JSS2 IST TERM BASIC SCIENCE E-NOTE

THE HUMAN BODY (SKELETON)

MUSCULAR SYSTEM

RESPIRATORY SYSTEM

CIRCULATORY SYSTEM

DIGESTIVE SYSTEM

REPRODUCTIVE SYSTEM

EXCRETORY SYSTEM

HUMAN BEINGS AS HIGHER ANIMALS

MEASUREMENT OF LENGTH, TIME, WEIGHT AND VOLUME

WEEK 1

CONTENT:

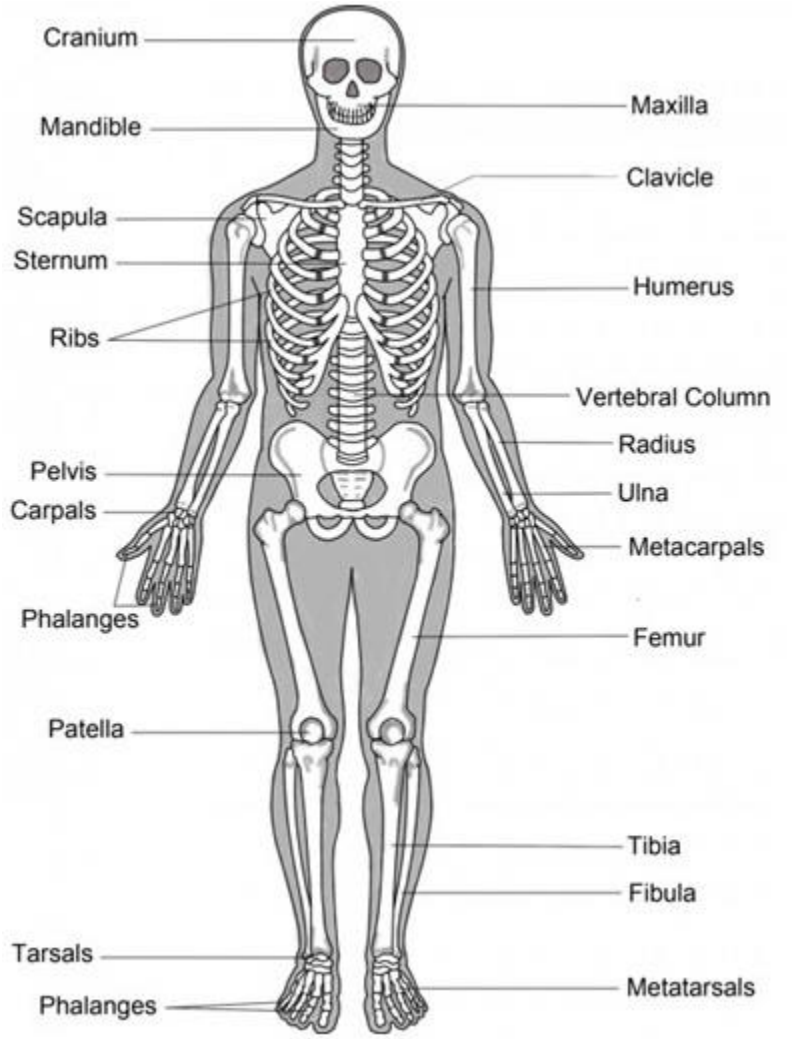
Topic: The Human Body (Skeletal System and Movement)

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
	Thoracic vertebra	Chest	12	13	12
	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 (humerus, 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 fibre-like material found at the ends of muscles. It binds two neighbouring 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.

<u>WEEK 2</u>

<u>Muscles</u>

Muscle is a band or bundle of fibrous tissue in a human or animal body that has the ability to contract, producing movement in or maintaining the position of parts of the body.

Classes of Muscles

They are;

- ☐ Voluntary Muscles: These are the muscles which have control over. They include muscles of arms and legs.
- ☐ Involuntary Muscles: These are muscles that meet on their own accord, e.g. stomach, muscle of intestine, heart.

Types of Involuntary Muscles

There are two main types:

- Bicep Muscles: These are the muscles that contact whenever we move the body.
- Tricep Muscles: These are the muscles that relax whenever we move the body.

Functions of Muscles

- ☐ It gives the body shape, movement and beauty
- ☐ It produces flesh that covers the bone.

Posture

This is the way we carry our body. Our posture can be improved through body exercise such as running, jumping, etc.

Tests and Exercises

1. The components of joint are (a) bone cartilage, tendon, Ligament (b) Cartilage chitin, muscle fibre, tendon (c) tendon, synovial capsules, cuticle, fibro elastic

   Answer: Bone cartilage tendon ligament

2. Elbow can be found in which type of joint (a) ball and Socket (b) Suture joint (c) Pivot joint (d) Hinge joint

   Answer: Hinge joint

3. Ankle can be found in which types of joint (a) pivot joint (b) Gliding joint (c) Ball and socket joint (d) None of the above. Answer: Gliding joint.

4. The two types of muscles are; (a) Involuntary and voluntary muscle (b) Tricept and voluntary muscle (d) Tricept and biceps muscle (d) None of the above.

   Answer: Involuntary and voluntary muscle.

5. Movable joints include (a) Suture and pivot joint (b) Socket and Hinge joint (c) Gliding and Suture joint (d) pivot and gliding joint. Answer: Socket and Hinge joint.

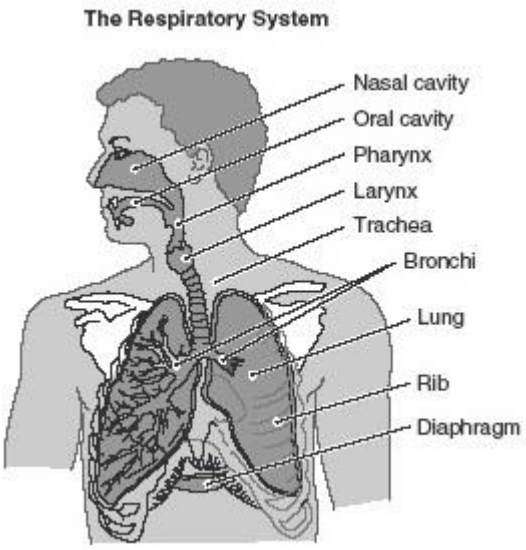
WEEK 3

Respiratory System

Introduction

Respiration is the breakdown (oxidation) of digested food mostly (carbohydrate and fat), with oxygen from the air taken in the cells of animals to release energy and produce carbon dioxide.

Parts of Respiratory System



These are made up of all the organs working together to supply the blood cells with oxygen and to free the cells from carbon dioxide. These organs include the nose, mouth, trachea, bronchi, bronchioles and alveoli.

- Nose: The nose has two openings known as nostrils through which air enters into the lungs.
- Trachea: This is a ringed tube connecting the pharynx and the bronchus. It is known as the wind pipe which filters and moistens air.
- Bronchi: These are the two branches of the trachea, i.e. the left and the right trachea. Each bronchus leads air from trachea into the lungs.
- Bronchioles: These are small passages that are very many in number through which air passes into the alveoli.
- Alveoli: These are air sacs which make up the lungs and are surrounded by blood capillaries. Gas exchange takes place in the blood capillaries of the alveoli.

Functions of the Respiratory System

Breathing

This is the taking in of air (rich in oxygen) into the lungs which is inspiration and releasing of air (rich in carbon (iv) oxide) from the lungs. Which is expiration. Breathing involves the following:

i. External respiration: This is the exchange of oxygen and carbon (iv) oxide between the air and blood in the lungs.

ii. Internal respiration: This is the exchange of oxygen and carbon (iv) oxide between the blood and tissue fluid.

iii. Cellular respiration: This is respiration that occurs in the cells of the body to produce energy.

The Mechanism of Breathing

Air which is rich in oxygen and (carbon (iv) oxide) from the surrounding environment enters the body through the nose. From the nose that air get into bronchioles through the trachea, to the pharynx and the bronchus (Bronchi). From the bronchioles, the air enters the alveoli where it diffuses into the blood. The oxygen then oxidizes the digested food substances to produce energy and carbon (iv) oxide and water are given out as waste products.

Problems Connected with Breathing

These are the problems that come up when there is an alteration in the respiratory or breathing process. They include:

- **Asthma**: This is a disease of the bronchi and bronchioles that is marked by wheezing, breathlessness (shortness of breath) and sometimes coughs. It occurs as a result of inflammation of the airway due to irritation. Any person suffering from this ill health is allergic (sensitive in a bad way) to certain substances, such as dust, pollen, cigarette smoke and industrial fumes.
- **Pneumonia**: This is a viral or bacterial infection of the lungs in which the bronchi and alveoli are filled with a thick fluid making gas exchange difficult. A patient suffering from pneumonia suffers from headache, chest pain and sometimes high fever.
- **Pulmonary Fibrosis**: This is as a result of inelasticity of the fibrous connective tissues that build up in the lungs. Under certain conditions, for reasons that are poorly understood, lung damage leads to pulmonary fibrosis. In other words, the normal structure of the lungs is disrupted by the accumulation of fibrous connective tissues proteins.
- **Pulmonary Tuberculosis**: This is caused by bacteria. The bacteria cause the inelasticity of the lungs, thereby making breathing difficult
- **Emphysema**: This is the damage of the walls of the air sacs/ alveoli resulting in a reduced surface area for gas exchange. The surface area for gas exchange is reduced, hence the oxygen reaching the brain and heart is also reduced. When this happens, the patient may feel depressed and sluggish. Therapy for this problem includes giving up smoking, engaging in physical exercise and giving oxygen artificially.

WEEK 4

Topic: Circulatory System

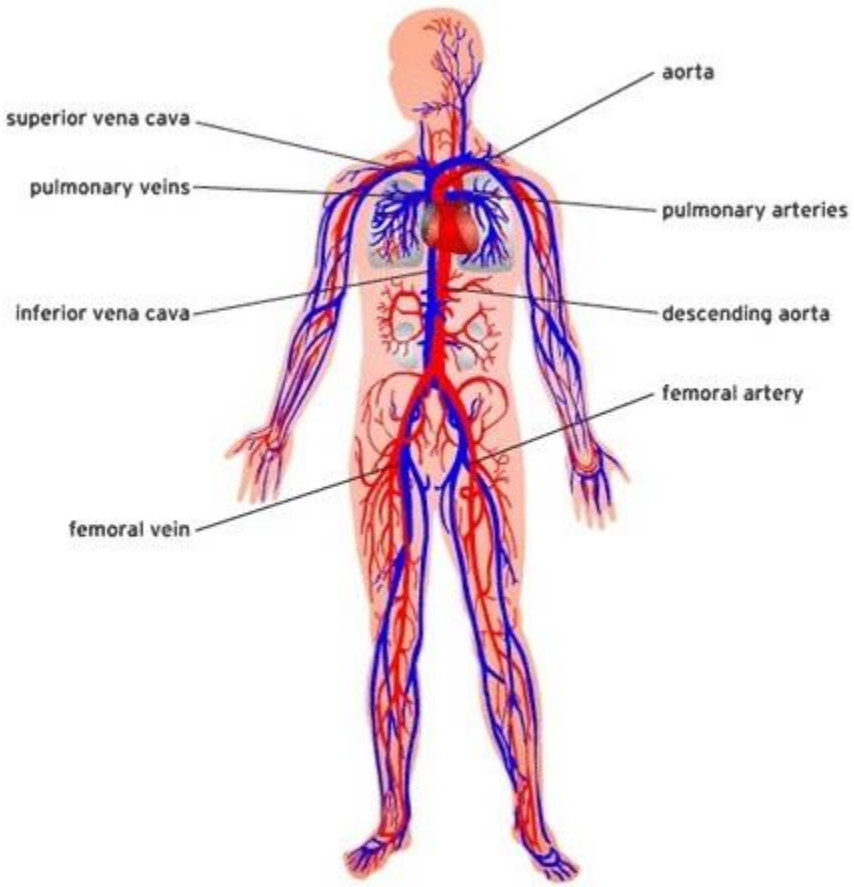
Introduction

Higher organisms e.g. man, require blood to carry materials to and from different parts of their body. There is need for organisms to transport oxygen from the lungs to other living cells within the organisms and also, dissolved food materials absorbed in the villi to other parts of the body which need them. Circulation is the process by which absorbed food materials are carried through arteries, capillaries and veins to all parts of the body where they are utilized for body functioning. Materials which are transported by blood in human body are water, salts, hormones, oxygen,

digested food, etc. waste materials also removed from the body through blood circulation.

Parts of the Circulatory System

The organs that are responsible for blood circulation in the body are together called the circulatory system. The circulatory system consists of the blood vessels and the heart.

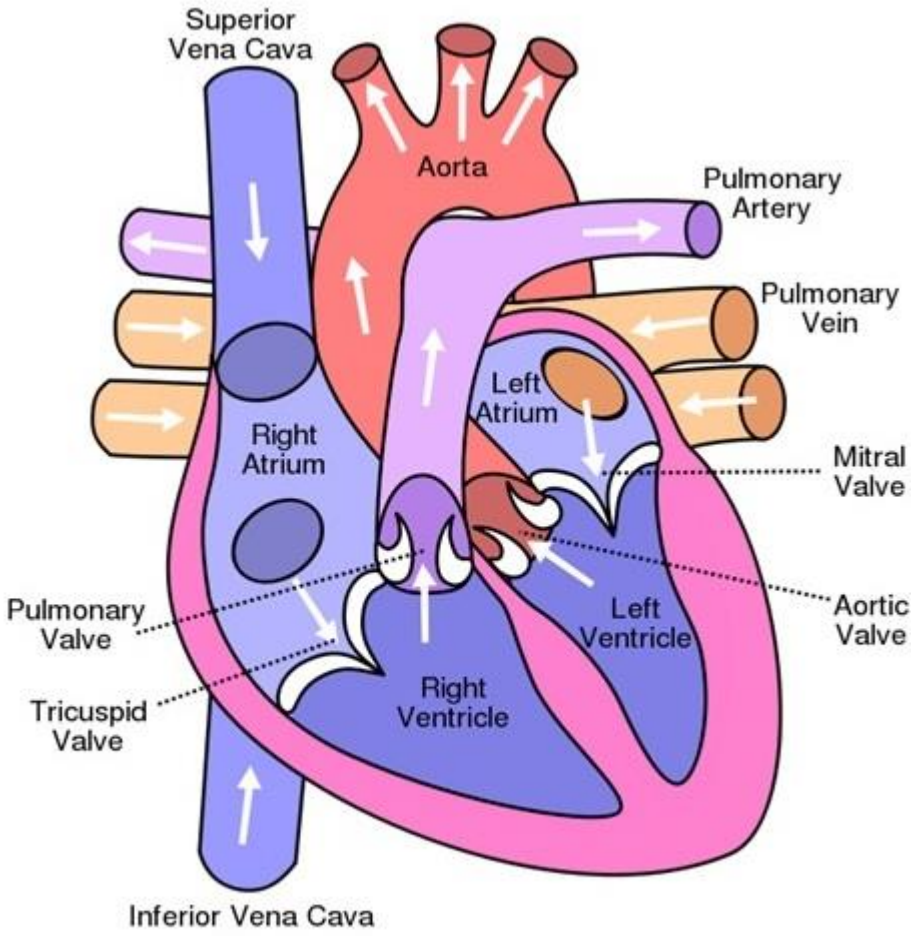


The Structure of the Circulatory System

The Heart

The heart pumps blood to all part of the body through the circulatory system. The heart is a muscular organ that lies in the chest cavity and is almost conical in shape. It is made up of four chambers. These four chambers include two upper chambers which are the right auricle and left auricle; and two lower chambers, the right ventricle and left ventricle. Blood enters the heart at the auricles and leaves from the ventricles. The heart is constantly beating, contracting and relaxing. There are about 70-75 beats

per minute although this beating rate may vary with individuals. Beating rate is faster in children than in adults.



The Structure of the Heart

Blood Vessels

These are channels or routes through which blood passes to different parts of the body. There are three types of blood vessels; the arteries, veins and capillaries.

1. **Arteries**: These are the blood vessel that carry blood away from the heart to all parts of the body except the pulmonary artery.
2. **Veins**: These are blood vessels that carry blood to the heart from all parts of the body except the pulmonary vein.
3. **Capillaries**: These are tiny networks of blood vessels that connect arteries to veins. Blood flows out from the heart through arteries to all

parts of the body, through capillaries and then into the veins, and back to the heart where circulation continues.

Characteristics of Capillaries

1. They are small, very thin walled vessels which lie between the cells of human organs.
2. They connect the arteries with the veins
3. They allow food and oxygen to pass from the blood to the body cells
4. They also collect waste materials from cells
5. They allow the exchange of materials between the blood and cells.

Importance of Circulatory system

1. Helps in excretion of waste products from the body
2. Digested food materials like glucose, amino acids, fatty acids and glycerol are carried from the intestine to the tissues where they are stored or used up, water and oxygen are also carried by the blood.
3. Protection of the body against diseases e.g. white blood cells
4. Regulation of the body temperature: the blood helps in the distribution of heat produced in muscles and organs like liver, to other parts of the body.
5. Helps in blood clotting in wounds e.g. blood platelets
6. Sustains life by supplying nutrients to cells

Blood defects and Diseases

Blood is made up of the blood particles and plasma. The blood particles are the:

1. Red blood cells (erythrocytes)
2. White blood cells (leucocytes)
3. Platelets (thrombocytes)

While plasma is the liquid part of the blood which consists of water, proteins, dissolved food materials, mineral salts, waste products, etc.

Blood defects are those imperfections associated with the normal state of the blood, for example, high blood pressure and low blood pressure. Blood diseases are illnesses associated with the blood such as anaemia.

There are several defects and diseases of the blood, but we shall consider defects and diseases such as anaemia, hemophilia, sickle cells and leukaemia.

Anaemia: This is a blood disease resulting from shortage of red blood cells in the blood. As a result of this, less oxygen is supplied to the cells and to the entire body system. There is usually general tiredness for the sufferer because the body requires more energy which it does not get for proper body functioning.

Sickle cells: This is a kind of anaemia caused by abnormally shaped (sickle shaped) red blood cells. These red cells cannot carry oxygen, hence the patient faints occasionally. The disease is inherited.

Leukaemia: This is another disease of the blood that occurs as a result of over production of the white blood cells. Hence, the balance of the blood components is altered so that there is imbalance of red and white blood cells. Intensive radiation exposure or moderately intense exposure for long periods increases the risk of acute and chronic lymphocytic leukaemia.

The Movement of Blood through the Left and Right Ventricles and Auricles

From the left side of the heart, blood flows from the pulmonary veins to the left auricle, to the left ventricle to the aorta and to all parts of the body. The blood here is oxygen-rich (re-oxygenated).

On the right side of the heart, blood flows from the vena cavae to the right auricle, to the right ventricle and then to the pulmonary artery.

The blood from two sides of the heart does not mix because of the presence of a dividing structure called septum.

WEEK 5

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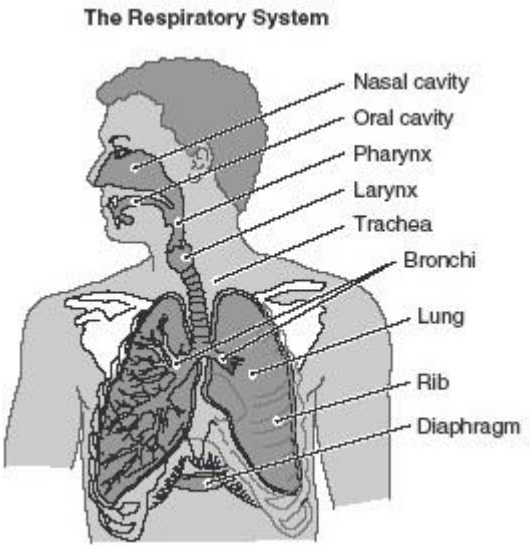

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WEEK 6

Human Reproductive System

Introduction

The reproductive system or genital system is a system of sex organs within an organism which work together for the purpose of reproduction. Reproduction is a process involving coming to life of new organisms either from one parent or a pair of parent organisms. Reproduction allows continuity of life. It may be sexual or asexual.

☐ Sexual reproduction involves the fusion of two different sex cells which usually come together from two different parents to produce an offspring. Gametes are formed by a kind of cell division called meiosis.

☐ Asexual reproduction involves only one parent. An individual produces an offspring by itself. There is no fusion of nuclei, and the cells which give rise to the offspring usually divide by means of mitosis.

Structure and Functions of Female Reproductive System

The female reproductive system is designed to carry out several functions. It produces the female egg cells called the ova for reproduction. The system is designed to transport the ova to the site of fertilization. The fertilization of an egg by a sperm normally occurs in the fallopian tubes. The fertilized egg is implanted into the walls of the uterus (womb), beginning the initial stages of pregnancy. If fertilization and/or implantation do not take place, the system is designed to menstruate. In addition, the female reproductive system produces female sex hormones that maintain the reproductive cycle. The human female reproductive system contains three main parts: the vagina, which leads from the vulva, the vaginal opening, to the uterus; the uterus, which holds the developing fetus; and the ovaries, which produce the female's ova.

I. Vagina: The vagina is a canal that joins the cervix (the lower part of uterus) to the outside of the body. It also is known as the birth canal.

II. Uterus (womb): The uterus is a hollow, pear-shaped organ that is the home to a developing fetus. The uterus is divided into two parts: the cervix, which is the lower part that opens into the vagina, and the main body of the uterus, called the corpus. The corpus can easily expand to hold a developing baby. A channel through the cervix allows sperm to enter and menstrual blood to exit.

III. Ovaries: The ovaries are small, oval-shaped glands that are located on either side of the uterus. The ovaries produce eggs and hormones.

IV. Fallopian tubes or oviduct: These are narrow tubes that are attached to the upper part of the uterus and serve as tunnels for the ova (egg cells) to travel from the ovaries to the uterus. In conception, the fertilization of an egg by a sperm normally occurs in the fallopian tubes. The fertilized egg then moves to the uterus, where it implants into the lining of the uterine wall.

Structure and Functions of Male Reproductive System

The male reproductive system includes the scrotum, testes, spermatic ducts, sex glands, and penis. These organs work together to produce sperm, the male gamete, and the other components of semen. These organs also work together to deliver semen out of the body and into the vagina where it can fertilize egg cells to produce offspring.

I. Testes: are two oval-shaped organs present in the lower part of the abdomen. The 2 testes, also known as testicles, are responsible for the production of sperm and the male sex hormone, testosterone.

II. Scrotum: This is a sac-like organ made of skin and muscles that houses the testes. It protects the testes and epididymis.

III. Epididymis: It is a long (6m) coiled tube on the outside of testes. It is for the temporary storage of sperm after production until when matured.

IV. Sperm duct or vas deferens: is a narrow tube which leads from the epididymis to the seminal vesicle. They join with the tube from the bladder to form the urethra. It carries urine or sperms though cannot carry both together.

V. Prostate gland, Seminal vesicle and Cowper's gland: are along the sperm tubes and urethra. They secrete fluid (seminal fluid) containing food and enzymes to activate the sperms as well as make them mobile (fluid + sperm = semen).

VI. Penis: is an intromittent organ for introducing sperms into the female reproductive organ (vagina). The penis contains spongy tissues which can be filled with blood and become erected. It introduces the sperm into the vagina of the female and for urination.

VII. Urethra: is a narrow tube which prolongs into the penis. The urethra is urinogenital in function, that is, it serves as a means of reproduction as well as excretion. It aids the passage of sperm into vagina and the passage of urine out of the body.

Sex cells

The reproductive sex cells are also known as gametes. The formation of gametes called gametogenesis takes place in the gonads (Testes and Ovaries)

Male Gametes or Sex Cells called sperms are produced in the testes by a process called spermatogenesis. The gamete is unicellular in nature. The sperm consists of a head which contains the nucleus, a middle piece and a whip-like tail or flagellum.

Parts and Functions of Sperm Cell

I. Acrosome: is located at the posterior end of the head which contain lytic enzymes used to dissolve the egg membrane and enhances the penetration of the egg during fertilization.

II. Middle piece: it contains numerous mitochondria which generate the energy used by the sperm to swim towards the egg.

III. Nucleus: is found in the head of the sperm cell and contains the genetic materials which fuse with the nucleus of the egg or ovum.

IV. Long whip-like tail or flagellum: it helps to move the sperm cell.

Female Sex Cells or Gametes: also called the eggs or ova are produced in the ovaries by a process called oogenesis. The human female gametes are larger than the sperm. It consists of the cytoplasm, a nucleus in the centre, granules and yolk droplet. The yolk provides a source of nourishment for the embryo, especially at the early stages of development. The nuclei of the sperm and ovum contain chromosomes (thread-like materials) which carries the genes. The genes are the transmittable character from parents to offspring.

TESTS AND QUESTION

1. After sperm are produced, they are delivered first to the (a) vas deferens (b) urethra (c) Epididymis (d) seminal vesicle Answer: Epididymis

2. What is the name of the vesicle at the tip of a sperm cell that contains enzymes that will help the sperm cell penetrate an egg cell

it encounters? (a) scrotum (b) nucleus (c) mitochondria (d) acrosome Answer: Acrosome

3. In humans, fertilization of egg normally takes place when the egg and sperm unite in the (a) vagina (b) fallopian tube (c) uterus (d) ovaries. Fallopian tube

4. The duct that transport sperm into the urethra is_____ (a) vas deferens (b) epididymal duct (c) ureter (d) none of the above Answer: Vas deferens

5. The production of ova is called _____ (a) spermatogenesis (b) oogenesis (c) ovanogenesis (d) all of the above Answer: Oogenesis

WEEK 7

EXCRETORY SYSTEM

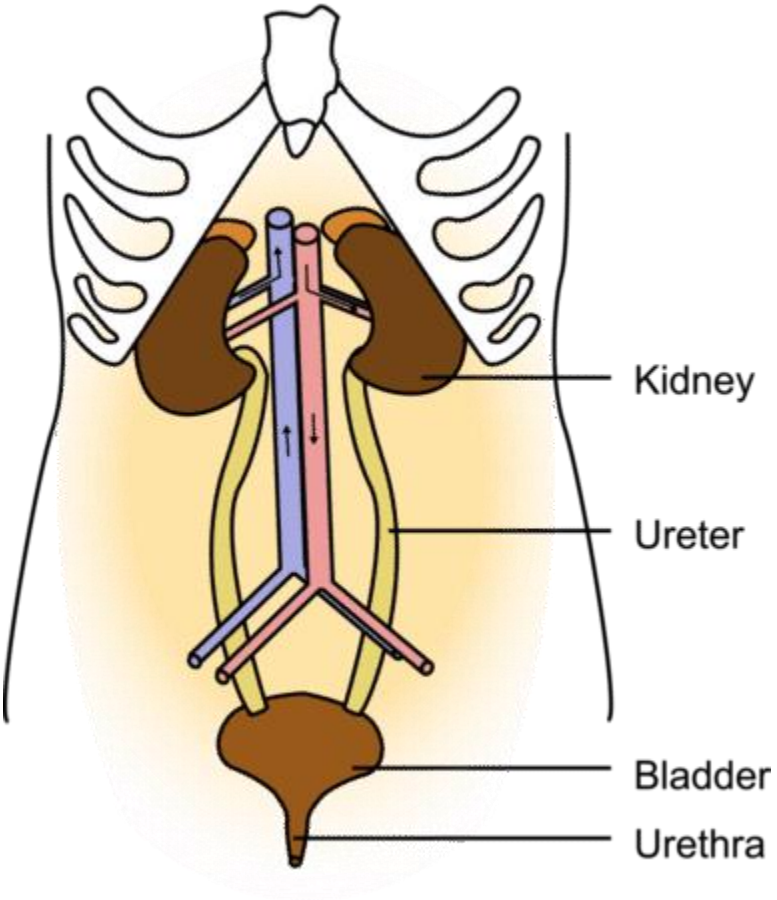
Excretion

Excretion is the process of removing wastes and excess water from the body. It is one of the major ways the body maintains homeostasis. Although the kidneys are the main organs of excretion, several other organs also excrete wastes. They include the large intestine, liver, skin, and lungs. All of these organs of excretion, along with the kidneys, make up the **excretory system**. This lesson focuses on the role of the kidneys in excretion. The roles of the other excretory organs are summarized below:

- The large intestine eliminates solid wastes that remain after the digestion of food.
- The liver breaks down excess amino acids and toxins in the blood.
- The skin eliminates excess water and salts in sweat.
- The lungs exhale water vapor and carbon dioxide.

Urinary System

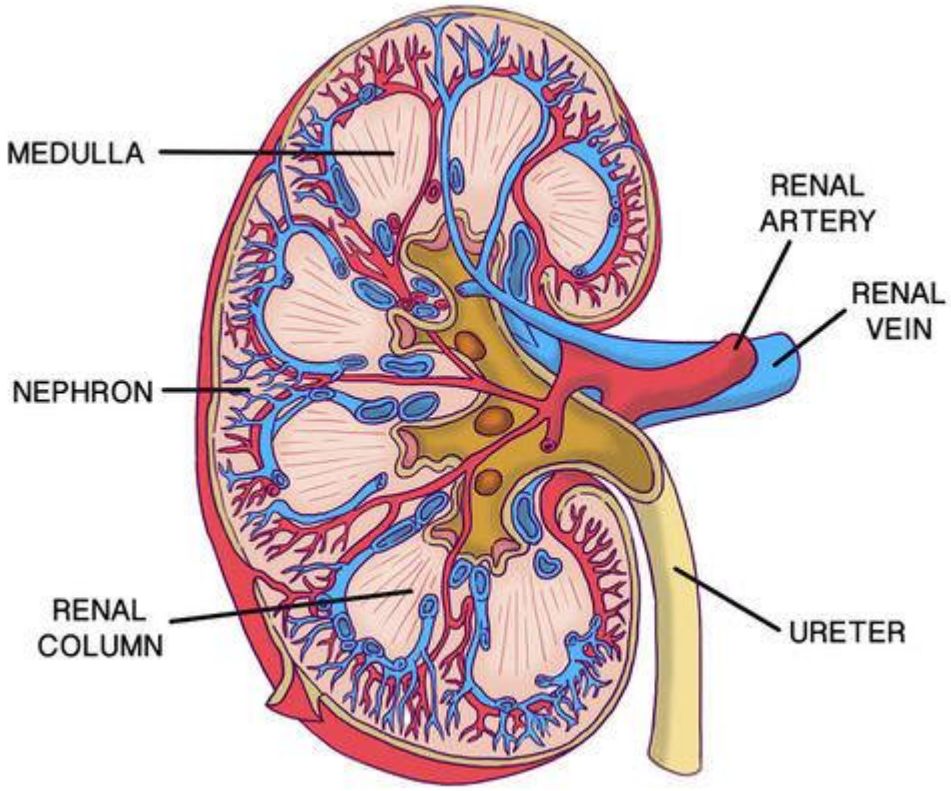
The kidneys are part of the **urinary system**, which is shown in **Figure** below. The main function of the urinary system is to filter waste products and excess water from the blood and excrete them from the body.



The kidneys are the chief organs of the urinary system.

Kidneys and Nephrons

The kidneys are a pair of bean-shaped organs just above the waist. A cross-section of a kidney is shown in **Figure** below. The function of the kidney is to filter blood and form urine. **Urine** is the liquid waste product of the body that is excreted by the urinary system. **Nephrons** are the structural and functional units of the kidneys. A single kidney may have more than a million nephrons!

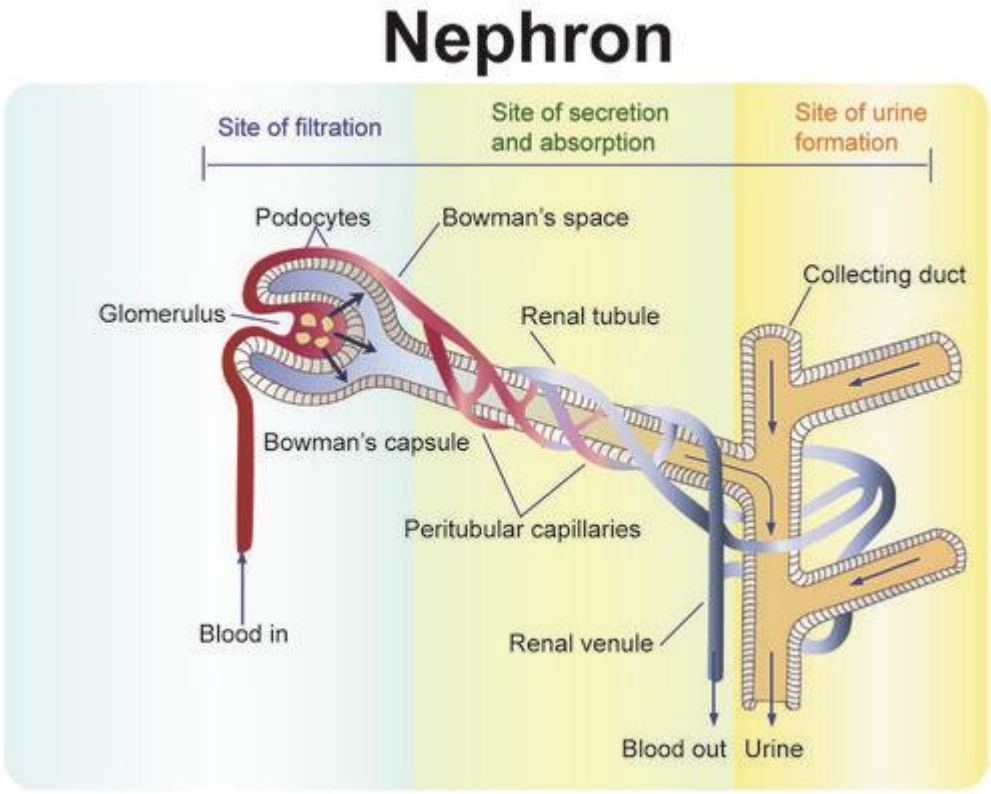


Filtering Blood and Forming Urine

As shown in **Figure** below, each nephron is like a tiny filtering plant. It filters blood and forms urine in the following steps:

1. Blood enters the kidney through the renal artery, which branches into capillaries. When blood passes through capillaries of the glomerulus of a nephron, blood pressure forces some of the water and dissolved substances in the blood to cross the capillary walls into Bowman's capsule.
2. The filtered substances pass to the renal tubule of the nephron. In the renal tubule, some of the filtered substances are reabsorbed and returned to the bloodstream. Other substances are secreted into the fluid.

3. The fluid passes to a collecting duct, which reabsorbs some of the water and returns it to the bloodstream. The fluid that remains in the collecting duct is urine.



The parts of a nephron and their functions are shown in this diagram.

Excretion of Urine

From the collecting ducts of the kidneys, urine enters the **ureters**, two muscular tubes that move the urine by peristalsis to the bladder (see **Figure** above). The **bladder** is a hollow, sac-like organ that stores urine. When the bladder is about half full, it sends a nerve impulse to a sphincter to relax and let urine flow out of the bladder and into the urethra. The **urethra** is a muscular tube that carries urine out of the body. Urine leaves the body through another sphincter in the process of **urination**. This sphincter and the process of urination are normally under conscious control.

Kidneys and Homeostasis

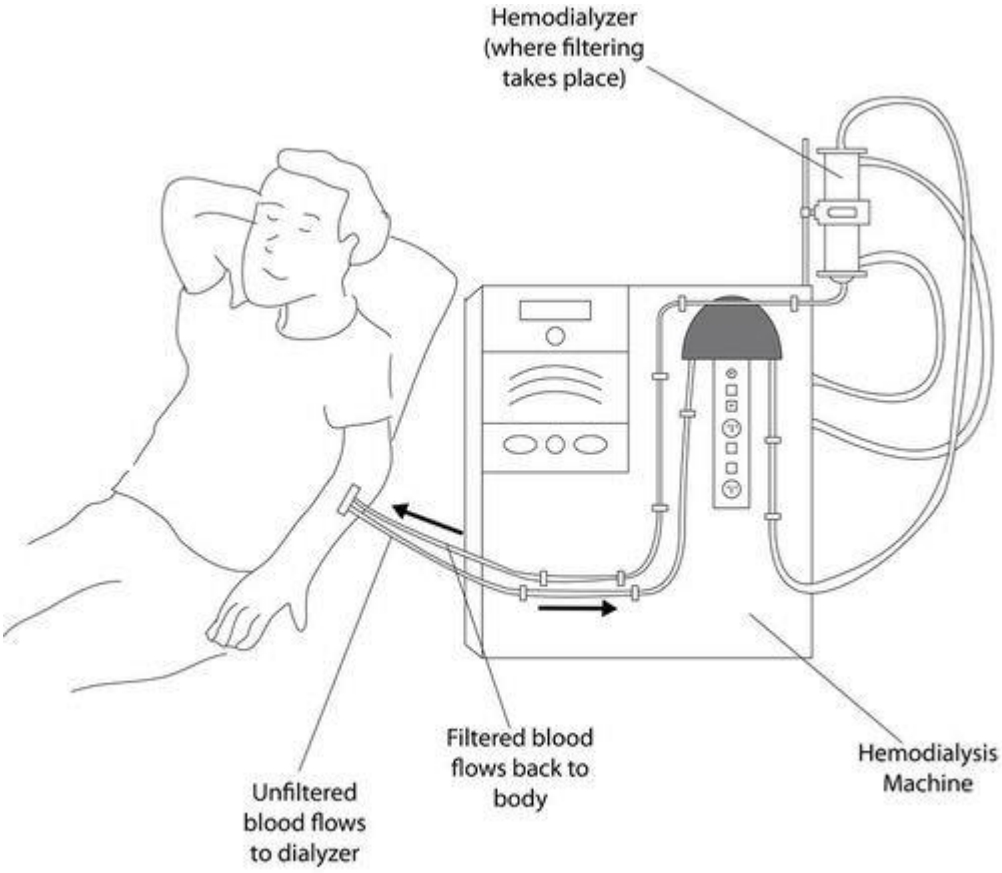
The kidneys play many vital roles in homeostasis. They filter all the blood in the body many times each day and produce a total of about 1.5 liters of

urine. The kidneys control the amount of water, ions, and other substances in the blood by excreting more or less of them in urine. The kidneys also secrete hormones that help maintain homeostasis. Erythropoietin, for example, is a kidney hormone that stimulates bone marrow to produce red blood cells when more are needed. The kidneys themselves are also regulated by hormones. For example, antidiuretic hormone from the hypothalamus stimulates the kidneys to produce more concentrated urine when the body is low on water.

Kidney Disease and Dialysis

A person can live a normal, healthy life with just one kidney. However, at least one kidney must function properly to maintain life. Diseases that threaten the health and functioning of the kidneys include kidney stones, infections, and diabetes.

- Kidney stones are mineral crystals that form in urine inside the kidney. They may be extremely painful. If they block a ureter, they must be removed so urine can leave the kidney and be excreted.
- Bacterial infections of the urinary tract, especially the bladder, are very common. Bladder infections can be treated with antibiotics prescribed by a doctor. If untreated, they may lead to kidney damage.
- Uncontrolled diabetes may damage capillaries of nephrons. As a result, the kidneys lose much of their ability to filter blood. This is called **kidney failure**. The only cure for kidney failure is a kidney transplant, but it can be treated with dialysis. **Dialysis** is a medical procedure in which blood is filtered through a machine (see **Figure** below).



A dialysis machine filters a patient's blood.

Lesson Summary

- Excretion is the process of removing wastes and excess water from the body. It is one of the major ways the body maintains homeostasis. Organs of excretion make up the excretory system. They include the kidneys, large intestine, liver, skin, and lungs.
- The kidneys filter blood and form urine. They are part of the urinary system, which also includes the ureters, bladder, and urethra.
- Each kidney has more than a million nephrons, which are the structural and functional units of the kidney. Each nephron is like a tiny filtering plant.
- The kidneys maintain homeostasis by controlling the amount of water, ions, and other substances in the blood. They also secrete hormones that have other homeostatic functions.

- Kidney diseases include kidney stones, infections, and kidney failure due to diabetes. Kidney failure may be treated with dialysis.

EVALUATION

1. What is excretion?

2. List organs of the excretory system and their functions.

3. Describe how nephrons filter blood and form urine.

4. State the functions of the ureters, bladder, and urethra.

WEEK 8

HUMAN BEINGS AS HIGHER ANIMAL

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, aeroplanes, 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

WEEK 9

Topic: <u>Measurement</u>

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 Metre	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:

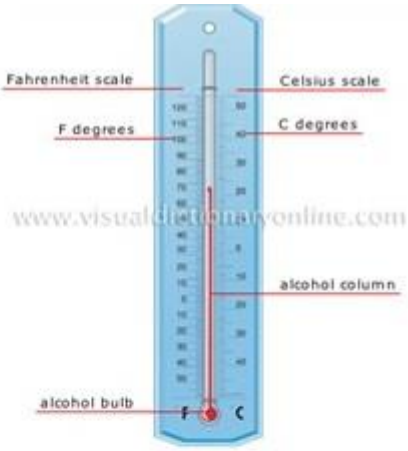
$$ms^{-2} = \frac{m}{s^2}$$

MEASURING DEVICES

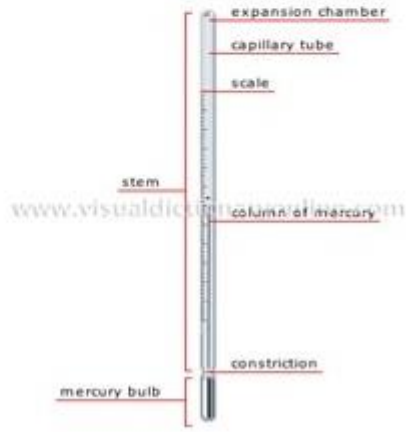
Instruments for determining various quantities such as temperature, mass, height, length, voltage and mechanical force.

Measure of temperature

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



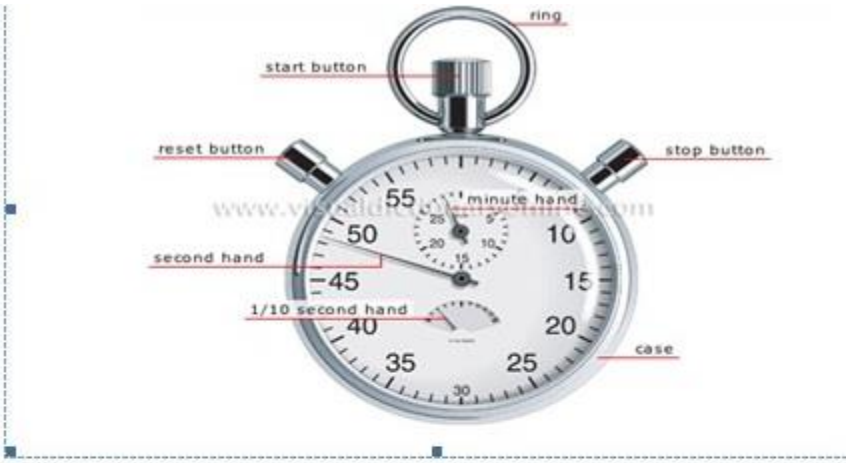
Thermometer



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

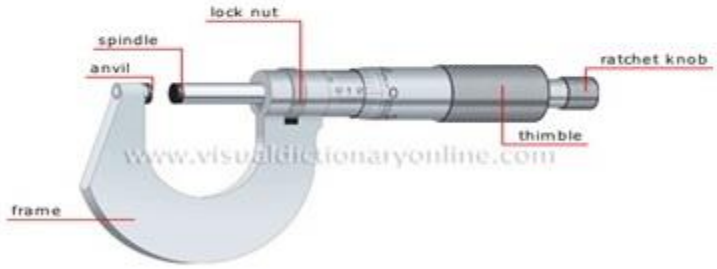
Roberval's balance

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.

ruler

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?