

**UPSC**  
**NCERT Summary**  
**What, Why & How – 2**

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### **PLANTS CAPTURE INSECTS**

Certain plants which grow in soil poor in nutrients depend on insects for their nutritional requirement. These carnivores' plants use a combination of deception and a trapping device to get their meals.

Some insects – eating plants like the venus fl trap (*dionaea muscipula*) have leaves moulded into twin blade traps with teeth like projections on their margins which interlock to trap any insect sitting on the leaf. Leaves of another plant names *drosera* have glandes all over them which secrete a sticky substance to trap insects. The pitcher plant has fluid filled pitches – shaped structure into which unwary insects fall and drown. All insects eating plants secrete digestive juices to digest their prey.

### **WATER RISE IN TALL TREES**

Cells in the root hairs of plant contain dissolved sugars and salts. Water surrounding the root moves into them to equalize the pressure. This is called osmosis.

The increased water pressure in root hairs forces water up-ward, cell by cell through the roots and trunk to reach the leaves. In addition to this, during the growing season, a tree passes tones of water into the atmosphere from its leaves through transpiration.

This creates a partial vacuum that is quickly filled by the water being pushed up from the roots. Water molecules stick together, and as water is lost during transpiration, this cohesion causes a chain reaction that is transmitted all the way down.

### **ANNULAR RINGS IN PLANTS FORMED**

The annular rings or the altering dark light circles seen in a cross section of a tree are produced because of differences in the rate of growth in different seasons. As it happens, the entire tissue in the trunk of a tree does not divide or grow to increase the girth of the tree. There is a layers of dividing tissue called the cambium sandwiched between the fibrous xylem (the water carrying tissue).

However, the cambium divides at different rates in different seasons. In winter, its growth is slower than in other season, say in spring, when conditions for growth are fairly favorable. Thus, the relatively small numbers of cells produced in winter remain compacted together producing a dark band while the cells produced during the spring season spread out into a boarder light band. These growth patterns are repeated at annual intervals and hence the annular rings thus indicate the age of a tree as well as the changes in climate that might have occurred in the tree's life time.

## **LIGHTING OCCURS**

Lightening is couosed by an electric discharge in thunder clouds. These are clouds that rise to great heights and have strong air currents in them. The ice crystals, water droplets and other particles present in these collide with each other and get electrically charged.

Air usually works as an insulator to prevent these electric charges from escaping. But when the charge build up in the thundercloud crosses a certain level, the insulation effect of air breaks down and causes a massive discharge which we see as flashes of lighting. As the discharges takes place, the surroundings are suddenly expands to produce the sound which we hear as thunder. Lighting can pass from one cloud to another or from a cloud to the ground.

## **ARTIFICIAL RAIN PRODUCED**

Rain occurs when the water vapour in the clouds forms water drops or ice crystals large and heavy enough to fall to the ground. This process is hastened if the cloud has tiny particles of matter for the water vopour to condense on. Artificial rain produced by introducing these particles into the clouds by a process called cloud seeding.

Clouds can be seeded in different ways. The seeding agent can be sprayed into a cloud from an air plane or sent up in a rocket. If the wind is strong enough, it can be dispersed in the form of smoke from the ground. At cloud temperature above 0oC solid carbon dioxide or crystals of silver dioxide is used. Water vapour in the clouds condenses around the seeding agent to form rain drops. If the temperature is below 0oC ice crystals are formed. When the ice crystals pass through air warmer than 0oC, they melt and fall as rain. Artificial rain is best produced from moistureladen clouds. It cannot be produced from a cloudless sky.

## **WOOLLENS KEEP US WARM**

Wool fibres are made of a particular protein (keratin) which is a bad conductor of heat and as a result does not allow heat to escape. This helps us in keeping warm during winter. These fibers are wavy in structure, the property commonly known as

crimp. Crimp imparts resilience to the fibres due to which fibres quickly recover from wrinkling and crushing. Because of this wavy structures the fibres do not come perfectly close and as a result a large number of air pockets are formed. The air entrapped within these pockets acts as an insulator and traps body heat inside.

### **CURD FORMED**

This bacteria produces lactic acid by the fermentation of the milk sugar lactose. The lactic acid so formed by the bacteria action contains positive hydrogen ions which are attracted to the negative particles of the protein casein. As the latter are neutralized, these protein molecules no longer repel one another but coagulate. The optimum temperature at which lactobacillus acts is around 40 °C. so milk is usually warmed to this temperature before setting it to curdle.

### **Stars Born**

Stars take birth out of clouds of hydrogen, helium and dust particles present in galaxies. Due to the turbulent motion in these gas clouds, the dust particles undergo random collisions and condense under the influence of strong gravitational pull. As the gases and dust particles begin condensing, the temperature inside rises due to increasing pressure. As the condensing mass grows bigger the gravitational pressure at the centre increases further till the intense heat raises the temperature to around 10 millions degree Celsius. At this temperature the hydrogen atoms start colliding so vigorously that they fuse with each other to form helium atoms. In the process some mass is lost. For every 1000 kg of hydrogen used up, 993 kg of helium is formed. The rest is converted into tremendous amount of energy according to the relation ship  $E=mc^2$ , where E is the energy, m the mass and c the velocity of light. This energy is liberated in the form of light and heat and a star is born.

### **TEMPERATURE OF SUN MEASURED**

There are many ways of measuring temperature. The most common is the mercury thermometer in which an expanding Column of mercury in a glass capillary indicates the temperature. But a mercury thermometer cannot be used to measure temperature above 357°C. for measuring higher temperature such as that in a furnace, instruments called pyrometers are used. But for measuring the sun's temperature a different technique is used. It makes use of the fact that the colour at which a hot object gives off the maximum energy is directly related to the temperature of the hot body.

This is governed by a law known as Wien's law. The sun gives off light which is a mixture of several colours. When the spectrum of sunlight is analyzed by using special instruments called bolometer it is found that the maximum intensity falls in

the green part of the sun's spectrum. From this and by using Wien's law, we obtain a value of 5800 K for the sun's surface temperature.

### **SPACESUITS PROTECT**

A spacesuit is protective gear that protects an astronaut from the hostile environment of extremely low pressure, low temperature and radiation in space. It is made up of several layers of strong synthetic materials including Teflon and nylon which shield the astronauts from tiny particles called micrometeoroids. The intense solar radiations are reflected by a white plastic layer which has a metallic coating. The interior of the suit is pressurized but for which the astronaut's blood would boil off in the vacuum of space. A backpack carries water both for drinking as well as to keep the astronaut cool. Water flows through pipes in the astronaut's suit and carries away body heat.

### **FIREWORKS DISPLAY COLOURS**

Fireworks are produced by metals or metal salts present in the fireworks. Metals have the property of emitting light of a particular colour while they burn. For instance, when sodium or its salts burn, yellow light is given out. Similarly, on burning, finely divided aluminum gives out bright white light. Strontium salts give out red colour while copper and barium salts produce intense blue and green colours respectively. Fireworks manufacturers make use of this property of metals and their salts and use them in various combinations in crackers to produce spectacular fireworks displays.

### **PLANETS SPHERE SHAPED**

All the planets of our solar system were formed out of the same cloud of gas and dust that gave rise to the sun, some five billion years ago. As random collisions and gravitational forces compacted the gas and dust particles into the various planets the heat generated brought the masses into a molten state. Since surface tension of a liquid tends to make the surface area minimum and the sphere has the minimum surface area for a given volume, all the planets in the molten state become spherical and have retained that shape as they cooled.

### **SEA WATER SALTY**

Sea water is salty because it contains many dissolved salts, mostly sodium chloride with small proportions of potassium, magnesium, calcium and carbonates. The salt comes mainly with river water that flows through rocks eroded by frost and rain. The gradual wearing away of mountains releases minerals which are carried down

by rivers to the ocean comes mainly with river water that flows through rocks eroded by frost and rain. The gradual wearing away of mountains releases minerals which are carried down by rivers to the ocean as dissolved salts.

Some salt also enters sea water from the rocks beneath the sea bed; the river water carrying salts to the sea does not taste salty because the salts are present in extremely small concentration. Whereas in the case of the oceans, water is continuously evaporating even as more and more salt continues to be added with river water. This, over millions of years has led to the high concentration of dissolved salts in sea water.

### **LIGHTNING ACCOMPANIED BY THUNDER**

Lightning occurs when a massive electrical discharge takes place between two oppositely charged clouds or between a charged cloud and the ground. The charges develop in thunder clouds due to the friction of water droplets with air as the droplets move up and down with the rising and descending air currents within the cloud. During a bolt of lightning, thousands of amperes of electricity flow through the air in a fraction of a second. This rapidly heats up the air along its path which expands very fast producing shock waves which we hear as thunder. Although the lightning and thunder are produced at the same instant, we hear the thunder later because light travels faster than sound.

### **SYNTHETIC FABRICS DRY TOO QUICKLY**

Synthetic fibers are made artificially. They are solid, smooth and straight in structure unlike a natural fiber like cotton which is hollow. So when synthetic fabrics are soaked in water, only surface of the fibers gets wet as water does not enter the body of the fiber. That is why these fabrics absorb very little amount of water and dry quickly as the water drips away. Such fabrics are also known as, 'dripdry'.

### **SOAP DOES NOT FORM LATHER IN HARD WATER**

Soaps are salts of fatty acids. Common soaps are water soluble and potassium salts of fatty acids. Soap cannot form lather unless it dissolves in water. Hard water does not dissolve soap because the calcium and magnesium salts present in it produce insoluble substances by reacting with soap. These insoluble substances separate out as scum and reduce the effectiveness of the soap as a cleansing agent.

### **FLUORESCENT TUBES CONSUME LESS POWER**

In filament lamps a good part of the electrical energy is used up in heating the filament which in turn glows throwing light around. While in fluorescent tubes light

is produced by electrical discharge in a glass tube, the inside of which is coated with a fluorescent material. The filaments at the two ends are used only to start the discharge. The discharge passing through vapors of mercury produce UV radiations which excites the fluorescent. Coating producing visible light. Since very little heating is involved in the process and most of the electrical energy is used in producing light, fluorescent tubes consume less power than filament lamps.

### **ICE MELTS WHEN SUBJECTED TO PRESSURE**

One of the laws of fusion is that the melting point of substances which expand on freezing is lowered by the increase of pressure, while it is raised in the case of those which contract on solidification. Ice belongs to the first category of substances, that is, it expands on freezing. Ice has an open structure which collapses when subjected to pressure, producing water which occupies lesser volume. That is why ice when subjected to pressure.

### **THERE A DISTURBANCE ON TV WHEN WE OPERATE AN ELECTRICAL SWITCH**

When an electrical switch is operated it produces a spark at the contact point. This spark emits electromagnetic radiation. Since radio and TV signals are also electromagnetic in nature, the bursts of electromagnetic radiation produced by a spark is also received by the radio or TV set. This lead to the disturbance which is heard as cracking sounds on the radio and snowy lines on the TV picture.

### **COLOURED SOAPS PRODUCE WHITE BUBBLES**

Foam or lather is nothing but a large collection of small soap bubbles. A soap bubble is, in turn, a very thin film of soap solution enclosing some air. Because of the low surface tension of soap solution, the film can stretch and spread and form innumerable bubbles with a very large total surface area. Because of this, whatever slight tint present in the thin film of the coloured soap solution gets subdued. Although a soap film is more or less transparent, the lather or foam looks white because the light striking this large collection of bubbles gets scattered. That is why all kinds of foam look white.

### **THINGS BURN**

Burning is a chemical process in which the material burns combines with oxygen with the generation of large amounts of heat. As a result the temperature of the burning material rises to several hundred degrees Celsius and it may burst into flames. Therefore, any substance that readily combines with oxygen at a few hundred degrees and produces a lot of heat will burn if ignited. Such substances

such as paper, wood, cloth, plastics, rubber etc. are usually rich in carbon and hydrogen. Some volatile liquids such as alcohol, petrol, etc. catch fire easily because they produce highly combustible vapors.

### **A DRIED PIECE OF COTTON APPEAR DARKER WHEN WET**

Cotton is a natural fibre. When woven or knitted into cloth, the fibres are loosely packed and contain lot of air spaces. When light falls on these fibres it is scattered from the boundaries of the fibres and the colour of the cloth appears lighter. But when the fabric is soaked in water, the air pockets of the fibres get filled with water. This reduces the amount of Light Scattered from the fabric. Therefore, more light reflected from the coloured fabric reaches to the eye and the colour appears deeper. However, synthetic and silk fibres are smooth in structure and leave no air space when woven or knitted. So the colour of silk or synthetic fabric is not altered when the fabric is soaked in water.

### **WATER AND OIL MIX**

A phenomenon called polarity prevents oil and water from mixing. All molecules carry electrical charge which is distributed uniformly or non-uniformly over the length of the molecule.

In polar compounds, the positive and negative charges are concentrated at the two ends of the molecule. When such substances are mixed together, the positive and negative regions of their molecules attract each other and as a result a clear solution is obtained. Water is a polar substance and mixes freely with other polar substances. Oil molecules, on the other hand, are non-polar. When polar and non-polar substances are mixed together, the mutual attraction of polar molecules separates out the non-polar molecules and the two substances do not mix.

### **ACID RAIN**

Natural rain always contains small amount of dissolved carbon dioxide which makes it slightly acidic. But large-scale burning of coal or oil in industries, power plants and vehicles produce large amounts of gases such as sulphur dioxide, nitrogen oxides, etc., which are released into the atmosphere. Under favourable conditions they react with water vapour and oxygen in the atmosphere to produce sulphuric and nitric acids which eventually come down with rain, snow or fog. The countries worst affected by acid rains are southern Sweden, Norway, parts of central Europe and Eastern Region of North America.

## **AIDS**

Acquired Immune Deficiency Syndrome (AIDS) is the most devastating and fatal diseases of the 21st Century it is a viral disease caused by the Human Immune Deficiency Virus (HIV).