BASIC SCIENCE 2

FOR

Junior Secondary School

AKADALEARN

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JSS2 FIRST TERM NOTES ON BASIC SCIENCE

Week 1

Topic: Living Things (Habitat)

Introduction

Every living organism, whether plant or animal, has a particular place where it normally lives. There are those that live on land and those that live in water. The kind of place or environment where an organism normally lives is called its HABITAT. Specifically, it means the home where an organism inhabits. Every organism is able to adjust itself to its habitat in order to survive.

Habitat is any environment in which an organism naturally lives. It is an area where physical and chemical constituents require by a particular organism are met.

Habitat may be small such as the school field or large such as an ocean in the case of a whale.

Types of Habitats

- **Aquatic Habitat**: It is a water environment in which organisms live naturally. It includes ponds, streams, river, ocean etc. It is sub-divided into:

1. Marine (Salt water)
2. Estuarine (Mixture of salt and fresh water)
3. Fresh water (Water that do not contain salt)

Organisms that live in aquatic environment include: crabs, salamander, shrimps, fish, whale, spirogyra etc.

- **Terrestrial Habitat**: is simply the land environment where certain organisms e.g. snails, grasshopper, etc. live in naturally. The nature of terrestrial habitat is influenced by soil and rain. Terrestrial habitat is divided into the following:

1. **Marsh:** is a low land soil that is usually flooded.
2. **Rain forest:** is a type of terrestrial habitat that has scattered tall trees of about 40cm or above with a story layers having shrubs and herbs.
3. **Grassland:** is a type of terrestrial habitat that is covered with grasses and it includes temperate grassland, savanna grassland and meadow grassland.
4. **Arid land:** include the deserts both series and hot deserts.

Organisms found in terrestrial habitat are kangaroo, camel, termites, snakes, lizard, etc. Plants that live in terrestrial habitat include horn worth, lilies and duck weed.

- **Arboreal Habitat**: this is a habitat that involves tree trunks and tree tops. This is an environment where organisms with the ability to fly, climb and grasp are found e.g. snakes, monkeys and birds.

Questions

1. _____ is simply the land environment where certain organisms e.g. snails, grasshopper, etc. live in naturally
2. ____ is any environment in which an organism naturally lives.
3. ____ include the deserts both series and hot deserts
4. ____ is a habitat that involves tree trunks and tree tops

Answers

1. Terrestrial habitat
2. Habitat
3. Arid land
4. Arboreal habitat

Week 2

Topic: Adaptation of Living Things to their Habitat

Characteristics of Organisms Found in Aquatic Habitat E.g. Fish

Organisms in this habitat are adapted to their habitat through:

1. The use of gills for respiration.
2. Possession of well streamlined body.
3. The use of fins and web digits for locomotion e.g. fish.
4. The ability to feed by filter method.
5. Possession of lateral line to detect danger e.g. tilapia fish.
6. The ability to float due to intercellular air space.
7. Possession of a mucilaginous cover that protects some plants e.g. spirogyra.

Characteristics of Organisms Found in Terrestrial Habitat

1. Organisms in this habitat are adapted to their habitat through:
2. Organisms could be herbivores, such as grass cutters, squirrels or carnivores, such as leopards and lions.
3. Possession of distinct coloration with the environment which helps them to stay away from their predators.
4. Possession of four limbs, two forelimbs and two hind limbs.
5. Terrestrial plants that are drought evading complete their life cycles within a few months.
6. When there is no rainfall desert trees shed their leaves to reduce the rate of transpiration.
7. Roots of most terrestrial plants are long and twisted to enable them absorb more water.
8. Some plants grow thorns in place of leaves as defense from herbivores.
9. Possession of exoskeleton (chitins) for protection and support.

Characteristics of Organisms Found in Arboreal Habitat

1. Organisms in this habitat are adapted to their habitat through:
2. Possession of wings for flight.
3. Possession of two legs for movement before flying.
4. Possession of long hind limbs which enables them climb trees.
5. The ability of plants in this habitat to possess climbing roots while others have tendrils.

Questions

1. One of this is not an adaption for aquatic organisms
   a. possession of two legs
   b. possession of well streamlined body
   c. the use of fins and web digits for locomotion
   d. the ability to feed by filter method
2. The ability of plants in this habitat to possess climbing roots while others have tendrils is peculiar to the
   a. Aquatic habitat
   b. Arboreal habitat
   c. Terrestrial habitat
   d. None of the above
3. List three Organisms found in Terrestrial habitat
4. Organisms in aquatic habitat have ____ bodies
   a. floating
   b. streamlined
   c. straight
   d. round

Answers

1. A
2. B
3. Glasscutters, squirrels, leopards and lions
4. B

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 supplied 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:

1. Tiny solids/dust particles.
2. Oxides of carbon from burning coal-smoke.
3. Oxides of Sulphur and nitrogen-from burning coal, crude oil.
4. Gaseous hydrocarbon and chlorofluorocarbons.
5. 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.
Smoke (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

1. Air pollution can be controlled by using anti-pollution devices by motor vehicles, aircraft, ships, etc.
2. Producing more efficient combusting fuel.
3. Educating people on the dangers of air pollution.
4. Enacting laws that will punish organizations and individuals whose activities pollute water.

ASSESSMENT

1. Define Air Pollution?
2. List FIVE sources of Air pollution?
3. List FOUR control of Air Pollution?

Week 4

Topic: Uniqueness of Human Beings

Introduction

Among the living things, human beings are animals because they:

- cannot make their food
- move from place to place
- have no chlorophyll
- have complex organs for respiration, excretion, reproduction and sensitivity
- respond quickly to changes in their environments
- practise courtship in production

Although, human beings are animals, it is clear that in many ways, they are special.

Man is a mammal and belongs to the class called primates. Primates share common features such as:

1. Hair or fur on some parts of their body,
2. Give birth to young ones alive and the young are fed with milk from the mother's mammary glands
3. They have nails on their hands, and can stand upright or erect.
4. Apart from all these shared characteristics of primates, man is unique due to his highly developed brain that enables him to reason and solve problems. This constitutes his intelligence.

A human being is an animal but a very special kind of animal. Human beings are higher animals because of the presence of backbones. They are said to be unique. But what makes them unique? What is it that makes human beings different from other animals? Among the animals, only human beings have the ability of reasoning and problem solving.

Unique Characteristic of Human Being

Human Being as an Intelligent Animal

Human beings belong to a special group of animals called primates. Primates are higher animals which have large brains, forward facing eyes, nails and hands with grasping thumbs facing other fingers. Some animals like monkeys, chimpanzee and gorilla belong to this group but human beings show greater advancement than these other primates by:

1. having higher intelligence due to highly developed brain
2. Demonstrating higher ability to handle tools due to the position of their thumb opposite the other fingers.

Reasoning

The highly developed brain of man enables him to reason, plan and solve problems better than other animals. The highly developed brain gives man the following:

1. Ability to reason, think, learn and remember things.
2. Ability to developed language communication and power of speech.
3. Ability to control the environment and use it to his advantage.
4. Ability to handle tools and easy manipulation of things with his fingers.
5. Ability to socialize with others, love and sympathize with his fellow man.
6. Ability to know what is right and wrong.
7. Ability to stand erect and walk on their two legs, etc.

The Brain of Man

The human brain enables human beings to

1. think
2. reason
3. remember
4. solve problems
5. make inference
6. communicate
7. control the environment and other living things in the habitat

The brain of man is enclosed in a bony case called the cranium (skull) and it is divided into three regions namely:

1. The fore brain: This is where the cerebrum (the largest part of the brain) of the brain is located. It is the centre for voluntary actions, conscious sensation, sense of smell, reasoning, intelligence, memory speech, etc.
2. The mid brain: This connects the fore and hind brain and controls the eye muscles and posture.
3. The hind brain: Is made up of the cerebellum and the medulla oblongata. The cerebellum controls muscular activities of the body, hearing vision, taste and smell, etc. The medulla oblongata controls body functions such as respiration, circulation, reproduction, excretion, etc. it is located on the hind region of the brain.

Problem Solving

The highly developed brain of man enables man to think of making tools and coordinate the hands as well as manipulate tools for solving some of his problems such as farming, fishing, hunting, washing, cooking, building, repairing of machines equipment, driving, etc.

1. The problem of movement was solved by the production of cars, boats, aero planes, etc.
2. Cooking by the use of stoves and gas cookers.
3. Shelter by building houses.
4. Farming by using machines like tractors.

Intelligence

Intelligence can be defined as the aggregate or global capacity of the individual to act purposefully, think rationally and deal effectively with his environment. Intelligence changes overtime and develops with age. It is inherited but requires environmental factors for it to develop fully.

Types of Intelligence

- Scholastic intelligence
- Social intelligence
- Business intelligence

Intelligence can be measured by using the test formula by Weschler.

$$I.Q = \frac{M.A}{C.A} \times 100$$

I.Q = Intelligence Quotient

M.A = Mental age

C.A = Chronological age

The intelligence quotient of a child is the ratio of his mental age to his chronological age multiply by a hundred. The mental age of a child is the age of which a child is operating educationally. For instance, if the average score of a 6-year-old child in a given test is 10, then the test score of ten is equivalent to a mental age of 6. Chronological age is the actual age in years from birth.

Therefore, I.Q above 100 = brilliant

I.Q equal to 100 – average

I.Q below 100 – is below average.

Uses of intelligence

1. It provides the ability to reason and solve problems.
2. It enables one to memorize words, ideas, concepts and numbers quickly.
3. It helps one to perceive objects and things quickly e.g. recognizing similarities and differences.
4. It provides the ability for imaginary manipulation of objects in space.
5. It is very useful in skills such as observation, measurement and inference.

Application of Basic Intelligence Skill

Observation: This means looking at things carefully and closely to understand their features and differences.

Measurement: Is the process of determining the size, quantity, quality or degree of something. All these are done by the use of our intelligence through the use of measuring devices.

Inference: This is the process or act of forming your own opinion based on what you already know. This is common to scientific studies.

Questions

1. What makes human beings unique?
   a. higher intelligence due to highly developed brain
   b. they have eyes
   c. they have nails
   d. they have hands

2. The brain of the human being is divided into ___ parts
   a. 2
   b. 3
   c. 4
   d. 5

3. The ____ controls muscular activities of the body, hearing vision, taste and smell
   a. Cerebrum
   b. Medulla
   c. Cerebellum
   d. Hemisphere

4. IQ means ____
   a. Intelligent Quality
   b. Intelligent Quotient
   c. Intellectual Quotient
   d. Intellectual Quality

5. List three types of intelligence

Answers

1. A

2. B

3. C

4. B

5. Scholastic intelligence, Social intelligence, Business intelligence,

Week 5

Topic: Measurement of Growth and Developmental Changes

Introduction

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 yrs)
- Childhood (age 2 – 11 yrs)
- Adolescence (age 11 – 18 yrs)
- 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?

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 eats 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 number of cells is termed **Growth**. In growth, the body by itself makes its own new flesh to add to the 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 is termed as a physical change, whereas development is said to be physical as well as social or psychological change. Development also means transformation or improvement. When the term growth is related to living beings, it can mean the increase in weight, height and bone seize. On the other hand, development is the process of developing skills and capacities. It deals with the behavioral aspect of a living being.

Growth and development goes side by side, and both have profound effects upon each other. When a child is born, passes through various stages and ultimately a whole picture of a person emerges.

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 eight and mass	Development of manual skills, playing football.
Adolescence	Increase in height and mass	Development of Boys – thick muscles, pubic hair, facial hair, ability to produce sperm. Girls – rounded face, tick thighs, pubic hair, increased buttocks and breasts
Adulthood	Growth stops	Changes in the body continue, organs begin to weaken

Assessment

- Differentiate between Growth and Development**?**

Week 6

Topic: Human Development

Changes from Infancy to Adulthood

Human development is a lifelong process of physical, behavioral, cognitive, and emotional growth and change. In the early stages of life—from babyhood to childhood, childhood to adolescence, and adolescence to adulthood—enormous changes take place. Throughout the process, each person develops attitudes and values that guide choices, relationships, and understanding.

- **Baby** (age 0 – 2 yrs)
- **Childhood** (age 2 – 11 yrs)
- **Adolescence** (age 11 – 18 yrs)
- **Adulthood (**age 18 and above)

The following are the stages of growth and development through which every children passes:

A. Infancy: (From Birth to 2 Years)

Early childhood is a time of tremendous growth across all areas of development. The dependent newborn grows into a young person who can take care of his or her own body and interact effectively with others

Common features of infancy are

1. A child jumps, walks and learns to talk.
2. A child starts learning about simple, social concepts.
3. The body growth is accelerated.

B. Early Childhood (2-6 Years)

The common features of this stage are:

1. Infancy features are strengthened.
2. Physical growth occurs like, expansion of muscles, speed in body actions, changes occur in respiration, blood pressure develops etc.
3. Language skill is developed and learns new words.
4. New concepts about social relations develop.
5. Memory increases.
6. They ask questions about the environment.
7. Socially he/she develops new friends, and wants social approval of his/her actions.
8. Emotional development starts to develop.

C. Adolescence (12-19 Years)

This is the period of adulthood and to some extend of maturity, physically and socially. This is called the spring, romantic, and the period of "storm & stress". The development and growth vary from culture to culture and environment factors that influence a person at this stage. Some basic characteristics of this stage are as follows:

1. Physical Growth

Here children are active, and sharp. They are keen observers. They give more attention to body – beauty and strength. Boys love strength and play the games, where power is shown.

2. Mental or Intellectual Development

1. They think in abstraction.
2. They can anticipate the future needs and plan for that.
3. The children ability to solve complex problems increase. They try to understand complicated issues, and to solve the complex problems
4. They develop the communicative abilities and talk for hours.

5. Confidence is developed which make them to make decisions about future.
6. Moral concepts are developed and know that what is morally and socially good and wrong.

3. Emotional Development

Here the adolescent period is not rational but emotional. That's why it is called the period of stress and storm. They are entering a new stage, which therefore, want emotional adjustment. Emotional disturbance is produced when they don't adjust to new situation or role for which they are supposed to be.

Characteristics of Emotions in Adolescence

1. Complexity: They experience complexity in various issues and start adjustment. When that adjustment doesn't develop, storm and stress develop.
2. Development of Abstract Emotions: They develop emotions with those things which do not exist in real situation. Wants and desires are generated by abstract emotions.
3. Widening of Emotional Feelings: Here they select a hero/heroin. Idealization and imagination start. And get emotional attachment with that idealization.
4. Bearing Tension: They start to learn that how to bear a difficult emotional situation.
5. Sharing of Emotions: They share emotions, especially with peer groups. That develops loyalty and emotional confidence among peer groups.
6. Hopes & aspirations develop about the future.
7. This stage gives increase to compassion in them.

Common Emotional Patterns

The following are some emotional patterns which can be seen in students:

1. Worries/Anxieties: These can be imaginative or real. These can be the products of school work, exam, school problems or home problems.
2. Phobias: Phobias or fears can be from material objects, meeting with people, talking to strangers etc.

3. Anger, Love and Hate: These are some emotional patterns, which have its own causes, and effects.

As for emotions are concerned, the fear of failure makes you to work hard. Emotions can be realized through good and positive activities. Now it is the responsibility of home, school, teachers & parents to understand the emotional state of the children and to avoid the bad effects of emotional disturbance. “Become emotions can make or mar one’s life”.

ASSESSMENT

1. List FOUR Characteristics of Emotions in Adolescence?
2. List THREE Common Emotional Patterns?

Week 7 & 8

Topic: Human Development

Introduction

Characteristics features of developmental stages

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

1. **Childhood** – This is the stage from birth to puberty. It is characterized by light body weight, small size, very rapid growth particularly in the first two years of life, very active body and restlessness.
2. **Puberty** – This 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. The stage is characterized by
   – development of secondary sexual characteristics such as facial hair, mustache, broken voice, breasts in girls and pubic hair in both boys and girls.
   – rapid gain in height and weight
   – well-formed bones i.e. bones become stronger
   – very active body
3. **Adolescence** – This is the stage before adulthood. It is characterized by:
   – well-formed productive system
   – height and weight still increasing
4. **Adulthood** – This is the stage of full maturity. An individual can become a mother or a father in this stage. It is characterized by:
   – no change in height but there could be changes in size and weight
   – 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 function of body organs e.g. the heart, lungs and 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 developmental changes would either be temporary or permanent changes when they occur. The permanent changes remain for life and 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 etc. These changes are usually due to food intake and are temporary. Other examples of temporary changes are:

- **bedwetting**
- **sweating**
- **rise in temperature**

Temporary changes may naturally disappear after some time. They can also be corrected medically or buy=y change in behavior, whereas permanent changes remain with the individual throughout life.

Summary

- Growth is increase in size due to addition of new body cells
- Development is the series of changes by which living things come into maturity
- The changes in body size, height and weight over time are called growth changes
- Developmental changes can be described as the transition from one stage of life another

Assessment

1. Childhood is characterized by
   a. development of secondary features
   b. small size
   c. well-formed reproductive systems
   d. well-formed bones
2. ____ is the stage of full maturity
   a. Adolescence
   b. Childhood
   c. Adulthood
   d. Puberty
3. One of these is not a temporary change
   a. bedwetting

b. well-formed bones
c. sweating
d. rise in temperature

4. _____ changes may naturally disappear after some time
5. _____ is increase in size due to addition of new body cells

Answers

1. B
2. C
3. B
4. Temporary
5. Growth

WEEK 9

Topic: Changes in Matter

Introduction

Matter is anything that has mass and occupies space. Changes occur in matter in our everyday life. These changes may be as a result of growth in plants and animals. Changes in temperature also affect matter.

Types of Changes

There are two types of changes in matter, namely; temporary and permanent.

Temporary Change: This is a change in which no new substance is formed and can be easily reversed. For instance, If water is kept in a deep freezer, it becomes solid (ice). However, if the ice is left at room temperature, it soon changes to liquid.

Examples of temporary changes are:

a) Freezing of liquid to solid

b) Liquefaction of gases to liquid

c) Melting of solid to liquids

d) Sublimation

e) Evaporation

f) Crystallization

g) Distillation and fractional distillation

h) Heating of iron, ring boiler, cooker

Permanent Changes: This is a change that is not easily reversed because new substance is formed. For example, if a piece of wood is burnt, it turns into wood is burnt, it turns into wood ash and charcoal. This change from wood to wood ash is not reversible.

Examples of permanent changes are:

a) Rusting of iron

b) Dissolving metals in acids

c) Adding water to quicklime

d) Fermentation

e) Decay of substances

Characteristics of Temporary Change

1. No new substance is formed
2. It is easily reversed
3. No change in the mass of substance involved
4. Does not involve great heat

Characteristics of permanent change

1. New substances are formed
2. Not easily reversible
3. Change in mass of substance involved
4. Involves a large amount of heat

Causes of Change in matter

1. Change in temperature – heating or cooling
2. Chemical reactions
3. Nature of substances – for example – radioactive materials.

ASSESSMENT

1. What is matter?

2. There are two types of changes in matter, name them?

3. List TWO causes of matter?

WEEK 10

Topic: Changes in Living Things

Introduction

Growth can be defined as the quantitative increase in size, weight and height of a living thing. These changes which are observable and measurable accompany age increase. For growth to occur there has to be cell division and this division continues throughout the life of an organism and depends on nutrition and environment. Development deals with increase in the ability of the child to function properly in his environment. However, growth and development occur together in all aspects of life from birth till maturity.

Growth Changes

- **Height:** This refers to the increase in length of a living organism. it is measured in meters. Your ability to grow taller depends on such factors as the type of food you eat, environmental conditions, diseases and hereditary (characters inherited from parents by their children).
- **Weight**: Weight increases with growth, this makes an individual to become heavier as his age increases.
- **Size: the height,** the girth and the weight of an individual determine his size. Size therefore does not depend on the age of the individual alone but on the height, the weight and girth of the individual.

Developmental Changes

Developmental changes begin from conception of the child to adulthood. Physical developmental changes at:

Infancy (from 1-10 years)

- Rapid growth is noticed at very early stage.
- The child learns and starts walking, running and feeding himself at mid infancy.
- At the tail end of infancy, there is an increase in muscular co-ordination and the boys are usually taller and heavier than the girls.

Adolescence stage (11-16 years)

- This stage which marks the end of infancy usually experiences rapid physical growth in boys and girls and is often referred to as growth spurt.
- This growth spurt that occurs at each adolescent period is known as puberty.
- At the early stage of puberty, between the ages of 10 – 14 years, girls grow faster than boys, while from 15 – 20 years old the boys grow faster than the girls.

Adulthood (Above 20 years)

- Growth in height (length) ceases.
- The adult increases in weight and girth.
- The body skeleton becomes more rigid and firm.

Characteristic Features of Stages of Development

Infancy

1. Presence of hairs on the head.
2. Milk teeth predominant at this stage.
3. Bones are soft, hence the child's inability to lift heavy loads.
4. The child is guided in most activities he/she engages in.

Adolescent stage

For the Boys:

1. Development of deep voice.
2. Broad shoulders are noticed.
3. Enlargement of the testes.
4. The legs and neck become muscular.
5. Hairs appear on the face, armpits, face and private parts.

For the Girls:

1. They experience menstruation.
2. They develop wide or broad hips and pelvic.
3. Development of enlarged breasts.
4. Appearance of hairs on the armpits and private parts.

Adulthood

1. Possession of permanent teeth.
2. Gradual setting of baldness or grey hairs.
3. Wrinkles appears later in life.
4. Weakness of bones and organs.
5. Decrease in physical growth and development.

ASSESSMENT

1. Differentiate between Growth and Developmental Changes?

WEEK 11

Topic: Changes in Non-Living Things

Introduction

Matter is anything that has mass and occupies space. Examples are stone, book, biro ruler, etc.in everyday life, matter undergoes changes.

Types of Changes

There are two types of changes in nature. These are:

1. Physical change
2. Chemical change

Physical Change: is one that is temporary and can easily be reversed. In this case, no new substance is formed.

Examples of physical changes include:

i. Dissolution of sugar in water

ii Freezing of liquid to solid

iii Liquefaction of gases to liquid

iv. Melting of solid to liquids

v. Sublimation

vi. Evaporation

vii. Crystallization

Distillation and fractional distillation

ix. Heating of iron, ring boiler, cooker.

Chemical Change: is one that is permanent and not easily reversed. This is because a new substance is formed.

Examples of chemical changes include:

i. Burning of magnesium ribbon in air

ii. Rusting of iron

iii. Dissolving metals in acids

iv. Adding water to quicklime

v. Fermentation

vi. Decay of substances etc.

Characteristics of Physical and Chemical Changes

The characteristics of physical and chemical changes can be demonstrated by considering the differences between physical and chemical changes as found in non-living things.

Differences between physical and chemical changes

Physical Change	**Chemical Change**
No new substance is formed	New substances are formed
It is easily reversed	Not easily reversible
No change in the mass of substance involved	Change in mass of substance involved
It may or may not involve heat	In most cases, it involves a large amount of heat

ASSESSMENT

1. What are the types of Changes?
2. List FOUR characteristics of Physical changes?
3. List FOUR characteristics of Chemical changes?

SECOND TERM NOTES ON BASIC SCIENCE

Week 1

Topic: Work, Energy and Power

Introduction Work and energy are common concepts we always encounter in our lives on a daily basis. If one does not have energy, one cannot do any work. The stored up energy (potential energy) in our muscular system is converted to kinetic energy. When work and energy are related, they have the same unit of measurement called Joule.

Concepts of Work, Energy and Power

Work

Work is said to be done when a body moves in the direction of the force i.e.

Work = force x distance moved in the direction of the force

$W = f \times d$

Where W = work done,

f = force (F = mass (m) x acceleration of free fall due to gravity (g))

$g = 10 m/s^2$

d = distance moved in the direction of the force

Therefore, a force of gravity acting on a 2kg box is 20N; and on a 3kg box is 30N etc.

It is important to note that if the force applied to a body cannot cause motion or displacement, work is not done. For example, if a man was pushed against a wall so much that he began to sweat, but the wall did not move, one cannot say that he has done any work.

Energy

Since work done is the product of force and distance in the direction of the force, therefore,

$F = mg$

$W = mgh$

Where m = mass in kg

g = Acceleration of free fall due to gravity in m/s^2

h = distance moved by the force in meters work done on a 2 kg box = 2 x 10 x 1.5

= 20N x 1.5m

= 30Nm

(Newton meters is the same as joule)

Work done on a 5kg box = 50N x 1.5m

= 75J

The amount of work done on a 5kg box is the greatest, therefore, the 5kg box requires the greatest amount of energy and the 2kg box requires less amount of muscular energy.

Therefore, work done is the measure of the energy used. Then, we can define energy as the ability to do work.

Potential energy is the energy possessed by a body by the virtue of its position and kinetic energy is the energy possessed by a body in motion. These two types of energy are generally called mechanical energy.

Potential energy (W)= mgh

Kinetic Energy (K.E) = $\frac{1}{2}mv^2$

Power

Power is defined as the rate of doing work.

P = Work done/ Time

P = W/t

Work done = Fs = mgs

Therefore, P = mgs/t

Where:

P = power in Watts

F = force in Newton

T = time in seconds

M = mass in Kg

g = acceleration of free fall due to gravity

The S.I. unit of power is Joules per second (J/s) or Watts (W)

Calculation Involving Work Done Per Time (Power)

Example: How much power does a student of 25kg mass who climbed a stair with 20 steps and one step is 15cm high in 30s has? (Assume g = $10m/s^2$).

Solution:

Distance covered = 20 steps x 15cm

= 300cm = 3m

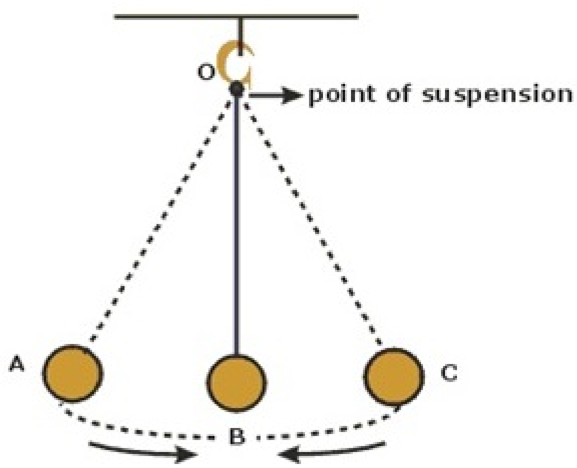
Power = mgs/t

= 25kg x $10m/s^2$ x 3m / 30s

= 25 Watts

Energy Transfer: Conversion of Potential Energy to Kinetic Energy

Simple Pendulum



At point A and C, the potential energy is maximum and kinetic energy is zero (because there is no motion at those points). However, at point B the kinetic energy is maximum and potential energy is zero (because the motion is maximum at that point). We can therefore conclude that the potential energy on the bulb at point A has been converted to kinetic energy at point B and the kinetic energy of the bulb at point B has been converted to potential energy at point C.

Furthermore:

Work, Energy and Power

- Meaning or work, energy and power
- Concept of work, energy and power
- Forms of energy (heat, light, kinetic, potential etc.)

Meaning of work, energy and power

Work, energy and power are often used in every day conversation. Work is thought to mean any kind of physical and mental activities, while power is expressed in terms of strength. In science, these terms: work, energy and power have special meanings. For work to be used in science, two things are necessary. There will be force and the force must produce motion. Power on the other hand is the rate at which work is done. Energy is the ability to do work, however the new thing to consider here is thst it is considered in relation to other aspects of our daily lives. In this chapter, the concept of work, energy, power and their calculation will be explained.

Of work, energy and power Concept

Work:

Work is a product of force and distance moved in a given direction, and the quantity of work done is always equal to the quantity of energy put in. In science, work is said to be done when a force can produce movement in a measured direction, i.e. **work = force X distance (f X d).** Work can simply be defined as the product of distance moved and the force applied in the direction of movement. Note that the useful force is the part of the force, which acts in the direction of movement. If the force is directed in another direction other than that of motion, its component in the direction of motion is the one to use to multiply the distance to obtain the work done.

Generally, for any work done, there must be energy input since energy is the capacity of any system or a body to do work. Both energy and work are measured in units called joules, named after the scientist P. Joules who carried out earlier studies on energy.

Force is that which changes a body's state of rest or uniform motion in a straight line. It can as well be expressed as: Force = mass X acceleration (F = M X A) where F is force, m is mass and a is acceleration. The unit if force is Newton. If force = mass X action, then Work can be given as: work = mass X acceleration X distance.

This is a simple formula that can be used to calculate work done especially against gravity.

Work done and energy transferred are measured in joules (J). The work done on an object can be calculated if the force and distance moved are known.

A change in momentum happens when a force is applied to an object that is moving or is able to move. The total momentum in an explosion or collision stays the same.

Work, force and distance

You should know, and be able to use, the relationship between work done, force applied and distance moved.

Background

Work and energy are measured in the same unit, the joule (J). When an object is moved by a force, energy is transferred and work is done. But work is not a form of energy – it is one of the ways in which energy can be transferred.

The equation

This equation shows the relationship between work done, force applied and distance moved:

work done (joule, J) = force (newton, N) × distance (metre, m)

The distance involved is the distance moved in the direction of the applied force.

Power:

Power is also related to the concepts of energy and work. Power is defined as the rate of doing work, i.e. work done divided by time.

Power = <u>Work done</u>

Time taken

The unit of power is watt (w), you can use the formula to solve problems.

Example:

What is power of a child that has done work of 50J in 10 seconds?

Solution:

P = <u>Work</u> = <u>50</u> = 5 watts

Time 10

Forms of energy:

Energy has been defined as the capacity to do work. The following are the various forms of energy:

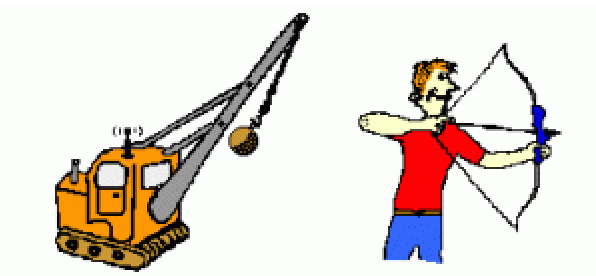
- Solar energy
- Heat energy
- Light energy
- Mechanical energy (this is further divided into two: potential energy and kinetic energy)
- Electrical energy
- Chemical energy
- Sound energy

The main source of energy is the sun, it comes as light and heat energy and transformed or changed to other forms. All forms of energy can be transformed or changed from one form to another to another. Electrical energy can be changed to light energy, such as when electricity passes through an electric bulb. Chemical energy can be changed into heat e.g. when you light up a kerosene lamp. The law of conservation of energy explains the transformatory behavior of energy. It states that energy can neither be created nor destroyed but can be changed from one form to another. All forms of energy are measured in Joules.

Potential and Kinetic energy

A stone on the ground does not have energy so long as it is lying on the ground, the stone cannot be seen doing any work. However, if a stone is placed on a table and if it falls off, it can break a lamp on which it falls. The stone here has done some work by virtue of its position. Therefore, when the stone is on the table, it has energy stored up as a result of its position. The type of energy possessed by a body due to its position is called Potential energy. This energy increases as the height of the table increases and it decreases as it falls to the ground. When it reaches the ground, it has zero potential energy. On the other hand, kinetic energy is the energy possessed by a moving body. For example, a moving car, a running man, a falling orange, a fired bullet, a rolling ball, etc. possess kinetic energy.

An object can store energy as the result of its position. For example, the heavy ball of a demolition machine is storing energy when it is held at an elevated position. This stored energy of position is referred to as potential energy. Similarly, a drawn bow is able to store energy as the result of its position. When assuming its *usual position* (i.e., when not drawn), there is no energy stored in the bow. Yet when its position is altered from its usual equilibrium position, the bow is able to store energy by virtue of its position. This stored energy of position is referred to as potential energy. **Potential energy** is the stored energy of position possessed by an object.



The massive ball of a demolition machine and the stretched bow possesses stored energy of position - potential energy.

ASSESSMENT

How much power does a student of 25kg mass who climbed a stair with 20 steps and one step is 15cm high in 30s has? (Assume $g = 10m/s^2$)?

Week 2

Topic: Potential and Kinetic Energy

POTENTIAL AND KINETIC ENERGY

A stone on the ground does not have any energy so long as it is lying on the ground. The stone cannot be doing any work. However, if a stone is placed on a table and it falls off, it can break a lamp on which it falls. The stone here has done some work by virtue of its position. Therefore, when the stone is on the table, it has energy stored up as a result of its position. The type of energy possessed by a body due to its position is called Potential Energy. This energy increases as the height of the table increases and it decreases as it falls towards the ground. When it reaches the ground, it has zero potential energy. Potential energy is the energy that is stored in an object due to its position relative to some zero position. Potential energy, expressed in science as U, is energy that is stored within an object, not in motion but capable of becoming active. An object possesses gravitational potential energy if it is positioned at a height above (or below) the zero height. When you stand at the top of a stairwell you have more potential energy than when you are at the bottom, because the earth can pull you down through the force of gravity, doing work in the process. When you are holding two magnets apart they have more potential energy than when they are close together. If you let them go, they will move toward each other, doing work in the process.

The formula for potential energy depends on the force acting on the two objects. For the gravitational force the formula is P.E. = mgh, where m is the mass in kilograms, g is the acceleration due to gravity (9.8 m / s^2 at the surface of the earth) and h is the height in meters. Notice that gravitational potential energy has the same units as kinetic energy, kg m^2 / s^2. In fact, all energy has the same units, kg m^2 / s^2, and is measured using the unit Joule (J).

Examples of Potential Energy:

- A rock sitting at the edge of a cliff has potential energy. If the rock falls, the potential energy will be converted to kinetic energy.
- A stretched spring in a pinball machine has elastic potential energy and can move the steel ball when released.
- When a crane swings a wrecking ball up to a certain height, it gains more potential energy and has the ability to crash through buildings.

- Tree branches high up in a tree have potential energy because they can fall to the ground.
- A stick of dynamite has chemical potential energy that would be released when the activation energy from the fuse comes into contact with the chemicals.
- The food we eat has chemical potential energy because as our body digests it, it provides us with energy for basic metabolism.

Kinetic energy is the energy possessed by a moving body. For example, a moving car, a man running, a falling orange, a fired bullet all possess kinetic energy. This is energy possessed by an object in motion. Kinetic energy is directly proportional to the mass of the object and to the square of its velocity: $K.E. = 1/2\ m\ v^2$. If the mass has units of kilograms and the velocity of meters per second, the kinetic energy has units of kilograms-meters squared per second squared. Kinetic energy is usually measured in units of Joules (J); one Joule is equal to 1 kg m^2 / s^2.

Examples of Kinetic Energy

- Flowing flood water can wash away railway lines and bridges.
- Water flowing out of a dam can run a turbine to generate electricity.
- The wind during a storm can uproot big trees.
- The moving wind can run the blades of a wind mill and can be used for producing electricity or for doing some mechanical work.

Example 1

Calculate the work done if a box is pulled by a person with a force of 150N through a distance of 50m.

Work done = force x distance

Force – 150N

Distance – 50m

Work = 150 x 50 = 7500 joules

Example 2

Suppose a body of mass 1kg is lifted through a height of 1m, how much work is done.

The force of gravity on a mass of 1kg is 10 newtons. Distance moved by the force is 1m.

Work done (force x distance) = 10N x 1m (joules)

Example 3

Suppose a ball of mass m kg falls from a height h m to the ground. Calculate the potential energy and the kinetic energy of the ball.

Mass of the ball = m kg

Acceleration due to gravity = gm/s^2

Distance of fall = h m

Kinetic energy = mgh joules

Suppose the potential energy of the ball was used up at the time it hits the ground, work done = potential energy = mgh joules

Example 4

The kinetic energy of a boat is calculated at 36,000 J. If the boat has a mass of 6,000 kg, with what velocity is it moving?

We identify the information given in the problem:

KE = 36,000 J

mass = 6,000 kg

We now place the information into the kinetic energy formula:

$KE = 1/2\ mv^2$

$36{,}000\ J = 1/2\ (6{,}000\ kg) \times (v)^2$

$36{,}000\ J/(1/2 \times 6{,}000\ kg) = v^2$

$12 = v^2$

$\sqrt{12} = v^2$

$3.5 = v$

Kinetic Energy to Potential Energy

When a body is thrown up, its velocity gradually decreases as it goes up due to the downward pull of earth. As a result, its kinetic energy decreases and its potential energy increases gradually as the body goes up.
This continues until at a certain height, the kinetic energy of the body becomes zero. At this point, the body has maximum potential energy. So, when a body is thrown up, its kinetic energy decreases and the potential energy increases, because its kinetic energy gradually changes into potential energy.

Practice Questions

1. Calculate the kinetic energy of a moving boat at velocity of 3m/s. The mass of the boat is 60kg.
2. Suppose a body of mass 30kg is lifted through a height of 6m, and the force exerted on the body is 15N, how much work is done?
3. A man of 50 kg climbs to the top of a building which is 40 m high. What is the potential energy of the man?
4. The kinetic energy of a car is found to be 40,000 J. What velocity is the car traveling if its mass is 10,000 kg

Answers

1. KE = 1/2 mv^2
   m = 60kg
   v = 3
   KE = 1/2 x 60 x 3 x 3 = 270 J
2. Work done = force x distance
   force = N15
   distance = 6m
   Work done = 15 x 6 = 90Nm
3. Weight of the man = mass x gravity

= 50 kg x 9.8 m/s^2 = 490 N

Gravitational Potential energy (GPE) = weight x height

= 490 N x 40 m = 19600 J = 19.6 kJ

4. Kinetic energy (KE) = ½ mv^2

$40{,}000 = (½) \times (10{,}000\ kg) \times (v^2)$

$v^2 = 40{,}000/5000 = 8$

$\sqrt{v} = \sqrt{8}$

$v = 2.8\ m/s$

Furthermore, on Potential and Kinetic energy

A stone on the ground does not have energy so long as it is lying on the ground, the stone cannot be seen doing any work. However, if a stone is placed on a table and if it falls off, it can break a lamp on which it falls. The stone here has done some work by virtue of its position. Therefore, when the stone is on the table, it has energy stored up as a result of its position. The type of energy possessed by a body due to its position is called Potential energy. This energy increases as the height of the table increases and it decreases as it falls to the ground. When it reaches the ground, it has zero potential energy. On the other hand, kinetic energy is the energy possessed by a moving body. For example, a moving car, a running man, a falling orange, a fired bullet, a rolling ball, etc. possess kinetic energy.

Calculating work, potential and kinetic energy and power:

Example 1:

Calculate the work done if a box is pulled by a person with force of 150N through a distance of 50m.

Work done = Force X Distance

Force = 150N

Distance = 50M

Work done = 150 X 50 = 7500 Joules

Energy transfer when work is done:

When an object is dropped from above the ground, work is done as the object is pulled to the ground. As the object is falling and work is done, the potential energy of the body is changed to kinetic energy. In principle, the quantity of potential energy stored in a body is always equal to the kinetic energy produced when the body is released to do work. In order words, when energy changes, for example from potential to kinetic, there is always an accompanying work done.

Question:

1. Power can be described as:

- the ability to do work
- anything that changes the position of a body
- distance moved in the direction of uniform motion
- rate of doing work

2. Define work and energy

ANS: Work is a product of force and distance moved in a given direction, while energy is the ability to do work.

3. Explain the meaning of potential and kinetic energy

ANS: potential energy is the energy stored in a body at rest while kinetic energy is the energy of a body in motion.

Week 3

Topic: Energy Transfer When Work is Done

Introduction

Work is the force acting on an Object to cause a displacement. Work is done on an object when you transfer energy to that object. If one object transfers (gives) energy to a second object, then the first object does work on the second object. When an object is dropped from above the ground, work is done as the object is pulled to the ground. As the object is falling and work is done, the potential energy of the body is changed to kinetic energy. **Work done** and **energy transferred** are measured in joules (J). The **work done** on an object can be calculated if the force and distance moved are known. A change in momentum happens when a force is applied to an object that is moving or is able to move. In principle, the quantity of potential energy stored in a body is always equal to the kinetic energy produced when the body is released to do work. In order words, when energy changes, for example from potential energy to kinetic energy, there is always an accompanying work done.

Work-Energy Principle –The change in the kinetic energy of an object is equal to the net work done on the object.

Assessment

1. A force of 20N pushing an object 5 meters in the direction of the force. How much work is done?
2. The work done on an object is 5 Kilo joules and the object moved a distance of 800cm. Calculate the force acting on the object.

Answers

1. Work done = Force x distance
   20N x 5m = 100Nm or joules
2. Work done = Force x distance
   Force = Work done/distance
   work done = 5 kilo joule convert to joules = 5 x 1000 = 5000 joules
   distance = 800 cm.
   100cm = 1m
   800 cm = 8m
   Force = 5000/8 = 625N

Further discussion on Energy transfer when work is done

If you apply a force over a given distance – you have done work. Work = Change in Energy. If an object's kinetic energy or gravitational potential energy changes, then work is done. The force can act in the same direction of motion. Or, the force can act against the motion. (Drag and friction do that.) Forces can act when objects touch.

In general, the energy transferred depends on the amount of force and the distance over which that force is exerted.

If the man pushes the rock in the direction of the force, he has done work. If the rock rolls back and pushes him, then the rock does work on the man.

No work: If the net force is perpendicular to the motion then no work is done. If you push on an object and it doesn't move, then no work is done. If an object's kinetic energy doesn't change, then no work is done.

Another Equation for Calculating Work:

Work = Mass * Gravity * Height and is measured in Joules. Imagine you find a 2 -Kg book on the floor and lift it 0.75 meters and put it on a table. Remember, that "force" is simply a push or a pull.

Work = Mass X Gravity X Height

= 2 X 10 X 0.75

= 14.7 Joules

Energy is defined as the ability to do work. If you can measure how much work an object does, or how much heat is exchanged, you can determine the amount of energy that is in a system. As with work, energy is also measured in Joules. Energy is not created nor destroyed according to the Law of Conservation of Energy. Energy only changes form. It is transformed from one kind of energy to another. In fact, the energy that makes your body work can be traced back to the sun. Solar energy is transformed to chemical energy in the plants. We get chemical energy from the plants and animals we eat.

In science, we say that work is done on an object when you transfer energy to that object. If you out energy into an object, then you do work on that object (mass). If a first object is the agent that gives energy to a second object, then the first object does work on the second object. The energy goes from the first object into the second object. At first we will say that if an object is standing still and you get it moving, then you have put energy into that object. The object has kinetic energy as a result of your work. You pushed it through a displacement, you did a work on the object.

For example, a golfer uses a club and gets the stationary golf ball moving when s/he hits the ball. The club works on the golf ball as it strikes the ball. Energy leaves the club and enters the ball, this is a transfer of energy. Thus we say that the club did work on the ball, and before the ball was struck, the golfer did work on the club. The club was initially standing still, and the golfer got it moving when he or she swung the club.

So, the golfer does work on the club, transferring energy into the club, making it move. The club does work on the ball, transferring energy into the ball, getting it moving.

Questions

1. How much work is done if a force of 20N is used to displace an object 3m?

Work done = Force X distance

W = 20N X 3m = 60Nm or 60 Joules

2. A force of 15.73N acts on an object over a displacement of 16.93m. The force and displacement are in the same direction. How much work does the force do on the object?

Work done = Force X distance

W = 15.73N X 16.93m = 266.31J

3. How much work is done by a force of 25N that operates over a displacement of 6.2m?

Work done = Force X distance

W = F X D = 25 X 6.2 = 155J

Week 4

Topic: Family Life Education

Contents:

1. Meaning of Family Life Education
2. The Importance of Sex Education

Meaning of Family Life Education

Family life Education is the form of educating the family member on important and general issues needed for the development of their personal and general life.

It also refers to what young people or adolescents should know about their sexual activity and reproductive health. The need for educating young mind is necessary cause lack of education results into danger for the young ones who are ignorant.

ex Education

Sex education is the process of acquiring the necessary knowledge and information about the changes that occur in the body. These changes are physiological changes that occurs as a result of growth and development.

Sex education is related to the sex organs, their function, uses and abuse of the sexual part of the body.

Sex Education is very important, it provides knowledge, information and understanding on how the youths, adolescents and adults can handle sexual problems.

In teaching sex Education, there are some basic facts about human nature that is needed the students must know, which are some of the changes which are noticed and they are as follows

Girls

- They start menstruation
- Development of big breast
- Pimples appear on the face
- Pubic hair grows around genitals

Boys

- The testes contain live sperm or semen which is capable of fertilizing the egg produced by the girl
- Pubic hair grows around the genitals
- The voice begins to break and become deep like a men own.

The Importance of Sex Education

Sex Education is important for the following reasons:

- It helps every individual to know that human body should not be misused
- The knowledge of sex education assists individual to appreciate God's purpose
- It makes children aware of the true meaning of life and decent living
- It enlightens everyone the danger involves in sexual indiscipline
- It will help to prevent unwanted pregnancies, sexually transmitted disease, abortion etc
- Sex education increases the level of understanding and awareness of the problems associated with human growth and development.
- It stimulates healthy interaction between the opposite sex i.e reducing the rate of sexual immorality

Agents of Sex Education

Agents of sex education are those who are liable and more knowledgeable to teach impart the young ones about Sex.

- Parents/ guardian
- Teachers
- Religious leaders

Assessment

1. ———— is the process of acquiring the necessary knowledge and information about the changes that occur in the body.
   (a) sex education
   (b) sex interaction
   (c) moral teaching
   (d) immoral teaching
2. Characteristics found in the girls during puberty is
   (a) deep voice
   (b) increase in breast
   (c) the testes produces sperm
   (d) none of the above
3. Sex Education is important for the following except
   (a) it encourages illicit sex
   (b) It makes children aware of the true meaning of life and decent living
   (c) It enlightens everyone the danger involve in sexual indiscipline
   (d) It will help to prevent unwanted pregnancies, sexually transmitted disease, abortion.
4. The agents of Sex Education is all except
   (a) parents
   (b) prostitute
   (c) teachers
   (d) religious leaders
5. Sex Education should be taught also to eradicate unwanted pregnancy. True/ False

Week 6 & 7

Topic: Kinetic Theory

Introduction

A Greek philosopher proposed that matter was made up of particles which he called **ATOMS.** He made various statements about the nature of atoms. His ideas about atoms are stated below

1. Matter is made up of minute indivisible particles called atoms.
2. Atom cannot be created or destroyed.
3. All the atoms of an element are alike and different from the atoms of all other elements.
4. Atoms combine in small whole numbers to form new substances.

All these ideas collectively form Dalton's atomic theory. Since Dalton's atomic theory was proposed, scientist have acceoted the idea that matter is made up of small particles called protons, neutrons and electrons.

The Kinetic Theory of Matter states that matter is composed of a large number of small particles that are in constant motion. The law states that the tiny particles of matter are continually moving and so possess kinetic energy. In other words, kinetic theory of matter recognizes that matter is composed of very small particles (ions, atoms and molecules) whose different pattern of arrangements and motions result in the different possible states in which matter can occur. It also explains the properties of these states. An increase in temperature causes an increase in average kinetic energy. This theory is also called the Kinetic Molecular Theory of Matter and the Kinetic Theory.

There are three states of matter; these are solid, liquid and gas.

Substances can change from one state to another. Kinetic theory can explain the change of state by considering all matter (substances) to be made of particles.

The main aspects of the kinetic theory are:

- Matter is composed of very tiny particles (atoms or molecules), which are separated from each other by interparticle distances.
- Each particle of matter is in constant motion.
- In a gas, the particles can move around freely and independently.

- In a liquid, particle movement is a bit constrained and limited to sliding/flow movement within its volume.
- In a solid, particle movement is fully constrained and restricted to only vibrational motion of particles in their fixed positions within the solid.
- The particles of matter experience forces of attraction amongst themselves. These attractive forces decrease rapidly with increasing distance between the particles.
- Particles in solids are very close to each other, and the attractive forces are large enough to hold the particles in fixed positions. Thus, a solid has a fixed shape and a fixed size (volume).
- The particles of liquids are a little further apart and are free to slide and flow, taking the shape of the container. Thus, a liquid has no fixed shape. However, since the particle movement is restricted to within the space occupied by the liquid, a liquid does have a fixed size (volume).
- The separations between particles of a gas are quite large, resulting in complete freedom of motion. Hence, a gas has neither fixed shape nor fixed size (volume), and tends to expand to fill up the entire volume of its container.
- Because the particles are in motion, they possess kinetic energy. The temperature of matter is a measure of the average kinetic energy possessed by the particles. When heat is applied to matter, it gets absorbed and translated to increased kinetic energy of the particles (which means greater motion), resulting in a rise in temperature.

Assumptions of the Kinetic Theory of Gases

This theory describes the behavior of an Ideal gas.

1. The gas molecules move randomly in straight lines colliding with each other and with the walls of the container. The collisions of the gas molecules on the walls of the container constitute the gas pressure exerted on the container
2. The collisions of the gas molecules are perfectly elastic. When two individuals collide, their individual energies may change and one may move faster than the other but the total kinetic energy remains the same
3. The actual volume occupied by the gas molecules themselves are negligible relative to the volume of the container
4. The cohesive forces between the gas molecules are negligible

5. The temperature of the gas is a measure of the average kinetic energy of the gas molecules.

Week 8 & 9

Topic: Kinetic Theory

Introduction

A Greek philosopher proposed that matter was made up of particles which he called **ATOMS.** He made various statements about the nature of atoms. His ideas about atoms are stated below

1. Matter is made up of minute indivisible particles called atoms.
2. Atom cannot be created or destroyed.
3. All the atoms of an element are alike and different from the atoms of all other elements.
4. Atoms combine in small whole numbers to form new substances.

All these ideas collectively form Dalton's atomic theory. Since Dalton's atomic theory was proposed, scientist have accepted the idea that matter is made up of small particles called protons, neutrons and electrons. Matter contains very tiny particles such as atoms, molecules or ions. These particles are always in continuous random motion. The energy which these particles possess that enable them move about is called kinetic energy. The word kinetic is derived from the Greek word "kineo" which means, "I move". Therefore, kinetic energy is the energy possessed by any body or object as it moves from one place to another.

The Kinetic Theory of Matter states that matter is composed of a large number of small particles that are in constant motion. The law states that the tiny particles of matter are continually moving and so possess kinetic energy. In other words, kinetic theory of matter recognizes that matter is composed of very small particles (ions, atoms and molecules) whose different pattern of arrangements and motions result in the different possible states in which matter can occur. It also explains the properties of these states. An increase in temperature causes an increase in average kinetic energy. This theory is also called the Kinetic Molecular Theory of Matter and the Kinetic Theory.

There are three states of matter; these are solid, liquid and gas.

Substances can change from one state to another. Kinetic theory can explain the change of state by considering all matter (substances) to be made of particles.

The main aspects of the kinetic theory are:

- Matter is composed of very tiny particles (atoms or molecules), which are separated from each other by antiparticle distances.
- Each particle of matter is in constant motion.
- In a gas, the particles can move around freely and independently.
- In a liquid, particle movement is a bit constrained and limited to sliding/flow movement within its volume.
- In a solid, particle movement is fully constrained and restricted to only vibrational motion of particles in their fixed positions within the solid.
- The particles of matter experience forces of attraction amongst themselves. These attractive forces decrease rapidly with increasing distance between the particles.
- The molecules collide with each other and with the walls of the vessels in which they are contained
- The collisions made by the gas molecules are said to be perfectly elastic. This means that the collisions do not result in any change in the kinetic energy of the gas.
- A distance that is large compared with their sizes separates the gas molecules from each other. This means that actual volume occupied by the gas molecules themselves is negligible when compared with the volume of the vessel containing the gas.
- An increase in temperature tends to increase the motion of the gas molecules. This implies that the average kinetic energy of the gas molecules is directly proportional to the absolute temperature of the gas
- The increase in temperature leads to increase in volume of the gas
- Particles in solids are very close to each other, and the attractive forces are large enough to hold the particles in fixed positions. Thus, a solid has a fixed shape and a fixed size (volume).
- The particles of liquids are a little further apart and are free to slide and flow, taking the shape of the container. Thus, a liquid has no fixed shape. However, since the particle movement is restricted to within the space occupied by the liquid, a liquid does have a fixed size (volume).
- The separations between particles of a gas are quite large, resulting in complete freedom of motion. Hence, a gas has neither fixed shape nor fixed size (volume), and tends to expand to fill up the entire volume of its container.

- Because the particles are in motion, they possess kinetic energy. The temperature of matter is a measure of the average kinetic energy possessed by the particles. When heat is applied to matter, it gets absorbed and translated to increased kinetic energy of the particles (which means greater motion), resulting in a rise in temperature.

Assumptions of the Kinetic Theory of Gases

This theory describes the behavior of an Ideal gas.

1. The gas molecules move randomly in straight lines colliding with each other and with the walls of the container. The collisions of the gas molecules on the walls of the container constitute the gas pressure exerted on the container
2. The collisions of the gas molecules are perfectly elastic. When two individuals collide, their individual energies may change and one may move faster than the other but the total kinetic energy remains the same
3. The actual volume occupied by the gas molecules themselves are negligible relative to the volume of the container
4. The cohesive forces between the gas molecules are negligible
5. The temperature of the gas is a measure of the average kinetic energy of the gas molecules.

Further note on Kinetic Theory: Assumptions

Introduction:

Earlier in this course, it has already beung taught that matter is anything that has mass and occupies space. For many centuries, people wandered what matter was made of. About 400AD a Greek Philosopher proposed that matter was made up of particles, which he called atoms. About 1806AD, Dalton – a British scientist – expanded the idea of atoms. His ideas about atoms are stated below:

1. Matter is made up of minute indivisible particles called atoms
2. Atoms cannot be created or destroyed
3. All the atoms of an element are alike and different from the atoms of all other elements.
4. Atoms combine in small whole numbers to form a new substance.

All these ideas collectively form what is now known as the Dalton's Atomic theory. Since Dalton's atomic theory was proposed, scientist have accepted the idea that matter is made up of particles. Some of Dalton's proposal have been modified with time. Modern scientists consider atoms to be made up of small particles called proton, neutron and electrons.

In the 19th century, the Kinetic theory was introduced. In previous lessons, it has been taught that kinetic energy is the energy a body has by virtue of its motion. The kinetic theory of matter assumes that the particles that makes up matter have energy, and that these particles are in constant motion. Our objective in this lesson is to study the idea contained in kinetic theory and examine how it explains various behaviors of matter such as change of state, boiling and evaporation, and the factors that affect evaporation.

Assumptions of Kinetic theory:

Kinetic theory is a theory that deals with energy due to the movement of particles. The basic assumptions of kinetic theory are:

1. Matter is made up of tiny indivisible particles that are in constant motion and therefore possess kinetic energy
2. Increase in heat supply and increase in temperature causes increase in the motion of the particles and thus, increase in average kinetic energy of the particles
3. Increase in the kinetic energy of the particles due to increase in the heat supply brings about change in the state viz: solid, liquid and gas.

Structure of solids, liquids and gases

Structure of solids:

The particles of solids are closely packed together and are held together by strong attraction force or forces of cohesion. The cohesion forces are strong enough to restrict the movement of the particles. These particles however possess kinetic energy due to vibration and are able to rotate about their fixed positions but cannot move from place to place. As a result, solids have definite shape and volumes and are difficult to be compressed.

Structure of liquid:

The particles in liquid are slightly further apart from each other than in solids. Therefore, the forces of attraction between them are less and the particles are slightly free from one another. The particles have more kinetic energy than the particles of solids and are therefore able to move or flow. Although, the particules cannot move but they are still under the influence of the forces of cohesion, making their movement restricted. Liquids therefore still have definite or fixed volumes but no definite shapes or form. Instead, they take the shape of their containers.

Structure of gases:

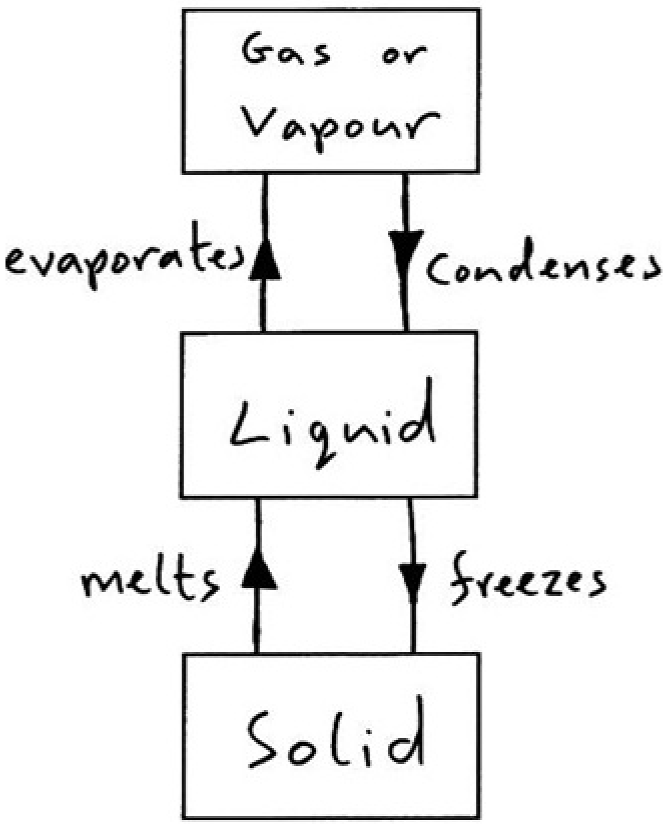
In a gas, the particles are father apart from each other than the particles in solids and liquid. Thus the cohesive forces between the particles in gases are negligible. The particles have much more kinetic energy than the particles of solids and liquids and therefore move about in all directions at the greatest speed. As a result, gases do not have definite shape nor definite volume but occupy the volume of their containers.

Week 10

Topic: Kinetic Theory

Change of State and Kinetic Theory

The kinetic theory of matter gives a clear explanation of the internal processes involved at the particle level when matter undergoes a change of state.



A given substance can exist as a solid, liquid or gas. Change of state is brought about by a change in temperature. When a substance is heated, its particles acquire more kinetic energy and when cooled they become less energetic.

Process of Heating

Theoretically, heating a solid to higher and higher temperatures changes its phase to a liquid, and finally to a gas.

- **Fusion (solid to liquid)**

A solid consists of low kinetic energy vibrating particles locked into position by antiparticle attractive forces. When heat is applied, energy is absorbed and the particles start vibrating more vigorously. Finally, the vibrations become energetic enough to overcome the attractive forces, and the particles start sliding out of their positions to flow about. The solid is now melting into a liquid.

- **Vaporization (liquid to gas)**

On further application of heat to the liquid, the particles move around more energetically within the volume of the liquid. Finally, they become energetic enough to start escaping from the surface of the liquid, overcoming the backward pull by their neighbors in the volume of the liquid. The process of boiling has begun, wherein the liquid converts to gas as particles escape to move around independently without any constraints.

- **Evaporation (liquid to gas)**

According to the kinetic theory, the temperature is a measure of the average kinetic energy possessed by the particles of matter. This means that in any sample of matter, there will be particles with higher kinetic energy than average, balanced by those with lower energy than average. So, even in a liquid whose temperature is not high enough for boiling to occur, there will be some particles with sufficient kinetic energy to break through the surface of the liquid overcoming the backward pull of others. They slowly escape as gas particles, and the process is called evaporation.

Process of Cooling

Generally, cooling a gas changes its phase to a liquid, and finally to a solid.

- **Condensation (gas to liquid)**

When a gas is cooled (i.e. heat is removed) progressively, the free moving particles start losing kinetic energy and slowing down. Finally, the forces of attraction between the lower energy particles colliding with each other are strong enough to hold them together, and the gas begins to condense into liquid.

- **Solidification (liquid to solid)**

The particles still have energy enough to slide about within the volume of the liquid, but further cooling lowers this energy further.

Explanation of Some Phenomena Using Kinetic Theory

Application of the Kinetic Theory of Matter to Explain the Nature of Gases

The three properties of gases that are especially important are infusibility, thermal expansion and compressibility. All gases are characterized by infusibility, but the rates at which different gases diffuse depend on their molecular weights.

When heated, gases expand to a much greater extent than do solids or liquids- all gases tend to behave alike in this respect. In comparison with solids and liquids, gases are very easily compressed – all gases tend to behave alike in this regard also. These properties, as well as the empirical laws governing the behavior of gases can be explained by the kinetic theory.

- **Explanation of Diffusion of Gases by the Kinetic Theory**

Diffusion is a phenomenon whereby particles of a substance move from an area of high concentration into an area of low concentration. Gases diffuse rapidly. For example, if a small quantity of an odorous gas, e.g. hydrogen supplied, is released at one point of a room, the smell soon gets to all parts of the room. This can be explained using the kinetic theory of gases.

From the assumptions of the theory, we have that:

Gases are made of discrete particles called molecules, and not a single piece. If they were made of a single piece, then, the smell of the hydrogen sulphide would not pervade the whole room at the same time, but would probably be perceived at one corner of the room at a time.

The molecules are relatively far apart and are in rapid, random motion, moving at high speeds in straight lines. This account for the smell getting to every part of the room in a couple of minutes after the release.

- **Explanation of Compressibility of Gases By the Kinetic Theory**

Compressibility of gases can be explained from the assumption of the kinetic theory, which states that a gas consists of particles that are separated from one another by large spaces. Based on this, it is therefore easy to bring the molecules closer together (i.e. compressed) when the volume of the container is reduced.

Reduction in volume leads to decrease in temperature (according to Charles' law, $V \alpha T$). Hence, compression of gases results in a drop of temperature in the system – the kinetic energy of the system also drops.

- **Explanation of Expansion of Gases by the Kinetic Theory**

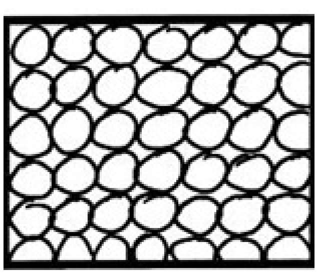
Expansion of gases can be explained by the kinetic theory from the assumptions which state that: Gases are in constant rapid motion, moving at great speeds, occupying the volume of the container.

The average kinetic energy of all the molecules is assumed to be directly proportional to the absolute temperature of the gas. The greater the average kinetic energy of gas molecules, the greater they are able to move and occupy more volume. Therefore, at higher temperatures, gases obtain higher kinetic energy, and thus expand (or occupy large volumes).

Structure of Solids, Liquids and Gases

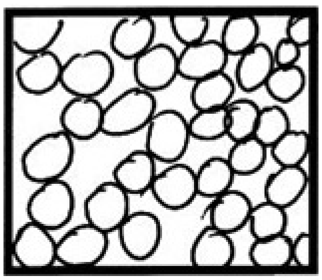
Solid State

In a solid, particles are closely packed in a regular arrangement and are unable to move about. They are held together by strong attraction forces or forces of cohesion. The cohesion forces are strong enough to restrict the movement of the particles. The cohesive forces may be electrovalent, covalent or even Vander Waal's force. The particles vibrate about a fixed position and have a definite shape and definite volumes. These particles however possess kinetic energy due to vibration and are able to rotate about their fixed positions but cannot move from one place to another. Solids have definite shape and volumes and cannot be easily compressed.



Liquid State

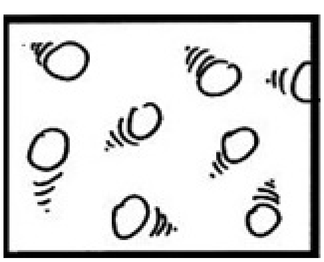
The particles are closely packed in a random arrangement. The particles are slightly further apart from each other than in solids. The particles can move through the liquid because they have more kinetic energy than solid and they are no longer held in a fixed position but they cling together. A liquid does not have a fixed shape but normally takes the shape of its container. The forces of attraction between liquids are less but the particles have more kinetic energy than the particles of the solid. Though the particles can move about but they are still under the forces of cohesion making their movements a bit resticted. Liquids have definite and fixed volumes but no definite shape.



Gas State

The particles are far apart. There motion is random and independent of the other particles. The forces of attraction between particles in a gas are very weak, so the particles are free to move about in all directions at great speed. They can be restricted only by the walls of the container. Because of the large spaces between the molecules, a gas can be compressed easily. The forces of cohesion between particles in gases are negligible. The particles have much more kinetic energy than the particles of solid and liquids and therefore move about in all directions at the greatest speed. Gases do not have definite shape or volume but they occupy the volume of their containers.

A good aroma (odor) of your mother's food, which reaches you in the sitting room, clearly demonstrates how easily gas particles mix with air and move about and far too. The same is true when a classmate of yours in one corner of your classroom passes out a foul gas (i.e. carbon (IV) oxide), which quickly spreads to other parts of the classroom.

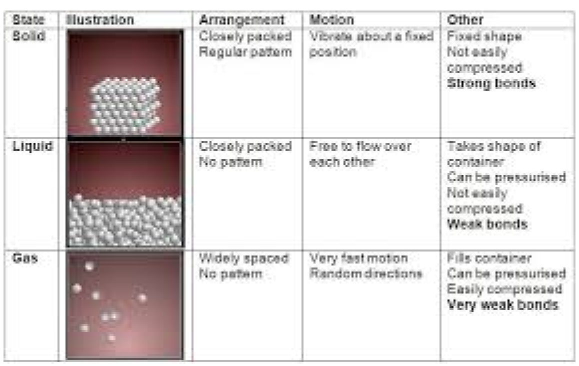


Summary of properties of states of matter

Property	**Solid**	**Liquid**	**Gas**
Motion	There is no movement of particles	There is a slight movement of particles	There is very rapid movement of particles
Volume	It has a fixed volume	It has a fixed volume	It occupies the whole volume of the vessel
Shape	It has a fixed shape	Takes the shape of container	It takes the shape of vessel and fills it completely
Compressibility	It incompressible	It is incompressible	It is highly compressible

Further lesson on Kinetic theory (contd.)

Gases, liquids and solids are all made up of atoms, molecules, and/or ions, but the behaviors of these particles differ in the three phases. The table below illustrates the microscopic differences



State	Illustration	Arrangement	Motion	Other
Solid		Closely packed Regular pattern	Vibrate about a fixed position	Fixed shape Not easily compressed **Strong bonds**
Liquid		Closely packed No pattern	Free to flow over each other	Takes shape of container Can be pressurised Not easily compressed **Weak bonds**
Gas		Widely spaced No pattern	Very fast motion Random directions	Fills container Can be pressurised Easily compressed **Very weak bonds**

Note that:

- **Particles in a:**
    - gas are well separated with no regular arrangement.
    - liquid are close together with no regular arrangement.
    - solid are tightly packed, usually in a regular pattern.
- **Particles in a:**

- gas vibrate and move freely at high speeds.
- liquid vibrate, move about, and slide past each other.
- solid vibrate (jiggle) but generally do not move from place to place.

Liquids and solids are often referred to as ***condensed phases*** because the particles are very close together.

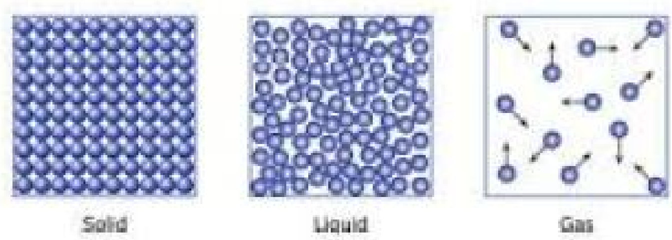
The following table summarizes properties of gases, liquids, and solids and identifies the microscopic behavior responsible for each property.

Some Characteristics of Gases, Liquids and Solids and the Microscopic Explanation for the Behavior

gas	**liquid**	**solid**
assumes the shape and volume of its container **particles can move past one another**	assumes the shape of the part of the container which it occupies particles can move/slide past one another	retains a fixed volume and shape rigid – particles locked into place
compressible **lots of free space between particles**	not easily compressible little free space between particles	not easily compressible little free space between particles
flows easily **particles can move past one another**	flows easily particles can move/slide past one another	does not flow easily rigid – particles cannot move/slide past one another

ASSESSMENT

1. What are the processes of Heating?
2. In a tabular form, Summarize the properties of states of matter?



ASSESSMENT

1. List SIX main aspects of the kinetic theory?
2. Matter is made up of minute indivisible particles called___

Week 11

Topic: Boiling and Evaporation

Introduction

Kinetic Theory explains boiling as follows. In a liquid such as water, the particles are in continuous motion but the speed of movement is not as fast as in gas. When heat is applied to water in a beaker or container, the particles of water gain energy. This additional energy makes the particles move faster than before. As more and move particles gain higher energy they move rapidly in all directions. The mass of water begins to move physically at a particular temperature. At this temperature, the particles acquire greater kinetic energy and begin to escape into vapor. At this stage, boiling is said to be taking place. Boiling is therefore a state in which all particles of the liquid have acquired energy and are moving rapidly in all directions, especially in the direction of the open mouth of container.

Using Molecular Structure to Explain Kinetic Theory

Kinetic theory can be used to explain certain phenomena in nature to show the differences in them. Such phenomena are evaporation, boiling and vapor pressure.

Evaporation

Evaporation is a process whereby molecules of a liquid with higher kinetic energy escape through the liquid surface into the space above the liquid. Such molecules are said to vaporize.

In any given liquid sample, some particles possess more kinetic energy than others. So, when such energetic particles come near the liquid surface, they break away from the attractive forces of other nearby liquid particles and escape into the space above. When this happens, we say the liquid is evaporating.

Boiling

Boiling is said to take place when a liquid freely changes into vapor when it is heated. The temperature at which this happens is called the boiling point.

For a liquid to boil, it must be heated. When this happens, the rate of evaporation increases. Boiling takes place because liquid molecules acquire more kinetic energy when the liquid is heated. The molecules then collide with each other and with the walls of the vessels to build up pressure in the liquid. At this time, a saturated vapor pressure for the liquid results.

This pressure builds up and increases until a temperature is reached at which the saturated vapor pressure of the liquid is equal to the atmospheric pressure at that time. At this stage, bubbles of vapor form in the liquid and rise to the surface. The liquid is now said to be boiling.

Distinction between Evaporation and Boiling

S/N	**Evaporation**	**Boiling**
	Lowers kinetic energy of molecules	Increases kinetic energy of molecules
	Does not need heating to place	It needs heating before it could take place
	Can take place at any temperature	It takes place at finite temperature

Vapor Pressure

This is the pressure that is built up when escaping molecules of a liquid collide with each other and the walls of the containing vessel. It is therefore formed by evaporation in a closed system. At this time, some vapor molecules hit the liquid surface and re-enter the liquid. This is called condensation. Therefore, two forces or processes (i.e. evaporation and condensation) are in operation here.

As the above processes continue, there comes a time when the number of molecules condensing into liquid is equal to the number of molecules evaporating from the liquid. At this point, equilibrium is set up between evaporation and condensation making the vapors pressure to remain constant. This vapor pressure is called the saturated vapors pressure of the liquid at that temperature.

Factors That Affect Evaporation

In a liquid, the particles are in motion. When water is heated, the motion of the particles will become more rapid than before. Each particle that collides with another one will change direction. As the heating continues, the particles gain more energy. Some particles will gain sufficient energy to break through the surface tension of the liquid and escape as gas. When this happens, the groups of particles will be seen as vapors. The process is called **Evaporation**. Evaporation of liquids occurs at all temperatures but the rate of evaporation increases with increase in temperature. Evaporation results in the escape of energetic particles from the liquid is lowered, this results in the drop in temperature of the liquid.

The following factors affect evaporation of liquids, namely:

1. **Wind speed:** How slow or fast the wind is at a particular time
2. **Humidity: T**he amount of water vapor in the atmosphere
3. **Temperature:** How hot or cold the liquid and the atmosphere are
4. **Vapors pressure** of liquid: The degree of saturation of liquid vapors
5. **Viscosity of liquid**: How thick or thin a liquid phase is.

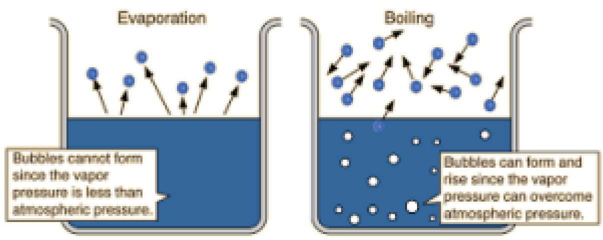
Week 12

TOPIC: Boiling and Evaporation

Vaporization (or **vaporization**) of an element or compound is a phase transition from the liquid phase to vapor. There are two types of vaporization: evaporation and boiling.

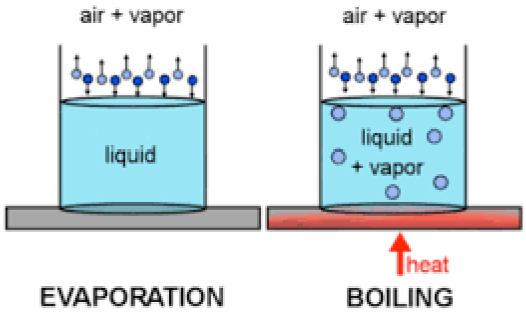
Evaporation is a phase transition from the liquid phase to vapor (a state of substance below critical temperature and critical pressure) that occurs at temperatures below the boiling temperature at a given pressure. Evaporation usually occurs on the surface. Evaporation may occur when the partial pressure of vapor of a substance is less than the equilibrium vapors pressure.

Boiling is a phase transition from the liquid phase to gas phase that occurs at or above the boiling temperature. Boiling, as opposed to evaporation, occurs below the surface. Boiling occurs when the equilibrium vapors pressure of the substance is greater than or equal to the environmental pressure. For this reason, boiling point varies with the pressure of the environment. Evaporation is a surface phenomenon whereas boiling is a bulk phenomenon.

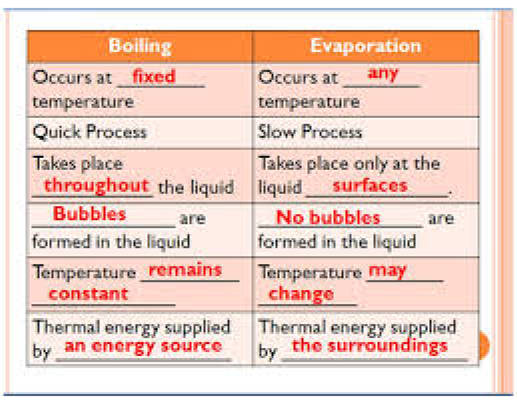


So **vaporization** is conversion of state of liquid into gas. Now why does this happen? Because the kinetic energy or simply let's say the force holding the liquid molecules together is overcome due to some external source (say sunlight) and they escape the confines of the liquid. Now think of it, it could happen actively by applying purposeful a source, like a burner or passively that is naturally.

When I apply an active external source, like putting water on burner, it's **boiling**. It happens in the whole liquid. However, if you don't apply an external source the whole phenomenon would still occur at the **surface** due to the accumulating energy passively to overcome the kinetic forces. This accumulation is very low and hence evaporation is slow and only on surface.



Summary of the difference between boiling and evaporation



Boiling	Evaporation
Occurs at fixed temperature	Occurs at any temperature
Quick Process	Slow Process
Takes place throughout the liquid	Takes place only at the liquid surfaces.
Bubbles are formed in the liquid	No bubbles are formed in the liquid
Temperature remains constant	Temperature may change
Thermal energy supplied by an energy source	Thermal energy supplied by the surroundings

ASSESSMENT

1. Distinguish between Evaporation and Boiling?
2. Define Vaporization?

WEEK 13

Topic: Crude Oil and Petrochemicals

Introduction

Nigeria as a nation is blessed with abundant mineral resources. These minerals include coal, columbine, limestone, tin and crude oil. Crude oil is also called petroleum. Crude oil is a mixture of hydrocarbons. It occurs naturally beneath the earth surface. In Nigeria, it is dark brown in color. It is a source of great revenue to Nigeria. It is believed that natural crude oil (petroleum) was formed from deep carbon deposits (remains of animals and plants) that date back to formation of the earth.

Meaning of Crude Oil as Petrochemicals

Crude oil is a mixture of hydrocarbons. It exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities.

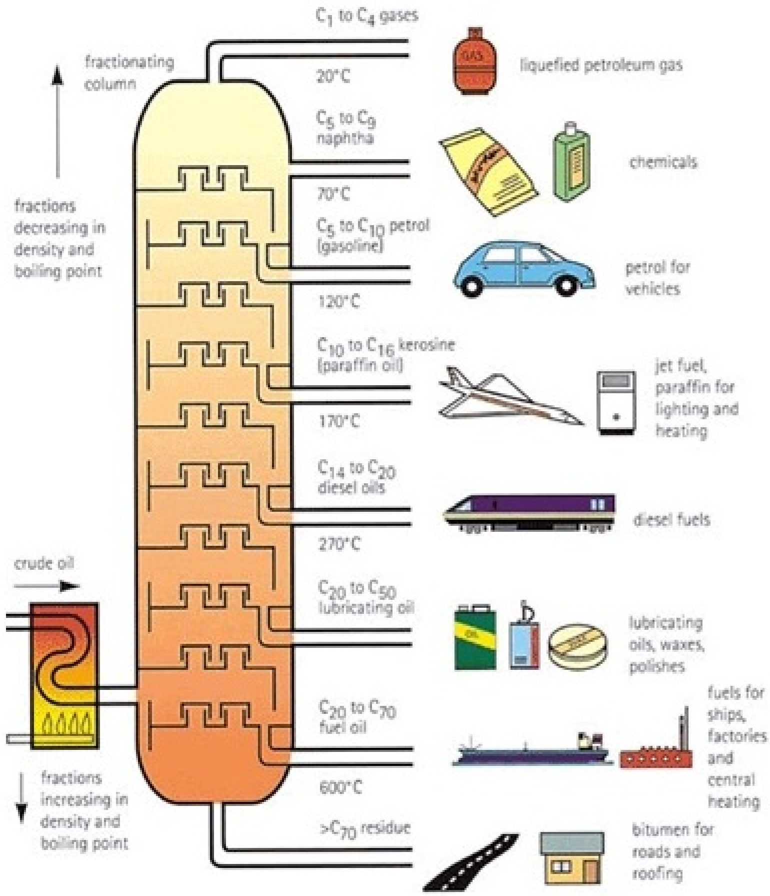
Crude oil occurs in large quantities in Nigeria, especially in Bayelsa, Edo, Imo, rivers, Delta, Abia, Ondo and Cross river state. It is dark brown in colour though its composition and consistency vary from place to place. In fact, different oil producing areas yield significantly different varieties of crude oil. We have light and heavy crude oil. The light one has low metal and sulphur content, light in colour and flows easily. It is very expensive. The heavy one has high metal and sulphur content and must be heated to become fluid. It is less expensive.

Meaning of Petrochemicals

Petrochemicals are chemical substances produced from petroleum in refining operations. They are heavy part of petroleum used mainly to produce plastic materials.

Refining of Crude Oil

Petroleum or crude oil occurs naturally. it contains many useful products also called fractions. These are separated by the method of fractional distillation. This process of obtaining useful fractions from petroleum is called refining.



Fractional distillation of Crude Oil

Fractional distillation of Crude Oil

Fractions of petroleum from refining are petroleum gases (Methane, butane, etc.), petrol or gasoline, kerosene, diesel, lubricating oil and bitumen (asphalt).

Uses of Refined Crude Oil Fractions

1. Petroleum gases are used for welding and as cooking gases
2. Petrol is used for driving cars
3. Kerosene is used for cooking, lighting lanterns and as aviation fuel
4. Diesel is used for driving lorries and trucks
5. Lubricating oil is used for removing rust and loosening nuts
6. Bitumen is used for road construction

Uses of Petrochemicals

1. Padding lining for insulation
2. Raw materials for making plastic items such as chairs, tables, pipes, plates, etc.

Importance of Crude Oil and Petrochemicals

Crude oil and its allied petrochemical products play important roles in the development of Nigeria as a nation. Such roles include:

1. Earning foreign exchange
2. Creating employment for workers
3. Bringing about industrialization in the areas where oil is discovered or refined
4. Providing raw materials for small-scale industries
5. Bringing about international recognition by other countries of the world
6. Providing opportunity for technology transfer

ASSESSMENT

1. List SIX Uses of Refined Crude Oil Fractions?
2. List FIVE importance of Crude oil?

WEEK 14

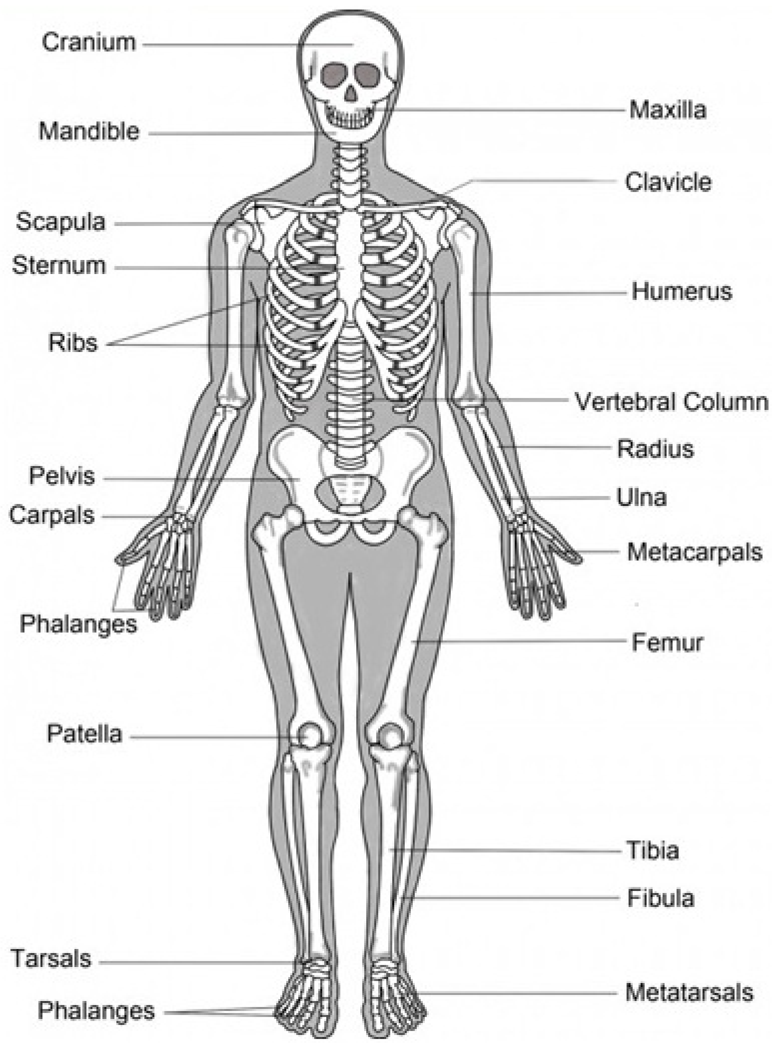
Topic: The Human Body (Skeletal System and Movement)

Introduction

The human body has a bony framework known as the skeleton which gives the body shape, rigidity, support, etc. These supporting structures in the organism which helps the body in running, jumping, moving from place to place and bending to pick objects form the skeletal system. These acts of changing position from one point or position to another, or from one direction to another is known as movement.

In fact, the body of animals consists of:

1. Bones called skeletons
2. Flesh called muscles
3. Fluid called blood



The Skeletal System of Man

The skeleton is made up of two main parts:

1. Axial Skeleton
2. Appendicular Skeleton

The axial Skeleton

The axial skeleton is made up of the skull and the vertebra, which include the spine and the chest plate. The skull refers to the bones of the head and it protects the brain. The vertebrae are otherwise referred to as backbones. These bones are placed end to end to form a hollow tube through which the spinal cord passes. The vertebra therefore protects the spinal cord.

There are 5 types of vertebrae in mammals

	Types	Position	Man	Rat	Rabbit
1	**Cervical vertebra**	Neck	7	7	9
2	**Thoracic vertebra**	Chest	12	13	12
3	**Lumbar vertebra**	Upper trunk abdomen	5	6	7
4	**Sacral vertebra**	Lower trunk abdomen	5	4	3-4
5	**Caudal vertebra**	Tall	14	27-30	16

Appendicular Skeleton

The appendicular skeleton is made up of the limbs and limb girdles which is directly concerned with movement in animals.

The limbs: There are two pairs of limbs in every animal, these are the forelimbs and the hind limbs. In man, the forelimbs are free and are called hands. In other animals except Ape and Gorilla, both the fore and hind limbs are used for walking. The forelimbs consists of the arm(hummers, ulna and radius) and the hands(carpals, metacarpals and phalanges) while the hind limbs consists of the legs(femur, fibula and tibia) and the feet(tarsals, metatarsals and phalanges).

Limb Girdles: Generally, there are two limb girdles and they support the weight of the body. They are:

The pectoral (Shoulder) Girdles: This is a group of large flat bones in the shoulder region to which the forelimbs are attached.

The Pelvic (Hip) Girdles: This is another group of large flat bones in the hip region to which hind limbs are attached.

What are bones?

Bones are made of hard chemical materials called calcium (ii) Tetraoxophosphate (vi), calcium (ii) Trioxocarbonate (iv). These materials are living cells make bone from soluble compounds of calcium and phosphorus in the blood which come from the food you eat. Newly formed bone is soft and easily bent. The human body has a total of about 206 bones.

Cartilages, Ligaments, tendons and Muscles

1. **Cartilage**: The end of bones have a covering materials called cartilage, which is made of a tough elastic tissue. The cartilage prevents these ends from the wears and tears (friction) that would have been caused by the movement of the bone on the other. Cartilage is a special type of connective tissue.
2. **Ligament**: This is the tight cord which holds bones together. Joints are held together by bones and sheets of very tough connective tissues known as ligament.
3. **Tendons**: The tendon is a tough fiber-like material found at the ends of muscles. It binds two neighboring bones together and holds a fluid which serves as lubricant to reduce friction as the bones move against one another.

Muscles

Muscles are bundles of elastic substance in an animal body. Muscles are attached to bones by means of tendons. Muscles cam contract and relax to produce movement in the animal body. The skeletal and muscular systems work together to produce movement.

Muscles can contract (get shorter) and relax in order to move the bones of the body. There are muscles which can be moved voluntarily when you wish, this is called the voluntary muscle and this muscle controls the movement of the hands, legs etc. While some muscles move involuntarily of their own accord i.e. no control over them, this is called involuntary muscle. The heart muscle cannot be controlled.

Generally, there are three types of muscles namely:

1. **Skeletal Muscles**: Are muscles attached to the bones of the skeleton which help them move.
2. **Smooth Muscles**: Are muscles that lined many structures in our body such as intestine and blood vessels.
3. **Cardiac Muscles**: Are special striped muscles with the ability to work continuously. They form the walls of the heart.

Joints

A joint is the spot where two or more bones meet. The head, neck, legs move as a result of the presence of joint in them. There are five types of joints in the body and these joints give us different movements (they are movable joints); these are:

1. Ball and Socket Joint: This joint is for free movement in all directions e.g. in hip joint and shoulder joint.

2. Hinge Joint: This joint is for movement in one plane e.g. elbow joint and knee joint.
3. Sliding Joint: For sliding one bone over another e.g. wrist joint, ankle joint.
4. Pivot Joint: This is a joint that allows rotation of one part of the body on another. Example is found between the atlas and axis vertebrae region.
5. Suture Joint: Joint in the skull.

Reasons Human Beings Move

Movement is an act of changing position from one point or position to another, or from one direction to another. This is brought about by the action of the muscles on the bones. Muscles are attached to the bones at two points. One end of it is attached to an immovable bone (or rigid bone e.g. shoulder blade) which is the origin; and the other end to a moveable bone known as the insertion (e.g. radius). Muscles can only contract (shorten) and relax but not expand (widen). When a muscle contracts, it becomes shorter and thicker and pulls the moveable bone. When a muscle relaxes, it straightens and becomes thinner.

Most muscles act in pairs in such a way that when one of the pairs contracts, the other relaxes. Muscles acting in pairs in this manner are known as antagonistic muscles. One of the pairs is called extensor, that causes the hands to straighten out. The other part of the pair which bends the limb is called flexor. The muscles act on the bones and this brings about movement. The contraction and relaxation of the muscles also brings about movement.

Importance of Movement to Human Beings

1. Human beings need to move about because they have to:
2. Move from one place to another.
3. Escape from danger.
4. Be able to respond to stimuli.
5. Exercise the body.

ASSESSMENT

1. The human body has a bony framework known as the___
2. List FIVE importance of movement to Human beings?

3. There are five types of joints in the body and these joints give us different movements (they are movable joints); these are?

THIRD TERM NOTES ON BASIC SCIENCE

Week 1 & 2

Topic: Thermal Energy

Introduction

Energy transfer is the process of transmitting or transferring energy from one place to another. The word thermal means heat. Thermal energy is the transfer of heat from one place to another.

Heat Flow

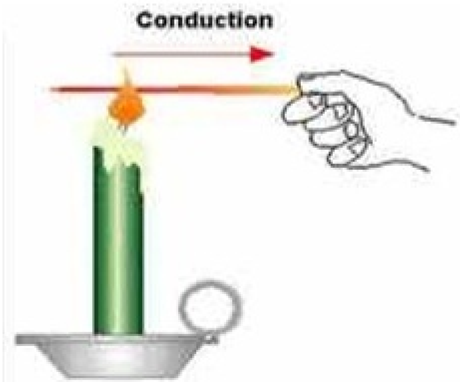
Energy transfer means that energy moves from one place to another (without changing form). The process of heat flow from the sun to us is referred to as radiation. The process of heat flow from the soup to the spoon discussed is referred to as conduction. There is the third process of heat flow known as convection. Therefore, heat flow means that heat energy is transferred from a hotter part of an object to the cooler part of the object. Heat is a form of energy that flows from a hot area to a cold one. When you are in the hot sun, you feel hot. The heat travels from the sun through the atmosphere to your skin. When you put a kettle of cold water on fire, the water gets hot. The heats flows or travels from the fire through the kettle into the water.

Transfer of Heat Energy

The three processes of heat transfer are conduction, convection and radiation.

Conduction

When particles in a matter (or substance preferably a metallic substance) are heated, the particles vibrate, hitting the successive ones (which are not in contact with the source of heat). This raises their temperature until all the particles in the metallic substances are heated up. In this way, heat is being conducted along the metallic substance and this process is called conduction.



Usually, heat flows from a hot to a cold body. You know that heat is a form of energy and a hot body has energy stored up (in form of potential energy) in it. In order to convert this potential energy into kinetic energy, heat then passes to another particle which has lower energy. Therefore, a hot body must lose heat energy to a cooler one.

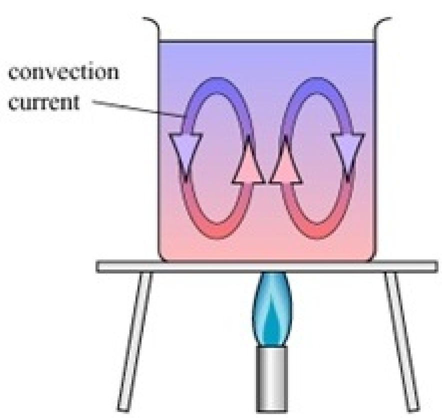
There are good conductors and bad conductors of heat.

Good conductors of heat are substance s, which conduct heat readily; all metals are good conductors of heat.

Bad conductors are substances that do not conduct heat readily. Liquids and gases are bad conductors of heat. Water is an example of a bad conductor of heat. But mercury is a metallic liquid, hence it conducts heat readily.

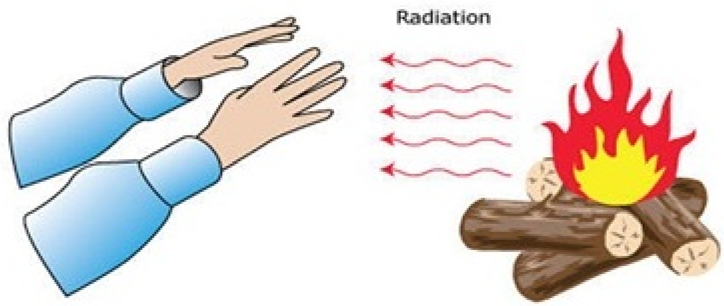
Convection

Heat transfer in convection is peculiar with liquids. The heat flows from the bottom of a liquid container to the top by the actual movement of the liquid molecules. This transfer of heat by the movement of liquid molecules is known as convection



Radiation

Radiation is a method of heat transfer that does not require material medium for transmission. Heat energy is transmitted by means of waves. Heat energy from the sun reaches us by radiation. Heat can travel in invisible waves from hot places to cooler places. Heat travelling this way does not need any medium (solids, liquids or gases) to travel through. Heat can travel through a vacuum. A vacuum is a space in which there is nothing at all, not even air. There is a vacuum in space between the earth and the sun. The heat from the su travels through this vacuum to the earth and through the earth to other obects.

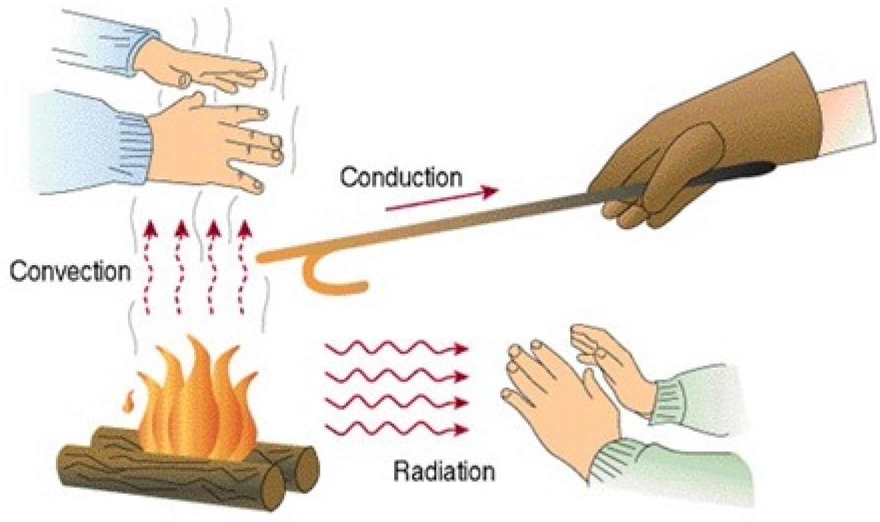


Summary of the Three Types of Heat Transfer

Table 1: Three Types Of Heat Transfer

Conduction heat transfer	Radiation heat transfer	Convection heat transfer
• Heat flows from a hot part of one body to a cooler part on another body. • The two bodies must be in contact with each other. • Conduction is the primary mechanism for heat transfer between solids. • Fourier's law governs conduction heat transfer.	• Heat is exchanged between two or more bodies. • It's defined as electromagnetic radiation in the wavelength range of 0.1 to 100 μm (including visible light). • It's the only means of heat transfer between entities separated by a vacuum, such as heat radiated from the sun to the Earth.	• Heat is transferred between a solid surface and a moving fluid at a different temperature. • Natural convection occurs when the solid's temperature is due to a natural, external fluid motion. • Forced convection occurs when air is blown over the solid using fans or other devices that generate a fluid motion.

Diagram of the Three Types of Radiation



Topic: Energy and Appliances in the HOME

ASSESSMENT

1. Define Radiation?
2. The three processes of heat transfer are___
3. What is energy transfer?

Week 3

Topic: Reproductive Health

Meaning of Reproductive Health

Reproductive health is the ability of people to have a satisfying and safe sex life and the capability to reproduce as well as the freedom to decide if, when and how often to do so.

Significance of Reproductive Health

Reproductive health is significant because it promotes good sexual health which enhances life and personal relations. It is also a prerequisite for social, economic and human development i.e. human energy and creativity is the driving force of development and this cannot be generated by a sick person. It sets the stage for health beyond the reproductive years for both men and women. Similarly, the health of a newborn is largely a function of the mother's health, and nutritional status and her access to good health care. Furthermore, reproductive health takes care of reproductive health problems at various stages in life, thereby preventing health problems at later stages in life. It contributes enormously to physical and psychosocial comfort and closeness. Reproductive health creates awareness on the dangers associated with disease, abuse, exploitation, unwanted pregnancy, etc.

Care and Protection of the Reproductive System

This is done through:

1. Circumcision of the male at childbirth reducing the effect of micro-organisms on the fore skin of the penis.
2. Regular bathing of the individual and drying of the reproductive organs.
3. Shaving of the pubic hair to avoid the growth of bacteria and fungi.
4. Ensuring thorough cleanliness of the toilet system to avoid contracting diseases, such as candidacies.
5. Washing of undies (pants) regularly.
6. Using sanitary pads by females during menstruation to avoid getting stained and infections.
7. Using tissue paper to clean up after urinating.

Breast Feeding

Breastfeeding is the normal way of providing young infants with the nutrients they need for healthy growth and development. Virtually all mothers can breastfeed, provided they have accurate information, and the support of their family, the health care system and society at large.

Colostrum, the yellowish, sticky breast milk produced at the end of pregnancy, is recommended by WHO as the perfect food for the newborn, and feeding should be initiated within the first hour after birth.

Exclusive breastfeeding is recommended up to 6 months of age, with continued breastfeeding along with appropriate complementary foods up to two years of age or beyond.

Importance of breastfeeding

Breastfeeding a baby exclusively for the first 6 months, and then continued breastfeeding in addition to appropriate solid foods until 12 months and beyond, has health benefits for both the mother and child.

Importance of breastfeeding for mother

Research shows that breastfeeding has significant health benefits for mothers.

Breastfeeding:

1. Assists the uterus return to its pre-pregnant state faster.
2. Can help women to lose weight after baby's birth.
3. Reduces the risk of ovarian cancer and pre-menopausal breast cancer.
4. Reduces the risk of osteoporosis
5. Reduces the risk of mothers with gestational diabetes developing Type 2 diabetes.

Importance of breastfeeding for baby

1. Less illness
2. Babies who are fed breast milk have a lower risk of :

- Gastro-intestinal (gut) illness

- Allergies
- Asthma
- Diabetes
- Obesity
- Some childhood cancers
- Respiratory tract (chest) infections
- Urinary tract infections
- SIDS (cot death).

3. Breastfed babies are less likely to be hospitalized.

Importance of Knowledge of Genetic Disorder in Family

A genetic disorder is a disease that is caused by an abnormality in an individual's DNA. In other word, genetic disorder is an illness caused by abnormalities in genes or chromosomes. Abnormalities can range from a small mutation in a single gene to the addition or subtraction of an entire chromosome or set of chromosomes. Sickle cell disease, cystic fibrosis, cancer, obesity, mental illness, Alzheimer disease and Ta

Y-Sachs disease are examples of genetic disorders

Knowledge of genetic disorder may assist the family by:

- Identifying the likelihood that certain diseases or conditions may develop based on genetic information, and then anticipating the timing of the expected disorder in the person's life cycle.
- Helping families prepare pragmatically and emotionally for expected challenges, such as: living with uncertainty, care giving strains, and losses associated with various genetic conditions as they may unfold.
- Helping families create meaning that sustains hope and promotes mastery.
- Identify effective treatments, or teaching coping skills for disorders with little hope for treatment.
- Can lead to better care and management of the patient and ultimately to improved quality of life

ASSESSMENT

1. Define reproductive health?
2. List FIVE ways the care and protection of the productive system is done?
3. Mention FIVE ways the Knowledge of genetic disorder may assist the family?

WEEK 4

Topic: Measurement

Introduction

Measurement is one of the fundamental concepts in experimental sciences, including physics. Measurement is the process of attaching a numeric value to an aspect of a natural phenomenon, such as the volume of the milk produced by a cow, in order to be able to describe that phenomenon accurately and make comparisons to other similar phenomena.

Importance of measurement

Unless we are able to measure some phenomena, we cannot say we scientifically know anything about that thing.

Measurement gives a base to understand the universe. All around us we are surrounded by various things. We might not note it but unconsciously we are actually "measuring" things and understanding them one way or the other. We are surrounded by Measurement.

Fundamental or Basic Unit

You measure things by defining a standard unit and then stating the measurement in terms of multiples of that unit. A fundamental unit of measurement is a defined unit that cannot be described as a function of other units.

The International System of Units (SI) defined seven basic units of measure from which all other SI units are derived.

SI Base Units

The SI unit system consists of seven base units, with a number of other units derived from those foundations. Below are the base SI units, along with their precise definitions:

- **Meter (m)** – The base unit of length
- **Kilogram (kg) –** The base unit of mass
- **Second (s)** – The base unit of time
- **Ampere (A)** – The base unit of electrical current

- **Kelvin (degrees K)** – The base unit of thermodynamic temperature
- Mole (mol) – The base unit of substance; the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilograms of carbon 12. When the mole is used, the elementary entities must be specified and may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles.
- **Candela (cd)** – The base unit of luminous intensity

These SI base units or commonly called metric units in summary are:

Measure	Unit	Symbol	Area of Science
Time	Second	s	All
Length or distance	Meter or Meter	m	All
Mass	Kilogram	kg	Physics
Electric Current	Ampere	A	Physics
Temperature	Kelvin	K	Physics
Luminous Intensity	Candela	cd	Optics
Amount of Substance	Mole	mol	Chemistry

Although these SI base quantities are supposed to be a set of mutually independent dimensions, some may well be interdependent.

Derived Units

With these base units, we can combine them to form derived units, such as the Newton, acceleration or speed; as an example, let us look at speed. Speed is described by the following equation:

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

As you know, Distance is in Metres, and Time is in Seconds, so m divided by s obviously gives us m/s. Since this is higher physics, it needs to be put into index notation, which means that the derived unit now becomes ms^{-1} If we write this as a non-negative power, then we get:

$$ms^{-1} = \frac{m}{s^1}$$

Now, let us use this derived unit to find another unit commonly met, Acceleration.

Acceleration is the rate of change of Velocity, described by the equation:

$$Acceleration = \frac{Final\ Velocity - Initial\ Velocity}{Time\ Taken}$$ or in symbols: $$a = \frac{v-u}{\Delta\ t}$$

Thus, if we divide ms^{-1} by the Time Taken (in seconds) we get ms^{-2}

Again, if we write this as a non-negative power, we get:

$$ms^{-2} = \frac{m}{s^2}$$

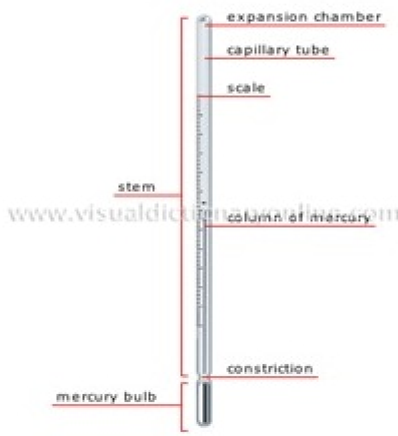
MEASURING DEVICES

Instruments for determining various quantities such as temperature, mass, height, length, voltage and mechanical force.

Measure of temperature

Temperature: physical quantity corresponding to the level of heat or cold, which is measured by means of a thermometer.

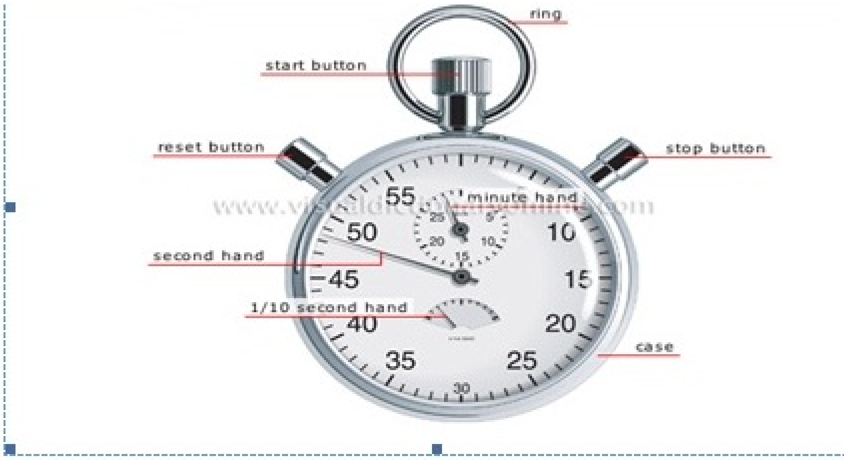
Thermometer



Clinical thermometer

Measure of time

Time: physical quantity corresponding to a phenomenon or an event that is measured with devices such as watches and stopwatches.



Stopwatch

Analog watch

Measure of weight

Mass: physical quantity that characterizes an amount of matter (mass) that is measured by means of a scale.

beam balance

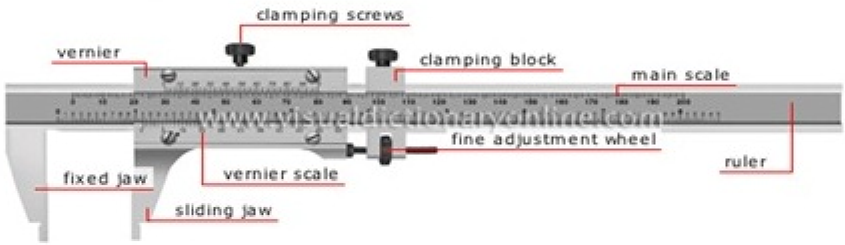
bathroom scale

Roberval's balance

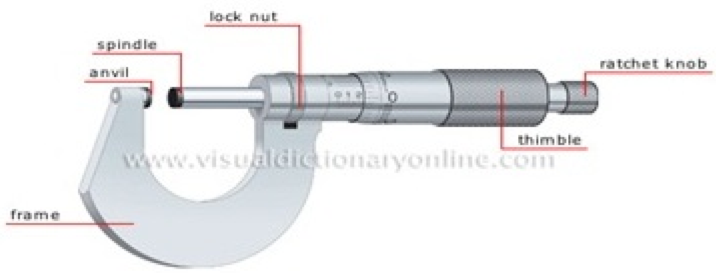
Spring balance

Measure of thickness

Thickness: dimension corresponding to the distance between two surfaces of the same body.



Venier caliper



Micrometer caliper

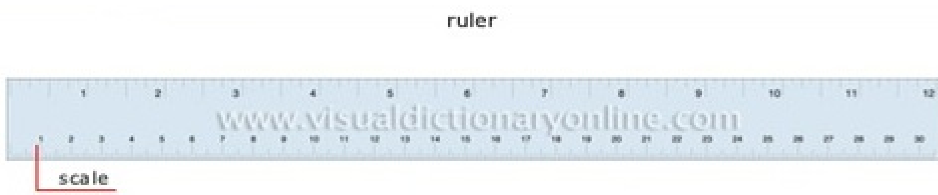
Measure of distance

Distance: interval separating two points in space.

Pedometer

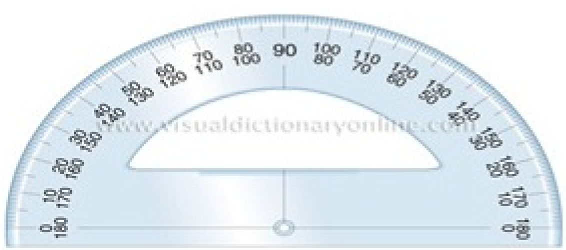
Measure of length

Length: the longer dimension of an object as opposed to its width.



Measure of angles

Angle: figure formed by two intersecting lines or planes; it is measured in degrees.



Protractor

ASSESSMENT

1. Define measurement?
2. List THREE importance of measurement?

WEEK 5

Topic: Force

Introduction

You must have seen a broken down vehicle in your town or village. Assuming this car is to be taken to a nearby mechanic village, what do you think must be done to it? To make the broken down car move to the mechanic village, you have to push it or get a towing van to pull it to the mechanic village. The pushing or pulling of the car to the place is an application of force. It is force that is pushing or pulling the car. To make the car go faster, we push harder, that is, we apply greater force. Note that push and pull are examples of force.

What is Force?

A force is a push or pull upon an object resulting from the object's interaction with another object. Whenever there is an interaction between two objects, there is a force upon each of the objects. When the interaction ceases, the two objects no longer experience the force. Forces only exist as a result of an interaction.

In other words, force can be defined as a physical phenomenon that is capable of causing, increasing, retarding and changing the direction of motion and can stop motion.

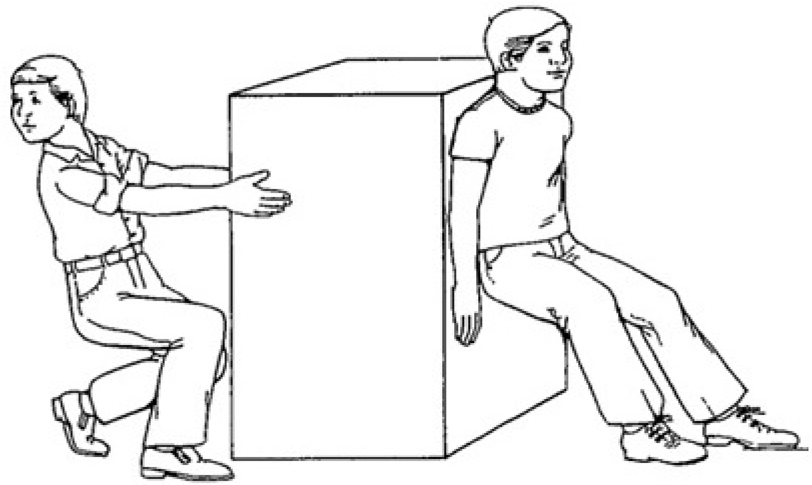
Types of Forces

There are two types of forces, these are:

- **Contact forces**
- **Non-contact forces**

Contact Forces

A contact force exists between two or more surfaces when the force or source of the force is in contact with the object it is acting upon. For example, when people are pushing a car, they place their hands on the car and push.



Other examples include pull, frictional forces, reaction forces, tension forces and up thrust. More than one contact force can exist on a body. For example, a book placed on a table of weight W, is opposed by the reaction force R of the table. The pulling force F is counterpoised or counterbalanced by the frictional force acting between the table surface and the book.

Frictional force:- is a force that oppose the motion of one body over the other
.

Effect of frictional force

1. It leads to wasting of energy, when two surrounding forces move over each other, heat is generated as a result of friction. The energy required to turn the machine, will be converted heat energy which reduces the energy output.

2. It leads to wearing away of the surfaces in contact.

Non-contact Forces (Force Field)

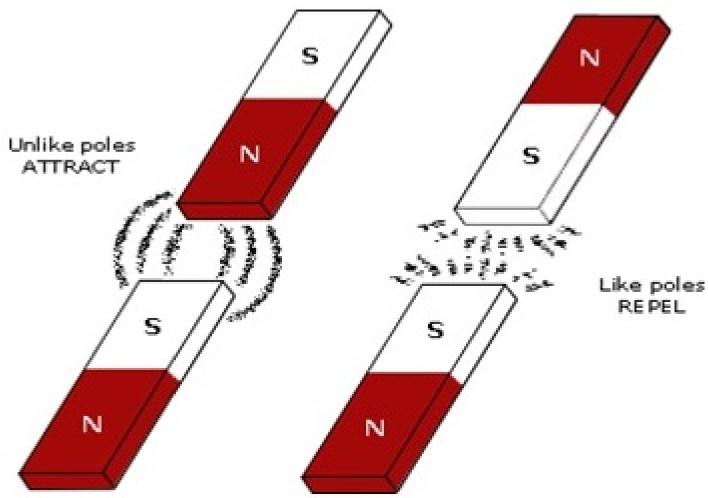
We have explained that contact force exists between two or more surfaces. However, in a force field i.e. forces at a distance, it is not compulsory for the bodies in question to touch each other before a force can be experienced. Therefore, non-contact force or force field can be described as the region or space where force can be experienced. Examples of force fields include gravitational pull, magnetic and electric attraction and repulsion

Magnetic Force

Magnetic force field is the space or region where magnetic force can be experienced. Magnetic force field can be produced in the surface around a bar magnet or in the region surrounding a current carrying conductor.

Magnetic force is the force that attracts metallic objects towards a magnet. If you bring two magnetic bars close to each other, you will experience any of these:

An attraction or a repulsion. If the two bars have the same pole (One end of a magnet is called pole and the two ends are called poles) repulsion occurs but, if they have different poles, then attraction occurs. This experience illustrates the discovery by Peter Peregrinus (i.e. like poles repel and unlike poles attract).

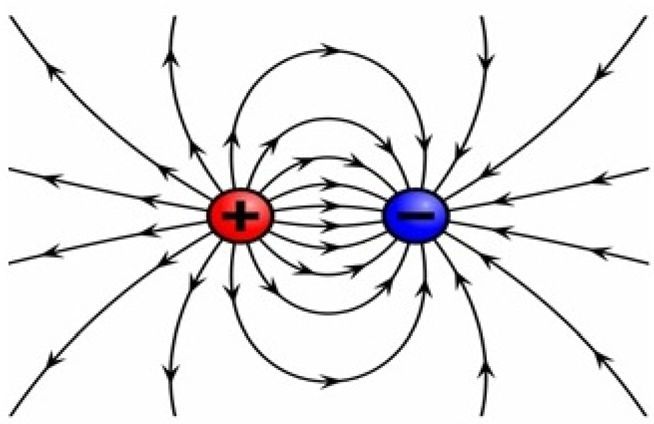


Gravitational force field

Gravitational force field course body thrown up to fall back on the ground.

Electric Force

You must have noticed that during harmattan, when you wear some clothing like those made from polyester, they produce some sound and in fact, some of them attract your body hair. This phenomenon can be explained as electric force. These are electric changes both in the clothing and in the body hair.



The Effects of Forces

A force acting on an object may cause the object to change shape, to start moving, to stop moving, to accelerate or decelerate. When two objects interact with each other they exert a force on each other, the forces are equal in size but opposite in direction.

Force is an influence tending to change the motion of a body or produce motion or stress in a stationary body.

Force change the motion of a body: Force changes the motion of body that are already in motion and produce motion in a stationary body. Example a car moving on a road suddenly hit behind by a truck, you will notice the tendency of the car motion increase. The force applied by the truck affect the motion of the car. A stationary body hit behind by a moving body, the position of the stationary body changes.

Force change the direction of both stationary body and body in motion: Newton second law state that the rate of change of momentum of a body is directly proportional to the applied force and take place in the direction in which the force acts.

ASSESSMENT

1. Define Force?
2. Mention TWO types of force?

WEEK 6
Topic: Energy and Appliances in the Home

Introduction

Energy lights our cities, powers our vehicles, and runs machinery in factories. It warms and cools our homes, cooks our food, plays our music, and gives us pictures on television.

Energy is defined as the ability or the capacity to do work.

We use energy to do work and make all movements. When we eat, our bodies transform the food into energy to do work. When we run or walk or do some work, we 'burn' energy in our bodies. Cars, planes, trolleys, boats, and machinery also transform energy into work. Work means moving or lifting something, warming or lighting something. There are many sources of energy that help to run the various machines invented by man.

Forms of Energy

Some of the many forms that energy takes are:

- **Mechanical energy, which includes**

– Potential energy, stored in a system or energy stored in an object
– Kinetic energy, from the movement of matter or energy of a moving object

- Radiant or solar energy, which comes from the light and warmth of the sun.
- Thermal energy is energy associated with the heat of an object or energy of an object due to its temperature.
- Chemical energy is an energy stored in the chemical bonds of molecules, energy stored in fuel (i.e. food) which is released when chemical reactions take place
- Electrical energy is energy associated with the movement of electrons or energy transferred by an electric current
- Electromagnetic energy is the energy associated with light waves (including radio waves, microwaves, x-rays, infrared waves).
- Mass (or nuclear) energy is energy found in the nuclear structure of atoms.

Note: Potential energy is energy stored in an object. Chemical, nuclear, gravitational, and electrical are all stored energy. Kinetic energy does the work. Light, heat, motion, and sound are examples of kinetic energy.

What are the Sources of Energy?

Primary energy sources (meaning energy is created directly from the actual resource) can be classified in two groups: nonrenewable or renewable. Secondary sources are derived from primary sources.

Non-Renewable Energy Sources – Energy from the ground that has limited supplies, either in the form of gas, liquid or solid, are called nonrenewable resources. They cannot be replenished, or made again, in a short period of time. Examples include: oil (petroleum), natural gas, coal and uranium (nuclear). Oil, natural gas and coal are called "fossil fuels" because they have been formed from the organic remains of prehistoric plants and animals.

Renewable Energy Sources – Energy that comes from a source that's constantly renewed, such as the sun and wind, can be replenished naturally in a short period of time. Because of this we do not have to worry about them running out. Examples include: solar, wind, biomass and hydropower. Currently, less than 2% of the world's electricity comes from renewable resources. There is a global debate as to whether geothermal energy is renewable or nonrenewable.

Secondary Energy Sources – Energy that is converted from primary sources are secondary sources of energy. Secondary sources of energy are used to store, move, and deliver energy in an easily usable form. Examples include electricity and hydrogen.

Use of energy in the home

We have many uses of energy both in the home and at work. Lack of energy will mean that most of the activities we should have done with ease will be difficult to do.

We may not be able to do some of such activities. Some of the things we can do with energy are shown in the below

Uses	Appliances
Boiling water	Immersion heater
Keeping the room cool	Air conditioner
Producing light for seeing in the dark	Candle or rechargeable lamp
Cooking food and boiling water	Electric cooler
Keeping food and drinks fresh and cool respectively	Refrigerator
Viewing news broadcasts, entertainment, advertisements and education	Television
Listening to news broadcasts, entertainment, advertisements and education	Radio

ASSESSMENT

1. Define energy?
2. What are the forms of energy?
3. List THREE sources of energy?
4. List FIVE things we can do with energy at home?

WEEK 7

Topic: DRUG ABUSE

Contents:

- Meaning of Drug
- Meaning of Drug Abuse+
- Methods of Drug Use
- Common ways of misusing drug
- Social risk factors in Drug abuse
- Causes of Drug Abuse
- Peer Influence

A. Meaning of Drug

Drug is a chemical substance that changes a person's mood or behavior when it is smoked, injected, inhaled, drank or swallowed in pill form. A drug is any substance other than food that by its chemical or physical nature can affect the structure or functions in living organism. When drugs are administered under proper medical supervision, they can serve three objectives namely

1. to relieve suffering
2. to combat disease
3. to save life

B. Meaning of Drug Abuse and Misuse

Drug Misuse means

- the use of a drug for a purpose or condition for which it is not suited
- The use of a drug for an appropriate purpose but in improper dosage.

Drug abuse is the overuse and misuse of legal and illegal drugs by individuals without prescription by medical personnel to cause a change in their physiological and psychological state which lead to legal and interpersonal problems. It also means the excessive or persistent use of a drug without regrad to accepted medical practice.

Drug abuse can also be defined as the inappropriate use of drugs. It is the habitual taking of addictive or illegal drugs. It is the use of drugs or substance in a wrong way.

Drug abuse means taking drugs not according to doctor's prescription. It could be by either taking overdose or under dose. Some common hard drugs that are easily abused or misused are heroin, cocaine, valium, madras and Indian hemp. People who abuse drugs easily are athletes, prostitutes and criminals.

C. Methods of Drug Abuse

1. **Self-Injection** – This involves injecting drugs directly into the blood stream through capillaries, arteries or veins. Injecting drugs is the fastest method for experiencing the high from drug use because it puts the drug directly into the bloodstream. Drugs can be injected into the soft tissue, into the muscle or directly into the vein. Individuals who inject drugs will experience the high within 3 to 5 seconds (immediately).
2. **Sniffing/Inhaling/Snorting** – Some individuals snort/sniff drugs such as ecstasy, cocaine, heroin and amphetamines. Drugs enter into the bloodstream through the nasal mucus membranes and through the stomach. Individuals snorting/sniffing drugs will experience the drug sensation within about 15 minutes after snorting their drugs.
3. **Absorption through the skin –** Drugs used in this form are mild body creams. Some are used to maintain the skin while some are used to treat skin diseases.
4. **Oral/Swallowing** – Ingesting or swallowing drugs is the most common method of drug use. The individual takes the drugs by mouth. The drugs pass to the stomach and then into the bloodstream
5. **Rectal –** Drugs are delivered into the bloodstream through the rectum's mucus membrane. This is not a common method of drug abuse, drugs that have been taken using this method are cocaine, speed and ecstasy.
6. **Smoking –** This method gets the drugs into the body's system a bit faster than swallowing the drugs because the smoke goes into the lungs where it quickly moves into the bloodstream. The most common drugs that are smoked are marijuana, heroin, crack and opium.

D. Common Ways of Misusing Drugs

- When a patient misunderstands the directions for use of prescribed drugs. For example, not taking the drugs at stipulated times, periods or intervals.

- Taking drugs not prescribed by the doctor – When a patient shares a prescribed drug with a friend or family member for whom the drug was not prescribed.
- When a patient takes the prescribed drugs for a purpose or condition other than that for which it was intended. For example, administering drugs intended for the treatment of stomach ache for headache.
- When a patient takes a dosage other than the recommended. In this case it might be overuse (overdose) or underuse (underdoes).
- Taking drugs to gain confidence or boldness to commit crimes such as suicide, rape, assault, hurting someone etc.
- Taking drugs to induce sleep without seeking for prescription from some qualified medical personnel
- Taking drugs to attain full sexual satisfaction
- Smoking so many cigarettes
- Taking alcoholic drinks to the extent of getting drunk
- Taking easily available substances like analgesic tablets, coffee at all times to stay awake
- Taking hard drugs like cocaine, marijuana and heroin to get high

E. Social Risks Factors In Drug Abuse

1. **Being brought up in a drug dependent family** – A child that grows up in this type of family will see nothing wrong in using drugs any how
2. **Having negative self – esteem** – A person with negative self-esteem is never satisfied with needs and may be setting unrealistic goals.
3. **Being unable to resist peer pressure** – In some groups, drugs are often part of social events and in the desire to fit in, the person certainly has to conform to the norms or rules of the group
4. **Being economically disadvantaged** – The little money the drug user has is often spent on drugs
5. **Experiencing Family Disruption** – A drug abuser may withdraw from family and friends as he or she becomes more dependent on drugs
6. **Mind-altering drugs –** e.g. alcohol and marijuana slow user's reaction and often impairs users sense of reasoning and judgement. Other risks or

consequences of drug abuse include:
i – the high tendency or attempt to commit suicide, risk of contracting HIV/AIDS
ii – gradual death of the liver (from alcohol)
iii – arrest for drug possession
iv – sexually transmitted diseases contraction
v – unwanted pregnancy

F. Causes of Drug Abuse

While many people use drugs, only a small percentage abuse drugs, but it has been noted drug abuse often runs in families, suggesting genetics is one of the causes of drug abuse. While having parents that abuse drugs puts a child at risk, it is possible for the child to grow up without drug abuse problems. It is also possible to abuse drugs without having any other drug abuser in the family. It is clear genetics alone is not the cause of drug abuse.

There are certain life circumstances, particularly among younger users, that are risk factors for, rather than the direct cause of, drug abuse. Parental abuse and neglect are commonly seen as part of the cause of drug abuse. An adolescent or pre-adolescent may be trying to gain attention from an inattentive parent or escape an abusive one by using drugs; prolonged attempts through drug use can be a cause of drug abuse. A drug user, or the presence of drugs in the home, can also be a major cause of drug abuse.

1. **Curiosity** – Some young people take drugs as a result of the desire to find out how it feels like to take drugs. Curiosity leads them to experimenting
2. **Lack of self-confidence** – A teenage boy may have a teenage girl he likes and wishes to befriend but he doesn't have the boldness to approach her. His lack of confidence to approach her may lead him to taking alcohol in order to boost his confidence.
3. **Trying to fit in a peer group –** A teenager may start smoking because he wants to fit in with his peer group.
4. **Trying to have a grown-up feeling** – Some youths take drugs because it gives them a feeling of being grown up
5. **Reduction of stress and frustration** – Some persons start taking drugs when they are under stress or feel frustrated as regards a particular situation in their lives.

G. Results of Drug Abuse

1. Drug abuse can lead to loss of job; workers who are addicted to drug become inefficient in their job and therefore can be sacked.
2. It can lead to stomach upset.
3. Some drugs lead to mental disorder; some drug when abuse leads to insanity.
4. It can lead to damaged nostrils and lungs.
5. It can lead to broken home
6. It can lead to skin rashes.
7. It can lead to poor academic achievement.
8. It can lead to uncontrollable sexual urge.
9. Drug abuse hurts the people who take drugs and the people around them, including families, kids, and babies who aren't born yet. Drug abuse hurts the body and the brain, sometimes forever.
10. It can lead to injection abscesses.
11. It can cause accident

H. Assessment

1. Causes of drug abuse include
   a. experimenting
   b. doing what others do
   c. the desire to feel like a grown up
   d. All of the above
2. The results of drug abuse are the following except
   a. it can lead to broken home
   b. it can lead to good marriage
   c. it can lead to mental disorder
   d. it can lead to loss of job
3. Which of the following statement is true about drug users
   a. A drug user develops positive self-esteem
   b. A drug user can resist peer pressure
   c. A drug user is economically disadvantaged
   d. A drug user does not depend on drugs

4. ____ is an example of a dug that can be abused
   a. coca cola
   b. cocaine
   c. valium
   d. heroine

5. Drugs are used for the following positive things except _____
   a. for preservation
   b. for growth
   c. for healing
   d. for misbehaving

Answers

1. D
2. B
3. C
4. A
5. D

Week 8 & 9

Topic: Crude Oil and Petrochemicals

Introduction

Nigeria as a nation is blessed with abundant mineral resources. These minerals include coal, columbine, limestone, tin and crude oil. Crude oil is also called petroleum. Crude oil is a mixture of hydrocarbons. It occurs naturally beneath the earth surface. In Nigeria, it is dark brown in color. It is a source of great revenue to Nigeria. It is believed that natural crude oil (petroleum) was formed from deep carbon deposits (remains of animals and plants) that date back to formation of the earth.

Meaning of Crude Oil as Petrochemicals

Crude oil is a mixture of hydrocarbons. It exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities.

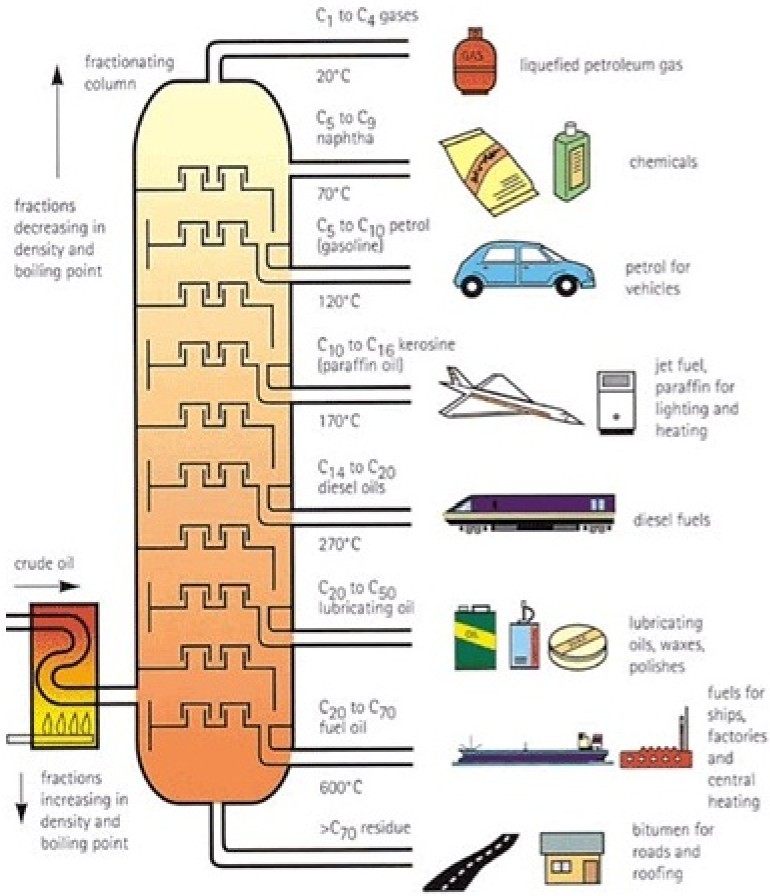
Crude oil occurs in large quantities in Nigeria, especially in Bayelsa, Edo, Imo, rivers, Delta, Abia, Ondo and Cross river state. It is dark brown in color though its composition and consistency vary from place to place. In fact, different oil producing areas yield significantly different varieties of crude oil. We have light and heavy crude oil. The light one has low metal and Sulphur content, light in color and flows easily. It is very expensive. The heavy one has high metal and Sulphur content and must be heated to become fluid. It is less expensive.

Meaning of Petrochemicals

Petrochemicals are chemical substances produced from petroleum in refining operations. They are heavy part of petroleum used mainly to produce plastic materials.

Refining of Crude Oil

Petroleum or crude oil occurs naturally. it contains many useful products also called fractions. These are separated by the method of fractional distillation. This process of obtaining useful fractions from petroleum is called refining.



Fractional distillation of Crude Oil

Fractional distillation of Crude Oil

Fractions of petroleum from refining are petroleum gases (Methane, butane, etc.), petrol or gasoline, kerosene, diesel, lubricating oil and bitumen (asphalt).

Uses of Refined Crude Oil Fractions

1. Petroleum gases are used for welding and as cooking gases
2. Petrol is used for driving cars
3. Kerosene is used for cooking, lighting lanterns and as aviation fuel
4. Diesel is used for driving lorries and trucks
5. Lubricating oil is used for removing rust and loosening nuts

6. Bitumen is used for road construction

Uses of Petrochemicals

1. Padding lining for insulation
2. Raw materials for making plastic items such as chairs, tables, pipes, plates, etc.

Importance of Crude Oil and Petrochemicals

Crude oil and its allied petrochemical products play important roles in the development of Nigeria as a nation. Such roles include:

1. Earning foreign exchange
2. Creating employment for workers
3. Bringing about industrialization in the areas where oil is discovered or refined
4. Providing raw materials for small-scale industries
5. Bringing about international recognition by other countries of the world
6. Providing opportunity for technology transfer

ASSESSMENT

1. Define Petrochemical?
2. List FIVE importance of crude oil and Petrochemical?
3. list FIVE uses of refined crude oil fractions?

WEEK 10

Topic: Elements, Compounds and Mixtures

Introduction

In our environment, we see iron nails, Sulphur roll, copper wire, aluminum sheets, etc. we also breathe in oxygen (air) to stay alive. These substances: iron, Sulphur, copper and oxygen, are referred to as elements.

Elements

Elements are substances that cannot be separated into simpler substances.

Any substance that contains only one kind of an atom is known as an element. Salt is made up of the elements sodium and chloride. Water is made up of the elements hydrogen and oxygen.

Each element is represented by a unique symbol. The notation for each element can be found on the periodic table of elements.

The elements can be divided into three categories that have characteristic properties: metals, nonmetals, and semimetals. Most elements are metals, which are found on the left and toward the bottom of the periodic table. A handful of nonmetals are clustered in the upper right corner of the periodic table. The semimetals can be found along the dividing line between the metals and the nonmetals.

Elements are made up of atoms, the smallest particle that has any of the properties of the element. John Dalton, in 1803, proposed a modern theory of the atom based on the following assumptions.

1. Matter is made up of atoms that are indivisible and indestructible.

2. All atoms of an element are identical.

3. Atoms of different elements have different weights and different chemical properties.

4. Atoms of different elements combine in simple whole numbers to form compounds.

5. Atoms cannot be created or destroyed. When a compound decomposes, the atoms are recovered unchanged.

These are the first 20 elements and their symbols, listed in order:

1 – H – Hydrogen
2 – He – Helium
3 – Li – Lithium
4 – Be – Beryllium
5 – B – Boron
6 – C – Carbon
7 – N – Nitrogen
8 – O – Oxygen
9 – F – Fluorine
10 – Ne – Neon
11 – Na – Sodium
12 – Mg – Magnesium
13 – Al – Aluminum
14 – Si – Silicon
15 – P – Phosphorus
16 – S – Sulfur
17 – Cl – Chlorine
18 – Ar – Argon
19 – K – Potassium
20 – Ca – Calcium

Chemists use one or two letters to represent elements. The symbol for aluminum is Al. The symbol for oxygen is O. The symbol for oxygen is O. "O" stands for one atom of oxygen. Oxygen atoms are joined in pairs. To write a pair of oxygen atoms using symbols, we use the symbol O and the number 2. Oxygen would be (O_2). A pair of oxygen atoms is a molecule of oxygen. A molecule is the smallest particle of a substance that exists independently. Molecules of most elements are made up of only one of atom of that element. Oxygen, along with nitrogen, hydrogen, and chlorine are made up of two atoms. The two balls represent the two oxygen molecules.

Compound

A compound is a substance formed when two or more elements are chemically joined. Water, salt, and sugar are examples of compounds. When the elements are joined, the atoms lose their individual properties and have different properties from the elements they are composed of. A chemical formula is used a quick way to show the composition of compounds. Letters, numbers, and symbols are used to represent elements and the number of elements in each compound.

Elements combine to form chemical compounds that are often divided into two categories.

- Metals often react with nonmetals to form ionic compounds. These compounds are composed of positive and negative ions formed by adding or subtracting electrons from neutral atoms and molecules.
- Nonmetals combine with each other to form covalent compounds, which exist as neutral molecules.

By convention, no subscript is written when a molecule contains only one atom of an element. Thus, water is H_2O and carbon dioxide is CO_2.

Mixtures

Mixtures are two or more substances that are mixed together but not chemically joined. In other word, a mixture contains two or more substances which can easily be separated by physical means. The constituents can be elements or compounds or both. In a given mixture, the constituents which may be present in different proportions retain their individual identities (properties). This is because their physical and chemical properties are not changed by simple mixing. Examples of mixtures are air, urine, blood, milk, Coca-Cola, petroleum, etc. forming a mixture does not involve chemical change. For instance, a mixture of common salt and water can easily be separated, with each other's component retaining its properties.

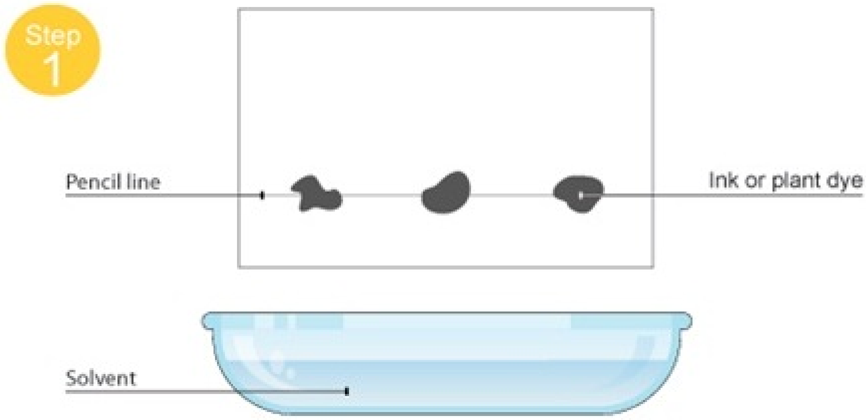
Methods of separating mixtures

The different substances in mixtures are usually easily separated from one another. The method you use depends upon the type of mixture you have.

Chromatography

This is good for separating dissolved substances that have different colors, such as inks and plant dyes. It works because some of the colored substances dissolve in the liquid better than others, so they travel further up the paper.

Separating dissolved substances

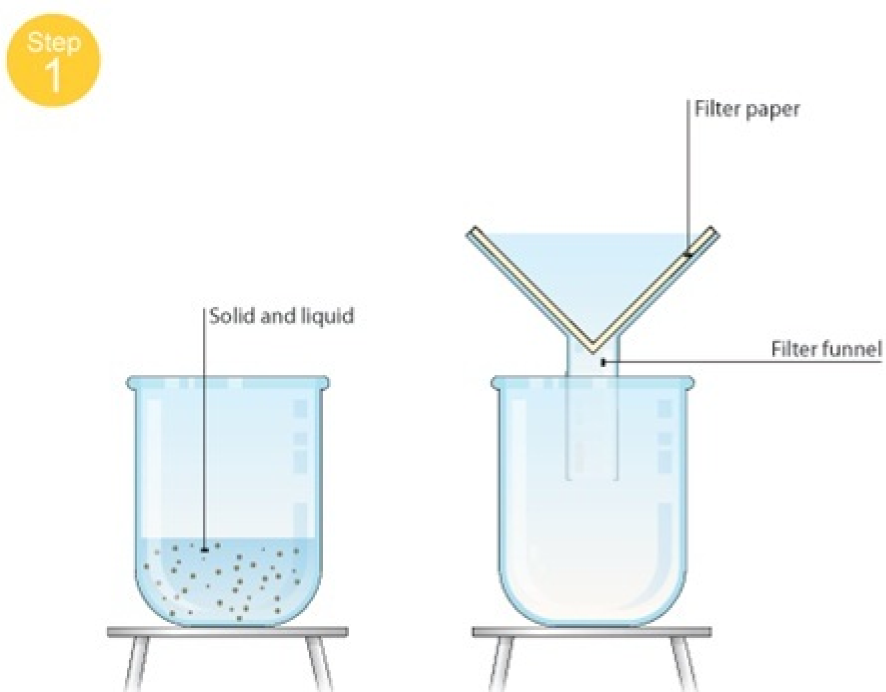


Filtration

Filtration is good for separating an insoluble solid from a liquid. (An insoluble substance is one that does not dissolve).

Sand, for example, can be separated from a mixture of sand and water using filtration. That's because sand does not dissolve in water.

Separating insoluble solids

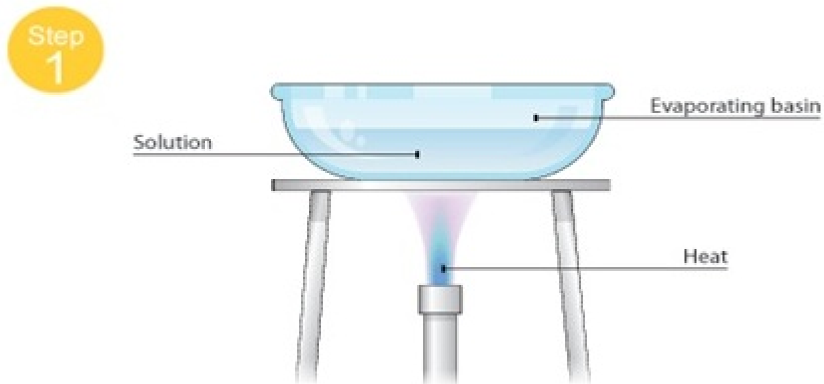


Evaporation

This is good for separating a soluble solid from a liquid (a soluble substance does dissolve, to form a solution).

For example, copper sulphate crystals can be separated from copper sulphate solution using evaporation. Remember that it is the water that evaporates away, not the solution.

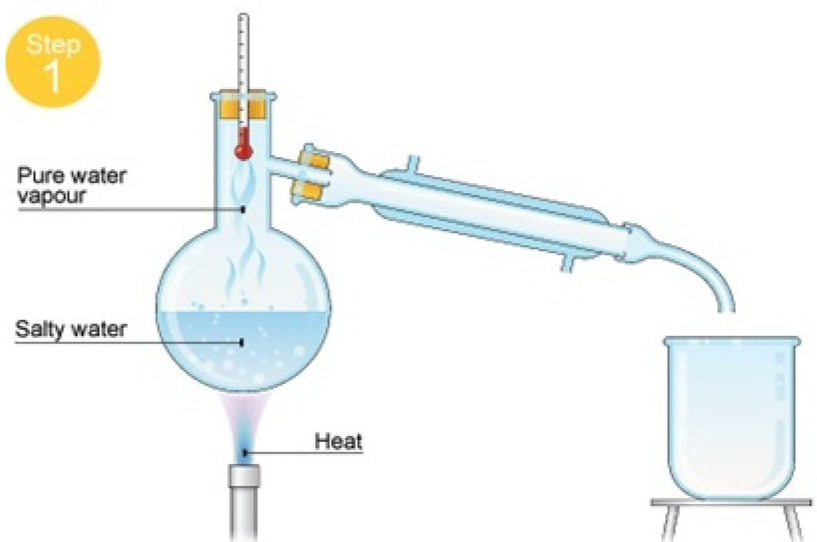
Separating a soluble solid



Simple distillation

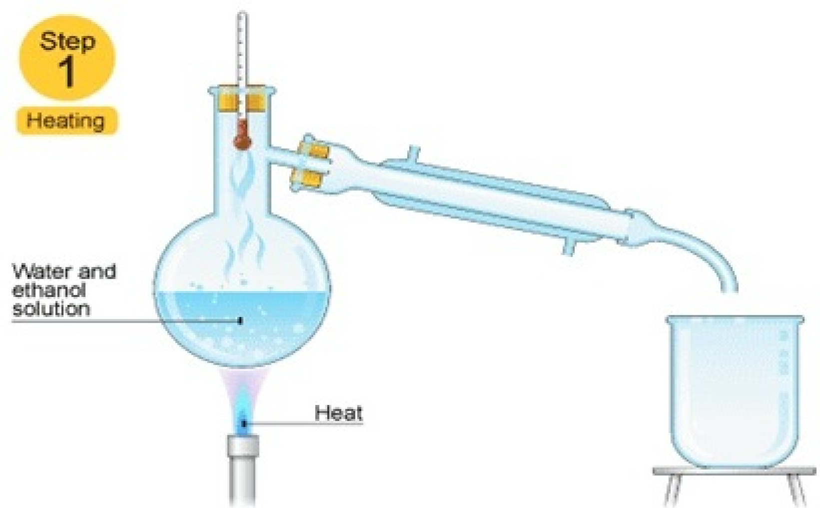
This is good for separating a liquid from a solution. For example, water can be separated from salty water by simple distillation. This method works because the water evaporates from the solution, but is then cooled and condensed into a separate container. The salt does not evaporate and so it stays behind.

Separating a liquid from a solution



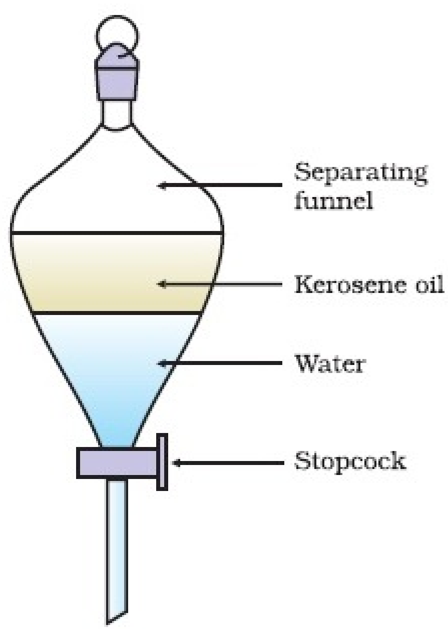
Fractional distillation

This is good for separating two or more liquids from each other. For example, ethanol (alcohol) can be separated from a mixture of ethanol and water by fractional distillation. This method works because the two liquids have different boiling points.



Separating funnel

If two liquids are immiscible, then a separating funnel is used.



For example: If you pour a mixture of oil and water into the funnel, the oil floats on top of the water. All that is left to do is for the tap to be opened to allow the water to pour through. The tap is closed once all the water has passed.

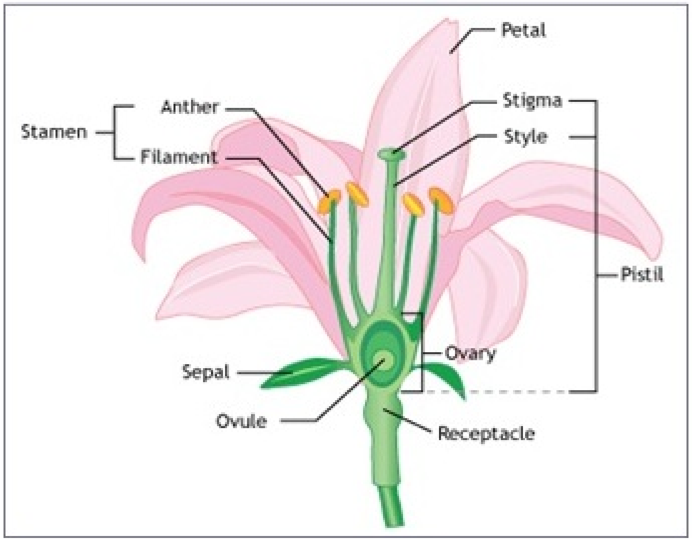
ASSESSMENT

1. Define Elements?
2. Elements can be divided into three categories, what are they?

WEEK 11

Topic: Reproduction in Plants

Introduction



Plant reproduction is the production of new individuals or offspring in plants, which can be accomplished by sexual or asexual reproduction. Sexual reproduction produces offspring by the fusion of gametes, resulting in offspring genetically different from the parent or parents. Asexual reproduction produces new individuals without the fusion of gametes, genetically identical to the parent plants and each other, except when mutations occur. All living things reproduce. Reproduction is the process of generating offspring.

Types of Reproduction

There are two main types of reproduction: sexual and asexual. Some organisms reproduce by only one type of reproduction and others can reproduce by both.

Asexual reproduction

The type of reproduction where cells from only one parent are used, is called asexual. Only genetically-identical organisms are produced by this type of reproduction.

Asexual reproduction in bacteria

Asexual reproduction is very common in microorganisms. Bacteria reproduce by binary fission. During binary fission, the cell divides into two daughter cells that are similar in size and shape.

Asexual reproduction in plants

Asexual reproduction in plants is also called vegetative reproduction. It usually involves only the plant's vegetative structures like roots, stems and leaves. For example, raspberries can produce a new generation using their stems; potatoes, using their roots; and geraniums can be grown from any piece of a parent plant.

Sporulation

Some types of mold reproduce through sporulation. They produce reproductive cells – spores – that are stored in special spore cases until they are ready to be released. After they are released they will develop into new, individual organisms. Bread mold reproduces by sporulation.

Budding

During budding, a new organism starts growing from the parent's body. At first it looks like a bud. This bud later develops into a mature organism. Sometimes it stays attached to the parent's body and sometimes it breaks off. Hydras reproduce by budding.

Gemmules

Gemmules are special structures that are found in sea sponges. A parent sponge releases gemmules that later develop into mature sponges.

Regeneration

In the process of regeneration, detached pieces of the parent's body can develop into a new organism if this body part contains enough genetic information. Some flat worms and starfish can reproduce by regeneration.

Advantages and disadvantages of asexual reproduction

- Asexual reproduction works well for organisms that stay in one place. Because they do not move, it is difficult for them to find a mating partner.
- Stable environments are the best places for organisms that reproduce asexually.
- Asexual reproduction is also much less time and energy consuming.
- Asexually-produced generation does not have any genetic variations. That means that these organisms will not have any 'material' for adapting to environmental changes. That is why many asexually-reproducing organisms can reproduce sexually as well.

Sexual Reproduction

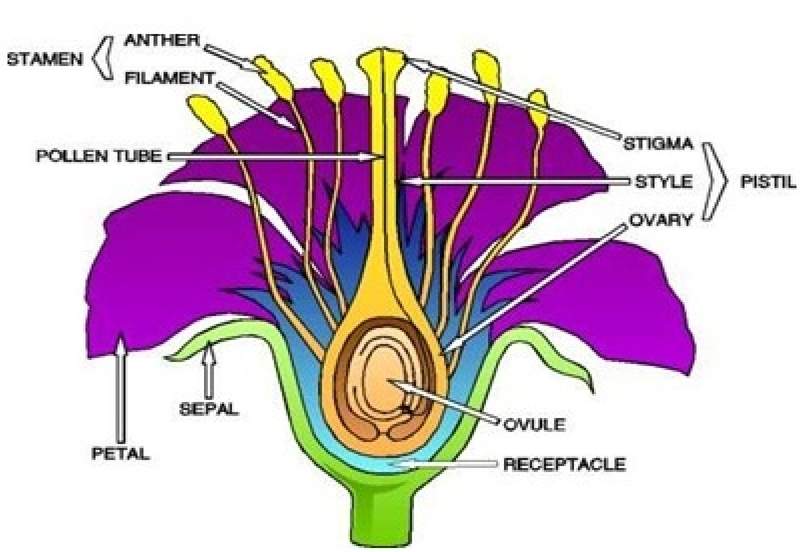
During sexual reproduction, two gametes from both parents fuse, forming a zygote. A zygote is also referred to as a fertilised egg. All gametes are haploid cells, meaning they have only one set of chromosomes (1n). So, when gametes fuse, they form a diploid organism: $1n+1n=2n$.

Sexual reproduction in algae

The simplest form of sexual reproduction in algae is conjugation, in which two similar organisms fuse, exchange genetic material and then break apart. Some multicellular green algae undergo a process called alternation of generations. During this process, generations of different types of organisms are produced: haploid and diploid. Haploid generation reproduces sexually. It is followed by diploid generation that reproduces asexually.

Sexual reproduction in flowering plants

Flowers contain both male and female parts. The female part is called the pistil, which consists of the ovary, ovule, style and stigma at the tip. Inside the ovary are the ovules. Each ovule contains an egg cell. The male structure is called the stamen. It consists of the filament and the pollen-producing anther. A new seed is formed when an egg cell joins with a pollen cell in the process of pollination. Pollination occurs when pollen grains are carried from the anther of the stamen to the stigma of the pistil.



ASSESSMENT

1. There are two main types of reproduction, they are___
2. Define Regeneration?