Subject: Science **Class – VIII**

FORCE AND PRESSURE

Force: It is defined as an external influence which tends to set a stationary body in motion or tends to change the speed and direction of a moving body or which tends to make the moving body to come to rest. Force is a vector quantity with magnitude as well as direction. The S.I. unit of force is 'Newton'.

Unit of force: The S.I. unit of force is Newton, and is defined as the force requiredtoproducean acceleration of 1 m/s^2 in a body of mass 1 kilogram.

i.e. 1 Newton = 1 kg x 1 m/s^2 or $1N = 1\ kgm/s^2$ ……

From the unit of force, it is clear that force is the product of mass and acceleration.

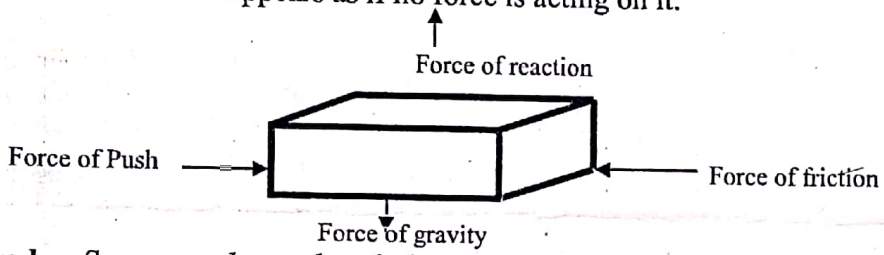
i.e. Force = Mass x Acceleration

$F = m \times a$

Effects of Force: Some of the important effects of force are.

i. A force can change the state of motion of a body. i.e, it can make a stationary body to move and increase or decrease the speed of a moving body.
ii. It can change the direction of motion of a moving body.
iii. It can change the shape and size of a body.

Balanced Forces: When the resultant of all the forces acting on a body is zero, then the forces are said to be *balanced forces*. A body under balanced forces does not change position of rest or of uniform motion and it appears as if no force is acting on it.



Example: Suppose a heavy box is lying on the ground.When we push it, it will not move though four forces are acting on it, i.e. the force of our push, force of gravity, force of friction and force of reaction. Since the four forces are acting on the box and it does not move at all, this shows that the resultant of all forces acting on it is zero. Therefore, the box behaves as if no force is acting on it. Thus the forces acting on the stationary box are balanced forces.

Unbalanced force: When the resultant of all the forces acting on an object is not zero, then the forces are called as unbalanced forces. When unbalanced forces act on a body, they produce a change in its state of rest or of uniform motion.

Example:Suppose a toy car is lying on the ground. When we push it, it will move. There are four forces acting on it. i.e. force of our push, force of friction, force of gravity and the force of reaction of ground. In this case, the force of gravity on the car and the force of reaction of the ground are equal and opposite,so, they balance each other. But the force of our push is however greater than the force of friction. So, they do not balance each other. Thus, the resultant of all forces acting on the toy car is not zero and therefore the forces are unbalanced.

Contact force: Forces which act on a body directly or through a connector are called contact forces. If a body A is in contact with another body B, then A can exert a force on B and B can exert a force on A. These forces are called as contact forces. The different types of contact forces are muscular force, mechanical force, frictional force and collision force etc.

Muscular force: The force resulting due to the action of muscles is known as muscular force. The forces applied in the act of pushing, pulling or lifting things around us are muscular forces.

Collision force: When two objects collide with each other, the contact force that comes into play is known as collision force. e.g. Force of collision between a bus and a car is a contact force.

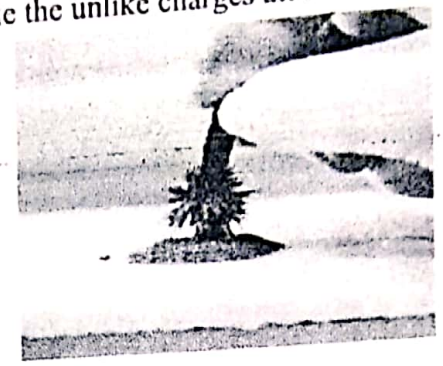
Mechanical force: If the force is generated by the machines to make a body move, it is called a *mechanical force*.

Frictional force: When a body slides over a rough surface, the force that acts on the body parallel to the surface in direction opposite to the motion of the body, this force is called the *frictional force*.

Non-contact Forces: The forces which act on bodies without being physically touched are called the non contact forces. These forces act from a distance on an object and are also known as *action- at- a-distance force.*

Gravitational force: It is the force of attraction between particles of matter. Every object exerts this force on every other object. The magnitude of the force depends on the masses of the two objects and the distance between them.**The gravitational force exerted by the earth on all other bodies is called the force of gravity or simply gravity.**

Electrostatic force: The force with which the electrically charged body can attracts or repels the other objects is called electrostatic force. Two like charges repel while the unlike charges attract each other. Force of attraction produced by a comb when rubbed with hair attracts the bits of paper.



Magnetic force: The force exerted by magnets on each other and on some metals like iron, nickel, cobalt and alloys such as steel etc. is known as magnetic force. E.g. a bar magnet pulls iron filings towards itself.

Friction: Friction is a force that opposes the motion or tendency of motion between two surfaces in contact with each other.

Advantages of friction:-

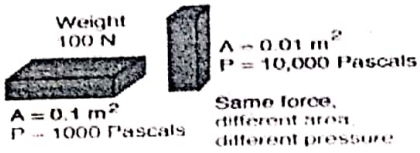
1) Safe walking on the floor, motion of vehicle etc. are possible due to friction.
2) It is the force of friction,which holds the screws and nails in the wood.
3) Writing with pens, pencils, holding objects (things) with hands etc. is possible due to friction.
4) A match stick is lightened due to friction.

Disadvantages of friction:-

1) Energy is wasted in overcoming the force of friction.
2) Friction causes wear and tear of the parts that rub each other.
3) The large amount of power loss in engines isdue to friction.
4) Friction reduces the speed of a moving object.

Pressure: Pressure is the defined as the force per unit area applied in a direction perpendicular to the surface of an object. Pressure is an effect which occurs when a force is applied on a surface. The standard unit for pressure is the Pascal, which is a Newton per square meter.

$$Pressure = \frac{Force}{Area} = \frac{F}{A}$$



Unit of pressure: In S.I. system, force is measured in Newton and area in square meter. Therefore, S.I. Unit for pressure is the Pascal (Pa), equal to one Newton per square meter (N/m^2 or $kg{\cdot}m^{-1}{\cdot}s^{-2}$). One Pascal is defined as the force of one Newton applied on an area of one square meter. i.e. 1 Pa = 1 N/m^2. The total force acting on a given surface is known as thrust.

$$\therefore \quad \textbf{Pressure} = \frac{\textbf{thrust}}{\textbf{area}}$$

Pascal's law: Pascal's law states that if pressure is applied at any point in a liquid, it is transmitted equally throughout the liquid. For example when the cork of a bottle filled with water is pushed down, pressure is applied on the water in the bottle. This pressure is equally transmitted throughout the liquid and thus the walls of the bottle are pushed from inside by the liquid. Under extreme, pressure, the glass breaks and the bottle explodes.

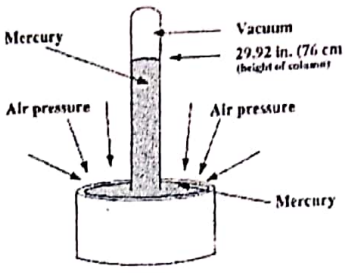
Atmospheric pressure: The atmosphere is the layer of air around the earth. It extends up to 1000 km above the surface of the earth and has a total weight of 4.5×10^{18} kg (i.e., five million billion tons). This weight exerts a pressure on the surface of the earth which is called atmospheric pressure. Barometer is a device used to measure the atmospheric pressure or air pressure. Atmospheric pressure or air pressure is also called Barometric pressure. Evangelista Torricelli invented the mercury barometer.At sea level it is about 10^5 Pa. We do not normally feel the large atmospheric pressure because the pressure inside our bodies is almost the same as the external pressure and so it is balanced.At high altitudes the air pressure is less, therefore the breathing is difficult and nose

bleeding may occur. Hence, modern aircrafts have pressurised cabins in which air pressure is increased sufficiently to safeguard the passengers and the crew.

Vacuum: A vacuum is the volume of space that is essentially empty of matter, so that gaseous pressure is much less than standard atmospheric pressure or simply "free space". To create such free space/empty matter having pressure less than atmospheric pressure needs a device which is called vacuum pump. A vacuum pump is used to remove gas molecules from a sealed volume in order to leave behind a partial vacuum.

Mercury Barometer: A simple barometer can be prepared in the following manner:

Take a hard glass tube about 1m long. Fill the tube completely with clean dry mercury. Close the one end of the tube with your thumb and invert it over a trough filled with mercury, with the open end of the tube dipping into mercury. Remove your thumb only when the open end of the tube is well immersed into the mercury in the trough. Hold the tube in the vertical position by fixing it to a stand. On removing the thumb, you find that some mercury from the tube flows into the trough. The mercury column now stands up to a height of 760 mm above the mercury surface in the trough.He (Evangelista Torricelli) explained that the column of mercury was supported in the tube by the atmospheric pressure acting on the surface of the mercury in the trough. Thus, the atmospheric pressure can be 'indirectly' measured by the column of mercury it can support. Therefore, the atmospheric pressure of 760 mm at a place implies that its magnitude is such that it supports a column of mercury 760 mm (76 cm)long.



Mercury Barometer

Atmospheric pressure is measured with a barometer. Evangelista Torricelli constructed the first mercury barometer in 1643. In a barometer the atmospheric pressure is balanced by a column of mercury. Normal atmospheric pressure at sea level is 760 mm or

Textual questions:

Q1. Give two examples each of situation in which you push or pull to change the state of motion of objects.

Ans.Two examples of push force are as follows:

(i) The football player kicks the moving football to change its direction.

(ii) A goalkeeper saving a goal.

Two examples of pull force are as follows:

(i) Rope is pulled to draw water from a well. This changes the state of motion of the water bucket.

(ii) A boy pulling a toy car.

Q2. Give two examples of situations in which applied force causes a change in the shape of an object.

Ans. Two examples of forces that cause a change in the shape of an object are as follows:

(i) Squeezing of a plastic bottle changes the shape of the bottle.

(ii) Deformation of clay by pressing it between the hands.

Q3. Fill in the blanks:

a) To draw water from a well we have to __pull__ at the rope.

b) A charged body __attracts__ an uncharged body towards it.

c) To move a loaded trolley we have to __either push or pull__ it.

d) The north pole of a magnet __repels__ the north pole of another magnet.

Q4. An archer stretches her bow while taking aim at the target. She then releases the arrow, which begins to move towards the target. Based on this information fill up the gaps in the following statements using the follow terms.

muscular, contact, non-contact, gravity, friction, shape, attraction

a) To stretch the bow, the archer applies a force that causes a change in its __shape__.

b) The force applied by the archer to stretch the bow is an example of __muscular__ force.

c) The type of force responsible for a change in the state of motion of the arrow is an example of a __contact__ force.

d) While the arrow moves towards its target, the forces acting on it are due to __gravity__ and that due to __friction__ of air.

Q5. In the following situations identify the agent exerting the force and the object on which it acts. State the effect of the force in each case.

(a) Squeezing a piece of lemon between the fingers to extract its juice.
(b) Taking out paste from a toothpaste tube.
(c) A load suspended from a spring while its other end is on a hook fixed to a wall.
(d) An athlete making a high jump to clear the bar at a certain height.

Ans:

Situation	Agent	Object	Effect
(a) Squeezing a piece of lemon between the fingers to extract its juice.	**Fingers**	**Lemon**	**The effect of the force is that the juice is extracted from the lemon.**
(b) Taking out paste from a toothpaste tube.	**Fingers**	**Toothpaste Tube**	**The effect of the force is that the toothpaste is coming out from the tube.**
(c) A load suspended from a spring while its other end is on a hook fixed to a wall.	**Load**	**Spring**	**The effect of the force is that the spring expands as the other end is on a hook fixed to a wall.**
(d) An athlete making a high jump to clear the bar at a certain height.	**Athlete**	**Athlete's Body**	**The effect of the body is that the athlete will jump on the other side of the bar at a certain height.**

Q6. A blacksmith hammers a hot piece of iron while making a tool. How does the force due to hammering affect the piece of iron?

Ans. The force applied due to hammering causes the change in shape of iron and iron can be moulded in the shape of the required tool.

Q7. An inflated balloon was pressed against a wall after it has been rubbed with a piece of synthetic cloth. It was found that the balloon sticks to the wall. What force might be responsible for the attraction between the balloon and the wall?

Ans. The force which is responsible for the attraction between the balloon and the wall is electrostatic force. When we rub the balloon by a synthetic cloth, it gets charged. When it is taken near the wall, it will get attracted towards the uncharged wall because of the electrostatic force which is the force exerted by a charged body on another uncharged body.

Q8. Name the forces acting on a plastic bucket containing water held above ground level in your hand. Discuss why the forces acting on the bucket do not bring a change in its state of motion.

Ans. We make use of muscular force to hold a bucket of water above the ground. This muscular force acts against the force of gravity that pulls the bucket towards the ground. The two forces are equal in magnitude but opposite in direction. Therefore, the net force on the bucket is zero. Hence, there is no change in its state of motion.

Q9. A rocket has been fired upward to launch a satellite in its orbit. Name the two forces acting on the rocket immediately after leaving the launching pad.

Ans. The two forces acting on the rocket are the force of gravity, which pulls the rocket towards the ground, and the force of friction due to earth's atmosphere, which opposes its motion.

Q10. When we press the blub of a dropper with its nozzle kept in water, air in the dropper is seen to escape in the form of bubbles. Once we release the pressure on the bulb, water gets filled in the dropper. The rise in the dropper is due to

(a) Pressure of water
(b) Gravity of the earth
(c) Shape of rubber bulb
(d) Atmospheric pressure

Ans.(d) The rise of water in the dropper is due to **atmospheric pressure.**

MATERIALS: METAL AND NON-METALS

Metals: Metals are defined as the elements which loose the electrons from their outermost shell to form the positive ions i.e they are electropositive elements. The electropositive behaviour of metals is due to low ionisation energies. It is this electropositive behaviour of metals which produces their characteristic chemical properties.

For example: Sodium is a metal with atomic number 11, i.e. it has 11 electrons revolving around its nucleus with the following electronic configuration 2, 8, 1 with only one electron in its outermost shell which it will donate to some other element to form the positive sodium ion.

i.e. $Na \longrightarrow Na^{+} + e^{-}$

(2, 8, 1) (2, 8) (Electron)

Some examples of metals are sodium(Na), Potassium(K), Magnesium(Mg), Calcium(Ca), Aluminium(Al), Copper(Cu), Gold(Au), Silver(Ag) etc.

Physical properties of metals: The important physical properties of the metals are:

i. Metals in their pure state possess shiny surface known as metallic lustre. Most of the metals lose their brightness when exposed to air for a long time and acquire dullness due to corrosion. It is the shiny appearance that makes metals good reflectors of light.

ii. Metals are highly malleable, i.e. metals can be drawn into sheets when beaten (hammered) without breaking. Gold and silver are the best malleable metals.

iii. Metals are highly ductile, i.e. metals can be drawn into thin wires. All metals are not equally ductile Silver is one of the most ductile metal.

iv. Metals are good conductors of heat, i.e. metals can allow heat to pass through them. Silver is the best conductor of heat. The poorest conductor of heat among the metals is lead.

v. Metals are good conductors of electricity, i.e. metals allow the electric current to pass through them and offer less resistance to the flow of current. Silver and copper are the best electrical conductors.

vi. Metals are solid at room temperature. The only exception is mercury. Gallium also has melting point (30°C) at the room temperature. It melts when held in the hand.

vii. Metals possess high tensile strength that is metals can be bent to a very large extent and heavy weights can be suspended from metallic wires without breaking the wire.

viii. Metals possess high densities. Most of the metals possess densities greater than 5 g cm^{-3}. Among metals Osmium is the heaviest metal with a density of 22 g cm^{-3} and Lithium is the lightest metal with a density0.5 gcm^{-3}.

ix. Most of the metals are hard except some alkali metals like sodium and potassium which can be cut easily with a knife.

x. All metals possess high melting and boiling points except mercury, gallium and alkali metals. Among metals, tungsten has the highest and mercury has the lowest melting point.

xi. Metals form homogenous mixtures with each other and also with non- metals to form alloys, e.g. Brass is an alloy of copper and zinc.

xii. Metals are generally sonorous, i.e. metals produce sound when hit with some other solid objects.

xiii. Metals usually have a silver or grey colour except copper and gold which have reddish brown and yellowish colour respectively.

Chemical properties of metals: some of the important chemical properties of metals are.

i. **Reaction of metals with oxygen (air):** All metals combine with oxygen to form their respective metal oxides. Metal oxides are basic in nature. Some of the metal oxides combine with water to form alkalis. Due to their basic nature metal oxides turns red litmus paper blue. Metal oxides are ionic compounds formed by the transference of electrons from metal atom to oxygen atom.

e.g. $4Na\,(s) + O_2\,(g) \longrightarrow 2\,Na_2O$ (Sodium oxide)

$Na_2O + H_2O \longrightarrow 2\,NaOH$ (Sodium Hydroxide)

ii. **Reaction of metals with water**: Metals react with water to form respective metal hydroxide (or metal oxide) and liberate hydrogen gas. Less reactive metals like copper, silver and gold do not displace hydrogen from the water. Some metals react with water vigorously and some metals do not react with water under ordinary conditions.

Sodium and potassium react vigorously with cold water and displace hydrogen gas.

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2$$
$$2K + 2H_2O \longrightarrow 2KOH + H_2$$

Magnesium reacts very rapidly with hot water to from magnesium oxide and it does not react with cold water.

$$Mg + H_2O \longrightarrow MgO + H_2$$

Zinc reacts rapidly but only with steam

$$Zn + H_2O\,(g) \longrightarrow ZnO + H_2$$

Iron displaces hydrogen from water when steam is passed over red hot iron. The reaction is reversible in nature.

$$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$$

iii. **Reaction of metals with acids**: Metals usually displace hydrogen gas from dilute acids. Only less reactive metals like copper, silver and gold do not react with dilute acids. Metals on reacting with acids produce salt and displace hydrogen gas.

Sodium reacts with dilute hydrochloric acid with an explosive violence and hence show that sodium is a very reactive metal.

$$2Na + 2HCl \longrightarrow 2NaCl + H_2$$

Magnesium reacts rapidly with dilute hydrochloric acid to form magnesium chloride and hydrogen gas.

$$Mg + 2HCl \longrightarrow MgCl_2 + H_2$$

Zinc combines with dilute hydrochloric acid, but less rapidly than magnesium. This shows zinc is less reactive than magnesium.

$$Zn + 2HCl \longrightarrow ZnCl_2 + H_2$$

iv. **Reaction of metal with metal salts (Displacement reaction)**: The basic principle of displacement reactions is that a more reactive metal can displace a less reactive metal from the solution of its salt.

e.g. when zinc combines with copper sulphate it produces zinc sulphate solution and displaces copper, this shows that zinc is more reactive than copper. But the reverse of this reaction is not possible.

$$\underset{\text{(Zinc)}}{Zn\,(s)} + \underset{\text{(Copper Sulphate)}}{CuSO_4\,(aq)} \longrightarrow \underset{\text{(Zinc Sulphate)}}{ZnSO_4\,(aq)} + \underset{\text{(Copper)}}{Cu\,(s)}$$

Copper when combines with silver nitrate replaces silver to form copper nitrate. This showsthat copper is more reactive than silver.

$$\underset{\text{(Copper)}}{Cu\,(s)} + \underset{\text{(Silver Nitrate)}}{AgNO_3\,(aq)} \longrightarrow \underset{\text{(Copper Nitrate)}}{Cu(NO_3)_2} + \underset{\text{(Silver)}}{Ag}$$

Non-metals: Non - metals are defined as the elements which gain electrons to form negative ions, i.e. they are electronegative elements. Since large amount of energy is needed to remove one or more electrons from non-metals, so non- metals do not form positively charged ions. On the other hand, energy is released when a non-metal accepts one or more electrons. Thus non-metals readily form negatively charged ions by the gain of electrons. Therefore non-metals are electronegative elements.

For example: Chlorine is a non -metal with atomic number 17, i.e., it has 17 electrons revolving round the nucleus in their orbits with the following electronic configuration 2,8,7 with 7 electrons in its outermost shell. It has to gain an electron from some other combining element to complete its outermost shell to form the negative chlorine ion.

$$\text{i.e. } \underset{(2,8,7)}{Cl} + \underset{\text{(Electron)}}{e^-} \longrightarrow \underset{(2,8,8)}{Cl^-}$$

Some examples of non-metals are Hydrogen (H), Oxygen (O), Nitrogen (N), Chlorine (Cl), Bromine (Br), Sulphur(S), Phosphorous (P), Carbon(C) etc.

Physical properties of non metals: Some of important physical properties of non- metals are

i. Non-metals do not possess any lustre (except iodine which is a non- metallic solid but has lustre).

ii. Non-metals are soft and brittle and can break into pieces when hammered except diamond which is the hardest known substance.

iii. Non-metals are neither malleable nor ductile, i.e. non- metals cannot be drawn into sheets and thin wires.

iv. Non-metals are generally bad conductors of heat and electricity except graphite which is a good conductor of electricity due to presence of free electrons in it.

v. Non-metals are non- sonorous substances. i.e. non- metals cannot produce sounds when hit with a hard object.

vi. Non-metals generally have low melting and boiling points except boron, diamond, and graphite which have high melting and boiling points.

vii. Non-metals have generally low densities, i.e. non- metals are generally lighter than metals. Sulphur has the lowest density of $2.0 g\ cm^{-3}$.

viii. Non-metals have low tensile strength. i.e. non -metals can break easily and cannot have the resistance to bear the force as that of metals.

ix. Non-metals can exist in solid, liquid, and gaseous states at room temperature. Carbon sulphur, phosphorous, and iodine are solid, bromine is the only non-metal in liquid state while hydrogen, oxygen chlorine etc. are gaseous in state.

Chemical properties of non-metals: Some of the important chemical properties of non-metals are

i. Reaction of non-metals with oxygen: Non-metals when heated react with oxygen to form their respective oxides which are either acidic or neutral in nature and are never basic in nature. The non-metallic oxides are covalent compounds formed due to the sharing of electrons between the non- metals and the oxygen atom.
e.g. formation of carbon dioxide molecule.

O : : C : : O OR O=C=O

The non-metallic oxides which react dissolve in water to form acids are called acidic oxides. These oxides turn blue litmus paper red.

$$C(s) + O_2(g) \longrightarrow CO_2(g)$$

The non-metallic oxides which neither react with acids nor with bases are called neutral oxides. These neither turn blue litmus paper red nor red litmus to blue.

$$2C(s) + O_2(g) \longrightarrow 2CO(g)$$

ii. **Reaction of non-metals with water:** Non-metals usually do not react with water (or steam) to produce H_2 gas. It is because non-metals cannot reduce the hydrogen (H^+) ions of water to hydrogen gas. However some highly reactive non-metals like fluorine react with water to form oxygen and ozone.

$$2F_2(g) + 2H_2O(l) \longrightarrow 4HF(aq) + O_2(g)$$
$$3F_2(g) + 3H_2O(l) \longrightarrow 6HF(aq) + O_3(g)$$

iii. **Reaction of non-metals with dilute acids:** Non-metals do not react with acids to displace hydrogen gas, because non-metals are electron acceptors and cannot supply electrons to H^+ ions to reduce them to hydrogen gas.

iv. **Reaction of non-metals with hydrogen:** Non-metals combine with hydrogen to form covalent hydrides. These hydrides are generally gases or liquids, but these hydrides do not conduct electricity.
Hydrogen when it combines with liquid sulphur at 440°C or 713 K form hydrogen sulphide. $8H_2(g) + S_8(l) \longrightarrow 8H_2S$

v. **Reaction of non-metals with salts:** A more reactive non-metal displaces a less reactive non-metal from the solution of its salt.
when chlorine is passed through the solution of sodium bromide, bromine is displaced with the formation of sodium chloride.

$$2NaBr(aq) + Cl_2(g) \longrightarrow 2NaCl(aq) + Br_2(l)$$

Difference between metals and non-metals :

METALS	NON-METALS
1. Metals show metallic lustre(shiny appearance).	1. Non-metals do not show metallic lustre (Shiny appearance).
2. Metals are generally hard except sodium and potassium.	2. Non-metals are generally soft except diamond and boron.
3. Metals are malleable and ductile. (can be drawn into sheets and wires).	3. Non-metals are neither malleable nor ductile. They are brittle.
4. Metals are good conductors of heat and electricity.	4. Non-metals are generally bad conductors of heat and electricity except graphite and gas carbon.
5. Metals generally have high melting and boiling points, except mercury and gallium.	5. Non-metals generally have low melting and boiling points.
6. Metals are sonorous (can produce sound when hit with a solid).	6. Non-metals are generally non sonorous (cannot produce sound when hit with a solid).
7. Metals generally have high density.	7. Non-metals have generally low densities.
8. Metals generally have high tensile strength and cannot be broken easily.	8. Non-metals generally have low tensile strength and can be broken easily.
9. Metals are generally solid (except mercury gallium which are liquids) at room temperature.	9. Non-metals are either solids or gases at room temperature, only bromine is in liquid state at room temperature.
10. Metals are electropositive elements and can lose electrons.	10. Non-metals are electronegative elements and hence gain electrons to form negative ions.
11. Metals form basic oxides	11. Non-metals form either acidic or neutral oxides.
12. Most of the metals displace hydrogen from water or steam.	12. Non-metals generally do not react with water or steam except fluorine.
13. Metals which are more reactive than hydrogen displace hydrogen from dilute acids.	13. Non- metals do not react with dilute acids and hence do not displace hydrogen from dilute acids.

Corrosion of Metals: Corrosion is an oxidation reaction with atmospheric oxygen in the presence of water on the surface of a metal. Iron corrodes more quickly than most other transition metals to form an iron oxide. Corrosion or rusting of iron is accelerated in the presence of O_2 and also in the presence of salt solution.

The two conditions necessary for the corrosion of metals are

i. Presence of air (or oxygen) and
ii. Presence of water vapour (or moisture).

Prevention of Corrosion: The various methods used to prevent corrosion are

i. The most common method used for preventing of rusting of iron objects is to coat their surfaces with paint.
ii. Greasing and oiling of the metal surfaces also prevents the surface of metals from rusting.
iii. Metals can also be prevented from rusting by the process of galvanization. The process of coating iron objects with a thin layer of zinc is called galvanization. It is usually done by dipping the iron object in molten zinc. When zinc is coated on the iron objects, iron cannot come in contact with air and moisture and hence prevent rusting of iron.
iv. Corrosion of metals can be prevented by coating with tin, chromium and nickel which are known as tin plating, chromium plating etc.
v. Rusting of iron can be prevented by alloying it, to make stainless steel and other metals can also be prevented from rusting by alloying them with other metals, as alloys are corrosion resistant.

Uses of metals: The important uses of metals are

i. Metals like aluminum, copper stainless steel are used in making utensils used at home.
ii. Metals with high melting points are used in making electrical wires and bulb filament.

iii. Metals are used in the manufacture of automobile, airplanes, ships, trains etc.
iv. Un-reactive and expensive metals like silver and gold are used in making of jewellary.
v. Metals are used in the construction of buildings and bridges (reinforced concrete).
vi. Metals are used in manufacturing of all machine parts and minting of coins.
vii. Metals with low melting point like mercury is used in thermometers.

Uses of non-metals: The important uses of non- metals are

i. Non-metals are used in the process of water purification.
ii. Non-metals are used in manufacturing of fertilizers to enhance the growth of plants.
iii. Non-metals are used in the making of crackers.
iv. Non-metals are used in the preparation of some antiseptics and ointments.
v. Non-metal like oxygen is essential for life is used by living organisms during the process of respiration.

Note: For mineral wealth of J&K refer to page No. 135 & 138 of NCERT text book

Textual questions:

Q1. Which of the following can be beaten into thin sheets?
(a) Zinc (b) Phosphorus (c) Sulphur (d) Oxygen

Ans. (a) Zinc

Q2. Which of the following statements is correct?
(a) All metals are ductile.
(b) All non-metals are ductile.
(c) Generally, metals are ductile.
(d) Some non-metals are ductile.

Ans. (c) Generally, metals are ductile.
However, metal mercury – liquid at room temperature, cannot be drawn into wires and is not ductile.

Q3. Fill in the blanks:

a) Phosphorus is a very __reactive__ non-metal.
b) Metals are __good__ conductors of heat and __electricity__.
c) Iron is __more__ reactive than copper.
d) Metals react with acids to produce __hydrogen__ gas.

Q4. Mark 'T' if the statement is true and 'F' if it is false.
a) Generally, non-metals react with acids. **(F)**
b) Sodium is a very reactive metal. **(T)**
c) Copper displaces zinc from zinc sulphate solution. **(F)**
d) Coal can be drawn into wires. **(F)**

Q5. Some properties are listed in the following table. Distinguish between metals and non-metals on the basis of these properties.

Ans.

Properties	Metals	Non-metals
1. Appearance	1. They are lustrous.	1. They are dull.
2. Hardness	2. They are hard.	2. They are soft.
3. Malleability	3. They are malleable.	3. They are not malleable.
4. Ductility	4. They are ductile.	4. They are not ductile.
5. Heat conduction	5. They are good conductors of heat.	5. They are poor conductors of heat.
6. Conduction of electricity	6. They are good conductors of electricity	6. They are poor conductors of electricity.

Q6. Give reasons for the following.

(a) Aluminum foils are used to wrap food item.

(b) Immersion rods for heating liquids are made of metallic substances.

(c) Copper cannot displace zinc from its salt solution.

(d) Sodium and potassium are stored in kerosene.

Ans.(a) Aluminum foils are used to wrap food items because aluminum metal is malleable. Therefore, it can be beaten into thin foils. Moreover, it does not react with food.

(b) Metals are good conductors of heat and electricity. Therefore, immersion rods for heating liquids are made of metallic substances.

(c) A highly reactive metal can displace a less reactive metal from its salt in an aqueous solution. But zinc is more reactive than copper. Therefore, copper cannot displace zinc from its salt solution. $Cu_{(s)} + ZnSO_{4\,(aq)} \rightarrow$ No displacement reaction

(d) Sodium and potassium are stored in kerosene because they are highly reactive elements. They can easily catch fire even when in contact with air.

Q7. Can you store lemon pickle in an aluminum utensil? Explain.

Ans. No, we cannot store lemon pickle in aluminum utensils because lemon pickle contains acids, which can react with aluminum (metal) liberating hydrogen gas. This can lead to the spoiling of the pickle.

Q8. In the following table some substances are given in column I. In column II some uses are given. Match the items in column I with those in column II.

Ans.

Column I		Column II	
(i)	Gold	(d)	Jewellery
(ii)	Iron	(e)	Machinery
(iii)	Aluminum	(c)	Wrapping food
(iv)	Carbon	(f)	Fuel
(v)	Copper	(b)	Electric wire
(vi)	Mercury	(a)	Thermometers

Q9. What happens when,

(a) Dilute sulphuric acid is poured on a cooper plate?

(b) Iron nails are placed in copper sulphate solution?

Ans. (a) When dilute sulphuric acid is poured on a copper plate, the copper metal reacts with sulphuric acid to liberate hydrogen gas.

$$\underset{\text{(Copper)}}{Cu} + \underset{\text{(Sulphuric acid)}}{H_2SO_4} \longrightarrow \underset{\text{(Copper Sulphate)}}{CuSO_4} + \underset{\text{Hydrogen}}{H_2\,(g)}$$

(b) Iron being more reactive displaces copper from copper sulphate solution. In this reaction, the blue colour of copper sulphate fades and there is deposition of copper on the iron nail.

$$\underset{\text{(Iron)}}{Fe} + \underset{\text{(Copper Sulphate)}}{CuSO_4} \longrightarrow \underset{\text{(Iron Sulphate)}}{FeSO_4} + \underset{\text{Copper}}{Cu}$$

Q10. Sarish took a piece of burning charcoal and collected the gas evolved in a test tube.

(a) How will she find the nature of the gas?

(b) Write down word equations of all the reactions taking place in this process.

Ans. (a) Add a few drops of water in the test tube containing gas. Now, cover the test tube and

shake it well. After shaking, test the solution with blue litmus and red litmus. It will turn blue litmus red. Thus, the gas is acidic in nature.

(b) Charcoal reacts with oxygen to form carbon dioxide gas.

$$\underset{\text{(Carbon from charcoal)}}{C} + \underset{\text{(oxygen)}}{O_2} \longrightarrow \underset{\text{(Carbon dioxide)}}{CO_2}$$

Carbon dioxide reacts with water to form carbonic acid, which turns blue litmus paper red.

$$\underset{\text{(Carbon dioxide)}}{CO_2} + \underset{\text{(Water)}}{H_2O} \longrightarrow \underset{\text{(Carbonic acid)}}{H_2CO_3}$$

Q11. One day Reeta went to a jeweler's shop with her mother. Her mother gave old gold jewellery to the goldsmith to polish. Next day when they brought the jewellery back, they found that there was a slight loss in its weight. Can you suggest a reason for the loss of weight?

Ans. To polish a gold ornament, it is dipped in aacid called aquaregia (a mixture of HCl and HNO_3). On getting the environment of aquaregia, the outer layer of gold dissolves and the inner shiny layer is visible. The dissolving of the upper layer of jewellerycauses a reduction in the weight of the jewelry.

Q12. Why phosphorous is stored in water?

Ans. Non-metal phosphorus (white or yellow)like other non-metals does not react with water. On the other hand when phosphorus comes in contact with air it readily combines with air to form phosphorus pent oxide (P_2O_5). To prevent it coming in contact with air, it is placed in water.

BIOLOGY

Reaching the age of Adolescence

Puberty: Puberty is the time in which sexual and physical characteristics mature. It occurs due to hormonal changes. The changes bring about reproductive maturity.

Adolescence: Adolescence is the time between the beginning of sexual maturation (puberty) and adulthood. It is a time of psychological maturation, in which a person becomes "adult-like" in behavior. Adolescence is roughly considered to be the period between 13 and 19 years of age. The adolescent experiences not only physical growth and change but also emotional, psychological, social, and mental change and growth.

Changes at puberty:

Boys and Puberty: Adolescence is the time between childhood and adulthood. It lasts roughly from age 11-13 until adulthood. Adolescence includes puberty, physical changes, a change in thinking ability, and all the social and emotional changes that happen during this stage of life. Adolescence can be an exciting time as well as a tough time in a boy's life. The changes that happen to a boy's body during puberty can be summarized as:

Physical Changes During Puberty for Boys:

i. Height and weight increase.
ii. Growth of facial hair, moustaches and beard.
iii. Vocal cords get thicker and longer - boys' voices deepen.
iv. The body develops an increased number of red blood cells.
v. Sweat and oil glands become more active, and body odour changes.
vi. Acne can develop.
vii. Some boys develop small and temporary breast tissue.
viii. Reproductive system develops completely.

Girls and Puberty: Adolescence includes puberty, the physical changes, a change in thinking ability, and all the social and emotional changes that happen during this stage of life. It lasts roughly from age 9 until adulthood. Adolescence can be an exciting time and a tough time in a girl's life. The changes that happen to a girl's body during puberty are summarized as:

Physical Changes During Puberty for Girls

i. Mammary glands develop inside the breasts.
ii. Height and weight increase.
iii. Hips and waist become more defined.
iv. Menstruation begins.
v. Mood changes may occur.
vi. Fat tissue normally increases.
vii. Vocal cords get thicker and longer. The voice usually becomes high pitched.
viii. Sweat and oil glands become more active, and body odour changes.
ix. Acne may develop.
x. Reproductive system develops completely.

Secondary sexual characters:

The secondary sexual characteristics begin to appear during puberty as a result of hormonal stimulation. They become apparent first in females, a little later in males. By the time their physical growth is completed, the bodies of men and women show several marked differences.

Endocrine glands and their functions

i. Thyroid gland: It is a soft butterfly shaped gland and secretes the thyroxine hormone which controls growth and development. Its excessive secretion causes quick metabolism whereas its less secretion causes slow metabolism leading to overweight and sluggishness.
ii. Ovary: Ovary produces Estrogen and Progesterone, which controls the sexual characteristics in females. It maintains pregnancy and childbirth.
iii. Testis: Testis produces testosterone, which controls development of secondary and accessory sexual characteristics in males.
iv. Pituitary gland: These glands secretes growth hormones like ADH, ACTH, FSH and TSH, which regulates tissues and bones growth, controls the amount of water reabsorbed by the kidney, stimulates adrenal cortex to male cortisone, stimulates the ovary to produce oestrogen and stimulates thyroid to make thyroxin respectively.

Pineal: It is a small reddish grey vascular solid body lying between the two cerebral hemispheres of the brain. It secretes melatonin hormone which regulates the working of gonad.

Hormonal action: The endocrine system acts by releasing hormones that in turn trigger actions in specific target cells. Receptors on target cell membranes bind only to one type of hormone. More than fifty human hormones have been identified; all act by binding to receptor molecules. The binding hormone changes the shape of the receptor causing the response to the hormone.

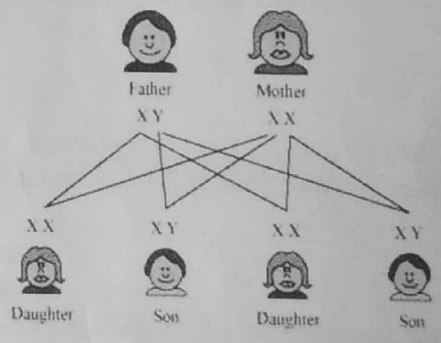
Role of hormones in initiating reproductive function: The human body also possesses ductless glands which release their secretions directly into the bloodstream. These glands are called endocrine (Greek: internally secreting) glands. Their secretions, which may stimulate or regulate the functioning of various other, often remote organs, are known as hormones (from the Greek hormaein: to arouse). Every human body contains a number of endocrine glands and many different hormones which serve a great variety of purposes.

In regard to sex and reproduction, the most important endocrine glands are the pituitary gland and the male and female gonads or sex glands. The pituitary gland is located at the base of the brain. It is sometimes called the "master gland" because its hormones stimulate and coordinate the other endocrine glands. Among the pituitary hormones that are of particular interest here are FSH (follicle-stimulating hormone) and LH (luteinizing hormone). They stimulate the male and female gonads to produce hormones of their own.

The gonads or sex glands are the testicles in the male and the ovaries in the female. The hormones produced by the gonads are called gonadal hormones, and they can be divided into clearly distinct groups. One group of hormones that are particularly prominent in mature males is known as androgens. Another group of hormones particularly prominent in mature females are known as estrogens. (The female gonads also produce still another hormone called progesterone, which is important for a woman's reproductive life.) However, while there is a greater amount of androgens in men and of estrogens in women, both groups of hormones are present in every individual. The gonadal hormones play an important role in a person's sexual maturation.

Role of hormones in metamorphosis: As in insects, a complex interaction of hormones in the amphibian larva precipitates metamorphosis. Ultimately, two major classes of hormones act together to control amphibian metamorphosis: the thyroid hormones (made by the thyroid gland) and prolactin (made by the pituitary gland). Thyroid hormones function somewhat like the molting hormones of insects, in that an increase of their concentration relative to prolactin leads to metamorphosis of the larva into the adult. Prolactin functions somewhat like the juvenile hormones of insects, in that it tempers the action of the thyroid hormones. In most species, thyroid hormones increase dramatically in concentration during metamorphosis and this stimulates resorption of certain larval organs and differentiation of new adult organs.

Sex Determination: During the formation of gametes, the females will have only one type of gametes, all with one X chromosome. However, the males will produce two types of gametes or sperms, one with X chromosome and one with Y chromosome. Thus the sex of a zygote is determined by which male gamete fuses with the female gamete. If the X gamete fuses with the female gamete (also X), the zygote will be a female and if the Y gamete fuses with the female gamete, the zygote will be a male. This type of sex determination is called XX-XY type.



Reproductive health: The physical and mental well being of an individual is regarded as an individual's health. Adolescents have unique reproductive and sexual health needs. Therefore the adolescents growing body require proper care and maintenance, which can be summarized as:

i. Adolescence is the stage of rapid growth and development, hence the diet for an adolescent has to be planned carefully keeping in view the requirements with respect to a balanced diet which includes proteins, carbohydrates, fats and vitamins in requisite proportions.

ii. Maintenance of personal hygiene in order to avoid the bacterial infections due to increased activity of sweat glands.

iii. Adolescents should lead an active life, exercise and play outdoor games regularly so that they have proper physical and mental growth.

iv. Adolescents should be made aware of the bad habits and other social evils prevalent in the society so that they may not be confused or feel insecure in making their decisions.

S: Acquired Immunodeficiency Syndrome (AIDS) is caused by a retrovirus known as the Human Immuno rus (HIV), which infects cells of the human immune system, destroying or impairing their function.

Modes of Transmission: HIV is transmitted through unprotected physical relationship, transfusion of contaminated blood, sharing of contaminated needles and between a mother and her infant during pregnancy.

Adam's apple: A familiar anatomic feature in the front of the neck that is due to the forward projection (outgrowth) of the thyroid gland the largest and most prominent cartilage of the larynx. The thyroid cartilage tends to enlarge at adolescence, particularly in males. Enlargement of the Adam's apple is considered, as one of the secondary sexual characteristics. The primary purpose of the structure is to protect the delicate voice-box from injuries.

Menstruation: The menstrual cycle is the process by which a woman's body gets ready for the chance of a pregnancy each month. The average menstrual cycle is 28 days but it can range from 21 days to 35 days.

Most menstrual periods last from three to five days. At about the age of 10 to 13 years, the ovaries of females are stimulated by the follicle stimulating hormone (FSH) of the pituitary. This is called the onset of puberty and is accompanied by release of hormones estrogen and progesterone. These hormones control the production of ova or eggs and appearance of secondary sexual characteristics. Unlike males where sperms can be produced throughout the life of man, in females the reproductive phase only lasts till the age of 45-50 years. This phase is characterized by the presence of menstrual cycle. Each menstrual cycle typically occurs in about 28 to 30 days. Thus it occurs every month.

Menopause: Stoppage of menstruation is termed as menopause. The menopausal transition begins with varying menstrual cycle lengths and ends with the final menstruation. This phenomenon develops in women between the age groups ranging from 45-50 years of age.

Textual questions: (Page no. 130)

Ans1. Hormones are chemical substances which are the secretion of the endocrine glands and are called hormones. They are responsible for changes taking place in the body at puberty.

Ans2. Adolescence is the time period between the beginning of puberty and adulthood. During this period, the body undergoes several changes alongside reproductive maturity. It begins around the age of 11 and lasts till 18 or 19 years of age. The period of adolescence may vary from person to person.

Ans3. Menstruation is the process of the shedding of the uterine lining on a regular monthly basis. It begins at puberty and is the reproductive cycle of the female body. Every month, the uterus prepares itself to receive a fertilized egg. Therefore, the inner lining of the uterus becomes thick and is supplied with blood to nourish the embryo. If the egg is not fertilized, then the lining of the uterus breaks down and gets released in the form of blood through the vagina. This lasts for about two to eight days. This cycle occurs every month and is known as the menstrual cycle.

Ans4. Changes at puberty:

i. Sudden increase in height and weight.
ii. Broadening of shoulders and widening of chest in boys. In girls, the region below waist becomes wider.
iii. In boys, under the influence of hormones, the larynx becomes prominent, the vocal cords become longer and thicker. These changes cause the voice to become hoarse.
iv. Appearance of hair in areas such as underarms, face, hands, and legs.
v. Appearance of acne as a result of excessive secretion of oil from skin.
vi. Testis grows and starts producing sperms in males, whereas in females, the ovary enlarges and start producing matured eggs.

Ans5.

Endocrine gland	Hormones
1. Testis	1.Testosterone
2. Ovary	2. Oestrogen, Progestrone
3. Thyroid	3. Thyroxine
4. Adrenal	4. Adrenaline
5. Pancreas	5. Insulin
6. Pituitary	6. Growth hormone

Sex hormones are hormones produced by sex organs. For example, testosterone is the male sex hormone duced by the testis, and oestrogen is the female sex hormone produced by the ovary. These hormones affect he sexual features of an organism. Hence, they are known as sex hormones.

Functions of sex hormones:

Testosterone: This hormone brings about secondary sex characters in boys such as the growth of a beard, the voice becoming hoarse, development of reproductive organs, etc.

Oestrogen: This hormone is responsible for the development of secondary sexual characters in females such as the enlargement of breasts, development of female reproductive organs, etc.

Ans7. (a-ii) Adolescents should be careful about what they eat, because proper diet is needed for the rapid growth taking place in their body.

(b-i) Reproductive age in women starts when their menstruation starts.

(c-ii) The right meal for adolescents consists of chapatti, dal, vegetables.

Ans8. (a) Adam's apple: In human males, the larynx grows larger during puberty and can be seen as a protruding part of the throat. This protrusion is known as the Adam's apple. In boys, under the influence of sex hormones, the larynx becomes prominent. As a result, the vocal cords become longer and thicker, causing the voice to become hoarse. However, in females, the larynx is of a small size and is hardly visible. Therefore, girls have a high pitched voice, while the voice of boys is deep.

Ans8 (b) Secondary sexual characters are those features that help in distinguishing the male and the female body from each other. They are physical or behavioral characteristics that appear in humans at the time of puberty.

Secondary sexual characters in boys:

(i) Appearance of moustache and beard.

(ii) Appearance of chest hair.

(iii) Growth of hair in genital area and other parts of the body.

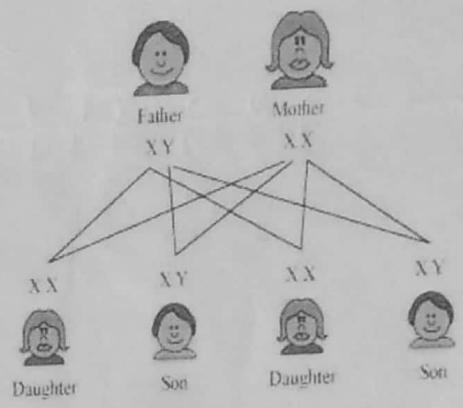
Secondary sexual character in girls:

(i) Enlargement of breasts due to the development of mammary glands.

(ii) Growth of hair in genital area and other body parts.

Ans8 (c) Sex determination in an unborn baby:

The sex of a baby is determined by the type of male gamete that fuses with the female gamete. All human beings have 23 pairs of chromosomes in their nuclei. Out of these 23 pairs, the last pair is known as the sex chromosome. This last pair is homologous or similar in females and is represented as XX, whereas in males it is dissimilar or heterozygous and is represented as XY.



Therefore, the male gametes can be either, 22+X or 22+Y and the female gametes are 22+X only.

If the X factor of male crosses with the female gamete, the resultant combination will be XX, a female child whereas if the Y factor of the male crosses with the female gamete, the resultant combination will be XY, a male child.

Ans 9. Cross word puzzle: Try yourself.

Ans10. The graph depicts the relation between the age and height of both boys and girls. During puberty, there is a sudden increase in height of both boys and girls. On the basis of the above graph, it can be observed that during the age of 4-8 years, girls have less height as compared to boys. However, as soon as girls reach 12- 13 years, their height shows a sudden increase and becomes more than boys. In later years, growth in both sexes becomes stable. Growth during puberty is under the control of hormones.