CLASS-X

SEE Based Questions

What is inside?
- SEE base questions and their solutions.
  (also "Give Reason" and "Numerical Problems")
- Some important figures.
- Some Important full-forms.
- Some important "Terms" and "Definitions".
- Some Important formulae.

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CLASS-X

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01. Force

1. What is gravitational force? What are the two factors that affect the gravitational force? What are the effects of them?

The force of attraction between any two masses in the universe is known as gravitational force.

Mass of the bodies and distance between their centers affects the gravitational force.

Product of the masses is directly proportional whereas the square of distance between their centers is inversely proportional to the value of gravitational force.

2. Write the Newton's universal law of gravitation and also prove $F = \dfrac{GMm}{d^2}$ with necessary diagrams. Why this law is called universal law?
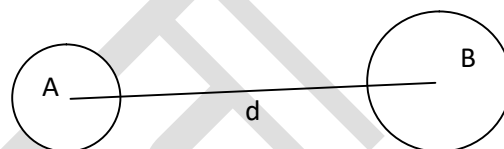
Newton's universal law of gravitation states that "The force of attraction between any two masses in the universe is directly proportional to the product of the masses and inversely proportional to the square of distance between their centers."

Suppose,

Mass of the body A = m_1 kg

Mass of the body B = m_2 kg

Distance between the centers of A and B = d metre

Then, According to the Newton's universal law of gravitation, the gravitation force (F) produced betweens these masses is,

directly proportional to the product of the masses.

i.e. $F \propto m_1 \times m_2$ ············· (i)

and, inversely proportional to the square of distance between their centers.

i.e. $F \propto \dfrac{1}{d^2}$ ················ (ii)

combining equation (i) and (ii), we get,

$$F \propto \dfrac{m_1 \times m_2}{d^2}$$

Or, $F = G\dfrac{m_1 \times m_2}{d^2}$

Here G is the proportionality constant known as the universal gravitational constant. Its value is 6.67×10^{-11} Nm^2/kg^2.

3. What do you mean by gravitational constant (G)? Write its value with SI unit.

The force of gravitation produced between two unit masses placed between unit distance is called the gravitational constant. Its value is 6.67×10^{-11} Nm^2/kg^2.

4. If the earth revolves around the sun as shown in the figure then what is the different in its gravitation while it travels from point P to Q? Explain.

The value of gravitational force is inversely proportional to the square of distance between the centers of the bodies. So, as the distance between the earth and the sun increases from P to Q, their gravitational force also goes on decreasing.
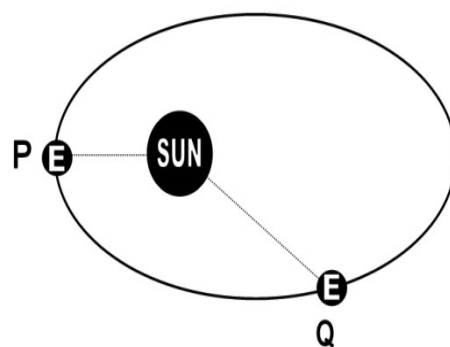
5. Satellites do not need any type of energy to revolve around the earth. Why?

The satellite does not need any type of energy to revolve around the sun because the necessary centripetal force is provided by the gravitational force between the planet and satellite.

6. What will be the affect in gravitation in the following cases:

a. If one of them mass is doubled keeping the distance constant

Let, mass of object A = m_1, mass of object B = m_2 and distance between the centers of A and B = d. Then,

Gravitational Force $(F_1) = G\dfrac{m_1 \cdot m_2}{d^2}$

Again, If the mass of object A becomes $2m_1$ then,

Gravitational Force $(F_2) = G\dfrac{2m_1 \cdot m_2}{d^2} = 2 \times G\dfrac{m_1 \cdot m_2}{d^2} = 2F_1$

Hence, the gravitational force becomes double if we increase the mass of an object to double.

b. **If both masses are doubled keeping the distance constant**

   Let, mass of object A = m_1, mass of object B = m_2 and distance between the centers of A and B = d.
   Then,

   Gravitational Force (F_1) = $G\dfrac{m_1 \cdot m_2}{d^2}$

   Again,
   If the mass of object A becomes $2m_1$ and mass of object B becomes $2m_2$ then,

   Gravitational Force (F_2) = $G\dfrac{2m_1 \cdot 2m_2}{d^2} = 4 \times G\dfrac{m_1 \cdot m_2}{d^2} = 4F_1$

   Hence, the gravitational force increases by 4 times if we double the mass of both objects.

c. **If the distance is doubled keeping the masses constant**

   Let, mass of object A = m_1, mass of object B = m_2 and distance between the centers of A and B = d.
   Then,

   Gravitational Force (F_1) = $G\dfrac{m_1 \cdot m_2}{d^2}$

   Again, If the distance between the object became 2d then,

   Gravitational Force (F_2) = $G\dfrac{m_1 \cdot m_2}{(2d)^2} = \dfrac{1}{4} \times G\dfrac{m_1 \cdot m_2}{d^2} = \dfrac{1}{4}F_1$

   So, if the distance between the objects became double then the gravitation decreases by 4 times.

d. **If the distance is halved keeping the mass constant.**

   Let, mass of object A = m_1, mass of object B = m_2 and distance between the centers of A and B = d.

   Then, Gravitational Force (F_1) = $G\dfrac{m_1 \cdot m_2}{d^2}$

   Again, If the distance between the object became $\dfrac{d}{2}$ then,

   Gravitational Force (F_2) = $G\dfrac{m_1 \cdot m_2}{\left(\frac{d}{2}\right)^2} = 4 \times G\dfrac{m_1 \cdot m_2}{d^2} = 4F_1$

   So, if the distance between the objects became double then the gravitation decreases by 4 times.

7. **What is acceleration due to gravity? On what factors does it depend? In which place on earth it has maximum and minimum value? Write its average value and direction.**

   The acceleration produced in a freely falling body on earth is called acceleration due to gravity. It depends upon mass of the planet and its radius. It has its maximum value at poles and minimum value at equator regions. Its average value on earth is 9.8 m/s^2 and direction is towards the centre of the earth.

8. **Mass of Jupiter is 319 times that of the earth, but its acceleration due to gravity is only 2.5 times that of the earth. What is the reason?**

   The acceleration due to gravity of a planet is directly proportional to its mass and inversely proportional to the square its radius. So, as the mass of Jupiter is 319 times of the earth its acceleration due to gravity also should be 319 times that of the earth but due to the large radius of Jupiter it is only just 2.5 times that of the earth.

9. **What is the affect in the acceleration due to gravity of the earth if we contract it into the volume of moon? Write.**

   The acceleration due to gravity of a planet is directly proportional to its mass and inversely proportional to the square its radius. So, if we contract the volume of earth into the volume of moon its radius decreases which correspond increases the value of its acceleration due to gravity.

10. **Define free fall. What is the weight of the body during free fall?**

    If a body is falling freely towards the earth surface without any resistance then it is called free fall.
    The effective weight of the body becomes zero (0) during freefall.

11. **Define weightlessness? At which condition a body feels weightlessness?**

    Weightless is the condition at which the effective weight of an object becomes zero.
    A Body feels weightlessness when it is in free fall or in zero gravity zones (space).

12. **What is the affect in acceleration due to gravity if a person in jumping with parachute? Explain.**

    If a person jumps with parachute, he exerts high air resistance which prevents its motion from being free fall so he can smoothly land on the surface of the earth without any injury.

13. Write any four consequences of the gravitation.

   Any four consequences of gravitational force are:
   (i)   It makes the planets revolve around the sun.
   (ii) It helps to hold the atmosphere of the planets.
   (iii) It helps in water cycle, flow of water in river and tide in ocean.
   (iv) It helps in launching artificial satellites on space.

14. What is the main conclusion of coin and feather experiment?

   The main conclusion of coin and feather experiment is that acceleration due to gravity is independent with the mass of the objects so every object in vacuum falls in equal time if they dropped from same height in earth but in presence of atmosphere they fall with different speed due to the air resistance.

15. How does a paratrooper land safely when jumped from an aeroplane?

   The parachute wore by the paratrooper exerts high air resistance and prevent his motion from being free fall so he can land safely when jumped from an aeroplane.

16. Write the difference between:

   a. Gravity and Gravitation

Gravity	Gravitation
1. The force by which an object near the earth's surface is attracted to its center is called gravity.	1. The force of attraction between any two masses in the universe is called gravitation.
2. It is given by F = mg	2. It is given by $F = G\dfrac{m_1 m_2}{d^2}$

   b. Gravity and Acceleration due to gravity

Gravity	Acceleration due to gravity
1. The force by which an object near the earth's surface is attracted to its center is called gravity.	1. The acceleration produced in a freely falling object towards earth surface is called acceleration due to gravity.
2. Its SI unit is Newton (N).	2. Its SI unit is m/s^2.

   c. Mass and Weight

Mass	Weight
1. The total quantity of matter containing in a body is called its mass.	1. The amount force by which an object is attracted to the centre of the earth is called its weight.
2. It is universal constant.	2. Its value is different for different places.

   d. Acceleration due to Gravity (g) and Gravitational Constant (G)

Acceleration due to Gravity	Gravitational Constant
1. The acceleration produced in a freely falling object towards earth surface is called acceleration due to gravity.	1. The gravitational force produced between two unit masses placed between unit distance is called gravitation constant.
2. Its average value on earth is 9.8 m/s^2.	2. It's value is 6.67×10^{-11} Nm^2/kg^2.

   e. Free fall and Weightlessness

Free fall	Weightlessness
1. If a body is falling freely toward the earth surface without any resistance then it is called free fall.	1. The condition at which the effective weight of an object becomes zero is called weightlessness.
2. It is the cause of weightlessness.	2. It is the result of free fall.

17. Give Reason:

   a. A body has constant mass but its weight differ from place to place.

   The value of weight is given by W=mg. Since, the value of mass (m) is constant but the value of acceleration due to gravity (g) is different for different places which result the weight of a body differ from place to place.

   b. If two bodies one in equator region and another in polar region dropped from the same height, always the body in polar region drops faster.

The acceleration due to gravity of earth is inversely proportional to the square of its radius. Since the earth is not perfectly sphere so it has less polar radius than its equatorial radius which results more acceleration due to gravity in polar region and an object drops faster there.

c. A folded paper falls faster than same being unfolded.

A folded paper has less surface area so it exerts less air resistance and falls faster than the same being unfolded.

d. Both iron nail and feather fall at a same time inside the vacuum.

The acceleration due to gravity is independent with the mass of the objects so every object in vacuum falls in equal time if they dropped from same height in earth but in presence of atmosphere they fall with different speed due to the air resistance.

e. It is difficult to lift large stone than small one.

The force of gravity is proportional to the mass of the objects so the earth applies more amount of gravity force with large object and becomes difficult to lift.

f. Tide rises on the sea.

The combined gravitational forces exerted by the Moon and the Sun results the attraction of sea water towards them and hence produces tide on the sea.

g. G is called universal constant.

G is called universal constant because its value does not depend upon mass of the objects, their distances, their size, their medium, temperature, etc.

h. A stone and feather fall together on moon surface when drop simultaneously.

The acceleration due to gravity is independent with the mass of the objects so every object in vacuum falls in equal time if they dropped from same height in earth but in presence of atmosphere they fall with different speed due to the air resistance. Since there in no any air resistance on the moon surface a stone and a feather fall together when they drop simultaneously.

i. The probability of getting hurt is more when jumped from a significant height.

The speed of a falling object increases very rapidly in each second due to the acceleration due to gravity of earth, so because of large final velocity the probability of getting hurt is more when a person jumps from a significant height.

18. Numerical:

a. At which condition the value of gravitation (F) is 6.67×10^{-11}? Calculate.

Let,

Mass of object A = m_1

Mass of object B = m_2

Distance between their centers = d

Now,

Gravitational force (F) = $G \dfrac{m_1 \times m_2}{d^2}$ .... (1)

Put $m_1 = m_2$ = 1 kg and d = 1 m, then equation (1) becomes,

$$F = \dfrac{6.67 \times 10^{-11} \times 1 \times 1}{1^2}$$

$$= 6.67 \times 10^{-11} N$$

The value of gravitation is 6.67×10^{-11}N if two 1 kg masses are placed between 1 metre distance.

b. Mass of Jupiter is $1.9 \times 10^{27} kg$ and Sun is $2 \times 10^{30} kg$. If they are $76.8 \times 10^7 km$ far away from each other then calculate the gravitational force between them. **(Ans: $4.30 \times 10^{26} N$)**

Mass of Jupiter (m_1) = 1.9×10^{27} kg

Mass of Sun (m_2) = 2×10^{30} kg

Distance between their centers (d) = 76.8×10^7 km = 76.8×10^{10} m

Gravitational Constant (G) = 6.67×10^{-11} Nm^2/kg^2

Now,

Gravitational force (F) = $G \dfrac{m_1 \times m_2}{d^2}$ .... (1)

$$= \frac{6.67 \times 10^{-11} \times 1.9 \times 10^{27} \times 2 \times 10^{30}}{(76.8 \times 10^{10})^2}$$
$$= 4.30 \times 10^{26} \text{ N}$$

c. If the distance from Nepal to moon is $3 \times 10^5 km$ and mass of moon is $7 \times 10^{22} kg$ then by what amount of force the unit mass of water in the rivers of Nepal is attracted towards the moon?
Mass of Moon (m_1) = 7×10^{22} kg **(Ans: $5.19 \times 10^{-5} N$)**
Mass of Water (m_2) = 1 kg
Distance between them (d) = 3×10^5 km = 3×10^8 m
Gravitational Constant (G) = 6.67×10^{-1} Nm^2/kg^2
Now,

$$\text{Gravitational force (F)} = G \frac{m_1 \times m_2}{d^2} \quad \text{................. (1)}$$
$$= \frac{6.67 \times 10^{-11} \times 7 \times 10^{22} \times 1}{(3 \times 10^8)^2}$$
$$= 5.19 \times 10^{-5} \text{ N}$$

d. On 2060/05/10 the mars approached the earth at least distance first time in the history. If the force of gravitation between the earth and the mars was $6.67 \times 10^{16} N$ then what was their distance? (Mass of Earth = $6 \times 10^{24} kg$ and mass of mars = $6 \times 10^{23} kg$) **(Ans: $6 \times 10^{10} m$)**
Mass of Earth (m_1) = 6×10^{24} kg
Mass of Mars (m_2) = 6×10^{23} kg
Gravitational force (F) = 6.67×10^{16} N
Distance between Mars and Earth (d) = ?
Now,

$$\text{Gravitational force (F)} = G \frac{m_1 \times m_2}{d^2} \quad \text{................. (1)}$$
$$6.67 \times 10^{16} = \frac{6.67 \times 10^{-11} \times 6 \times 10^{24} \times 6 \times 10^{23}}{d^2}$$
or, $$d^2 = \frac{6.67 \times 10^{-11} \times 6 \times 10^{24} \times 6 \times 10^{23}}{6.67 \times 10^{16}}$$
or, $$d^2 = 36 \times 10^{20}$$
or, $$d = \sqrt{36 \times 10^{20}} = 6 \times 10^{10} \text{ m}$$

e. If the earth is contacted to the size of the moon then what will be the weight of 1000 kg mass in earth? (mass of earth = $6 \times 10^{24} kg$ and radius of moon = $1.7 \times 10^5 m$) **(Ans: 13850000 N)**
Mass of Earth (M) = 6×10^{24} kg
New radius of Earth (R) = 1.7×10^5 m
Gravitational Constant (G) = 6.67×10^{-11} Nm^{2}kg^{-2}
Now,

$$\text{Acceleration due to Gravity (g)} = \frac{GM}{R^2} \quad \text{................. (1)}$$
$$= \frac{6.67 \times 10^{-11} \times 6 \times 10^{24}}{(1.7 \times 10^5)^2}$$
$$= \frac{40.02 \times 10^{13}}{2.89 \times 10^{10}} = 13850 \text{ m/s}^2$$

Again, Weight of an object (W) = mg = 1000 × 13850 = 13850000 N

f. An apple having mass of 200 gm is falling towards the surface of the earth. Calculate the acceleration of the apple towards the earth and also calculate the acceleration of the earth towards the apple. (mass of earth = $6 \times 10^{24} kg$ and radius of earth = $6.4 \times 10^6 m$)
Mass of Earth (m_1) = 6×10^{24} kg **(Ans: $9.77 \ m/s^2$, $3.26 \times 10^{-25} m/s^2$)**
Mass of apple (m_2) = 200 gm = 0.2 kg
Radius of earth (r) = 6.4×10^6 m
Now, Gravitational force between apple and the earth is given by,

$$F = G \frac{m_1 \times m_2}{r^2} \quad \text{................. (1)}$$

$$= \frac{6.67 \times 10^{-11} \times 6 \times 10^{24} \times 0.2}{(6.4 \times 10^6)^2} = 1.954 \text{ N}$$

So, the acceleration of apple towards earth $(a_a) = \frac{F}{m_2} = \frac{1.954}{0.2} = 9.77 \text{ m/s}^2$

And, the acceleration of earth towards apple $(a_e) = \frac{F}{m_1} = \frac{1.954}{6 \times 10^{24}} = 3.26 \times 10^{-25} \text{m/s}^2$

g. If a body has 10 N weight when it place at $6.4 \times 10^6 m$ distance from the centre of the earth then calculate its weight if it placed to $1.28 \times 10^7 m$ from the centre of the earth. **(Ans: 2.5 N)**
Distance from centre of earth (d_1) = 6.4×10^6 m
Weight of body at d_1 (W_1) = 10 N
Distance from centre of earth (d_2) = 1.28×10^7 m
Weight of body at d_2 (W_2) = ?
We know,

$$\frac{W_2}{W_1} = \frac{d_1{}^2}{d_2{}^2}$$

or, $\frac{W_2}{10} = \left(\frac{6.4 \times 10^6}{1.28 \times 10^7}\right)^2$

or, $W_2 = 10 \times 0.25$

or, $W_2 = 2.5 \text{ N}$

h. If two bodies placed at the distance of $2.5 \times 10^4 km$ has the gravitation of 250 N then what should be the new distance to reduce their gravitation by half? **(Ans: $3.54 \times 10^7 m$)**
Distance from centre of earth (d_1) = 2.5×10^4 km = 2.5×10^7 m
Weight of body at d_1 (W_1) = 250 N
Distance from centre of earth (d_2) = ?
Weight of body at d_2 (W_2) = $\frac{W_1}{2} = \frac{250}{2} = 125 \text{ N}$
We know,

$$\frac{W_2}{W_1} = \frac{d_1{}^2}{d_2{}^2}$$

or, $\frac{125}{250} = \left(\frac{2.5 \times 10^7}{d_2}\right)^2$

or, $\frac{1}{2} = \left(\frac{2.5 \times 10^7}{d_2}\right)^2$

or, $\frac{1}{\sqrt{2}} = \frac{2.5 \times 10^7}{d_2}$

or, $d_2 = \sqrt{2} \times 2.5 \times 10^7 = 3.54 \times 10^7 \text{m}$

i. The mass of earth is $6 \times 10^{24} kg$ and its radius is $6400\ km$. What is the mass of the man weighing 977 N in a spring balance? **(Ans: 100 kg)**
Mass of earth (M) = 6×10^{24} kg
Radius of earth (R) = 6.4×10^6 m
Weight of the man (W) = 977 N
Mass of the man (m) = ?
We know, acceleration due to gravity of earth is given by,

$$g = \frac{GM}{R^2}$$

$$= \frac{6.67 \times 10^{-11} \times 6 \times 10^{24}}{(6.4 \times 10^6)^2}$$

$$= 9.77 \text{ m/s}^2$$

Now, Weight (W) = m × g

or, $m = \frac{W}{g} = \frac{977}{9.77} = 100 \text{ kg}$

j. The radius of the earth is $6400\ km$, height of Mt. Everest is $8848\ m$. If the value of 'g' on the surface of the earth is $9.8\ m/s^2$, calculate the value of 'g' at the top of Mt. Everest and also find the weight of a man having $80\ kg$ at the top of Mt. Everest.   **(Ans: $9.77\ m/s^2$, 781.6 N)**

Radius of Earth (R_1) = $6.4 \times 10^6\ m$

Acceleration due to gravity on surface (g_1) = $9.8\ m/s^2$

Radius from top of Mt. Everest (R_2) = $6.4 \times 10^6 + 8848 = 6408848\ m$

Acceleration due to gravity at the top of Mt. Everest (g_2) = ?

We know,

$$\frac{g_2}{g_1} = \frac{R_1{}^2}{R_2{}^2}$$

or, $\dfrac{g_2}{9.8} = \left(\dfrac{6.4 \times 10^6}{6408848}\right)^2$

or, $g_2 = 9.8 \times (0.9986)^2$

$= 9.8 \times 0.9972 = 9.77\ m/s^2$

∴ Weight of the person at the top of Mt. Everest (W) = $m \times g_2 = 80 \times 9.77 = 781.6\ N$

k. A stone dropped freely from 45 m height of a tower. It reaches the ground in 3 seconds. Calculate the acceleration due to gravity of the stone.   **(Ans: 10 m/s^2)**

Given, Height (H) = 45 m

Initial velocity (u) = 0 m/s

Time taken (t) = 3 sec.

Acceleration due to gravity (g) = ?

We Know,

$$H = ut + \frac{1}{2}\,gt^2$$

or, $45 = 0 \times 3 + \dfrac{1}{2} \times g \times 3^2 = \dfrac{9}{2} \times g$

or, $g = \dfrac{45 \times 2}{9} = 10\ m/s^2$

02. Pressure

1. Write Pascal's law and explain with an example.

Pascal's law states that "When a pressure is applied in a liquid containing in a closed vessel, equal pressure is transmitted perpendicularly in every parts of the liquid."

For example in a hydraulic lift, if we apply P amount of pressure in an small piston then it gives same amount of pressure in its output piston with large output force and helps to lift up a heavy load.

2. At what condition a body having more density than liquid floats on it?

According to the law of floatation and Archimedes principle, a body having more density than liquid floats on it if it exerts the upthrust force equal with its weight.

3. State Archimedes principle and explain with diagram.

Archimedes principle states that, "If a body is partially or fully immersed in a liquid, it exerts an upthrust force equal to the weight of the liquid displaced by it."

Suppose a body having W_1 weight in air is immersed in water and found its weight to be W_2 while measuring there. The lost in its weight is due to the upthrust force provided by the water. That means the water applies (W_1-W_2) amount of upthrust force to it. While immersing the body in water it displaced some amount of water which weight will found exactly equal with the upthrust force.

ie. Upthrust = Weight of Water Displaced = (W_1-W_2)
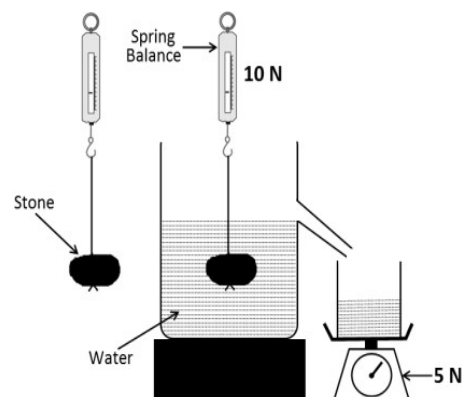
4. Explain law of floatation with an example.

Law of floatation states that, "The floating body displaces its weight of liquid." For example a boat of W_1 weight displaces the water of W_1 weight.

5. **What is the role of hydraulic press for increasing the output force?**

   Hydraulic press is an instrument based on the principle of Pascal's law. When a small amount of force is applied from its small piston then equal pressure is transmitted which results the production of large output force on large piston.

6. **In which principle hydraulic jack is made? For what purpose it can use?**

   Hydraulic jack is made in the principle of Pascal's law. It is use to lift of the vehicles while exchanging their tyres.

7. **In the given syringe there are two pistons each at one end of the syringe. Justify that more force applied in piston A produce less force in piston B.**

   In the given figure, the area of piston A is greater than the area of piston B.

   ie. $A_A > A_B$

   If P_A be the pressure exerted in piston A and P_B be the pressure exerted in piston B, then,

   $$\frac{F_A}{P_A} > \frac{F_B}{P_B} \qquad \left(\because \text{Pressure (P)} = \frac{\text{Force (F)}}{\text{Area (A)}} \right)$$

   But, according to the Pascal's law, $P_A = P_B = P$, then

   or, $\dfrac{F_A}{P} > \dfrac{F_B}{P}$

   or, $F_A > F_B$

   Hence, more force applied in piston A of the given syringe produce less force in piston B.

8. **What is the weight of your body? How much water should your body displace to float on water?**

   Weight of my body is 700 N so my body should displace same amount of water to float on it.

9. **How many force acts on body place in water? What are they and their direction?**

   Two types of force acts on the body placed in water. They are gravity and upthrust. The direction of gravity is towards the centre of the earth and the direction of upthrust is to the opposite of gravity.

10. **What is liquid pressure? On which factors does it depend?**

    The force exerted by the liquid on the unit area of its container is called liquid pressure. It depends upon the depth of the liquid (h), its density (d) and the acceleration due to gravity of that place (g).

11. **What is upthrust? What factors affect it?**

    The force with which a liquid pushes up an object immersed in it is called upthrust or buoyant force. It depends upon volume of the displace liquid (V), density of the liquid (ρ) and the acceleration due to gravity of that place (g).

12. **As shown in the picture, if a small stone is exposed to air (A) for the first time and secondly to water (B), then in which case A and B would be weightier? What principle can be proved from this experiment? What would be the difference in weight of the stone if salt solution was placed instead of water in the Eureka cans? Write with reason.**

    In case A (air) the stone would be weightier because the water applies more upthrust than air.

    Archimedes principle can be proved from this experiment.

    The weight of stone becomes further less if salt solution was placed instead of water because the salt solution has more density then water and upthrust force is directly proportional to density of the liquid.
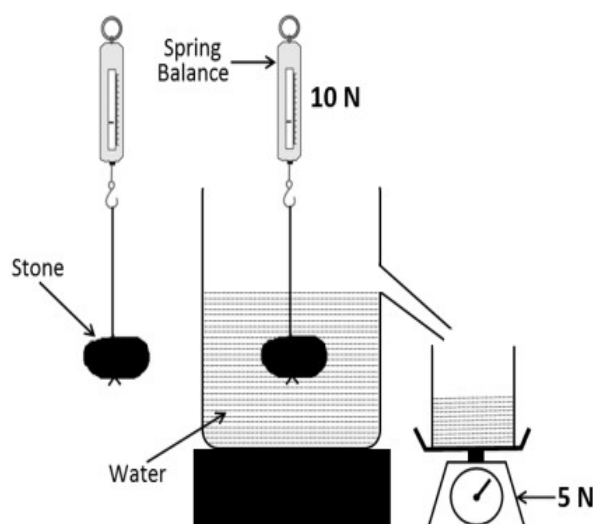
13. **Write the difference between :**

    a. **Force and Pressure**

Force	Pressure
1. Force is the tendency which changes the shape, size, potion and direction of a body.	1. The force acting perpendicularly in unit area is called pressure.
2. Its SI unit is Newton (N).	2. Its SI unit is Pascal (Pa).

b. Archimedes Principle and Law of Floatation

Archimedes Principle	Law of Floatation
1. Archimedes principle states that, "If a body is partially or fully immersed in a liquid, it exerts an upthrust force equal to the weight of the liquid displaced by it."	1. Law of floatation states that, "A floating body displaces its weight of liquid."
2. It deals about a body which is partially or fully immersed in the liquid.	2. It deals about a body which is floating on the liquid.

c. Density and Relative density

Density	Relative Density
1. Density of a substance is the amount of mass per unit volume.	1. Relative density is the ratio of the density of a substance to the density of water at 4^0C.
2. Its SI unit is kg/m^3.	2. It is a unit less quantity.

d. Hydrometer and Barometer

Hydrometer	Barometer
1. It is a device use to measure the density of the liquid	1. It is a device used to measure the amount of atmospheric pressure.
2. It works in the principle of Archimedes principle.	2. It works on the principle of atmospheric pressure.

14. Give reason:

a. A football tries to come outside whenever we try to push it inside the water.
   Water applies an upthrust force to the immersing object which pushes its outside to its surface so a football tries to come outside whenever we try to push it inside the water.

b. A balloon burst when it reached in a certain height.
   The atmospheric pressure gradually decreases with increasing in altitude. So, when a balloon rises up it gets burst due to the large pressure differences between the atmosphere and the air inside the balloon.

c. An iron nail sinks in water but a ship made up of thousands tons of iron floats there.
   Due to the large base area of the ship it exerts the large amount of upthrust force provided by the water so it float there but due to the less area an iron nail cannot able to exert much upthrust and hence it sinks there.

d. It is easier to lift water bucket under the water.
   While inside the water the water applies an upthrust force against the gravity so due to the less resultant weight it is easier to lift a water bucket under the water.

e. A dam has thicker bottom surface than its upper surface.
   The liquid pressure increases with increase in its depth so to prevent the bottom of the dam from high liquid pressure it is made thicker than its upper surface.

f. Deep sea divers wear diving suit.
   The liquid pressure increases with increase in its depth so to prevent the body from the injuries due to high liquid pressure the deep sea divers wear diving suit.

g. A hole at the bottom of boat is more dangerous than that at the side.
   The pressure of liquid is high at bottom than its surface. Due to this high pressure, a hole at bottom can quickly fill up the water inside the boat than the hole at the sides and sinks it. So, the hole at the bottom is more dangerous than the hole at the sides.

h. When two identical boats each of 200 kg is made and one place in pond and other in a sea, the boat in pond found to sink 200 cm more depth than the boat in sea.
   The upthrust force provided by the sea to the boat is more than the same boat placed in the pond because density of sea water is more due to the presence of salt solution. Hence the boat in sea sinks little less than the boat in pond.

15. Numerical:

a. If the depth of water in a rectangular tank is 5 m, find the pressure exerted by water at the bottom of the tank.   **(Ans: 4.9×10⁴ Pa)**

Given, Depth of the water (h) = 5 m
Density of the water (d) = 1000 kg/m^3
Acceleration due to gravity (g) = 9.8 m/s^2
Now using formula,

Liquid pressure (P) = h × d × g
$$= 5 \times 100 \times 9.8 = 49000 \text{ Pa}$$

b. In a hydraulic press the area of small piston and large piston is 10cm^2 and 1m^2 respectively. If 10N force is applied in small piston, what weight of body can be lifted up from its large piston?

Here, Force in small piston (F$_1$) = 10 N   **(Ans: 1000 N)**

Area of small piston (A$_1$) = 100 cm^2 = $\dfrac{100}{100 \times 100}$ m^2 = 0.01 m^2

Force in large piston (F$_1$) = ?
Area of large piston (A$_2$) = 1 m^2
Now, From Pascal's law,

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

or, $\dfrac{10}{0.01} = \dfrac{F_2}{1}$

∴   F$_2$ = 1000 N

c. Suppose A, B and C piston is frictionless. Calculate the force in B and cross section area of C.

Force in Piston A (F$_1$) = 200 N   **(Ans: 300 N, 0.0025 m²)**
Area of Piston A (A$_1$) = 20 cm^2 = 0.002 m^2
Force in Piston B (F$_2$) = ?
Area of Piston B (A$_2$) = 30 cm^2 = 0.003 m^2
Force in Piston C (F$_3$) = 250 N
Area of Piston C (A$_3$) = ?
Now, From Pascal's Law,
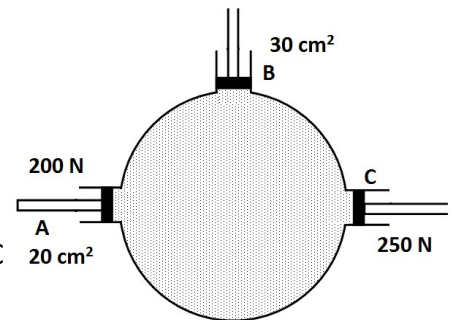Pressure at Piston A = Pressure at Piston B = Pressure at Piston C

or, $\dfrac{F_1}{A_1} = \dfrac{F_2}{A_2} = \dfrac{F_3}{A_3}$

or, $\dfrac{200}{0.002} = \dfrac{F_2}{0.003} = \dfrac{250}{A_3}$

or, $\dfrac{200}{0.002} = \dfrac{F_2}{0.003}$ or, $\dfrac{200}{0.002} = \dfrac{250}{A_3}$

or, $F_2 = \dfrac{200 \times 0.003}{0.002}$ or, $A_3 = \dfrac{250 \times 0.002}{200}$

or,   F$_2$ = 300 N   ∴   A$_3$ = 0.0025 m^2 = 25 cm^2

d. An ice block of dimension 30cm×20cm×10cm is placed in water. Calculate the part of ice above the water surface. The density of water is 1 gm/cm^3 and ice is 0.9 gm/cm^3.   **(Ans: $\dfrac{1}{10}$ part)**

Volume of ice block (v$_i$) = 30 × 20 × 10 = 6000 cm^3
Density of ice (d$_i$) = 0.9 gm/cm^3
Density of water (d$_w$) = 1 gm/cm^3
∴ Mass of ice = v$_i$ × d$_i$ = 6000 × 0.9 = 5400 gm
Now, from the law of floatation,

Mass of displaced water = Mass of ice = 5400 gm

∴ Volume of displaced water (v$_w$) = $\dfrac{\text{mass of displaced water}}{\text{density of water}} = \dfrac{5400}{1} = 5400 \text{ cm}^3$

Portion of ice under the water surface = $\dfrac{\text{volume of displaced water}}{\text{volume of ice}} = \dfrac{5400}{6000} = \dfrac{9}{10}$ part

Portion of ice above the water surface = $1 - \dfrac{9}{10} = \dfrac{1}{10}$ part

e. Study the figure and answer the following questions:

   (i) What is the weight of stone in air? Write the amount of upthrust force exerted on the stone?

   Weight of the stone in air = 10 + 5 = 15 N.   **[Ans: (i) 15 N, 5 N (ii) 1.5 kg (iii) 0.5 kg]**

   Amount of Upthrust = Weight of displaced water = 5 N

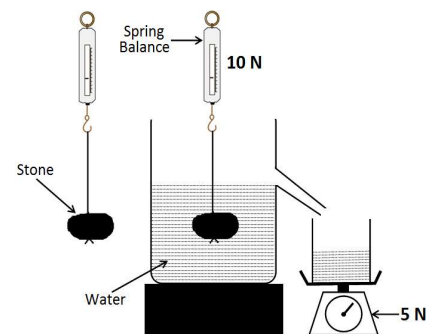   (ii) What is the mass of the stone?

   We have, 10 N = 1 kg

   or, 1 N = 0.1 kg

   ∴ Mass of the stone = 15 × 0.1 = 1.5 kg

   (iii) If 1 kg = 10 N, then find the mass of displaced liquid

   Weight of displaced liquid = 5 N

   ∴ Mass of displaced liquid = $\dfrac{5}{10}$ kg = 0.5 kg

f. A stone is weighted in air, water and salt solution. Study the given table and answer the following questions:

Medium	Weight
A	15 N
B	18 N
C	16 N

   i. Which medium is A, B and C?

   A is salt solution, B is air and C is water.

   ii. Which medium has high density and which has low density? Why?

   The medium A (salt solution) has high density as it exerted more upthrust and the medium B (air) has low density as it exerted less upthrust.

   iii. What is the upthrust when the stone is immersed in medium C?   **(Ans: 2 N)**

   Upthrust in medium C = (18 − 16) = 2 N

   iv. If 1 kg = 10 N, what is the mass of the givens stone?   **(Ans: 1.8 kg)**

   We have, 10 N = 1 kg

      or, 1 N = 0.1 kg

   Also, Weight of the stone in air = 18 N

   ∴ Mass of the stone = 18 × 0.1 = 1.8 kg

   v. Find the mass of the water displaced by stone.   **(Ans: 0.2 kg)**

   Upthrust applied by water = (18 − 16) = 2 N

   ∴ Weight of water displaced = Upthrust

            = 2 N

   ∴ Mass of displaced water = $\dfrac{2}{10}$ kg = 0.2 kg

03. Energy

1. How many types of source of energy are there on the basis of their use? Explain with example.

There are two types of sources of energy on the basis of their use. They are:

(i) Non-renewable source of energy → Those source of energy which has limited stock and can exhaust from nature is called renewable source of energy. Ex: Coal, Mineral oil, Natural gas, etc.

(ii) Renewable source of energy → Those source of energy that never exhaust from nature and can be obtain continuously is called renewable source of energy. Ex: Solar energy, Bio gas, Wind energy, Geothermal energy, Wood, Hydroelectricity, etc

2. What are the advantages of using solar energy as the alternative of fossil fuel?

The advantages of using solar energy as alternative source of energy are as follows:

(i) It is renewable source of energy so never get depleted.

(ii) It is free of cost and nature friendly.

(iii) It is available in every plane on the earth.

3. Why hydroelectricity is considered as more convenient in case of Nepal?

Hydroelectricity is considered as more convenient in case of Nepal because of the following reasons:

(i) The rivers of Nepal have the capacity to produce 83000MW electricity.

(ii) Although the cost of initial infrastructures is high, it becomes cheaper for the long term basis.

(i) It helps the country to overcome from the dependency of expensive petroleum products.

(ii) It is pollution free energy and can be transmitted to very far areas by using transmission wires.

4. 'Hydroelectricity is the consequences of Solar Energy". Justify it.

Hydroelectricity is produced from the conversion of kinetic energy of river water into electrical energy. The water in rivers formed from the melting snow in the Himalayas or due to heavy rain fall. Both the melting of snow and water cycle is due to presence of solar energy. So, the hydroelectricity is also the consequences of solar energy.

5. What do you mean by alternative source of energy? Explain its necessity in use and development for present world.

Those renewable source of energy that can be as the alternative of non-renewable source of energy is called alternative source of energy.

The population and energy demand of the world in increasing in geometric proportion so the alternative source of energy prevent us from energy crisis in near future and it also helps to preserve the non-renewable source of energy.

6. What is $E=mc^2$? What does E, m and c refers? Who proposed this equation?

$E = mc^2$ is the famous Einstein's mass energy equivalence relation. Here E refers Energy produced, m refers lost in mass and c refers the optimum speed of light. A German physicist, Albert Einstein proposed this equation in 1905 AD.

7. What is bio-mass? How it can be used as fuel?

The solid fuels obtain from plant, animals or from their waste product are called bio-mass. They can be used as fuel by burning them.

8. Why government is supporting, motivating and providing subsidies for the citizens for the development of bio-gas plant?

Most of the Nepalese people live in rural area. They are closely linked with the cattle and agriculture. So, the government is supporting, motivating and providing subsidies to them for the development of bio-gas plant to utilize the wasted cattle dung as a smoke free clean source of fuel and to decrease their dependency with forest and fossil fuel.

9. What is fossil fuel? Give examples and also mention its advantages.

The fuel obtains from the fossils of plant and animals which were buried million years ago is called fossil fuel. Example: Coal, Mineral oil, natural gas, etc. Its advantages are as follows:

(i) It is cheap and easily available.

(ii) It is easy to transport and store.

(iii) It is used to run vehicles, engine, machines etc.

10. Why petrol and coal is called non-renewable source of energy?

Petrol and coal has limited stock and can exhaust completely or it take millions of years for their reformation so they are called non-renewable source of energy.

11. What is coal? How it is formed?

Coal is the solid fossil fuel used in industries, factories, railways etc. They are formed when plants and animals are buried beneath the earth crust for million years ago.

12. What is energy crisis? Write the measures to solve it.

The shortage of energy sources due to over used by growing population is called energy crisis.

It can be solved by following ways:

(i) By avoiding unnecessary use of energy.

(ii) By conserving the existing sources of energy.

(iii) By developing the alternative source of energy.

13. Urbanization brings energy crisis. Explain.

Urbanization increases the energy demand. It consumes more amount of fossil fuel. Large urban centers with dense & large population & urban lifestyle create unnecessary consumption of resources. Over lighting, sound, industrialization, etc. also consumes more energy which brings energy crisis.

14. "We are facing energy crisis in near future." Justify it with any three points.

(i) The major source of energy in present world is fossil fuel which is going to deplete in near future.

(ii) The demand of energy is increasing by 2.3% every year.

(iii) The alternative sources of energy are not building enough to replace the demand of fossil fuel.

15. Differentiate between:

a. Renewable source of energy and Non-renewable source of energy

Renewable source of energy	Non-renewable source of energy
1. It can be reformed within short time and it will never deplete from the world	1. It has limited stock and will be completely deplete from the world.
2. It prevents us from energy crisis.	2. It leads us towards energy crisis.

b. Nuclear fusion and Nuclear fission

Nuclear fusion	Nuclear fission
1. During nuclear fusion, two or more lighter nuclei fuse to form a heavier nucleus.	1. During nuclear fission, a heavier nucleus breaks into two or more lighter nuclei.
2. Energy liberated during nuclear fusion is more than nuclear fission.	2. Energy liberated during nuclear fission is less than nuclear fission.

c. Tidal energy and Geothermal energy

Tidal energy	Geothermal energy
1. The energy of tide formed in ocean is tidal energy.	1. The heat energy stored beneath the earth crust is geothermal energy.
2. It is due to the gravitational pull of the sun and moon.	2. It is due to the extreme land pressure inside the crust.

16. Give Reason:

a. Hydroelectricity should be taken as major priority in context of Nepal.
   Hydroelectricity should be taken as major priority in context of Nepal due to the following reasons:
   (i) The rivers of Nepal have the capacity to produce 83000MW electricity.
   (ii) Although the cost of initial infrastructures is high, it becomes cheaper for the long term basis.
   (iii) It helps the country to overcome from the dependency of expensive petroleum products.
   (iv) It is pollution free energy and can be transmitted to very far areas by using transmission wires.
   (v) It is difficult to excavate the fossil mines in Nepal due to its geographical complication.

b. Present world is consuming more amount of fossil fuel.
   (i) Urbanization is being increasing.
   (ii) People are adopting luxurious lifestyle.
   (iii) Vehicles, electrical devices and other machineries are being invented and using extremely.

c. Coal and petroleum are called fossil fuel.
   Coal and petroleum are formed when the plant and animals are buried beneath the earth crust for millions of years. So, they are called fossil fuel.

d. Sun is called the ultimate source of energy.
   All the renewable and nonrenewable source of energy has direct or indirect consequences with the solar energy so the sun is called the ultimate source of energy.

04. Heat

1. Define heat and temperature on the basis of molecular theory.
   The total sum of kinetic energy of the molecules present in a body is called heat energy.
   The average kinetic energy of the molecules present in the body is call its temperature

2. Write any 5 difference between heat and temperature.

Heat	Temperature
1. Heat is the total sum of kinetic energy of the molecules present in a body.	1. Temperature is the degree of hotness or coldness of the body.
2. Its SI unit is Joule (J).	2. Its SI unit is Kelvin (K).
3. It is measured using calorimeter.	3. It is measured using thermometer.
4. It is the cause.	4. It is the effect.
5. It is a derived physical quantity.	5. It is a fundamental physical quantity.

3. Explain the difference between clinical and laboratory thermometer with necessary diagrams.
   Clinical thermometer is used to measure body temperature but the laboratory thermometer is us to measure the temperature of different substance in laboratory. The temperature range of clinical


Fig: Clinical Thermometer

Fig: Laboratory Thermometer
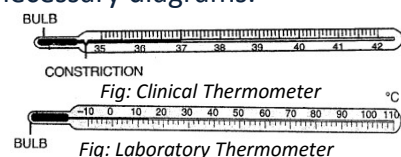
thermometers is 35°C to 42°C and that of laboratory thermometers is − 10°C to 110°C. There is a constriction present is clinical thermometer which is absence in case of laboratory thermometer.

4. Describe the structure and working mechanism of maximum and minimum thermometer.

Maximum and Minimum thermometer is a U shaped parallel tube made up of glass with a bulb at either end. The bulb is filled with alcohol which expands or contracts with change in temperature. The bend at the bottom of the thermometer contains a short column of mercury which moves up or down based on the expansion and contraction of alcohol. When the temperature rises, the alcohol expands and pushes the mercury up to a point along with its iron index which stuck there and indicates the maximum temperature. Similarly, another iron index shows the minimum temperature during contraction. These indexes are reset using magnets and become ready to measure the next maximum and minimum temperature.
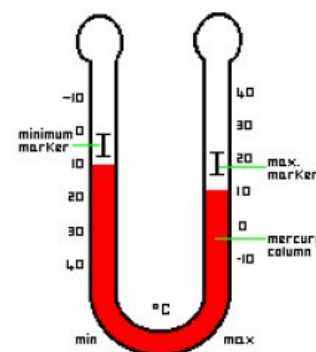
5. Alcohol thermometer cannot be used to measure the temperature of boiling water. Why?

The boiling point of alcohol is 78^0C and water is 100^0C. So, as the alcohol boil earlier than water, it cannot measure the temperature of boiling water.

6. Define specific heat capacity? Water has specific heat capacity of 4200 J/kg^{0}C. What does it mean?

The amount of heat required to lose or raise the temperature of 1 kg mass of a substance by 1^0C is called specific heat capacity.

Water has specific heat capacity of 4200 J/kg^{0}C. It means, 4200 J heat energy is required to lose or raise the temperature of 1 kg water by 1^0C.

7. Tepid sponge bath is done for high fever patient. Why?

Water has high specific heat capacity so it can absorb large amount of heat from fever patient to maintain his/her body temperature to be normal. So, tepid sponge bath is done for fever patient.

8. What changes will observe while heating water from 0^0C to 10^0C?

Water shows anomalous expansion while heating, so while heating water from 0^0C to 10^0C, its density first increases up to 4^0C then gradually decreases to 10^0C.

9. What is the relation between specific heat capacity and change in temperature of a body?

Heat require for a substance having mass m, specific heat capacity s and change in temperature Δt is,

$$Q = m \cdot s \cdot \Delta t$$

or, $\Delta t = \dfrac{Q}{m \cdot s}$

or, $\Delta t \propto \dfrac{1}{s}$ [Keeping constant Q and m]

Hence, specific change in temperature is inversely proportional to the specific heat capacity.

10. What is heat equation? Define 1 calorie heat.

Heat require for a substance having mass m, specific heat capacity s and change in temperature Δt is given by, $Q = m \cdot s \cdot \Delta t$. This is known as heat equation.

The amount of heat required to increase the temperature of 1 gm water by 1^0C is called 1 calorie heat.

11. Prove: Heat gain or lose by a body is equal to the product of the mass, specific heat capacity and change in temperature of the body.

Suppose m be the mass of a substance and Δt be its change in temperature, then,

Heat gain or lose (Q) by a substance is directly proportion to the mass of the body,

ie. $Q \propto m$ ·················· (1)

and change in temperature of the body.

ie. $Q \propto \Delta t$ ················· (2)

Combining equation (1) and (2) we get,

$Q \propto m \cdot \Delta t$

or, $Q = s \cdot m \cdot \Delta t$

Here s is proportionality constant and called the specific heat capacity of the substance.

∴ $Q = m \cdot s \cdot \Delta t$

12. What is principle of calorimetry? Why see breeze occurs during day and land breeze during night?

Principle of calorimetry states that, "Heat lose by a body is equal to heat gain by its surroundings."

Sea breeze and land breeze occurs because of the unequal heating rates of land and water. During the day, the land surface heats up faster than the water surface. Therefore, the air above the land is warmer than the air above the sea. As a result, warm air moves towards the sea and cold air moves towards the land and sea breeze occurs. But during night sea water cool slower and land cool faster. Therefore, the air above the sea is warmer than the air above the land. As a result, warm air moves towards the land and cold air moves towards the sea and land breeze occurs.

13. On what factors do heat lost and heat gain depends on? Write the relation between joule and calorie.
    Heat gain or lose depends upon mass, specific heat capacity and change in temperature of the body.
    1 Calorie = 4.2 Joule

14. Give Reason :
    a. In winter days we feel cold inside the room after getting up from bed but we feel the same room to be warm when we come after visiting outside.
       While getting up, our body is hotter than the room so the body loses heat and we feel cold but when we come after visiting outside, the body is colder than room so we absorb heat from room and we feel warm.

    b. Water kept in mud pots are found cool in summer.
       In mud pots there are tiny pores through which water kept inside comes out, absorbs heat from the pot and get evaporate. Due to this process, the pot loses its heat and become cold and correspondly decreases the temperature of its water by absorbing heat from it. So, the water kept in mud pots are found cool in summer.

    c. Water is used to cool down the hot engines of vehicles.
       Water has high specific heat capacity so it can absorb large amount of heat energy from the hot engines of vehicles to make it cool. So it is used to cool down the hot engines of vehicles.

    d. Water vapour burns more than boiling water.
       Although boiling water and vapour both has same temperature but water vapour burns more than boiling water because the vapour have extra more heat energy than boiling water called the latent heat of vaporization.

15. Numerical:
    a. Calculate the heat required to increase the temperature of 5kg water by 20^0C. **(Ans: 420000J)**
       Given, Mass of water (m) = 5 kg
       Specific heat capacity of water (s) = 4200 J/kg^{0}C
       Change in temperature (Δt) = 20^0C
       $\therefore$ Heat gain (Q) = m·s·Δt
       $\qquad\qquad$ = 5 × 4200 × 20 = 420000 J

    b. Calculate the heat lose to change the temperature of a metal having mass 5 kg from 30^0C to 20^0C. (specific heat capacity of metal = 188 JKg^{-1} ^{0}C^{-1}) **(Ans: 9.4×10^3J)**
       Given, Mass of metal (m) = 5 kg
       Specific heat capacity of metal (s) = 188 J/kg^{0}C
       Change in temperature (Δt) = 30^0C – 20^0C = 10^0C
       $\qquad$ $\therefore$ Heat lose (Q) = m·s·Δt
       $\qquad\qquad$ = 5 × 180 × 10 = 9400 J

    c. Calculate the heat required to increase the temperature of 500gm of a body having specific heat capacity 470 J/kg^{0}C by 80^0C. **(Ans: 1.88×10^4J)**
       Given, Mass of body (m) = 500 gm = 0.5 kg
       Specific heat capacity of water (s) = 470 J/kg^{0}C
       Change in temperature (Δt) = 80^0C
       $\therefore$ Heat gain (Q) = m·s·Δt
       $\qquad\qquad$ = 0.5 × 470 × 80 = 18800 J

    d. If 433.2 KJ heat is necessary to increase the temperature of 2 kg copper from 30^0C to 60^0C. Calculate its specific heat capacity. **(Ans: 7220 J/kg^{0}C)**
       Given, Heat gain (Q) = 433.2 KJ = 433.2 × 1000 J = 433200 J
       Mass of water (m) = 2 kg
       Change in temperature (Δt) = 60 – 30 = 30^0C
       Specific heat capacity of water (s) = ?

We know,

$\therefore$ Heat gain (Q) = m·s·Δt

or, 433200 = 2 × s × 30

or, $s = \dfrac{433200}{2 \times 30} = 7220$ J/kg^{0}C

e. What is the final temperature if 84 KJ heat is supplied to the water of 2 kg at 10^{0}C? **(Ans: 20^{0}C)**

Given, Heat gain (Q) = 84 KJ = 84 × 1000 J = 84000 J

Mass of water (m) = 2 kg

Specific heat capacity of water (s) = 4200 J/kg^{0}C

We know,

$\therefore$ Heat gain (Q) = m·s·Δt

or, 84000 = 2 × 4200 × Δt

or, $\Delta t = \dfrac{84000}{2 \times 4200} = 10$ ^{0}C

Hence, the final temperature of the water = 10 + 10 = 20^{0}C

f. What is the final temperature of the 20 kg water initially at 30^{0}C is heated with 4.2 × 10^{3}KJ heat by a 1000W heater? **(Ans: 80^{0}C)**

Given, Heat gain (Q) = 4.2 × 10^3 KJ = 4.2 × 10^3 × 1000 J = 4200000 J

Mass of water (m) = 20 kg

Specific heat capacity of water (s) = 4200 J/kg^{0}C

We know, Heat gain (Q) = m·s·Δt

or, 4200000 = 2 × 4200 × Δt

or, $\Delta t = \dfrac{4200000}{20 \times 4200} = 50$ ^{0}C

Hence, the final temperature of the water = 30 + 50 = 80^{0}C

g. Calculate the specific heat capacity of a substance if 1000W heater takes 2 minutes to change the temperature of 10kg of its mass from 25^{0}C to 30^{0}C. **(Ans: 2400 J/kg^{0}C)**

Given, Power of heater (P) = 1000 W

Time taken (T) = 2 min = 2 × 60 sec = 120 sec

Heat Energy (Q) = Power × Time = 1000 × 120 = 120000 J

Mass of substance (m) = 10 kg

Change in temperature (Δt) = 30 − 25 = 5^{0}C

Specific heat capacity (s) = ?

We know,

$\therefore$ Heat gain (Q) = m·s·Δt

or, 120000 = 20 × s × 5

or, $s = \dfrac{120000}{10 \times 5} = 2400$ J/kg^{0}C

h. What is the final temperature of the mixture if 200 ml milk at 90^{0}C is poured in 10 ml water at 15^{0}C? Considering the density and specific heat capacity of both milk and water to be identical.

Here, Let the initial temperature of mixture be T ^{0}C. **(Ans: 86.43^{0}C)**

Mass of milk (m$_1$) = 200 gm = 0.2 kg   [$\because$ 1 ml milk = 1 gm milk]

Change in Temperature of milk (Δt$_1$) = (90 − T) ^{0}C

Mass of water (m$_2$) = 10 gm = 0.01 kg   [$\because$ 1 ml water = 1 gm water]

Change in Temperature of water (Δt$_2$) = (T − 15) ^{0}C

Now, according to the law of calorimetry,

$\therefore$ Heat lose by milk = Heat gain by water

or, $m_1 \cdot s_1 \cdot \Delta t_1 = m_2 \cdot s_2 \cdot \Delta t_2$

or, 0.2 × (90 − T) = 0.01 × (T − 15)

or, 18 − 0.2T = 0.01T − 0.15

or, 0.01T + 0.2T = 18 + 0.15

or, 0.21T = 18.15

or, $T = \dfrac{18.15}{0.21} = 86.43$ ^{0}C

i. If an iron ball of 200gm when immersed in 500gm of water initially at 10^0C can change temperature of water to 30^0C, then calculate the initial temperature of that iron ball. (Specific heat capacity of iron is 470 J/kg^{0}C) **(Ans: 476.81^{0}C)**

Here, Let the initial temperature of the iron be T ^{0}C.

Mass of iron (m_1) = 200 gm = 0.2 kg

Specific heat capacity of iron (s_1) = 470 J/kg^{0}C

Change in Temperature of iron (Δt_1) = $(T - 30)^0$C

Mass of water (m_2) = 500 gm = 0.5 kg

Specific heat capacity of water (s_2) = 4200 J/kg^{0}C

Change in Temperature of water (Δt_2) = 30 – 10 = 20 ^{0}C

Now, according to the law of calorimetry,

$$\therefore \text{Heat lose by Iron = Heat gain by water}$$

or, $m_1 \cdot s_1 \cdot \Delta t_1 = m_2 \cdot s_2 \cdot \Delta t_2$

or, $0.2 \times 470 \times (T - 30) = 0.5 \times 4200 \times 20$

or, $T - 30 = \dfrac{0.5 \times 4200 \times 20}{0.2 \times 470} = 446.81$

or, $T = 446.81 + 30 = 476.81 \ ^0$C

05. Light

1. What is lens? Write its type and its use in our daily life.

   Lens is an optical instrument which converges or diverges the parallel beam of light. Convex lens and Concave lens are the 2 types of lens. Lens is used in eye, camera, telescope, microscope, projector etc.

2. Write any 3 difference between convex and concave lens.

Convex Lens	Concave Lens
1. It is thicker at center and thinner at edge.	1. It is thinner at center and thicker at edge.
2. It converges the parallel beam.	2. It diverges the parallel beam.
3. It forms both real and virtual images.	3. It always forms virtual images.
4. It has real focal point.	4. It has virtual focal point.

3. When an object is placed between focal point and optical centre of a lens, it formed erect, magnified and virtual image.

   a. Which lens is used in this case?

   Convex lens is used in this case.

   b. Draw the complete ray diagram of it.
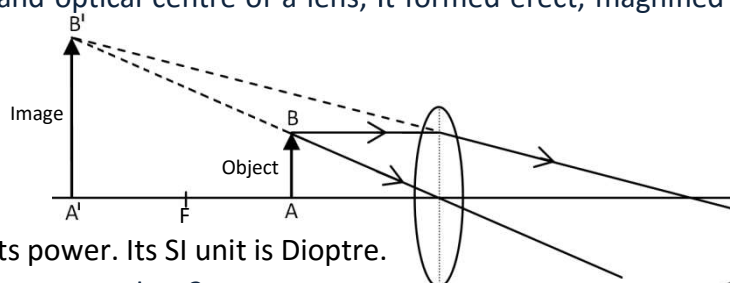
4. Define power of lens and also write its SI unit.

   The reciprocal of focal length of a lens is called its power. Its SI unit is Dioptre.

5. How the light refracted through convex and concave lens? Illustrate with diagram.

   The convex lens converges the parallel beam of light into focus whereas the concave lens diverges the parallel beam of light away from the focus after refraction.

Fig: Convex Lens   Fig: Concave Lens
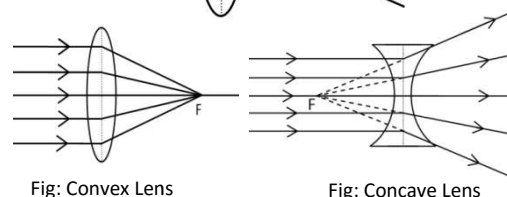
6. What is magnification? Explain the process to measure the magnification of a lens.

   The ratio of image size to the object size is called magnification of lens. To measure the magnification of lens, image size and object size is measure or the image distance and object image is measured. Then it is calculated by using the formula:

   Magnification on lens (M) = $\dfrac{\text{Size of Image (I)}}{\text{Size of Object (O)}} = \dfrac{\text{Image distance (v)}}{\text{Object distance (u)}}$ It is a unit less quantity.

7. What do you mean by defect of vision/eye? Write its type with diagram.

   When ciliary muscles fail to contract or expand the eye lens properly, it cannot focus the object according to its distance to form its image in retina and we cannot see the object properly. This is called defect of vision. Short-sightedness and Long-sightedness are its 2 types.

Fig: Short-sightedness   Fig: Long-sightedness
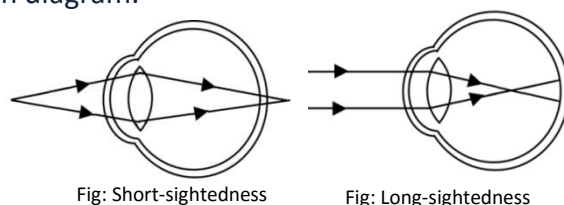
8. A type of defect in eye is shown in the figure. Answer the following questions:
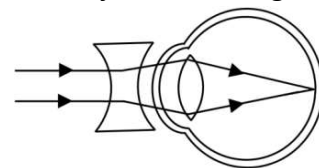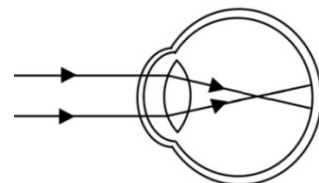   a. Which type of defect of vision is this?
      This type of defect of vision is called short-sightedness.
   b. What is the reason behind this defect?
      When ciliary muscles fail to expand the eye lens properly, it cannot focus the object according to its distance and the image form in front of retina.
   c. How this can be resolved, illustrate with figure.
      This can be resolved by using concave lens.

9. A student can easily read the words written in white board while sitting in last bench but he has to use spectacles while reading. Now, answer the following questions:
   a. Which type of defect in eye is this?
      This type of defect of vision is called Long-sightedness.
   b. What is the reason behind this defect?
      When ciliary muscles fail to contract the eye lens properly, it cannot focus the object according to its distance and the image form in beyond retina.
   c. How this can be resolved, illustrate with figure.
      This can be resolved by using convex lens.
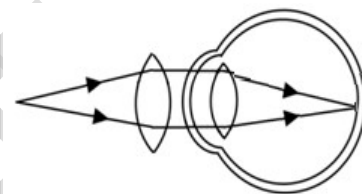
10. Difference Between:
    a. Lens of eye and lens of camera

Lens of Eye	Lens of Camera
1. Focal length of lens changes according to the distance of the object.	1. Focal length of lens is always same.
2. Focusing is done by changing the thickness of lens.	2. Focusing is done by changing the position of the lens.
3. Image forms in retina.	3. Image forms in photo film.

    b. Virtual image and Real image

Virtual Image	Real Image
1. Virtual image is formed when the rays of light appear to meet at a point after refraction.	1. Real image is formed when the rays of light actually meet at a point after refraction.
2. Screen projection is not possible.	2. Screen projection is possible.
3. Both concave lens and convex lens can form virtual image.	3. Real image is only formed by convex lens.

11. Give Reason:
    a. Convex lens is called conversing lens.
       Convex lens converges the parallel beam of light at focus after refraction so it is also called converging lens.
    b. The power of concave lens in negative.
       Concave Lens (Diverging Lens) has negative focal length, so they also have negative power values.
    c. Lens refracts the light.
       Lens is a transparent object formed from the combination of many prisms. When the light travels through the lens it get bend and diverges or converges due to the difference in the density of the mediums.
    d. Concave lens is used to correct short-sightedness.
       The eye suffering from short-sightedness forms the image infront of retina. If we used concave lens then it slightly diverges the rays of light and helps to form the image exactly on the retina and makes the object visible. So the concave lens is use to correct the short-sightedness.

12. Numerical Problems:
    a. Write the type and find the focal length of a lens which power is +1.0 D.   **(Ans: 1m)**
       The positive value of the power indicated that the lens is convex lens.
       Given, Power of Lens (P) = 1 D
       Focal length (f) = ?

we know, Power (P) = $\dfrac{1}{f}$

      or, $1 = \dfrac{1}{f}$

      or,   f = 1 m

b. A magnifying lens has power of +25D. What should be the distance between this lens and a book to read the words easily?   **(Ans: 4 cm)**

Given, Power of Lens (P) = 25 D

focal length (f) = ?

we know, Power (P) = $\dfrac{1}{f}$

      or, $25 = \dfrac{1}{f}$

      or, $f = \dfrac{1}{25}$ = 0.04 m = 4 cm

∴ Hence the distance between the lens and the book should be of 4 m

c. An object is placed at 3 cm far from a convex lens which focal length is of 2 cm. Draw the ray diagram, nature of image formed, calculate the power of the lens and also write one use of this type of lens.   **(Ans: +50D)**
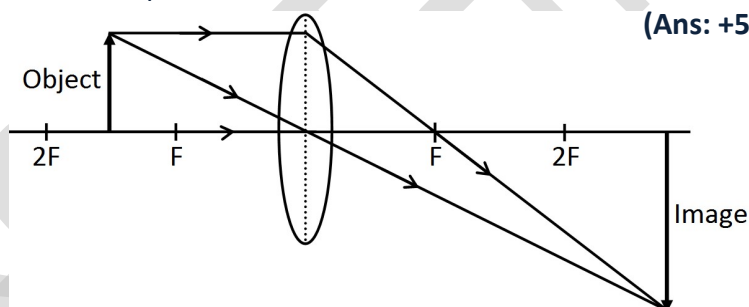
Given,

    Focal length (f) = 2 cm = 0.02 m

∴ Power of Lens (P) = $\dfrac{1}{f}$

      = $\dfrac{1}{0.02}$ = 50 D

Hence, the power of lens is +50 D.

Convex lens is used in microscope for the magnification of the image.

d. An object is placed twice of the focal length. If the focal length of a convex lens is 5 cm. Draw the ray diagram and calculate (a) Image distance (b) Magnification of lens (c) Power of the lens.

    (Ans: 10cm, 1, +20D)
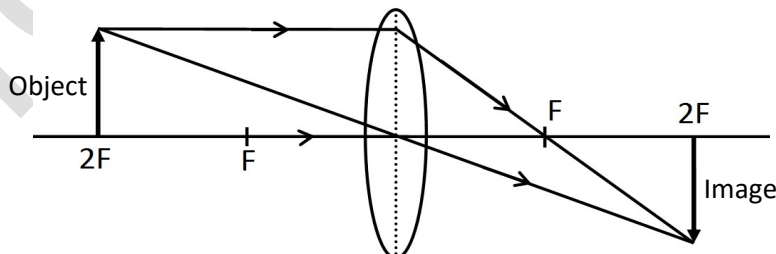
(a) Here,

    Focal length (f) = 5 cm = 0.05 m

    Object distance (u) = 10 cm = 0.1 m

    Since the image formed in 2F so,

    Image distance (v) = 10 cm = 0.1 m

(b) Magnification of Lens (M) = $\dfrac{v}{u}$

      = $\dfrac{0.1}{0.1}$ = 1

(c) Power of Lens (P) = $\dfrac{1}{f}$ = $\dfrac{1}{0.05}$ = + 20 D

e. A burning candle is placed at a distance of 12cm far from a convex lens having focal length of 8cm. Draw a ray diagram to show the formation of image. Also find out magnification and power of the lens. Write the size, nature and position of image too.   **(Ans: 2, +12.5D)**

Here, Object distance (u) = 12 cm = 0.12 m

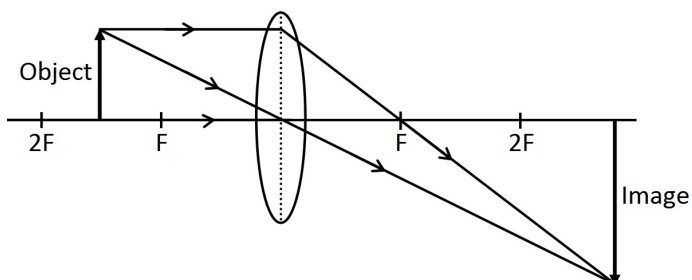Focal length (f) = 8 cm = 0.08 m

We know that,

$$\dfrac{1}{u} + \dfrac{1}{v} = \dfrac{1}{f}$$

    or, $\dfrac{u}{u} + \dfrac{u}{v} = \dfrac{u}{f}$

    or, $1 + \dfrac{1}{M} = \dfrac{0.12}{0.08}$

    or, $\dfrac{1}{M} = 1.5 - 1 = 0.5$

    or, $M = \dfrac{1}{0.5} = 2$

Power of Lens (P) = $\dfrac{1}{f}$ = $\dfrac{1}{0.08}$ = + 12.5 D

Characteristics of Image :

Size : Magnified

Nature : Real and Inverted

Position : Beyond 2F

06. Current Electricity and Magnetism

1. Define heating element? Why it is used in heater?

   The wire which produced heat while passing electric current through it, is called heating element. It converts electrical energy to heat energy, so it is used in heater.

2. Write any 3 difference between filament lamp and florescent lamp.

Filament lamp	Florescent lamp
1. It converts 10% electrical energy into light energy and 90% into heat energy.	1. It converts 30% electrical energy into light energy and 70% into heat energy.
2. It is filled with nitrogen or argon gas.	2. It is filled with mercury vapour.
3. It has the life span of 1000 hours.	3. It has the life span of 3000 hours.

3. What is filament? From which metal it is made? Write any 2 reasons.

   Filament is the lighting element used in filament lamp. It is made from Tungsten element. Tungsten wire is a lighting element and has very high melting point (3400^0C) and resistance so it used to make filament.

4. Write the function of mercury vapour and florescent powder in florescent lamp.

   Mercury vapour helps to emit UV-rays and florescent powder converts the UV-rays into visible light.

5. Write the full form of CFL and LED? "Use of CFL reduces the load shedding." Justify it.

   The full form of CFL is "Compact Florescent Light" and LED is "Light Emitting Diode". The power consumption of CFL is very low and it converts more amount of electrical energy into light energy. So due to this reason it can reduce the load shedding.

6. Write the working mechanism of electric bell with diagram.

   An electric bell converts the electrical energy into sound energy. When switch is pressed the electromagnet attracts the iron strip towards it. This brings the hammer in contact with the gong and hits the gong to produce sound. Due the displacement of iron strip, the circuit breaks and the electromagnet lose its magnetic strength, so the iron strip return back into its original position and again the circuit completed. This process continues and we hear the ringing of bell.

fig: electric bell
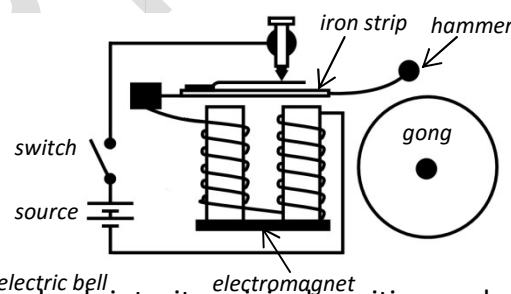
7. How a bicycle dynamo works? Explain in short.

   A bicycle dynamo works in the principle of faraday law of magnetic induction. When armature of dynamo is rotated, the magnetic flux of the magnet is cut by the conducting wire and it generates electromotive force (emf) in the wire.

8. How can we increase the amount of emf in a dynamo or in a generator?

   The amount of emf in dynamo or generator can be increased by following ways:
   (i) By increasing the speed of the rotation of the armature.
   (ii) By increasing the number of turns in coil.
   (iii) By decreasing the distance between magnet and coil.
   (iv) By using more powerful magnet.

9. Explain the structure of transformer with figure.

   A transformer is an electric device which converts high AC voltage into low AC voltage and vice-versa. It consists of rectangular soft iron core made up of laminated sheets kept one above another. Two insulating wire, each is wound many turns around two opposite arms of core and ones wire ends are connected to an AC source whereas the another wire ends functions as output.
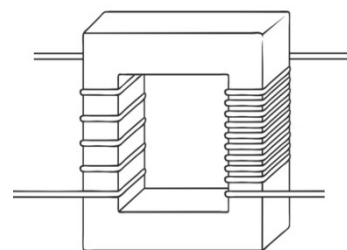
fig : Transformer

10. What is eddy current? Which substance is use to laminate the core of transformer?

    The unwanted current developed inside the core of the transformer is called eddy current. Varnish or Shellac is used to laminate the core of the transformer.

11. "The use of AC was limited if transformer was not invented." Justify it.

    Different electrical appliance has different ability of consuming the voltage. So if there was no transformer invented then we cannot supply the amount of voltage according to the requirement and we were not able to transmit the AC current through transmission wires. Hence, the use of AC becomes limited if transformer was not been invented.

12. List the safety measures while using electrical appliance.

The safety measures while using the electrical appliance are as follow:

(i)   We should not touch the switch and device with wet hand.

(ii) The naked wires should properly cover with seal tape.

(iii) Switch and suitable fuse should be connected in live wire so they can cut off the current.

(iv) The quality wire should be used and earthing should be done.

13. Define 1 KWh. *(Define 1 unit electric consumption.)*

The amount of electrical energy consumed when a 1KW electric device used for 1 hour is called KWh.

14. Write the difference between:

a.   Tungsten and Nichrome

Tungsten	Nichrome
1. It is a lighting element used in filament lamp.	1. It is a heating element used in heater.
2. It is a pure element.	2. It is a alloy of nickel and chromium.

b.   Electric motor and generator

Electric motor	Generator
1. It converts electrical energy into mechanical energy.	1. It converts mechanical energy into electrical energy.
2. It works on the principle of motor effect.	2. It works on the principle of magnetic induction.
3. It follows Fleming's left hand rule.	3. It follows Fleming's right hand rule.

c.   emf from dynamo and emf from battery

emf from dynamo	emf from battery
1. It is produced from the conversion of mechanical energy into electrical energy.	1. It is produced from the conversion of chemical energy into electrical energy.
2. It may be DC or AC.	2. It is always DC.

d.   Step up transformer and step down transformer

Step Up Transformer	Step Down Transformer
1. The output voltage is more than input voltage.	1. The output voltage is less than input voltage.
2. Secondary turns are more than primary turns.	2. Secondary turns are less than primary turns.

15. Give Reason:

a.   Nichrome wire is used as heating element.

Nichrome wire is used as heating element because it has high melting point and resistance.

b.   Air is not used to fill electric bulb.

At high temperature the filament wire react with air and break, so air is not used to fill electric bulb.

c.   Filament wire glows but other ordinary wires do not glow while passing electricity.

Filament wire has high resistance and melting point enough to emit light while passing electricity which is absence in case of ordinary wire.

d.   Inert gas is filled in filament lamp.

Inert gas does not react with filament even at high temperature. So, they are used in filament lamp.

e.   40W fluorescent lamp glows brighter than 40W filament lamp.

Florescent lamp converts 30% electric energy into light energy whereas filament only converts 10% into light energy. So, 40W fluorescent lamp glows brighter than 40W filament lamp.

f.   Transformer is used inside many electronic devices.

Different electrical device has different capacity of voltage consumption. So, to supply the suitable voltage according to the requirement, transformers are used in many electronic devices.

g.   Transformer core is laminated.

Some heat is also generated inside the core of the transformer due to the heating effect of electricity. So, to prevent the transformer from damage its core is laminated.

h.   Number of turns in primary coil and secondary coil of a transformer is never made equal.

Equal number of primary and secondary coil does not alter the amount of output voltage so they were never made equal.

i. The bulb of bicycle glows with more brightness while rotating its wheel faster and vice versa.

When the wheel of bicycle rotates faster, the wheel of dynamo also rotates faster and rate of change in magnetic flux increase which results increase in output voltage so, the bulb glows with more brightness.

16. Numerical Problems:

a. If 8 tube lights of 40W each are using 220V, then what should be the capacity of fuse. **(Ans: 1.46A)**

Given, Total Power of Tube lights (P) = 8 × 40 W = 320 W

Voltage in Circuit (V) = 220 V

We know,

$$Power (P) = I \times V$$
$$or, \quad 320 = I \times 220$$
$$or, \quad I = \frac{320}{220} = 1.46 \text{ A}$$

∴ The capacity of fuse should be 1.46 A.

b. If the primary volt in a transformer having primary turns 500 is 220V, then what should be its secondary turns to produce secondary voltage of 110V? **(Ans: 250 turns)**

Here, Primary Voltage (V_1) = 220 V

Primary Turns (N_1) = 500 turns

Secondary Voltage (V_2) = 110 V

Secondary Turns (N_2) = ?

We know,

$$\frac{V_1}{V_2} = \frac{N_1}{N_2}$$
$$or, \quad \frac{220}{110} = \frac{500}{N_2}$$
$$or, \quad N_2 = \frac{500 \times 110}{220} = 250 \text{ turns}$$

c. If the primary volt in a transformer having primary turns 5000 is 2KV, then what should be its secondary turns to produce secondary voltage of 220V? **(Ans: 550 turns)**

Here, Primary Voltage (V_1) = 2 KV = 2000 V

Primary Turns (N_1) = 5000 turns

Secondary Voltage (V_2) = 220 V

Secondary Turns (N_2) = ?

We know,

$$\frac{V_1}{V_2} = \frac{N_1}{N_2}$$
$$or, \quad \frac{2000}{220} = \frac{5000}{N_2}$$
$$or, \quad N_2 = \frac{5000 \times 220}{2000} = 550 \text{ turns}$$

d. If a transformer has 1000 input turns and input voltage of 220V, then what should be its output turns to produce 11V, 44V and 110V output voltage? **(Ans: 50, 200, 500 turns)**

Here, Primary Voltage (V_1) = 220 V

Primary Turns (N_1) = 1000 turns

Secondary Voltage (V_2) = 11 V	Secondary Voltage (V_2) = 44 V	Secondary Voltage (V_2) = 110 V
Secondary Turns (N_2) = ?	Secondary Turns (N_2) = ?	Secondary Turns (N_2) = ?
We know,	We know,	We know,
$\frac{V_1}{V_2} = \frac{N_1}{N_2}$	$\frac{V_1}{V_2} = \frac{N_1}{N_2}$	$\frac{V_1}{V_2} = \frac{N_1}{N_2}$
$or, \frac{220}{11} = \frac{1000}{N_2}$	$or, \frac{220}{44} = \frac{1000}{N_2}$	$or, \frac{220}{110} = \frac{1000}{N_2}$
$or, N_2 = \frac{1000 \times 11}{220}$	$or, N_2 = \frac{1000 \times 44}{220}$	$or, N_2 = \frac{1000 \times 110}{220}$
= 50 turns	= 200 turns	= 500 turns

e. The number of turns in the primary coil of a transformer is double than that of in the secondary coil. Calculate the input voltage if 110V is generated by the secondary coil. **(Ans: 220V)**

Here, Primary Voltage (V_1) = ?

Primary Turns (N_1) = 2N (Let)

Secondary Voltage (V_2) = N

Secondary Turns (N_2) = 110

We know,

$$\frac{V_1}{V_2} = \frac{N_1}{N_2}$$

or, $\frac{V_1}{110} = \frac{2N}{N}$

or, $V_1 = 2 \times 110 = 220\ V$

f. What is the electric consumption per day if a house is using 4 bulbs of 100W for 6 hours and 2 heaters of 2KW for 4 hours daily? **(Ans: 18.4 Unit)**

Here, Power of Bulbs (P_1) = 100 W = 0.1 KW

Number of Bulbs (N_1) = 4

Time of Use (T_1) = 6 hours

Power of Bulbs (P_2) = 2 KW

Number of Bulbs (N_2) = 2

Time of Use (T_2) = 4 hours

We know,

Electric Consumption (EC) = $P_1 \cdot N_1 \cdot T_1 + P_2 \cdot N_2 \cdot T_2$

= $0.1 \times 4 \times 6 + 2 \times 2 \times 4$

= 2.4 + 16 = 18.4 Unit

g. A house uses 30W four tube lights for 5 hours per day, 40W two TV for 4 hours per day, 750W one iron for 2 hours per week and 100W four bulbs for 4 hours per day. Calculate the monthly electric consumption and total electric bill if Rs.7.50 costs for 1 unit. **(Ans: 82.03 Unit, Rs.615.23)**

Here, Power of Tube lights (P_1) = 30 W = 0.03 KW

Number of Tube lights (N_1) = 4

Time of Use of Tube lights (T_1) = 5 × 30 = 150 hours

Power of TV (P_2) = 40 W = 0.04 KW

Number of TV (N_2) = 2

Time for Use of TV (T_2) = 4 × 30 = 120 hours

Power of Iron (P_3) = 750 W = 0.75 KW

Number of Iron (N_3) = 1

Time of Use of Iron (T_3) = $\frac{2}{7}$ × 30 = 8.57 hours

Power of Bulbs (P_4) = 100 W = 0.1 KW

Number of Bulbs (N_4) = 4

Time of Use of Bulbs (T_4) = 4 × 30 = 120 hours

We know,

Electric Consumption (EC) = $P_1 \cdot N_1 \cdot T_1 + P_2 \cdot N_2 \cdot T_2 + P_3 \cdot N_3 \cdot T_3 + P_4 \cdot N_4 \cdot T_4$

= 0.03×4×150 + 0.04×2×120 + 0.75×1×8.57 + 0.1×4×120

= 18 + 9.6 + 6.43 + 48 = 82.03 Unit

Monthly Cost of Electricity = 82.03 × 7.50 = Rs. 615.23

07. Classification of Elements

1. Write Mendeleev's periodic law and its importance.

   Mendeleev's periodic table law states that, "The physical and chemical properties of elements are in periodic function of their atomic masses." Its importance is as follows:

   (i) It was the first systematic classification of elements which made the study of elements easier and scientific.

   (ii) It leads the discovery of some elements and also helps to correct the atomic mass of some elements.

2. Write any four drawbacks of Mendeleev's periodic table. Does this defects resolved by modern periodic table? If yes then how?

The 4 drawbacks of Mendeleev's periodic table are as follow:

(i) Position of hydrogen in the periodic table was not clear.

(ii) Position of isotopes could not be explained by Mendeleev periodic table.

(iii) There was no any suitable place for lanthanides and actinides.

(iv) Elements like silver, copper, and gold were placed along with alkali.

Some of the defects were resolved by modern periodic table after rearranging the elements with increasing order of their atomic numbers. But position of hydrogen in this table is also still not clear.

3. Write modern periodic law and its five characteristics.

Modern periodic table law states that, "The physical and chemical properties of elements are in periodic function of their atomic number." Its importance is as follows:

(i) Elements are arranged according to their increasing atomic numbers.

(ii) Elements are kept in 4 different blocks: s-block, p-block, d-block and f-block.

(iii) Lanthanides and actinides are kept below the main table in a separate block.

(iv) It consist 18 groups and 7 periods.

(v) Inert gas are kept in zero (0) group (18 group).

4. Study the given electronic configuration of element A and B and answer the following questions:

$$A = 1s^2, 2s^2 2p^6, 3s^2 3p^6, 4s^1 \qquad\qquad B = 1s^2, 2s^2 2p^4$$
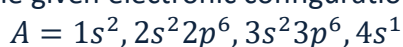
(i) In which group does A and B lies in periodic table?

A lies in group IA and B lies in group IVA

(ii) In which period does A and B lies in periodic table?

A lies in 4th period and B lies in 2nd period.

(iii) Write the valency of element A and B?

Valency of A is 1 and valency of B is 4.

(iv) Write the molecular formula of the compound formed with A and B.

The molecular formula of the compound is K_2O.

(v) In which block does A and B lies in periodic table? Why? Give reason.

A lies in s-block and B lies in p-block because the last electron of A enters in s-subshell and B enters in p-subshell.

5. What are metalloids? Write any 3 example of it also mention their position in periodic table.

Metalloids are the elements which show both property of metals and non-metals. For example: Boron, Silicon, Arsenic, etc. They are found in p-block between metal and non metal in modern periodic table.

6. In which group alkali metals are placed in periodic table? Why they are called alkali metals?

Alkali metals are kept in group IA in modern periodic table. They forms alkali when react with water so they are called alkali metals.

7. Why the elements in group IA is called alkali metals, group IIA is called alkaline earth metal, group VIIA is called halogens and group 0 is called noble gas?

Group IA metals react with water to form alkali so they are called alkali metals. Group IIA metals are found in the form of oxide and dissolve with water to form alkaline solution so they are called alkaline earth metals. Group VIIA elements react with metals to form salt so they are called halogens. Group 0 elements are called inert gas because they are inactive gas and don't react easily with others.

8. Write the difference between Mendeleev's periodic table and modern periodic table.

Mendeleev Periodic Table	Modern Periodic Table
1. Elements are arranged according to their increasing atomic mass.	1. Elements are arranged according to their increasing atomic number.
2. Problems of isotopes are not resolved.	2. Problem of isotopes are resolved.
3. No place for actinides and lanthanides.	3. Separate place for lanthanides and actinides.
4. No blocks were in this table.	4. s, p, d and f blocks are there in this table.

9. Which metal is more active among Na and K? Give reason.

Potassium (K) is more active than Sodium (Na). Although Na and K lie in same group, the atomic size of K is larger than Na due to the presence of one more shell in its atom. Because of the large size its valance electron is less attracted with the nucleus and easily loses by the atom during chemical reaction. So, it is more active than Na.

10. Which is more reactive among O and S? Why?

Oxygen (O) is more active than Sulphur (S). Although O and S lie in same group, the atomic size of O is smaller than S due to the absence of one more shell in its atom than S. Because of the smaller size, it can strongly attract the electrons from the atoms of other elements during chemical reaction. So, it is more active than S.

11. What do you mean by p-block element? Write any 5 examples.

Those elements whose outermost (last) electrons enter in p sub-sell are called p-block elements. For example: Boron, Carbon, Nitrogen, Oxygen, Fluorine etc.

12. In which block *(s, p, d, f)* the following element lies? Write in table:

H→s-block	Ne→p-block	Na→s-block	K→s-block	Al→p-block	Cl→p-block	He→s-block	Cu→d-block
Zn→d-block	U→f-block	Hg→d-block	Ni→d-block	Be→s-block	O→p-block	Si→p-block	Pu→f-block
C→p-block	Ca→s-block	Fe→d-block	Mn→d-block	Au→d-block	Ra→s-block	Ag→d-block	Li→s-block

13. Differentiate between metal and non-metal and write their position in periodic table.

Metals are the element having luster, malleability, ductility, high melting and boiling points and electro-positive in nature. Example: Li, Ca, Au, Al, etc. They are kept in left side in periodic table.

Non-metals are the elements which are non-lustrous, non-malleable, non-ductility, having low melting and boiling points and electro-negative in nature. Example: H, C, O, etc. They are kept in right side in periodic table.

14. An element 'A' belongs to group IA and 3rd period of the modern periodic table. Find out (a) Name of the element (b) The number of valence electrons (b) Valancy (c) It is metal or non-metal?

(a) The element is Sodium   (b) It has 1 valence electron   (c) Its valancy is 1   (d) It is a metal

08. Chemical Reaction

2. Define chemical reaction. Write any 5 factors that affects the rate of chemical reaction.

The process of forming the new products by association, dissociation or exchange of reactants is called chemical reaction. A chemical reaction can be affected by temperature, pressure, light, surface area, catalyst, etc.

3. What is the role of pressure in chemical reaction? Give one example of chemical reaction in which pressure is used.

In gas, increase in pressure increases the rate of chemical reaction. Some of the reaction is found to be possible only in the presence of high pressure. For example:

$$N_2 + 3H_2 \xrightarrow{high\ pressure} 2NH_3$$
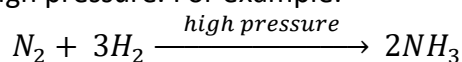
4. How the surface areas affect the rate of chemical reaction? Explain.

More surface are brings more amount of reactants together and helps to increase the rate of chemical reaction. For example, the powdered reactants reacts faster that a single one.

5. What are the types of chemical reaction? Explain them in brief with examples.

Some main types of chemical reactions are as follow:

(i) **Combination reaction :** The chemical reaction in which two or more reactants combine to form a single product is called combination reaction. For example: $N_2 + 3H_2 \rightarrow 2NH_3$

(ii) **Decomposition reaction :** The chemical reaction in which a single reactant dissociates into two or more products is called decomposition reaction. For example: $2KClO_3 \rightarrow 2KCl + 3O_2$

(iii) **Displacement reaction :** The chemical reaction in which the atom or radical of one reactant displace the atom or radical of another reactant is called displacement reaction.

For example: $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

(iv) Acid-base reaction : The reaction between acid and base to form a salt and water is called acid-base reaction. For example : $NaOH + HCl \rightarrow NaCl + H_2O$

6. Write the importance and limitations of chemical equations.

Importance of chemical equations:	Limitation of chemical equations:
1. It helps to identify the product and reactants.	1. It does not explain about the explosive nature of reactions.
2. It helps to know about the weight ratio of reactant and products.	2. It does not tell about the rate of reaction.
3. It helps to know the type of reactions.	3. It does not tell about the physical changes like colour, state, odour, etc

7. What is combination reaction? Write any 2 examples of it with balance chemical equation.

   A chemical reaction in which two or more reactants combined to form a single product is called combination reaction. For example: (i) $N_2 + 3H_2 \rightarrow 2NH_3$ (ii) $2H_2 + O_2 \rightarrow 2H_2O$

8. What is displacement reaction? Write any 2 examples of it with balance chemical equation.

   A chemical reaction in which the atom or radical of one reactant displaced the atom or radical of another reactant is called displacement reaction.

   For example: (i) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ (ii) $NaCl + AgNO_3 \rightarrow NaNO_3 + AgCl$

9. Define dissociation reaction. Write any 2 examples of it with balance chemical equation.

   A chemical reaction in which a single reactant dissociates into two or more products is called dissociation reaction. For example: (i) $2KClO_3 \rightarrow 2KCl + 3O_2$ (ii) $2H_2O_2 \rightarrow 2H_2O + O_2$

10. What is acid-base reaction? Write any 2 examples of it. Why this reaction is also called neutralization reaction.

    The reaction between acid and base to form a salt and water is called acid-base reaction.

    For example : (i) $NaOH + HCl \rightarrow NaCl + H_2O$ (ii) $KOH + HNO_3 \rightarrow KNO_3 + H_2O$

11. Differentiate between exothermic and endothermic reaction with example.

Exothermic Reaction	Endothermic reaction
1. Heat is evolved during reaction.	1. Heat is required to initiate the reaction.
2. Products are in less energy state than that of reactants.	2. Products are in high energy state than that of reactants.

12. Differentiate between catalyst and promoter.

Catalyst	Promoter
1. It changes the rate of chemical reaction.	1. It increases the activity of catalyst.
2. It may be positive or negative.	2. It is always positive.

13. Differentiate between combination reaction and decomposition reaction.

Combination reaction	Decomposition reaction
1. Two or more reactants combined to form a single product.	1. A single reactant dissociate into two or more products.
2. It may or may not require an external agent.	2. Generally, an external agent is required in this.

14. "Increasing temperature increases the rate of chemical reaction." Describe an experiment to justify the statement.

    Increase in temperature supplies the heat energy enough to brakes the preliminary bond between the atoms in a reactant. This atom immediate combined with the other atom from other reactant to form a new product. In this way, temperature increases the rate of chemical reaction.

    For example: At ordinary temperature nitrogen and hydrogen gas do not react with each other but at about 1500^0 they combine to form a new compound known as ammonia.

    Chemical reaction: $N_2 + 3H_2 + Heat \rightarrow 2NH_3$

15. Write an example of positive and negative catalyst with chemical reaction.

    Manganese dioxide is a positive catalyst and Glycerol is a negative catalyst.

    $$2H_2O_2 \xrightarrow{Mn\ _2} 2H_2O + O_2 \qquad\qquad 2H_2O_2 \xrightarrow{C_2H_5(OH)_3} 2H_2O + O_2$$

16. What is a catalyst? Why it is used in chemical reaction? Write.

    A catalyst is a substance which changes the rate of chemical reaction. It is used to increase or decrease the speed of chemical reaction.

17. Write in balance chemical equation:

    a. $4K + O_2 \rightarrow 2K_2O$
    b. $2Au + 3Cl_2 \rightarrow 2AuCl_3$
    c. $3Mg + N_2 \rightarrow Mg_3N_2$
    d. $CaCO_3 \rightarrow CaO + CO_2$
    e. $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$
    f. $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$
    g. $2HCl + K_2O \rightarrow 2KCl + H_2O$

    a. $2HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2H_2O$
    b. $CO_2 + C \rightarrow 2CO$
    c. $2Au + 3Cl_2 \rightarrow 2AuCl_3$
    d. $H_2 + Cl_2 \rightarrow 2HCl$
    e. $2Cu + O_2 \rightarrow 2CuO$
    f. $KOH + HCl \rightarrow KCl +\ H_2O$
    g. $2KClO_3 \rightarrow 2KCl + 3O_2$

18. Write in balanced chemical equation:

    a. $Copper + Oxygen \rightarrow Cupric\ oxide$
       $2Cu + O_2 \rightarrow 2CuO$

b. *Magnesium + Chlorine → Magnesium chloride*
   $Mg + Cl_2 → MgCl_2$
c. *Hydrogen + Oxugen → Hydrogen peroxide*
   $H_2 + O_2 → H_2O_2$
d. *Nitrogen + Hydrogen → Ammonia*
   $N_2 + 3H_2 → 2NH_3$
e. *Aluminium + Nitrigen → Aluminium nitride*
   $2Al + N_2 → 2AlN$
f. *Calcium carbonate → Calcium oxide + Carbon dioxide*
   $CaCO_3 → CaO + CO_2$
g. *Zinc + Hydrochloric acid → Zinc chloride → Hydrogen*
   $Zn + 2HCl → ZnCl_2 + H_2$
h. *Calcium bicarbonate → Lime stone + Water + Carbon dioxide*
   $Ca(HCO_3)_2 → CaCO_3 + H_2O + CO_2$
i. *Ammonia + Hydrogen chloride → Ammonium chloride*
   $NH_3 + HCl → NH_4Cl$
j. *Calcium oxide + Water → Calcium hydroxide*
   $CaO + H_2O → Ca(OH)_2$

19. What happens when:
   a. Magnesium ribbon burn in air
      It produces white ash of magnesium oxide.
      $$2Mg + O_2 → 2MgO$$
   b. Magnesium ribbon burn in CO_2 containing jar
      It burn with more brightness giving black carbon.
      $$2Mg + CO_2 → 2MgO + C$$
   c. Nitrogen and hydrogen reacts at high temperature and pressure
      It forms ammonia gas (NH_3).
      $$3H_2 + N_2 \xrightarrow{high\ temp./high\ press.} 2NH_3$$
   d. Sodium oxide is poured in a beaker containing sulphuric acid
      Sodium oxide reacts with sulphuric acid to gives sodium sulphate and water.
      $$Na_2O + H_2SO_4 → Na_2SO_4 + H_2O$$
   e. Hydrogen peroxide dissociates in presence of manganese dioxide
      Hydrogen peroxide dissociates to give oxygen gas.
      $$2H_2O_2 \xrightarrow{Mn\ 2} 2H_2O + O_2$$
   f. Potassium and hydrochloric acid react together
      Potassium reacts with acid and gives hydrogen gas.
      $$2K + 2HCl → 2KCl + H_2$$
   g. Calcium carbonate and hydrochloric acid react
      Calcium carbonate and hydrochloric acid react and form carbon dioxide gas.
      $$CaCO_3 + 2HCl → CaCl_2 + H_2O + CO_2$$
   h. When carbon dioxide is passed in a beaker containing calcium hydroxide for a short time
      It changes the colour of solution into milky white by forming lime stone.
      $$Ca(OH)_2 + CO_2 → CaCO_3 + H_2O$$
   i. When carbon dioxide is passed in a beaker containing calcium carbonate for a long time
      It change solution into colorless by changing the carbonates into bicarbonates.
      $$CaCO_3 + H_2O + CO_2 → Ca(HCO_3)_2$$
   j. A piece of potassium metal is kept in water
   It immediately reacts with water and gives potassium hydroxide and hydrogen gas.
      $$2K + 2H_2O → 2KOH + H_2$$
   k. Potassium chlorate is heated
      When potassium chlorate heated it gives oxygen gas.
      $$2KClO_3 → 2KCl + 3O_2$$
   l. Carbon dioxide is heated with coke
      When carbon dioxide is heated with coke (C) it changes into carbon monoxide.
      $$CO_2 + C → 2CO$$

m. Calcium react with water

Calcium reacts with water to give calcium hydroxide and hydrogen gas.

$$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$$
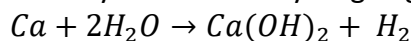
09. Acid, Base and Salt

1. What is an acid? Write its 4 examples and its 4 uses.

Acids are the compounds which give H^+ ions in the solution. Ex: HCl, H_2SO_4, HNO_3, H_2CO_3, CH_3COOH, etc

Uses of acids are as follow:

(i) Carbonic acid is used to make soda water.

(ii) Nitric acid is used to make chemical fertilizers, explosives, plastic, etc.

(iii) Sulphuric acid is used to make simple cell.

(iv) Hydrochloric acid present in our stomach helps in food digestion.

2. Differentiate between strong and weak acid with their example.

Strong Acid	Weak acid
1. Goes on complete ionization.	4. Goes on partial ionization.
2. Its P^H value is less than weak acid.	5. Its P^H value is more than strong acid.
3. It is highly corrosive.	6. It is less corrosive.
Ex: HCl, H_2SO_4, HNO_3, etc	7. Ex: Citric acid, Acetic acid, Formic acid, etc

3. Differentiate between: (a) Acid and Base   (b) Base and Alkali   (c) Acidic salt and Basic salt

Acid	Base
1. Acids are the compound which gives H^+ ions in the solution.	1. Bases are the oxides or hydroxides of metal.
2. It is sour in taste.	2. It is bitter in taste.
3. P^H values lies within 1 to 7.	3. P^H value lies within 7 to 14.

Base	Alkali
1. Base is metal oxides or hydroxide.	1. Alkali is metal hydroxide.
2. All bases are not alkali.	2. All alkalis are base.
3. It may or may not be soluble in water.	3. It is soluble in water.

Acidic Salt	Basic Salt
1. Acidic salts formed when strong acid react with weak base.	4. Basic salts formed when strong base react with weak acid.
2. Its P^H value is less than 7.	5. Its P^H value is more than 7.

4. Write any 3 physical and any 3 chemical properties of acid.
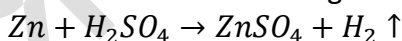
Physical properties of acids:

(i) Acid are sour in taste.

(ii) Acid changes blue litmus paper into red, methyl orange into red and phenolphthalein into colorless.

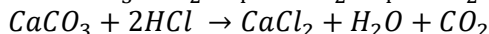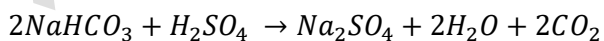(iii) Acids are corrosive in nature.

Chemical properties of acid:

(i) Acid reacts with base to form salt and water.

$$HCl + NaOH \rightarrow NaCl + H_2O$$
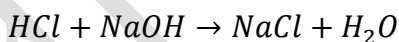
(ii) Acid react with metal to give hydrogen gas.

$$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2 \uparrow$$

(iii) Acid reacts with carbonates and bicarbonates to give carbon dioxide gas.

$$2NaHCO_3 + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O + 2CO_2$$
$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$

5. Write any two methods to identify whether the given compound is acid or not.

By testing with blue litmus paper: Acids change the colour of blue litmus paper into red.

By testing with methyl orange: Acids change the colour of methyl orange into red.

6. Why acids have sour taste?

Acids are sour in test due to the presence of H^+ ions.

7. Define base with 2 examples.

Bases are the oxides and hydroxides of metal. Example: calcium oxide (CaO), magnesium oxide (MgO), sodium hydroxide (NaOH), calcium hydroxide (Ca(OH)$_2$),etc.
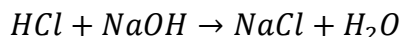
8. Write any 3 physical and any 3 chemical properties of base.

Physical properties of bases:

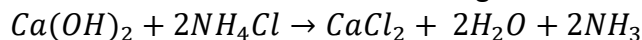(i) Bases are bitter in taste.

(ii) Base changes red litmus paper into blue, methyl orange into yellow and phenolphthalein into pink.

(iii) Bases are soapy to touch.
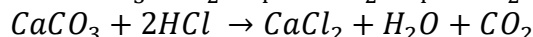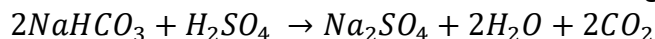
Chemical properties of acids:

(i) Base reacts with acid to form salt and water.

$$HCl + NaOH \rightarrow NaCl + H_2O$$

(ii) Base reacts with ammonium salt to give ammonium gas.

$$Ca(OH)_2 + 2NH_4Cl \rightarrow CaCl_2 + 2H_2O + 2NH_3$$

(iii) Acid reacts with carbonates and bicarbonates to give carbon dioxide gas.

$$2NaHCO_3 + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O + 2CO_2$$

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

9. How the magnesium ribbon change into base? Illustrate with chemical reaction.

When magnesium ribbon burned in presence of air, it forms magnesium oxide (MgO).

$$2Mg + O_2 \rightarrow 2MgO$$
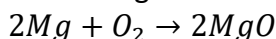
10. What is neutralization reaction? Write any 2 examples.

The reaction in which acid and base react to form a neutral salt is called neutralization reaction.

For example: $HCl + NaOH \rightarrow NaCl + H_2O$

$$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 + 2H_2O$$
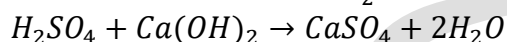
11. Why acid-base reaction is called neutralization reaction.

In Acid-base reaction, an acid loses its acidity and base loses its basicity to form a neutral salt so, it is also called neutralization reaction.

12. All alkalis are base but all bases are not alkalis. Why?

Bases are the oxide and hydroxides of metal so, alkali is also a base. But all base cannot dissolve in water so all base are not alkali.

13. Write any three properties of salt.

(i) NaCl is salty in taste, most of the salts are bitter and some are tasteless.

(ii) Generally, salts have high melting and boiling point.

(iii) Most of the salt dissolves in water.

14. Classify the following substance as acid, base and salt:

Calcium hydroxide → Base	Ammonium hydroxide → Base	Copper sulphate → Salt
Magnesium hydroxide → Base	Aquaregia → Acid	Vinegar → Acid
Ash → Base	Magnesium sulphate → Salt	Sodium chloride → Salt

15. Write one use of each of the following:

NaCl : It is used in flavoring food

NH_4Cl : It is used in lab prepration of NH_3

$NaHCO_3$: It is used to make baking powder

CaO : It is used in to produce anhydrous NH_3

KOH : It is used as fertilizer

H_2CO_3 : It is used to make soda water

Na_2CO_3 : It is used to remove hardness of water

$Mg(OH)_2$: It is used to remove the acidity in stomach

10. Some Gases

1. Study the figure and answer the following questions:

a. Which gas is collected in jar?

Carbon dioxide (CO_2) is collected in jar.

b. Write the chemical equation which represents this reaction.

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2 \downarrow$$
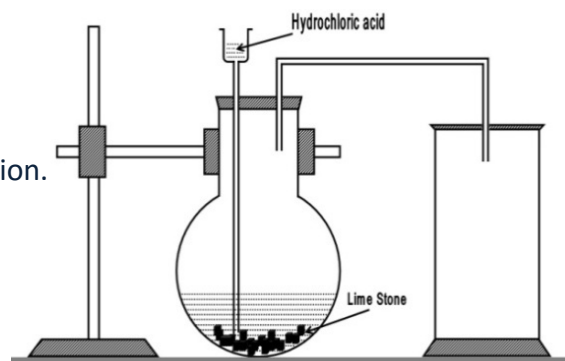
c. Which litmus paper is used to identify this gas?

Red litmus paper is used to identify this gas.

d. Why this gas is collected with erect jar?

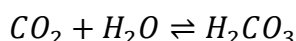CO_2 is heavier than air, so it is collected with erect jar.

e. Why it can't collect with downward displacement of water?

It is slightly soluble in water, so it can't collect with downward displacement of water.

2. Write any 3 chemical properties of CO_2?

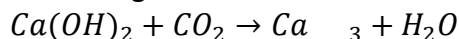(i) Carbon dioxide dissolves in water and forms carbonic acid.

$$CO_2 + H_2O \rightleftharpoons H_2CO_3$$

(ii) Carbon dioxide reacts with ammonia at 1500^0C to give Urea.
$$CO_2 + 2NH_3 \rightarrow NH_2\text{-}CO\text{-}NH_2 + H_2O$$
(iii) Carbon dioxide changes the colour of lime water into milky white by forming calcium carbonate.
$$Ca(OH)_2 + CO_2 \rightarrow Ca \quad _3 + H_2O$$

3. Write any 4 uses of carbon dioxide gas.
   (i) Plant use carbon dioxide in photosynthesis. $6CO_2 + 6H_2O \xrightarrow{sunlight} C_6H_{12}O_6 + 6O_2$
   (ii) It used in manufacturing of urea. $CO_2 + 2NH_3 \rightarrow NH_2CONH_2 + H_2O$
   (iii) It is used in fire extinguisher.
   (iv) It is used to make soda water. $CO_2 + H_2O \rightleftharpoons H_2CO_3$
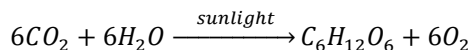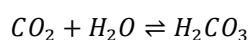
4. How carbon dioxide prepare in large scale?
   Carbon dioxide is prepared in large scale in industries by heating of lime stone.
 $$CaCO_3 \xrightarrow{\Delta} CaO + CO_2$$
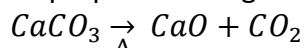
5. Why dil.H_2SO_4 is not used in the laboratory preparation of CO_2?
   Dil. H_2SO_4 forms $CaSO_4$ which is insoluble in water and forms a layer on the marble chips and prevents any more marble chips to come in contact with the acid. This results the reaction to be stop. So, dilute sulphuric acid is not used in the laboratory preparation of CO_2.

6. Explain the laboratory preparation of carbon dioxide gas with diagram.
   Carbon dioxide is prepared in laboratory by the reaction of lime stone with dilute hydrochloric acid. Some pieces of lime stone is kept in round bottom flask and the apparatus is fitted as shown in the figure. Now, dil. HCl is poured through Thistle's funnel and the reaction between acid and lime stone produced CO_2 which is collected in a gas jar by upward displacement of air.
   **Chemical Reaction:** $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2 \downarrow$
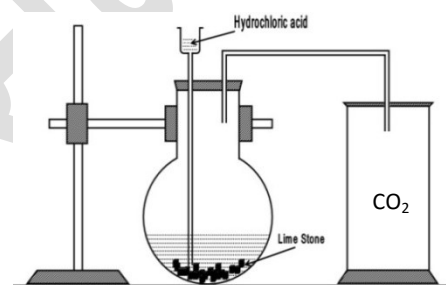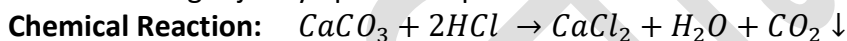
7. What is dry ice? Write its use.
   Dry ice is the frozen CO_2 gas at -78^0C. It is used to preserve the medicine.

8. Explain the laboratory preparation of ammonia with diagram.
   Ammonia is prepared in laboratory by heating the mixture of ammonium chloride and calcium hydroxide. First the mixture of NH_4Cl and $Ca(OH)_2$ is kept in a hard glass test tube and the apparatus is fitted as shown in the figure. When heat is applied to the mixture the reaction between NH_4Cl and $Ca(OH)_2$ produced NH_3 which is collected in a gas jar by downward displacement of air.
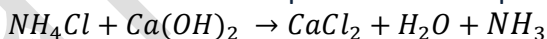   **Chemical Reaction:** $2NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O + 2NH_3$
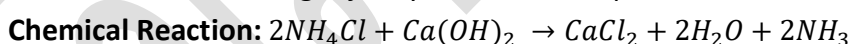
9. Study the figure and answer the following questions:
   a. Which gas is collected in jar?
      Ammonia (NH_3) gas is collected in jar.

   b. Write the chemical equation which represents this reaction.
      $NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + H_2O + NH_3$

   c. Which litmus paper is used to identify this gas?
      Blue litmus paper is used to identify NH_3.

   d. Why the hard glass test-tube is placed slanted?
      It is because the water vapour formed in chemical reaction may condense and may broke the test-tube.

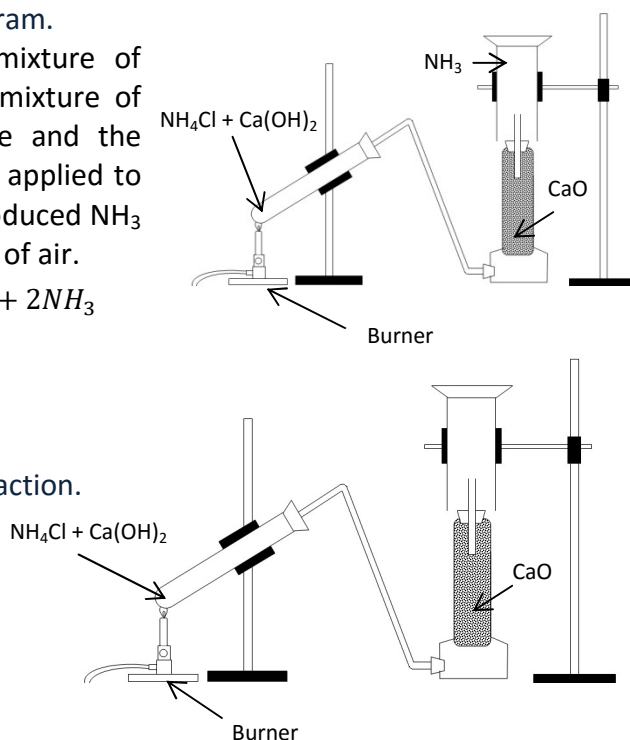   e. Why this gas is collected with inverted jar?
      NH_3 gas is lighter than air so it is collected in inverted jar.

   f. Why it can't collect with downward displacement of water?
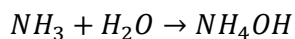 NH_3 is soluble in water so it can't collect with downward displacement of water.

   g. What is the use of lime tower is this gas preparation?
      The lime tower absorbs the water traces and makes anhydrous NH_3 gas.

10. Write any 3 chemical properties of ammonia?
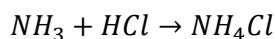   (i)   Ammonia dissolves in water to form ammonium hydroxide.
   $$NH_3 + H_2O \rightarrow NH_4OH$$
   (ii) At 1500^0C, ammonia reacts with carbon dioxide to give urea.
   $$CO_2 + 2NH_3 \rightarrow NH_2CONH_2 + H_2O$$
   (iii) Ammonia forms salt when react with acid.
   $$NH_3 + HCl \rightarrow NH_4Cl$$

11. Write any 4 uses of NH_3 gas.
   (i)   It is used for the manufacture of urea.
   (ii) It is used as cooling agent in refrigerator.
   (iii) It is used to make blue prints of maps.
   (iv) It is used in manufacturing of nitric acid, plastics, washing soda, etc

12. How NH_3 prepare in large scale?
   NH_3 is prepared in large scale by Haber's process. In this method, 3 parts of N_2 and 1 part of H_2 gas is heated at high temperature and pressure.
   $$N_2 + 3H_2 \xrightarrow[Fe/Mo]{500^0C / 250\ atm} 2NH_3$$
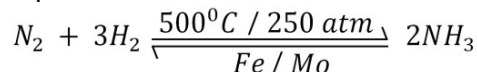
13. Differentiate between: (a) CO_2 and NH_3

Carbon dioxide (CO_2)	Ammonia (NH_3)
1. It is acidic in nature.	1. It is basic in nature.
2. It is heavier than air.	2. It is lighter than air.

(b) Quick lime and Lime water

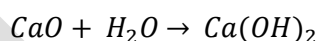| Quick lime (CaO)	Limewater (Ca(OH)$_2$)
1. It is in solid state.	1. It is in liquid state.
2. It is a base.	2. It is an alkali.
3. It is more reactive than lime water.	3. It is less reactive than quick lime.

20. What happens when:
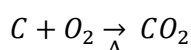   a. Limestone is heated strongly
      It gives carbon dioxide gas
      $$CaCO_3 \xrightarrow{\Delta} CaO + CO_2$$
   b. Quick lime is dissolve in water
      It forms lime water.
      $$CaO + H_2O \rightarrow Ca(OH)_2$$
   c. Charcoal burns in air
      It gives carbon dioxide gas
      $$C + O_2 \xrightarrow{\Delta} CO_2$$
   d. Charcoal burns with less air
      It forms carbon monoxide.
      $$C + O_2(less) \xrightarrow{\Delta} CO_2$$
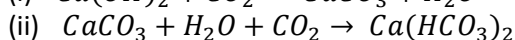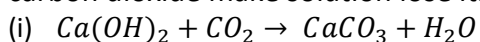   e. Carbon dioxide is passed in limewater for a short time
      It changes the colour of limewater into milky white by forming calcium carbonate.
      $$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$$
   f. Carbon dioxide is passed in lime water for a long time
      It first change the colour of the solution into milky white by forming calcium carbonate but more carbon dioxide make solution lose its milky white colour by forming calcium bicarbonate.
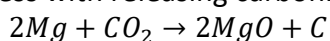   (i) $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$
      (ii) $CaCO_3 + H_2O + CO_2 \rightarrow Ca(HCO_3)_2$
   g. Burning matchstick is put inside the CO_2 jar
      Carbon dioxide is non combustible gas so it stops the fire.
   h. Burning magnesium ribbon is put inside the CO_2 jar
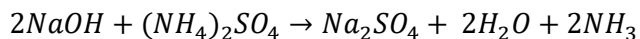   It burns with more brightness with releasing carbon.
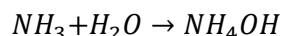 $$2Mg + CO_2 \rightarrow 2MgO + C$$
   i. CO_2 filled balloon release in air
      It falls towards the ground because carbon dioxide is heavier than air.
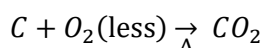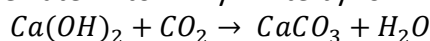
j. Mixture of sodium hydroxide (NaOH) and ammonium sulphate [$(NH_4)_2 SO_4$] is heated

It gives ammonia gas.

$$2NaOH + (NH_4)_2SO_4 \rightarrow Na_2SO_4 + 2H_2O + 2NH_3$$

k. Ammonia is dissolved in water

It forms ammonium hydroxide.

$$NH_3 + H_2O \rightarrow NH_4OH$$

l. Ammonia react with hydrochloric acid

It forms a salt called ammonium chloride.

$$NH_3 + HCl \rightarrow NH_4Cl$$

m. Ammonium hydroxide is treated with dilute sulphuric acid

It is a neutralization reaction and forms a neutral salt called ammonium sulphate along with water.

$$NH_4OH + H_2SO_4 \rightarrow (NH_4)_2SO_4 + 2H_2O$$
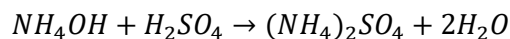
n. A glass rod dipped in HCl is brought near the mouth of gas jar containing ammonia.

A dense white flume of ammonium chloride is observed.

$$NH_3 + HCl \rightarrow NH_4Cl$$
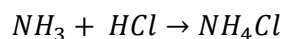
11. Metals

5. Introduce the following metals in short: *iron, aluminum, copper, silver* and *gold*

Iron → Symbol: Fe   Atomic number: 26   Atomic mass: 56   Valency: 2 or 3
Position in periodic table: 4th period, Group VIII   Electronic configuration: $1s^2, 2s^22p^6, 3s^23p^63d^6, 4s^2$
Main ores: Haematite, Magnetite, Limonite, Siderite, Iron pyrite, etc

Aluminum → Symbol: Al   Atomic number: 13   Atomic mass: 27   Valency: 3
Position in periodic table: 3th period, Group IIIA   Electronic configuration: $1s^2, 2s^22p^6, 3s^23p^1$
Main ores: Bauxite, China clay (Kaolin), Feldspar, Cryolite, etc.

Copper → Symbol: Cu   Atomic number: 29   Atomic mass: 63.57   Valency: 1 or 2
Position in periodic table: 4th period, Group IB   Electronic configuration: $1s^2, 2s^22p^6, 3s^23p^63d^{10}, 4s^1$
Main ores: Haematite, Magnetite, Limonite, etc.

Silver → Symbol: Ag   Atomic number: 47   Atomic mass: 107.88   Valency: 1
Position in periodic table: 5th period, Group IB   Elec. config: $1s^2, 2s^22p^6, 3s^23p^63d^{10}, 4p^24p^64d^{10}, 5s^1$
Main ores: Argentite, Silver copper glance, Pyrolite, Horn silver, etc.

Gold → Symbol: Au   Atomic number: 79   Atomic mass: 197.2   Valency: 1 or 3
Position in periodic table: 6th period, Group IB   Main ores: Alluvial soil, native gold, etc.
Electronic configuration: $1s^2, 2s^22p^6, 3s^23p^63d^{10}, 4s^24p^64d^{10}4f^{14}, 5s^25p^65d^{10}, 6s^1$

6. Define: (a) Ore   (b) Coinage metal   (c) Metallurgy

Ore: Ores are the natural minerals from which a metal can be extracted.

Coinage metal: The elements of group IB in modern periodic table (Cu, Ag, and Au) which were used in minting coins is called coinage metal.

Metallurgy: The process of extracting a pure metal from its ore is called metallurgy.

7. List the ores of iron and aluminum and write their 3/3 uses and properties.

Metal	Ore	Properties	Uses
Iron	Haematite	It is silvery-grey coloured metal.	It is used in construction.
	Magnetite	It is a ferromagnetic substance.	It is used to make weapons.
	Limonite	It's a good conductor of heat & electricity.	It is used as catalyst.
Aluminum	Bauxite	It is silvery coloured metal.	It is used to make electric wires.
	Kaolin	It is a lightest metal.	It is used to make utensils, pipes.
	Cryolite	It's a good conductor of heat & electricity.	It is used in wrapping food, drugs.

8. Why aluminum is used to make the body parts of aeroplane, ship, vehicles etc.? Give reasons.

Aluminum is used to make the body parts of aeroplane, ship, vehicles etc. because,

(i) It is lightest and strongest metal so it can carry a lot of weight in flight.

(ii) It doesn't get rust and corrode like iron.

(iii) It is non-combustible metal so makes the flight safe.

9. List the ores of silver, gold and copper and write their 3/3 uses and physical properties.

Metal	Ore	Properties	Uses
Silver	Argentite	It is white coloured lustrous metal.	In making coils, medal & jewellery.

	Silver copper glance, Pyrolite	It is malleable and ductile. Good conductor of heat & electricity.	It is used in electroplating. In photography & silvering mirrors.
Gold	Bauxite Kaolin Cryolite,	It is yellow coloured lustrous metal. It is an inert metal. It is highly malleable and ductile.	In making coils, medal & jewellery. It is used in electroplating. To make gold-leaf electroscope
Copper	Chalopyrite Copperpyrite Copper glance	It is reddish-brown coloured metal. It is malleable and ductile. Good conductor of heat & electricity	In making coils, medal & jewellery. It is used in electroplating. It is used to make electric wires.

10. Where we use copper in our daily life? Write in 6 points.
- In electric wires   ▪ In utensils   ▪ In pesticides   ▪ In electroplating   ▪ In ornaments   ▪ In medals

11. Why gold and silver can found in pure state in nature (native state)? Give reason.
Gold and silver are less reactive metals. They don't easily go under chemical change so they are generally found in pure state in nature.

12. Hydrocarbons and its Compounds

1. Define hydrocarbon. Write any 4 examples of it.
The compounds which are made up of carbon and hydrogen are called hydrocarbon. For example: methane, ethane, propyne, butane, etc.

2. Write any two differences between saturated and unsaturated hydrocarbon.

Saturated hydrocarbon	Unsaturated hydrocarbon
1. Carbon atoms are linked with single covalent bond.	1. Carbon atoms are linked with double or triple covalent bond.
2. Alkanes are unsaturated hydrocarbons.	2. Alkenes and alkynes are unsaturated hydrocarbons.

3. Differentiate between alkanes and alkenes.

Alkanes	Alkenes
3. Carbon atoms are linked with single covalent bond.	3. Carbon atoms are linked with double covalent bond.
4. Alkanes are unsaturated hydrocarbons.	4. Alkenes are unsaturated hydrocarbons.

4. Introduce the methane gas (CH_4) with its two advantages.
Methane is the first member of alkane series. It is used as gaseous fuel in the form of LPG and in manufacturing of chloroform, methyl alcohol, etc.

5. Define alcohol. Write its type with their molecular and structural formula.
Alcohols are the hydrocarbon having hydroxyl (OH) functional group. Alcohols are categorized in 3 types as monohydric alcohol, dihydric alcohol and trihydric alcohol.

Type of Alcohol	Monohydric alcohol	Dihydric alcohol	Trihydric alcohol
Molecular formula	CH_3OH	$C_2H_4(OH)_2$	$C_3H_5(OH)_3$
Structural formula	H | H—C—OH | H	OH OH | | H—C—C—H | | H H	OH OH OH | | | H—C—C—C—H | | | H H H

6. Write a short note about glucose and its importance.
Glucose is a white coloured crystalline powder, soluble in water and helps in production of ATP in the body. Our body obtains energy in the form of ATP so, glucose is important for us. The molecular formula of glucose is $C_6H_{12}O_6$.

7. What are the uses of ethyl alcohol?
Uses of alcohol are as follow:
(i)   It is used as alcoholic beverage.
(ii) It is used as fuel.
(iii) It is used as solvent for fat, oil, resin, etc.
(iv) It is used to make medicine and also used as sanitizing agent.
(v)   It is used to preserve biological specimens.

(vi) It is used in thermometer as thermometric substance.

8. What do you mean by homologous series? Write its characteristics.
The group of hydrocarbons which can be represented by same general formula is called homologous series. Characteristics of homologous series are follows:
(i)   They can be represented by same general formula.
(ii) Each successive member of homologous series differs by CH_2.
(iii) All the member have similar chemical properties.

9. Write the full form of IUPAC? For what purpose was it established?
The full form of IUPAC is "International Union of Pure and Applied Chemistry". It was established to create uniformity in chemistry also to address and to solve the problems of chemistry.

10. Define functional group and alkyl group.
The atom or radical in which the property of a particular hydrocarbon depends is called functional group. The group of atom formed after the removing one hydrogen from alkane is called alkyl group.

11. Write the molecular formula, condensed formula and structural formula of the following compounds:

Compound	Molecular Formula	Condensed formula	Structural formula
Ethylene	C_2H_4	$CH_2 = CH_2$	
Propene	C_3H_6	$CH_3 - CH = CH_2$	
Acetylene	C_2H_2	$CH \equiv CH$	$H-C \equiv C-H$
Ethyl alcohol	C_2H_5OH	$CH_3 - CH_2OH$	
Glycerol	$C_3H_5(OH)_3$	$CH_2OH - CHOH - CH_2OH$	
Glucose	$C_6H_{12}O_6$	CH_2OH-$CHOH$-$CHOH$-$CHOH$-$CHOH$-CHO	
Glycol	$C_2H_4(OH)_2$	$CH_2OH - CH_2OH$	
Methanol	CH_3OH	CH_3OH	

12. Give Reasons:
a. Ethane is called a saturated hydrocarbon.
In ethane, all the carbon atoms are bonded together with single covalent bond so, it is called saturated hydrocarbon.
b. Glycerol is a trihydric alcohol
There hydrogen of propane is displaced by three hydroxyl (OH) group to form glycerol. So, it is called trihydric alcohol.
c. Methane is called marsh gas.
Methane is found in marshy places from the decomposition of living organism, so it is called marsh gas.

13. Materials Used in Daily Life
1. What is scum?
An insoluble dirty layer formed when soap is used in hard water is known as scum.

2. Why detergent is called soapless soap?

A detergent differs with soap in chemical composition but it can be used as cleaning agent like soap. So, it is also called soapless soap.

3. What is cement? How this is prepared? Write its application.

Cement is a fine grey powder of calcium silicate and calcium aluminates which becomes hard when water is mixed and dried for some time. It is prepared by heating the mixture of lime stone and a special type of clay in the ratio of 2:1 at a temperature about 1600^0C.

$$CaCO_3 + Al_2O_3 + SiO_2 \rightarrow CaSiO_3 + CaAl_2O_3$$
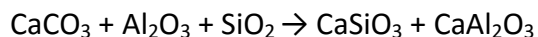
It is used in construction of RCC buildings, bridge, roads etc.

4. Gypsum is added in the cement while manufacturing. Why?

Gypsum [$CaSO_4 \cdot 2H_2O$] is a substance which increases the setting time of cement. So, it is added in the cement while manufacturing.

5. What is glass? Write its type. Write the application of different glass.

Glass is an amorphous, transparent homogenous mixture of silicates of alkali metals and alkaline earth metals. The applicants of different glasses are as follow:

Type of Glass	Uses
Silica glass(Quartz glass)	To make electrical equipments, gems and laboratory apparatus
Water glass	To make fire proof materials silica gel and silica garden
Ordinary glass (Soft glass)	To make bottle, optical fibers, delivery tubes, etc
Hard glass (potash lime glass)	To make hard glass test tubes, round bottom flask, beaker, etc
Borosilicate glass (Pyrex glass)	To make test tube, beaker, condenser, conical flask, etc.
Lead crystal glass (Flute glass)	To make prism, lens, electric bulb, TV, radar, tube, etc
Coloured glass	To make sun glasses, window's glass, decorating items, etc

6. Why glass is called super cool liquid?

Glass changes from liquid to solid state without forming its crystal so it is called super cooled liquid.

7. Which glass is used to make lens/prism and why?

Lead crystal glass is used to make lens/prism because this glass has high refractive index.

8. What is ceramics? Write the process of making vessels from ceramics and its use.

Ceramics is a type of clay containing the compound of carbon, nitrogen, oxygen and silica. It may also contain other substance like calcium, magnesium carbonate, iron oxide etc.

Process of making vessel from ceramics: At first the fine clay is mixed with water and casted in different required shape. Now, it is allowed to dry in sunlight then heated in furnace at a high temperature. It makes the object hard and porous. Then, a little amount of salt or tin oxide or lead oxide is added to make it shiny, smooth and waterproof. Colour and polish are also added to make it more attractive.

Uses: It is used to make household potteries, bathroom fitting, tiles, furnace, artificial teeth and bone joints, laboratory apparatus, resistors, high voltage insulators, etc.

9. What is plastic? Write its types with example and define them.

Plastics are the synthetic polymers made from carbon containing monomers. There are two types of Plastics called thermoplastics and thermosetting plastics.

Thermoplastics: The plastic which become soft on heating and can be mould again in different shapes is called thermoplastics. For example: polyethylene, PVC, polystyrene, etc.

Thermosetting plastics: The plastic which does become soft but become harder on heating is called thermosetting plastics. For example: Bakelite, melamine, urea-formaldehyde, etc

10. Why Bakelite is called thermosetting plastic? How it made?

The Bakelite does not become soft but become harder on heating, so it is called thermosetting plastics.

It is made from the polymerization of phenol (carbolic acid) and formaldehyde.

11. What is soap? What is added to make soap hard?

Soap is the sodium salt of long-chain fatty acids. Soaps are made harder by adding the salts like sodium lactate.

12. What is the role of compost fertilizer in the field of agriculture? Write in points.

The roles of compost fertilizer in the field of agriculture are:

(i) It provides all the nutrients like N, P, K, etc and increases the fertility of the soil.

(ii) It helps to conserve the water and protects the quality of the soil.

(iii) It is biodegradable and it makes the soil neither acidic nor basic.

13. Write the advantages of insecticides used in agriculture and also write its adverse effect in the environment.

Insecticides kill or control harmful insects. They help to increase the food production and also help to control several diseases by killing germs. But it may also kill some useful insects and may adversely affect the eco-system.

14. What is chemical pollution? Write its cause and its measures of control.

The contamination of harmful chemical substances like plastic, insecticides, fertilizers, detergent, smoke, acid, etc. in environment is called chemical pollution.

Causes of chemical pollution:	Measures of controlling chemical pollution:
(i) Chemical fertilizers and insecticides	(i) Industries and factories should be established far from human residential areas.
(ii) Household waste and plastics	
(iii) Smoke from vehicle and factories	(ii) Excessive use of insecticides must be stopped & organic fertilizers should be used instead of chemical fertilizers.
(iv) Colour food stuffs	
(v) Synthetic cleanser	(iii) The use of plastics and detergents should be minimized.

15. Nitrogen, phosphorus and potassium are essential for plants. Why?

Nitrogen helps plant in fast growth and development, formation of large amount of protein and chlorophyll. Phosphorus helps plant in root formation and its growth, immunity, seed formation and crops maturity. Potassium makes strong roots and stems, helps in proper growth of flower and making of protein, starch, sugar etc.

16. Define solid waste. Discuss the affects of decomposable and non-decomposable waste in the environment.

Solid waste is the unwanted or useless solid materials generated from human activities in residential, industrial or commercial areas. Decomposable waste produce a huge amount of microorganism around it which generate foul smell and can cause numerous communicable diseases in humans, plants, and animals. The non-decomposable waste cause permanent land pollution, water pollution, air pollution and it destroys the ecosystems.

17. Differentiate between :

Soap	Detergents
1. It is made from animal fat or vegetable oil.	1. It is made from hydrocarbons of petroleum.
2. It is biodegradable.	2. It is non-biodegradable.
3. It is weaker cleansing agent.	3. It is strong cleansing agent.
4. It is suitable for washing with soft water.	4. It is suitable for washing with both hard and soft water.

Thermoplastic	Thermosetting Plastic
1. It becomes soften on heating.	1. It becomes harder on heating.
2. It can be recycle for its reuse.	2. It cannot be recycle for its reuse.

Soft glass	Hard glass
1. It is also called soda lime glass.	1. It is also called potash lime glass.
2. It is obtained by heating mixture of silica, sodium carbonate and calcium carbonate.	2. It is obtained by heating mixture of silica, potassium carbonate and calcium carbonate.
3. It easily melts at lower temperature.	3. It does not melt at lower temperature.

Compost fertilizer	Chemical fertilizers
1. They are made from the decomposition of organic matters.	1. They are chemically synthesized in laboratory or in industries.
2. It is biodegradable.	2. It is non-biodegradable.
3. It is partially soluble in water.	3. It is strongly soluble in water

18. Write the full form of : RCC = Reinforced Cement Concrete   BHC = Benzene hexachloride

DDT = Dichloro diphenyl trichloroethane   PVC = Polyvinylchloride

NPK Fertilizer = Nitrogen, Phosphorus and Potassium containing Fertilizer

14. Invertebrate

1. How the silk thread are prepare from silkworm, Explain.

   The process of production of silk fibers from silkworm is known as sericulture. The extraction of silk starts by cultivating the silkworms on mulberry leaves. Once the silkworms change into pupa stage from its larva stage, the cocoons are treated in hot water or hot air in order to extract individual long silk fibers by unwinding the cocoon.

2. Draw the neat diagram of life cycle of silkworm.

fig: Life Cycle of Silkworm
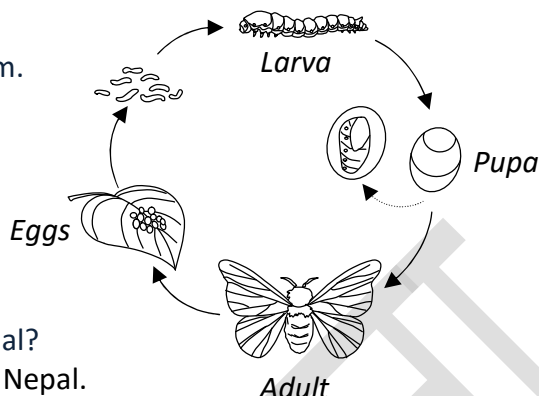
3. Which types of silkworm are cultivated in Nepal?

   Seri silkworm and Eri silkworm is cultivated in Nepal.

4. In which stage of silkworm they produced silk thread?

   Silkworm produced silk thread at the end of larva stage.

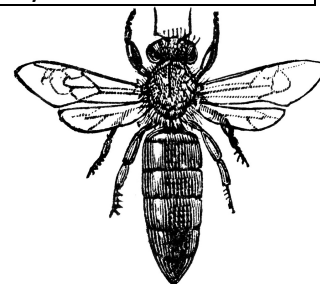5. Why silkworms are called beneficial insects? Explain with reason.

   Silkworm produces strong, light, attractive and expensive silk thread which can be use for commercial purpose, so it is called beneficial insects.

6. Write the difference between drone bee and workers bee.

Drone bee	Worker bee
1. They are male bees.	1. They are infertile female bees.
2. They were produced from unfertilized eggs.	2. They were produced from fertilized eggs.
3. Their responsibility is to mate with queen bee.	3. They work as cleaner, nurse, builder, solider and porter for the colony.

7. Explain the structure of queen bee with neat diagram.

   Queen bee is the largest bee, so it can be easily distinguished from other bees in a colony. Each colony has one queen bee. It has a small and round head and a smaller proboscis than other bees. It has a stinger at the end of long abdomen. A queen only leaves the hive for mating flight. The main function of queen is to lay eggs and to control the colony.


8. Why bees are consider as the useful insects for human? Write.

   Bee produces highly nutritious honey and also help in pollination in flower so it is consider as a useful insect.

9. Write the advantages of honey bee and silkworm.

   Silkworm produces strong, light, attractive and expensive silk thread which can be use for commercial purpose and bee produces highly nutritious honey and also helps in pollination in flowers.

10. Draw the neat diagram of life cycle of honey bee.
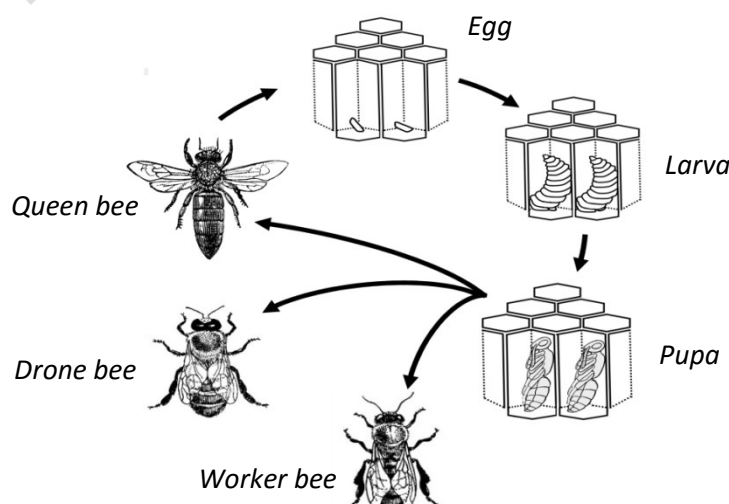
fig: life cycle of honey bee

11. Why it is necessary to study the life cycle of silkworm, write any two reasons.

It is necessary to study the life cycle of silkworm because,

(i) It helps to provide them a suitable environment to complete their life cycle.

(ii) It helps in sericulture to produce amount of silk thread for commercial purpose.

12. Differentiate between:

Apiculture	Sericulture
1. It is the rearing of honeybee.	1. It is the rearing of silkworm.
2. It produces honey in commercial manner.	2. It produces silk thread in commercial manner.
3. It requires large field of flowers for feeding.	3. It requires a lots of mulberry leaves for feeding.

| Male Bee	Female Bee
1. Drone bees are the male in the colony.	1. Queen & Worker bees are female in the colony.
2. Male bees are produce from unfertilized eggs.	2. Female bees are produced from fertilized eggs.
3. They do not have stingers.	3. They have stingers at the end of abdomen.

Larva of silkworm	Pupa of silkworm
1. It is the active stage of life cycle.	1. It is the in active stage of lifecycle.
2. Silk thread is produce at the end of this stage.	2. Silk thread is extract at this stage.
3. This stage is of about 1 month.	3. This stage is of about 2 weeks.

15. Human Nervous and Glandular System

1. What is neuron? Write its types?

Neuron is the structural and functional unit of nervous system. On the basis of function, neurons are of two types: (i) afferent or sensory neuron (ii) efferent or motor neuron

2. Draw a well leveled diagram of neuron

fig: neuron
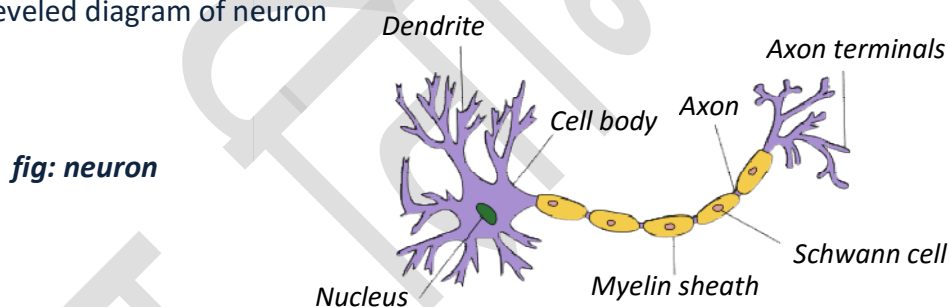
3. Define Meninges. Name the 3 layers of Meninges. Write the function of cerebrospinal fluid.

The three protective layers that covered the brain is known as Meninges. Duramater, arachnoid and piamater are the 3 layers of Meninges. The function of cerebrospinal fluid is to protect the brain from external shock and injuries.

4. Why pituitary is called master of all glands? Name the 2 hormones secreted by this gland.

Pituitary gland is called master of gland because it controls the activities of other gland. It secrets growth hormone (GH) and stimulation hormone (SH).

5. What is reflex action?

The immediate and involuntary response of our body to any stimuli is known as reflex action. For example: pulling back out hand when we touch a hot substance.

6. Why does person have instant death?

A person have instant due to the obstruction in some involuntary activities like respiration, blood circulation, etc.

7. Why the injuries in medulla oblongata cause instant death?

Any kind of injury or damage in medulla oblongata causes instant death because it regulates the involuntary activities of our body like respiration, blood circulation, etc.

8. Draw the neat diagram of brain and level cerebrum, cerebellum and medulla oblongata.

Fig: brain
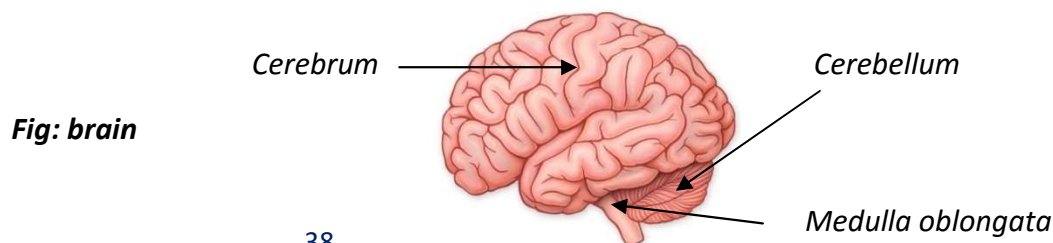
9. Why pancreas is called mixed (heterocrine) gland?

Pancreas produces both hormone and enzyme so it is called mixed gland.

10. Our food should contain iodine. Why?

Our body needs iodine to produce thyroxin hormone for the body metabolism and development and it also prevent us from a disease called goiter.

11. Name the hormones produce by gonads.

Testis of male and Ovaries of female are called gonads. Testis produces sperm and testosterone hormone and ovaries produces estrogen and progesterone hormone.

12. Hormones are called chemical messengers. Why?

Hormones are called chemical messenger because they regulate, control, co-ordinate and integrate the various activities of the body.

13. Why the adrenal gland is also called emergency gland? Write.

Adrenal gland produces adrenal hormones which prepares the body to face emergency condition so, this gland is also called emergency gland.

14. Write the name of A, B, C and D in the given figure and also write 1/1 function of each.

A is cerebrum
B is cerebellum
C is spinal cord
D is medulla oblongata
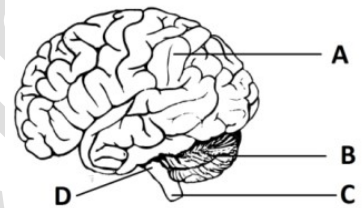
15. What happen when there is more or less of the following hormones in our body:

Hormone	Excess (More)	Deficiency (Less)
Growth hormone	Gigantism (Large growth)	Dwarfism
Insulin	Low sugar level	Diabetes
Cortisone	Feminine characters in male, Masculine characters in female	Weakness, low blood pressure, low blood sugar, etc.
Parathyroid	Tumor, Kidney stone	Tetany, Hypocalcemia
Adrenalin	High blood pressure	Weakness, Low blood pressure, etc.

16. Differentiate between :

Cranial nerve	Spinal nerve
1. It communicates between the brain and different organs of our head like eye, nose, ear, tongue, etc.	1. It communicates between brain and different parts of our body.
2. There are 12 pair of cranial nerves in our body.	2. There are 31 pairs of spinal nerves in our body.

Dendrites	Axon
1. It conducts nerve impulse towards the cell body.	1. It conducts nerve impulse away from the cell body.
2. There are many dendrites in a neuron.	2. There is a single axon in a neuron.
3. They are short and highly branched.	3. They are long and uniform.

Endocrine glands	Exocrine gland
1. They are ductless glands.	1. They are ducted glands.
2. They secrets hormones.	2. They secrets enzymes.
3. They transfer hormones directly through blood.	3. They transfer enzymes through duct.

Cerebrum	Cerebellum
1. It is the largest part of the brain.	1. It is the second largest part of the brain.
2. It controls the consciousness, intelligent, thought, etc. and also controls the functions of other part of the brain.	2. It co-ordinates the voluntary movement, muscular activities and maintains the body balance.
3. Less number of neurons is present in it.	3. About 50% of brain neurons are present in it.
4. Injury in cerebrum cause coma.	4. Injury in cerebellum cause dizziness.

Sensory nerve	Motor nerve
1. They are also called afferent nerve.	1. They are also called efferent nerve.
2. They carry nerve impulses from receptors to brain or spinal cord.	2. They carry nerve impulses from brain to different parts of the body.

16. Blood Circulation in Human Body

1. What is blood? Write its component and their functions.

Blood is the liquid connective tissue made up of plasma and blood cells.

Components of Blood	Function
RBC	They transport oxygen and carbon dioxide.
WBC	It protects and fights with various diseases.
Platelets	It helps in blood clotting and healing of wounds.
Plasma	It maintains the body temperature, helps in blood clotting and transport nutrients, hormone and waste materials.

2. Define heartbeat. Name the parts of blood circulation.

The rhythmic contraction and relaxation of cardiac muscles of the heart is called heart beat.

Heart, blood vessels and blood are the main parts in blood circulation.

3. Write the main functions of blood.

The main functions of blood are:

(i) **Transportation:** It transports oxygen and carbon dioxide, nutrients, hormones and waste materials.

(ii) **Regulatio**n: It regulates the amount of water in the body, maintains the body temperature and different chemicals.

(iii) **Protection:** It protects from various diseases, helps in blood clotting and healing of wounds.

4. Write the difference between:

Left ventricle	Right ventricle
1. It receives the pure blood coming from left auricle.	1. It receives the impure blood coming from right auricle.
2. It pumps the pure blood towards the body.	2. It pumps the impure blood towards the lungs.
3. Its wall is comparatively thicker than right ventricle.	3. Its wall is comparatively thinner than left ventricle.

Left auricle	Right auricle
1. It receives the pure blood coming from lungs to the heart.	1. It receives the impure blood coming from different parts of the body to heart.
2. It supplies the pure blood to the left ventricle.	2. It supplies the impure blood to right ventricle.
3. Its wall is comparatively thicker than right auricle.	3. Its wall is comparatively thinner than left auricle.
4. It takes part is pulmonary circulation.	4. It takes part is systemic circulation.

Artery	Vein
1. It carries pure blood except pulmonary artery.	1. It carries impure blood except pulmonary vein.
2. Valve is absent.	2. Valve is present.
3. Blood flows with high pressure and high speed.	3. Blood flows with low pressure and low speed.

Systolic pressure	Diastolic pressure
1. Occurs when left ventricle is contracted.	1. Occurs when left ventricle is relaxed.
2. Maximum blood pressure in the arteries.	2. Minimum blood pressure in the arteries.
3. Normal range is 90 to 130 mmHg in adults.	3. Normal range is 60 to 90 mmHg in adults.

Pulmonary arteries	Pulmonary veins
1. It is only one artery which carries impure blood.	1. It is only one vein which carries pure blood.
2. They carry impure blood from heart to lungs.	2. They carry pure blood from lungs to heart.
3. Divided into two branches, each for each lung.	3. Divided into four branches, two for each lung.

Red Blood Cells	White blood Cells
1. They are small, circular & biconcave structure.	1. They are large and irregular structure.
2. They do not have nucleus.	2. They have nucleus.
3. They transport O_2 and CO_2.	3. They prevent the body from various diseases.
4. They have life span of about 120 days.	4. They have life span of about 2 weeks.

Tricuspid valve	Bicuspid (Mitral) valve
1. It is present between right auricle and right ventricle.	1. It is present between left auricle and left ventricle.
2. It has three cusps.	2. It has two cusps.
3. It allows passing the impure blood through it.	3. It allows passing pure blood through it.

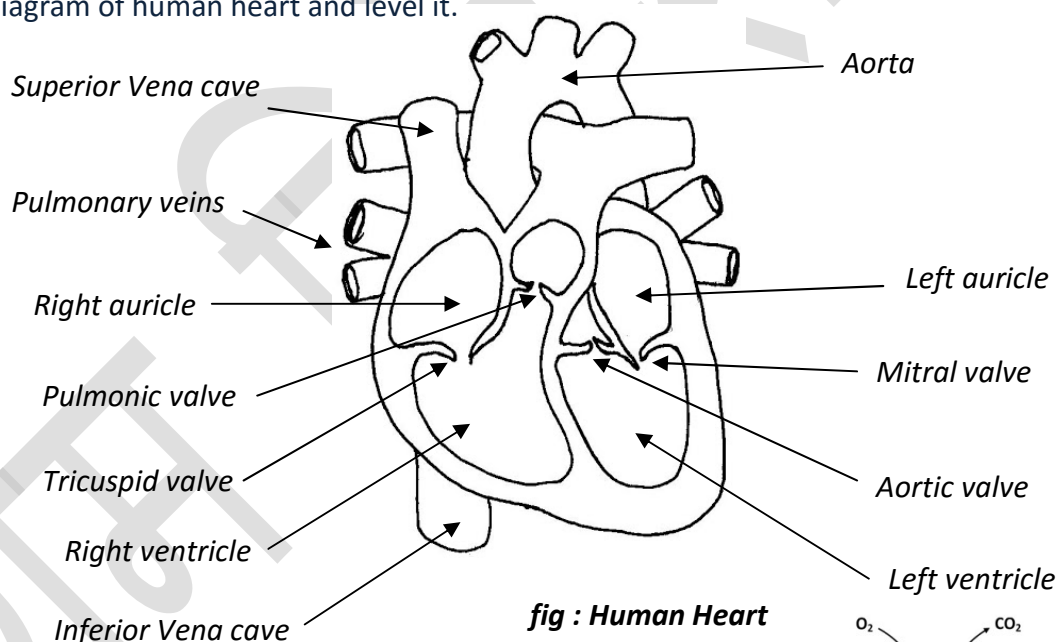| Systemic Blood Circulation	Pulmonary Blood Circulation
1. The blood circulation between heart & different parts of the body is systemic circulation.	1. The blood circulation between heart and lungs is called systemic circulation.
2. Oxygenized blood deoxygenizes during systemic circulation.	2. Deoxygenized blood oxygenizes during systemic circulation.

5. What is anemia?

   Anemia is a disease cause due to insufficient RBC in the body is known as anemia.

6. What happens when the numbers of WBC (leucocytes) increases than normal count?

   A person suffers from leukemia (blood cancer) when the numbers of WBC increases than normal count.

7. Draw a neat diagram of human heart and level it.


fig : Human Heart

8. Describe the human blood circulation process with diagram.

   There are two types of blood circulation in human body known as systemic blood circulation and pulmonary blood circulation.

   Systemic Blood Circulation: The blood circulation between heart and different body parts is called systemic blood circulation. When left ventricle contracts, the pure blood is pushed to different parts of the body through aorta and arteries and divided into capillaries where the exchange of oxygen and nutrients with carbon dioxide and waste materials take place, then the deoxygenated blood returns back to heart through veins and vena cava.

   Pulmonary Circulation: The blood circulation between heart and lungs is called systemic blood circulation. When right ventricle contracts, the impure blood is pushed to the lungs through pulmonary artery where the exchange of carbon dioxide and oxygen take place and the oxygenated blood return back to the left auricle of heart through pulmonary veins.

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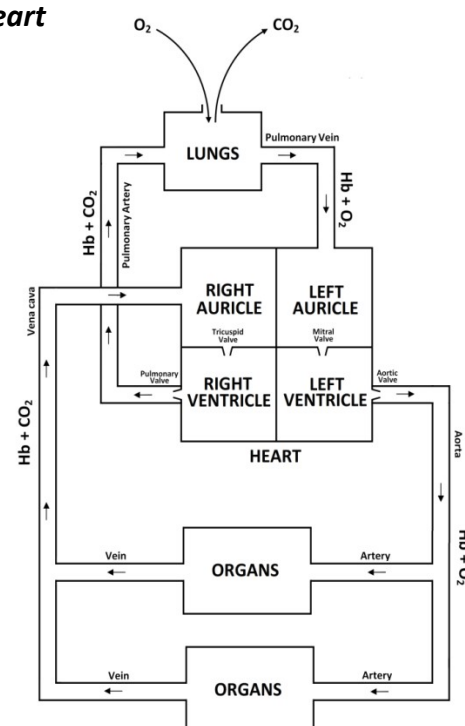
9. What is blood pressure? Which device is used to measure the blood pressure?

The pressure exerted by the blood on the wall of blood vessel is called blood pressure.

Sphygmomanometer is used to measure the blood pressure.

10. Write the advantages of blood circulation in human body.

The advantages of blood circulation in human body are:

- It supplies oxygen and nutrients to different organs.
- It prevents our body from various diseases and helps to cure from wounds.
- It helps in excretion of waste materials from our body.
- It regulates the water level in the body It maintains the body temperature.
- It transports the different hormones and chemicals.
- It balances the body with external atmospheric pressure.

11. Give reason:

a. Wall of artery are thicker than vein.

Blood flows with high pressure in arteries than veins, so to prevent the artery from being injury or burst due to high blood pressure its wall are thicker than veins.

b. Veins have valve.

Blood flows through veins with low pressure and in against of gravity so, there is presence of valve in order to stop back flow of blood.

c. Blood is red in colour.

RBC is made by a red coloured iron compound called haemoglobin, so it is red in colour.

d. Right auricle is larger than left auricle.

Veins carry deoxygenated blood from different parts of the body to our heart. Since a large volume of blood is collected in the right auricle than that of the left auricle, the right auricle is larger than the left auricle.

e. Arteries are deep seated but veins are superficial.

Arteries are deep seated inside because even a minor damage in arteries may result in loss of lots of blood due to its high blood pressure while the blood pressure inside veins very low and it contains deoxygenated blood so they are superficial.

12. What is diabetes? What are its symptoms? How to prevent our self from it? Write.

Diabetes is disease which imbalance the sugar level in blood due to lack of insulin hormone.

Symptoms of diabetes:	Prevention from diabetes:
▪ Frequent urination	▪ Reducing body weight
▪ Feeling hungry and thirsty	▪ Reducing mental stress
▪ Delay in healing of wounds	▪ Avoiding use of tobacco, smoking and alcohol
▪ Weight loss and dizziness	▪ Including green vegetables and fruits in food
▪ Defect in vision	▪ Doing regular physical exercise

13. How to prevent us from uric acid?

Uric acid can be decrease by:

- Drinking plenty of water
- Including 10 to 40 cheeries in diet
- Drinking baking soda water
- Avoiding legumes, sea food animal's fat, meat, etc.

14. What type of food should take by a blood pressure patient?

Blood pressure patient should not eat fats, reduce salt in food, avoid used of smoking, alcohol and tobacco.

17. Chromosome and Sex Determination

1. What is a chromosome?

Chromosomes are the thread like coiled structure which carries genetic characters from parent to offspring.

2. How many types of chromosomes are there on the basis of position of centromere? Explain with figure.

There are 4 types of chromosomes on the basis of position of centromere. They are:

Metacentric   Sub-metacentric 42 Acrocentric   Telocentric
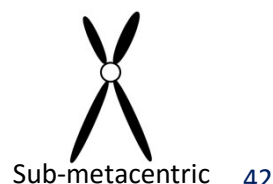
(i) **Metacentric chromosomes:** Chromosomes having centromere in the mid position with equal arms is called metacentric chromosomes.

(ii) **Sub-meta centric chromosomes:** Chromosomes having centromere in sub-median region with one arm slightly longer than other arm is called sub-metacentric chromosomes.

(iii) **Acrocentric chromosomes:** Chromosomes having centromere in the sub terminal region with one arm very shorter than other is called acrocentric chromosomes.

(iv) **Telocentric chromosomes:** Chromosomes having centromere at one end of the chromosomes is called telocentric chromosomes.

3. Define chromatids and centromere.

Each identical half of chromosomes is called chromatids. Centromere is the constricted region of the chromosomes.

4. What is gene? Where does it found? What it its main function?

Genes are the functional unit of heredity which transfers the heredity characters from one generation to another. They are found in chromosomes in nucleus. The main function of gene is to transfers the heredity characters from one generation to another.

5. Write the number of chromosomes in human, frog, housefly, onion, pinus, silkworm and honeybee.

Human → 23 pair	Gorilla →	Frog → 13 pair	Housefly → 6 pair
Onion → 8 pair	Pinus → 12 pair	Honeybee → 16 pair	

6. What is chromosomal disorder? Explain with example.

The disorder cause due to change in number of chromosomes are called chromosomal disorders. For example: Down's syndrome, Kilinefelter's syndrome, Turner's syndrome, etc

7. What types of disease is Down syndrome? Write its symptoms.

It is a chromosomal disorder due to the presence of additional copy of chromosomal number 21. It is also called trisomy 21. A children suffering from Down's syndrome has rounded face, board forehead, furrowed tongue, partially opened mouth, short neck, small stubby fingers, palm crease and Mongolian eyelids.

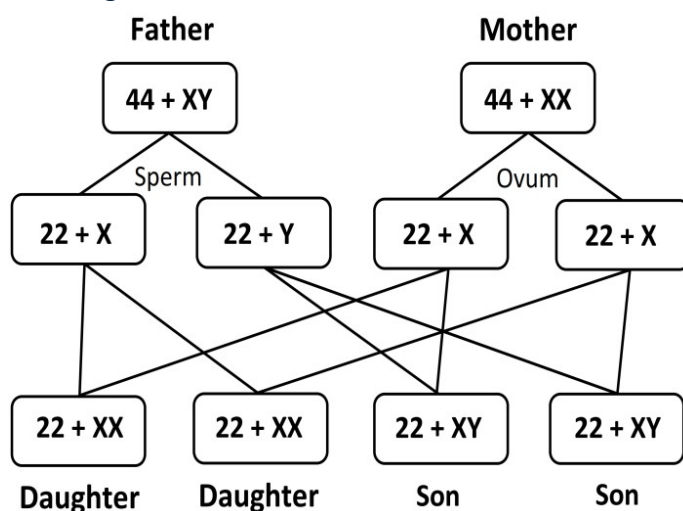8. Write the cause and symptoms of Turner's syndrome.

Turner's syndrome is observed in female due to having 45 chromosomes (44+XO) instead of 46 chromosomes. Female sterile, poorly developed breast, ovaries and small uterus and some male characteristics are shown as its symptoms.

9. If a woman has all the 4 children as daughter, can we say that her husband's sperm doesn't bears Y chromosomes?

No, we can't say that his husband sperm's does not bears Y chromosome. As 50% of male sperms bear X sex chromosome, remaining 50% bear Y sex chromosomes and female ovum bear only X sex chromome, the possibility of both son (XY) and daughter (XX) are equal. So, in above case, all the four times the X sex chromosomes of male fused to give birth to their daughters.

10. How the son and daughter determined? Illustrate with diagram.

In male human there are 22 pair of autosomes and two X sex chromosomes (44+XX). In female human there are 22 pair of autosomes and one X and another Y sex chromosones (44+XY). When a sperm having X chromosome fuse with an egg having X chromosomes a female zygote (44+XX) will form which develops into a daughter and when a sperm having Y chromosome fuse with an egg having X chromosomes a male zygote (44+XX) will form which develops into a son. Males are heterogamatic and females are homogamatic organism so the determination of the sexes only depends upon the male sperm.

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11. Write the difference between:
(a) Autosomes and Sex chromosomes

Autosomes	Sex chromosomes
1. They do not involve in sex determination.	1. They involve in sex determination.
2. Autosomes are 22 pairs in human.	2. Sex chromosomes are 1 pair in human.
3. Position of centromere is identical.	3. Position of centromere is not identical.
4. Autosomes pairs are homologous.	4. Sex chromosomes are homologous in female (XX) but non-homologous in male (XY).

(b) Sperms and Ovum

Sperms	Ovum
1. They are produced in testis.	1. They are produces in ovary.
2. They are male gametes.	2. They are female gametes.
3. They release millions at a time.	3. They release one at a time.
4. They are mobile and comparatively small.	4. They are immobile and comparatively large.

12. Give Reason:
a. Male are responsible for the birth of male child.

Male sperm has (22+X) or (22+Y) chromosomes and femele ova has both (22+X) chromosomes. When a sperm having (22+X) chromosomes fuse with an ova having (22+X) chromosomes a female zygote (44+XX) will form which develops into a daughter and when a sperm having (22+Y) chromosome fuse with an ova having (22+X) chromosomes a male zygote (44+XX) will form which develops into a son, so male are only responsible for the birth of male child.

b. Chromosomes are the heredity materials.

Chromosomes are made up of with DNA and DNA is made up with genes which carry genetic characters from one generation to other so, chromosomes are called heredity materials.

18.(A) Asexual and Sexual Reproduction

1. Define asexual reproduction. Write its two characteristics.

A type of reproduction in which offspring are produced from a single parent is called asexual reproduction. The characteristics of sexual reproduction are:
- Only a single parent is involve in reproduction.
- Offspring are genetically similar with their parents.
- It completes in short period of time.
- Mitosis cell division occurs in this reproduction.

2. What is vegetative propagation? Name any 3 plants that reproduce through this method.

The asexual reproduction in plants through its vegetative parts like root, stem, leaves etc. is called vegetative reproduction. For example: Sweet potato propagates by root, rose propagates by stem, bryophyllum propagates by their leaves, etc.

3. What is sexual reproduction? Explain the sexual reproduction in flowering plants with diagram.

The process of forming a new offspring by the fusion of male and female gametes is called sexual reproduction.

Sexual reproduction in flowering plants:

Flower is the reproductive parts of flowering plant. It consist calyx, corolla, androecium and gynoecium. Androecium is the male reproductive part and gynoecium is the female reproductive part. Anther of androecium produces pollen grains which transfer to stigma of gynoecium during pollination. Pollen grain in stigma produces pollen tube which grows towards the ovary. The nucleus of pollen grain undergoes meiosis cell division a forms 2 male gametes which travel with pollen tubes towards ovary among which one fuse with female gamete to form a zygote. This process is called fertilization. Then the ovary change into fruit and ovules change into seed and under favorable condition this seed germinates to give a new plant.

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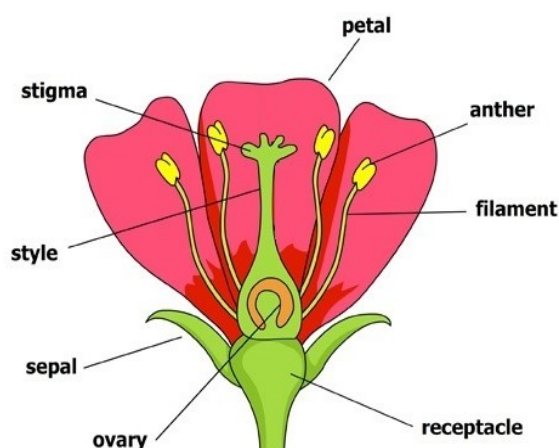
4. What is fertilization? Write the difference between internal and external fertilization.

The process of fusion of male and female gamete to form a zygote is called fertilization.

Internal fertilization	External fertilization
1. Fusion of male and female gametes occurs inside the female body.	1. Fusion of male and female gametes occurs outside the female body.
2. Less number of eggs produces with high survival rate.	2. Large number of eggs produces with low survival rate.
3. Parental care is required.	3. Parental care no or less required.
4. This type of reproduction occurs in reptiles, aves and mammals.	4. This type of reproduction occurs in pisces and amphibians.

5. What are the significances from asexual and sexual reproduction?

Significances of asexual reproduction	Significance of sexual reproduction
▪ Only a single parent is capable to reproduce.	▪ Unique offspring produced.
▪ Offspring are genetically similar with parent.	▪ Maintains genetic diversity in earth.
▪ Does not requires specialized sex organs.	▪ Slower reproduction rate but faster adaptation and evolution.
▪ Large number of offspring can be produced.	
▪ Reproduction completes in short period of time.	▪ Offspring are dispersed widely.

6. Sugarcane is planted with steam. What type of reproduction is this? Write any three reasons behind using this method.

This type of asexual reproduction is called vegetative propagation. People use this method due to the following reasons:

(i) Newly produced plants are genetically identical with the parent plant.

(ii) Large number of plant can be produce easily from a single plant.

(iii) Reproduction completes in short period of time.

7. How the zygote has diploid (2n) cells? Write.

A Zygote is formed by the fusion of a haploid (n) male and haploid (n) female gamete, so it has diploid (2n) cell.

8. Difference between:

Gamete	Zygote
1. Gametes are the unfertilized male and female reproductive cells.	1. Zygotes are the fertilized ovum.
2. Male and female gamete fused to form a zygote.	2. Zygote develops in an embryo and reproduces a new child.
3. They have haploid cells.	3. They have diploid cells.

Male gametes	Female gametes
1. They are produced in testis.	1. They are produces in ovary.
2. They are male gamete.	2. They are female gamete.
3. They release millions at a time.	3. They release one at a time.
4. They are mobile and comparatively small.	4. They are immobile and comparatively small.

Self-pollination	Cross-pollination
1. Pollen grains transfer from anther to stigma between the flowers of same plant.	1. Pollen grain transfer from anther to sigma between flowers of different plants.
2. It brings less variation in offspring.	2. It brings more variation in offspring.
3. It occurs in closed bisexual flowers.	3. It occurs in both unisexual & bisexual flowers.

Sexual reproduction	Asexual reproduction
1. Offspring are not genetically identical with their parents.	1. Offspring are genetically identical with their parents.
2. It leads to genetic diversity of species.	2. It doesn't leads to genetic diversity.
3. Gametes are produced and fused.	3. Gametes are not produced.
4. Reproduction period is comparatively long.	4. Reproduction period is comparatively short.

Fission	Budding
1. It is a type of asexual reproduction in which a mother cell divide into two or more daughter cells.	1. It is a type of asexual reproduction in which a new offspring is produced from a bud of parent.
2. Parents cannot be identifies after separation.	2. Parents can be identified after separation.
3. It is a natural process.	3. It can be introduce artificially.

9. "There was no so much biodiversity when there was no sexual reproduction." Justify it.

There was no so much biodiversity when there was no sexual reproduction. This can be justified by following points:

(i) Asexual reproduction produces genetically identical offspring but sexual reproduction produces mixed genetic offspring which may have some character distinct to their parents.

(ii) Sexual reproduction has more chance of genetic variation which is useful for evolution.

(iii) The offspring can disperse in large area.

10. What is pollination? Define self pollination and cross pollination.

The process of transfer of pollen grain from anther to stigma of a flower is called pollination.

The transfer of pollen grains from anther to stigma of same flower or another flower of same plant is called self-pollination.

The transfer of pollen grains from anther to stigma of different flowers of different plants is called cross-pollination.

11. How the following reproduce:

Potato → vegetative propagation through steam

Bryophyllum → vegetative propagation through leaf

Amoeba → fission

Rose → vegetative propagation through stem

Mucor → sporulation

Sweet potato → vegetative propagation through root

Begonia → vegetative propagation through leaf

Onion→ vegetative propagation through stem

Starfish → regeneration

Hydra → budding

Tapeworm → regeneration

Planaria → regeneration

Spirogyra→ fragmentation

Fern→ sporulation

Plasmodium → fission

mushroom→ sporulation

12. Give Reason:

a. Vegetative propagation is more beneficial for farmers.

Vegetative propagation is more beneficial for ferment because a large number of genetically identical plants can be easily produced with in the short interval of time.

b. A tapeworm is hermaphrodite.

A tapeworm has both male and female reproductive organs, so it is a hermaphrodite.

c. Gametes are haploid and zygotes are diploid.

Gametes are formed through meiosis cell division so, they have haploid cell and a zygote is formed by the fusion of a male and female gamete so, they are diploid.

d. Self pollination occurs in bisexual flowers.

Bisexual flower has both male and female reproductive parts, so the pollen grain of anther can transfer to stigma of same flower. This is call self-pollination.

18.(B) Artificial Vegetative Propagation in Plant

1. What is layering? Write its type.

Layering is a process of producing new plants by developing roots on the branch of parent plant. Some main types of layering are:

(i) Simple layering   (ii) Compound layering   (iii) Tip layering   (iv) Mound or stool layering

(v) Air layering

2. What is grafting? Write its type.

Grafting is a horticultural technique of joining two plants together permanently so that they will continue growing as a single organism. The major types of grafting are:

(i) Whip grafting   (ii) Tongue grafting   (iii) Cleft grafting

3. Define scion. How scion and stock are selected? Explain with figure.

   The scion is the part of the grafted plant that will produce the plant's shoots. The part of plant which is desired as root system is select for stock and the part of the plant which is desired as shoot system is selected for scion.
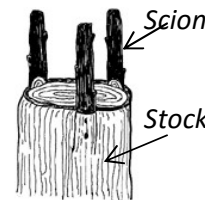

fig: cleft grafting

4. Define tissue culture? Write its importance.

   Tissue culture is the modern technique of developing the new plants the tissues of parent plant. The advantages of tissue culture are:
   (i)   A large number of plants can be grown from a single plant.
   (ii) New plants with high disease resistance can be grown
   (iii) It helps to conserve the rare and endangered plant.
   (iv) It produces mature plant quickly.

5. Write the difference between layering and grafting.

Layering	Grafting
1. Root are developed in the branch of parent plant and separated for planting.	1. Two parts of plant are joined to form a single permanent plant.
2. It requires a single plant.	2. It requires 2 different plants of same species.
3. Layering is done in a plant which already has desirable characters.	3. Grafting is done to obtain a plant with desirable characters.

6. Which method is useful among layering, cutting, grafting and tissue culture in context of Nepal? Justify with two reasons.

   I think tissue culture is more convenient in context of Nepal because:
   (i)   A large number of plants can be grown from a single plant body, so it can easily fulfill the plant demands of farmers.
   (ii) High disease resistance plants can be grown by tissue culture which can reduce the uses of pesticides and insecticides.
   (iii) It produces matured plant quickly and can increase the production rate.
   (iv) It helps to conserve the rare and endangered plant species found in Nepal.

7. Which types of plants are reproduced through grafting, layering and tissue culture? Write.

   Those plants which do not have viable seeds and takes a lot of time to be mature are reproduced by layering, grafting and tissue culture methods. Layering is done mostly in those plants which has low-growing branches and has desirable characters. Grafting is done in those plants which have to change into desirable characters and tissue culture is done for rare and endangered plant or if large number of plants are to be produced from a single plant.

8. What are auxin and cytokinin?

   Auxin is a plant hormone which helps to grow the root system and cytokinin is a plant hormone which helps to grow the soot system in tissue culture.

9. Explain in short about any two methods of grafting.

   (i) **Whip grafting:** In this grafting method, both stock and scion cut in slanted position with equal sized and kept the cut in contact. It is wrapped with grafting tape or wax. After 2-3 month the stock and scion joined grow as a single branch.

   (ii) **Cleft grafting:** In this grafting method, scions having small thickness are placed in the cleft of thick stock made my sawing off a branch. It is wrapped with grafting tape or wax which later joined and grows as a single branch.
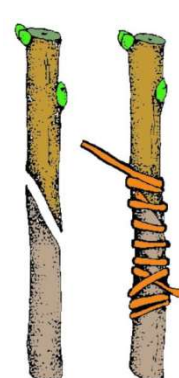

fig: whip grafting   *fig: cleft grafting*

10. Write the importance of artificial vegetative propagation.

    The importances of vegetative propagation are:
    (i)   Offspring of those plants can prepare which do not have viable seeds.
    (ii) A large number of plants can be grown from a single plant.
    (iii) New plants with high disease resistance can be grown.
    (iv) It helps to conserve the rare and endangered plants.
    (v)   It produces mature plant quickly.
    (vi) It is easier to understand and to do.

19. Heredity

1. **Define genetics. Who is the father of genetics?**

   The branch of science which deals with the study of heredity is known as genetics. Gregor Johann Mandel is known as the father of genetics.

2. **What is heredity? What is responsible for the transfer of heredity character to the offspring?**

   The process of transfer of parental characters to their offspring is called heredity. Genes are responsible for the transfer of heredity character to the offspring.

3. **Who perform an experiment in pea plant and who perform in drosophila?**

   Mendel performed an experiment in pea plant and T.H. Morgan performed in drosophila.

4. **Why Mendel select the pea plant (*Pisum sativum*) for his experiment? Write.**

   Mendel selected the pea plant for his experiment because:
   (i)   It has bisexual flower and can reproduce naturally.
   (ii) Cross-pollination can be done as per requirement
   (iii) It has a number of contrasting characters like: tall and short plant, yellow and green seed, round and wrinkled seed, etc.
   (iv) It can be easily cultivated.
   (v)   It has short life cycle which make possible to observe many successive generation.

5. **"Mendel experiment is not only can perform in plant but also in animals." Justify it any two reasons.**

   "Mendel experiment is not only can perform in plant but also in animals." This can be justified by the following reasons:
   (i)   Genes are responsible for the transfer of parent character to their offspring and both plant and animal cells bears genes.
   (ii) T.H Morgan already verified the Mendelism in case of animals by experimenting with Drosophila.

6. **What are dominant and recessive characters?**

   The character which is expressed phenotypically in F_1 generation is called dominant character and the character which is hidden phenotypically in F_1 generation is called recessive character.

7. **What is monohybrid cross? Show the result obtain in first and second generation in the filial chart when we perform the cross pollination between a pure tall pea plant and pure dwarf pea plant. Also mention the phenotype and genotype.**

   The cross pollution between two same species having one distinct character with each other is called monohybrid cross.
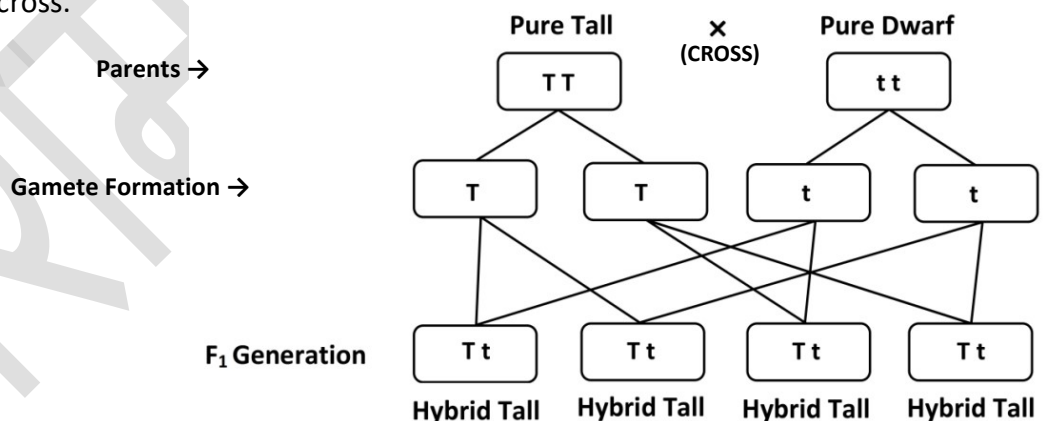

Phenotype → 3:1
Genotype → 1:2:1
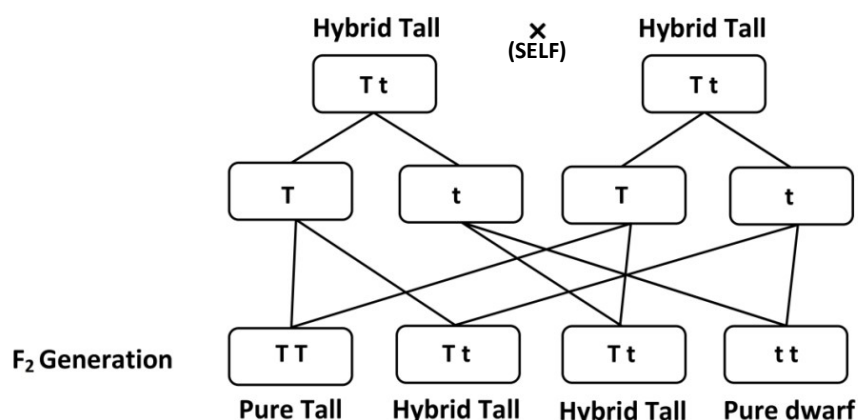
8. State Mendel's law and explain the law of dominance.

Law of dominance states that, "when a cross is made between a pair of pure contrasting characters, only one of them is expressed phenotypically while other remains hidden in F_1 generation". Here, the expressed character is called dominant character and hidden character is called recessive character.

For example: When a pure tall (TT) is cross pollinated with pure dwarf (tt) pea plants, all pea plants in F_1 generation becomes hybrid tall. Here tall is the dominant character and dwarf is the recessive character.
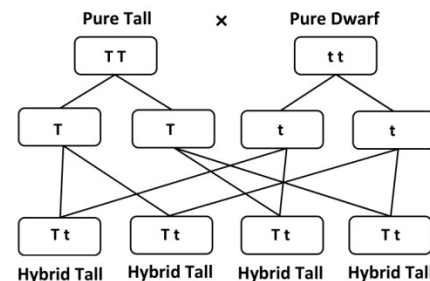
9. What is variation? Write its types on the basis of its factors?

Variation is the morphological or physiological change in organism caused by genetic or environment reasons. There are two types of variation. They are:

(i) **Heredity variation:** The variations which arise as a result of any change in the structure and function of the gene and are inherited from one generation to another are called heredity variation. Example : Colour of hair, Colour of eye, etc.

(ii) **Environment variation:** Two individuals with the same genotype may become different in phenotype when they come in contact with different conditions of food, temperature, light, humidity and other external factors. Such differences among organisms of similar heredity are known as environmental variation. Example: Tone of skin, Freckles, etc.

10. What is variation? Define its types on the basis of degree of differences with example.

Variation is the morphological or physiological change in organism caused by genetic or environment reasons. There are two types of variation on the basis of degree of differences. They are:

(i) **Continuous variation:** The variation that occurs gradually in one organism is called continuous variation. Example: Height of a person, Weight of an animal, etc.

(ii) **Discontinuous variation:** The variation that occurs suddenly is called discontinuous variation. Example: Blood group, gender, finger prints, etc

11. Fertilization between a black dog and a brown dog give birth to all black pups. Why they haven't grey once?

According to the Mandel's law of dominance, only the dominant character is expresses phenotypically and recessive character is hidden in F_1 generation. Since, black is the dominant character and brown is recessive character, so all the pubs are found black in F_1 generation. Also, the law of purity of gametes states that, gametes do not mix with each other to form a hybrid gamete, so we will not observe the grey pubs.

12. The result after performing the cross pollination between pea plant with red flower and pea plant with white flower is given in the table. Answer the following questions :

(i) In which generation this result can be seen?
   It can be seen in F_2 generation.

	R	r
R	RR	Rr
r	Rr	rr

(ii) What is the ratio of dominant and recessive character?
   The ratio of dominant and recessive character is 3:1

(iii) Which is pure red flowering plant?
   Plant having gametes RR is pure red flowering plant.

13. Differentiate between:

Dominant Character	Recessive Character
1. This character is expressed phenotypically in F_1 generation.	1. This character isn't expressed phenotypically in F_1 generation.
2. It is seen in 75% species in F_2 generation.	2. It is seen in 25% species in F_2 generation.
3. It can be expressed if there is presence of paired or unpaired dominant gene.	3. It can be expressed if there is absence of dominant gene.
4. It is indicate with capital alphabet.	4. It is indicated with small alphabet.

Monohybrid cross	Dihybrid cross
1. The cross between the parents having only one different contrasting character.	1. The cross between the parents having two different contrasting characters.
2. Observed phenotype is 3:1	2. Observed phenotype is 9:3:3:1
3. A single pair of gene is involved.	3. Two pair of gene is involved.

Variation	Mutation
1. It occurs gradually in an organism.	1. It occurs suddenly in an organism.
2. Heredity variation and Environmental variation are its two types.	2. Heredity mutation and acquired mutation are its two types.
3. It is affected by environment, crossing over of chromosomes during meiosis cell division, food, shelter, etc.	3. It is affected by X-ray, gamma-ray, UV-ray, chemicals, etc.

20. Environment Pollution and Management

2. Define environment pollution and environment management.

The adverse change in the natural state of environment due to the contamination of physical, chemical or biological components is called environment pollution.

Environmental management is the improvement in conservation of environment by properly managing the factors responsible for environment degradation.

3. What is air pollution? Write its affects and its control of measure in points.

The adverse change in the natural state of air due to the contamination of physical, chemical or biological components is called air pollution. It can be controlled by following ways:

(i) Factories and industries should be established far from human settlement.

(ii) The clean sources of energy like hydroelectricity, solar energy, wind energy, etc. should be used instead of petroleum products.

(iii) Filters and chimney must be used in industries.

(iv) Afforestation should be done and deforestation should be discouraged.

(v) Over population should be control.

(vi) Public awareness programme should be conducted.

4. What are the affects of air pollution in your surroundings? Write.

Effects of air pollutions are as follow:

(i) Reduction in visibility

(ii) Reduction in solar radiation

(iii) Green house effect

(iv) Inhabitation in biological growth of plants

(v) Adverse affect in human health

(vi) Depletion of ozone layer

(vii) Acid rain

(viii) Destruction of historical monuments

(ix) Climate change

5. What is water pollution? Write its affects and its control of measure in points.

The adverse change in the natural state of water due to the contamination of physical, chemical or biological components is called water pollution. Effects of water pollution are as follows:

(i) Lack of drinking water

(ii) Adverse effect in human health

(iii) Destruction of ecosystem

(iv) Death or mutation in aquatic animals

(v) Inhabitation in biological growth of plant

(vi) Soil pollution

Control of measure of soil pollution:

(i) Domestic and industrial wastes should be managed properly.

(ii) Dead bodies of animal should not be thrown near water resources.

(iii) Using compost fertilizer in agriculture instead of chemical fertilizer.

(iv) Proper drainage system must be developed.

(v) Public awareness should be conducted.

6. What is soil pollution? Write its affects and its control of measure in points.

The adverse change in the quality of soil due to the contamination of physical, chemical or biological components is called soil pollution. Effects of soil pollution are as follows:

(i) Death of useful microorganisms

(ii) Decrease in agricultural productivity

(iii) Destruction of ecosystem

(iv) Water and air pollution

(v) Inhabitation in biological growth of plant

(vi) Adverse effect in human health

Control of measure of soil pollution:

(i) Domestic and industrial wastes should be managed properly.

(ii) Dead bodies of animal should not be thrown near water resources.

(iii) Using compost fertilizer in agriculture instead of chemical fertilizer.

(iv) Use of plastics, pesticides and insecticides should be minimized.
(v) Human and animal excreta should manage properly.
(vi) Proper drainage system must be developed.
(vii) Public awareness should be conducted.

7. Write down the importance of forest and also mention the measures for conservation and management of it.

Importance of forest are:
(i) It provides food and shelter and protection for wild animals.
(ii) It consumes the carbon and releases the oxygen in atmosphere.
(iii) It provides food, tourism, furniture, etc.
(iv) It helps in the conservation of water resources and land.
(v) It helps to cool the air temperature by releasing the water vapour into the air.
(vi) Forests offer privacy, reduce the light reflection, offers a sound barrier and helps to guide wind direction and speed.

Measures for the conservation of forests:
(i) Scientific and systematic ways should follow while cutting down and planting trees.
(ii) Forest fire should be stopped.
(iii) Plantation should be done in bare and sloppy lands.
(iv) Forest preservation rules and laws should be strictly implemented.
(v) Public awareness on the importance of forest should be conducted.

8. Discuss the importance of water and also mention the measures for conservation & management of it.
Water is an essential compound for the survival of living organism. Water is used in various purposes in our life like cooking, drinking, cleaning, washing, irrigating land, etc. It also used in hydroelectricity, transport, tourism band also helps in economic growth of the country.

Measures of conservation and management of water resources:
(i) Supply and distribution of water must be managed and systemized.
(ii) Water must be efficiently stored and used.
(iii) Afforestation should be encouraged and deforestation should be discouraged.
(iv) Mixing poisons and using electric equipment to kill fish in the water should be stopped.
(v) Polluted water should be purified and reused.
(vi) Public awareness programme about the importance of water resources should be conducted.

9. What is green house effect? List down the effects of it.
The increase in earth temperature due to the production of green house gases like CO_2, CH_4, water vapour, etc. is called green house effect. Its effects are as follow:
(i) Increases the temperature of the earth.
(ii) Melting of Himalayas and sinking of islands.
(iii) Climate change

10. "Environment pollution affects the ecosystem." Justify this statement in points.
Environment pollution affects the eco system because:
(i) Environment pollution creates inhibition in biological growth of the plant.
(ii) It destroys the food chain of environment.
(iii) It reduces the ability of food, shelter and protection of the animals.
(iv) It brings harmful or deadly disease in living beings.
(v) It brings mutation in living beings.
(vi) Some organism may not able to adopt the sudden environmental change and can be extinct from nature.

11. Differentiate : (a) Primary pollution and Secondary Pollution

Primary pollutant	Secondary pollutant
1. They directly release from source to atmosphere.	1. Primary pollutant interacts and forms the secondary pollutant.
2. It can be controlled by reducing the pollutant production or managing the waste materials.	2. It can be controlled by understanding and interrupting the chemical reaction leading to their generation.
3. CO_2, CO, SO_2, CH_4, NO, water vapour, etc. are the primary pollutants.	3. Acid rain, ground level ozone, etc are the secondary pollutants.

12. Give Reasons:
   a. Green house gases are responsible for global warming.
   The reflected solar heat after striking on the earth surface cannot return to outer space and trapped in the atmosphere due to the presence of green gases, this results the global warming.

   b. Air pollution depletes ozone layer.
   Contamination of some gases in atmosphere like chlorofluorocarbon ($CFCl_3$), halogens, methyl bromide (CH_3Br), carbon tetrachloride (CCl_3), etc. when reach in ozonosphere and exposed in UV-ray, it reacts with ozone molecules and depletes the ozone layer.

   c. Afforestation is the best measure to reduce all type of pollutions.
   Forest helps in conservation of soil and water resources, it maintains the earth's temperature, consumes a lot of carbon from atmosphere, offers a sound barriers, changes the direction and speed of wind, so afforestation is the best measure to reduce all type of pollutions.

   d. CO gas is more harmful than CO_2.
   CO_2 is non-poisonous gas but CO is a poisonous gas. When we take CO gas in breath, it combines with haemoglobin and reduces the oxygen absorbing ability of blood and cause headache, dizziness, unconscious or death.

21. History of the Earth

1. List the different hypothesis about the origin of the earth and explain them in short.
   There are many hypothesis put forward to explain about the origin of earth. Some main hypothesis is:
   (i) **Planetsimal hypothesis (George Buffon hypothesis):** This hypothesis was proposed by George Buffon in 1749 AD. According to him, the earth along with the other planets and satellites are formed when a large comet collide with sun million years ago.

   (ii) **Nebular hypothesis (Kant-Laplace hypothesis):** This hypothesis was proposed by Immanuel Kant in 1755 AD and later modified by Simon Laplace in 1796 AD. According to this hypothesis, at the beginning our solar system consists of the mass of larger whirling clouds of hot gas and dust particles which cooled and the large mass forms as sun whereas the smaller masses becomes planets and satellite.

   (iii) **Tidal hypothesis (Jeans and Jeffery hypothesis):** This hypothesis was proposed by James Jeans in 1919 and later modified by Harold Jeffery in 1929 AD. According to this hypothesis, millions years ago a large star reached near the sun while revolving and due to its gravitational pull, the solar mass formed a tide and split in space which later cooled and formed the planets and satellites.

2. What is the estimated age of earth?
   The estimated age of earth is 4.5 billion years.

3. What is geological time scale? In how many spans of time it is divided?
   The time scale which covers the history of earth from its origin to present days is called geological time scale. It is divided into 4 spans of time as eon, era, period and epoch.

4. Write the similarities and dissimilarities between the evolution of organism in Mesozoic & Cenozoic era.

Similarities of Mesozoic era and Cenozoic era	Dissimilarities of Mesozoic era and Cenozoic era
a. Both are the smaller eras than others on the basis of time.	a. Reptiles were the dominant in Mesozoic whereas mammals are the dominant in Cenozoic era.
b. Hills and mountain forming activities occurs in both eras.	b. Dinosaur were originated in Mesozoic era but get extinct before Cenozoic era
c. Large numbers of animal originated and extinct in both eras.	c. Mammals weren't originated in Mesozoic era they were originated in Cenozoic era
d. Gymnosperms, angiosperms and reptiles were found in both eras.	

5. Write the era in which the following incident occurred :
   (i)   Origin of pieces (fish) and evolution → Paleozoic era
   (ii) Origin of fern and development → Paleozoic era
   (iii) Evolution of dinosaurs → Mesozoic era
   (iv) Origin of phenerogames → Mesozoic era
   (v)   Evolution of elephant, whale → Cenozoic era

(vi) Evolution of modern human → Cenozoic era

(vii) Dominance of human → Cenozoic era

(viii) Evolution of reptiles → Mesozoic era

(ix) Origin algae → Paleozoic era

(x) Origin of bacteria → Pre Cambrian era

(xi) Evolution of amphibians → Paleozoic era

(xii) Origin of aves (bird) → Mesozoic era

(xiii) Origin of earth → Pre Cambrian era

6. In which period dinosaurs originated, become dominance and extinct?

Dinosaur originated in Triassic period, become dominance in Jurassic period and extinct in Cretaceous period of Mesozoic era.

7. Define fossils. Explain the process of formation of fossils.

The impression of organ or whole body of the ancient plants or animals in the sedimentary rocks is called fossil.

Process of fossil formation: The process of formation of fossil is called fossilization. After the death of any organism, usually soft parts decay but the hard parts like teeth, bone, shell, etc. get compressed on mud, soil, sand and stone and give impression of organism. Overlying sediment compress the death body of organism to form fossils.

8. Why do scientists study fossils?

People studies about fossil because:

(i) Fossils help to know about evolution.

(ii) It helps to know about extinct plants and animals.

(iii) It helps to know the age of the rocks which helps to know about the climate of that time.

(iv) It helps to find the deposition of petroleum inside the earth's crust.

9. Write the name of different petroleum products with their uses.

Products	Uses	Products	Uses
Petroleum gas	Gaseous fuel	Kerosene	Fuel for household use
Petroleum ether	Solvent and Cleanser	Lubricating oil/grease	Lubricants in machines
Petrol	Fuel for light vehicles	Paraffin wax	Candle and match sticks
Diesel	Fuel for heavy vehicles	Petroleum coke	Fuel

10. What is coal? Explain the process of formation of coal.

Coal is a black brown combustible rock and carbon rich fossil fuel.

Formation of coal: Coal is formed from the dead bodies of plant and animals. Coals are formed when plants and animals are buried under earth's crust due to different geological phenomenon like flood, landslide, earthquake, volcano, etc. for millions of years with high pressure and temperature. Cellulose and Lignin of plants play important role in coal formation.

11. Define fossil fuel. How the formed? Also list its importance.

The fuel obtain by the process of fossilization of living organism are called fossil fuel. Fossil fuels are formed when plants and animals are buried under earth's crust due to different geological phenomenon like flood, landslide, earthquake, volcano, etc. for millions of years with high pressure and temperature.

The importance of fossil fuel are:

(i) Coal is used as fuel in railways, industries, factories, electricity power house, etc.

(ii) Minerals oil is use in vehicles, industries and factories as fuel.

(iii) Petroleum is used to make chemical fertilizers, plastics, paints, explosives, etc.

(iv) Black tar is used in road construction.

(v) Natural gas is used as fuel in house hold sectors as fuel.

12. How the scientist proved that the earth and humans are not originated at the same time? Write.

Scientist proved that the earth and humans are not originated at the same time by studying the age of fossils and the ancient climate.

Some of the proofs are as follow:

(i) The earth was formed 4.5 billion years ago but the oldest fossil of human was found of only few millions years ago.

(ii) At the beginning, there was unfavorable temperature, atmosphere, land, water, etc. in earth for existence of life.

(iii) As humans are consumers in the food chain, green plants (producers) should originated first.

(iv) Human beings are the most developed species among animals, so they were formed through gradual evolution of other species which takes a long period of time.

13. Differentiate between :

Lignite	Anthracite
1. Lignite is the low quality coal as they produced low heat.	1. Anthracite is the high quality coal as they produce high heat.
2. It contains about 70% of carbon.	2. It contains about 90% of carbon.

Coal	Mineral oil
1. Coals are the solid carbon rich fossil fuel.	1. Minerals oils are the liquid hydrocarbon fossil fuel.
2. Quality of a coal depends upon amount of carbon percent.	2. Quality of mineral oil is made by separating the different components using fractional distillation.
3. It is comparatively less combustible.	3. It is comparatively more combustible.

14. Give Reason :

a. Use of fossil fuel is not good.

Burning of fossil fuel releases harmful gas like CO, CO_2, smoke which pollutes the environment and adversely affects the health of living beings. So they are not food for use.

b. Mesozoic era is also known as era of reptiles.

The dinosaurs and many other reptiles was originated and become dominant in Mesozoic era so, it is also called the era of reptiles.

c. Fossils are only found in sedimentary rocks.

Fossils are found in sedimentary rocks because these rocks form at low temperature and pressure. Igneous rocks form at temperatures and pressures that are high enough to destroy any organic remains.

22. Climate Change and Atmosphere

1. List out any five national level practices related with climate change and explain any two.

The five national level practices related with climate change are:

▪ National Communication Report
▪ Climate Change Policy, 2076 (2019)
▪ Strategic Programme for Climate Change Adaptation (The Rio Earth Submit)
▪ National Adaptation Programme for Climate Change
▪ Local Adaptation Programme Related to Climate Change

National Communication Report: Nepal has submitted a detailed report on climate change to the Conference of the Parties (COP) of United Nations Organization for Climate Change Conference. This detailed report is called national communication report. This report includes the impact of climate change and the methods of adaptation.

National Adaptation Programme for Climate Change: Government of Nepal has prepared national adaptation programme in September 2010. This programme is designed to evaluate the risk of climate change. There are 9 integrated programmes to conduct 250 programmes.

2. List out some international efforts related with climate change and explain any two.

▪ United Nations Framework Convention on Climate Change
▪ Conference of the Parties (COP) of UNFCCC
▪ Agenda 21
▪ Intergovernmental panel on Climate Change (IPCC)
▪ Kyoto Protocol
▪ Emission control measures of green house gases on the basis of Kyoto Protocol
▪ Reduction of emission due to deforestation

Agenda 21: Agenda 21 is an outcome of Rio Summit. It is a dynamic program for supporting the conservation of environment. According to Agenda 21, the conservation of environment is achieved through sustainable development and mitigation measures of climate change. The number 21 stands for 21st century. The main slogan of Agenda 21 is "Think Globally and Act Locally".

Intergovernmental Panel on Climate Change: It is the forum of scientists from all over the world, who are responsible for an objective and scientific analysis and investigation of climate change. It was established in 1988 AD by two UN member organizations named, World Meteorological Organization (WMO) and United Nations Environmental Programme (UNEP). It provides the objective and scientific data about climate change as well as its impact and mitigation.

3. Define atmosphere. Why it is important to us?
   Atmosphere is a thick layer of which covers the earth. Its importance is as follows:
   (i) It provides the necessary gases for the survival of living things.
   (ii) It helps regulates the heat from the sun.
   (iii) It plays an important role in water cycle.
   (iv) Ozone layer protects the earth from harmful UV-rays of sun.
   (v) It provides atmospheric pressure.
   (vi) It protects the earth from small meteors.

4. Mention the different layers of atmosphere with one features of each.
   There are five layers in the atmosphere. They are:
   (i) Troposphere → Climate change like cloud formation, lighting, etc. take place in this layer.
   (ii) Stratosphere → Ozone layer of stratosphere protects us from harmful UV-radiation of sun.
   (iii) Mesosphere → It is the coldest layer of atmosphere.
   (iv) Thermosphere → Gas molecules changes into corresponding ions in this layer.
   (v) Exosphere → Gas molecules has are less effect of gravity and the can escape out of atmosphere.

5. What is ozone layer? Write any two reasons of ozone layer depletion.
   Ozone layer is a protective layer in stratosphere which protects us from harmful UV-radiation of sun.
   The reasons of ozone layer depletion are:
   (i) Due to emission of the gases like CFC, methyl chloroform, carbon tetrachloride, methyl bromide, etc. in atmosphere.
   (ii) Due the presence of hydroxide ions, nitric oxide in the atmosphere.

6. List the effects of ozone layer depletion.
   The effects of ozone layer depletion are:
   (i) It causes different disease like skin cancer, skin irritation, cataract, loss of immunity, etc in human.
   (ii) It decreases the production of crops.
   (iii) It causes global warming.
   (iv) If affects the fertility of the animals.

7. How chlorofluorocarbon (CFCs) destroy the ozone layer. Explain
   When a CFC atom slowly moves upward to the stratosphere it dissociated by powerful UV-rays releasing nascent chlorine. The nascent chlorine atom reacts with ozone and depletes the ozone layer. A single atom of chlorine can destroy a large number of ozone molecules.

$$CF_2Cl_2 \xrightarrow{UV-rays} CF_2Cl + Cl$$
$$Cl + O_3 \xrightarrow{UV-ra} ClO + O_2$$
$$ClO \xrightarrow{UV-rays} Cl + O$$
$$O + O_3 \xrightarrow{UV-ra} O_2 + O_2$$
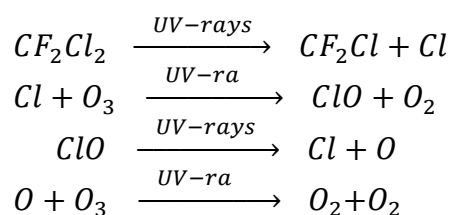
8. What are the effects on living organism due to the formation of hole in ozone layer?
   The effects of ozone layer depletion are:
   (i) It causes different disease like skin cancer, skin irritation, cataract, loss of immunity, etc in human.
   (ii) It decreases the production of crops.
   (iii) It causes global warming.
   (iv) If affects the fertility of the animals.

9. What is artificial green house? Why is it warmer inside at night?

Artificial green house is an artificial house, made by glass or plastic which can trap the solar heat and increases its inner environmental temperature.

It traps the solar heat inside it, so it is warmer inside at night.

10. Why we should reduce the use of CFC in our daily life? Give two reasons.
    (i) CFC is the main component responsible for the depletion of ozone layer.
    (ii) CFC is also a green house gas which causes global warming.

11. Write any three industrial gases and also mention its adverse effects.
    (i) Carbon dioxide: CO_2 is the main component responsible for global warming.
    (ii) Carbon monoxide: CO is a poisonous gas and reduces the oxygen absorbing ability of blood.
    (iii) Sulphur dioxide: SO_2 cause acid rain and decreases the fertility of soil.

12. Differentiate between :

Troposphere	Stratosphere
1. Temperature decreases with increase in altitude.	1. Temperature increases with increase in altitude.
2. Ozone in troposphere is a secondary pollutant.	2. Ozone layer in stratosphere is a protective layer.

Mesosphere	Exosphere
1. It is the coldest layer of atmosphere.	1. Temperature is very hot during day and very cold during night.
2. Meteors falling towards the earth buns in this layer.	2. Gas atoms have less effect of gravity so they can escape towards the outer space.

Artificial green house	Natural green house
1. Transparent glass or plastics traps the heat.	1. Green house gases like CO_2, CH_4, water vapour, etc. traps the heat.
2. It helps to grow the plants in any season in any regions.	2. It causes the global warming.

13. Give Reason :
    a. Life is possible in earth due to presence of atmosphere.

    Life is possible in earth due to the presence of atmosphere because it provides the necessary gases for the survival of living things, helps regulates the temperature, plays an important role in water cycle and protects from harmful UV-rays of sun.

    b. Troposphere is influenced highly by human activities.

    Troposphere is the lowest layer of the atmosphere so all the animal and plant directly inter-related with this layer of atmosphere. Human activities produced smoke, dust, fog, cloud, etc which mixed in this layer and makes it polluted.

    c. Green house effects are advantageous.

    The natural green house effect makes our earth warm enough for the survival of living beings and the artificial green house help to grow the crops in any season in any region so, the green house effects are advantageous.

    d. The earth also acts as a green house.

    The green house gases like carbon dioxide, methane, water vapour etc. traps the solar heat and increases the temperature of the earth. So, the earth also acts as a green house.

    e. Troposphere is also called changeable layer.

    Troposphere is called changeable layer because the temperature decreases with increase in altitude in this layer.

    f. Stratosphere is called protective layer.

    The ozone layer of present in stratosphere protects us from harmful UV-radiation of sun. So, it is also called the protective layer.

    g. Thermosphere is also called ionosphere.

    Thermosphere is also called ionosphere because in this layer the gaseous molecules are found to be changed into corresponding ions.

# 23. The Earth and the Universe

1. **What is universe?**
   The huge space which contains everything including all existing matter and energy is called universe.

2. **What is solar system? What are including in it?**
   The sun and all the heavenly bodies that revolve around it are collectively called solar system. It includes the sun, planets, satellites, dwarf planets, comets, asteroids, meteors, etc.

3. **Explain the structure of the solar system with figure.**
   The solar system consists of a medium sized star called the Sun. All the eight planets, dwarf planets, comets, asteroids, metros, etc. revolve in their elliptical orbit around the sun and the numerous satellites revolve around their planets. The nearest planet from sun is Mercury and the farthest plant is Neptune. The earth is only one planet of the solar system where life exists and Moon is its only one natural satellite of it.
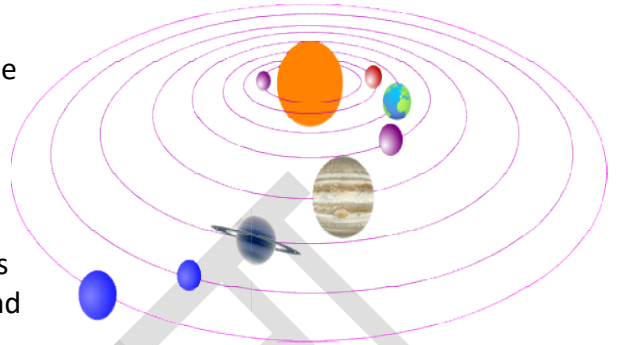
4. **Why mars is also called red planet?**
   The surface of the mars consist red coloured compound called limonite, so it seem to be red in colour and called red planet.

5. **Why we can't see the surface of Jupiter? Write.**
   The outer atmosphere of Jupiter consist a thick and dense cloud of methane and ammonia gas so, we can't see its surface.

6. **What is galaxy? Write its type with examples.**
   Galaxy is the group of billions of starts that revolves around the galactic center. Galaxies are classified into three groups:
   (i) Spiral Galaxy: Milky Way, Andromeda, Triangulum, etc.
   (ii) Elliptical Galaxy: M 49, M 59, IC 1101, etc.
   (iii) Irregular galaxy: Large Magellanic Cloud, Canis Major Dwarf, etc.

7. **Write in short about Milky Way.**
   Milky Way is a spiral shaped galaxy. A galaxy is a group of billions of stars. Milky Way consists about 10^{11} stars. Our solar system is at the edge of Milky Way galaxy. All the stars including our sun revolve around its galactic center.

8. **Define zodiac sign. Draw the diagrams of any two zodiac signs.**
   Out of 88 constellations, 12 constellations are found on the path of sun which we called zodiac sign.
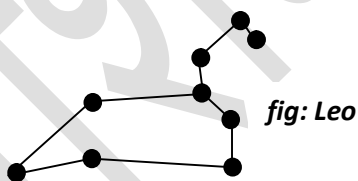
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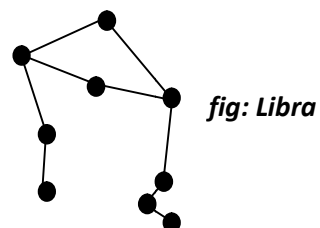
fig: Libra

9. **Write a short note on Ursa major and Orion.**
   Ursa major : It is also called great bear or saptarishi. Great bear is given for its bear like shape and it is called saptarishi due to its 7 stars. It can be seen in northern part of the sky at night in Baisakh and Jestha.
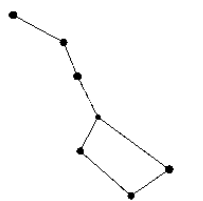
   fig: Ursa major

   Orion: It has 7 stars. It seems like a hunter so it is called Orion. This constellation is easily seen in sky of northern hemisphere in push and magh.
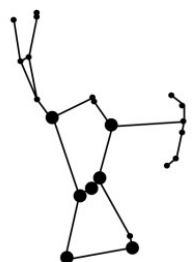
   fig: Orion

10. **What is satellite? Describe about artificial and natural satellite.**
    A satellite is a heavenly body which revolves around the planet.
    Artificial Satellite: Artificial satellites are the human lunched satellite. They help in telecommunication, weather forecasting, space exploration, weapons, etc. For example: Hubble telescope, Nepalisat-1, etc.

Natural Satellite: They are naturally occurring satellites which revolve around the planets. Example: Moon, Titan, Triton, etc.

11. Where does the artificial satellite keep in the space? What is the reason behind lunching it?

Artificial satellites are kept in geostationary orbit in the space. The reasons of lunching satellite are:

(i) To study about sun, star, nebula, planets, etc.

(ii) For Weather forecasting

(iii) To do some experiments which are not possible on the surface of the earth.

(iv) For telecommunication.

(v) For the advance technological weapons.

12. Differentiate between:

Planet	Satellite
1. Planets revolve around the sun.	1. Satellites revolve around the planet.
2. There are only 8 planets in the solar system.	2. There is numerous satellites present in the solar system.

Meteors	Meteoroids
1. They completely burn away in mesosphere.	1. They fall and come on the surface of the earth.
2. Large number (about 250 million) meteors enter in the earth's atmosphere.	2. Only few (about 500) meteoroid reach to the surface of the earth.
3. Previously they are asteroids.	3. Previously they are meteors.

Light year	Astronomical unit
1. The distance travelled by light in vacuum in one year is called light year.	1. The distance between sun and earth is known as astronomical unit.
2. 1 light year = 9.46×10^{15} m	2. 1 AU = 1.5×10^{11} m

Comets	Asteroids
1. They are made up with ice and dust particles.	1. They are made up rocks and metals.
2. They forms their tail due to solar wind.	2. They do not form any tail.
3. They revolve around the sun in highly elliptical orbits.	3. They revolve around the sun in elliptical orbits.

Galaxy	Constellation
1. The group of billions of star in the sky which revolve around its galactic center is called galaxy.	1. The group of few stars which does not change their structure but seem in different place in different season in sky is called constellation.
2. There is large number of galaxy seen in the sky.	2. There are only 88 constellations in the sky.

Comet	Star
1. They do not have their own light.	1. They have their own light.
2. They revolve around the sun.	2. They revolve around the galactic center.

Artificial Satellite	Natural Satellite
1. They are the man made satellite for the purpose of research, telecommunication, weather forecasting, weapons, etc.	1. They were naturally formed during the formation of our solar system.
2. Thousands of artificial satellite was launched by different countries in the space.	2. Moon is one and only the natural satellite of the earth.

Comets	Meteors
1. They revolve around the sun in highly elliptical orbit.	1. They enter in the atmosphere of the earth and burnt out there.
2. They are made up with ice of gases and dust particles.	2. They are made of with rocks or metals.
3. Same comet reappears after fix duration.	3. Same meteor never reaper because it burnt out in atmosphere completely.

13. Give Reasons:
   a. A comet is not actually a star.
      Comment is not actually a star because:
      (i) A star has its own light but a comet does not have its own light.
      (ii) A star revolves around the galactic center but a comment revolves around the sun.
   b. The tail of comet disappears while it goes far away from the sun.
      Tail of comet is formed form due to the evaporation of its frozen gas and dust particles by solar heat but at a far distance the solar heat is not enough, so it get disappears.
   c. Some comets disappear forever from the sky.
      Some comet collides with planet, satellites, asteroids or other heavenly body in the sky so they get disappeared forever.
   d. Sun is a star.
      Sun is a star because it has its own light and it revolves around the galactic center of Milky Way.

Some Important Full Forms

CFL = Compact Fluorescent Lamp

LED = Light emitting Diode

IUPAC = International Union of Pure and Applied Chemistry

CFCs = Chlorofluorocarbon

LPG = Liquefied Petroleum Gas

ATP = Adenosine Triphosphate

RCC = Reinforced Cement Concrete

PVC = Polyvinylchloride

R = "Alkyl Group"

DDT = Dichloro diphenyl trichloroethane

BHC = Benzene hexachloride

Hb = Haemoglobin

CNS = Central Nervous System

PNS =Peripheral Nervous System

ANS = Autonomous Nervous Syndrome

RBC = Red Blood Cell

WBC = White Blood Cell

DNA = Deoxyribonucleic acid

RNA = Ribonucleic acid

IBA = Indole-3-butyric acid

emf = electro motive force

AC = Alternating Current

DC = Direct Current

AU = Astronomical Unit

NPK Fertilizer = Nitrogen, Phosphorus and Potassium containing Fertilizer

Some Important Diagrams
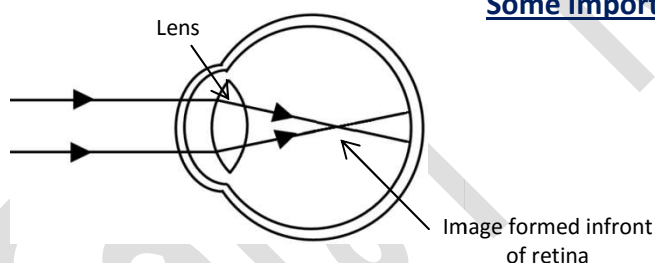
1. Short sightedness (Myopia)
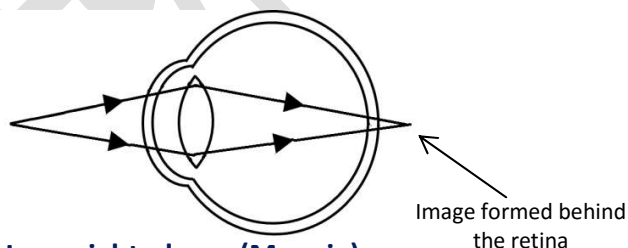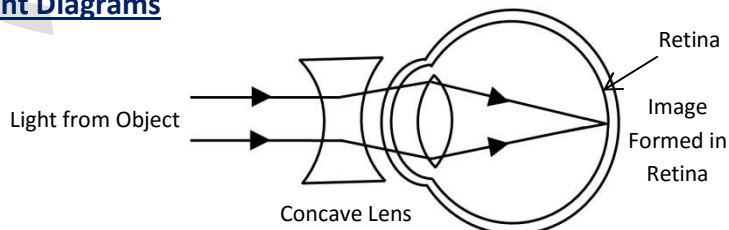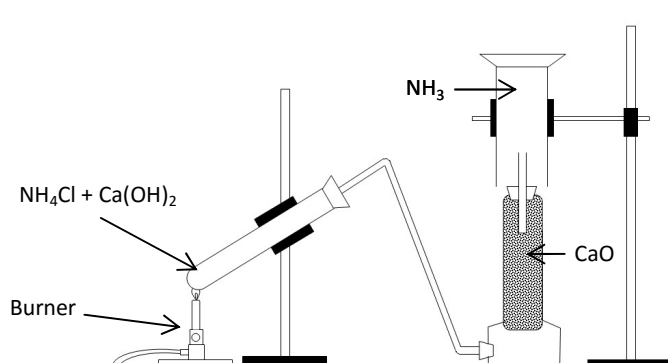

2. Removal of Short sightedness
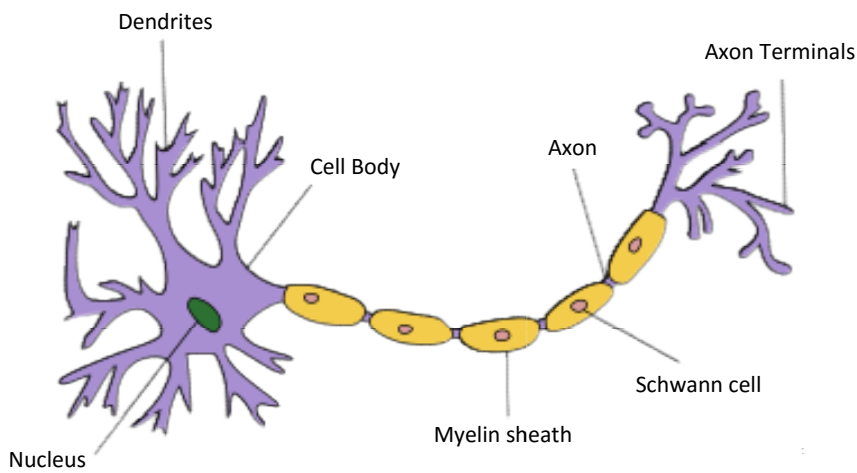

3. Long sightedness (Myopia)
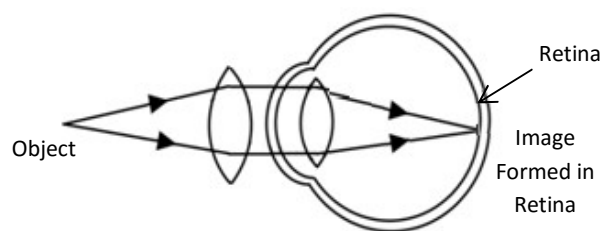
4. Removal of Long sightedness
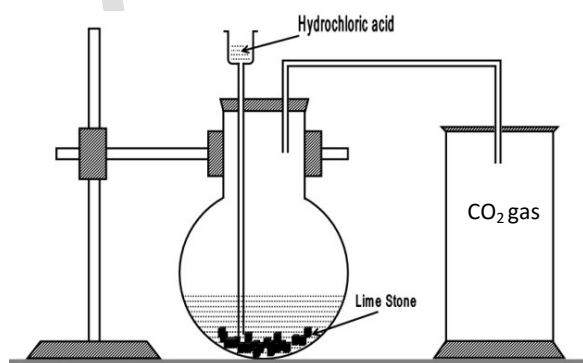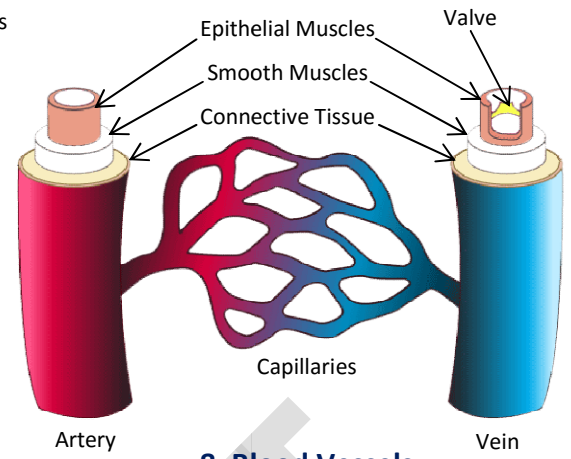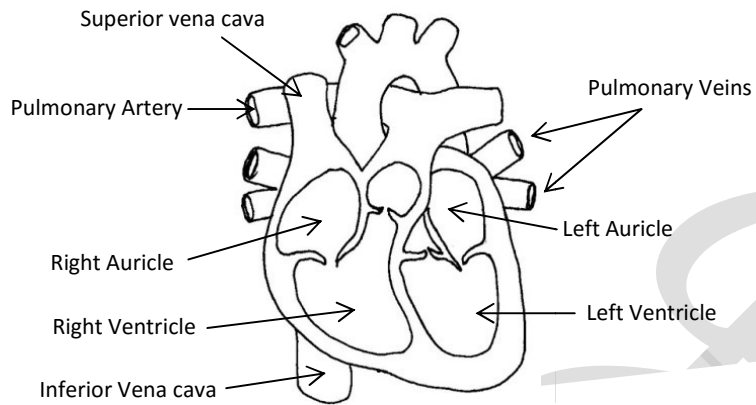

5. Lab Preparation of Carbon dioxide

6. Lab Preparation of Ammonia

7. Structure of Neuron

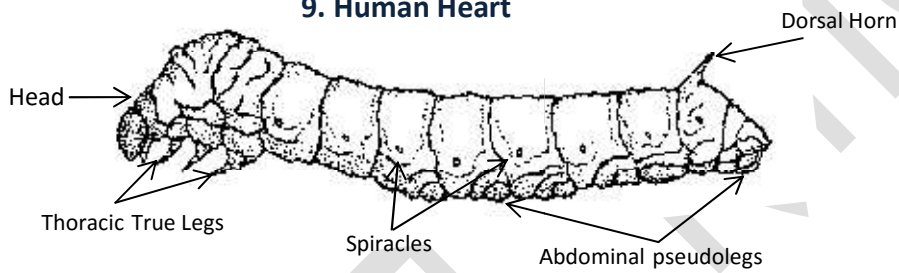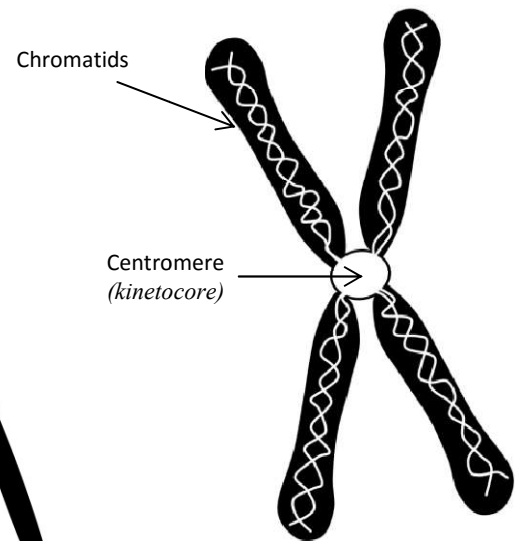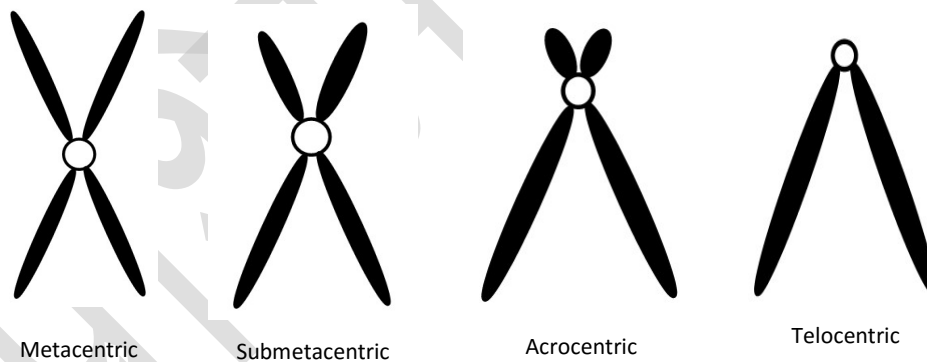8. Blood Vessels

9. Human Heart
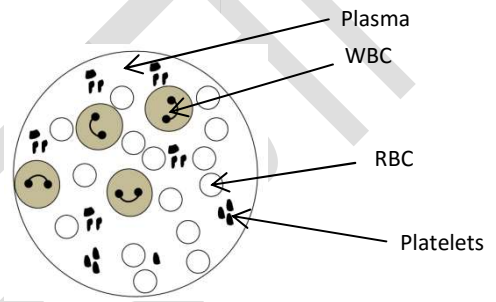
10. Blood

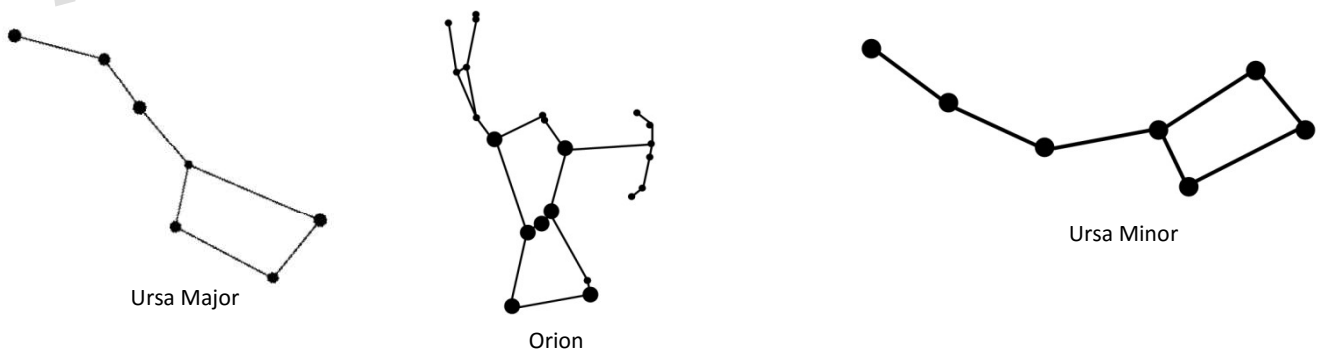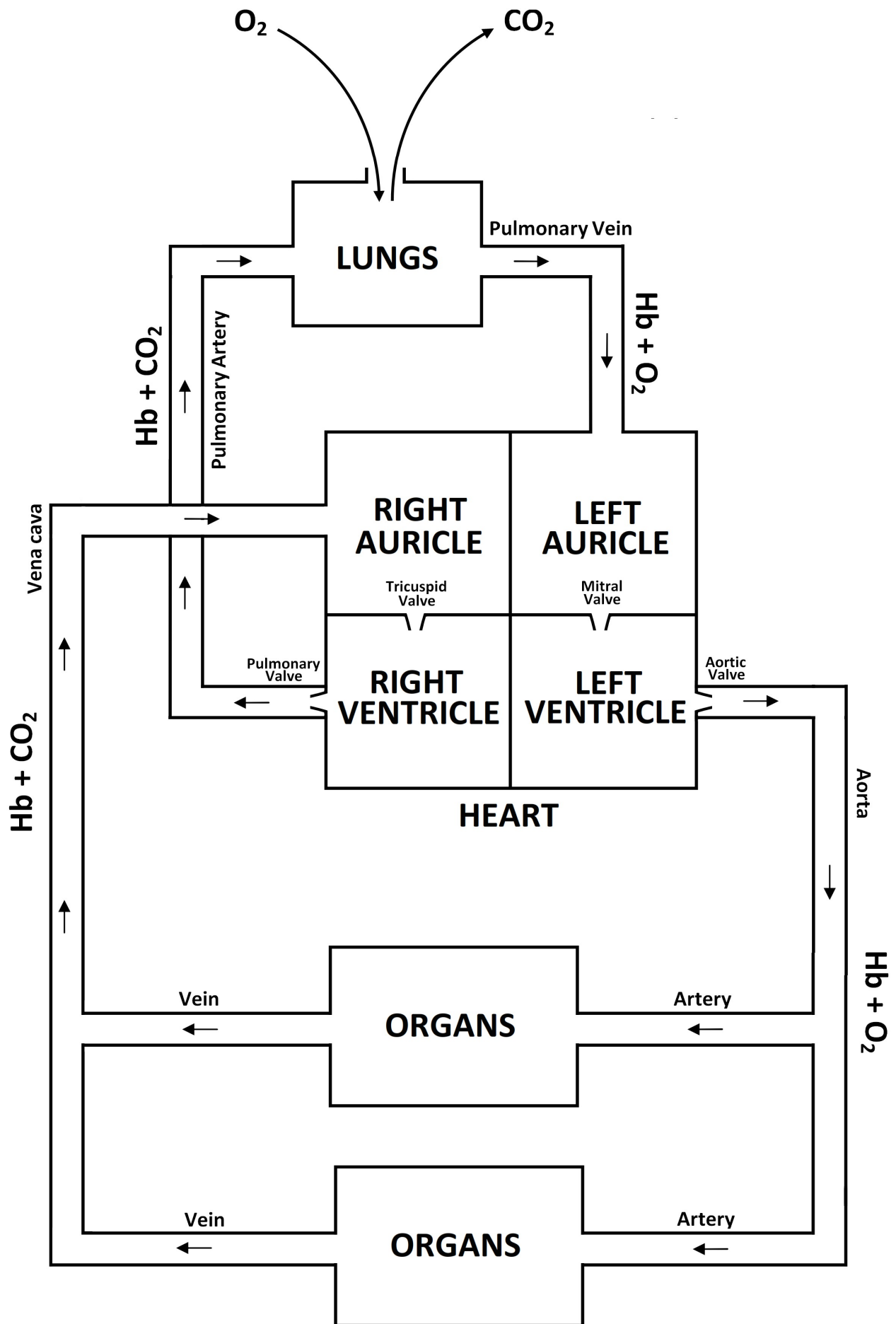11. Silkworm Larva / Caterpillar

12. Chromosome

Metacentric   Submetacentric   Acrocentric   Telocentric

13. Structure of 4 Different Types of Chromosomes

Ursa Major

Orion

Ursa Minor

14. Structure of Some Constellations

15. Blood Circulation Process in Human Beings

The diagram shows:

O₂ → LUNGS → CO₂

- **LUNGS**
- Pulmonary Vein
- Pulmonary Artery
- Hb + CO₂
- Hb + O₂
- Vena cava
- Hb + CO₂

HEART
- RIGHT AURICLE
- LEFT AURICLE
- Tricuspid Valve
- Mitral Valve
- Pulmonary Valve
- Aortic Valve
- RIGHT VENTRICLE
- LEFT VENTRICLE
- Aorta
- Hb + O₂

- Vein — ORGANS — Artery
- Vein — ORGANS — Artery

SOME IMORTANT VALUES

- Gravitational Constant (G) → 6.67×10^{-11} Nm^2/kg^2
- Average acceleration due to gravity of Earth (g) → 9.8 m/s^2
- Acceleration due to gravity at Pole → 9.83 m/s^2
- Acceleration due to gravity at Equator → 9.78 m/s^2
- Acceleration due to gravity of Moon (g) → 1.67 m/s^2
- Acceleration due to gravity of Jupiter (g) → 25 m/s^2
- g of Moon → $\frac{1}{6} \times g$ of Earth
- Mass of Earth → 6×10^{24} kg
- Radius of Earth → 6.38×10^6 m
- Density of Water → 1000 kg/m^3 *(1 gm/cm³)*
- Standard Atmospheric Pressure → 760 mmHg *(10^5 Pa)*
- Solar Energy Radiation → 4×10^{26} J/s
- Average Solar Radiation in Earth → 1.4 KW/m^2
- Surface Temperature of Sun → 5700 ^{0}C
- Core Temperature of Sun → 1.5×10^7 ^{0}C
- Boiling Point of Mercury → 357 ^{0}C
- Melting Point of Mercury → -39 ^{0}C
- Boiling point of Alcohol → 78 ^{0}C
- Melting point of Alcohol → -117 ^{0}C
- Scale in Laboratory Thermometer → -10 ^{0}C to 110 ^{0}C
- Scale in Clinical Thermometer → 35^{0}C to 42^{0}C *(94⁰F to 108⁰F)*
- Normal human Body Temperature → 37 ^{0}C or 98.6 ^{0}F
- Specific heat capacity of Water → 4200 J/kg^{0}C
- Farthest point for Normal eye → Infinity (∞)
- Nearest point for Normal Eye → 25 cm
- Melting point of Tungsten → 3400 ^{0}C
- Glowing temperature of Filament → 2900 ^{0}C
- Energy conversion of Filament → 90% Heat & 10% Light
- Energy conversion of Florescent → 70% Heat & 30% Light
- Life span of Filament Lamp → 1000 Hours
- Life Span of Fluorescent Lamp → 3000 Hours
- Normal Domestic Voltage → 220 V
- 1 Unit Electric Consumption → 1 KWh → 3.6×10^6 J
- No. of Lanthanides Elements → 14
- No. of Actinides Elements → 14
- Diatomic Elements → H, N, O, F, Cl, Br, I
- Alkali Metals → Li, Na, K
- Alkaline Earth Metals → Be, Mg, Ca
- Halogens → F, Cl, Br, I
- Non-Metals → H, He, B, C, N, O, F, Ne, P, S, Cl, Ar
- Metalloids → Si, Ge, As
- Noble Gas → He, Ne, Ar, Xe
- Molecular Weight of CO_2 → 44 amu
- Volume of CO_2 in Atmosphere → 0.03%
- Temperature of frozen CO_2 (Dry Ice) → -78 ^{0}C
- Molecular Weight of NH_3 → 17 amu
- No of Cranial Nerve Tissue → 12 pairs
- No. of Spinal Nerve Tissue → 31 Pairs
- Blood in Adult Human → 5.5 Liters
- Blood → 45% Blood Cells + 55% Plasma
- Plasma → 90% Water + 10% Others
- Life Span of RBC → 90 to 120 Days
- Life Span of WBC → About 2 Weeks
- Life Span of Platelets → 2 to 3 Days

- Normal Blood Pressure → 120/80 mmHg

Species	No. of Chromosomes
Human	46
House Fly	12
Frog	26
Gorilla	48
Solanum	48
Onion	16
Pinus	24
Mucor	2
Honey Bee	32

- Troposphere → Surface to 16 km
- Stratosphere → 16 km to 50 km
- Mesosphere → 50 km to 80 km
- Thermosphere → 80 km to 720 km
- Exosphere → 720 km above
- Ozone layer → 25 km to 40 km
- Estimate Age of Earth → 4.5 Billion Years
- Distance Between Sun and Earth → 1.5×10^{11} m
- Temperature of Venus → 480 ^{0}C
- Halley Comet's 1 revolution → 76 Years
- Speed of Solar Wind → 500 km/sec
- No. of Constellation in Sky → 88
- Zodiac Constellation → 12
- No. of Stars in Milky Way → About 10^{11}
- Geostationary Orbit → 36900 km above the earth's surface

- Preparation of Coloured Glass

SN	Colour Imparted	Metallic Oxide
1	Blue	Cobalt oxide
2	Black	Nickel oxide
3	Green	Chromium oxide
4	Purple	Manganese oxide
5	Yellow / Brown	Ferric oxide
6	Red	Cuprous oxide
7	White	Tin oxide

- Electronic configuration of Iron (Fe-26) → $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^6, 4s^2$
- Electronic configuration of Aluminum (Al-13) → $1s^2, 2s^2 2p^6, 3s^2 3p^1$
- Electronic configuration of Copper (Cu-29) → $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^{10}, 4s^1$
- Electronic configuration of Silver (Ag-47) → $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^{10}, 4s^2 4p^6 4d^{10}, 5s^1$
- Electronic configuration of Gold (Au-79) → $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^{10}, 4s^2 4p^6 4d^{10} 4f^{14}, 5s^1 5p^6 5d^{10}, 6s^1$

SOME IMPORTANT TERMS

FORCE

- **Heliocentric Model** = Sun at the centre of the Universe
- **Geocentric Model** = Earth at the centre of the Universe
- **Buoyancy Force =** Upward pushing force of fluid/air

PRESSURE

- **Eureka Can** = A special type of vessel used to prove the Archimedes Principle
- **Barometer** = A Device used to measure atmospheric pressure
- **Syringe** = An Instrument used to inject the medicine into the body or used to take out the blood from body
- **Hydraulic Press** = A device which works on Pascal's Law for the magnification of output force
- **Up stroke** = Up stroke of the piston is the condition in which the piston is pulled up when the handle of the water pump is push down
- **Down Stroke** = Down stroke of the piston is the condition in which the piston is pushed down when the handle of the water pump is lifted up

ENERGY

- **Ethyl mercaptan** = A substance which is used to detect the leakage of natural gas
- **Anthracite** = A high quality coal
- **Lignite =** A low quality coal
- **Crude Oil** = Raw petroleum fluid
- **$E=mc^2$** → Einstein's famous mass energy equivalence equation
- **Nuclear fusion** = Two lighter nuclei fusing to form a heavy nucleus
- **Nuclear fusion** = A heavy nucleus splitting into lighter nuclei
- **Capillary Tube** = A small narrow tube inside the thermometer through which the thermometric substance can move while heating
- **Constriction** = A part in thermometer which is made to stop the immediate falling back of mercury into the bulb
- **Principle of Calorimetry** = Heat lose by a body is equal to the heat gain by its surroundings

LIGHT

- **Optical instrument** = Device which works using the ray of light
- **Biconvex Lens** = Lens having convex surface in its both sides
- **Plano Convex Lens** = Lens having one side convex and other side as plane
- **Concavo Convex Lens** = A concavo-convex lens is a lens in which the convex face has a smaller curvature than the concave face

- **Biconcave Lens** = Lens having concave surface in both side
- **Plano Concave Lens** = Lens having one side concave and other side as plane
- **Convexo Concave Lens** = A convexo-concave lens is a lens in which the concave face has a smaller curvature than the convex face
- **Optical Centre** = The middle point inside the Lens.
- **Focal Point** = Point at which a lens converses the ray of light
- **Focal Length** = Distance from optical centre to focal length
- **Power of Lens** = Reciprocal of Focal Length of a Lens
- **Diopter** = SI unit of Power of Lens
- **Myopia** = Short Sightedness
- **Hypermyopia** = Long Sightedness
- **Cornea** = A transparent layer of eye in front of eye lens
- **Conjunctiva =** A transparent membrane that covers the Cornea

ELECTRICITY AND MAGNETISM

- **Tungsten** = A metal which is used as lighting element in filament lamp
- **Inverter** = A device which can change AC to DC and DC to AC
- **Enamel** = A substance which is used to insulate the transformer wires
- **Varnish/Shellac** = A substance which is used to insulate the core of the transformer
- **Eddy Current** = An unnecessary current developed inside the core of transformer
- **1 KWh** = Electric consumption of 1 KW electric device for 1 hour

CLASSIFICATION OF ELEMENTS

- **Lanthanides** = Elements from atomic no. 58 to 71 (in f-block)
- **Actinides** = Elements from atomic no. 90 to 103 (in f-block)
- **Alkali Metals** = Group IA elements
- **Alkaline Earth Metals** = Group IIA elements
- **Halogens** = Group VIIA elements
- **Nobel gas/Inert gas** = Group 0 elements
- **Transitional Metal** = d-block elements
- **Duplet** = Having 2 electrons in K-shell
- **Octet** = Having 8 electrons in valance cell

CHEMICAL REACTION

- **Endothermic Reaction** = The chemical reaction which requires heat to initiate the reaction
- **Exothermic Reaction** = The chemical reaction which evolve heat during reaction

ACID, BASE AND SALT

- **Organic Acid** = Acid that found in living organism (Citric acid, Acetic acid, Lactic acid, Vinegar, etc.)
- **Mineral (Inorganic) Acid** = Acid that can prepare in laboratory (HCl, H_2SO_4, HNO_3, H_2CO_3, etc)
- **Metallic radical** = Basic radical
- **Non-metallic radical** = Acid radical
- **Strong Acid/Base** = Acid/Base which goes in complete ionization
- **Weak Acid/Base** = Acid/Base which goes in partial ionization
- **Alkali** = Water soluble bases
- **Neutral Salt** = (Strong Acid + Strong Base) or (Weak Acid + Weak Base)
- **Acidic Salt** = (Strong Acid + Weak Base)
- **Basic Salt** = (Strong Base + Weak Acid)
- **Hydrated Salt** = The salt whose molecules is attached with certain water molecules

SOME GASES

- **Dry ice** = Frozen CO_2 gas (-78^0C)
- **Carbogen** = Mixture of O_2 and CO_2 which is used to give artificial respiration for a patient
- **Carbonation** = The chemical reaction of carbon dioxide to give carbonates, bicarbonates, and carbonic acid
- **Haber's Process** = Large scale manufacturing process of NH_3

METAL

- **Mixed Metal** = Brass (Copper + Zinc), Bronze (Copper + Tin + Zinc), Silver amalgam (Silver + Tin + Mercury)
- **Metallurgy** = Process of extracting metal
- **Ore** = Natural minerals from which a metal can be extracted
- **Coinage Metal** = Group IB (coin minting metals)
- **Gold Leaf Electroscope** = Electric charge detecting device

HYDROCARBONS AND ITS COMPOUNDS

- **Paraffin** = Alkanes (Less Reactive)
- **Olefins** = Alkenes (Makes Oily substance with Halogens)
- **Acetylenes** = Alkynes(First Member of Alkynes Series)
- **Homologues Series** = Group of hydrocarbons which we can represent by same general formula
- **Homologue** = Each member in Homologous Series
- **Nomenclature** = The process of naming a hydrocarbons and its compounds
- **Marsh gas** = Methane (Available in Marshy Places)
- **Ethanol** = C_2H_5OH (An alcohol used to prepare hard drinks)
- **Monohydric Alcohol** = An alcohol which has only one OH group
- **Dihydric Alcohol** = An alcohol which has two OH group

- **Trihydric Alcohol** = An alcohol which has three OH group
- **Glycerol/Glycerin** = $C_3H_5(OH)_3$ (A trihydric alcohol)
- **IUPAC Name of Glycerol** = propane-1,2,3-triol
- **Glycol** = $C_2H_4(OH)_2$ (A dihydric alcohol)
- **IUPAC Name of Glycol** = ethane-1,2-diol
- **Dextrose** = Glucose ($C_6H_{12}O_6$)
- **ATP** = Energy carrying molecules in living cells

MATERIALS USED IN DIALY LIFE

- **$Al_2O_3 \cdot SiO_2$** = A special type of clay use to manufacture cement
- **Slurry** = A paste of $CaCO_3$ and $Al_2O_3 \cdot SiO_2$
- **Gypsum** = A substance which is used in manufacturing of cement to increase the setting time of the cement
- **Mortar** = The mixture of Cement, Sand and Water
- **Annealing** = The process of cooling down of just made hot glass vessel
- **Silica Glass** = Silica (SiO_2)
- **Water Glass** = $SiO_2 + K_2CO_3$ or Na_2CO_3
- **Potash Lime Glass/Hard Glass** = $SiO_2 + K_2CO_3 + CaCO_3$
- **Ordinary Glass/Soft Glass** = $SiO_2 + Na_2CO_3 + CaCO_3$
  Borosilicate Glass/Pyrex Glass = $SiO_2 + Na_2CO_3 + CaCO_3 + B_2O_3$
- **Lead Crystal Glass/Flute Glass** = $SiO_2 + K_2CO_3 + PbO$
- **Kaolin** = A clay used to prepare whitish ceramics
- **Polymerization** = Process of making polymers from monomers
- **Thermosetting Plastic** = Plastic which shape cannot be changed on heating but becomes more stronger
- **Thermosplastic** = Those plastics which shape can be changed on heating
- **Saponification** = The process of making soap from animal fats or vegetable oil with sodium hydroxide (NaOH)
- **Soapless Soap** = Detergents (It not a true soap as sodium salt of animal fat or vegetable oil but used as cleaning agent like soap)
- **Scum** = An insoluble dirty layer formed in water when a soap is used in hard water
- **Aldrin/ Dialdrin/ DDT/ BHC/ Methoxy Chloride** = Insecticides

INVERTEBRATE

- **Bombyx mori** = Seri silkworm (Feeds on Mulberry Leaves)
- **Attacus ricini** = Eri Silkworm (Feeds on Cluster Leaves)
- **Cocoon** = Pupa stage of Silkworm
- **Sericulture** = Commercial cultivation of silkworm
- **Nuptial Flight** = The mating flight of queen bee with drone bee outside the hive
- **Royal Jelly** = A nutritious food of Honey Bee
- **Apiculture** = Commercial cultivation of honey bee

- **Metamorphism** = The developing process of honeybee or silkworm from egg to an adult

HUMAN NERVOUS AND GLANDULAR SYSTEM
- **Cardiospinal Fluid** = A fluid present in Meninges which protect the brain from external injuries
- **Coma** = A disease due to injury in Cerebrum which takes a person into a deep sleep.
- **Ganglia** = The group of small nerve tissue made from grey matter which helps in communication between brain and spinal chord
- **Goiter** = Swelling of thyroid gland due to lack of iodine
- **Tetany** = Spasm of Muscles due to lack of Parathyroid Hormone
- **Cortisone** = A hormone from adrenal gland that sometimes also function as sex hormone
- **Nerve impulse** = an electric signal which carries an information through nerve cell

BLOOD CIRCULATION IN HUMAN BODY
- **Fibrinogen** = A component in plasma that helps in blood clotting along with platelets
- **Erythrocytes** = Red Blood Cells (RBC)
- **Leukocytes** = White Blood Cells (WBC)
- **Thrombocytes** = Platelets
- **Anemia** = A disease due to lack of RBC in body
- **Lukemia** = A disease due to excessive WBC in body (blood cancer)
- **Haemophilia** = A disease due to lack of platelets
- **Oxyhaemoglobin** = Oxygen carrying blood
- **Pericardium** = The two layered outermost cover on heart
- **Pericardial Fluid** = A fluid in pericardium which protects the heart from external injury
- **Sphygmomanometer** = A instrument used to measure the human blood pressure
- **Arterial Pressure** = Systolic Pressure
- **Systolic pressure** = Maximum pressure in blood vessels during heart contraction
- **Diastolic Pressure** = Minimum pressure in blood vessels during heart relaxation

CHROMOSOME AND SEX DETERMINATION
- **Kinetochore** = Centromere of Chromosome
- **Chromatids** = Arms of Chromosomes
- **Chromatic Reticulum** = Fine threads like networks in chromosomes
- **Sex Linked Disease** = Disease transfer by chromosomes
- **Somatic cell** = Any cell other than reproductive cells
- **Gametes** = Reproductive cells
- **Aneuploidy** = Change is number of chromosome during cell division
- **Maternal Chromosome** = Chromosome coming from mother

- **Paternal Chromosome** = Chromosome coming from father
- **Autosomes** = Any chromosomes in gametes other than sex chromosomes
- **Trisomy 21** → Cause of Down's Syndrome (45+XX) or (45+XY)
- **Karyotype** = (44+XXY) → Cause of Klinefelter's Syndrome
- **Monosomy** = (44+X0) → Cause of Turner's Syndrome

ASEXUAL AND SEXUAL REPRODUCTION
- **Unisexual** = An organism having only male and female organs in one individual
- **Bisexual/Hermaphrodite** = An organism having both male and female organs in one individual
- **Scion** = A small shoot of plant which is join with stock in grafting
- **Stock** = The part of plant in grafting which has root and in which the scion is joined.
- **Auxin** = A plant hormone which helps to grow the root of plant in tissue culture
- **Cytokinin** = A plant hormone which helps to grow the shoot of plant in tissue culture
- **Monohybrid Cross =** Cross pollination between same plant species having only one different contrasting character.
- **Dihybrid Cross =** Cross pollination between same plant species having two different contrasting character.

HEREDITY
- **Phenotype** = Physical difference in organism
- **Genotype** = Genetic Difference in organism

ENVIRONMENTAL POLLUTION AND MANAGEMENT
- **DDT, BHC, Aldrin, Dialdrin** = insecticides
- **Tropopause** = Uppermost layer of troposphere
- **Stratopause** = Uppermost layer of stratosphere
- **Mesopause** Uppermost layer of mesosphere
- **Thermopause** = Uppermost layer of thermosphere
- **Changeable layer** = Troposphere
- **Ozonosphere** = Stratosphere
- **Ionosphere** = Thermosphere
- **Fringe region** = Exosphere

HISTORY OF ERATH
- **George Buffon's Hypothesis** = Planetesimal Hypothesis
- **James and Jeffrey Hypothesis** = Tidal Hypothesis
- **Kant-Laplace Hypothesis** = Nebular Hypothesis
- **Red Planet** = Mars (Due to presence of Limonite)
- **Hurricane** = A heavy storm
- **Eon** = Largest unit in geographical time scale
- **Epoch** = Smallest unit in geographical time scale

FORMULAE

1. FORCE

(a) Force (F) = m × a

(b) Gravitational (F) = $G\dfrac{m_1 m_2}{d^2}$

(c) Acceleration due to gravity (g) = $\dfrac{GM}{R^2}$

(d) Acceleration due to gravity at a certain height (g·) = $\dfrac{GM}{(R+h)^2}$

(e) Relation between acceleration due to gravity at different height in earth: $\dfrac{g_1}{g_2} = \dfrac{d_2{}^2}{d_1{}^2}$

(f) Relation between weights at different height in earth: $\dfrac{W_1}{W_2} = \dfrac{d_2{}^2}{d_1{}^2}$

(g) Gravity (F) = $G\dfrac{Mm}{R^2}$ = m×g

(h) Weight (W) = m×g

2. PRESSURE

(a) Pascal's law: $\dfrac{F_1}{A_1} = \dfrac{F_2}{A_2}$

(b) Upthrust = Weight of body in air − Weight of body water
   = Weight of displaced water

(c) Weight of floating body = Weight of displaced water

(d) Portion of a floating body above the water surface = $\dfrac{\text{Volume of Displaced Water}}{\text{Volume of Floating Body}}$

3. ENERGY

(a) Energy produced from lost in mass (E) = mc^2

4. HEAT

(a) Heat Loss or Gain (Q) = m·s·Δt

(b) Principle of Calorimetry: Heat Loss (Q_1) = Heat Gain (Q_2)

   or, $m_1 \cdot s_1 \cdot \Delta t_1 = m_2 \cdot s_2 \cdot \Delta t_2$

(c) Heat energy of heater (Q) = Power (P) × Time (t)

5. LIGHT

(a) Power of Lens (P) = $\dfrac{1}{\text{Focal Length (f)}}$

(b) Magnification of Lens (M) = $\dfrac{\text{Image Size (I)}}{\text{Object Size (O)}} = \dfrac{\text{Image Distance (v)}}{\text{Object Distance (u)}}$

(C) Relation between focal length, object distance and image distance: $\dfrac{1}{f} = \dfrac{1}{u} + \dfrac{1}{v}$

6. ELECTRICITY AND MAGNETISM

(a) Voltage conversion in transformer: $\dfrac{\text{Primary Voltage }(V_1)}{\text{Secondary Voltage }(V_2)} = \dfrac{\text{Primary Turns }(n_1)}{\text{Secondary Turns }(n_2)}$

(b) Capacity of Fuse (I) = $\dfrac{P}{V}$

(c) Electric consumption (EC) = P × N × T