moon ? What is his acceleration due to gravity on moon ?

Solution : Given, Weight of man on earth $W_1 = 1200$ N

Weight of man on moon $W_2 = 200$ N

Gravitational acceleration of earth = 10 m/s^2

Now, $W = mg$

Or $m = W/g$

$= 120$ kg

So, mass on moon will be 120 kg as it is constant everywhere so mass of man on moon = 120 kg. **Ans.**

Now, $W_2 = mg_2$

Or $200 = 120 \times g$

Or $g = \frac{200}{120} = \frac{10}{6} = \frac{5}{3}$

$= 1.66$ m/s^2 **Ans.**

Example 6. *An object is thrown vertically upwards and reaches a height of 78.4 m. Calculate the velocity at which the object was thrown ? (g = 9.8 m/s^2)*

Solution : Given, $h = 78.4$ m, $v = 0$, $g = 9.8$ m/s^2, $u = ?$

$v^2 = u^2 - 2gh$

Or $0 = u^2 - 2 \times 9.8 \times 78.4$

Or $u^2 = \frac{2 \times 98 \times 784}{10 \times 10}$

Or $u = \sqrt{\frac{2 \times 2 \times 49 \times 784}{10 \times 10}}$

$u = \frac{2 \times 7}{10}\sqrt{784}$

Or $u = 39.2$ m/s^2 **Ans.**

Example 7. *What is the mass of an object whose weight is 49 Newton ?*

Solution : Given, Weight of object W = 49N

$g = 9.8$ m/s^2

Now, $W = mg$

Or $m = \frac{W}{g} = \frac{49}{9.8}$

$= 5$ kg **Ans.**

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

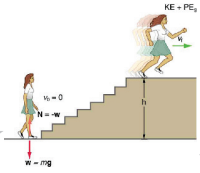
1. State the universal law of gravitation.
2. Write the formula to find the magnitude of the gravitational force between the earth and an object on the surface of the earth.
3. Is value of G constant at all the places ?
4. What is the weight of an object of mass 1 kg ? **Ans :** 9.8N
5. A body has weight of 10 kg on the surface of earth. What will be its weight when taken to the centre of the earth ? **Ans :** 0
6. What is the value of gravitational acceleration acting on a free falling object ?
7. What is the value of universal constant G and its unit ?
8. Why do pin sinks in water ?
9. Name a factor on which *g* depends.
10. Name the balance used to measure weight of an object.

SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. Mass of an object is 1600 gm on the earth. What is its mass on the moon ? Why ? **Ans :** 1600 gm
2. Two objects placed in a room, are not pulling each other. Why ?
3. Name the force responsible for the motion of moon around the earth. How can some objects move around the earth ?
4. State Archimedes' Principle and explain it with example.
5. State two factors on which buoyant force depends.

LONG ANSWER TYPE QUESTIONS (5 Marks)

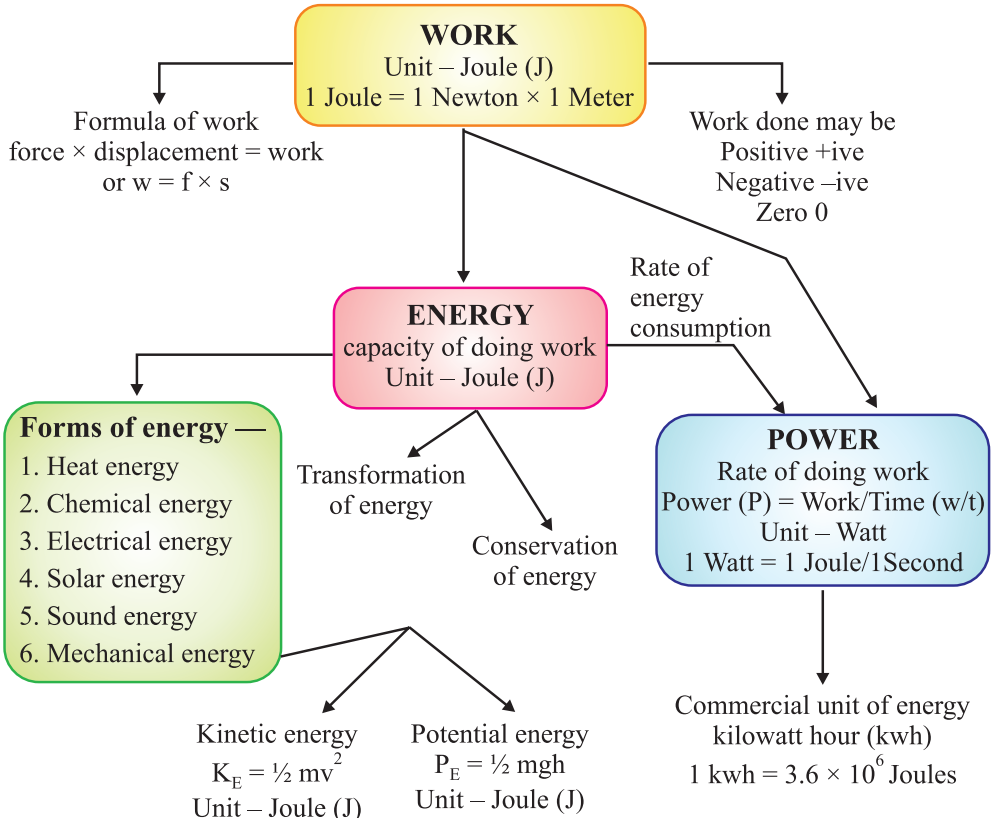
1. Density of aluminium is 2700 kg m^{-3}. What is its relative density ? Denisty of water is 1000 kg m^{-3}. Define relative density. **Ans :** 2.7
2. A ball is released from a height of 1 metre. What time it will take to reach the surface of the earth ? **Ans :** 0.45 s
3. A ball thrown up, vertically returns to the thrower after 6 s. Find :
   (a) the velocity with which it was thrown up. **Ans :** 29.4 m/s
   (b) the maximum height it reaches and **Ans :** 4.9 m
   (c) its position after 4 s. **Ans :** 39.2 m



Chapter - 11

Work And Energy

CHAPTER AT A GLANCE



Work

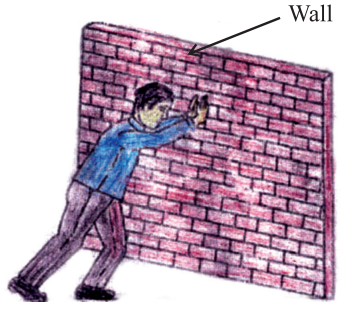
For doing work, energy is required.

- In animals, energy is supplied by food they eat.
- In machine, energy is supplied by fuel.

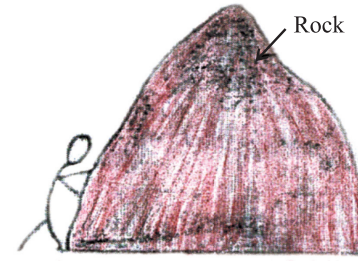
Not much work inspite of working hard : Reading, writing, drawing, thinking,

analysing are all energy consuming. But in scientific manner, no work is done in above cases.

- *Example :* A man is completely exhausted in trying to push a rock (wall), but work done is zero as wall is stationary.
- A man standing still with heavy suitcase may be tired soon but he does no work in this situation as he is stationary.



When a force is applied on the wall, the wall does not move. So work is not done



When a force is applied on the rock, the rock does not move. So work is not done

Work is said to be done when :

(i) a moving object comes to rest.

(ii) an object at rest starts moving.

(iii) velocity of an object changes.

(iv) shape of an object changes.

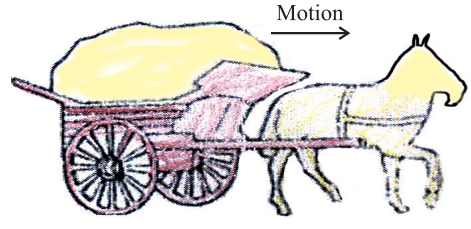
Scientific Conception of Work

- Work is done when a force produces motion in a body.
- Work is said to be done when a force is applied on a body and the body moves under the influence of force.

Condition of Work

(i) Force should be applied on the body.

(ii) Body should be displaced.



Examples : Work is done when :

(i) A cyclist is pedaling the cycle.

(ii) A man is lifting load in upward or downward direction.

Work is not done when :

(i) A coolie carrying some load on his head stands stationary.

(ii) A man is applying force on a big rock.

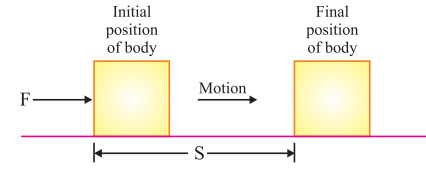
Work Done by a Fixed Force

Work done in moving a body is equal to the product of force and displacement of body in the direction of force.

$$\text{Work} = \text{Force} \times \text{Displacement}$$

$$W = F \times S$$

Work is a scalar quantity.



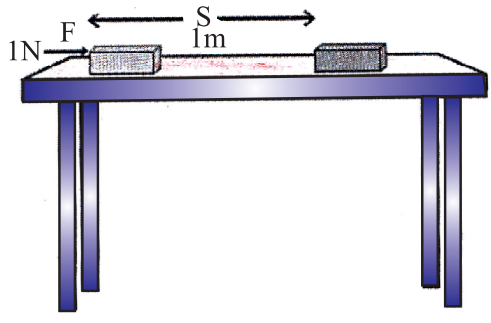
Unit of Work

Unit of work is Newton metre or Joule.

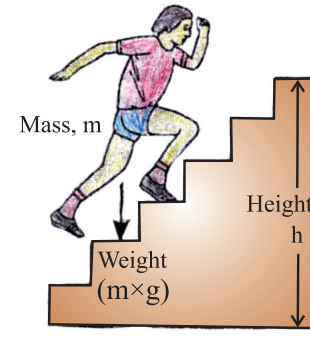
When a force of 1 Newton moves a body through a distance of 1 metre in its own direction, then the work done is 1 Joule.

$$1 \text{ Joule} = 1 \text{ Newton} \times 1 \text{ metre}$$

$$1 \text{ J} = 1 \text{ Nm}$$



1J = 1N × 1 m



During climbing work is done against gravity

The amount of work done depends on the following factors :

(i) Magnitude of force : Greater the force, greater is the amount of work & vice-versa.

(ii) Displacement : Greater the displacement, greater is the amount of

work & vice-versa.

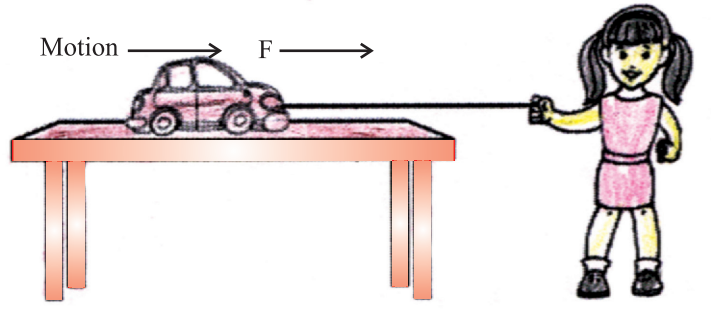
Negative, Positive and Zero Work

Work done by a force can be positive, negative or zero.

(i) Work done is **positive** when a force acts in the direction of motion of the body.[Fig. (a)] ($\theta = 0^o$).

Example : A child pulls a toy car with a string horizontally on the ground. Here work done is positive.

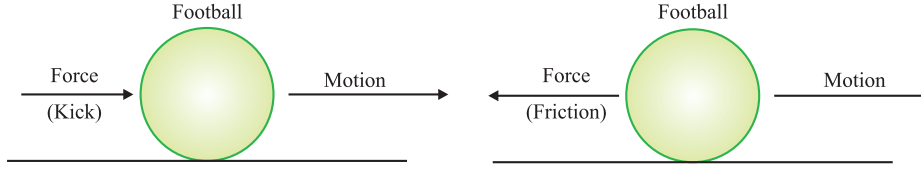
$$W = F \times S$$



Positive work

(ii) Work done is **negative** when a force acts opposite to the direction of motion of the body.

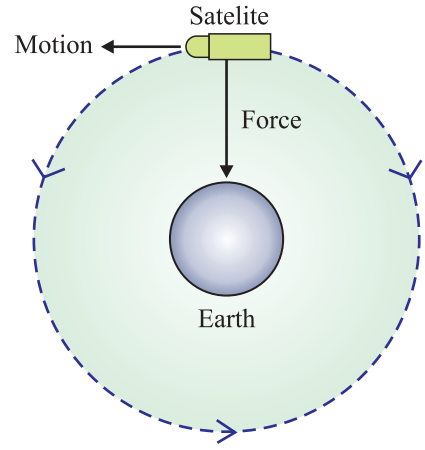
Example : When we kick a football lying on the ground, the force of our kick moves the football. Here direction of force applied & motion of football is same so work done is positive. But when football slows due to force of friction acting in a direction opposite to direction of motion of football [Fig. (b)], work done is negative.



Positive work **Negative work**

(iii) Work done is **zero** when a force acts at right angles to the direction of motion.

Example : The moon moves around the earth in circular path. Here force of gravitation acts on the moon at right angles to the direction of motion of the moon. So work done is zero.



Zero work

- -ve (negative) sign indicates that work is done against gravity.

Note that if work is done against the direction of motion (gravity), then it is taken –ve.

Example. *A coolie lifts a luggage of 15 kg from the ground and put it on his head 1.5 m above the ground. Calculate the work done by him on the luggage.*

Solution : Mass of luggage (m) = 15 kg

Displacement (S) = 1.5 m

So, Work done, W = F × S

= mg × S [$f = mg$]

= 15 × 10 × 1.5 [g = 10 m/s^2]

[g = force of gravity]

= 225.0 kg m/s^2

= 225 Nm = 225 J

Hence, work done = 225 J.

Energy

(i) The sun is the biggest source of energy.

(ii) Most of the energy sources are derived from the sun.

(iii) Some energy is received from nucleus of atoms, interior of the earth and the tides.

Definition : The capacity of doing work is known as energy.

The amount of energy possessed by a body is equal to the amount of work it can do. Working body losses energy, body on which work is done gains energy.

Energy is a scalar quantity.

Unit : The SI unit of energy is Joule (J) and its bigger unit is kilo joule (kJ).

$$1 \text{ kJ} = 1000 \text{ J}$$

The energy required to do 1 Joule of work is called 1 Joule energy.

Forms of Energy

Main forms of energy are :

(i)	Kinetic energy	(ii)	Potential energy
(iii)	Heat energy	(iv)	Chemical energy
(v)	Electrical energy	(vi)	Light energy
(vii)	Sound energy	(viii)	Nuclear energy

- Sum of kinetic energy & potential energy of a body is called mechanical energy.

Mechanical energy

The energy possessed by a body on account of its motion or position is called mechanical energy.

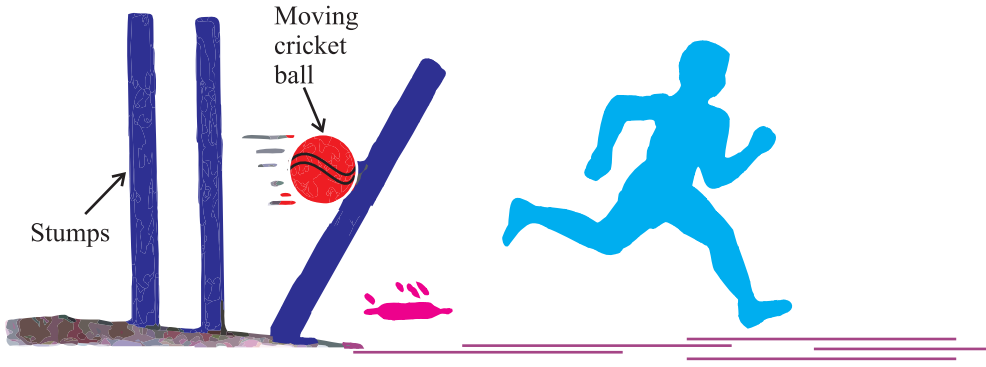
Kinetic Energy

The energy of a body due to its motion is called kinetic energy.

Examples of kinetic energy :

- A moving cricket ball
- Running water
- A moving bullet
- Flowing wind
- A moving car
- A running athelete
- A rolling stone

- Flying aircraft



Kinetic energy

Kinetic energy is directly proportional to mass and the square of velocity.

Formula for Kinetic Energy

If an object of mass 'm' moving with uniform velocity 'u', it is displaced through a distance 's'. Constant force 'f' acts on it in the direction of displacement. Its velocity changes from 'u' to 'v'. Then acceleration is 'a'.

$$\text{Work done, W} = f \times s \qquad \text{...(i)}$$

and

$$f = ma \qquad \text{...(ii)}$$

According to third equation of motion, relationship between u, v, s and a is as follows :

$$v^2 - u^2 = 2as$$

So,

$$s = \frac{v^2 - u^2}{2a} \qquad \text{...(iii)}$$

Now putting the value of f and s from (ii) and (iii) in equation (i),

$$\text{W} = ma \times \frac{v^2 - u^2}{2a}$$

$$= \frac{m}{2} \times v^2 - u^2 = \frac{1}{2} m\left(v^2 - u^2\right)$$

If $u = 0$ (when body starts moving from rest)

$$\text{W} = \tfrac{1}{2}mv^2$$

Or

$$E_K = \tfrac{1}{2}mv^2$$

Example. *An object of mass 15 kg is moving with uniform velocity of 4 m/sec. What is the kinetic energy possessed by it ?*

Solution : Mass of the object, $m = 15$ kg

Velocity of the object, $v = 4$ m/s

$$E_K = \frac{1}{2}mv^2$$

$$= \frac{1}{2} \times 15 \text{ kg} \times 4 \text{ ms}^{-1} \times 4 \text{ ms}^{-1}$$

$$= 120 \text{ J}$$

The kinetic energy of the object is 120 J.

Potential Energy

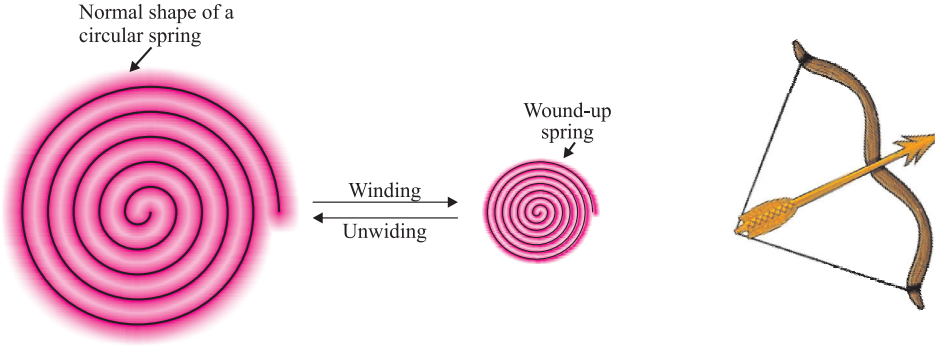
The energy of a body due to its position or change in shape is known as potential energy.

Examples :

(i) Water kept in dam : It can rotate turbine to generate electricity due to its position above the ground.

(ii) Wound up spring of a toy car : It possess potential energy which is released during unwinding of spring. So toy car moves.

(iii) Bent string of bow : Potential energy due to change of its shape (deformation) released in the form of kinetic energy while shooting an arrow.



Factors affecting Potential Energy

(i) Mass : P. E. $\propto m$

More the mass of body, greater is the potential energy and vice-versa.

(ii) Height above the ground :

P. E. $\propto h$ (Not depend on the path it follows)

Greater the height above the ground, greater is the P.E. and vice-versa.

(iii) Change in shape : Greater the stretching, twisting or bending, more is

the potential energy.

Potential Energy of an Object on a Height

If a body of mass 'm' is raised to a height 'h' above the surface of the earth, the gravitational pull of the earth ($m \times g$) acts in downward direction. To lift the body, we have to do work against the force of gravity.

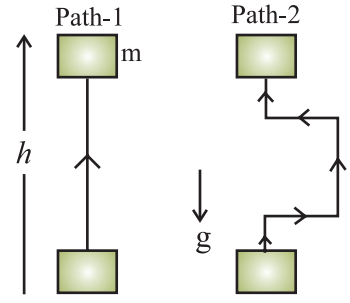
Thus, Work done, W = Force × Displacement

Or W = $m \times g \times h = mgh$

This work is stored in the body as potential energy (gravitational potential energy).

Thus, Potential energy, $E_P = m \times g \times h$

where g = acceleration due to gravity.



Ep = M×g×h = Ep = mgh

Example. *If a body of mass 10 kg is raised to a height of 6 m above the earth, calculate its potential energy.*

Solution : Potential energy of the body = mgh

Mass of body = 10 kg

Height above the earth = 6 m

Acceleration due to gravity = 10 m/s^2

So, E_P = 10 × 10 × 6

= 600 J

Thus, potential energy of the body is 600 Joules.

Transformation of Energy

The change of one form of energy to another form of energy is known as transformation of energy.

Example :

(i) A stone on a certain height has entire potential energy. But when it starts moving downward, potential energy of stone goes on decreasing as height goes on decreasing but its kinetic energy goes on increasing as velocity of stone goes on increasing. At the time stone reaches the ground, potential energy becomes zero and kinetic energy is maximum.

Thus, its entire potential energy is transformed into kinetic energy.

(ii) At hydroelectric power house, the potential energy of water is transformed into kinetic energy and then into electrical energy.

(iii) At thermal power house, chemical energy of coal is changed into heat energy, which is futher converted into kinetic energy and electrical energy.

(iv) Plants use solar energy to make chemical energy in food by the process of photosynthesis.

Law of Conservation of Energy

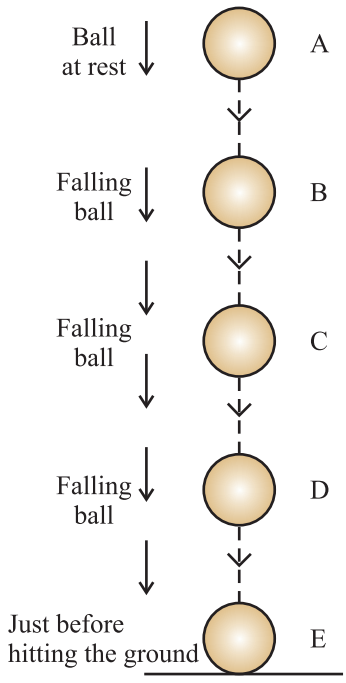
- Whenever energy changes from one form to another form, the total amount of energy remains constant.
- "Energy can neither be created nor be destroyed."
- Although some energy may be wasted during conversion, but the total energy of the system remains the same.

Conservation of Energy during Free Fall of a Body

- A ball of mass 'm' at a height 'h' has potential energy = mgh.
- As ball falls downwards, height 'h' decreases, so the potential energy also decreases.
- Kinetic energy at 'h' is zero but it is increasing during falling of ball.
- The sum of potential energy & kinetic energy of the ball remains the same at every point during its fall.

$$\frac{1}{2}mv^2 + mgh = \text{Constant}$$

Kinetic energy + Potential energy = Constant



Ball	P.E. of Ball	K.E. of Ball	Total Energy of Ball (P.E. + K.E.)
A	20J	0J	20 + 0 = 20J
B	15J	5J	15 + 5 = 20J
C	10J	10J	10 + 10 = 20J
D	5J	15J	5 + 15 = 20J
E	0J	20J	0 + 20 = 20J

Rate of Doing Work – Power

"Power is defined as the rate of energy consumption."

$$\text{Power} = \frac{\text{Work done}}{\text{Time taken}} \quad \text{Or} \quad P = \frac{W}{t}$$

where P = Power

W = Work done

t = Time taken

Unit of Power

SI unit of Power is Watt (W) = 1 Joule/second.

$$1 \text{ Watt} = \frac{1 \text{ Joule}}{1 \text{ second}} \quad \text{Or} \quad 1 \text{ W} = \frac{1 \text{ J}}{1 \text{ s}}$$

Power is one Watt when one Joule work is done in one second.

$$\text{Average Power} = \frac{\text{Total work done or total energy used}}{\text{Total time taken}}$$

Power of Electrical Gadget

The power of an electrical appliance tells us the rate at which electrical energy is consumed by it.

Bigger unit of Power : Bigger unit of power is called Kilowatt or KW.

1 Kilowatt (KW) = 1000 Watt = 1000 W or 1000 J/s

Example. *A body does 20 Joules of work in 5 seconds. What is its power ?*

Solution : $$\text{Power} = \frac{\text{Work done}}{\text{Time taken}}$$

Work done = 20 Joules

Time taken = 5 sec.

$$P = \frac{20\ J}{5\ s}$$

So, Power = 4 J/s = 4 W

Thus, power of the body is 4 Watts.

Commercial Unit of Energy : Joule is very small unit of energy and it is inconvenient to use it where a large quantity of energy is involved.

For commercial purpose, bigger unit of energy is Kilotwatt hour (KWh).

1 KWh : 1 KWh is the amount of energy consumed when an electric appliance having a power rating of 1 Kilowatt is used for 1 hour.

Relation between Kilowatt hour and Joule

1 Kilowatt hour is the amount of energy consumed at the rate of 1 Kilowatt for 1 hour.

1 Kilowatt hour = 1 Kilowatt for 1 hour

= 1000 Watt for 1 hour

= 1000 Watt × 3600 seconds (60 × 60 seconds = 1 hour)

= 36,00,000 Joules

So, 1 KWh = 3.6×10^6 J = 1 unit

Example. *A bulb of 60 Watt is used for 6 hrs. daily. How many units (KWh) of electrical energy are consumed ?*

Solution : Power of bulb = 60 W = $\frac{60}{1000}$ KW = 0.06 KW

t = 6 hours

Energy = Power × Time taken = 0.06 × 6 h

= 0.36 KWh = 0.36 units

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

1. Define the term 'work'.
2. Define 1 Joule of work.
3. Give an example in which a force does positive work.
4. Give an example in which a force does negative work.
5. Define the term energy of a body.
6. Write the units of : (a) Work, (b) Energy.
7. Define Power.
8. Define 1 Watt energy.
9. Define 1 Kilowatt hour.

SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. What do you undertstand by kinetic energy ? Write its formula.
2. On what factors does the kinetic energy of a body depends ?
3. What happens to potential energy of a body when its height is doubled ? *(Ans. Doubled)*
4. How many joules are there in 1 Kilowatt hour ?
5. What is conservation of energy ? Explain with an example.

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. What are the quantities on which the amount of work done depend ? How are they related to work ?
2. A load of 100 kg is pulled up to 5 m. Calculate the work done. (g = 10 m/s^2) *(Ans. 5000 J)*

3. A body of mass *m* is moving with a velocity 5 ms^{-1}. Its kinetic energy is 25 J. If its velocity is doubled, what is its kinetic energy ?

(Ans. 100 J)

LONG ANSWER TYPE QUESTIONS (3 Marks)

1. A boy weighing 50 kg climbs up a vertical height of 100 m. Calculate the amount of work done by him. How much potential energy he gains ? (Given $g = 9.8\ m/s^2$) *(Ans. 4.9×10^4 J)*

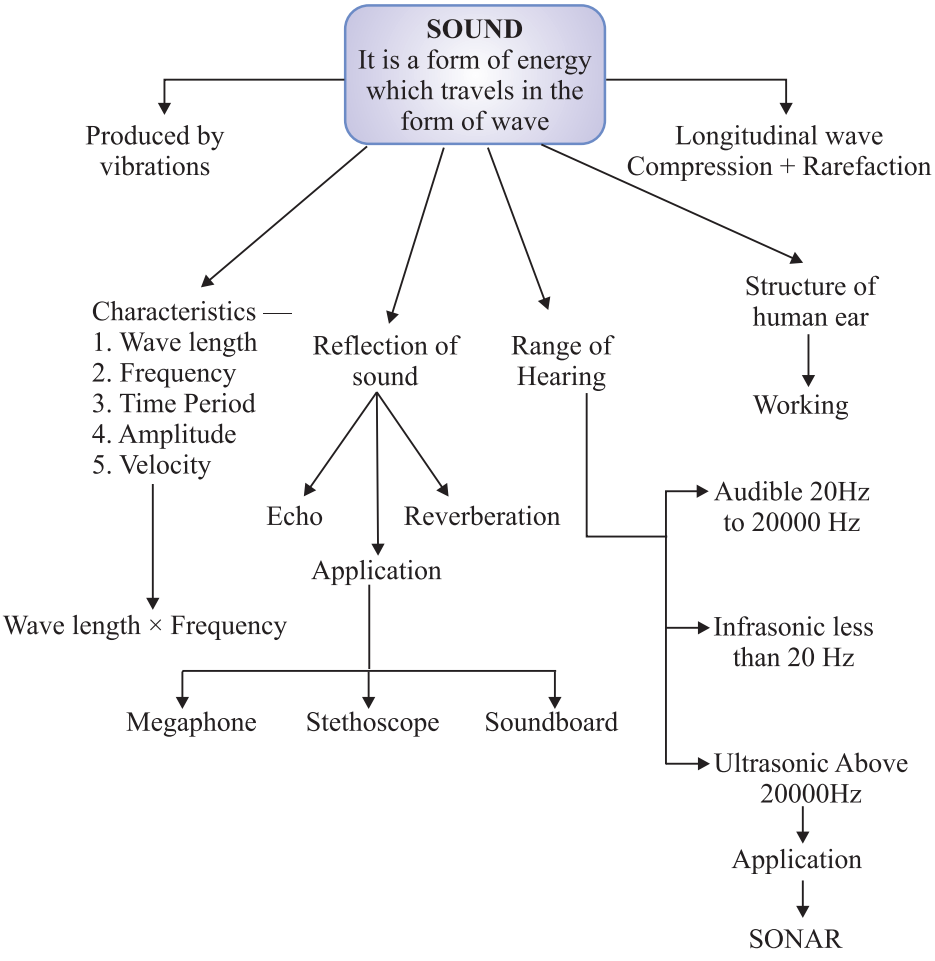
2. Five electric fans of 120 watts each are used for 4 hours. Calculate the electrical energy consumed in kilowatt hours. *(Ans. 2.4 KWh)*

3. The power of an electric heater is 1500 Watt. How much energy it consumes in 10 hours ? *[Ans. 15 KWh (units)]*

Chapter - 12

Sound

CHAPTER AT A GLANCE



Sound

(i) The sensation felt by our ears is called sound.

(ii) Sound is a form of energy which makes us hear.

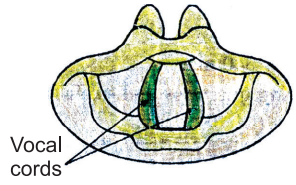
(iii) Law of conservation of energy is also applicable to sound.

(iv) Sound travels in form of wave.

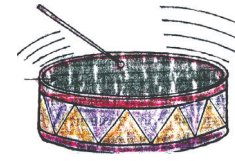
Production of Sound

Sound is produced when object vibrates or sound is produced by vibrating objects.

- The energy required to make an object vibrate and produce sound is provided by some outside source (like our hand, wind etc.).
- *Example :* Sound of our voice is produced by vibration of two vocal cords in our throat [Fig. (a)].
- Sound of a drum or tabla is produced by vibration of its membrane when struck [Fig. (b)].

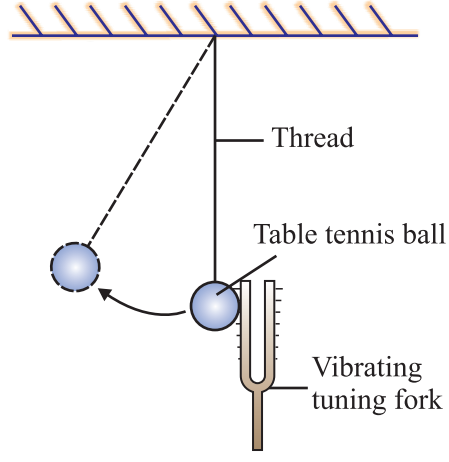


(a) Sound is produced when our vocal cords vibrate



(b) Sound is produced when the skin of a drum vibrates

- In laboratory experiments, sound is produced by vibrating tuning fork. The vibrations of tuning fork can be shown by touching a small suspended pith ball (cork ball) with a prong of the sounding tuning fork. The pith ball is pushed away with a great force.



Sound can be produced by following methods :

(i) By vibrating string (sitar)

(ii) By vibrating air (flute)

(iii) By vibrating membrane (table, drum)

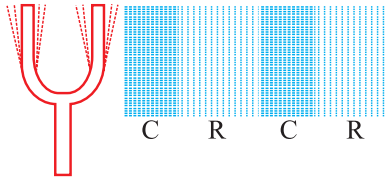
(iv) By vibrating plates (bicycle bell)

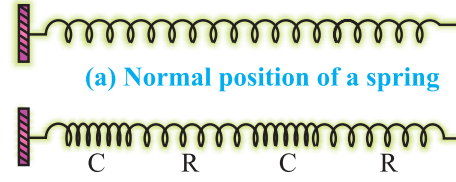
(v) By friction in objects

(vi) By scratching or scrubbing the objects etc.

Propogation of Sound

- The substance through which sound travels is called a medium.
- The medium may be solid, liquid or gas.
- When an object vibrates, then the air particles around it also start vibrating in exactly the same way and displaced from their stable position.
- These vibrating air particles exert a force on nearby air particles so they are also displaced from their rest position and start to vibrate.
- This process is continued in the medium till sound reaches our ears.
- The disturbance produced by sound travels through the medium (not the particles of the medium).
- Wave is a disturbance which travels through a medium and carries energy.
- So sound travels in wave form known as mechanical waves.





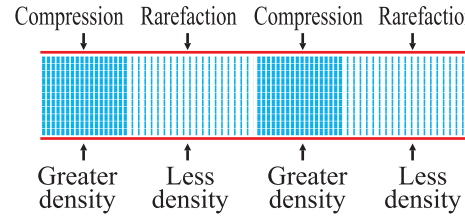
(a) Normal position of a spring

(b) Longitudinal wave in a spring

Sound Waves are Longitudinal Waves

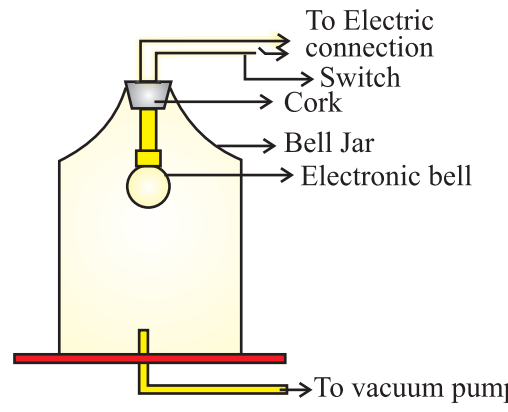
- When a body vibrates then it compresses the air surrounding it and form a area of high density called compression (C).
- Compression is the part of wave in which particles of the medium are closer to one another forming high pressure.
- This compression move away from the vibrating body.
- When vibrating body vibrates back a area of low pressure is formed called rarefaction (R).
- Rarefaction is the area of wave in which particles of the medium are further apart from one another forming a low pressure or low density area.

- When body vibrates back and forth, a series of compression and rarefaction is formed in air resulting in sound wave.
- Propogation of sound wave is propogation of density change.



Sound needs Medium for Propogation

- Sound waves are mechanical waves.
- It needs material medium for propogation like air, water, steel etc.
- It cannot travel in vaccum.
- An electric bell is suspended in airtight bell jar connected with vacuum pump.
- When bell jar is full of air, we hear the sound but when air is pumped out from the bell jar by vacuum pump and we ring the bell, no sound is heard.
- So medium is necessary for propagation of sound.



Experiment to show that sound cannot travel through vacuum

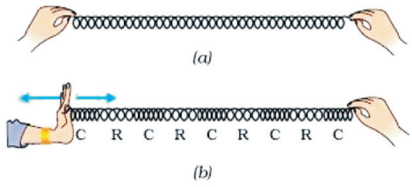
Sound Waves are Longitudinal Waves

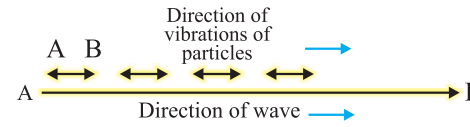
(i) A wave in which the particles of the medium vibrate back and forth in the same direction in which the wave is moving, is called a **longitudinal wave**.

- When we push and pull the slinky compression (number of turns are more or closer) and rarefaction (number of turns are less or

farther) are formed.

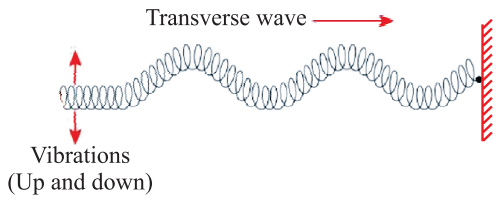
- When a wave travels along with slinky, its each turn moves back and forth by only a small distance in the direction of wave. So the wave is longitudinal.
- The direction of vibrations of the particles is parallel to the direction of wave.

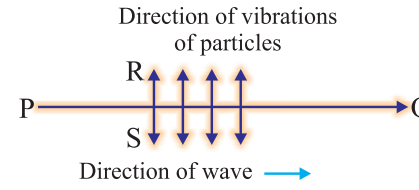




(ii) When one end of a slinky is moved up and down rapidly whose other end is fixed, it produces **transverse wave.**

- This wave possess along the slinky in horizontal direction, while turns of slinky (particles) vibrate up and down at right angle to the direction of wave.
- Thus in transverse wave particles of the medium vibrate up and down at right angles to the direction of wave.
- Light waves are transverse waves but they don't need a material medium for propagation.

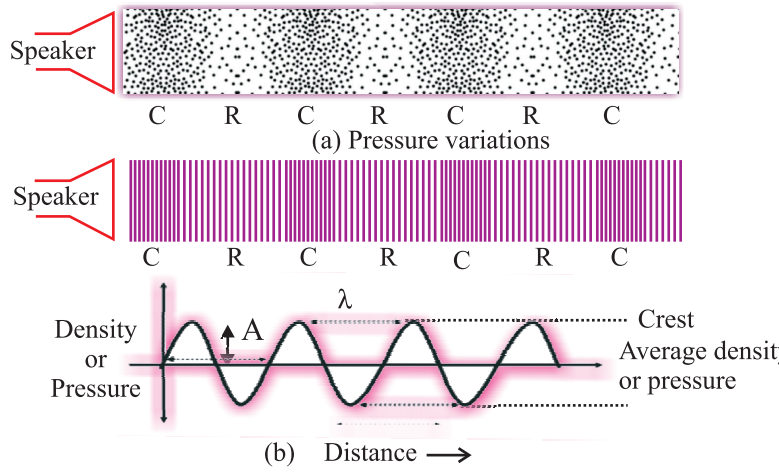




Characteristics of Sound Wave

The characteristics of sound waves are : wavelength, frequency, amplitude, time period and velocity.

- When a wave travel in air the density and pressure of air changes from their mean position.
- Compression is shown by crest while rarefaction is shown by trough.
- Compression is the region of maximum density or pressure.
- Rarefaction is the region of minimum density or pressure.

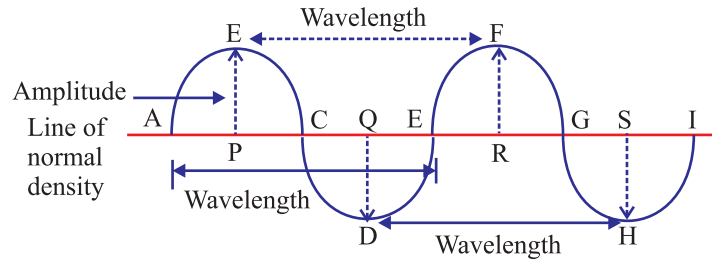


(i) Wavelength :

(a) In sound waves the combined length of a compression and an adjacent rarefaction is called its wavelength.

(b) The distance between the centres of two consecutive compressions or two consecutive rarefactions is also called its wavelength.

(c) It is denoted by the Greek letter lamda λ. Its SI unit is metre.



(ii) Frequency :

(a) No. of complete waves produced in one second or number of vibrations per second is called frequency.

(b) Number of compressions or rarefactions passed in one second is also frequency.

- Frequency of wave is same as the frequency of the vibrating body which produces the wave.
- The SI unit of frequency is hertz (Hz). The symbol of frequency is ν (nu).
- **1 Hertz :** One Hz is equal to 1 vibration per second.
- Bigger unit of frequency is kilohertz kHz = 1000 Hz.

(iii) Time Period :

(a) Time taken to complete one vibration is called time period.

(b) Time required to pass two consecutive compressions or rarefactions through a point is called time period.

- SI unit of time period is second (s). Time period is denoted by T.
- The frequency of a wave is the reciprocal of the time period.

$$v = \frac{1}{T}$$

(iv) Amplitude :

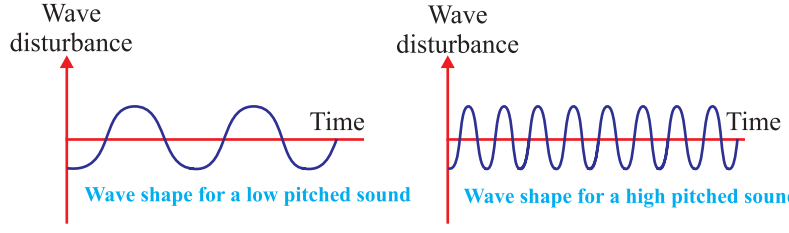
The maximum displacement of the particle of the medium from their original undisturbed position is called amplitude of the wave.

- Amplitude is denoted by A and its SI unit is metre (m).

Sound have characteristics like pitch and loudness and timbre.

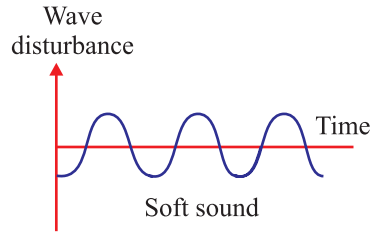
Pitch : The pitch of sound depends on the frequency of sound (vibration). It is directly proportional to its frequency. Greater the frequency, higher is the pitch and lesser the frequency, lower is the pitch.

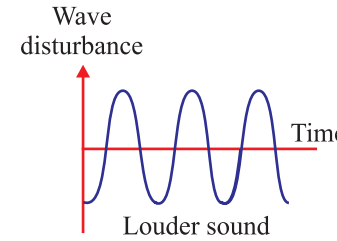
- A woman's voice is shrill having a high pitch while a man's voice is flat having low pitch.
- High pitch sound has large number of compressions and rarefactions passing a fixed point per unit time.



Loudness : The loudness depends on the amplitude of the sound wave.

- Loudness is the measure of the sound energy reaching the ear per sec.
- Greater the amplitude of sound wave, greater is the energy, louder the sound; short is the amplitude, less is the energy, soft is the sound.
- Loudness is measured in decibel 'dB'.





Quality or Timbre : The timbre of a sound depends on the shape of sound wave produced by it. It is the characteristic of musical sound.

- It helps us to distinguish between two sounds of same pitch & loudness.
- Sound of single (same) frequency is called **tone** while a mixture of different frequencies is called **note**. Noise is unpleasant to hear while music is pleasant to hear and it is of good quality.

(v) Velocity :

The distance travelled by a wave in one second is called velocity of the wave. Its SI unit is metre per second (ms^{-1}).

$$\text{Velocity} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

$$V = \frac{\lambda}{T}$$

(λ is the wavelength of the waves travelled in one time timeperiod T)

$$V = \lambda v \quad \left(\frac{1}{T} = v\right)$$

So, Velocity = Wavelength × Frequency

This is the wave equation.

Example. *What is the frequency of sound wave whose time period is 0.05 second ?*

Solution : Frequency, $v = \frac{1}{T}$

Given $T = 0.05$ s

So, $$v = \frac{1}{0.05} = \frac{100}{5} = 20 \text{ Hz}$$

Hence frequency = 20 Hz.

Speed of Sound in Various Mediums

(i) Speed of sound depends on the nature of material through which it travels. It is slowest in gases, faster in liquids and fastest in solids.

(ii) Speed of sound increases with the rise in temperature.

(iii) Speed of sound increases as humidity of air increases.

(iv) Speed of light is faster than speed of sound.

(v) In air, speed of sound is 344 ms^{-1} at 22ºC.

Sonic Boom

Some aircrafts, bullets, rockets etc. have 'supersonic speed'.

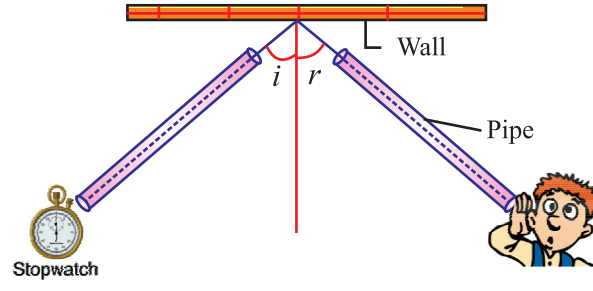
- Supersonic refers to the speed of an object which is greater than the speed of sound and it produces extremely loud sound waves called 'shock waves' in air.
- Sonic boom is an explosive noise caused by shock waves.
- It emits tremendous sound energy which can shatter the glass panes of windows.

Reflection of Sound

Like light, sound also bounce back when it falls on a hard surface. It is called reflection of sound. The laws of reflection of light are obeyed during reflection of sound.

(i) The incident sound wave, the reflected sound wave and normal at the point of incidence lie in the same plane.

(ii) Angle of reflection of sound is always equal to the angle of incidence of sound.



Reflection of Sound

Echo

The repetition of sound caused by the reflection of sound waves is called an echo.

- We can hear echo when there is a time gap of 0.1 second in original sound and echo (reflected sound).
- Echo is produced when sound reflected from a hard surface (*i.e.,* brick wall, mountain etc.) as soft surface tends to absorb sound.

v To calculate the minimum distance to hear an echo :

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Here Speed of sound in air = 344 ms^{-1} at 22ºC

Time = 0.1 second

So, $$344 = \frac{\text{Distance}}{0.1 \text{ sec}}$$

Or Distance = 344 × 0.1 = 34.4 m

So, distance between reflecting surface and audience = $\frac{34.4}{2}$ = 17.2 m (at 22ºC).

- Rolling of thunder is due to multiple reflection of sound of thunder from a number of reflecting surfaces such as clouds and the earth.

Reverberation

(i) The persistence of sound in a big hall due to repeated reflection of sound from the walls, ceiling and floor of the hall is called reverberation.

(ii) If it is too long, sound becomes blurred, distorted and confusing.

Methods to reduce reverberation in big halls or auditoriums

(i) Panels made of felt or compressed fibre board are put on walls and ceiling to absorb sound.

(ii) Heavy curtains are put on doors and windows.

(iii) Carpets are put on the floor.

(iv) Seats are made of material having sound absorbing properties.

Difference between Echo and Reverberation

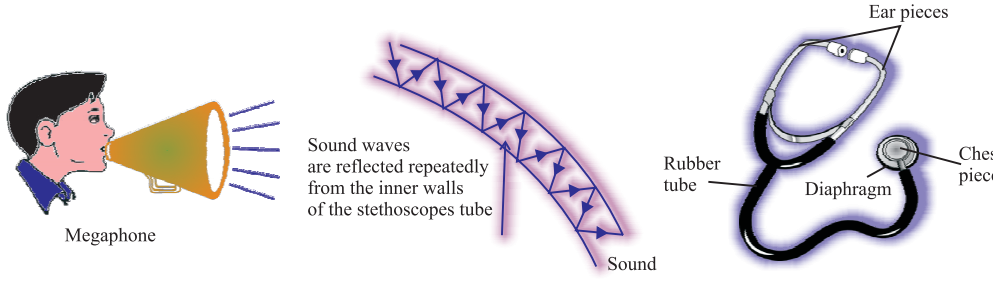
Echo	Reverberation
1. The repetition of sound caused by reflection of sound wave is called echo.	1. The persistence of sound in a big hall due to repeated or multiple reflections of sound from the walls, ceiling and floor of the hall is called reverberation.

2. Echo is produced in a big empty hall. Here is no multiple reflections of sound. Sound is not persistant.	2. If reverberation is too long, sound becomes blurred, distorted and confusing due to overlapping of different sound.

Applications of Reflection of Sound

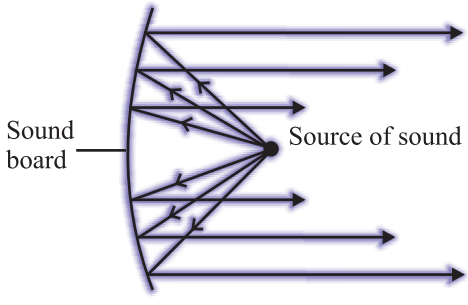
(i) Megaphone, loudspeakers, bulb horns and trumpets, shehnai etc. are designed to send sound in a particular direction without spreading all around. All these instruments have funnel tube which reflects sound waves repeatedly towards audience. In this amplitude of sound waves adds up to increase loudness of sound.

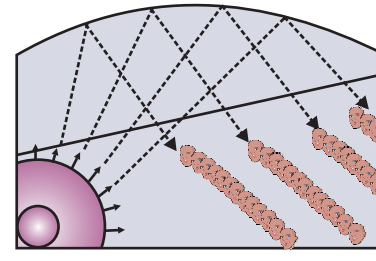
(ii) **Stethoscope :** It is a medical instrument used for listening the sounds produced in human body mainly in heart and lungs. The sound of the heartbeats reaches the doctor's ears by the multiple reflection of the sound waves in the rubber tube of stethoscope.



(iii) **Sound Board :** In big halls or auditoriums sound is absorbed by walls, ceiling, seats etc. So a curved board (sound board) is placed behind the speakers so that his speech can be heard easily by audiences. The soundboard works on the multiple reflection of sound.

(iv) The ceiling of concert halls are made curved, so that sound after reflection from ceiling, reaches all the parts of the hall.





Concert hall

Range of Hearing

(i) Range of hearing in human is 20 Hz to 20000 Hz.

- Children younger than 5 years and dogs can hear upto 25 KHz.

(ii) The sounds of frequencies lower than 20 Hz are known as 'infrasonic sounds'.

- A vibrating simple pendulum produces infrasonic sounds.
- Rhinoceroses communicate each other using frequencies as low as 5 Hz.
- Elephants and whales produces infrasonic waves.
- Earthquakes produces infrasonic waves (before shock waves) which some animals can hear and get disturbed.

(iii) The sounds of frequencies higher than 20 KHz are known as 'ultrasonic waves'.

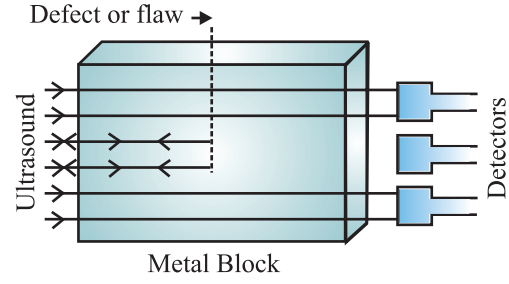
- Dogs, parpoises, dolphins, bats and rats can hear ultrasonic sounds.
- Bats and rats can produce ultrasonic sounds.

Hearing Aid

It is battery operated electronic device used by persons who are hard of hearing. Microphone convert sound into electrical signals, than those are amplified by amplifier. Amplified signals are send to the speaker of hearing aid. The speaker converts the amplified signal to sound and sends to ear for clear hearing.

Applications of Ultrasound

(i) It is used to detect cracks in metal blocks in industries without damaging them.



(ii) It is used in industries to clean 'hard to reach' parts of objects such as spiral tubes, odd shaped machines etc.

(iii) It is used to investigate the internal organs of human body such as liver, gall bladder, kidneys, uterus and heart.

(iv) **Ecocardiography :** These waves are used to reflect the action of heart and its images are formed. This technique is called echocardiography.

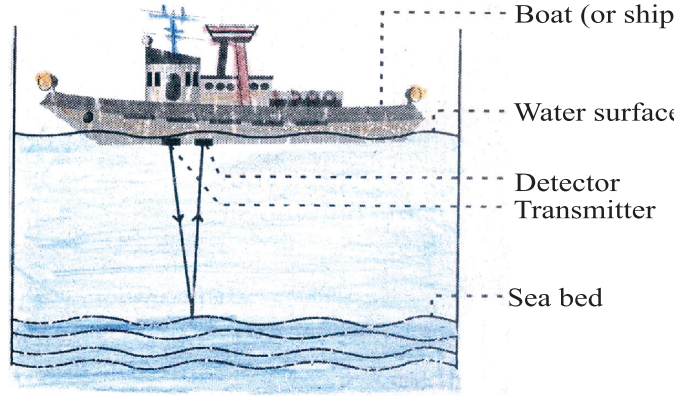
(v) **Ultrasonography :** The technique of obtaining pictures of internal organs of the body by using echoes of ultrasound waves is called ultrasonography.

(vi) Ultrasound is used to split tiny stones in kidneys into fine grains.

SONAR

The word 'SONAR' stands for 'Sound Navigation And Ranging'.

- SONAR is a device which is used to find distance, direction and speed of underwater objects.
- SONAR consists of a transmitter and a receptor or detector and installed at the bottom of a ship.
- The transmitter produces and transmits ultrasonic waves.
- These waves travel through water and after striking the objects on the bottom of sea, are reflected back and received by detector.



SONAR

- These reflected waves are converted into electric signals by detector.
- The sonar device measures the time taken by ultrasound waves to travel from ship to bottom of sea and back to ship.

Half of this time gives the time taken by the ultrasound waves from ship to bottom.

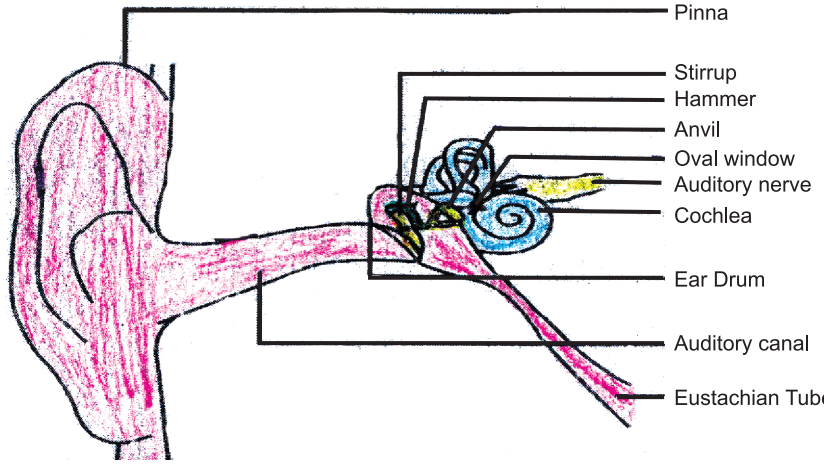
Let the time interval between transmission and reception of ultrasound signal is t. Speed of sound through sea water is v, total distance travelled by waves = $2d$. Then, $2d = v \times t$. This is called echo ranging.

The sonar is used to find the depth of sea, to locate underwater hills, valleys, submarines, icebergs and sunken ships etc.

- Bats fly in the dark night by emitting high pitched ultrasound waves which are reflected from the obstacle or prey and returned to bats ear. The nature of reflection tells the bat where the obstacle or prey is and what it is like.

Structure of Human Ear

- The ear consists of three parts : outer ear, middle ear and inner ear.
- The ears are the sense organs which help us in hearing sound.
- **The outer ear** is called **pinna**. It collects the sound from surroundings.
- This sound passes through the auditory canal.
- At the end of auditory canal, is a thin elastic membrane called ear drum or tympanic membrane.
- **The middle ear** contains of three bones : hammer, anvil and stirrup linked with one another. Free end of hammer touches ear drum and that of stirrup linked with membrane of oval window of inner ear.
- The lower part of middle ear has a narrow 'Eustachian tube'.
- **The inner ear** has a coiled tube called cochlea, which is connected with oval window. Cochlea is filled with a liquid containing nerve cells. Other side of cochlea is connected to auditory nerve which goes to brain.



Working :

- When compression of sound wave strikes the ear drum, the pressure on the outside of ear drum increases and pushes the ear drum inwards.

While during rarefaction ear drum moves outwards. Thus, ear drum starts vibrating back and forth.

- These vibrations are increased by three bones and middle ear transmits these amplified pressure variations received from sound waves to inner ear.
- In the inner ear the pressure variations are turned into electric signals by the cochlea.
- These electric signals are sent to the brain via auditory nerve and the brain interprets them as sound.

Working of Human ear

Pinna → Ear canal → Ear drum → Hammer → Anvil → Stirrup → Oval window → Cochlea → Auditory nerve → Brain

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

1. Why sound waves are called mechanical waves ?
2. Which characteristic of sound determine : (a) Pitch, (b) Loudness ?
3. Write wave formula for velocity of sound.
4. Write the hearing range of human being.
5. What is sound ?
6. Name the two types of waves which can be generated in a slinky.
7. What is SI unit of frequency ? Write its bigger unit also.
8. How is sound produced ?
9. In which medium sound travels fastest : air, water or steel ?
10. Name two devices which work on the reflection of sound.

SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. State two laws of reflection of sound.
2. Define the term wavelength & frequency.
3. Define the term time period and amplitude.

4. Explain why, the flash of lighning reaches us first and the sound of thunder is heard a little later ?

5. What is meant by supersonic speed ?

6. Why are the ceiling of concert halls made curved ?

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. What is reverberation ? How can reverberation in a big hall be reduced ?

2. What is echo ? How is echo formed ? How thunder of clouds is formed ?

3. Write any three applications of ultrasound.

4. Explain how bats use ultrasound to catch the prey.

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. What is SONAR ? Explain its working. Give its uses.

2. A wave is moving in air with a velocity of 340 m/s. Calculate the wavelength if its frequency is :

   (a) 512 vibrations per second (b) 100 Hz.

3. A sonar station picks up a return signal after 3 seconds. How far away is the object ? [Speed of sound in water = 1440 m/s]

4. A stone is dropped from the top of a tower 500 m high into a pond of water at the base of tower. When is the splash heard at the top ? Given $g = 10\ ms^{-2}$ and speed of sound = $340\ ms^{-1}$.

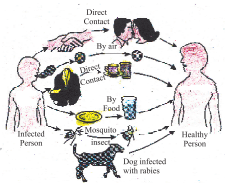
Hints to Long Answer Type Questions

2. (a) 0.66 metre (b) 3.4 m

3. 2160 m

4. 11.47 s

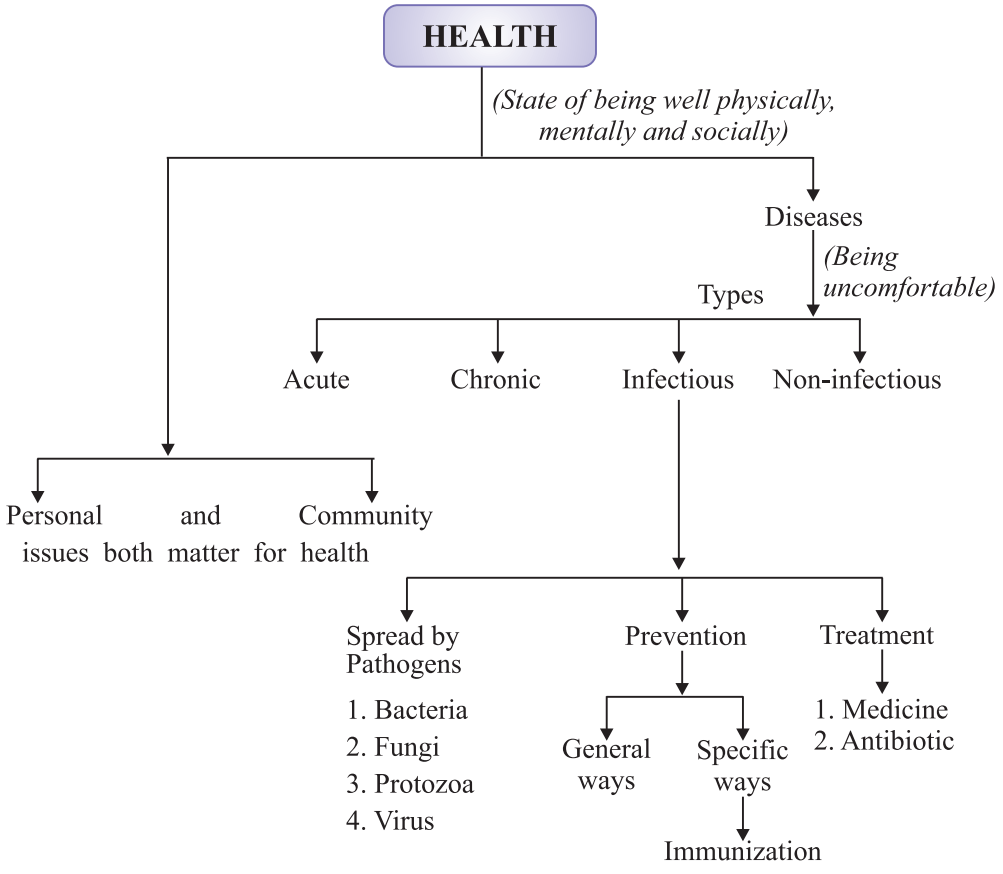
[*Hint :* Time taken by stone to reach at pond, t = ?, Use $s = ut + ½gt^2$, $500 = 0 + ½ \times 10t^2$; so, $t^2 = 100$ or $t = 10$ sec.]



Chapter - 13

Why Do We Fall Ill ?

CHAPTER AT A GLANCE



Health is a general condition of a preson's mind and body. According to WHO (World Health Organisation) health is a "state of physical, metal and social well-being of a person".

To make people aware and conscious of keeping healthy and disease-free we celebrate WORLD HEALTH DAY on 7th April.

- 'Health' is a state of being well enough to function well physically, mentally and socially.
- Disease : Any disturbance in the structure or function of any organ or part of body.
- The various causes of diseases are pathogens (virus, bacteria), lack of nutritious diet/balanced diet and lack of public health services.
- Acute diseases occur suddenly and lasts for a short duration while chronic diseases develop slowly and lasts for long period of time.
- The diseases/infections can be prevented by life style (exercise, proper sleep, enough relaxation) modification, taking balanced diet, good personal health and hygiene and also maintaining a clean and healthy surrounding.
- Treatment involves killing of the microbes/pathogens.

Health

- Health is a state of physical, mental and social well-being.
- The conditions necessary for good health are :
  (i) Good physical and social environment.
  (ii) Good economic conditions.
- Good physical and social environment includes clean surroundings, good sanitation, proper garbage disposal and clean drinking water.
- Good economic conditions includes job opportunities for earning to have nutritious food and to lead a healthy life.

Personal and Community Issues Both Matter for Health

Community Health :

- All those activities which people do both individually and in groups for the development of their society, constitute the community health.
- Personal and community health are supplementary to each other.
- We protect ourselves by keeping our body clean.
- For this, we also require a good and healthy environment in our surroundings.
- We can have this only by the means of community health and

development.

- So, both personal and community health are inter-related.

Differences between Being Healthy and Disease-free

Being Healthy	Being Disease-free
1. It is a state of being well enough to function well physically, mentally and socially.	1. It is a state of absence from diseases.
2. It refers to the individual, physical and social environment.	2. It refers only to the individual.
3. The individual has good health.	3. The individual may have good health or poor health.

Disease and Its Causes

What does disease look like ?

- When a person is affected by a disease either the functioning or the appearance of one or more systems of the body will change for the worse.
- These changes give rise to symptoms and signs of disease.
- On the basis of the symptoms the physicians look for the signs of a particular disease and conduct tests to confirm the disease.

Types of Diseases

(i) **Acute Diseases :** Acute diseases which last for only very short period of time and affect body suddenly and quickly. *E.g.,* Cold, cough, typhoid etc.

(ii) **Chronic Diseases :** The diseases which last for a long time, even as much as a life time, are called chronic diseases. *E.g.,* Diabetes, tuberculosis, elephantiasis etc.

Causes of Diseases

Diseases are caused by :

- Pathogens like virus, bacteria, fungi, protozoans or worms.
- Poor health and under nourishment.
- Hereditary and genetic disorder.

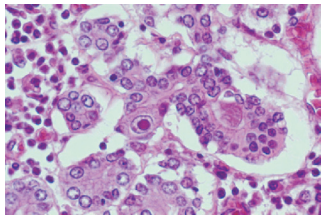
- Lack of proper treatment of immunization.
- Environmental pollution (air, water etc.)

Infectious and Non-infectious Diseases

(i) Infectious Diseases : The diseases which spread due to infection by micro-organisms are called infectious diseases. It is communicated from diseased person to healthy person, caused by some biological agents/pathogens like viruses, bacteria, fungi, protozoans, fungi worms.

(ii) Non-infectious Diseases : The disease which does not spread by contact between infected and healthy person through air and water, is called non-infectious disease. *E.g.,* Arthritis, heart disease.

Pictures of Different Micro-organisms



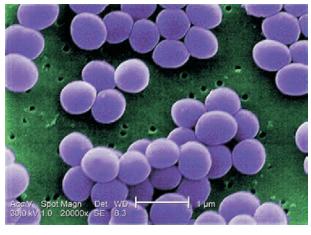
(i) The picture shows SARS viruses coming out of the surface of an infected cell (see the arrows for example).

(ii) 500 nanometer = 0.5 micrometer = 0.001 millimeter.

(i) The picture shows Trypanosoma, a protozoan organism.

(ii) It causes sleeping sickness.

(iii) The saucer-shaped substance lying next to the protozoa, is a red blood cell.



(i) The picture shows *Staphylococcus* bacteria.

(ii) The *Staphylococcus* bacteria causes acne.

(iii) The scale is indicated at the line at the top left of the picture. It is 5 micrometers long.

(i) The given picture shows an adult roundworm from the small intestine.

(ii) Its technical name is *Ascaris Lumbricoides.*

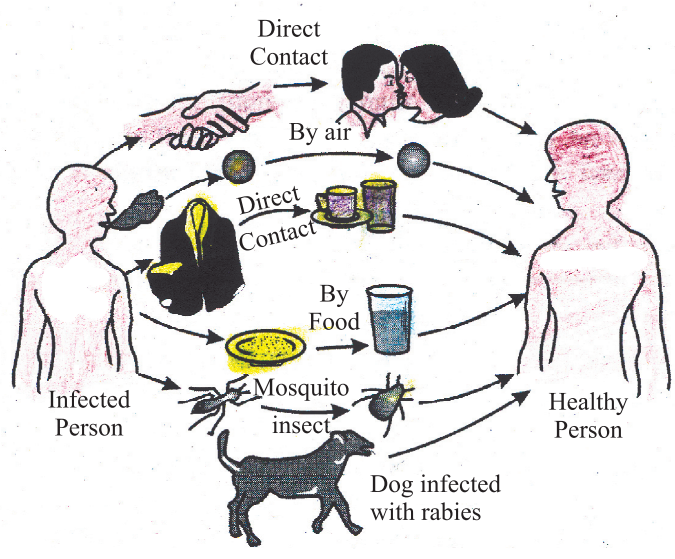
(iii) The ruler next to it shows 4 centimeter to give an idea of the scale.

Micro-organisms :

S. No.	Infectious Agents	Diseases
1.	Viruses	Common cold, influenza, measles, chicken pox, AIDS, Hepatitis-B etc.
2.	Bacteria	Cholera, typhoid, TB, tetanus, anthrax, food poisoning etc.
3.	Fungi	Skin infections
4.	Protozoan	Malaria, kala-azar, amoebic dysentery, sleeping sickness
5.	Worms	Intestinal infections, elephantiasis

Antibiotics

- Antibiotics blocks biochemical pathways important for bacteria. Hence, they are effective against them. *E.g.,* Penicillin, tetracycline.
- Many bacteria make a cell wall to protect themselves, the antibiotics (Penicillin) blocks the bacterial process that builds cell wall.
- Antibiotics works only against the **bacteria** and **not** against the **viruses.**



Common method of transmission of diseases

(Diseases spread from affected person to healthy person)

Means of Spread of Infectious Diseases

Infectious diseases spread from an infected person to a healthy person through air, water, food, vectors, physical contact and sexual contact.

- **Through air :** By sneezing and coughing, the microbes spread into air and enter into the body of a healthy person, like common cold, tuberculosis, pneumonia etc.
- **Through water :** The microbes enter into our body by drinking/eating polluted and contaminated water/food, like cholera, amoebic dysentery etc.
- **Vectors :** Some organisms like female anopheles mosquito also work as a vector of disease, like malaria, dengue, yellow fever etc.
- **Through sexual contact :** Syphilus, AIDS spread by sexual contact with infected person. AIDS virus can also spread through blood transfusion and from the mother to her child during pregnancy and through breast feeding.

AIDS (Acquired Immuno Deficiency Syndrome)

Causes :

AIDS is caused by a retro-virus called HIV (Human Immuno Deficiency Virus).

Method of transmission of AIDS :

The transmission of AIDS from an infected to a healthy person takes place :

- through sexual contact
- blood transfusion
- use of infected needle or blade etc.
- This may also get transmitted from infected mother to her foetus.

Prevention :

- Avoid transfusion of infected blood. This can be done by testing whether the blood is HIV negative or not.
- Always use disposable needle and syringe.
- Avoid sexual contact with unknown person.
- Avoid the same razor used in the salons.

ORGAN – Specific and Tissue-specific Manifestations

Disease causing microbes enter the body by different means and goes to different organs and tissues.

(i) Microbes which enter through the nose are likely to go to the lungs. (Bacteria which cause tuberculosis of lungs).

(ii) Microbes which enter through the mouth are likely to stay in the gut (bacteria which causes typhoid) or liver (bacteria which causes jaundice).

(iii) Virus which causes AIDS enter the body through sexual organs during sexual contact and spread through the lymph to all parts of the body and damages the immune system.

(iv) Virus which causes Japanese encephalitis (brain fever) enters the body through mosquito bite and goes and infects the brain.

Principles of Treatment :

The treatment of infectious diseases consists of two steps. They are **to reduce the effects** of the disease (symptoms) and **to kill the microbes** which caused disease.

(i) To reduce the effects of the disease : This can be done by taking medicines to bring down the effects of the disease like fever, pain or loose motions etc. and by taking bed rest to conserve our energy.

(ii) To kill the microbes : This can be done by taking suitable antibiotics and drugs which kills the microbes and the disease is cured.

Principles of Prevention

There are two ways of prevention of infectious diseases. They are general ways and specific ways.

(i) General ways of prevention : Public hygiene is most important for prevention of infectious diseases. Proper and sufficient food for everyone will make people healthy to resist the infection.

Air borne diseases can be prevented by living in conditions that are not crowded. Water borne diseases can be prevented by providing safe drinking water. Vector borne diseases can be prevented by providing clean environment.

(ii) Specific ways of prevention : There are disease specific measures which are used to fight them. It is done by **Immunisation.** This is the

process of introducing a weakened pathogen inside the body of the host to fool his/her immune system to produce antibodies against that particular disease. Not only does our immune system fight the disease (feeble pathogen), but also keeps a memory of the incident by keeping those antibodies in blood. Thus, next time even if the disease will strike the host's body with full vigor, the body will be able to protect itself with the help of these antibodies. This is also the basic law followed by vaccination programmes done for infants.

A Few Diseases

Disease	Pathogen	Vector (if any)	
1. Malaria	Protozoa	Female anopheles mosquito	Recurrent fever, chills
2. Typhoid	Bacteria – *Salmonella*	Cockroaches etc.	High fever and intestinal infections
3. AIDS	Virus – HIV	–	Not a disease in itself, it affects our lymph glands thereby decreasing our immunity
4. Dengue	Virus	Female *aedies egypte* mosquito	Headache + fever
5. Worms	Worms in intestine	–	Stomach ache
6. Kala azar	Protozoa – *Leishmania*	–	Brain fever
7. Round worms	Ascaris in intestine	–	Stomach ache
8. SARS	Bacteria	–	–
9. Swine flu	Virus	Pig + human	Fever – spreads
10. Bird flu	Virus	Birds	Fever – spreads
11. Ebola	Ebola virus	–	Fever – spreads

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

1. Why is food necessary for us ?
2. Write the full form of WHO.
3. Name two non-infectious diseases.
4. Write two water-borne diseases.

SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. Write the difference between acute and chronic disease.
2. Write the expanded form of AIDS.
3. What is the difference between 'Being healthy' and 'Disease free' ?
4. Name two methods for treatment of infectious diseases.

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. How do micro-organisms enter into our body ?
2. Name four diseases caused by protozoa, virus, bacteria, fungi.
3. What are the different means by which infectious diseases spread ?
4. What precautions can you take in your school to reduce the incidence of infectious diseases ?

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. Name five diseases against which immunization vaccines are available.

OR

Name two diseases that can be prevented by using vaccine.

2. Fill in the blanks :

   (i) .....is a state of physical, mental and social well-being.

   (ii) AIDS is a.....(communicable/non-communicable) disease.

   (iii) Common cold is a.....(acute/chronic) disease.

(iv) Breathing in polluted air causes.....disease.

(v) Small pox is prevented through..... .

Hints to Long Answer Type Questions

1. Protozoa – Malaria, Virus – Polio, Bacteria – Pneumonia, TB, Fungi – Skin disease

2. (i) Health (ii) communicable (iii) acute

   (iv) respiratory (v) vaccination

Chapter - 14

Natural Resources

CHAPTER AT A GLANCE

Biosphere

- Living resources → Biotic → *E.g.,* plants, animals
- Non-living resources → Abiotic → Air, Water, Land

Pollution *(Contamination of natural resources)*

- Air pollution
  1. Green house effect
  2. Ozone depletion
  3. Acid rain
- Water pollution
  1. Chemical waste
  2. Domestic waste
  3. Thermal waste
- Land pollution
  1. Industrial waste
  2. Agricultural waste

Insecticides, Pesticides

- Life on earth depends on resources like soil, water, air and energy from sun.
- Uneven heating of air over land and water-bodies causes winds.
- Evaporation of water from water-bodies and subsequent condensation give us rain.

- Pollution of air, water and soil affect the quality of life.
- We need to conserve our natural resources and use them in a sustainable manner.
- Various nutrients are used again and again in a cycle fashion. This leads to a certain balance between the various components of the biosphere.

Natural Resources

The resources available on the earth and the energy from the sun are necessary to meet the basic requirements of all life forms on the earth.

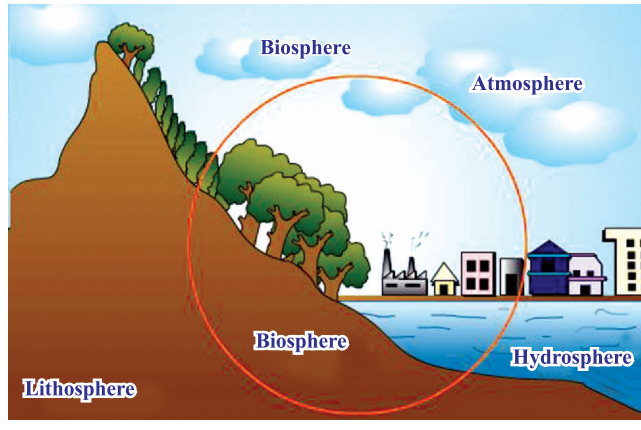
The stocks of nature which are useful to mankind are known as natural resources. *E.g.*, air, water, soil, minerals etc.

What are these resources on the earth ?

The outermost crust of the earth is called the **lithosphere**. Water covers 75% of the earth's surface. It is also found underground. These comprise the **hydrosphere.** The air that covers the whole of the earth like blanket is called the **atmosphere.**

Biosphere

All living things on earth together with atmosphere, the hydrosphere and the lithosphere interact and make life possible is known as biosphere. It may be :



Biotic components : Plants and animals.

Abiotic components : Air, water and soil.

AIR

- Air is a mixture of different gases.
- Air contains oxygen which is essential to living organisms for respiration. So it is called breath of life.

Role of Atmosphere

- Air is a bad conductor of heat. It keeps the average temperature of the earth constant during the day and even during the course of the whole year.
- Prevents the sudden increase in temperature during day time and during the night, it slows down the escape of heat into outer space. *E.g.,* At moon, there is no atmosphere and so the temperature varies from 190ºC to 110ºC.

The Movement of Air : Winds

- During the day, the direction of wind is from sea to land. This is because the air above the land gets heated faster and starts rising.
- During the night, the direction of wind is from land to sea. This is because at night, both land and sea start to cool.
- The movement of air from one region to the other creates winds.

RAIN

- Rain is formed by evaporation and condensation of water through water cycle in which distribution of water takes place. Rain is very important because it carries out all the agriculture processes in the plants.
- So we should conserve rain by contracting dams, pools etc.

Air Pollution

- An increase in the content of harmful substance (pollutants) in the air like carbon dioxide, carbon monoxide, oxides of sulphur, nitrogen, fluoride, lead, nickel, arsenic and dust particles etc. causes air pollution. It may cause :

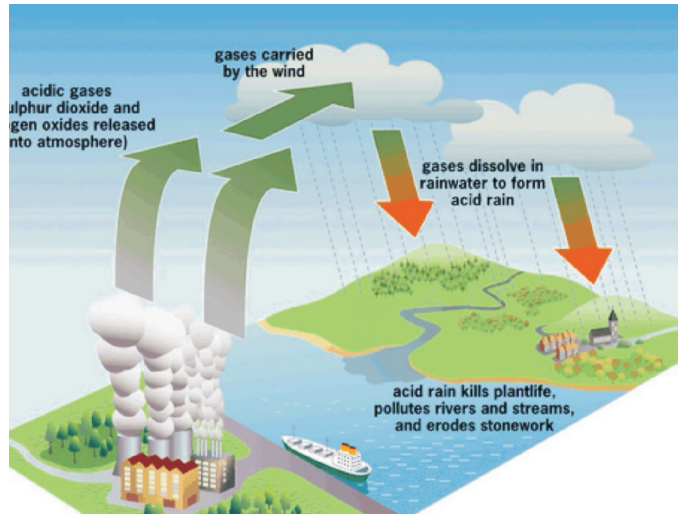
In humans : Respiratory and renal problems, high blood pressure, eye irritation, cancer.

In plants : Reduced growth, degeneration of chlorophyll, mottling (patches/ spots of colour) of leaves.

Acid Rain

- When fossil fuels are burnt, gases like sulphur dioxide and nitrogen dioxide (NO_2) are released.

- These gases are dissolving in water form nitric acid and sulphuric acid.



Acid rain kills plant life, pollutes river and streams

Green House Effect

- Carbon dioxide keeps the earth warm much like glass which keeps the green house warm.
- Increase in carbon dioxide (CO_2) :
  - (i) intensifies green house effect.
  - (ii) leads to global warming.
  - (iii) increase in average temperature of earth.
  - (iv) may lead to melting of polar caps.
  - (v) sub-merging number of coastal cities.

Changes in environment affects us and our acitivities change the environment around us.

Environmental Problems Caused by Humans

Depletion of Ozone Layer

- Ozone layer is present in the stratosphere which is a part of our atmosphere from 16 km to 60 km above sea level.
- Ozone is an allotrope of oxygen. Its molecule is made up of three oxygen atoms. Molecular formula is O_3.

- Ozone layer absorbs the ultra-violet rays coming from the sun and protects living being from their harmful effects like skin cancer, cataract in eyes, weaken immune system.
- The decline of ozone layer thickness in Antartica was first observed in 1985 and was termed as ozone hole.

Reason of Ozone Depletion

- Excessive use of CFCs (Chloro Fluoro Carbon) in refrigeratos, jet planes, spray cans, fire extinguishers.
- Nuclear explosion

Smog

- Smog is a type of air pollution.
- The word 'smog' comes from the blend of two words : Smoke and fog.
- Smog can form in any climate where there is a lot of air pollution especially in cities.

Water : A wonder Liquid

- The most unusual natural compound found on earth and which fulfills almost various demands of different living things.
- About three-fourth of the earth surface is 75% are covered with water.
- It is present underground, a very large area on the surface (sea, ocean etc.) and also in the form of water vapour in the atmosphere.

Water Necessary for all Organisms

- It maintains a uniform temperature of the body.
- All cellular processes take place in a water medium.
- All the reactions that take place within our body and within our cells occur between substances that are dissolved in water.
- Water forms the habitat of many plants and animals.

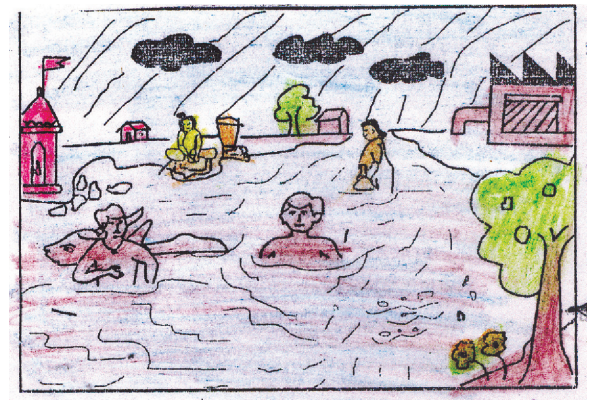
Water Pollution

When water becomes unfit for drinking and other uses, then water is said to be polluted.

Causes of Water Pollution

- Dumping of wastes from the industries into water bodies.

- Washing of clothes near water bodies.
- Spraying chemical in water field.
- Dumping household wastes into the water bodies.



Various causes of water pollution

(Bathing of humans and animals, disposal of factory wastes, washing clothes etc.)

Soil

Soil is the portion of the earth surface consisting of disintegrated rock and decaying organic material. It provides the support for many plants and animals.

Creation of Soil : Various Factors

Factor 1. Sun

The sun heats up rocks during the day so that they expand. At night these rocks cool down and contract. Since all parts of the rocks do not expand and contract at the same rate, this results in the formation of cracks and ultimately the huge rocks breaks up into smaller pieces.

Factor 2. Water

Fast flowing water carries big and small particles of rock downstream. These rocks rub against other rocks and the resultant abrasion causes the rocks to wear down into smaller particles.

Factor 3. Wind

Wind carries sand from one place to another.

Living Organisms

Lichen (A slow growing plant)

Lichen, moss also grow on surface of rocks. While growing, they release certain substances that cause the rock surface to powder down and form a thin layer of soil.

Soil Erosion

Carrying away of upper fertile layer of soil by rain, wind, human activities and wrong agricultural practice is called soil erosion.

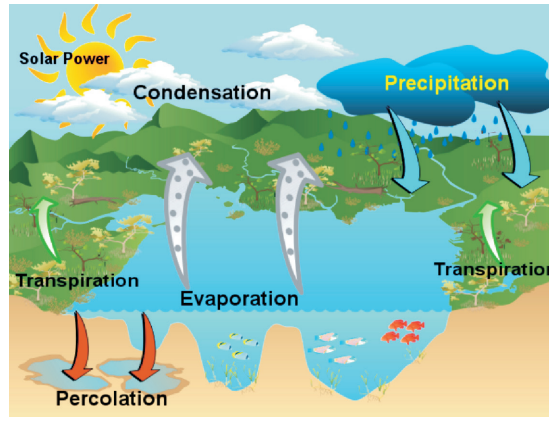
Causes

- Over grazing of land.
- Removal of top soil by wind and water.
- Due to lack of trees the upper layer of soil is eroded by air and water.
- Leaving land uncultivated for long time.

Biogeochemical Cycles

- The flow of substances from non-living to living and back to non-living is called the cycling of substances.
- The cycling of chemical elements like carbon, oxygen, nitrogen, phosphorus, sulphur and water in the biosphere is called **biogeochemical cycle.** It operates through soil, water, air and biotic factors.

Water Cycle



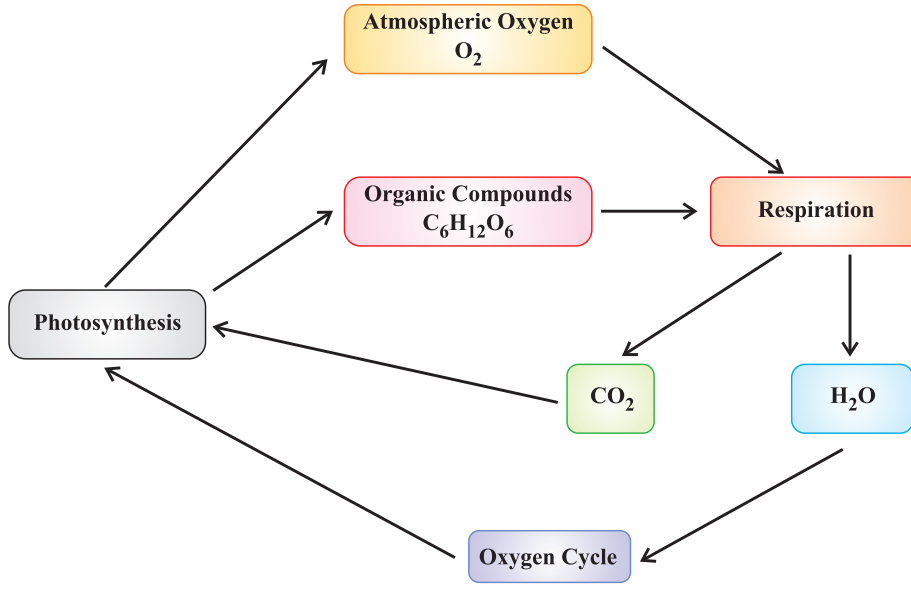
Water Cycle

- The whole process in which water evaporates and falls on the land as rain and later flows back into the sea via rivers is known as **water cycle.**
- When sun shines, water evaporates continuously from the water bodies and forms **water vapour.** This water vapour rises up and goes into the **atmosphere.**
- The plants absorb water from the soil and use it during the process of **photosynthesis.**

They also loose water by the process of **transpiration**.

- The water vapour produced by transpiration also goes into the **atmosphere.**
- The process of respiration and evaporation from the surface of animal body produces water vapour which goes into the atmosphere.
- The evaporation and condensation of water vapour leads to rain. During winter, the water falls down in the form of dew or snow.
- All of the water that falls on the land does not immediately flow back into the sea. Some of it seeps into the soil and becomes part of the underground reservoir of fresh water.
- The underground water is again taken by plants and water cycle continues.

Oxygen Cycle



Oxygen Cycle

The % of oxygen in air is 21%.

- The cyclic process by which oxygen element is circulated continuously through the living and non-living components of the biosphere constitutes oxygen cycle.
- Human beings and animals take oxygen from the atmosphere during the process of respiration.

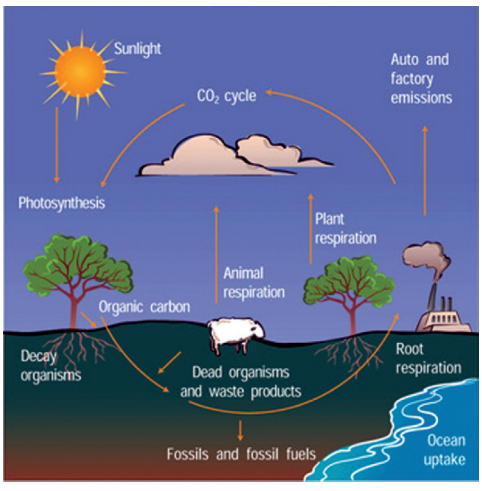
The decomposition of dead organisms also takes in oxygen from the atmosphere.

Respiration and decay of dead organisms release CO_2 and water.

- The carbon dioxide and water are used by the green plants during the process of photosynthesis.
- They give out oxygen during this process. This oxygen is again used by human beings and animals.

Thus, the oxyen cycle keeps repeating in nature.

Carbon Cycle



Carbon Cycle

0.03-0.04% carbon is present in the atmosphere in the form of CO_2.

- Carbon cycle maintains the balance of the element carbon in the atmosphere. Carbon is found in various forms on the earth.
- Carbon is present in the atmosphere as carbon dioxide.
- Carbon can also occur as carbonates and bicarbonate salts in minerals.

- Carbon is the essential part of nutrients like carbohydrates, fats, proteins, nucleic acids and vitamins.
- Carbon cycle keeps the level of CO_2 constant in the atmosphere.

The Carbon Cycle starts in plants as :

Step I.

Plants use CO_2 in the atmosphere, convert it into glucose in the presence of sunlight by the process of photosynthesis. Plants and animals break these carbohydrates for energy and release CO_2 through respiration.

Step II.

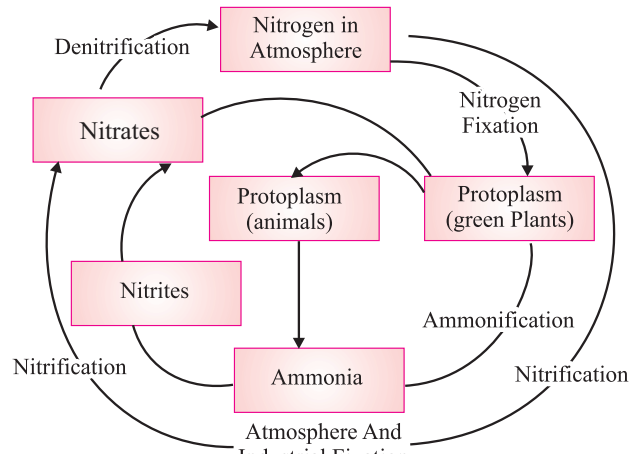
When the plants and animals die, fungi and bacteria decompose the dead remains. This releases the carbon in the remains as carbon dioxide.

Step III.

Some of the dead plants and animals which get buried under the earth under certain temperature and pressure get transformed into fossil fuels like coal and petroleum.

On burning these fuels, CO_2 is released into the atmosphere.

Nitrogen Cycle



Nitrogen Cycle

The sequence in which nitrogen passes from the atmosphere to the soil and organisms, and then is eventually released back into the atmosphere, is called nitrogen cycle.

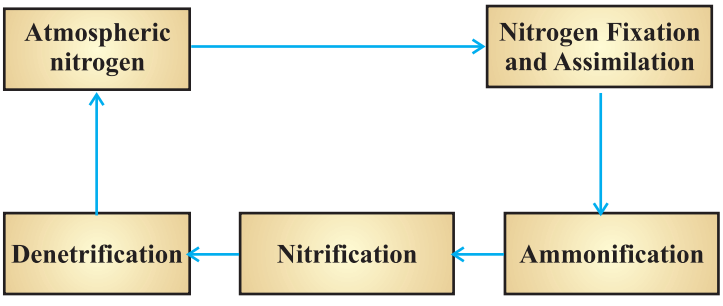
- Nitrogen makes up 78% of the earth's atmosphere.

- Nitrogen is an essential constituent of proteins, nucleic acids like DNA and RNA, vitamins and chlorophyll.
- Plants and animals cannot utilize atmospheric nitrogen readily.
- It has to be fixed by some organisms called nitrogen fixers.
- Nitrogen-fixing bacteria like *Rhizobium* live in symbiotic association in the root nodules of certain leguminous plants.

Root nodules of leguminous plant

- These bacteria convert atmospheric nitrogen into ammonia which is utilized readily by plants.
- Nitrogen-fixing bacteria along with free living bacteria in the soil achieve 90% of nitrogen fixation.
- Lightning plays an important role in nitrogen fixation. When lightning occurs, the high temperature and pressure convert nitrogen and water into nitrates and nitrites.
- Nitrates and nitrites dissolve in water and are readily used by aquatic plants and animals.

- **Ammonification :** It is the process by which soil bacteria decompose dead organic matter and release ammonia into soil.
- **Nitrification :** It is the process by which ammonia is converted into nitrites and nitrates.
- **Denitrification :** It is the process by which nitrates are converted into atmospheric nitrogen.



A flow chart to show the important stages of Nitrogen Cycle

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

1. What are the resources present on the earth ?
2. Name two gases of air.
3. Expand the term CFCs.
4. Write the formula of ozone.
5. Which acids are present in acid rain ?
6. Name four water borne diseases.
7. What are the nitrogen-fixing bacteria called ?

SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. Name three types of soil.
2. Name the disease that can be caused by UV rays.
3. What is the major source of fresh water ?

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. Draw a neat and labelled diagram of water cycle in nature.
2. How is green house effect related to global warming ? Explain.
3. What are the causes of soil erosion ?
4. Why is water necessary for all organisms ?

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. Write the differences between oxygen and ozone.
2. Explain the oxygen cycle.

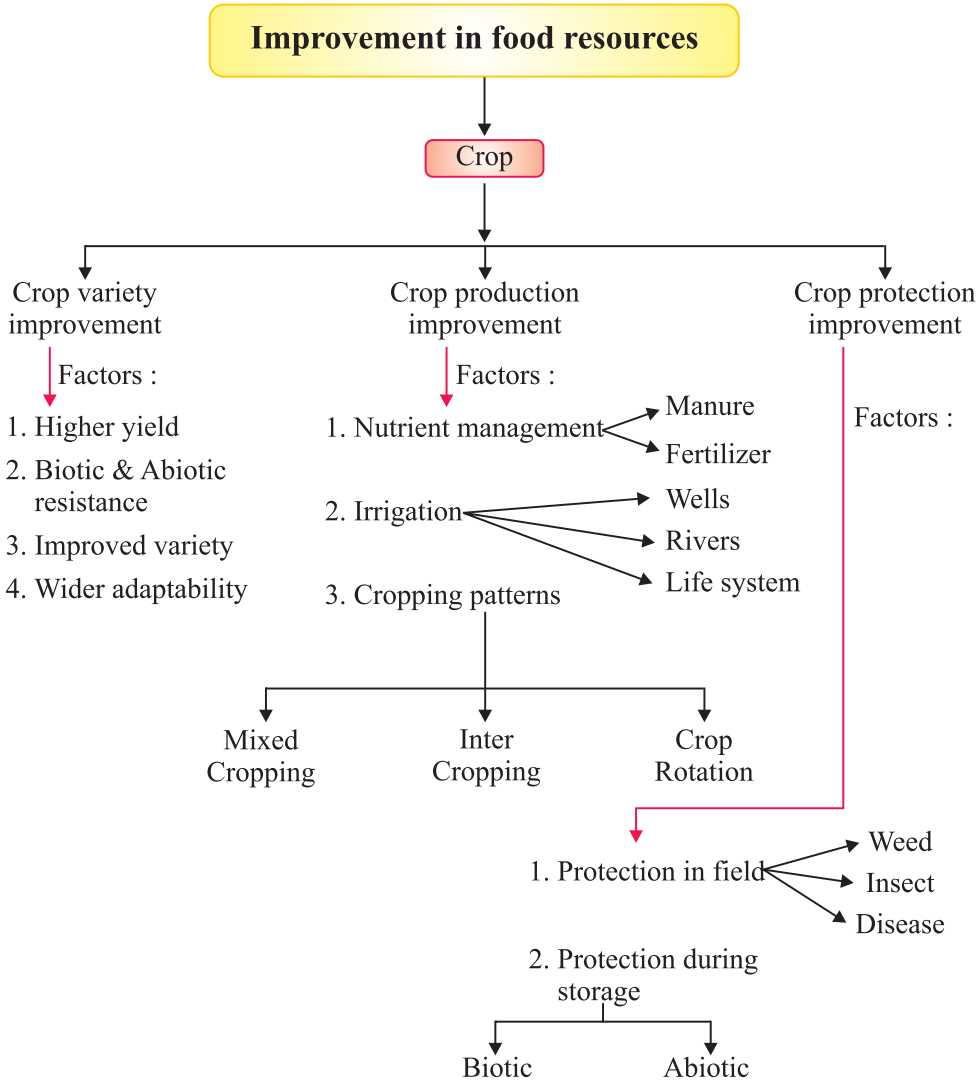
OR

What are the factors or processes that make soil ?

Chapter - 15

Improvement In Food Resources

CHAPTER AT A GLANCE



- *All living organisms need food for health, growth and development.*
- *Food provides nutrients like carbohydrates, fats, protein, vitamins and minerals.*
- *Both plants and animals are major sources of food.*
- *India has a high population of more than one billion and is still growing.*
- *To feed this growing population we need more than a quarter of a billion tonnes of grain per year.*
- *This can be done by farming on more land but India is already intensively cultivated. Hence, it is necessary to increase the efficiency of production for both crops and livestock.*

Green Revolution

Green revolution is a programme introduced in many countries to increase food production by use of modern technology, proper irrigation, improved seeds etc.

White Revolution

White revolution is a programme in India to increase production of milk in India. This programme made India self-sufficient in production of milk.

Improvement in Crop Yields

Types of Crops :

(a) **Cereals :** They include crops like wheat, rice, maize, barley etc. They provide us carbohydrates.

(b) **Seeds :** Not all seeds of plants are edible like seeds of apple or cherries. Edible seeds include cereals, pulses, oil seeds and nuts. They provide us fats.

(c) **Pulses :** They include legumes such as gram, pea, black gram, green gram, lentil. They provide us proteins.

(d) **Vegetables, spices and fruits :** They provide us vitamins & minerals.

They include apple, mango, cherry, banana, water-melon etc.

Vegetables like spinach, leafy vegetables, carrot etc.

Spices like chilly, black pepper, fodder crops, oats etc.

Crop Season :

Different crops require different conditions (temperature, moisture, etc.), different photo-periods (duration of sunlight) for their growth and completing life cycle.

The two types of crops seasons are :

(a) Kharif Season : These crops grow during rainy season (June to October). *E.g.* of Kharif crops are black gram, green gram, pigeon pea, rice, paddy, soyabean.

(b) Rabi Season : These crops are grown during November to April. Rabi crops are known as winter crops. *E.g.,* wheat, gram, peas, mustard, linseed etc.

Approaches which enhance the crop yield are as following :

(i) Crop variety improvement

(ii) Crop production improvement

(iii) Crop protection improvement

(A) Crop Variety Improvement : Factors by which variety improvement can be done are :

- Good and healthy seeds
- **Hybridization :** It is the process of crossing between two or more genetically dissimilar plants to produce a new variety with good properties of both the crops.

Properties to be possessed by improved seeds

Or

Factors for which variety improvement in crops is done

(a) Higher yield : To increase the productivity of the crop per acre.

(b) Improved quality : Quality of crop products vary from crop to crop.

(c) Biotic & Abiotic resistances : Crop production reduces due to biotic and abiotic factors. Varieties resistant to these factors can improve crop production.

(d) Wider adaptability : Crops which can grow in different conditions, will help in setting high production.

(e) Desired agronomic traits : Crops which contain desired agronomic traits (height, branching, leafs), sets high production.

(B) Crop Production Improvement : It involves different practices carried out by farmers to achieve higher standards of crop production. They are :

(a) Nutrient management

(b) Irrigation

(c) Cropping patterns

(a) Nutrient Management : Like other organisms, plants also require some elements for their growth. These elements are called nutrients.

Sources	Nutrients
Air	Carbon, oxygen
Water	Hydrogen, oxygen
Soil	**(i) Macro nutrients :** Nitrogen – required by plants in large amount, phosphorus, potassium, calcium, magnesium, sulphure.

(ii) Micro nutrients : Iron, Mn – required in small amount, boron, Zn, copper, molybdenum, chlorine.

Manure and Fertilizers

To increase the yield, the soil can be enriched by supplying nutrients in the form of manure and fertilizers.

Manure :

- It is a source of organic matter.
- It supplies small quantities of nutrient to the soil.
- It is prepared by the decomposition of animal excreta and plant waste.

Various forms of Manures :

(A) Compost : The process in which animal excreta (like cow dung), kitchen waste, plant remains, waste food, sewage waste etc. are decomposed in pits is known as composting.

(B) Vermicompost : Compost prepared by using earthworms to hasten the process of decomposition of plants and animals refuse is called vermicompost.

(C) Green manure : Some plants like sun hemp, guar etc. are grown and after sometime mulched by ploughing in the field. These green plants turn into green manures. They are rich in nitrogen and phosphorus.

Fertilizers :

Fertilizers are prepared in factories. They are made up of chemical substances. They have large amount of nutrients like nitrogen, phosphorus and potassium.

Fertilizers are easily absorbed by the plants since they are soluble in water. It is costly.

Difference between Manures and Fertilizers

Manures	Fertilizers
1. These are organic substances.	1. These are inorganic substances.
2. These are made up of natural substances (decomposition of plant and animal waste).	2. These are made of chemical substances.
3. These have less amount of nutrient.	3. These have large amount of nutrients.

4. These are cheap and are prepared in rural homes or fields.	4. These are costly and are prepared in factories.
5. Manures are slowly absorbed by the plants since they are insoluble in water.	5. Fertilizers are easily absorbed by the plants since they are soluble in water.
6. It is difficult to store and transport.	6. Their storage and transportation is easy.

(b) Irrigation : The process of supplying water to the crop plants is called irrigation.

Methods of Irrigation :

(i) Wells : These are of two types :

Dug wells : In dug wells, water is collected by bullock-operated devices or by pumps.

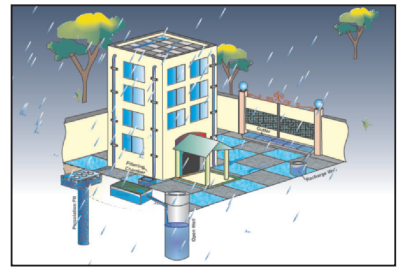
Tube wells : It makes very deep underground water available for irrigation. Motor pump is used to lift water.

(ii) Canals : These get water from large rivers.

(iii) River lift system : In this system, water is directly taken from rivers through pumps. This system is useful for irrigation in areas close to river.

(iv) Tanks : These are small storage reservoirs.

(v) Rain water harvesting : Rain water harvesting is a accumulation of water in tanks for later use. This also prevents soil erosion.



(c) Crop Patterns : Different patterns are used to maximize the production from crop field. They are :

(i) Mixed cropping

(ii) Inter cropping

(iii) Crop rotation

(i) Mixed cropping : Growing two or more than two crops together on the same piece of land is called mixed cropping. *E.g.,* wheat and gram, wheat and mustard, groundnut and sunflower.

(ii) Inter cropping : Two or more crops are grown on the same field in a definite pattern. Few rows of one followed by few rows of the other. *E.g.,* Soyabean + maize, Finger nullet (Bajra) + Cow pea (lobia)

(iii) Crop rotation : Crop rotation is policy of growing different crops one after another on the same field.

- If some crop is grown again and again on the same field, same nutrients are extracted from soil again and again. So we should choose different crops so that all nutrients of soil are used.
- **Advantages :**

  (1) Soil fertility is maintained.

  (2) It controls pests and weeds.

  (3) Several crops can be grown in succession with only one soil preparation.

(C) Crop Protection Improvement

To protect crops against diseases caused organisms and other harming factors is called crop protection. Following methods are used to control these problems :

(a) Pest control during growth

(b) Storage of grains

(a) Pest control during growth : Pest is any destructive organism which can destroy or harm crops or products obtained from them. Pests are of many types :

(i) Weeds : Unwanted plants in the cultivated field *e.g.,* xanthium.

(ii) Insects : Insects can harm plants in following ways :

- They cut the root, stem and leaf.
- They suck the cell sap from various parts of the plant.

(iii) **Pathogens :** Any organism such as bacteria, fungi and viruses which cause diseases in plants are called pathogens. They are transmitted through air, water, soil.

(b) **Storage of grains :** For getting seasonal foods throughout the year, they are stored in safe storage. But during storage of grains, they can be destroyed and wasted by various means.

(i) **Biotic problem :** Due to living organisms like insects, birds, mites, bacteria, fungi.

(ii) **Abiotic problem :** Due to non-living factors such as moisture, inappropriate temperature etc.

These factors affect quality degradation, loss in weight, change in colour, poor germinability.

Organic Farming

Use of fertilizers and pesticides has their own disadvantages. They cause pollution, damage soil fertility in long run. Grains, fruits, vegetables obtained may contain harmful chemical in small amount.

Organic farming is a farming system with no or very little use of chemicals like fertilizers and pesticides.

Different ways to protect food grains before they are stored for future use :

(a) **Drying :** The food grains should be properly dried in the sun.

(b) **Maintenance of hygiene :** The grains must not contain insects. The godowns should be cleaned well. The cracks in the roof and on the walls and floor should be sealed completely.

(c) **Fumigation :** Godowns and stores should be properly sprayed with fumigants. Specially, the seeds should be treated with insecticides and fungicides.

(d) **Storage devices :** Cleaned and dried grains should be stored in gunny bags or other proper bags. Airtight, moisture-resistant and temperature-resistant storage devices have been developed by various organizations. These should be used.

ANIMAL HUSBANDRY

Animal husbandry is a scientific management of domestic animals in an efficient manner to obtain food and other useful products from them.

Cattle farming : Purpose of cattle farming is :

(a) For getting milk

(b) Ploughing fields

(c) Bull cart for transportation

Types of cattle :

- Cow (Bos indicus)
- Buffalo (Bos bubalis)

Milch animals : These includes milk producing animals (female cattle).

Draught animals : Those animals which do not produce milk and are used for agricultural work.

Lactation period : The period of milk production between birth of a young one and the next pregnancy is called lactation period.

Care of Cattle

(1) Cleanliness

- Roofed shelter with good ventilation for protection from rain, heat and cold.
- Regular brushing of skin of cattle.
- Sloping floor for shelter for avoiding water-logging.

(2) Food

- Roughage mainly containing fibre
- Concentrates containing proteins
- Food containing micronutrients (vitamins and minerals) for enhanced milk production

Diseases : Diseases can cause death and reduce milk production.

- Parasites are small organisms living inside or outside the body of another organism (host). They derive food from the body of host.
- External parasites on skin of cattle cause skin diseases.
- Internal parasites like worms cause stomach and intestine problems and

flukes cause liver problems.

- Bacteria, virus cause infectious diseases (diseases that can be easily transmitted from one to another).

Poultry Farming : Poultry farming is done for eggs and meat. They both provide protein to our diet.

Broilers : Birds grown for obtaining meat are called broilers. They can be used after 6-8 weeks from their birth.

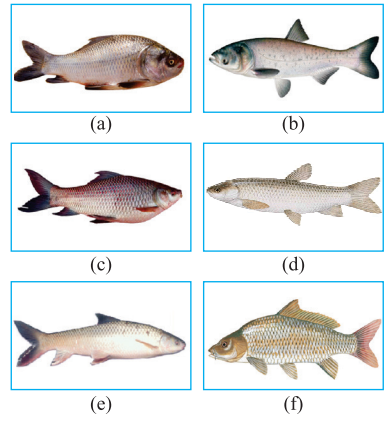
Layers : Birds grown for obtaining egg are called layers. They can be used after 20 weeks when sexual maturity has been attempt to lay eggs.

Most of the broilers and layers are cross-breed.

Breeding is done to enhance following properties in hens :

- More and better quality chicks.
- Low maintenance.
- Breeding is done to produce dwarf broilers (meat-giving birds). Feeding cost is the biggest expense in poultry farms. Dwarf broilers need less food and can reduce cost by 30%. Also, they can tolerate more heat.

Fish Production :



(a) Catla (b) Silver carp (c) Rohu (d) Grass carp (e) Mrigal (f) Common carp

Fish production is a great source of protein to our diet.

Fish production is of two types :

(1) **Finned fish production/True fish production :** Production and management of cartilaginous and bony fishes such as pomphret, tuna, cod, catla, prawns, rohu etc.

(2) **Unfinned fish production :** Production of shell-fish such as prawns, mollusks.

Depending on the mode of obtaining fishes, fishing are of two types :

(1) **Capture fishing :** Naturally living fishes in various water bodies are captured.

(2) **Culture fishing :** Fishes of desired variety are cultivated in confined areas with utmost care to get maximum yield. This is also called aquaculture. Aquaculture can be done in oceans, rivers, lakes, ponds etc. When it is done in oceans, it is called mariculture.

Marine fishing : Marine fishing includes fish production in ponds, rivers, reservoirs.

- Popular marine fishes includes pomphret, tuna, sardines, Bombay duck. Some costly fishes found in sea like nullets, prawns, seaweed, oysters.
- Using satellites, regions of high fish population in sea can be found. Echo-sounders are also used.

Inland fishing : It includes fish production in fresh water (for example ponds, rivers, lakes, reservoirs) and brackish water (for example estuaries).

Composite Fish Culture

- 5 to 6 varieties in a single fish pond.
- They are selected so that they do not compete for food. They should have different food requirement.

Example :

Catla : Feeds in the upper part of water.

Rohu : Feeds in middle part of water.

Mrigals, common carps : Feeds at bottom.

- **Advantage :** More yield.

  Problems : Many fishes lay eggs during monsoons only, due to which