Natural resources are things that are found in nature and are useful to man. To qualify as a natural resource, a substance must satisfy: It should be available in plenty, it should be helpful in fulfilling the various requirements of man and in maintaining the environment around him and it should be within easy reach. Air, water, soil, forests, energy, minerals, coal and petroleum, flora and fauna, etc., are all natural resources. All the natural resources necessary to support life.

Environment: 'environment' means 'surroundings' that include the following components.

1. Atmosphere: The envelope of gases extending to a height of about 1600 km from the surface of the earth is called the atmosphere.

2. Hydrosphere: The part of the environment which contains water in all its various forms is called the hydrosphere. Hydrosphere includes ground water (the seas, the oceans, the rivers, etc.), underground water,ice caps and water vapours.

3. Lithosphere: The earth's outer surface is called the lithosphere. It is the solid component of the earth which includes the sand, rocks and mountains.

4 Biosphere: The parts of the lithosphere, the hydrosphere and the atmosphere in which life exists together form the biosphere. It has both living and nonliving worlds. The living world is called the biotic component, whereas the nonliving one is called the abiotic component. Soil, water and air constitute the abiotic component.

AIR: is a mixture of gases that makes up the earth's atmosphere. It mainly consists of about 78% nitrogen and 21% oxygen. Apart from these gases, air also contains small amounts of several other gases such as carbon dioxide, water vapour. The proportions of water vapour and dust decrease with altitude. Air contains no water vapour beyond 12 km above sea level. The amount of dust also decreases with altitude. **Usefulness of Air:**

1. Air is required for respiration: The correct proportions of nitrogen and oxygen are required for our respiration. A normal human being requires about 250 kg to 265 kg of air a day to carry out its normal activities. During respiration, we breathe in oxygen from the air and breathe out carbon dioxide. The inhaled oxygen combines with haemoglobin of our blood to form oxyhaemoglobin. The latter acts as the oxygen-carrier to the cells of our body. In the cell, oxygen oxidizes sugar molecules to produce carbon dioxide and water, and liberates heat energy. We use this energy to perform various works.

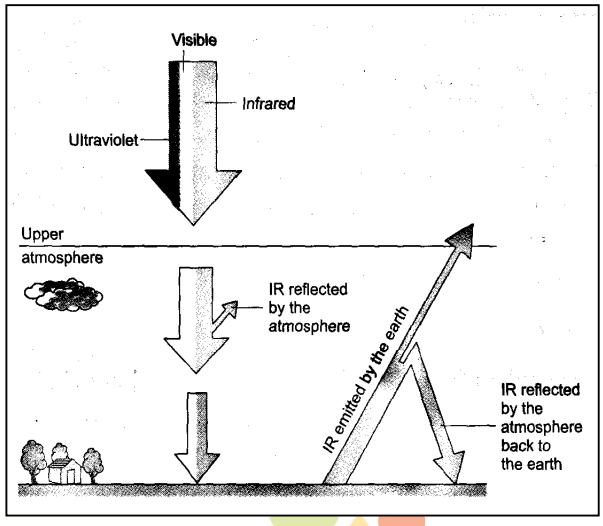
2. Air is required for burning of fuels: It is the oxygen of air that is essentially required for burning of things. Nothing will burn in the absence of oxygen. Fuels are mostly mixtures of hydrocarbons (compounds formed from the combination of carbon and hydrogen). When they burn in air, carbon dioxide and water vapour are produced with the release of heat energy. Fuel + Oxygen $\longrightarrow$ Carbon Dioxide + Water Vapour + Energy

3. Plants require air to make their food: Plants require carbon dioxide of the air to make their food by a process called photosynthesis. In photosynthesis, green plants consume carbon dioxide and water vapour from the air and the energy of the sun to prepare sugar (food).

4. Air moderates the temperature of the earth: Air plays a very important role in keeping the temperature of the earth within a certain range. This happens as a result of a phenomenon known as the greenhouse effect. **A green house** is a glass building used for growing plants that need protection from cold. Glass reflects infrared radiations of longer wavelengths but allows those with shorter wavelengths to pass through. This behaviour of glass is used to make a greenhouse. The solar radiation which passes through the glass heats up the surfaces inside the greenhouse. These warm surfaces then radiate heat. This radiation consists mainly of IR of longer wavelengths. They are reflected by the glass of the greenhouse. Thus, the heat inside the greenhouse is trapped which keeps the greenhouse warm. A similar effect takes place in the atmosphere. The carbon dioxide present in the atmosphere behaves like glass. It allows the IR radiations of shorter wavelengths to pass through, but reflects the IR radiations

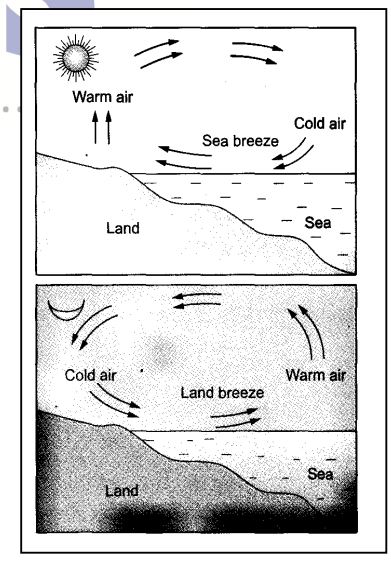
of longer wavelengths. During the day, solar radiations including IR radiations of shorter wavelengths, heat up the surface of the earth. The surface of the earth then reradiates some of these radiations in the form of heat. The IR radiations from the surface of the earth have longer wavelength. So, they are reflected by the carbon dioxide in the atmosphere. The heat is thus trapped which keeps the earth warm even during the night. Had there been no carbon dioxide in the air, the nights would have been abnormally cold and life would not have existed on earth.

5. Air brings rain on the earth: Rainfall depends upon the movement of air.



- Hot air is lighter than cold air.
- The land gets heated and cools more rapidly than water.
- Air moves from a region of higher pressure to one of lower pressure.
- Air always contains some amount of water vapour.

All the places on the earth are not uniformly heated up by the sun. When a place becomes heated, the surrounding air also becomes warm. The warm air, being lighter, rises up. A low pressure region is thus created there. The cold air from the cooler and high pressure regions then moves in to take its place. This movement of air takes place due to uneven heating of different places on the earth. Due to the unequal heating of places, convection currents are produced in the air. When air moves horizontally, it is called wind.



Sea breeze and land breeze: During the day, when air is heated by the heated land or by the water in the sea, it rises up. Since land gets heated faster than water, the air above the land too is heated faster than the air above the sea water. As the air rises, a low pressure area is created and air from the sea moves into this area. Thus, the movement of air takes place from the sea side to the land side. This is called sea breeze. During the night, both the land and the sea start cooling. But, the cooling of sea takes place at a slower rate than that of the land. Thus, a low pressure area is created in the sea. The air then moves from the land to the sea. This is called land breeze. These breezes always occur in the coastal areas.

Condensation and Precipitation: air always contains some amount of water vapour at a given temperature. When the temperature of air decreases, the capacity of air to hold water vapour also decreases, and vice versa. When the temperature of air falls below a certain temperature, the excess water vapour present in the air gets transformed into very small droplets of water. This process is called condensation and the temperature at which condensation takes place is called the dew point. For condensation to take place a surface is required. Such a surface is called the nucleus. Tree leaves, grass and dust particles in air are examples of nucleii around which condensation occurs. Condensation of water vapour leads to the formation of clouds, rain, snow, sleet and hailstone.

Clouds and rain: During the day, when water bodies (oceans, lakes, ponds, etc.) are heated up by the sun, a large amount of water goes into air as water vapour. Some amount of water also goes into air due to a number of biological activities. This air also becomes heated. When this warm and moist air rises up, it expands and gets cooled. When the temperature falls below the dew point, the excess water present in the air gets condensed around the dust particles, forming tiny droplets of water. When the temperature drops further, these droplets get condensed into tiny crystals of ice. These crystals, being very light, float in the sky with the currents of air. Millions of such droplets come together to form larger droplets called clouds. When these droplets become big enough and heavy, they cannot stay in the air. They come down on earth as rain.

Fog: when condensation of water vapour takes place in the lower layers of the atmosphere, fog is formed. Fog reduces visibility and creates traffic hazards.

Smog: In industrial areas, smoke emitted from the chimneys of factories gets mixed up with the fog. As a result, smog is formed. Thus, smog is a. combination of smoke and fog.

Monsoons and cyclones: Monsoon is a seasonal wind. It flows in a fixed direction during a particular season. When the season changes, its direction also changes. Monsoons are caused when there is a large difference between the temperatures of the land and the sea. During summer, the interior part of Indian subcontinent gets extremely heated up. A low pressure zone is thus created. Moist wind from the Indian Ocean flows towards this zone causing heavy rainfall. This is called south-west monsoon. During the winter, when temperature falls sharply, a high pressure region is created in the Indian subcontinent. The sea remains warmer than the land, causing the pressure over it to be lower. Therefore, cold dry winds blow towards the sea from north-east direction. In India, it brings rain after crossing the Bay of Bengal. This is called north-east monsoon. In a cyclone, strong winds blow in a spiral towards the low-pressure area at the centre.

Snow: Snow Sometimes, it so happens that the temperature of air becomes 0°C or lower. The excess water vapour present in the air condenses to form minute crystals of ice. These crystals also condense to form bigger crystals. When they become very heavy they fall down on earth as snow.

Hailstones: Sometimes, strong air currents carrying the raindrops move upwards, to a height where the temperature is lower than the freezing point of water. The raindrops get frozen there. The frozen drops begin to fall down covered with a layer of water. During the course of their falling they are pushed up again by air currents. The layer of water also freezes. This process is repeated a number of times and many layers of water get frozen around the original drop. This gives rise to a pellet of ice which we call hailstone.

Sleet: when the falling ice crystals or hailstones pass through warm layer of air, they melt partially and form a mixture of snow and rain. This mixture is called sleet.

Air Pollution: When air contains enough harmful impurities which affect the well-being of the living and the nonliving, it is said to be polluted. We can say that air pollution is caused by the presence or excess of substances which change the physical, chemical or biological characteristics of air. The substances that cause pollution are called **pollutants.** Pollution can be caused either by natural causes or by human beings. The pollution from natural causes are usually beyond human control. We can lessen, if not totally eliminate, man-made pollutants.

Pollution due to natural causes: Gases and particulate matter released during volcanic eruptions is one source of air pollution. Smoke and ash from forest fires, fog, dust blown by strong winds, pollen, etc., are also natural air pollutants. However, the pollution of air caused by natural causes is very little and usually does not affect us adversely.

Pollution caused by man: Most of the pollution from human activities comes from industries and vehicles burning fossil fuels. Smoke from these sources is the primary air pollutant.

Smoke also gets into the air from other sources like aeroplanes, kitchens and steam-engines. Burning of fuels and other industrial activites release harmful gases such as carbon dioxide, carbon monoxide, oxides of sulphur and nitrogen, particulate matter, etc. The oxides of sulphur and nitrogen in the air cause acid rain which affects monuments, etc.

Pollution caused by the burning of fossil fuel (coal): The burning or combustion of coal produces carbon dioxide, carbon monoxide, sulphur dioxide, oxides of nitrogen and smoke.

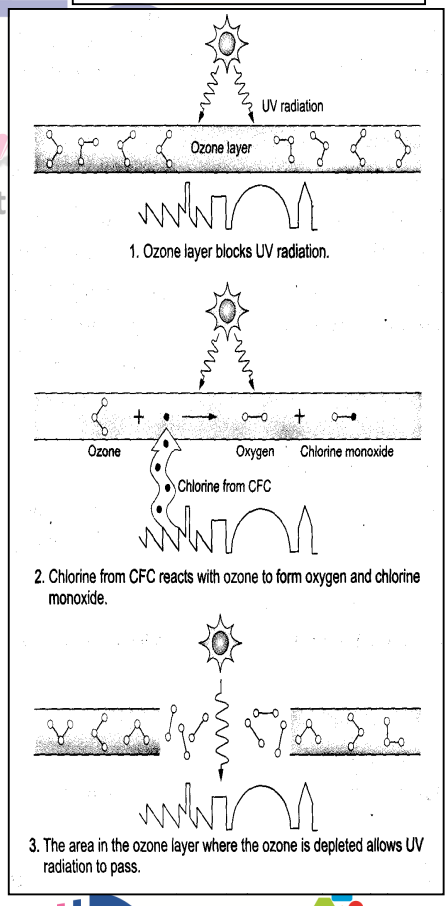
1. When coal burns in a sufficient supply of oxygen, carbon dioxide is produced. It is a harmless and nontoxic gas. Carbon dioxide in air keeps the earth warm by trapping radiation. This is called the greenhouse effect. However, large concentration of carbon dioxide in the atmosphere increases the greenhouse effect, leading to unnatural global warming.
2. When coal burns in an insufficient supply of oxygen, it burns incompletely and forms carbon monoxide, which is poisonous. When inhaled, carbon monoxide combines with the heamoglobin of our blood and forms carboxyhaemoglobin. This causes suffocation and even death.
3. During combustion of coal, sulphur present in the coal is oxidized to sulphur dioxide. Sulphur dioxide is an extremely suffocating and corrosive gas. It dissolves in atmospheric water to form sulphuric acid which falls on the earth with the rain. This rain is known as acid rain which damages crops, harms living tissues and corrodes structures like the Taj Mahal.
4. The burning of coal also produces smoke. The smoke present in the air affects our lungs.

Pollution caused by the burning of petroleum-based fuels: The various pollutants produced by the burning of petrol are carbon monoxide, unburnt hydrocarbons, some alcohols and acids, and lead compounds. Petrol is a mixture of liquid hydrocarbons. In an engine, it burns very fast. But, the burning does not take place completely. Petrol burns to produce mainly carbon dioxide and water vapour. But, due to its incomplete burning some carbon monoxide, unburnt hydrocarbons, etc., are also produced. Carbon monoxide and other undesirable gases go into the atmosphere and pollute it. At the high temperature produced in a petrol engine, nitrogen and oxygen of the air present in the engine combine to form the oxides of nitrogen. These oxides are also discharged into the atmosphere. Nitrogen dioxide (NO_2) is a poisonous gas. It causes irritation, and damages our lungs.

$$CFCl_3 \xrightarrow{\text{light}} CFCl_2 + Cl$$

$$Cl + O_3 \longrightarrow \underset{\text{chlorine monoxide}}{ClO} + O_2$$

$$ClO + O \longrightarrow Cl + O_2$$



Depletion of ozone layer: The ozone hole: Ozone is a gas which exists as a diatomic molecule (O_3). At about 10 - 15 km above the surface of the earth, there exists a region which is rich in ozone. This region is called the ozonosphere. The presence of ozone layer is important as it absorbs the ultraviolet radiation from the sun and thereby prevents the radiation from reaching the surface of the earth. Unfortunately, the amount of ozone in the ozonosphere is gradually being depleted due to some human activities. Certain types of compounds of carbon, fluorine and chlorine, called chlorofluorocarbons (CFCs), or freons, are freely used

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in air-conditioners, refrigerators, aerosol sprays, shaving foam, etc. Freons rise up very high in the atmosphere and break down to form chlorine atoms. These chlorine atoms interact with the ozone to form oxygen. As ozone gets converted into oxygen, the amount of ozone in the ozone Iayer decreases. Over time this has created an ozone-deficient area in the atmosphere. This area is called the ozone hole. This is most prominent over **Antarctica.**

Effects of the ozone hole:

1. Ultraviolet radiation has many harmful effects. Without the shield of ozone ultraviolet rays may directly come on the earth, causing a number of health problem such as skin cancer and cataract.
2. Ultraviolet rays adversely affect plant life too.

WATER

Water constitutes about 73% of the earth's surface, and is present in oceans, rivers, Iakes, ponds, etc. It is also an important constituent of the atmosphere and living matt addition, there is water under the ground, and this is known as groundwater. The total body of water on the surface of the earth is called the **hydrosphere.** Water is a valuable natural resource. It is the most abundant substance on the earth it is an inexhaustible natural resource. Water is indispensable for life processes. We drink water, use water to cleanse ourselves, prepare food, grow crops, etc. Water is used in many industrial processes. It has been estimated that the water reserve in the river systems of our country about 1,869 km^3 whereas the groundwater reserve is about 432 km^3.

Sources of Water in Nature: Water in its liquid form occurs in nature as rainwater, surface water and underground water. It is also found in the soil and in the air.

1. Rainwater: is the purest form of natural water because it is naturally distilled Water. Water vapour from the seas and oceans form clouds. The water vapour in the clouds condenses and forms water droplets which fall on the earth as rain. Thus, rainwater is fairly pure.
2. Surface water: On the surface of the earth water is mostly found in seas, oceans, lakes, ponds, rivers etc. Oceans are a vast reservoir of water. Seas and oceans are fed by river water. Impurities like dissolved salts pass into the sea. In fact, sea water contains a higher percentage of dissolved salts than any other kind of natural water. Sea water, therefore, becomes saline. Fresh water is present on the poles and on some high mountains in the form of ice. The water in rivers, lakes and ponds is fresh water.
3. Underground water: Water found under the ground is actually surface water that has percolated deep into the earth and has collected in underground pools or streams. This water has undergone filtration through porous strata and hence does not contain suspended impurities. Hence, it is fit for drinking purposes.

Water is essential for the growth and sustenance of both plant and animal lives. We know that water makes up a large percentage of animal and plant cells. In the absence of water, plant and animal cells cannot survive. Importance of water in human life

In the human body, processes like digestion, circulation and excretion are largely regulated with the help of water.

1. Water dissolves all salts and nutrients present in the food consumed by us. These are then absorbed by the body.
2. Blood, which is made up mostly of water, carries dissolved food materials to the cells.
3. Water is required for excretion as well. Waste products are dissolved in water and excreted from the body. Water aids in the proper movement of the bowels and prevents constipation.
4. An aqueous medium is required to carry out all the metabolic reactions in the body.
5. Water helps in regulating our body temperature through sweating followed by evaporation of the sweat. Sweat requires a certain amount of heat to evaporate. It takes this heat from the body which, in turn, loses heat and cools down.

$$6CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{sunlight}} \underset{\text{glucose}}{C_6H_{12}O_6} + 6O_2$$

Importance of water in plant life:

1. Water helps in the germination of seeds and the growth of plants.
2. Green plants prepare their food by a process known as photosynthesis. They combine water and carbon dioxide in the presence of sunlight to form Carbohydrates like glucose.
3. Water dissolves the nutrients in soil and fertilizers for easy absorption by plants.
4. Water provides a good medium for the transport of minerals and food within the plant.
5. Water provides appropriate pressure to plant tissues for the maintenance of their structure.

Habitat of aquatic animals: Water provides a safe habitat for aquatic animals. Fish play a vital role in the life of man because they are a very good source of nutritious food. They are rich in proteins. Vitamins A and D are also extracted from marine fish. Rohu, cutla, singhara and magur are a few examples of freshwater fish (found in ponds, rivers, canals, etc.). Some of the marine fish found off the Indian coast are Bombay duck, eel and pomfret.

Dependence of living organisms on water: Plants require water for their growth. No useful plant can be grown in a desert, where there is shortage of water. Only thorny plants and shrubs grow there. In a heavy rainfall area, where there is plenty of water, both plants and animals of different varieties grow and live together.

Water Pollution: Water free from harmful impurities and fit for drinking is called pure or fresh water. It is essentially required by all living organisms to carry out their various activities. But, the unrestricted and reckless activities of man make water dirty and unfit for drinking. The impure and dirty water is called 'polluted water'.

1. Waste water from factories: Waste water released from factories contains several harmful chemicals. These chemicals are used in factories for making paints, detergents, etc. This waste water goes into rivers and lakes. The chemicals present in it destroy aquatic plants and animals. They are highly toxic and dangerous to human beings
2. Use of pesticides and fertilizers: A number of fertilizers and pesticides are freely used by farmers to increase their agricultural yield. These substances are poisonous. The contaminated water may then get into the bodies of animals causing several types of diseases.
3. Sewage disposal: Sewage coming out from towns and cities are dumped into rivers Domestic and animal sewage helps the aquatic weeds to grow fast. The unrestricted growth of weeds makes water deficient in dissolved oxygen. So, aquatic life which uses dissolved oxygen is badly affected.
4. Change in temperature: In a dam, the temperature of water deep within is lower than that on the surface. When water is released from dams, there is a sudden change in temperature of water in the river. The change in temperature of river water is also caused by hot water released from industries. This affects the life forms present in water badly because they are used to live within a certain temperature range only. The eggs and larvae of several animals perish under such a sudden change in temperature.

How to curb water pollution?

1. Sewage should not be released directly into rivers or lakes. They should be properly treated in sewage treatment plants.
2. Harmful chemicals should not be dumped into water bodies. They should be transformed into some useful substances.
3. Pesticides and fertilizers should be used only in a restricted manner.

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