Science Notes Part 26 To 30

26] Combustion And Flame

In the Stone Age, people never knew the use of fire. They ate raw food. Accidently they discovered that by rubbing two stones together, they could produce fire. Later they used fire for cooking, getting light and for safeguarding their lives from animals. Fire is obtained by the rapid oxidation of a substances in the chemical process of combustion, releasing heat, light and various other products.

Combustion And Its Types

Combustion is the burning of substances in air or oxygen to release heat and light. The substance that undergoes combustion is called **fuel**.

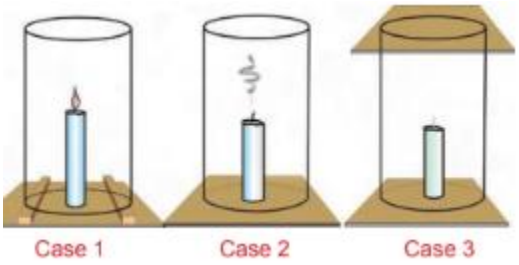
There are many substances that can burn. They can be classified depending on their state state as solid, liquid and gas. Cowung, coal and firewood are solid fuels. Kerosene and petrol are liquid fuels. LPG, coal gas, natural gas and bio-gas are gaseous fuels.

Magnesium burns to form magnesium oxide and produces heat and light. Coal burns in air producing carbon dioxide, heat and light. This process is an example of combustion. The substances that undergoes combustion are called **combustible substances**.

Substances like paper, straw, wood, matchsticks, etc. are combustible substances. Substances like stone, glass, iron nails, etc. do not burn on being exposed to flame. Such substances are called non-combustible substances.

Conditions under which combustion takes place.

The candle burns freely in case 1 when air can enter the chimney from the bottom. In case 2, when air does not enter the chimney from the bottom, the flame flickers and produces smoke. In case 3 the flame finally goes off, because the air is not available. Therefore you can easily understand that air is necessary for combustion.



Ignition temperature

When a sparkler is lighted with a burning candle, it does not burn immediately. It takes some time and only when it attains a particular temperature, it starts burning.

A fuel has to be heated to a certain minimum temperature before it can catch fire. This temperature is different for different fuels. Some substances catch fire immediately, while some take a longer time. The lowest temperature at which a fuel catches fire is called its **ignition temperature**.

When water is poured over a burning substance, it absorbs heat from the substance. As a result the temperature of the substance falls below the ignition temperature, and it stops burning.

A log of wood has a huge mass. So, when we heat it with a flame, the heat received by the log is dissipated through its bulk mass. And the log takes a long time to attain its ignition temperature. On the other hand, wood shavings, having a smaller mass, attain the ignition temperature more readily. So, a large piece of wood takes a longer time to start burning than wood shavings.

Types of combustion

Combustion can be of different types. It can be spontaneous, rapid, slow and incomplete.

Spontaneous combustion

Some combustion reactions take place without the application of heat energy. When white phosphorus is exposed to air at room temperature, it catches fire immediately; even without being lit by a match stick. This type of combustion reaction that occurs without the help of any external heat source is called spontaneous combustion.

Rapid combustion

Bring a burning match stick or gas lighter near a gas stove in the kitchen with the help of your parents. Turn on the knob of the stove. What do you observe ? The gas burns rapidly. Such combustion is known as **rapid combustion**. Bursting of fire crackers, burning of camphor, magnesium ribbon in air, gas in a burner and kerosene in a stove are good examples of rapid combustion.

Slow combustion

Combustion that takes place at a very slow rate is called **slow combustion.** During this type of combustion low heat and light are produced. Food oxidized in our body to release energy is an example of slow combustion.

Carbohydrates + Oxygen ⟶ Carbon dioxide + water + heat energy

Incomplete combustion

Combustion takes place in the presence of oxygen. If the supply of oxygen is insufficient, then combustion will be incomplete. This is called incomplete combustion. Carbon forms carbon monoxide when it undergoes **incomplete combustion.**

Carbon + Oxygen ⟶ carbon monoxide

Fire Control

Heat energy in the form of fire plays an important role in our daily life. Unfortunately, fire has an enormous destructive quality, if it is not controlled properly. We read in the newspaper about the destruction by fire leading to loss of life and property. Thus, it is important to know not only the methods of controlling fire, but also the different means of putting out the fire when they get out of control.

Fire can be controlled and extinguished by

1. removing any combustible substances near the region of fire;

2. cutting off the supply of air by using sand or blanket;

3. bringing down the ignition temperature by using water;

Usually sand and water are thrown on burning substances to extinguish fire. Sand reduces the supply of air and cools it. **Water should not be used for oil fire**. Oil being lighter, floats, spreads and causes severe damage. So, oil fire should be extinguished by using substances like foamite. Fire that is caused by electrical appliances or installations, can be put out by using solid carbon dioxide or carbon tetrachloride. Water should not be used as there is a risk of getting an electric shock.

Fire Extinguishers

All of us are familiar with fire extinguishers, the red painted steel containers kept in factories, hospitals, schools, theatres, business places, etc. In the event of a fire breaking out, fire extinguishers can be used to put out the fire.

Flame And Its Structure

Parts of a candle flame

Zone of non-combustion:

This is the dark zone that lies around the wick. It contains unburnt gas particles. No combustion takes place here as no oxygen is available.

Zone of partial combustion:

In this zone, the hydrocarbons present in the oil gas from wax decompose into free carbon and hydrogen. The unburnt carbon particles impart a pale yellow colour to the flame. This is the luminous part of the flame.

Zone of complete combustion (blue) :

This is the non-luminous thin zone of the flame. It is the outermost hottest region in the flame that is invisible. Here, carbon and hydrogen are completely oxidized to carbondioxide and water vapour.

Hydrocarbon + Oxygen ⟶ Carbondioxide (blue flame) + Water (vapour)

Efficiency Of Fuels

Any substance that can be burnt or otherwise consumed to produce heat energy is called a fuel. Wood, natural gas, petrol, kerosene, diesel, coal, and LPG are commonly used as fuels.

We use fuels to run all forms of modern transportation like automobiles, trains, buses, ships, and aeroplanes. Fuels are the important source of energy for many industries. Thermal power stations depend heavily on fuels for generating electricity. We also use fuels for domestic purposes, e.g. cooking.

Characteristics of a good fuel:

We know that a large number of substances burn to produce heat energy. But not all of these substances can be used as fuel. The characteristics of a good fuel are as follows:

1. It should be cheap and readily available.

2. It should be easy to store, transport and handle.

3. It should not produce toxic fumes or smoke or other harmful products on combustion.

4. The amount of soot or ash left behind should be minimum.

5. It should have a high calorific value.

6. It should have a low ignition temperature.

Calorific Value

The main constituents of fuels are hydrocarbons. During combustion, these hydrocarbons get oxidized to form carbon dioxide and water. Heat is evolved in this process (exothermic process).

Hydrocarbon + Oxygen -→ Carbon dioxide + Water + Heat energy

Fuel

The nature of the fuel can be determined by the amount of heat energy evolved. The higher the heat energy evolved, the better is the fuel.

The amount of heat energy liberated when 1 kg of the fuel is burnt completely in oxygen is called the calorific value of the fuel. The calorific values of some common fuels are given in Table

Calorific value of some fuels

Fuel	Calorific value (Kcal/Kg)
Wood	4000
Coal	7000
Coke	8000
Kerosene	10,300
Petrol	11,500
Natural gas	8000-12,000
Water gas	3000-6000
Hydrogen	34,000
Methane	13,340
LPG	11,900

Types of Fuels

There are three types of fuels. They are solid, liquid, and gaseous fuels. Solid Fuels Coal, wood, charcoal, coke, and paraffin wax are some commonly used solid fuels. The drawbacks of solid fuels are as follows:

1. They have a high ignition temperature.

2. They produce a large amount of residue (soot, ash) after combustion.

3. Their calorific value is low.

Liquid Fuels

Petrol, kerosene, and diesel are some commonly used liquid fuels which are obtained from petroleum (an oily mixture of hydrocarbons in its crude form). Ethyl alcohol is also a liquid fuel. Locomotives, buses, and lorries use diesel as fuel.

Gaseous Fuels

Gases such as methane, carbon monoxide and hydrogen are combustible. Natural gas, producer gas, coal gas, water gas, LPG (Liquefied Petroleum Gas), and biogas (gobar gas) are other examples of gaseous fuels. Gaseous fuels are preferred over solid and liquid fuels because of the following advantages:

• They have a low ignition temperature.

• They burn completely (complete combustion) and leave no residue (soot, ash, smoke).

• They are easy and safe to handle, transport, and store.

• They have a high calorific value.

• They are cheap.

Natural gas

Natural gas is obtained from petroleum wells. It contains a mixture of hydrocarbons (methane and ethane). It is one of the cheapest available gaseous fuels.

Producer gas, coal gas and water gas

Producer gas, coal gas, and water gas are important gaseous fuels used in industries. All these are obtained from coal or coke.

LPG (Liquefied Petroleum Gas)

It is the most widely used gaseous fuel for cooking. LPG is a mixture of propane (15%) and butane (85%) liquefied under pressure. It has a high calorific value. A small amount of ethyl mercaptan, an inert gas with a characteristic odour, is added to LPG to detect any leakage.

Biogas (Gobar gas)

Gobar gas contains a mixture of methane and ethane and is a very cheap form of gaseous fuel.Gobar gas is becoming increasingly popular in villages, where cattle can be maintained in large numbers. It is also comparatively less expensive.

Fuels And Environment

The increasing fuel consumption has harmful effects on the environment.

1. Carbon fuels like wood, coal and petroleum release unburnt carbon particles. These fine particles are dangerous pollutants causing respiratory diseases like asthma.

2. Incomplete combustion of these fuels gives carbon monoxide gas. It is a very poisonous gas. It is dangerous to burn coal in a closed room, because the carbon monoxide gas produced can kill persons sleeping in that room.

3. Combustion of most fuels releases carbon dioxide in the environment. Increased concentration of carbon dioxide in the air causes global warming.

4. Burning of coal and diesel releases sulphur dioxide. It is an extremely suffocating and corrosive gas. Moreover, petrol engines give off gaseous oxides of nitrogen. Oxides of sulphur and nitrogen dissolve in rain water and form acids. Such rain is called **Acid Rain**. It is very harmful for crops, buildings and soil.

The use of diesel and petrol as fuels in automobiles is being replaced by CNG (Compressed Natural Gas), because CNG produces harmful products in very small quantities. CNG is a cleaner fuel.

Global Warm(N)ing

It is the rise in temperature of the atmosphere of the earth. This results, in the melting of polar glaciers, which leads to a rise in the sea level, causing floods in the coastal areas. Low lying coastal areas may even be permanently submerged.

27] Heat and Light

Heat

The energy which can be transferred from a hotter body to a colder body and which produces a sensation of hotness or coldness is called heat.

SOURCES OF HEAT:

1. The Sun

The sun gives us light.

2. Combustion

Burning of coal, kerosene etc., produces heat.

These are called **fossil fuels** since they are made from the remains of plants and animals that died millions of years ago and were buried deep inside the earth.

3. Friction

The weather becomes very cold in winter. If we rub our hands together, they become warm. The faster we rub, the hotter they become. Rubbing two things together produces heat due to friction.

The ancient man used friction to produce a spark. Sometimes he rubbed two flint stones to make a fire.

4. Electric current

When electric current flows through a conductor heat energy is produced. The water heater, iron box, electric kettle etc. work on this principle.

Hot And Cold Objects

Heat energy is not visible but can be felt.

Heat And Temperature

Heat energy is not visible but can be felt. To measure the heat energy we use the physical quantity, namely temperature. Temperature measures the degree of hotness or coldness of a body.

Thermometer

Since the sensation of hotness or coldness is relative, we use thermometers to measure the temperature.

This principle is used in the construction of thermometer.

Almost all television channels end their news telecast with a mention of the maximum and minimum temperatures recorded in major cities for the day. In some channels the term Celsius is used, while in some other channels the term Fahrenheit is used. What is the difference?

Both Celsius and Fahrenheit are valid terms used in the measurement of temperature. Thermometers have two different scales to measure temperature.

a) Centigrade or Celsius scale.

b) Fahrenheit scale.

Thermometers have two fixed points based on which graduations are marked. These are called the upper fixed point and the lower fixed point. The distance between these two fixed points is divided into an equal number of degrees.

The lower fixed point is the **melting point of pure ice.**

The upper fixed point is the **boiling point of water**.

TEMPERATURE SCALES	UPPER FIXED POINT	LOWER FIXED POINT	NUMBER OF DIVISIONS
CELSIUS	100° C	0° C	100
FAHRENHEIT	212° F	32° F	180

To convert Celsius into Fahrenheit we use the relation

$$\frac{C}{100} = \frac{(F-32)}{180}$$

'C' : Reading shown by the Celsius thermometer.

'F' : Reading shown by the Fahrenheit thermometer.

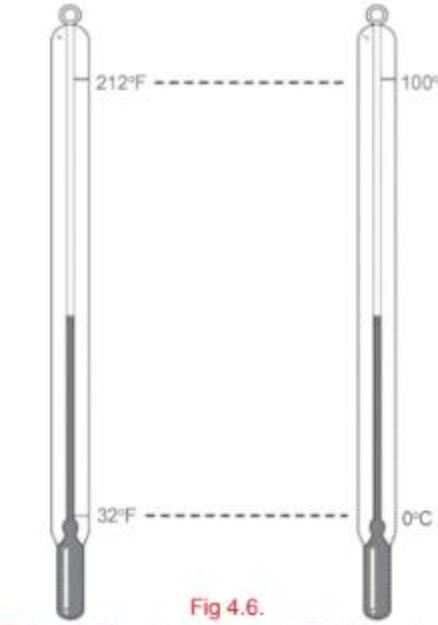


Fig 4.6.

Why mercury and alcohal are used as thermometric liquids?

Most thermometers use mercury because

1. it is opaque and shiny.

2. does not stick to glass.

3. it is a good conductor of heat.

4. it shows large expansion for small temperature changes.

5. it expands uniformly. In some thermometers ALCOHOL is used.

Measuring Temperature

Laboratory Thermometer

The laboratory thermometer consists of a thick walled glass tube enclosing a fine uniform bore capillary tube. There is a cylindrical bulb at one end. The bulb and a part of the stem are filled with mercury. The top end is sealed after removing air. The graduations are marked from -10 degree C to 110 degree C When the bulb is immersed in hot water, the mercury in the bulb expands and rises up in the capillary tube. The level of mercury in the tube gives the measure of temperature of the hot water.

Clinical Thermometer

It consists of a thick walled glass tube marked in degrees enclosing a capillary tube of fine bore. There is a cylindrical bulb at one end. Air is removed from the tube and the other end is sealed. The bulb and a part of the stem are filled with mercury. There is a constriction just above the bulb which prevents mercury from flowing back into the bulb.

The reading of the mercury level gives the body temperature of the patient. The thermometer is marked from 35 degree C to 42 degree C. The normal body temperature is 36.9 degree C (98.4 degree F). This is indicated by an arrow mark in the thermometer. It is used only to measure the temperature of the human body.

Clinical thermometers are available with Fahrenheit markings. They are also available with both Celsius and Fahrenheit markings.

Light

Light and darkness: Light is a form of energy that gives us the sense of vision. The absence of light causes darkness. To see objects, our eye should receive light from them.

Reflection

When light falls on a transparent material like clear glass it passes through it. However, when it falls on opaque objects like table, chair, etc. some of it bounces back.

This bouncing back of light from a surface is called reflection.

Mirror

Most of the light falling on a mirror is reflected, but other objects do not reflect as much light.

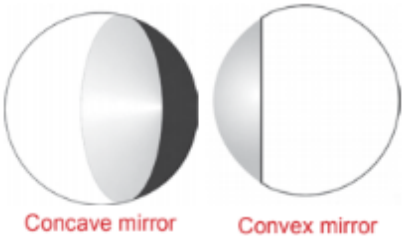
A mirror is a shiny surface which reflects almost all the light falling on it.

Most mirrors are made of glass. A mirror that is flat is called a plane mirror.

Spherical Mirrors

So mirrors need not necessarily be plane. Curved surfaces can also act as mirrors. Look at your reflection in a polished steel spoon. Do both surfaces of the spoon give the same kind of image?

Some mirrors have a plane reflecting surface, some others have a bulged reflecting surface and yet some more have a hollow reflecting surface. The mirror with the bulged reflecting surface is called a convex mirror and the mirror with a hollow reflecting surface is called a concave mirror. These are known as curved mirrors.



Representation of mirrors in diagrams

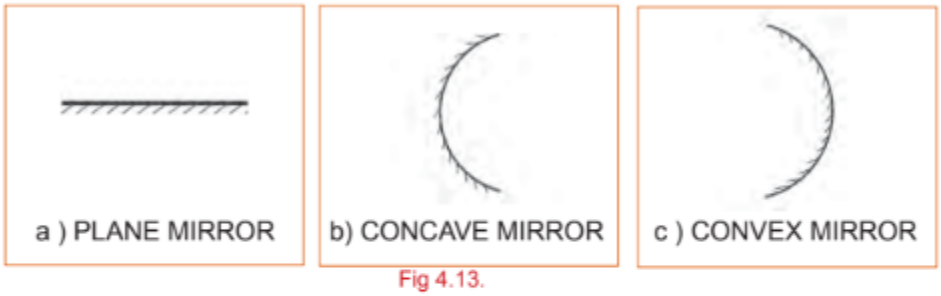
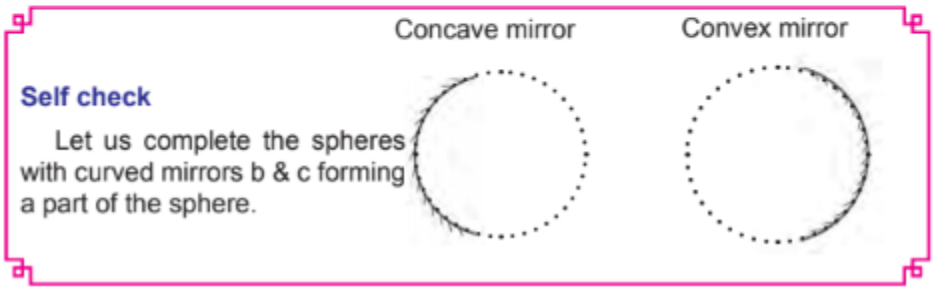


Fig 4.13.



Any curved surface is a part of a sphere. Hence convex and concave mirrors are referred to as spherical mirrors.

Are you now convinced that concave and convex mirrors are a part of the sphere? What happens when light falls on spherical mirrors?

Concave mirror makes the light meet at a point after reflection (converges) and convex mirror diverges the light.

The image formed on the paper or screen is called a real image.

When the object is placed very close to the concave mirror, an erect and enlarged virtual image is formed inside the mirror.

Sun Light – White or Coloured?

The rainbow is seen as a large arc in the sky with many colours, in the opposite direction of the sun, when it rains. The rainbow is a spectacular demonstration of white light as a combination of many colours.

Rainbows occur when sunlight from behind the observer falls on water droplets. So, we infer that sunlight consists of many colours.

When observed carefully, there are seven colours, though it may not be easy to distinguish all of them. The colours are **Violet, Indigo, Blue, Green, Yellow, Orange and Red represented as VIBGYOR**.

What is dispersion?

White light is made up of seven colours. It is possible to split it into its constituent colours. The splitting up of white light into its seven constituent colours is called dispersion. This band of colours is called a spectrum. Can these colours be mixed to give white light?

Yes, this can be done with the help of a Newton's disc.

Newton's disc is a circular disc with segments painted in the seven colours of the spectrum. The disc is supported on a stand. It is provided with a handle to rotate the disc.

When the disc is rotated fast, the colours disappear and the disc appears almost white.

28] Crop Production And Management

India is an agricultural country. We all totally depend on agriculture for our basic needs like food, clothing and shelter. Food is essential for our survival. It provides energy and materials required for the growth and maintenance of our body.

Indian population had grown by 21.34% between 1991 and 2001. It is expected to exceed by 20% in 2050. How do you think food can be provided to such a large number of people? In - order to provide sufficient food for a larger population, regular production, proper management, storage and application of recent technology are to be implemented in agriculture.

1.1. Agricultural Practices

With the increase in population , the demand for food has also gone up. The available land for agriculture has been decreasing. Therefore improved, agricultural practices have to be introduced.

All the activities which are involved in the cultivation of crops from sowing to harvesting are known as agricultural practices.

Agriculture : Science that deals with the growing of plants and animals for human use is called agriculture.

Basic practices of crop production

Production of crops involves several activities carried out by the farmers over a period of time. These activities are given below.

- Preparation of soil and sowing
- Adding manure and fertilizer
- Irrigation
- Protection from weeds
- Harvesting
- Storage and Marketing

Preparation Of Soil and Sowing

Before sowing the seeds, we have to prepare the soil. Preparation of soil is the first essential stage for -cultivation of crops.Turning and loosening the soil involves,

i) Ploughing or tilling

ii) Levelling and

iii) Manuring

i) Ploughing: It is the process of loosening soil. Ploughing is important because it,

- Provides good aeration to roots in order to breathe
- Retains moisture for a long period
- Promotes growth of useful micro organisms to bring nutrient rich soil to the top
- Helps in the removal of undesirable plants (weeds)

Ploughing is done in two ways

i) Manual ploughing: It is one of the old and traditional methods of agriculture. A farmer ploughs the field with a plough pulled by a pair of bulls.

ii) Machinery ploughing: Now a days ploughing is done by tractor driven cultivator. The use of cultivator saves labour and time. The other ploughing tools are spade, shovel, hoe and pick-axe.

ii) Levelling: The ploughed field may have big pieces of soil crumbs, so, it is necessary to break these crumbs with the leveller. It also ensures uniform irrigation.

iii) Manuring: Sometimes manure is added before tilling. It helps in proper mixing of manure with soil. Sowing: It is the most important step of crop production. The process of putting seeds into the soil is called

sowing. Before sowing, the land must be watered. Seeds used for sowing should be of good quality, healthy and free from infection. Sowing is done by two methods.

i) Manual sowing: It is the traditional method of sowing where the seeds are sown manually by scattering them in the moist soil.

ii) Seed Drill: It is a method of sowing the seeds through the funnel or using two or three pipes having sharp ends.

Seed drill helps in uniform distribution of seeds, covering the seed after sowing and preventing the seeds from being damaged by birds.

Adding manure and fertilizers

All the plants get their nutrients from the soil. Repeated cultivation of crops make the soil deficient in minerals. So farmers add manure and fertilizers to the soil to ensure that the crops get proper nutrients.

The substances which are added to the soil in the form of nutrients for the healthy growth of plants are called manure or fertilizers.

Irrigation

Plants need water for germination, drawing nutrients and preparing their food by photosynthesis.

The process of supplying water to crops in the field at different intervals is called irrigation. It varies from crop to crop, season to season and soil to soil.

Some of the sources of irrigation are well, tube wells, ponds, lakes, rivers, dams and canals.

Methods of irrigation

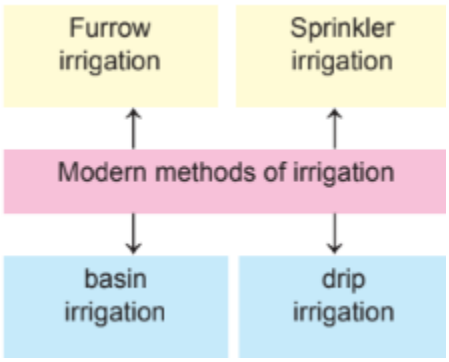
i) Traditional Method

In our country traditional systems of irrigation like,

- pulley system (moat)
- chain pump and
- lever system (rahat)

have been used for centuries to lift water from water reservoirs and supply it to the field for irrigation. These methods are cheaper but not much efficient.

ii) Modern Methods



Furrow irrigation: In this method water is allowed to enter the field through channels of furrows made between two rows of crop. e.g., sugar cane, banana, paddy, etc.

Basin irrigation: In this method the field is just filled with water. e.g. Paddy field.

Sprinkler irrigation: This irrigation is used where the soil cannot retain water for a long time. Here the water is sprinkled by sprinklers. e.g. Lawn

Drip irrigation: In this irrigation the water falls drop by drop directly at the position of the roots, so it is called drip irrigation. It is the best method to save water. It helps to irrigate grapes, banana, brinjal, etc.

Care must be taken not to water the field excessively. Excess water on the field may cause a condition called water logging which may harm the crops.

Protection from weeds (Unwanted plants)

Weeds are undesirable plants growing naturally along with the crop.

Removal of these weeds is called weeding. Weeding should be done then and there. The weeds must be removed because they compete with crops

for water, nutrients, space and light thereby affecting their growth.

Some weeds become poisonous.

The common types of weeds are

- Grass
- Amaranthus
- Chenopodium

Methods of weeding

i) Manual weeding: Weeds may be manually removed by hand by uprooting them or by using some tools like hand fork, khurpa and harrow.

ii) Chemical Control: The chemical substances which destroy the weeds but do not harm the crop are called weedicides. eg. Dalapon, metachlor, 2-4- Dichlorophenoxy- acetic acid.

Excess use of chemical weedicides cause water and land pollution. Traces of these poisonous chemicals may remain in crops themselves. There fore it is very important to use them with extreme caution.

Harvesting

Once the crop gets matured, it has to be gathered. The process of cutting and gathering a matured crop is known as **harvesting.**

All over the world harvest season is celebrated with excitement. Pongal (Tamilnadu), Bihu (Assam), Holi (Punjab), Onam (Kerala), etc., are the harvest festivals celebrated in India.

What is your experience in harvesting? Harvesting of paddy in our country is either done manually by sickle or a machine called harvester.

In small farms crops are usually cut down using a hand held tool called a sickle. In big farms a large vehicle called harvester combine is used.

Grains are separated from the stalks by the process of threshing. This is carried out by beating the cut stalks against hard floor or with a machine called mechanical thresher.

The chaff (pieces of straw and husk after threshing) is separated from the whole grain by **winnowing.**

Storage and marketing

Grains are kept safe from moisture, insects and microorganisms. If they are not kept in a proper manner they will get spoiled and cannot be consumed. Farmers store grains in jute bags and metallic-bins. In a large scale the grains are stored in godowns, silos, (very tall cement tanks) and granaries. Fresh fruits and vegetables have much moisture content and thus they get spoilt soon. Therefore they are stored in cold storage.

marketing

Increase in agricultural production alone will not bring about prosperity for farmers. It is important that agricultural products fetch a remunerative price. Warehousing and marketing facilities are essential to ensure this strategy.

Government has taken more steps to assist marketing of agricultural product and to promote the status of small farmers. Tamilnadu Government has established "Uzhavar Sandhai" to satisfy the need of consumers and the small scale village farmers.

Regulated markets eliminate unhealthy marketing practices and exploitation of the products by middlemen. The government provides loan at a very low rate of interest to the farmers for cultivation.

Crop Rotation

What will happen if the same crop is grown again and again on the same land? By repeated planting of the same plant a part of minerals gets depleted in the soil. It then leads to very poor yield. One way of improving the crop yield is by crop rotation. In this method different crops are grown alternately. The practice of growing a cereal crop and the pulse crop alternately in the same field in successive season is called as **crop rotation**.

Leguminous plants have root nodules associated with symbiotic bacteria which fix atmospheric nitrogen.

For example wheat and paddy (plants need nitrogen to make protein, they can't use nitrogen directly from the air) absorb more nitrogen from soil. This loss of nitrogen can be replaced naturally by leguminous plants which have symbiotic bacteria in their root nodules.eg. pea, soya, bean are cultivated after wheat or paddy.

Biotechnology in agriculture

Biotechnology is the field of -applied biology that involves the use of living organisms and bioprocesses in engineering, technology, medicine and other field requiring bioproducts. Biotechnology has also revolutionised research activities in the area of agriculture.

There are seven different techniques that are used in plant improvement.

1. Selection: It is a process of choosing a desirable crop.

2. Hybridisation: A hybrid (new variety) is produced by crossing the already existing two varities with desirable qualities.

3. Polyploid breeding: Method to increase the chromosomal number.

4. Mutation breeding: Radiations(UV and X-rays) induces mutation to develop new variety of crops.

5. Protoplast fusion: Production of hybrids by the fusion of protoplasts along with nuclei of two different species.

6. Tissue culture: Culturing the plant tissue in artificial, controlled, aseptic conditions (in virto) to raise plantlets.

7. Genetic engineering: Its objective is to identify, isolate and introduce a desirable gene/genes into a crop plant that normally do not possess them. These new plants whose genes are modified/transferred are called transgenic plants.

Genetic engineering

Genetic engineering is a part of biotechnology. It offers new hope to the farmers who are struggling hard with plant pests and diseases.

The aim of agricultural biotechnology is to give transgenic plants carrying desirable traits like

- Disease / Insect / Herbicide resistant.
- Increased photosynthetic efficiency.
- Nitrogen fixing ability.
- Increased size of storage roots, seeds, fruits and vegetables.
- Oil seeds (soya) rich in PUFA (poly unsaturated fatty acid) recommended for heart patients.
- Potatoes with vaccines, improves starch and vitamin A is produced.

Genetically modified (GM) seeds, biofertilizers, biofuels are also produced.

Biotechnology in food processing

Food processing industry is the oldest and largest industry using biotechnological processes. Biotechnology in food processing is used to improve existing processes such as

- Production of additives and
- Processing aids.

Improving of microorganisms in order to improve process, control, yield, safety and quality of the processed products.

Application of biotechnology in processing of food

- Gene modification and transfer.
- Development of recombinant vaccines vitamins and proteins.
- Improving the quality, safety and consistency of fermented foods.
- Improving of microorganisms in order to improve process, control and yield of the processed products.

● Improving the processing properties eg., Development of the “flavr Savr, tomato” variety, genetically modified to reduce its ripening rate.

Bioethics of genetic engineering

Besides many benefits, the ethical, social and legal implications of these potent gene technologies have led to considerable concern about the possibility of accidentally producing new pathogens responsible for fatal diseases or developing ‘genetic monsters’.

29] Reaching The Age Of Adolescence

Adolescence and puberty

The word ‘Adolescence’ is derived from the Latin word ‘adolescere’ which means ‘to grow’. The period of transition from childhood to adulthood is called adolescence. The World Health Organization (WHO) defines adolescence as the period of life between 11 and 19 years of age.

Since adolescent period covers the “teens period”, adolescents are usually called teenagers. It is a period when lots of changes take place in the body and mind. Hormonal changes result in unusual swings in emotions.

Adolescents shoot up in height and gain weight. The growth spurt begins two years earlier for girls than for boys. But it lasts longer for boys. The rapidly changing body proportions and the new sensations attributed to sexual development confuse and cause anxiety to the adolescents.

Puberty

Puberty is the period in life when the body’s reproductive system gets ready to work. Generally, boys attain puberty at the age of 14 to 15 years, while girls reach puberty at a comparatively lower age of 11 to 12 years.

As you grow up, people will be quick to notice that you are getting taller but they may not see that you also change in shape. Let us see this in detail.

Changes at Puberty

The following changes take place in the body of boys and girls at Puberty

1. Increase in Height: There is a sudden increase in the height of both boys and girls during puberty. The rate of growth in height varies from person to person. Some may grow rapidly at the start of puberty and then slow down, while as others may grow gradually. The height of an individual depends upon the genes which are inherited from parents.

2. Change in Body Shape: The changes occurring in adolescent boys and girls are different. In girls hips become broader and the pelvic region widens. In boys, shoulders broaden and the body muscles grow more than that of the girls.

3. Change in Voice: At puberty the voice box or the larynx begins to grow. The larynx in boys is larger than that in girls. The voice box in boys can be seen as the Adam's Apple, in their throat In boys, the voice becomes deep and harsh, where as girls have high pitched voice.

4. Increased activity of Sweat and Sebaceous glands: The secretion of sweat and sebaceous glands (Oil glands) increases during puberty. This causes acne and pimples on the face of boys and girls at this time.

5. Development of Sex Organs

The Reproductive Organs in boys and girls become fully functional at Puberty. In boys, the male sex organs like the testes and penis develop completely. The testes start producing sperms.

In girls, the ovary enlarges and eggs begin to mature. Ovaries start releasing matured eggs.

These sex organs produce sex hormones, which play an important role in the process of reproduction and in the development of secondary sexual characteristics.

Apart from these changes that are taking place in emotional, mental and intellectual areas, they may experience various moods such as being happy, sad, angry, excited or irritated.

Secondary sexual characters

Certain characters help to distinguish the male from the female. They are called secondary sexual characters. Some of the secondary sexual characters that develop in girls and boys are as follows:

Boys

1. Facial hairs such as beard and moustaches develop.

2. Hair develops under the armpit, under chest and in the pubic regions.

3. Voice becomes deeper.

4. Muscles develop, and shoulder becomes broad.

5. Increase in weight.

Girls

1. Development and enlargement of breasts.

2. Hair develops under the armpit and in the pubic regions.

3. Hips broaden and pelvic region widens

4. Initiation of menstrual cycle.

5. Deposition of fat around hips, these changes which occur at adolescence are controlled by

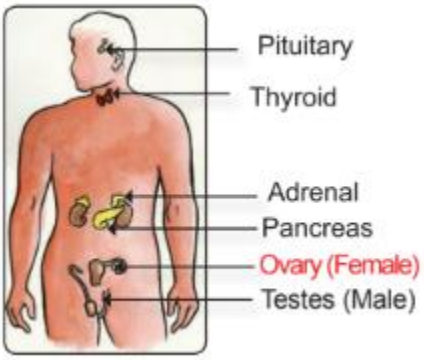
hormones.

Ductless glands Introduction

The word gland means having some secretions. There are two types of glands. 1. Exocrine gland gland with duct

2. Endocrine gland – gland -without duct.

The exocrine gland secretes enzymes which are important for digestion. The ductless or endocrine glands secrete hormones. They are special chemical substances that make wonders in our body. The following are the important Endocrine Glands (Ductless) present in our body.



1. Pituitary

2. Thyroid

3. Pancreas

4. Adrenal

5. Testes (Male) Ovaries (Female)

The secretions of the ductless glands (hormones) are carried away by the blood stream. Let us see the functions of these glands.

1. Pituitary gland: It is located just below the brain. It is called as the master gland because it controls the functioning of all other endocrine glands. Your growth depends on the secretion of the pituitary gland. It secretes growth hormone. A person having less growth hormone remains very short (Dwarfism) ; on the

other hand, a person having much growth hormone becomes very tall (Gigantism). In adults, excess secretion leads to a condition called acromegaly.

2. **Thyroid gland**: It is located in the throat region. It secretes a hormone called thyroxine. The function of thyroxine is to control the rate of Metabolism, growth and respiration. The deficiency of thyroxine hormone in children is known as cretinism. It slows down growth and mental development. Sometimes the gland may enlarge causing a disease called Goitre.

3. **Pancreas:** Pancreas is located just below the stomach in the body. Pancreas is both exocrine and endocrine in nature. The endocrine part is called Islets of langerhans. It has alpha and beta cells, which secretes glucagon and insulin. Both control sugar metabolism in the body. Deficiency of insulin in the body causes a disease known as diabetes mellitus.

4. **Adrenal gland:** These are also known as supra renal glands, as they are located just on the top of the kidneys. It secretes adrenalin hormone. This hormone is produced during stress or emergency situations. It regulates heart beat, breathing rate, blood pressure etc.

5. **Testes and ovaries:** Testes and ovaries secrete sex hormones. Testes produce testosterone and ovaries produce oestrogen hormones. We have already learnt that these hormones are responsible for male and female secondary sexual characters.

Role of hormones in reproduction

Most hormones are at work from the moment you are born. Sex hormones are different because they start to work later on. They gradually prepare the body for reproduction.

The sex hormones are responsible for the fundamental change in growth and development and stimulate the developments of secondary sexual characters.

The testes and the ovaries are the reproductive Organs; both are stimulated by the pituitary hormone during puberty.

In Boys

In male, the testes produces the male sex hormone testosterone. This hormone helps in the development and maintenance of the primary and secondary sexual characters and functions of sperms.

In Girls

In female, the ovaries secrete estrogen and progesterone responsible for the primary and secondary sexual characters. Apart from testes and ovaries the Adrenal Cortex also secretes steroid hormones in both the sexes. These hormones are responsible for adolescent growth spurt.

Reproductive phase of life in humans

What is Reproductive Phase? How long does it last in males and females?

The phase in an individual's life during which there is production of gametes is called Reproductive Phase. In females it is normally between 13 to 50 years, and in males, it is from the age of 13 to life long. The reproductive age may vary from person to person.

The following are the various reproductive phases in the life of a female.

1. Ovulation: Release of an ovum from the ovary - usually one egg is released every month.

2. Menstruation or the period: This is the outward sign of the routine cycle of egg production and hormone change in a woman's body. It takes about 3 – 5 days.

3. Pregnancy: When the egg gets fertilized by the sperm, the zygote is implanted in the uterus for further development this results in pregnancy.

4. Menopause: The menopause marks the end of the reproductive phase of a woman's life, the chief outward sign is the cessation (stop) of the monthly flow of menstrual blood. The usual age is around 50.

Sex Determination

Do you know which is responsible for the determination of sex? What makes the fertilized egg to develop either into a boy or a girl?

If you want to know about that, you should know about the chromosomes. Chromosomes are thread like structures present in the nucleus of the cell. All the cells contain 23 pairs of chromosomes, The last pair of chromosome is different in males and females. The last pair determines the sex, so it is called as **sex chromosome.**

Sex chromosomes are of two types, These are named as X. and Y chromosomes. Usually a woman has two 'X' chromosomes (XX) and male has one 'X' and one Y chromosome (XY), in their cells. During gamete (reproductive cell) formation the number of chromosomes are reduced into half. (46 chromosomes are reduced into 23).

When a sperm containing 'X' chromosome fertilizes the egg, the zygote will have two 'X' (XX) chromosomes. The zygote will develop into a female child. Similarly, when a sperm containing 'Y' chromosome fertilizes the egg, the fertilized egg will have one 'X' chromosome and one 'Y' chromosome (XY), and it will develop into a male child.

Now you know that the sex chromosomes of the father determine the sex of a child. The belief that the mother is responsible for the sex of her baby is completely wrong.

Reproductive Health

During adolescence growing children need special attention towards diet, exercise and personal hygiene. The personal hygiene includes female and male reproductive health.

The following are some of the measures that girls and boys need to take to maintain personal hygiene.

● Take bath atleast once a day, paying special attention to underarms, groins and genitals.

● Change the underwear daily. The underclothes should be made of cotton.

Menstrual hygienics:

Menstruation in females is as natural as our regular physiological activities like breathing, drinking, eating, urinating and defecation etc., It is a cyclical process that is present in all the mammalian females.

● So It is a natural phenomena, that is neither to be worried nor to be ashamed. Sanitary napkins (pads) or a pad made of clean soft cloth which can absorb moisture should be used for absorbing menstrual flow.

● Sanitary napkins or cloth should be changed frequently depending upon the menstrual flow. If a cloth is being used repeatedly, it should be cleaned with soap and hot water and dried in sunlight for reuse.

● Wash with soap and water before using a fresh napkin.

Nutritional Needs

The adolescents need more calories and other nutrients due to spurt in growth and increase in physical activity.

The nutritional deficiencies during this period not only retard the physical growth, but also impair the intellectual development and delays sexual maturation. The diet of adolescents should meet the demands of physical and intellectual growth, provide adequate reserves for illness / pregnancy and prevent onset of adulthood diseases related to nutrition. e.g., Hypotension and osteoporosis. (Bones become brittle)

A very good amount of proteins and carbohydrate is necessary during this growth period. Apart from that, adolescents need to keep in mind the following dietary consideration:

Minerals: Since there is an increase in skeletal mass and blood volume, the body needs calcium, phosphorous and iron.

Calcium: Calcium intake needs to be increased to prevent osteoporosis in later life. It is present in milk and milk products.

Iodine: It helps to prevent thyroid gland related diseases.

Iron: Lack of iron in the diet results in anemia. To make up for the loss, have a diet rich in iron. In boys, iron deficiency occurs due to muscle spurt if it is not adequately supplemented. In girls, iron deficiency

occurs due to menstruation in addition to the spurt in muscular growth if it is not adequately supplemented.

Green leafy vegetables, jaggery and whole pulses are rich sources of iron. During adolescent period, take hygienic balanced diet.

Personal Hygiene

Personal hygiene is a clear indicator of man's personality. Personal hygiene should start from the hair tip and ends down at the toes.

Remember and practise the following 10 tips for your personal hygiene

1. Shower or bath daily.

2. Always wash your hands before and after meals.

3. Keep fingernails clean, and avoid wearing nail polishes or jewellery.

4. Wash your teeth and mouth before and after each meal.

5. Avoid touching your face, nose, or mouth, while preparing food.

6. Avoid coughing or sneezing around food.

7. If you want to taste the food, use a clean spoon.

8. Change your clothes, especially undergarments, everyday.

9. Do not defecate in open field. Use clean toilets for defecatio

10. If you are not well, do no take self medication. Consult a doctor.

Prevention and protection from sexual and other abuses

Preventing childhood sexual abuse Taking steps to prevent childhood sexual abuse is an ongoing parental responsibility. In 80% of cases the abuser is someone the child knows as a trusted or loved adult or older child who may use threats, bribery or tricks to take advantage of the child's innocence.

There are three stages in the Prevention of sexual abuse. They are

1. Primary Prevention

2. Secondary Prevention

3. Tertiary Prevention

Primary Prevention: It involves preventing the abuse from happening in the first place. Avoid being alone in company of suspected person. Don't wear provocative dresses. Do not let allow anyone to hug, pet or kiss you. Take care of the way you sit. When you are going to school by auto, bus or by train keep distance from the other sex.

Secondary Prevention: It includes early detection and reporting of perpetrators for the purpose of stopping the perpetrators and minimizing the negative effect on the child.

Tertiary prevention: It focuses on the treatment of abused children and adults who have developed signs and symptoms of distress.

Warning signs of sexual abuse: Children who have been sexually abused often show the following signs:

- A sudden dramatic change in behaviour or personality.
- Recurring nightmares.
- Regression to early behaviour patterns such as bed wetting.
- Withdrawal from friends and family members.
- Imitating adult sexual behaviour.
- Hostile, aggressive behaviour.

Substance abuse: To pre-teens and teens, alcohol, tobacco and drugs may seem like a quick way to move into the adult world. These substances cause serious problems, and their use leads to **addiction.** Alcohol is the most abused substance among teenagers. Consumption of alcohol leads to frequent memory loss and hepatitis (liver damage).

Drug: (Fr. drogue – a dry herb) is a chemical which is taken for some illness and is withdrawn when the desired effect is achieved.

Illegal Drugs: Illegal drugs are drugs used for recreation, but it is against the law to take them, because it is extremely dangerous. The side effects are serious and the drugs are highly addictive, ruining people's lives.

The effects of the drug on the addict's life style can lead to a very unpleasant death. These drugs slowly reduce the functioning of nervous system and heart functions. Opium, Heroine, Marijuana and Cocaine are some of the illegal drugs.

These drugs slowly change the behaviour of the users:

some of the behavioural changes are as follows:

1. Rejection of old friends and the acquiring of new ones.

2. Sudden lack of interest in hobbies or extracurricular activities.

3. Staying away from home after school.

4. Drop in grades and disinterest in school work.

5. Less concern with personal appearance.

6. Mood swings or extreme irritability. So, please say a big 'No' to drugs if you come across any temptation in your life.

Prevention of drug abuse

1. Children should avoid the company of drug addicts.

2. Advertisements of drugs on public media should be banned

3. Doctor's advice and prescriptions should be strictly followed.

Smoking hazards

Cigarettes have been deemed one of the greatest health hazards of the 20th century and are now widely regarded as the chief preventable cause of death. Tobacco products such as cigarettes, cigars, smokeless tobacco (like snuff and chewing tobacco) are more dangerous. When a cigarette is burned, it is broken down into its chemical elements from which lethal chemical compounds are created.

The period between puffs allows time for nicotine, ammonia, acetone, formaldehyde, hydrogen cyanide and some 4000 other chemical constituents to become irritants, poisons, mutagens and more than 40 types of carcinogens.

Some of the evil effects of smoking are

● Raising bad cholesterol (Low Density Lipid), decreasing good cholesterol (High Density Lipid)

● Blood vessels are constricted, damages the lining of the arteries making the blood more sticky. This increases the risk of blood clots and dramatically raises the risk of a heart attack or stroke.

● 80% of cancerous deaths are linked to it. Smoking aggravates asthma, bronchitis, pneumonia and emphysema.

● Also the causative agent for peptic ulcers, cataracts.

● Cigarettes increase the risk of infertility in both men and women.

● Children of smokers are also far more susceptible to asthma and ear infections.

Healthy food

Sprouting

Why should we sprout?

Sprouts are a living, enzyme-rich food, natural and low in calories. Their vitamin A content will usually double, various B group vitamins will be 5 - 10 times higher, and vitamin C will increase by a similar order. Their protein content becomes easily digestible and rich new nutrients such as enzymes are created. They contain significant amounts of calcium, iron and zinc.

When a dormant seed sprouts, its starch is converted into simple sugars and long chain proteins are split into smaller, easily digestible molecules. Sprouted beans and seeds are like a predigested food, one of the most enzyme-rich and nutritious foods known.

What can we sprout?

Most seeds sprout easily, as do many legumes. Nuts are more difficult to sprout. It is recommended that soaking all the nuts, legumes and grains that we consume, which then become a wonderful, highly nutritious and essential component of a living food diet.

Best sprouting results in sunflower seeds and mung beans. This may be a reflection of the local conditions and suppliers.

Mung beans make an excellent sprout, used widely in cooking. However, they primarily use the sprouts and not the beans, and the sprouts are often stir-fried.

Soya and kidney bean sprouts are toxic and may be avoided.

An easy method to prepare bean sprouts at home.

1. First remove the damaged bean seeds.

2. Soak them in a clean water overnight or for about 12 hours.

3. Drain, rinse and place them in a wide mouthed bottle. Allowing room for the sprouts to grow.

4. Cover the jar with cotton cloth.

5. Keep it in the dark area of your house as sunlight makes them taste bitter.

As soon as the bean germinate, all the starches, oil and other nutrients packed into it – to nourish the tiny plant begin to turn into vitamins, enzymes and other forms of proteins mineral and sugars. The Vitamin C

content of the bean increases, when it starts sprouting. Rinse the bean sprouts two to four times a day. They will be pale green fresh and ready for eating in two to six days.

Cancer and its prevention

Normally body cells grow and reproduce in an orderly way. In contrast cancerous cells multiply rapidly. This is due to damaged genetic material of the cell. This stage is known as initiation. It can be influenced by external factors like radiation, viral infections and certain chemicals. These cancerous cells create lots of problem in our metabolism and invade to the other areas through blood streams, where they cause secondary tumours. This stage is called **metastasis**.

What causes cancer?

Cancer is ultimately the result of cells that uncontrollably grow and do not die. Normal cells in the body follow an orderly path of growth, division and death. Programmed cell death is called **apoptosis**, and when this process breaks down, cancer begins to form. Unlike regular cells, cancer cells do not experience programmatic death and instead continue to grow and divide. This leads to a mass of abnormal cells that grows out of control.

What are the symptoms of cancer?

Cancer symptoms are quite varied and depend on where the cancer is located, where it has spread, and how big the tumour is. Some cancers can be felt or seen through the skin – a lump on the breast or testicle can be an indicator of cancer in those locations. Skin cancer (melanoma) is often noted by a change in a wart or mole on the skin. Some oral cancers present white patches inside the mouth or white spots on the tongue.

Other cancers have symptoms that are less physically apparent. Some brain tumours tend to present symptoms early in the disease as they affect important cognitive functions.

Pancreas cancers are usually too small to cause symptoms until they cause pain by pushing against nearby nerves or interfere with liver function to cause a yellowing of the skin and eyes called jaundice. Symptoms also can be created as a tumour grows and pushes against organs and blood vessels. For example, colon cancers lead to symptoms such as constipation, diarrhoea, and changes in stool size. Bladder or prostate cancers cause changes in bladder function such as more frequent or infrequent urination.

How is cancer classified?

There are five broad groups that are used to classify cancer.

1. **Carcinomas** are characterized by cells that cover internal and external parts of the body such as lung, breast, and colon cancer.

2. **Sarcomas** are characterized by cells that are located in bone, cartilage, fat, connective tissue, muscle, and other supportive tissues.

3. **Lymphomas** are cancers that begin in the lymph nodes and immune system tissues.

4. **Leukaemia** are cancers that begin in the bone marrow and often accumulate in the bloodstream.

5. **Adenomas** are cancers that arise in the thyroid, the pituitary gland, the adrenal gland, and other glandular tissues.

Prevention

The following are some of the ways to prevent diseases like heart attack, cancer, diabetes and hypertension. Smoking causes lung cancer. It also affects mouth, throat, oesophagus, pharynx, larynx liver etc. Smoking should be totally avoided.

- High intake of fruits and vegetables are protective against many forms of diseases like heart attack, cancer, diabetes and hypertension. A vegetarian diet is typically high in fibre, low in saturated fat compared to meat eaters.
- High intake of beta carotene, vitamin C and other vitamin containing food should be taken. Apart from citrus variety of fruits, bean sprouts is also an excellent source of vitamin C.
- Try to reduce your weight, if you are obese.
- Avoid pickles and salty foods.
- Treatment involves surgery, chemotherapy, radiotherapy and hormonal therapy.

30] Pictorial Feature Of Plant Kingdom

Robert.Harding Whittaker, American plant ecologist classified the plants and animals into five kingdoms.

Fungi

Fungi do not have chlorophyll and cannot prepare their own food.

All of us would have noticed the sudden growth of mushrooms soon after the rain in humus soil. They belong to the kingdom of fungi. Fungi is a third kingdom of Whittaker which includes moulds, mushrooms, toadstools, puff balls and bracket fungi.

Features of fungi

1. They may be unicellular (e.g., Yeast) or multicellular (Rhizopus, Agaricus and Aspergillus)

2. They are non- green organisms as they lack chlorophyll.

3. Their body is made up of hyphae called mycelium and is covered by cell wall made up of chitin.

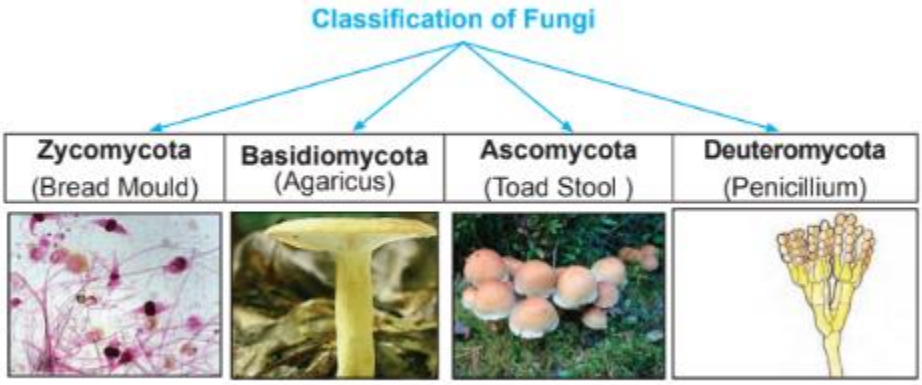
4. It reproduces by sexual or asexual reproduction.

5. Based on nutrition, fungi are classified into three types.

● **Parasites**- Fungi living on other living organisms. e.g., Puccinia.

● **Saprophytes**- Fungi living on dead and decaying matter. e.g., Agaricus, Rhizopus.

● **Symbionts**- Fungi (living associated with algae (lichens) or on the roots of higher plants (Mycorrhizae).



We and fungi

Food

The Mushrooms are rich in protein and minerals. The most commonly eaten mushroom is button mushroom i.e., Agaricus. All the mushrooms are not edible. There are 2,000 species of edible mushrooms.

Edible mushroom: e.g., Agaricus campestris, Agaricus bisporus etc.

Poisonous mushrooms (Toadstools)Amanita muscaria, Amanita phalloides (death cup)etc.

Poisonous mushrooms are usually brightly coloured.

2. Antibiotics

It is a chemical substance extracted from one living organism to kill or stop the growth of the other living organism.

Such antibiotic, like Penicillin, is extracted from fungi, Penicilium and other common anitbiotics are Streptomycin, Neomycin, Kanamycin, Gentamycin and Erythromycin.

3.Vitamins

Fungi Ashbya gospii and Erymothecium ashbyii are used in the synthesis of Vitamin B-riboflavin

Fungal diseases

Human- Mycoses (growing on skin, nails, hair, organs), athletes foot, and ringworm.

Animals - Ergot, athlets foot.

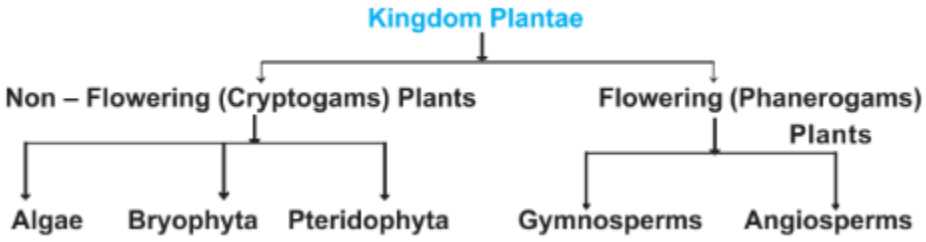
Plants - Rust, black rot, black spot, canker.

Claviceps purpuria – Hallucinogenic fungi cause the greatest damage to the frustrated youth by giving unreal, extra ordinary lightness and hovering sensation.

Aspergillus cause allergy to children while Cladosporium protects against allergy.

Flowering and non- flowering Plants

The plants are classified into flowering and non-flowering plants. The classification of kingdom plantae is given below



Non-flowering plants (cryptogams)

Algae

1. They are green water plants called algae. They are lowest and simplest primitive plants. Their body is not differentiated into root, stem or leaf.

2. They may be unicellular, multicellular, filamentous or branched and tree like.

3. They posses chlorophyll and can prepare their own food.

4. Their cell wall is made up of cellulose.

5. Algae reproduce by

- vegetative reproduction (fragmentation) e.g. spirogyra
- Asexual reproduction(Spores)
- Sexual reproduction
- Scalariform conjugation and Lateral conjugation e.g., Spirogyra

● By producing sex organs Antheridia and archegonia e.g., Chara.

Classification of Algae

Algae have photosynthetic pigments which may be green, brown, red or blue green according to the dominant pigment present in them.They are classified on the basis of their colour as given below.

S.No.	1	2	3	4
Colour	Blue-green	Green	Brown	Red
Pigment	Phycocyanin	Chlorophyll	Fucoxanthin	Phycoerythrin
Class	Cyanophyta	Chlorophyta	Phaeophyta	Rhodophyta
Reserve Food	Cyanophycean Starch	Starch	Laminarian Starch	Floridean Starch
Example	Oscillatoria 	Chlamydomonas 	Sargassum 	Polysiphonia 

Uses of Algae

1. Food

● The following algae are used as food by human being, domestic animals and fishes. e.g., Ulva, Laminaria,Sargassum, Chlorella

2. Agar Agar

● This substance is obtained from the red algae e.g., Gelidium and Gracillaria.

● It is used to make ice creams.

● It is used as culture medium

for growing plants in test tubes.

(Tissue culture)

3. Iodine

● It is obtained from Laminaria a brown algae.

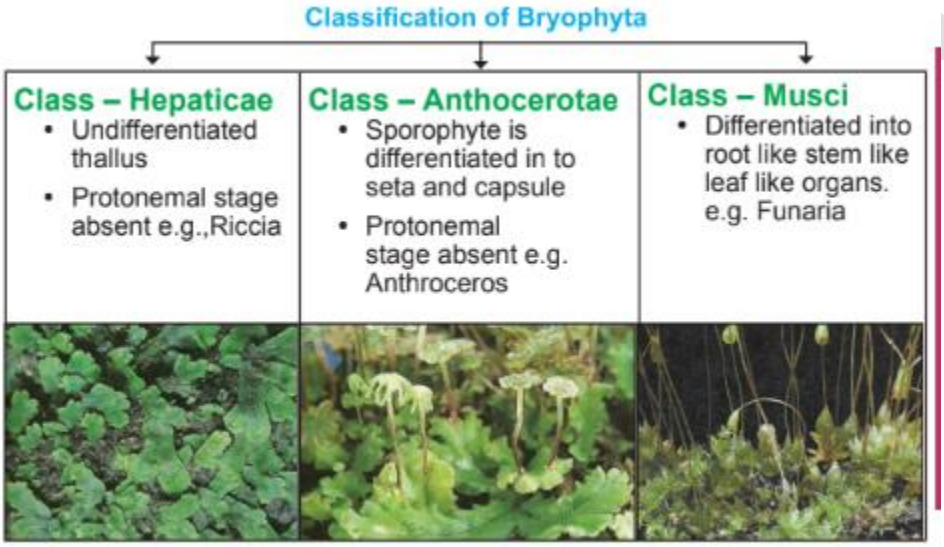
4. Algae in space travel

● Chlorella pyrenoidosa is used in space travel to get rid of CO_2 and other body waste and it also decomposes human urine.

Bryophytes

The trees and rocks of hilly areas are covered by thick green carpet of tiny plants. They are the first plants to come out of water to get adapted to live on the land. But can reproduce only in the presence of water.

- The mosses has root like stem like and leaf like structure.
- They have alternation of generation. (Sporophytic phase alternates with the Gametophytic phase)
- They reproduce sexually by gametes and asexually by spores, gemma and fragmentation.
- They live both on land and water so they are called amphibious cryptogams.



Uses of Bryophytes

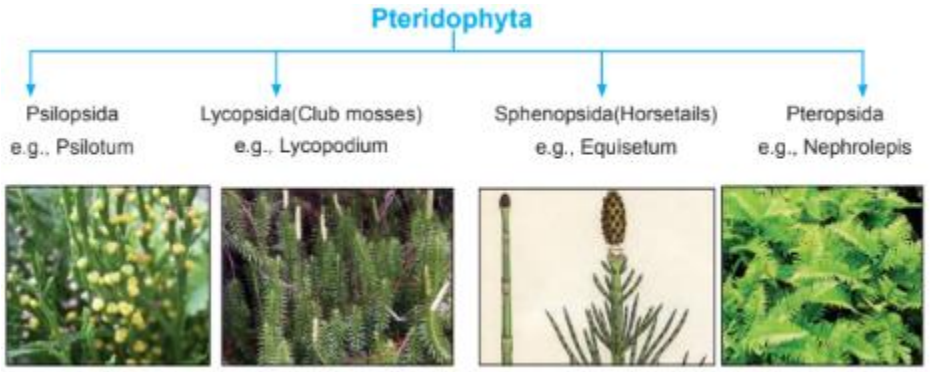
- Peat moss or sphagnum in dried condition is used as fuel.
- Sphagnum is also used as antiseptic and absorbent bandage in the hospitals.
- Sphagnum is also used as seed bed in green houses.
- Bryophytes control soil erosion as they form a carpet over the soil.

Pteridophytes

The first successful group of cryptogames to live on the land with a vascular system are pteridophytes. They are called vascular cryptogams (xylem and phloem are present in order to conduct water and food). These plants are living since the Jurassic period.

- Leaves are called as fronds (sporophylls) They bear sporangia on the ventral [lower] side
- The leaves are dimorphic [two types of leaves] in selaginella

- Stem is a rhizome. They are seedless true land plants
- They reproduce by means of spores
- Spores may be homosporous or heterosporous.
- Sporophyte alternates with the gametophyte.



Uses of Pteridophytes

- Grown as ornamental plants for their beautiful fronds.
- Marselia is used as food
- Dryopteries is used as vermifuge.
- Lycopodium powder is used as medicine.

Gymnosperms

- Plant body is differentiated in to root ,stem and leaf.
- Well developed tap root system
- Leaves vary in nature
- Gymnosperms undergo secondary thickening
- They have two phases in its life cycle. Sporophytic and Gametophytic phase
- Most of the Gymnosperms produce male and female cones

Classification of Gymnosperms

1.Cycadales:- e.g.,cycas

- Palm like small plants (erect and unbranched)

● Leaves are pinnately compound forming a crown

● Taproot system have coralloid roots

Cycas tree

2. Ginkgoales:- e.g., Ginkgo biloba

Ginkgo biloba

● It is the only living species of the group

● It is a large tree with fan shaped leaves.

● They produce offensive smell.

3. Coniferales:- e.g., Pinus

● Evergreen trees with cone like appearance

● Needle like leaves or scale leaves

● Seeds are winged

Pinus tree

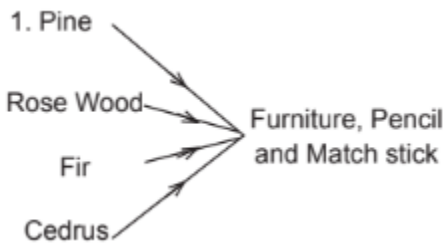
4. Gnetales:- e.g., Gnetum

● Small group of plants with advanced characters

● Ovules are naked present on flower like shoot

Gnetum

Uses of gymnosperms



2. Timber, oils and resins are produced from Pinus. Resins are used in the manufacturing of paints, oinments and varnishes.

3.Ephedra → Ephedrine (Alkaloide) → cures Asthma

4.Gnetum → cures rheumatism. Agathis → paper pulp → paper.

5.Araucaria (Monkey's puzzle) → evergreen ornamental plant.

Angiosperms

1. Angiosperms are flowering plants which forms one of the major groups of seed plants with atleast 2,60,000 living species.

2. They occupy every habitat on earth except extreme environments. They can be small herbs, shrubs, lianes or giant trees.

3. Conducting tissues (xylem and phloem) are present.

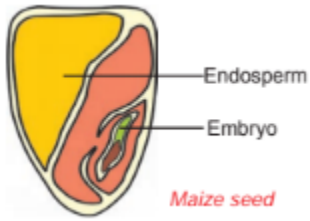
4. Secondary growth is observed (formation of bark).

Angiosperms

5. Ovules are enclosed within the carpels of ovary which later gets modified into fruit. Ovules become seeds and seeds have cotyledons. Angiosperms are crucial for human existence. They are the sources for food, clothing fibres, medicine and timber.

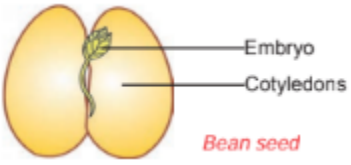
Monocotyledons

The plants which have seeds with only one cotyledon are called as monocotyledons. e.g., Grass, Paddy, Maize and Wheat



Dicotyledons

The plants which have the seeds with two cotyledons are called as dicotyledons. e.g., Bean, Pea, Mango.

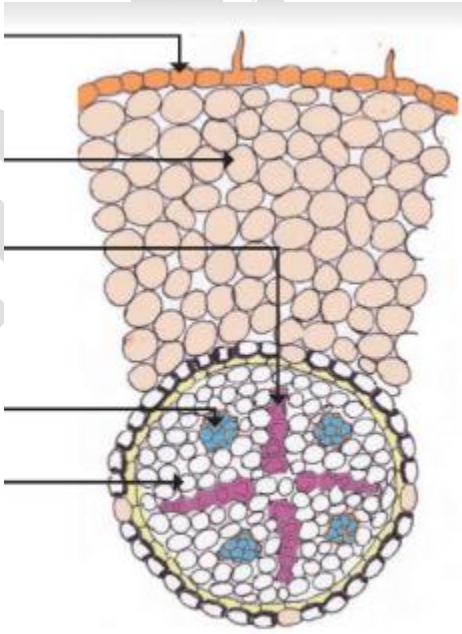


Morphology of dicot and monocot plant

Parts of the plant	Dicot	Monocot
Root	Tap root system	Fibrous root system
Leaf	Reticulate veination	Parallel veination
Flower	Calyx and corolla are differentiated eg. Mango, Neem. Floral parts are in the sets of 4 or 5.	Calyx and corolla not differentiated but fused to form perianth. Floral parts are in the sets of 3.

Structure of root

- The outer most layer of the root is rhyzodermis. It gives rise to unicellular root hairs.
- The next layer is cortex, helps in conduction and storage.
- The xylem vessels transport water from roots to various parts of the plant.
- The phloem tissues translocates food from leaves to other parts of the plant.
- There is a conjunctive tissue between xylem and phloem.
- Pith is the centre part of the root. It is present in monocot and absent in dicot it helps in storage.



T.S. of Dicot root

Many xylem bundles in monocot (Polyarch)
Four xylem bundles in dicot (Tetrarch)

Structure of a stem

● Cuticle - waxy coating

● Epidermis - barrel shaped cells, gives protection and produces multi cellular epidermal hairs

● Cortex- it is divided into three layers.

Collenchyma – thick walled, gives mechanical support.

Chlorenchyma - thin walled, filled with chlorophyll and helps in photosynthesis.

Parenchyma - thin walled, helps in storage and ventilation.

● Endodermis (Starch Sheath) – barrell shaped, helps in protection and conduction.

● Pericycle - parenchyma alternates with sclerenchyma

● Vascular bundle

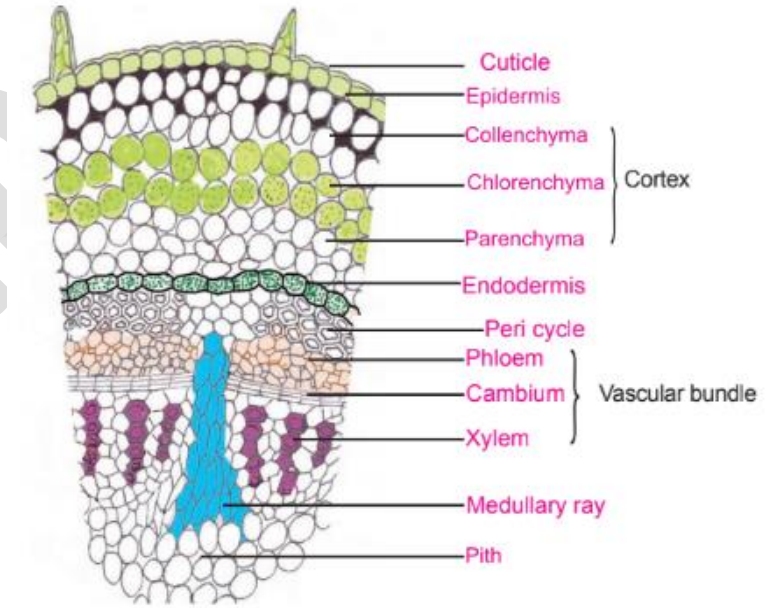
Phloem - Translocates food

Cambium - secondary growth

Xylem - conducts water

● Medullary ray- extends between vascular bundles

● Pith- helps in conduction



T.S of Dicot stem (Sunflower)

Structure of leaf

● Cuticle – Outermost layer.

● Upper epidermis– Barrel shaped cells. Helps in protection.

● Vascular bundle - xylem conducts water, phloem translocates food.

● Lower epidermis – barrell shape , have stomata,helps in exchange of gases and transpiration.

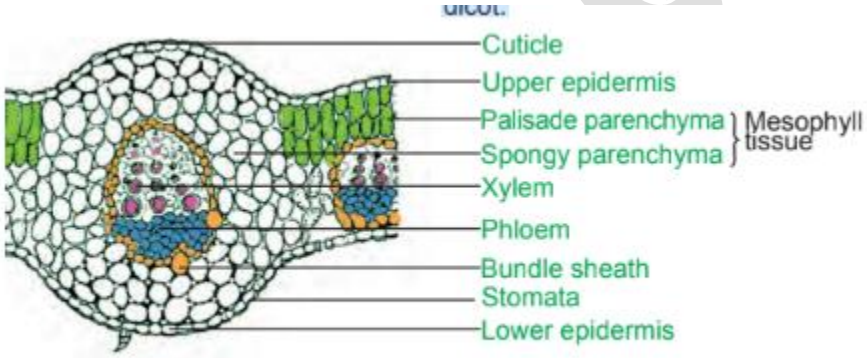
● Mesophyll tissue

Palisade parenchyma – cylindrical cells have more choloyphyll and helps in photosynthesis.

Spongy parenchyma – oval or round shaphed with less chlorophyll helps in storage and conduction.

Isobilateral – (either spongy or palisade parenchyma are present) in monocot.

Dorsiventral – (both palisade and spongy parenchyma are present) in dicot.



T.S of Dicot leaf (Sunflower)