JSS2 SECOND TERM BASIC EDUCATION

1. Environmental pollution
2. Ways of reducing pollution risk
3. Consequence of air pollution
4. Ecology
5. Changes in matter
6. Changes in living things
7. Changes in non-living things
8. Crude oil and petroleum chemical

WEEK 1

Topic: Environmental Pollution

Introduction

The environment is the whole of our surrounding and it is made up of living and non-living components. The non-living components consist of water, air, land etc. The three non-living components are important for life on earth. The discharge of waste substances into the environment in quantities that are harmful to human beings is called POLLUTION. Pollution is the introduction of a contaminant into a natural environment, usually by humans. In other words, Pollution is the addition to the ecosystem of something which has a detrimental effect on it. One of the most important causes of pollution is the high rate of energy usage by modern, growing populations.

When some physical, chemical or biological changes occur in our physical environment it is known as pollution and the substances which brings these changes are known as Pollutants. The sources for the pollution can be natural or manmade.

Different kinds of pollution are found, but we will discuss the following:

Air Pollution.

Water Pollution.

Land Pollution.

Air Pollution

Air pollution is the accumulation in the atmosphere of substances that, in sufficient concentrations, endanger human health or produce other measured effects on living matter and other materials. In other words, Air pollution is defined as any contamination of the atmosphere that disturbs the natural composition and chemistry of the air. This can be in the form of particulate matter such as dust or excessive gases like carbon dioxide or other vapours that

cannot be effectively removed through natural cycles, such as the carbon cycle or the nitrogen cycle.

Among the major sources of pollution are power and heat generation, the burning of solid wastes, industrial processes, and, especially, transportation. The six major types of pollutants are carbon monoxide, hydrocarbons, nitrogen oxides, particulates, sulphur dioxide, and photochemical oxidants.

Air pollution comes from a wide variety of sources. Some of the most excessive sources include:

Vehicle or manufacturing exhaust

Forest fires, volcanic eruptions, dry soil erosion, and other natural sources

Building construction or demolition

Depending on the concentration of air pollutants, several effects can be noticed. Smog increases, higher rain acidity, crop depletion from inadequate oxygen, and higher rates of asthma. Many scientists believe that global warming is also related to increased air pollution.

Examples of Air Pollution

Noise Pollution
Noise pollution or unwanted sounds that are carried by the air, have an irritating and detrimental effect on humans and other animals. Careful planning of streets and buildings in towns and better control over noisy vehicles may add to the control of noise pollution.

Tobacco Smoke
Tobacco smoke is one of the major forms of pollution in buildings. It is not only the smoker who is infected, but everyone who inhales the polluted air. There is a very strong connection between smoking and lung cancer. Bronchitis is common among smokers and unborn babies of mothers who smoke also suffer from the harmful effects of smoking.

Exhaust Gases of Vehicles

Pollution from exhaust gases of vehicles is reponsible for 60% of all air pollution and in cities up to 80%. There is a large variety of harmful chemicals present in these gases, with lead being one of the most dangerous.

Combustion of Coal

The combustion of caol without special precautions can have serious consequences. If winds do not blow away the poisonous gases, they can have fatal effects and may lead to death.

Acid rain

Acid rain is the term for pollution caused when sulfur and nitrogen dioxides combine with atmospheric moisture to produce highly acidic rain, snow, hail, or fog. The acid eats into the stone, brick and metal articles and pollutes water sources. Coal in South Africa is rich in sulphur and the power stations in the Mpumalanga Province could be reponsible for acid rain over other areas of our country.

Control Measures

Although individual people can help to combat air pollution in their own immediate environment, efficient control can be best achieved by legislation. Some commonly enforced control measures include

The establishment of more smokeless zones;

Control over the kinds of fuel used in cars, aeroplanes, power stations, etc.

Water Pollution

Water pollution is the introduction into fresh or ocean waters of chemical, physical, or biological material that degrades the quality of the water and affects the organisms living in it. In other words, Water pollution involves any contaminated water, whether from chemical, particulate, or bacterial matter that degrades the water's quality and purity. Water pollution can occur in oceans, rivers, lakes, and underground reservoirs, and as different water sources flow together the pollution can spread.

This process ranges from simple addition of dissolved or suspended solids to discharge of the most insidious and persistent toxic pollutants (such as pesticides, heavy metals, and non-degradable, bioaccumulative, chemical compounds).

Causes of water pollution include:

Domestic waste substances include the following

Soap and detergents used in washing clothes, dishes and cars may flow back into the source of water supply such as lake, stream, river etc

Oil such as vegetable oil, kerosene, petrol from cars, palm oil, diesel from generator are spilled in the home or washed out from pots and maybe allowed to flow into the source of water supply

Refuse dumped beside river or stream may decay amd produce toxic materials which can be washed into the source of water supply

Dungs from animals, chickens, dog or cow left on land may decay and the poisonous material may be washed into the water source.

Other Sources of water pollutants generated from industries are

Acids eg hydrocyanic acid which is present in water squeezed out from cassava

Soap and detergent used in washing industrial equipment may flow back to nearby water sources

Leaching of soil pollution into water supplies

Organic material decay in water supplies

Alcohol may be washed out from breweries

The effects of water pollution include decreasing the quantity of drinkable water available, lowering water supplies for crop irrigation, and impacting fish and wildlife populations that require water of a certain purity for survival.

Examples of Water Pollution

Industrial affluents
Water is discharged from after having been used in production processes. This waste water may contain acids, alkalis, salts, poisons, oils and in some cases harmful bacteria.

Mining and Agricultural Wastes
Mines, especially gold and coal mines, are responsible for large quantities of acid water. Agricultural pesticides, fertilizers and herbicides may wash into rivers and stagnant water bodies.

Sewage Disposal and Domestic Wastes
Sewage as well as domestic and farm wastes were often allowed to pollute rivers and dams.

Control Measures

The following measures can be used to stop water pollution:

Every intelligent people should be wise enough not to pollute water in any way;

By research and legislation the pollution of water bodies, even though not entirely prevented, must be effectively controlled.

Land Pollution

Land pollution is the degradation of the Earth's land surface through misuse of the soil by poor agricultural practices, mineral exploitation, industrial waste dumping, and indiscriminate disposal of urban wastes. It includes visible waste and litter as well as pollution of the soil itself.

Examples of Land Pollution

Soil Pollution
Soil pollution is mainly due to chemicals in herbicides (weed killers) and pesticides (poisons which kill insects and other invertebrate pests). Litter is waste material dumped in public places such as streets, parks, picnic areas, at bus stops and near shops.

Waste Disposal
The accumulation of waste threatens the health of people in residential areas.

Waste decays, encourages household pests and turns urban areas into unsightly, dirty and unhealthy places to live in.

Control Measures

The following measures can be used to control land pollution:

anti-litter campaigns can educate people against littering;

organic waste can be dumped in places far from residential areas;

inorganic materials such as metals, glass and plastic, but also paper, can be reclaimed and recycled.

Ozone Layer Depletion: Effects and Causes of Ozone Depletion

The ozone layer is responsible for absorbing harmful ultraviolet rays, and preventing them from entering the Earth's atmosphere. However, various factors have led to the depletion and damage of this protective layer.
Ozone is a colourless gas found in the upper atmosphere of the Earth. It is formed when oxygen molecules absorb ultraviolet photons, and undergo a chemical reaction known as photo dissociation or photolysis. In this process, a single molecule of oxygen breaks down into two oxygen atoms. The free oxygen atom (O), then combines with an oxygen molecule (O2), and forms a molecule of ozone (O3). The ozone molecules, in turn absorb ultraviolet rays between 310 to 200 nm (nanometers) wavelength, and thereby prevent these harmful radiations from entering the Earth's atmosphere. The process of absorption of harmful radiation occurs when ozone molecules split up into a molecule of oxygen, and an oxygen atom. The oxygen atom (O), again combines with the oxygen molecule (O2) to regenerate an ozone (O3) molecule. Thus, the total amount of ozone is maintained by this continuous process of destruction, and regeneration.

Causes of Ozone Depletion
Ozone is a triatomic form of oxygen (O3), found in the Earth's atmosphere. A combination of low temperatures, elevated chlorine and bromine concentrations in the upper stratosphere are responsible for the destruction of ozone. The production and emission of chlorofluorocarbons (CFCs), is the leading cause of

ozone layer depletion. CFC's accounts for almost 80% of the total depletion of ozone.

Other ozone-depleting substances (ODS), include hydrochlorofluorocarbons (HCFCs), and volatile organic compounds (VOCs). These are often found in vehicle emissions, byproducts of industrial processes, refrigerants, and aerosols. ODS are relatively stable in the lower atmosphere of the Earth, but in the stratosphere, they are exposed to ultraviolet radiation and thus, they break down to release a free chlorine atom.

This free chlorine atom reacts with an ozone molecule (O3), and forms chlorine monoxide (ClO), and a molecule of oxygen. Now, ClO reacts with an ozone molecule to form a chlorine atom, and two molecules of oxygen. The free chlorine molecule again reacts with ozone to form chlorine monoxide. The process continues, and this results in the depletion of the ozone layer.

Possible Effects of Ozone Depletion

As ozone depletes in the stratosphere, it forms a 'hole' in the layer. This hole enables harmful ultraviolet rays to enter the Earth's atmosphere. Ultraviolet rays of the Sun are associated with a number of health-related, and environmental issues.

Impact on Humans

Skin cancer: Exposure to ultraviolet rays poses an increased risk of developing several types of skin cancers, including malignant melanoma, basal and squamous cell carcinoma.
Eye damage: Direct exposure to UV radiations can result in photokeratitis (snow blindness), and cataracts.
Immune system damage: Effects of UV rays include impairment of the immune system. Increased exposure to UV rays weakens the response of the immune system.
Accelerated aging of skin: Constant exposure to UV radiation can cause photo allergy, which results in the outbreak of rash in fair-skinned people.

Other effects: Ozone chemicals can cause difficulty in breathing, chest pain, throat irritation, and hamper lung functioning.

Effects on Amphibians

Ozone depletion is listed as one of the causes for the declining numbers of amphibian species. Ozone depletion affects many species of amphibians at every stage of their life cycle.

Some of the effects are mentioned below:

Hampers growth and development in larvae
Changes behaviour and habits
Causes deformities in some species
Decreases immunity. Some species have become more vulnerable to diseases and death
Retinal damage and blindness in some species

Effects on Marine Ecosystems

In particular, plankton (phytoplankton and bacterioplankton) are threatened by increased UV radiation. Marine phytoplankton play a fundamental role in both the food chain as well as the oceanic carbon cycle. Plankton play an important role in converting atmospheric carbon dioxide into oxygen. Ultraviolet rays can influence the survival rates of these microscopic organisms, by affecting their orientation and mobility. This eventually disturbs and affects the entire ecosystem.

Impact on Plants

In some species of plants, UV radiation can alter the time of flowering, as well as the number of flowers.
Plant growth can be directly affected by UV-B radiation. Despite mechanisms to reduce or repair these effects, physiological and developmental processes of plants are affected.

Another observation is an increase in the ozone present in the lower atmosphere due to the decrease in the ozone in the stratosphere. Ozone present in the lower

atmosphere is mainly regarded as a pollutant and a greenhouse gas, that can contribute to global warming and climate change. However, studies have pointed out that the lifespan of lower atmospheric ozone is quite less, compared to stratospheric ozone. At the same time, increase in the level of ozone in the lower atmosphere can enhance the ability of sunlight to synthesize vitamin D, which can be regarded as an important beneficial effect of ozone layer depletion.

Practice Questions

Pollution is the introduction of a _____ into a natural environment, usually by humans.
a) contamination
b) contaminant
c) pollutes
d) dirts

Ozone is a _____ form of oxygen (O3), found in the Earth's atmosphere
a) diatomic
b) monoatomic
c) triatomic
d) hexatomic

One of the following is not a cause of water pollution
a) Increased sediment from soil erosion
b) smoke from chimney
c) Improper waste disposal and littering
d) Leaching of soil pollution into water supplies

One of the following is not an impact of ozone depletion on humans
a) hampering of growth
b) skin cancer
c) eye damage
d) aging of skin

As ozone depletes in the stratosphere, it forms a _____ in the layer
a) hole

b) space
c) base
d) line

One of the following is not a cause of air pollution.
a) Exhaust Gases of Vehicles
b) Smoke from chimney
c) Acid rain
d) Sewage

_____ are unwanted sounds that are carried by the air, have an irritating and detrimental effect on humans and other animals.
a) air pollution
b) pollutants
c) smoke
d) noise pollution

One of the following is not a control measure for pollution
a) anti-litter campaigns can educate people against littering
b) organic waste can be dumped in places far from residential areas
c) littering of the streets with dirts
d) inorganic materials such as metals, glass and plastic, but also paper, can be reclaimed and recycled.

_____ is the degradation of the Earth's land surface through misuse of the soil by poor agricultural practices, mineral exploitation, industrial waste dumping, and indiscriminate disposal of urban wastes.
a) Land pollution
b) Soil pollution
c) Water disposal
d) Air pollution

_____ is the introduction into fresh or ocean waters of chemical, physical, or biological material that degrades the quality of the water and affects the organisms living in it.

a) Rain pollution
b) Sea pollution
c) Water pollution
d) Pollution

EVALUATION

1. Water pollution may be controlled by (a) making a good suck-away pit (b) repair of leakages in our roofs (c) Sweeping our room's regularly (d) Regular disposal of refuse
2. Define Water Pollution
3. Name six water pollutants
4. State five major causes of water pollution
5. Explain the effect of water pollution on:
(a) the environment
(b) human beings
(c) the economy
6. Write a full report of your visit to polluted water site, describing the causes, the effects of life in the community and most possible control measures.

WEEK 2

Ways of reducing pollution risk

Protection of our environment is one of our major responsibilities and a natural way of caring for self and for our future generations. There are several factors that would help reduce the impact of our consumption habits. Beneath are some of the practical ways that can be implemented in our daily life to reduce pollution.

Choosing a Transportation Facility

Avoid using a car for short-distance travel, instead, you can make use of a bicycle which will be beneficial in terms of health as well as in the reduction of air pollution.

Food Choices

As transporting the food across various parts of the country would lead to consumption of considerable fuel, we can minimize the consumption of excessive fuel by choosing food products that have been grown locally and naturally using viable methods. Hence reducing air pollution.

Energy choices

Ensure that you switch off the lights and other electrical appliances when you are not in the room. Unplugging them when not in use would also help to save energy. Use energy-efficient light bulbs.

Usage of Chemicals

Make use of eco-friendly chemicals because these are what we use for washing utensils, cars and homes get washed down into the sewage system that would, in turn, get collected as groundwater.

Avoid Flushing your Medication

Medicines with high dosage when end up in the sanitation system, are very difficult to isolate from the water system and would cause an adverse effect on people who would consume this water.

Conservation of Water

Avoid excess unwanted usage of water. Some of the simple ways to prevent wastage of water include, to make use of water-saving apparatus, fixing leakage of taps and avoid washing utensils with running water.

How to Create Awareness?

There are several ways that you could educate people on environmental pollution. Do some research online and get to know about the causes of pollution in your area. Share with many people as much as possible so that they are aware of the severity of pollution and the ways to prevent it. One can also create awareness by creating an environmental group.

WEEK 3

Topic: Air Pollution

Meaning of Air Pollution

Air pollution is the process of making air unsuitable for breathing by both plants and animals.

Air-borne solids that pollute the air include, dust released by industrial process, lead dust e.g. lead (II) bromide is released from the exhaust pipes of moving engines using leaded petrol. The release of poisonous gases such as sulphur (IV) oxide, carbon (II) oxide, hydrogen sulphide from exhaust pipes of engines causes air pollution. In our homes, we use firewood, coal, etc. as fuel. Gases are released from these fuels into the air causing pollution.

Sources of Air Pollution

The main air pollutants include:

Tiny solids/dust particles.

Oxides of carbon from burning coal-smoke.

Oxides of sulphur and nitrogen-from burning coal, crude oil.

Gaseous hydrocarbon and chlorofluorocarbons.

Noise / sound from blaring of loudspeakers.

Consequences of Air Pollution

Pollutants and their effects include:

Kinds of Air Pollutants	Effects on Plants and Animals

Smoke, soot and dust from burning of coal and firewood	When inhaled, they damage respiratory organs-lungs. They are also harmful to plants.
Lead dust	If inhaled, it accumulates in the body and becomes toxic to the body. Also destroys farm produce.
Smog (Mixture of air and smoke)	It reduces visibility and causes respiratory diseases in animals.
Oxides of carbon, especially carbon (II) oxide and carbon (IV) oxide	Reduce the amount of oxygen carried by blood to the body causing brain damage at high concentration. Plants make use of carbon (IV) oxide and water in the presence of sunlight to manufacture carbohydrate in a process known as photosynthesis.
Oxides of nitrogen and sulphur	When dissolve in rain water forms acid rain which is harmful to plants and animals. They also cause irritation of the eyes, nose, throat and respiratory tissue.
Hydrocarbons found in exhaust pipes of cars	It can cause cancer.

Control of Air Pollution

Air pollution can be controlled by using anti-pollution devices by motor vehicles, aircraft, ships, etc.

Producing more efficient combusting fuel.

Educating people on the dangers of air pollution.

Enacting laws that will punish organizations and individuals whose activities pollute water.

ASSESSMENT

Define Air Pollution?

List FIVE sources of Air pollution?

List FOUR control of Air Pollution?

WEEK 4

ECOLOGY

Introduction

An ecosystem is a basic functioning unit in nature. It is made up of living organisms (plants and animals) and their non-living environment. The biotic or living components such as the producers and consumers interact in their environment resulting in the ecosystem being a functional unit.

Autotrophs, Heterotrophs and Decomposers

Autotrophs

Autotroph is an organism that serves as a primary producer in a food chain. Autotrophs obtain energy and nutrients by harnessing sunlight through photosynthesis (photoautotrophs) or, more rarely, obtain chemical energy through oxidation (chemoautotrophs) to make organic substances from inorganic ones. Autotrophs do not consume other organisms; they are, however, consumed by heterotrophs.

Energy Production

Autotrophs produce their own energy by one of the following two methods:

Photosynthesis – Photoautotrophs use energy from sun to convert water from the soil and carbon dioxide from the air into glucose. Glucose provides energy to plants and is used to make cellulose which is used to build cell walls. E.g. Plants,

algae, phytoplankton and some bacteria. Carnivorous plants like pitcher plant use photosynthesis for energy production but depend on other organisms for other nutrients like nitrogen, potassium and phosphorous. Hence, these plants are basically autotrophs.

Chemosynthesis – Chemoautotrophs use energy from chemical reactions to make food. The chemical reactions are usually between hydrogen sulfide/methane with oxygen. Carbon dioxide is the main source of carbon for Chemoautotrophs. E.g. Bacteria found inside active volcano.

Heterotrophs

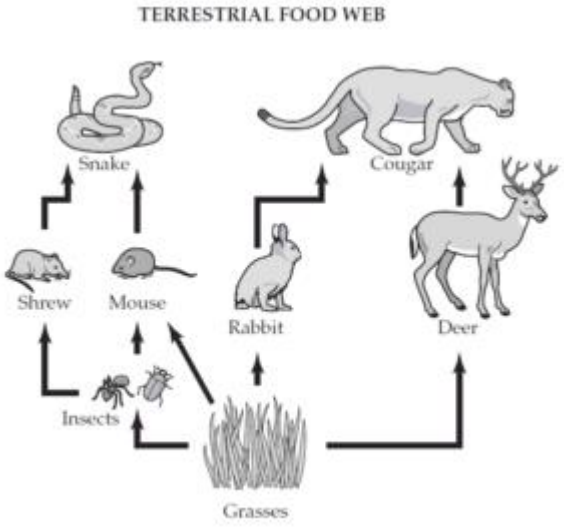
Heterotrophs are organisms that survive by feeding on organic matter produced by or available in other organisms. It is an organism that consumes other organisms in a food chain, hence, they are called consumers. In contrast to autotrophs, heterotrophs are unable to produce organic substances from inorganic ones. They must rely on an organic source of carbon that has originated as part of another living organism. Heterotrophs depend either directly or indirectly on autotrophs for nutrients and food energy.

Decomposers

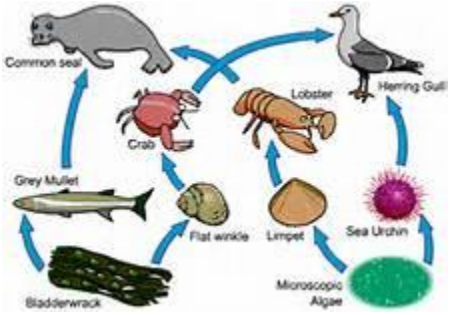
Decomposers are organisms that feed on dead organisms and other decaying organic materials. Fungi and bacteria are decomposers in energy transformation in an ecosystem. They are responsible for breaking down the complex organic compounds into simple nutrients. There are different types of decomposer organisms, which are responsible for returning simpler nutrients to the soil to be used by plants — and so the energy transformation cycle continues.

Food Chain and Food Web

Every organism needs to obtain energy in order to live. For example, plants get energy from the sun, some animals eat plants, and some animals eat other



animals.



food web (in an aquatic habitat)

Food Chain

A food chain is the sequence of who eats whom in a biological community (an ecosystem) to obtain nutrition. In other words, food chain is defined as a feeding relationship involving the transfer of energy through food from producers to consumers. A food chain starts with the primary energy source, usually the sun. The next link in the chain is an organism that makes its own food from the primary energy source — an example is photosynthetic plants that make their own food from sunlight (using a process called photosynthesis) and chemosynthetic bacteria that make their food energy from chemicals in hydrothermal vents. These are called autotrophs or primary producers.

Some eat the autotrophs; these organisms are called herbivores or primary consumers — an example is a grasshopper that eats grass.

The next link in the chain is animals that eat herbivores – these are called secondary consumers — an example is a rat that eat grasshopper.

The next link in the chain is animals that eat the secondary consumers – these are called tertiary consumers – an example is a snake the eat rat

In turn, these animals are eaten by larger predators — an example is an owl that eats snakes.

The tertiary consumers are eaten by quaternary consumers — an example is a hawk that eats owls. Each food chain ends with a top predator and animal with no natural enemies (like an alligator, hawk, or polar bear).

The arrows in a food chain show the flow of energy, from the sun or hydrothermal vent to a top predator. As the energy flows from organism to organism, energy is lost at each step.

Trophic Levels

The trophic level of an organism is the position it holds in a food chain.

Primary producers (organisms that make their own food from sunlight and/or chemical energy from deep sea vents) are the base of every food chain – these organisms are called autotrophs.

Primary consumers are animals that eat primary producers; they are also called herbivores (plant-eaters).

Secondary consumers eat primary consumers. They are carnivores (meat-eaters) and omnivores (animals that eat both animals and plants).

Tertiary consumers eat secondary consumers.

Quaternary consumers eat tertiary consumers.

Food chains “end” with top predators, animals that have little or no natural enemies.

When any organism dies, it is eventually eaten by detrivores (like vultures, worms and crabs) and broken down by decomposers (mostly bacteria and fungi), and the exchange of energy continues.

Some organisms’ position in the food chain can vary as their diet differs. For example, when a bear eats berries, the bear is functioning as a primary consumer. When a bear eats a plant-eating rodent, the bear is functioning as a secondary consumer. When the bear eats salmon, the bear is functioning as a tertiary consumer (this is because salmon is a secondary consumer, since salmon eat herring that eat zooplankton that eat phytoplankton, that make their own energy from sunlight).

A network of many food chains is called a food web. Food web is defined as a complex feeding relationship among organisms in the same environment with two or more inter-related food chains.

Numbers of Organisms:

In any food web, energy is lost each time one organism eats another. Because of this, there have to be many more plants than there are plant-eaters. There are more autotrophs than heterotrophs, and more plant-eaters than meat-eaters. Although there is intense competition between animals, there is also interdependence. When one species goes extinct, it can affect an entire chain of other species and have unpredictable consequences.

Equilibrium

As the number of carnivores in a community increases; they eat more and more of the herbivores, decreasing the herbivore population. It then becomes harder and harder for the carnivores to find herbivores to eat, and the population of carnivores decreases. In this way, the carnivores and herbivores stay in a relatively stable equilibrium, each limiting the other’s population. A similar equilibrium exists between plants and plant-eaters.

The number of organisms in a food chain can be represented graphically in a pyramid. Each bar represents the number of individuals at each trophic level (feeding level) in the food chain.

In this example a large number of caterpillars living in a single oak tree provide food for several blue tits, which in turn are consumed by a sparrowhawk.

The pyramid of numbers usually shows that the number of organisms at each trophic level gets smaller towards the top. This particular case is an exception – one tree provides food for many caterpillars.

Pyramid of Biomass

A pyramid of biomass is a more accurate indication of how much energy is passed on at each trophic level.

Biomass is the mass of living material in each organism multiplied by the total number of organisms in that trophic level. This makes it easier to compare the food value of a small number of large organisms with a large number of small organisms. Pyramids of biomass usually are a true pyramid shape.

The biomass in each trophic level is always less than the trophic level below. This is because biomass is a measure of the amount of food available. When animals eat, only a small proportion of their food is converted into new tissue, which is the food for the next trophic level. Most of the biomass that animals eat is either not digested, or used to provide the energy needed for staying alive.

Processes of Ecosystems

The diagram with the plants, zebra, lion, and so forth illustrates the two main ideas about how ecosystems function: ecosystems have energy flows and ecosystems cycle materials. These two processes are linked, but they are not quite the same.

Energy Flows and Material Cycles

Energy enters the biological system as light energy, or photons, is transformed into chemical energy in organic molecules by cellular processes including

photosynthesis and respiration, and ultimately is converted to heat energy. This energy is dissipated, meaning it is lost to the system as heat; once it is lost it cannot be recycled. Without the continued input of solar energy, biological systems would quickly shut down. Thus the earth is an open system with respect to energy.

Elements such as carbon, nitrogen, or phosphorus enter living organisms in a variety of ways. Plants obtain elements from the surrounding atmosphere, water, or soils. Animals may also obtain elements directly from the physical environment, but usually they obtain these mainly as a consequence of consuming other organisms. These materials are transformed biochemically within the bodies of organisms, but sooner or later, due to excretion or decomposition, they are returned to an inorganic state. Often bacteria complete this process, through the process called decomposition or mineralization.

During decomposition these materials are not destroyed or lost, so the earth is a closed system with respect to elements. The elements are cycled endlessly between their biotic and abiotic states within ecosystems.

ASSESSMENT.

Define the term “Ecosystem”.

Explain the following terms; Autotrophs, Heterotrophs and Decomposers.

What is a “Food chain”?

Draw an illustration of a food chain.

WEEK 5

Topic: Changes In Matter

Learning Objectives: By the end of the Lesson, The learners should be able to:.

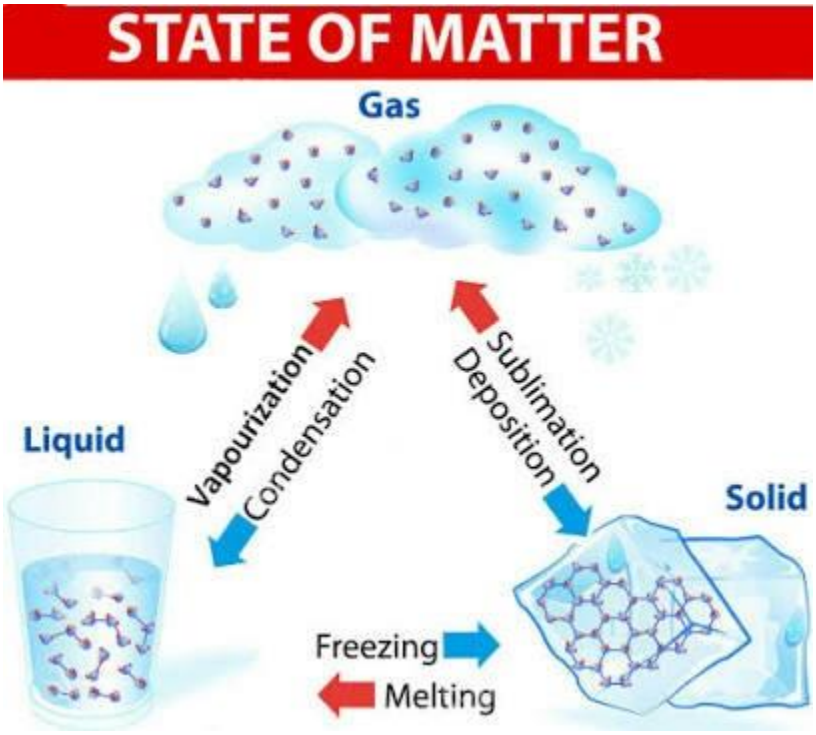
Define the term matter;

State and explain the types of changes in matter;

Give examples of each type of change.

CHANGES IN MATTER

The term “matter” can be defined as anything that has mass and can occupy space. Matter generally exists in three states: solid, liquid, or gas.



Matter can be living or non-living. Matter can also undergo changes when exposed to heat, air, light, water or pressure. Matter can also undergo natural or artificial changes. The changes which matter undergoes can be classified as

either temporary or permanent changes or physical and chemical changes. In this lesson, you will learn the different types of changes in matter, their characteristics, examples and causes.

TYPES OF CHANGES IN MATTER

Matter can change when exposed to light, heat, air, water and pressure. When a substance is heated, the substance could change completely to another substance. For example, when a piece of wood is burnt, it changes completely to form charcoal or ash. Similarly, when a green plant is exposed to light, some reactions occur in the leaves by the process of photosynthesis in which water and carbon dioxide in the presence of chlorophyll react to form sugar and oxygen. These changes above are changes which cannot be reverted. They are called permanent changes. Other examples of permanent changes include:

Yellowing of plant leaves

Decaying of plant and animal body

Growth in plant and animal body

Iron rust

Burning of substances, etc.

On the other hand, there are changes which occur in some substances, but the original substances can be recovered. These are referred to as temporary changes. Temporary changes are changes that are reversible, that is they can be reverted. Example include:

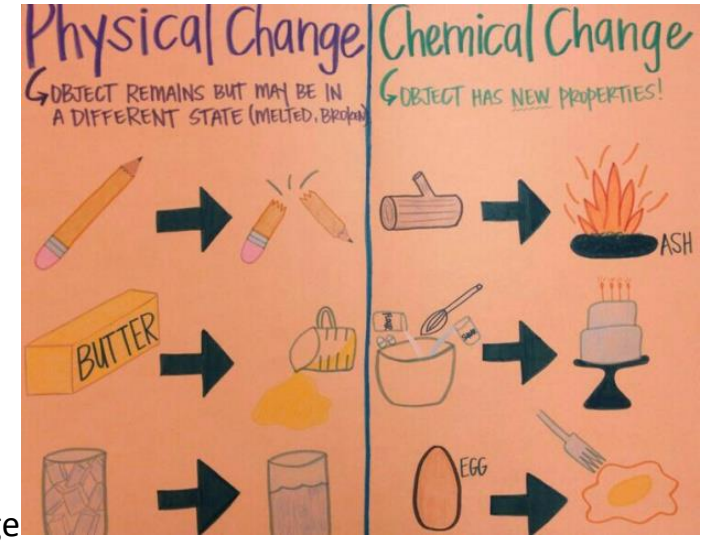
Water changes into ice.

Water and oil are mixed.

Skin or hair is bleached.

Iron rod is heated in flame.

A substance is dissolved in water

This chart below illustrates physical (temporary) change and chemical (permanent) change 

CAUSES OF CHANGES IN MATTER

Changes in matter do not just occur. They are usually caused by changes in the condition around the matter. For instance, matter will remain in its liquid state if there is no change in the temperature of its environment. Therefore, we can say that the major cause of changes in the states of matter is temperature. There are other conditions which lead to changes in matter. They include light, air, moisture and pressure.

EVALUATION

1. Which of these statements is not correct about matter?
a. Matter is always a solid material
b. Matter can undergo temporary or permanent changes
c. Heat can affect matter
d. Matter can exist in three states
2. List the changes that may occur in matter and give five examples of each of the changes
3. Differentiate between temporary and permanent change.
4. State factors that bring about temporary and permanent changes.

WEEK 6

Topic: Changes in Living Things (Growth and Development)

Learning Objectives: By the end of the Lesson, The learners should be able to:.

Define the terms growth and development;

Identify the growth and developmental changes in human;

State the features of each stage of growth and development in human.

Changes In Living Things (Growth And Development)

You would have noticed that a baby does not remain the same size after birth. As the baby is fed with breast milk, there are noticeable changes such as increase in the size of the body. When this is happening, we often say that the baby is growing. As growth is taking place, other changes occur, leading to overall physical development of the baby. With time, the baby develops from infancy to childhood, to adolescence and then to adulthood as follows.
Baby (age 0-2 years)
Childhood (2-11 years)
Adolescence (11-18 years)
Adulthood (age 18 and above)

Can you imagine when you were a baby? Can you think of those changes that have since then occurred in your body? In this chapter, you will learn about growth and development as part of the changes that occurs in your body.

DEFINING GROWTH AND DEVELOPMENT

One of the changes that are easily noticeable in a healthy baby some weeks or months after birth is increase in height, size and weight. The food the baby eat is important in helping the body to produce new body cells that will add to the body

size. The increase in size of an organism due to increase in size of cells is termed growth. In growth, the body by itself makes its own flesh to add to existing one. Growth may be measured by increase in height or weight.
Development is a series of orderly changes by which a living thing comes into maturity. These changes are different from increase in size (growth).

GROWTH AND DEVELOPMENTAL CHANGES

As you grow, the changes in your height and size is noticeable. If you compare your height and weight last year with what you are now, you will notice you have increased in both height and weight. The noticeable changes in the body size over time is termed growth change.

Growth And Developmental Stages In Human

Growth change can be determined by measurement of height and weight at time intervals while developmental changes can be observed by appearance of certain characteristic features and capabilities. Development leads to transition from one stage of life to another e.g. a baby develops from infancy to childhood, then to adolescence and to adulthood. These stages are characterized by certain features.

EXAMPLES OF GROWTH AND DEVELOPMENT IN HUMAN BEINGS

Stage	Growth	Development
Baby	Increase in height and mass	Ability to sit, walk, run, and appearance of teeth
Childhood	Increase in height and mass	Development of manual skills, playing football, etc.
Adolescence	Increase in height and mass	Development of: *Boys* . thick muscles . deep voice . pubic hair . facial hair . ability to produce sperm *Girls* . rounded face . increased buttocks . pubic hair . thick thighs . ability to produce eggs
Adulthood	Growth stops	Changes in the body continue, organs begin to weaken

Examples of Growth And Development in Human Beings

Developmental changes are progressive and moves from simple to complex.

CHARACTERISTICS FEATURES OF DEVELOPMENTAL STAGES

Each of the developmental stages, i.e. childhood, adolescence and adulthood is associated with some characteristics features.

1. Childhood

This is the stage from birth to puberty. It is characterize by light body weight, small size, very rapid growth particularly in the first two years of life, very active body and restlessness.

2. Puberty

Puberty is the transition stage from childhood to adolescence. It is the period when the body of a school age child turns into that of an adolescent. During this period, growth and development are observable. This stage is characterized by: Development of secondary sexual characters such as facial hairs, mustaches, broken voice in boys, breasts and rounded buttocks in girls and pubic hairs in both

boys and girls, etc;
Rapid gain in height and weight;
Well form bones i.e. bones become stronger
Very active body

3. Adolescence

Adolescence is the stage before adulthood and it's characterized by:
No changes in height but there could be changes in weight or sizes;
Ageing indicated by appearance of grey hair, reduced elasticity of the skin, gradual decline in body functions, including decline in reproductive capacity and decline in functions of body organs e.g. the heart, the lungs and the sense organs. The changes in adulthood are usually due to age but can include stress (anxiety) or inadequate feeding.

TEMPORARY AND PERMANENT CHANGES IN GROWTH AND DEVELOPMENT

The development changes could either be temporary or permanent changes when they occur. The permanent changes remain for life and they are not reversible. Those features associated with each of the human developmental stages of childhood, adolescence and adulthood are permanent changes.
There are however some temporary changes. Examples include growth of pimples in male and female at adolescence, malnutrition or kwashiorkor, fatness, enlargement of stomach after a meal or intake of water. These changes are usually due to food intake and are temporary. Other examples of temporary changes are:

Bed wetting

Sweating

Rise in body temperature

Temporary changes may naturally disappear after sometime. They can also be corrected medically or by change in behavior, whereas permanent changes remain with the individual throughout life.

Take a quick test for this lesson

1. Childhood is characterized by?

a. Development of secondary sexual features

b. Small size

c. Well formed reproductive system

d. Well formed bones

2. List any three growth changes in living things

3. List three examples of developmental changes in

Infancy

Adolescence

Adulthood

4. State the characteristics of growth and developmental changes

5. List any four changes in human growth and development and classify them as permanent or temporary changes

WEEK 7

Topic: Changes Non-Living Things (Physical And Chemical Change)

Learning Objectives: By the end of the Lesson, The learners should be able to:

Explain changes in nonliving things;

Identify and explain the types of changes in non-living things;

Perform simple experiment on physical change and chemical change;

Examine the differences between physical change and chemical change.

Discussions

CHANGES IN NON-LIVING THINGS

You have learnt in our previous lesson that matter can be a living thing or non-living thing. You have also learnt that matter exists in three states: solid, liquid, gaseous states. Matter undergoes some changes when exposed to some

conditions like heat, light or air. Matter can change from solid to liquid state, liquid to gaseous state and from gaseous to liquid state again, depending on the temperature. Matter undergoes different types of changes.

In this lesson, you will learn about changes in non-living things, and the characteristics of these changes.

TYPES OF CHANGES IN NON-LIVING THINGS

Non-living things do not grow, they do not move or feel. However, non-living things can undergo changes. They can be made to change from one state to another. They can be made to form new substances. They can combine with other substances to form new substances. Changes in which new substances are formed are referred to as chemical changes. The changes in which no new substances are formed are called physical changes. The following activities will help you to observe and identify these two types of changes in non-living things.

ACTIVITY 1: OBSERVING THE EFFECTS OF HEAT ON SUGAR SOLUTION

Materials Required

Sugar, evaporating dish, beaker, water, tripod, stand, burner, tablespoon, gauze.

PROCEDURE (Individual experiment)

Dissolve a tablespoon of sugar in 5cm^3 of water beaker,

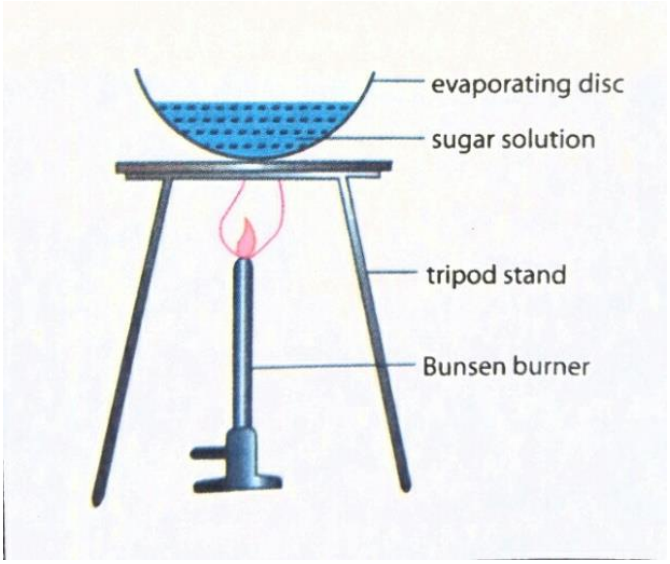
Record your observation,

Pour what is formed into an evaporating dish,

Heat gently over the burner until the water evaporates completely,

Record your observation,

What type of change do you observe?



Demonstration of Physical change

RESULT

You might have observed that first the sugar dissolved in water to form a solution, but when heated the water evaporated and the sugar solidified again. No new substances were formed in the evaporating dish.

ACTIVITY 2: HEATING SALT

Materials Required
Common salt, evaporating dish, beaker, water, tripod stand, burner, tablespoon

Procedure
As in activity 1 above
Record your observation

RESULT

As in activity 1, the common salt dissolved in water, and when heated, the water evaporated leaving only the solid salt in the dish. No new substance were formed.

ACTIVITY: 3 HEATING PARAFFIN WAX

Materials Required
A piece of white paraffin wax, tripod stand, burner, gauze, evaporating dish.

PROCEDURE (INDIVIDUAL EXPERIMENT: YOU ARE TO DO THIS ALONE)

Place the piece of wax into your evaporating dish.

Place the evaporating dish on the gauze over the burner

Heat gently till there is a change in state

Record your observation

Keep the wax in the dish to cool for about five minutes

What do you observe?

RESULT

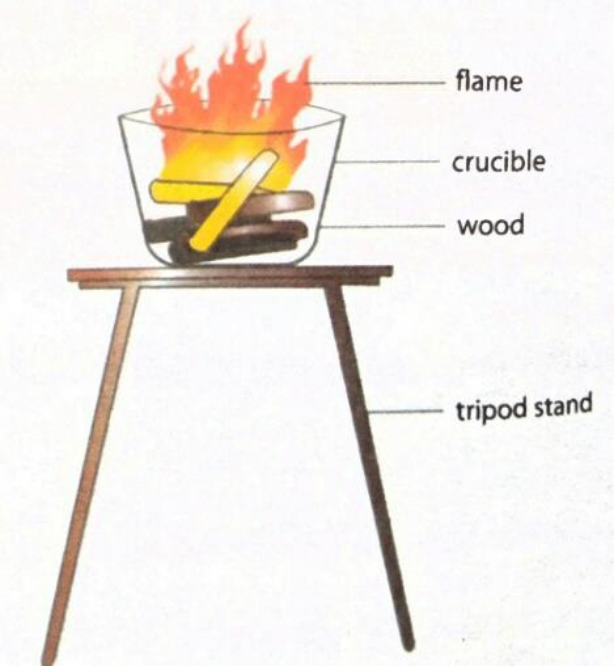
You might have noticed that what you observed is a little different from what you observe in Activities 10.1 and 10.2. Whereas the substances in Activities 10.1 and 10.2 solidified when heated, the wax in Activity 10.3 melted into a liquid when heated, but solidified again into a solid white wax when cooled. Again no new substance was formed.

ACTIVITY 4: BURNING WOOD

Materials Required
A small piece of dry wood that can burn easily, matches, a crucible and a tripod stand.

PROCEDURE (CLASS EXPERIMENT)

Your teacher will provide a piece of wood and other materials
Place the piece of wood in the crucible
Place the crucible on a tripod stand
Strike the match and light the wood
Allow the wood to burn out
Record your observation



Demonstration of Chemical Change

Note that it is better to use a piece of wood that can burn by itself. The use of kerosene or oil may introduce another element into the activity.

RESULT

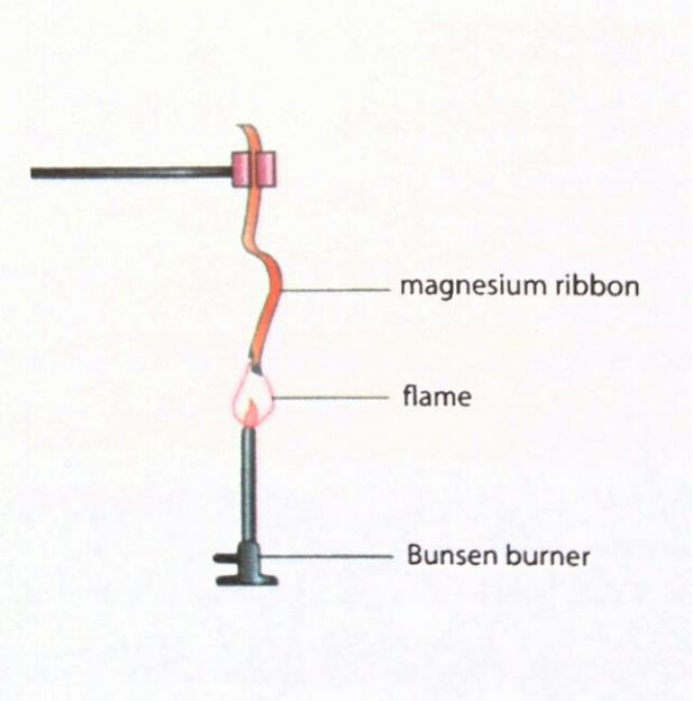
You might have observed that the wood burnt out in a black substance (charcoal). The original wood cannot be recovered.

ACTIVITY 5: BURNING OF MAGNESIUM

Materials required
A length of magnesium ribbon, a pair of tongs, burner

PROCEDURE (GROUP EXPERIMENT)

Your teacher will organize the class into groups,
Light the burner in your group,
Hold a length of the magnesium ribbon on a pair of tongs,
Hold the magnesium bearing tongs over the burner.
What do you observe?



Demonstration of chemical change: Burning of magnesium

RESULT

You might have observed that the magnesium burnt and turned into a white substance called ash. The original magnesium ribbon cannot be recovered.

What Are The Difference Between Physical And Permanent Changes? The differences can be deduced from their characteristics of which was observed during the experiments.

Characteristics of Physical change

The original substance can easily be recovered

New substances are not formed

Change is temporary

Characteristics of Chemical change

The original substance cannot be easily recovered

New substances are formed

Change is permanent

EVALUATION

1. In __ changes the original substance easily be recovered (a) chemical (b) heat (c) physical (d) solid
2. Give two examples of chemical and physical changes each.

3. List three differences between physical and chemical changes

WEEK 8

Topic: Crude Oil and Petrochemicals

Learning Objectives: by the end of the lesson, the students should be able to:

Explain the terms crude oil and petrochemicals;

Describe the process of refining crude oil;

State the uses of crude oil and petrochemicals;

State the importance of crude oil to Nigeria;

Name examples of materials made from petrochemicals.

CRUDE OIL

Crude oil is a dark brown liquid substance found under the ground or sea. It is locked up between rocks several meters under the ground. Crude oil cannot come out of the rock on its own and cannot be seen from the surface of the earth. That's why some scientists are trained to search for oil. The search for oil is called oil exploration. Oil companies do employ special scientists called geophysicists who are experts in geology and physics.

During oil exploration, geophysicists make use of special equipment to send signals to the rocks in the depth of the ground or sea to get some signals from the depths. These signals are used by geoscientists to examine the structure of the layers of the rocks which they used to identify the presence of crude oil. The presence of oil is confirmed by drilling with the aid of equipment called drilling rig. Strong pipes joined end to end are driven by the drilling rig down into the ground to reach the oil. As the pipes touch the oil, natural gas comes out first through the pipes. This is the gas used for cooking. Later, the main oil comes up through the pipe. From the pipes, it is sent through other pipes to oil storage tanks. The process of bringing out oil from the underground rocks is called oil production. What comes out from oil drilling is called petroleum or rock.

Oil is found in many countries of the world such as Europe, America, Middle East and Asia. Nigeria is one of the major producers of oil in the world. Oil is found in many parts of Nigeria especially the Niger-Delta areas. I Nigeria, Oil was first discovered in Oloigbiri oil field in Ogbia local government area of Bayelsa State. Oil is the major source of income in Nigeria.

CRUDE OIL AND PETROCHEMICALS.

Definition

Crude oil can be defined as the liquid form of unrefined petroleum. It is a dark brown or greenish flammable liquid. It consists of a complex mixture of various hydrocarbons that differ in appearance, composition and purity. Crude oil also contains small particles of minerals such as sulphur and metals. Other forms of petroleum are natural gas which is stored in cylinders and used for cooking and bitumen used for tarrying roads.

PETROCHEMICALS

Petrochemicals are chemical compounds which are derived from the refining of petroleum. For example, methane is a refinery product which is used to produce carbon black and gas. Other examples are ethane and propene, plastics such as polythene, synthetic fibres (nylon), rubber, etc; detergent; chemicals used for manufacturing of paints, medicine, insecticides, selective weed killers.

REFINING OF CRUDE OIL

We discussed earlier that crude oil produced from underground rocks is piped straight into oil storage tanks. From the storage tanks, crude oil is transported into its components. Since crude oil is a mixture, a physical method of separation is used. This method is called fractional distillation.

The fundamental process in the refinery that separates crude oil into its components is the fractional distillation. Reason being that crude oil components have different boiling points. The refining process therefore involves fractional distillation of crude oil fractions, purification and conversion of the fractions into more useful products.

STEPS INVOLVE IN FRACTIONAL DISTILLATION

Heating the crude oil in gas furnace at a high temperature of 500 degrees centigrades to 600 degrees centigrade by passing it through heating pipes in the gas furnace.

The vapour is passed into a tall fractionating tower, the temperature of which varies from 400 Centigrades at the bottom to 40 degree centigrades at the top.

Fractions of the crude oil are collected from the different temperature levels in the trays of the tower. Each tray contains several bubble caps through which the vapour with similar boiling temperature pass and condense. The most volatile components are found in the upper part of the tower, while viscous and solid components are collected at the bottom of the tower.

PRODUCTS OR FRACTIONS OBTAINED AFTER FRACTIONAL DISTILLATION OF CRUDE OIL AND THEIR USES

Crude oil is quite different from the petrol and oil used in vehicles. Petrol is just a fraction obtained from crude oil. The following are fractions from crude oil:

Petroleum gas or refined gas. This fraction is obtained at the uppermost part of the tower. It is the product with the least boiling point.

USES

a. It is sold as cooking gas

b. It serves as source of other chemicals.

2. Petrol or gasoline: This product is the second with relatively high temperature range and a number of carbon constituent than the refinery gas.

USES: It is a major source of fuel for internal combustion engine.

3. Naphtha: This product has a higher number of carbon atams per molecules than petrol and is usually further refined to get petrol.

USES:

a. It is used as chemical feed stock.

b. It is refined to give more gasoline.

4. Kerosene or paraffin oil: This product has higher viscosity than both gasoline and naphtha. It also contains higher number of carbon than gasoline and naphtha.

USES:

a. It is used as heating and lighting oil.

b. It can also be used to produce gasoline.

5. Heavy gas oil: This is usually coloured and more viscous than light gas.

USES

a. It s used as fuel for slow speed engines such as diesel engine.

b. Can be used to produce gasoline.

6. Light gas: This include diesel oil or gas oil. It is a viscous product.

USES:

a. Used as heating oil.

b. It is used in high speed diesel engine.

7. Lubricating oil, fuel oil and bitumen: These are thick and nonvolatile products. They are referred to as residues.

USES:

a. It serves as lubricant.

b. It is used in the production of candles and waxes.

c. It is useful in road surfacing.

d. It is also used for roofing.

USES OF PETROCHEMICALS

Petrochemicals are used as raw materials for industrial production of essential materials such as:

Raw materials for the production of polymers (plastics); paints; synthetic rubber and textiles.

Fertilizers

Pesticides

Good additives

Detergents

Cosmetics.

IMPORTANCE OF CRUDE OIL AND PETROCHEMICALS

They are sources of revenue

Sources of energy

Products and sources of industrial raw materials, thus making most industries functional.

ASSESSMENT

Done studying? Use the questions below to test your learning progress!

1. What do you understand by the terms crude oil and petrochemicals.
2. Describe the process of refining crude oil.
3. State the uses of crude oil and petrochemicals.
4. State the importance of crude oil and petrochemicals to your country if you are from oil producing country.
5. State the importance of crude oil to Nigeria.
6. Name examples of materials made from petrochemicals.