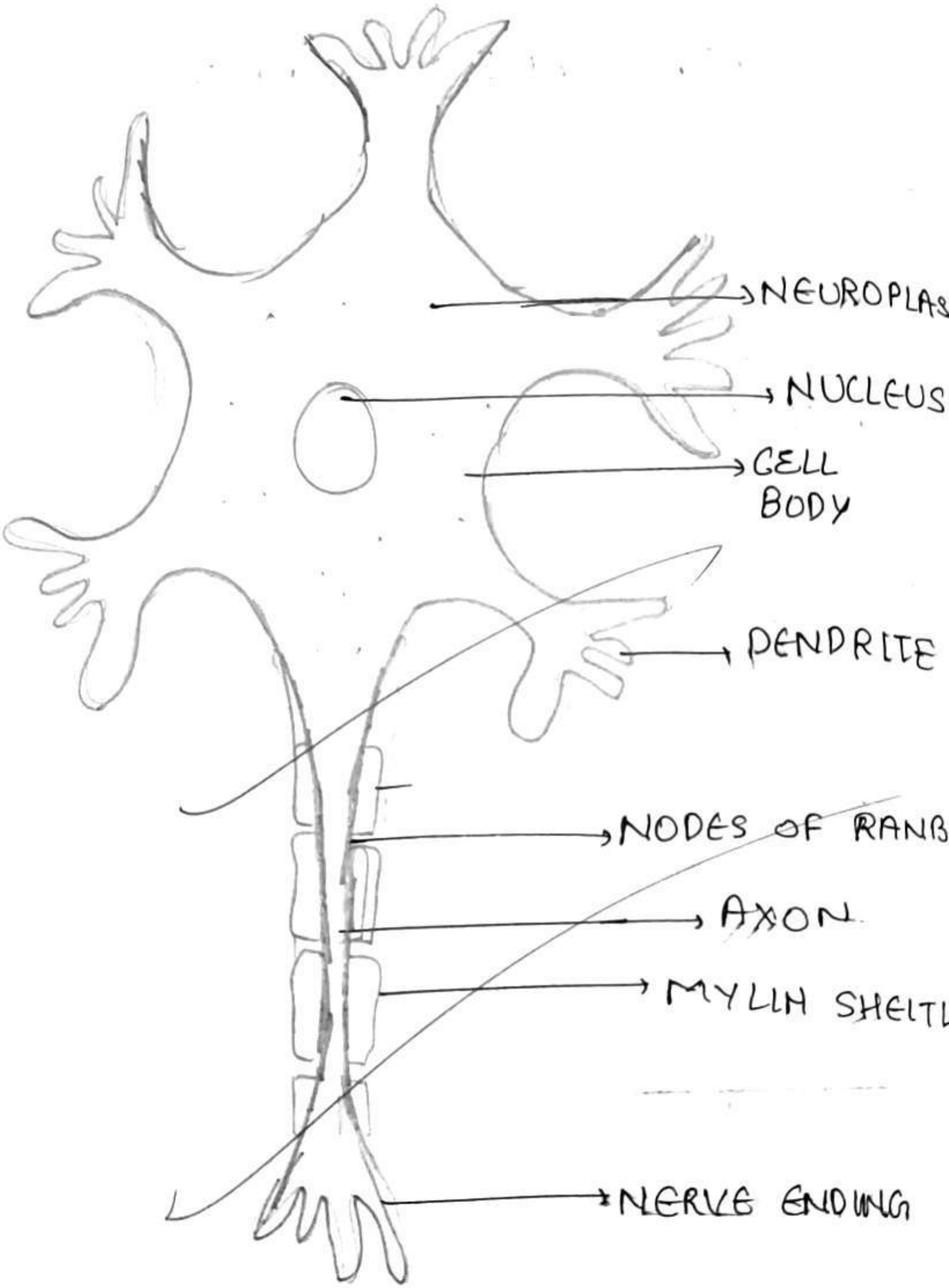
STRUCTURE OF NEURON



⇒ Inter Or Connecting Neurons: Neurons present in the brain which connect the sensory and motor neurons are called Inter neurons or connecting neurons.

* Types of Actions :-

→ Voluntary Action
→ InVoluntary Action

Imp
• Reflex Action → These are rapid, continous and automatic response of the body that occurs in presence of some stimulus.

⇒ Spinal Cord → Spinal Cord is the centre of reflex actions.
Ex → Knee jerk, Sneezing, coughing, etc.

Reflex Action Arc:

Hot Surface → Thermoreceptor → Sensory Nerve → Spinal Cord
(Stimuli) (Skin)

→ Brain → Motor Nerve → Effector Organ → Removal of Hand
(Response)

The pathway followed by the nerve impulses during the reflex action is called reflex action arc.

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HUMAN BRAIN:

→ It is the highest coordinating and controlling centre of the body. It is very well protected by in a bony box known as cranium. Brain contains three protective layer known as meninges [cerebroo spinal fluid] present between these layer protect brain from injuries. Brain is mainly divided into three parts.

FOREBRAIN: [PROSENCEPHALON]
It is the front part of brain that control maximum activities of body.

Cerebrum → It is the biggest part of the brain and is made up of two cerebraes hemisphere, it is the centre of speech, reasoning, higher mental activities, hearing, vision, touch, temperature, etc.

Olfactory Lobes → There are small lobes present below cerebral hemisphere and are the centre of smell. (Olfactory Receptors).

Diencephalon → It consist of hypothalamus. Hypothalamus is the centre hunger, thirst, and sleep. Pituitary gland is also attached to hypothalamus with a the help of stalk called infundibulum.

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Mid Brain →

It is the small region that control reflex movemen of head, neck and trunk. To produce response against auditory and visual reflex action.

Hind Brain →

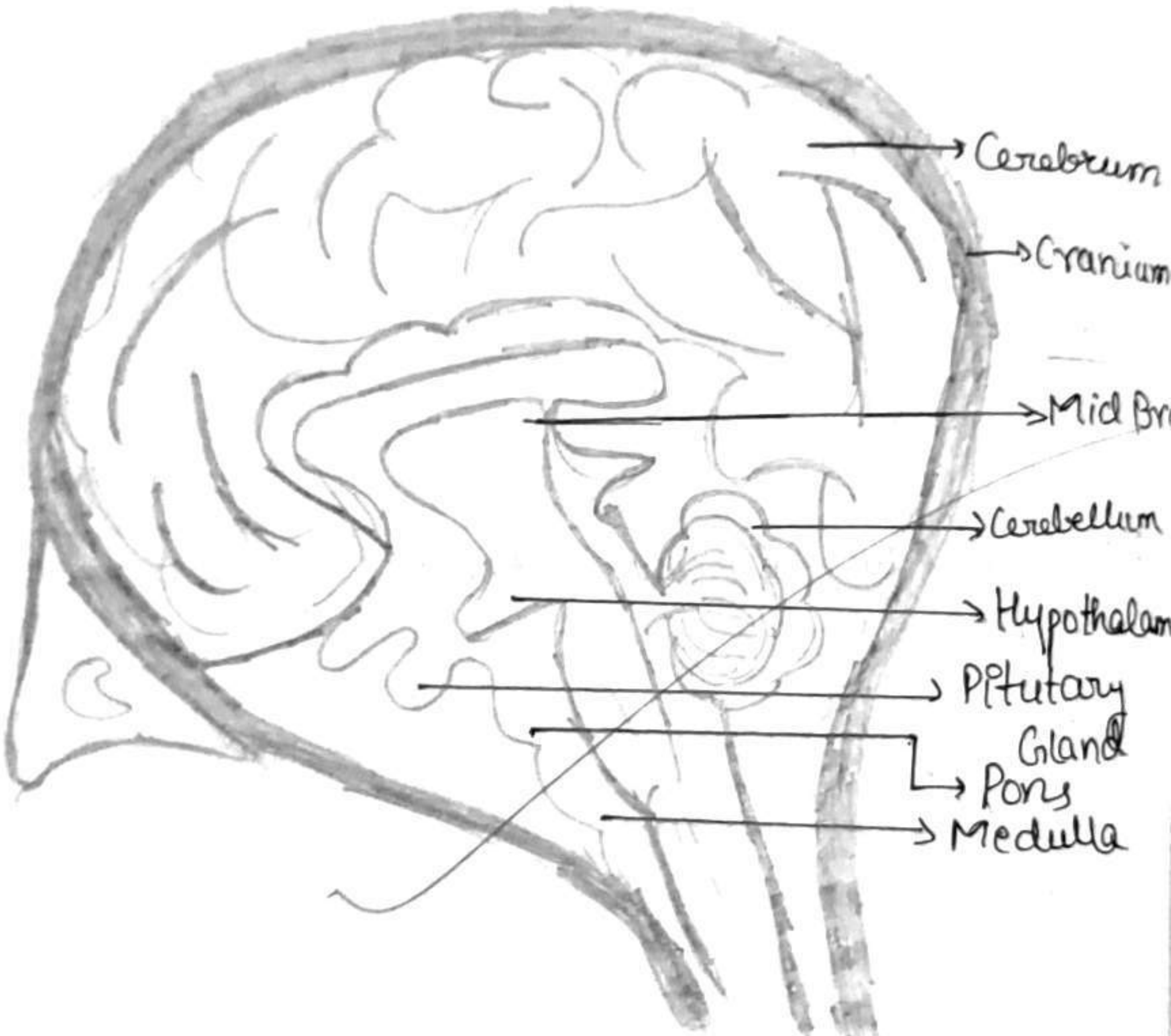
It has following three parts

→ Cerebellum → It control gesture and posture of body and help in balancing body during working of different kinds. It is the IInd biggest part of brains.

→ Pons Verolli → It works as centre of respiratory rhythm.

→ Medulla Oblongata → It control the rate of heartbeat, breathing movement, coughing, & relaxation and contraction of blood vessels, and vomiting, e

HUMAN BRAIN


Cerebrum
Cranium
Mid Br
Cerebellum
Hypothalam
Pituitary
Gland
Pons
Medulla

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SPINAL CORD :-

The medulla oblongata of brain extend downward. It is enclosed in vertebral column. It is surrounded by meninges. It produce 31 pair of spinal nerves to various parts of body. It acts as a centre of reflex actions and reduce the functions of brain.

II. CHEMICAL COORDINATION (ENDOCRINE SYSTEM)

Animal have one more system of control and coordination in their body.

Homonal system or Chemical control System

→ This system produces slow responses of the body such as growth, emotions, morphological and physical changes in the body.

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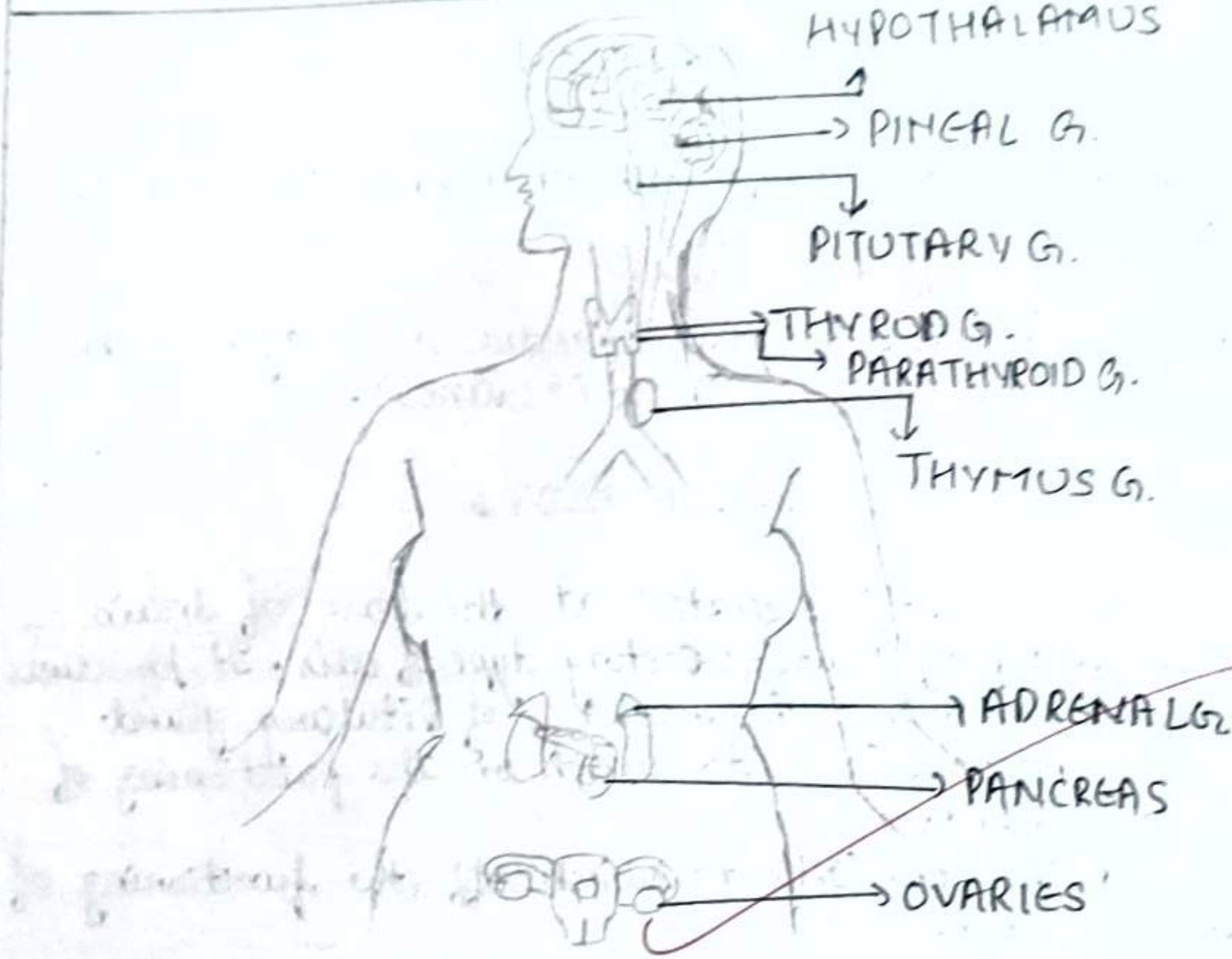

ENDOCRINE SYSTEM IN FEMALES

MIXED OR HETEROCRINE GLANDS:-
These glands consist of both endocrine as well as exocrine tissues

Ex- Pancreas, Gonads (Primary reproductive oragans in male i.e testes and in female i.e ovaries).

ENDOCRINE GLANDS IN OUR BODY:-

1. HYPOTHALAMUS: It is situated at the base of brain and is made up of neuro-secretory type of cells. It produces two hormones to control the working of pituitary gland.
   (i) Releasing hormone (RH) to switch on the functioning of pituitary gland.
   (ii) Inhibiting hormone (IH) to switch off the functioning of pituitary gland.

2. PITUTARY GLAND: It is small, funnel shaped, pink coloured pea gland connected to the hypothalamus thro a funnel shaped stalk. (Infundibulum). It is present at the base of brain and is also called master gland of the body because it produce several hormones to control the functioning of other endocrine glands. It consist of three lobes.
   (i) Anterior Lobe :→ GH → Growth Hormone (STH & Somatotrophic H
   Required for growth & developemen of the body.

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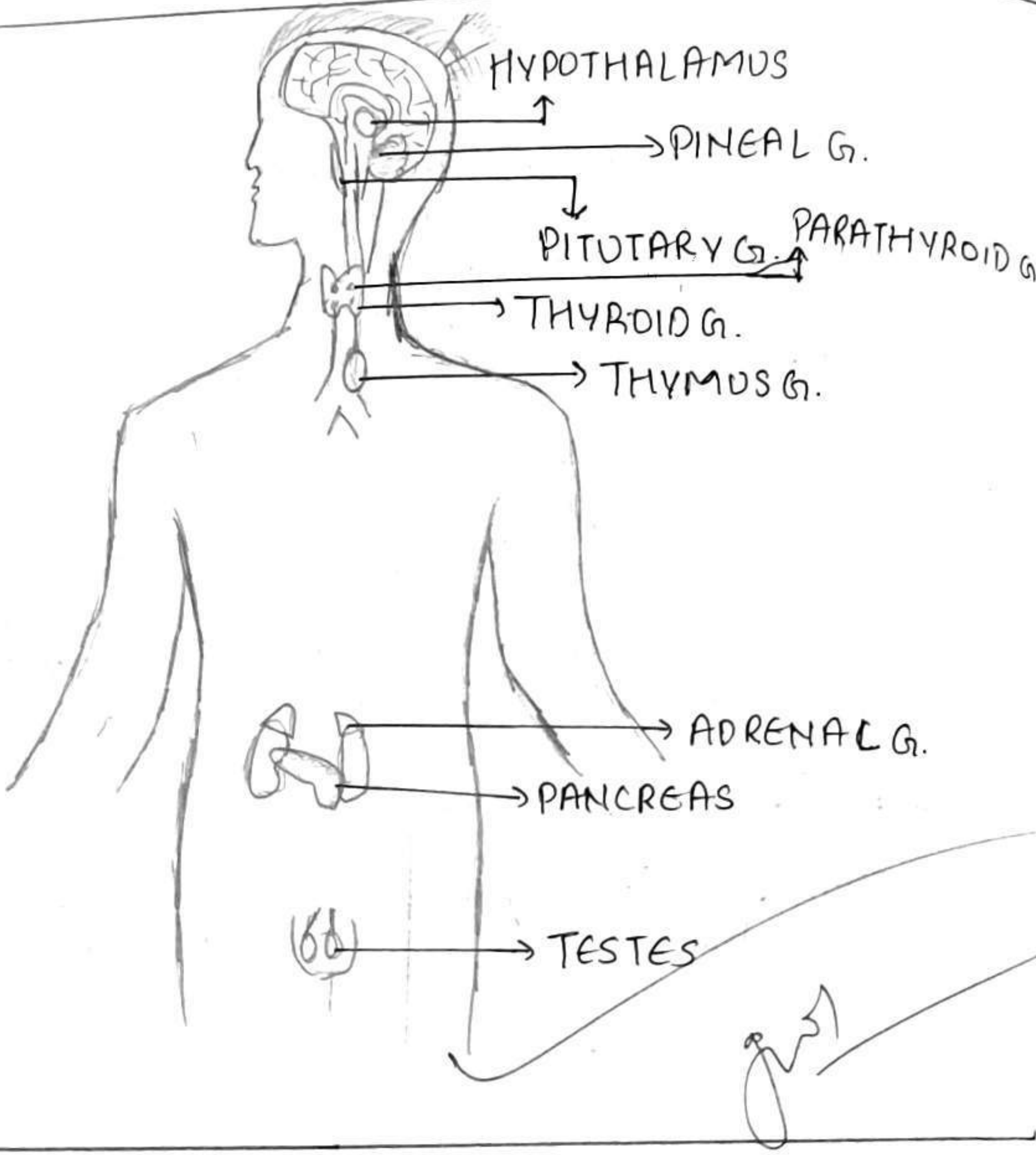

ENDOCRINE SYSTEM IN MALE.

PINEAL GLAND → Small reddish-grey, pine cone shaped and knob like body located on the dorsal side of forebrain and regulates the sleep wake cycle, secretes hormones called melatonin.

THYROID GLAND → Largest endocrine gland that lies between larynx and trachea and secrets thyroxine which regulates basal metabolic rate (BMR) and for proper physical and mental growth of the body.

⇒ Deficiency of Iodine causes enlargement of thyroid gland, it is called Goitre.

Imp ⇒ Thyroxin is required for metabolism of carbohydrates, proteins and fats.

PARATHYROID GLANDS → These are four small oval glands situated on the posterior side of thyroid gland. It produces parathyroid hormone to maintain the calcium level in the body.

ADRENAL GLAND: Yellowish, triangle shaped paired gland. Present on the upper part of the kidney. It is also called emergency gland and it prepares the body to face physical and emotional stress in emergency situation. It secretes adrenaline and noradrenaline hormone. Adrenaline hormone is secreted for meeting an emergency as in cold, emotional stress, pain, anger, fear, etc.

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and prepares the body for 3F conditions i.e fright, flight and fight.

THYMUS GLAND → It is soft, large and bilobed mass of lymphoid tissues. It is located on the dorsal side of heart and aorta and is called "Throne of Immunity". It maintains immunity of body in childhood stage but atrophies in puberty. It produces hormone called thymosin.

PANCREAS → It is elongated yellowish gland located in abdomen close to stomach. It is the second largest gland. Pancreas is a heterocrine type of gland. The endocrine part of pancreas produce two hormone i.e insulin and glucagon to regulate the blood glucose level. The exocrine part of pancreas produce pancreatic juice which help in digestion.

TESTES → They are the primary reproductive organ of male. The endocrine tissue of testes produce male sex hormone i.e testosterone (Androgens) while the exocrine tissue produce male gamete called sperm.

OVARIES → They are the primary reproductive organ of female. The endocrine tissue of ovaries produce three hormone i.e progestrone, oestrogen and relaxin. While the exocrine part of ovaries produce femal gamete called ova.

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Hormones :-

- The chemical messenger which affect various activities of the body are called hormones
- They are secreted by endocrine glands
- They travel in bloodstream and tissues and organs
- They affect the structure & function of body.

Endocrine glands	Exocrine glands
These do not have ducts. They release their secretion directly into the blood for further transport	These gland have ducts. They release their secretion on the body surfaces or cavity.
These ~~plots~~ produce hormones.	They generally produce hormones
Ex - Pitutary gland, Adrenal gland, etc.	Ex - Salivary gland, liver, sweat and tear gland, etc.

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Hypo.secretion of GH causes dwarfism (< 3 feet)
Hypersecretion of GH causes gigantism (> 7 feet)

2.) TSH (Thyroid Stimulating Hormone) → It activates the functioning of thyroid gland

3.) ACTH (Adenocortico Trophic Hormone) → Works on adrenal gland.

4.) LH (Luteinising Hormone)
5.) FSH (Follicle Stimulating Hormone) } → Works on gonads

6.) PH (Prolactin Hormone) → Parental feelings and production of milk in mammary glands.

(ii) Middle Lobe
→ MSH (Melanocyte Stimulating Hormone)
Control skin colour by producing melanin in the skin

(iii) Posterior Lobe
→ Oxytocin → Milk ejecting hormone, (Birth Hormone).

→ Vasopressin → Required for proper conc. of urine (ADH → Antidiuretic Hormone).

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CONTROL AND COORDINATION IN PLANTS:

Plants have following five hormones for control and coordination:

PLANT HORMONE / PHYTOHORMONE / PLANT GROWTH REGULATORS →

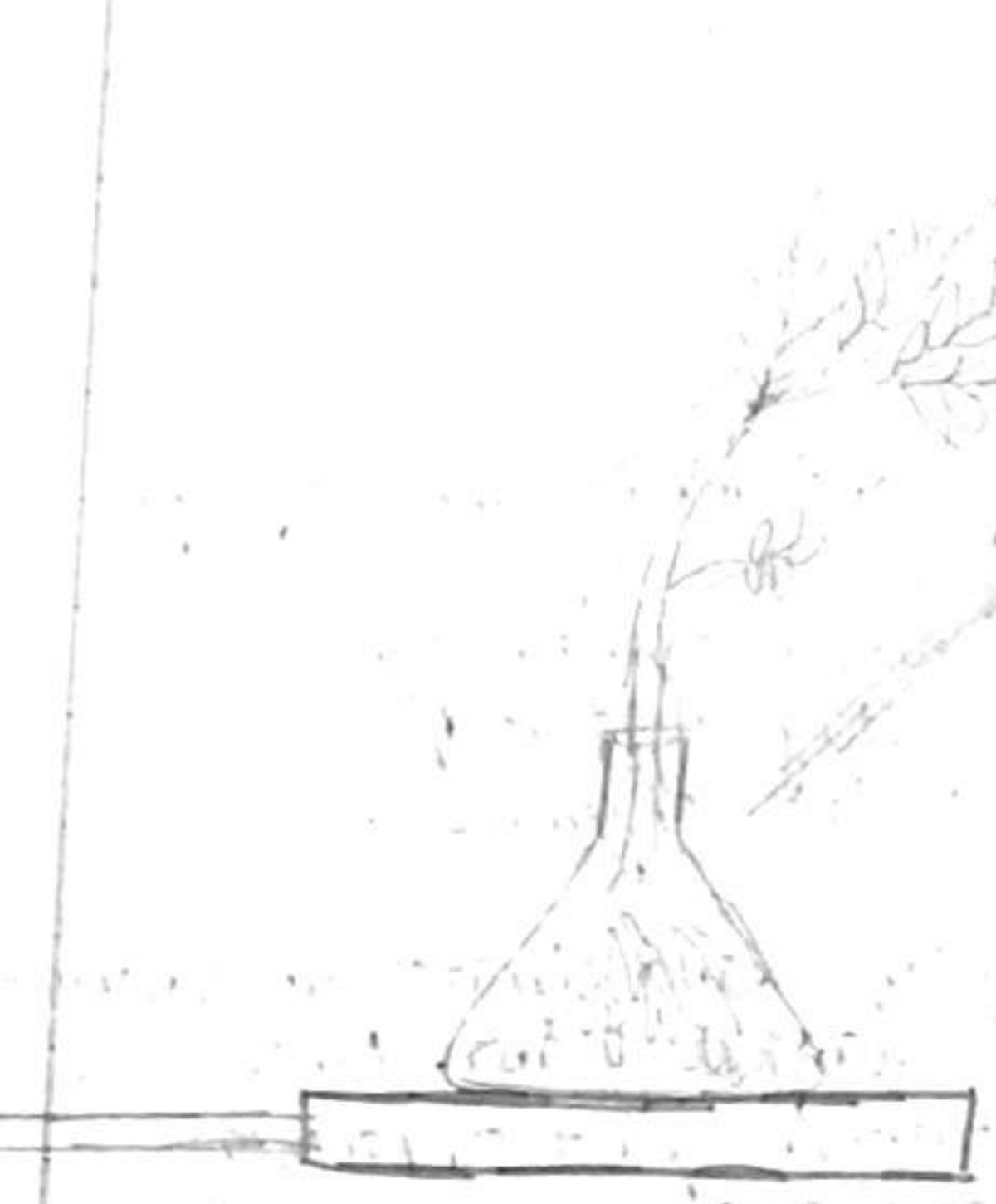
- Auxin
- Gibberellin
- Cytokinin
- Ethylene
- Abscisic Acid

Auxin → Chemically it is Indole-3-Acetic Acid (IAA).
It is produced at the growing tips of roots and shoot and promotes cell elongation and cell maturation. It also promote growth of stem and root. It also promote parthenocarpy in fruit formation.

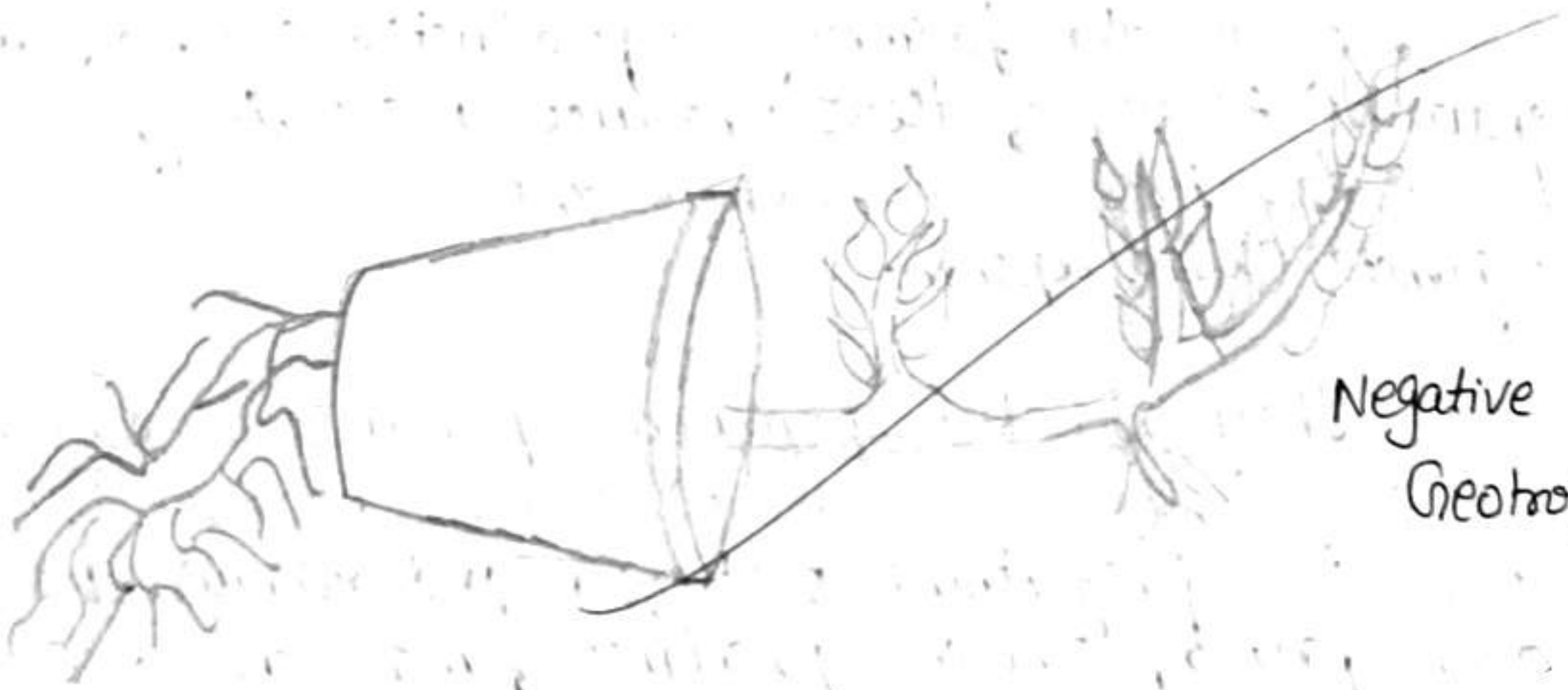
Parthenocarpy → It is the process of formation of fruits without fertilization.

Such fruits do not contain seeds Ex- Banana, Seedless grapes, e

Gibberellins → It is also known as Gibberelic Acid (GA). It also promote cell elongation and maturation. It is also required to increase the size of internode (bolting), Ex- Sugarcane and Cabbage. It is also used to make the



Response of plant to direction of light



Positive
Geotropism

Plant showing geotropism

Types of Tropic Movement :-

Phototropism → It is the tropic movement due to light.

Root - Negative Phototropic
Shoot - Positive Phototropic

Hydrotropism → It is the tropic movement due to water

Root - Positive Hydrotrppic
Shoot - Negative Hydrotropic

Geotropism → It is the tropic movement due to gravity

Root - Positive Geotropic
Shoot - Negative Geotropic

Chemotropic → It is the tropic movement due to chemical

Pollengrains of same plant - Positive Chemotropic
Pollengrain of different plant - Negative Chemotropic

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CHAPTER - 2 COMPLETE

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plant rosette (dense). ∴ decorate gardens Gibberellin also delay senescence (ageing) of plants and fruit.

• Cytokinins → Promote cell division in plants. they produce leaves and chloroplast. They also promote lateral shoot growth. It also overcome apical dominance. It also help in breaking down of dormancy (resting period) of seeds and floral buds.

• Ethylene → It is the only gaseous hormone in plants and stimulates fruit ripening. It also induces horizontal growth of seedlings. It promotes abscission and senescence of plant organs. It has many biological roles and hence, it is the most frequently used plant hormone.

Abscisic Acid → Its name is derived from the phenomenon of abscission. It is also known as ageing hormone. It increases tolerance to various kinds of stresses. form a stress hormone. It also inhibits seed germination and induces seed dormancy. It is related to changes associated with senescence and ageing.

PLANT MOVEMENTS →

Plants respond to various stimuli by showing different kinds of movements. Generally, it shows following two types of movements.

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1) Nastic Movement
2) Tropic Movement

NASTIC MOVEMENT	TROPIC MOVEMENT
1 It is growth independent movement.	→ It is growth dependent movement.
1 It is temporary.	→ It is permanent.
1 It is non-directional.	→ It is direction specific, either towards stimuli or away from stimuli.
1 It occurs in presence of i) Touch (Thigmonasty) Ex- touch-me-not plant, etc. (Mimosa pudica) ii) Light (Photonasty) Ex- Sunflower, etc. iii) Heat (Thermonasty) Ex- drooping of herbs during hot summer day, etc.	→ It occurs in presence of i) Light (Phototropism) ii) Water (Hydrotropism) iii) Gravity (Geotropism) iv) Chemical (Chemotropism) Ex- Growth of shoot towards sun

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