MODULE THREE

Welcome to the last module of your biology coarse. In this module you are going to study various topics as shown in the table of contents.

Objectives: PSBAT: Describe a reflex action and a reflex arc.
: State function of the various parts of the brain.
: Define drugs, and state the effects of over consumption of heroin, alcohol, nicotine, etc.

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UNIT 8.0

8.1 The nervous system in human beings

In unit 8.3 we looked at the endocrine system and we said is a system of communication by chemical messages, known as hormones. In this unit we are going to look at another way in which information is passed from one part of the body to another the nervous system.

Definition

The nervous system is the system of communication in the body by electrical messages known as the nerve impulses. The nervous system is made up of the following:

(i) the neurons
(ii) the spinal cord
(iii) the brain.

Each of the part stated above plays a vital role in the nervous system. Lets look at neurons first.

Neurons

(i) What do you think are the functions of the neurons?
(ii) In communication by telephone, what can represent the neurons, and as well as the brain.

Neurons consist of nerve fibres which carry electrical messages to and from various parts of the body. They consist of long nerve fibres. There are three types of neurons namely: sensory neurone, multipolar neurone and the motor neurone.

The Sensory Neurones

The sensory neurons carry nerve impulses from the receptors to the central nervous system (i.e. the brain and the spinal cord). It always connected to the sensory receptor on one end and its cell body is in the ganglion. In the sensory neurone, the dendrion is long while the axon is short. The figure below shows a typical structure of a sensory neurone. (space for a diagram)

Question

(i) Is a sensory neurone a cell or an organ?
(ii) How is the neurone specialized to carry out its functions?
(iii) How long do you think is your sensory neurone which connects your toes to the brain?

The motor neurone

The motor neurone carry the nerve impulses from the central nervous to various parts of the body. It is always connected to the muscle or any other effectors. It s cell body is found in the grey matter of central nervous system. Unlike the sensory neurone the motor neurone has a long axon and short dendrites. The figure below shows the structure of the motor neurone.

(space for a diagram)

Question

How do you think the motor neurone differs from the sensory neurone?

The Multipolar Neurone

The multipolar neurone carries electrical impulses between the sensory neurone and the motor neurone. It is also known as the connector neurone. The diagram below shows the structure of the multipolar neurone.

(space for a diagram)

The Reflex Actions

The Reflex actions are rapid automatic responses to stimuli. There are two types of reflex actions, namely:

(i) Simple reflex action
(ii) Conditional reflex actions.

The simple reflex actions which takes place in the spinal cord are known as spinal reflex actions while those which takes place in the brain are known as the cranial reflex actions.

All reflex actions are evolved in helping us to survive. The table below shows some reflex actions and their importance to our bodies.

Reflex	**Stimulus**	**Response**	**Survival value**
Coughing	Foreign particles in the respiratory lining	Violent contraction of the diaphragm and intercoastals	Prevents the lungs from damage
Pupil reflex	Bright light falls on the retina	Circular muscles of the Iris contracts	Prevents retina from damage
Swallowing	Food particles making contact with the back of the throat	Contraction of the muscles of the epiglottis	Prevents choking

A Reflex Arc

The reflex arc is basic working unit of the nervous system. It can be defined as a complete path taken by an electrical impulse in the reflex action. It consists of the following route.

a) Sensory Reception
b) Sensory Neuron
c) Central Nervous System
d) Relay Neuron
e) Motor Neuron
f) Effectors

Figure 1 below shows a reflex action involving the withdrawal of the hand from objects which are too hot while figure 1.2 involves the withdrawal of hand from sharp objects.

(insert a diagram)

N/B The brain is made aware of each reflex action even if it is not directly involved. Nerve fibers conducts impulses from the sensory side of a reflex arc up the spinal cord to the brain and from the brain to the opposite side of the spinal cord these make us aware of certain reflex actions and gives us some control over them. For example, you might not manage to drop a hot object if it were valuable china plate the brain is also involved, when they say “ouch” in response to pain. Crying out distracts our intention from pain see figure 1.1 above.

A Pupil Reflex

In a pupil reflex the retina is the affecter while the Iris is the effecter. The reflex action as described above prevents the eye from damage due to light. When in bright light the pupil becomes small. And when dim light it dilates see the figure below
(insert a diagram)

Below are the routes taken by the various reflex actions (reflex arc)

1. Pupil reflex
   Retina → Sensory neuron → The brain → The relay neuron → Motor neuron → The Iris
2. Knee jerk
   Stretch receptor → Sensory receptor → Spinal cord → Motor neuron → Muscle of the thigh
3. Withdrawal of the hand from hot objects
   Heat receptor → Sensory neuron → Spinal cord → Motor neuron → Biceps/triceps

Conditional Reflexes

Conditioned reflex learned reflexes in which the response has no natural relationship to the stimulus. In an experiment, a Russian Scientist, Ivan Pavlov rang a bell when a dog is fed, the dog then salivated in response to the bell, even when no food was given. The natural stimulus food had been replaced by unnatural one (the sound of the bell) Conditional reflexes can be unlearned if the unnatural stimulus is not repeated with the natural one. If the food was time, the dog will no longer salivate at the sound of the bell. N/B The reflex actions which occurs above the neck are controlled by the brain and are known as cranial reflexes for example, Eye blinking, pupil reflex, those which occur below the neck are controlled by the spinal cord and are called spinal reflexes e.g. the knee jerk, withdrawal of hand from hot objects e.t.c.

Questions:

1. How is the endocrine system similar to the nervous system of communication?
2. Below is the table which shows the difference between the endocrine system and the nervous system.
3. Study and complete the table.

Feature	Nervous system	Endocrine system
1. Message	Electrical	Chemical
2. Path		Ductless
3. Time of response		
4. Nature of response		
5.		
6.		

The Brain

The brain is the most complicated part of our body. Its general function is to control the various parts of the body by receiving and processing information from various parts of the body. The brain is connected to different parts of the body by the neurons.
The figure below shows the longitudinal section of the brain of a human being

(Insert a diagram)

As shown in the diagram, the brain is divided in different parts and each part of the brain controls a particular activity in the body.

The Medulla Oblongata:

This is the centre for the most important reflexes which includes control of the heart beat, breathing, peristalsis, swallowing.

The Cerebellum

The cerebellum is the second largely folded part of the brain. It is concerned with the control of balance, and muscular control. It is also said to be the centre of movement and locomotion.

The Pituitary gland

This part of the brain is concerned with the control of the endocrine system. It secretes several hormones e.g. F.S.H, A.D.H, L.H, growth hormone e.t.c and also controls hormonal secretion by other endocrine glands. The pituitary gland is also known as the Masters gland.

The Hypothalamus

The hypothalamus is concerned with the control of homeostasis. It controls temperature, blood concentration, by checking the sugar, salts and water levels in the blood. It also controls oxygen content in the body, hunger, thirst.

The cerebrum

The cerebrum is the largest part of the brain. It is heavily folded, and has many centres, which deals with various activities in the body e.g. speech, hearing, sight, memory, smell, taste, etc. See figure 1 which identifies the stated areas

(Insert diagram)

Questions

i) Into how many parts can the brain be divided?
ii) In an average human being, what is the approximate mass of the brain.
iii) About how many cells are in the human average brain?
iv) Name the part of the brain which controls cranial reflexes.
v) What do you think is the function of the cerebral-spinal fluid which surrounds the brain.
vi) What do you think is the function of the hind brain?

Summary

- The brain is a highly organized structure and has three types of centres.
- Sensory centres which receives incoming messengers from the sensory organs.
- Motor centres which carry instructions from the brain to the effectors, such as, glands, muscles, etc.
- Associated centres – which interpret the information delivered to the sensory centres and makes sure that appropriate instructions are given via the motor centres.
- The human brain is about 1.4Kg and contains 25,000,000,000 cells.
- Cranial reflexes are controlled by the grey matter of the brain
- Between the brain and the skull is the fluid which prevents the brain from damage due to shock (cerebral spinal fluid).
- The forebrain (front part of the brain) deals with many emotions and damage to this area may cause aggression, apathy, extreme sexual behaviour or any other emotional behaviour.

DRUGS AND DRUG ABUSE

i) What are drugs?
ii) Why do you think people take drugs?
iii) Give five examples of the drugs which you know in your community.
iv) See if you can group the drugs you have listed above according to their effects in the body.
v) What are side effects of drugs if not well used. For this question you can look at the side effect of a particular drug.

Definition:

Drugs are any externally administered substances (chemical) which modifies the way our body works. Drug abuse is a wrong use of drugs. Drugs can be abused in the following way:

i) taking a drug for a wrong purpose
ii) taking an over dose
iii) taking an under dose.

Types of Drugs

Drugs can be put in two categories which includes the following:

i) Medical drugs: (medicines – these are drugs used to treat an illness or disorder. We take medicine when we have a health problem with our body. Medicines can be administered to the body. Medicines can be administered to the body differently e.g. some drugs are taken orally (by the mouth) and others by injection, etc.
ii) Non medical drugs: these are the drugs taken for non medical purposes. People take these drugs for various reasons e.g. pleasure, to relax examples of such drugs are alcohol, cannabis, hallucinogens, heroin, cocaine, nicotine. We will look at the details of some of these drugs in details.

Lets look at some of the medical drugs and their effects in the body.

a) Pain Killers

Pain killers includes drugs like panadol, aspirin and brufein. Pain killers are the drugs which are used to relieve pain in the body. They work by suppressing to pain area of the brain, therefore painkillers are not drugs for treatment.

b) Antibiotics

These include drugs like Penicillin, Amphicilin, Tetracycline, Amoxyl are used for treating bacterial diseases e.g. Cholera, Syphilis, Typhoid, etc. These drugs act by destroying the bacteria in our body.

Questions:

i) How can the pain killers and antibiotics be abused?
ii) See if you can identify more painkillers and antibiotics in your local area.

Non Medical Drugs

i) Depressants

These are drugs which functions by lowering the brain activities of the body. Depressants reduces emotional tension and anxiety on the brain, and thus makes the body feel relaxed.

Examples of depressants include the following drugs:

Alcohol

People take alcohol for various reasons, which may include parties, relaxing and so on. Alcohol is taken orally. Once taken the drug lowers the chemical activities in the body by reducing the emotional tension and anxiety.

The drug has the following effects in the body.

Short term effects of over consumption of alcohol

- Slows down the reflex actions and this results in an increased reaction time.
- Causes unco-ordinated movements
- Results in loss of self control
- Misjudgement of distance
- Death if consumed excessively
- Frequent urination
- Alcohol disturbs sight
- Causes dilation of capillaries in the skin hence heat is lost from the body
- Distorted speeches.

If an individual makes alcohol taking a habit over a long period of time he/she will suffer from the lung term effects of alcohol – some long term effects of alcohol are:

Alcoholism – is also known as addiction to alcohol. It develops when an individual's body develops dependence and tolerance to higher concentration of alcohol. In

dependence it means the body can no longer work without alcohol while tolerance is a condition in which the body no longer get affected to certain dosages of alcohol.

In the absence of alcohol in the body alcoholics suffer from what are known as withdrawal symptoms. See the list below.

- Shivering
- Headache
- Nausea
- Vomiting
- Stomach cramps
- Shaking of hands and the body

If consumed over a long period of this alcohol may result in the damage to the following parts of the body the brain, the liver, and also causes stomach ulcers.

Malnutrition also is a long term effect of alcohol. Alcohol interferes with the nutrition of an individual.

Social economic effects of alcohol consumption in excess

- Loss of respect from the community. This applies to alcoholism and other bad behaviour shown as a result of alcohol.
- Poverty – most money meant for home use is spent on alcohol.
- Loss of employment
- Unproductivity – an individual become less productive as much of the time is spent on beer drinking.

Health effects of alcohol

- Stomach ulcers
- Malnutrition due to poor feeding habits
- Damage to the brain and liver cells
- Reduces sperm count (in males)
- In pregnant women it may cause miscarriages or babies born underweight
- Increases deposit of fats in the coronary arteries
- May cause cancer of the tongue and the oesophagus especially in heavy drinkers and smokers.

Heroin

Heroin is a very powerful sedative (depressant) which also functions by lowering the brain activities. The result is a reduced emotional tension and anxiety. Unlike alcohol heroin is taken by injection (i.e. direct into the blood stream).

Heroin when taken over a long period of time also results in an individual to develop addiction to the drug, which may cause serious withdrawal symptoms if the drug is not taken.

Some of the withdrawal symptoms due to heroin addiction are:

i) Severe stomach and muscle cramps
ii) Severe headache
iii) Nausea
iv) Vomiting
v) Hallucinations and convulsions
vi) Warely eyes
vii) Running nose

NOTE: The withdrawal symptoms stared above disappears immediately one takes heroin.
There are some social effects which are caused by heroin addiction.

What are some of the social effects of heroin?

i) High crime rate. An addict of heroin can do anything in order to get the drug.
ii) Unemployment. Individual become highly dependent on heroin
iii) Poverty
iv) Unproductivity

Questions

i) How do you think heroin is linked to transmission of HIV/AIDS
ii) Why do you think heroin is not used as a medical drug?

Stimulants

These drugs which speeds up the brain reactions and make you more alert. They include amphetamines which were widely used at one time to relieve blocked noses. Cocaine is powerful stimulant. It is obtained from the leaves of a certain plant. Caffeine present in coffee and tea, nicotine present in Tobacco smoke are mild stimulants.

Question

i) Why do you think sports men are in a habit of using stimulants
ii) Explain why some people find it difficult to stop tobacco smoking
iii) Apart from nicotine tobacco smoke contains other chemicals. Name the chemicals and state the effect of each on a human body.

Exercise

1) Arrange the following in order of the events in the reflex action
Retina, iris, sensory neurone, relay neurone, motor neurone, the brain.

2) Study the diagram below and answer the question that follow:

(Draw diagram)

a) Which structure is stimulated by the hammer?
b) Which structure carries impulses away from the spinal cord?
c) Which structure shortens as a result of the reflex action?
d) What would be the approximate length of structure E in humans?
e) On assumption that the impulses travel at 100 metres per second, how long would it take for an impulse to travel through this reflex action.

3) State the function of the parts of the brain listed below:

i) The medulla oblongata
ii) Cerebrum
iii) Cerebellum
iv) The pituitary gland

4) Using the terms pain killers, antibiotics, depressants and stimulants.

i) alcohol, heroin, panadol, nicotine, caffeine, penicillin, amphicilin

5) How is over consumption of alcohol and heroin connected to transmission of HIV/AIDS.

UNIT 8.5

Welcome to unit 8.5 of the study. In this unit you will look at sense organs like the eye and the ear, and also the common illnesses which affects these sense organs. You will find it interesting.

Objectives:

PSBAT: Draw the structure of the eye
State the functions of various parts of the eye
Describe the eye defects, and methods of correction
PSBAT: Draw the structure of the ear and state the function of its parts
Describe the causes and methods of preventing deafness.

The Eye

The eye is an organ of sight. This unit will concentrate on the activties in human eye.

The Structure of the Human Eye

Activity 3

Requirements: Mirror, pencil and clean razor.

Method: As seen from the mirror draw your right eye. What colour is your eye?
How many parts of your eye have you seen.

The picture below is the structure of a human being taken from the front view. See if you can identify some of the parts you have drawn in activity.

(insert a picture)

The other picture, picture 2.0 shows the external structure of the eye taken from a side view.

(insert picture)

Question:

Suggest the functions of the parts of the human eye you have identified in the diagrams and pictures above?

Explanation

The external structure of the eye consist of the following: the sclera, the cornea, eye lids, eye lashes, eye brows, pupil and the iris. Lets look at the role played by each part of the organ of sight.

i) The sclera

The sclera is made of tough connective tissue. It is the outer part of the eye. The function of the sclera is to protect the inner parts of the eye. In front of the eye ball the sclera is what we see as a white part of the eye.

ii) The Iris

The iris is a coloured disc of muscular tissue formed by the choroids layer in front of the eye ball. At the centre is a tinny hold known as a pupil. The function of the iris is to adjust the size of the pupil in order to allow the correct amount of light in the eyes. We will look at the details of the function of the iris.

In activity 3 the pupil is what you saw as a black part of the eye.

iii) The eye lids

The eyes lids protects the eye hall from the external interference by closing the eye ball inside the socket whenever necessary.

The internal structure of the eye

When the eye is cut length wise, we see the following parts which are not to be seen from outside.

Internal Structure of the Eye

(insert a picture)

iv) The Retina

The retina is a very sensitive part of the eye. It has the light sensitive cells, namely the cones and the rods. The rods are sensitive to light of low intensity, and can not distinguish colours while the cones are sensitive to light of high intensity and can distinguish colours.

Question

Why is it difficult to see colours in dim light e.g. at night. The nerve fibres from the rods and cones join together to form the optic nerve which connects the eye to the brain see the diagram above.

v) The blind spot

This area does not have the cones and the rods. It is a place where the nerves leaves the eye. If part of the image falls on the blind spot, no impression is recorded.

Activity 3

To find out, what happens when light falls on the blind sport.

Requirements: A pen, ruler and piece of paper

Method: Make a cross (+) and a dot (.) about 10cm apart on a piece of paper
Hold the piece of paper about 50cm away from your eyes (i.e. the front part of your eyes)
With your right closed concentrate on the cross and dot using your right eye
Bring the paper closely to your eye.

Questions

i) What happens to the paper as it brought close to the eye?
ii) What do you think is the cause of this?

Explanation

When the piece of part is positioned 50cm away from the eye both the cross and dot will be seen but as the paper brought close to the eye the cross disappears. This means light from cross was focused on the blind spot.

vi) The Fovea

The fovea is also known as the yellow spot. The yellow spot contains a high concentration of the cones. The fovea helps us see details of the images.

vii) The Choroids

This is the second layer from retina or the sclera. It contains melanin, a pigment which reduces internal reflection of light in the eye. The choroids also has blood vessels which supplies the eye with food and oxygen.

viii) The Cornea

This is the transparent part of the sclera found in front of the eye ball. The cornea allows light from the objects into the eye as well as helping retraction of light that enters the eye.

Question

a) Why do you think the cornea is able to refract light as it enters the eye?

b) On top of the cornea is a sensitive layer known as the conjunctiva. What is the function of the conjunctiva? And how does it protect the eye?

The aqueous and vitreous humour

The fluids maintains the shape of the eye ball. Apart from the function above the fluids also help in distribution of nutrients and oxygen to other parts of the eye which are not reached by the choroids and in refraction of light to the retina.

Question

The aqueous and vitreous humour are jelly like fluids. What colour do you think the fluids are?

ix) The Human Lens

The human lens is a crystalline convex lens. Unlike orderly lenses, the human lens is elastic. It is attached to the ciliary body by the suspensory ligament. The lens refracts incoming light further and focuses it on the retina.

Question:

What is meant by a human lens being elastic.

x) The Iris

Controlling the amount of light entering the eye.

The iris controls the amount of light entering the eye. This is done to prevent the retina from damage. The iris adjusts to light of low intensity and light of very high intensity. There are two types of antagonistic muscles in the iris and these are the radial muscles and the circular muscle.

Look at the pictures below:

(insert picture)

Questions

a) Which picture and the diagram represents vision in dim light. Give a reason for your answer.
b) Which picture and the diagram represents vision in bright light give a reason.

In Dim light

In dim light, the radial muscles contracts while the circular muscles relaxes. This causes t he pupil to dilate, hence allowing more light to enter the eye. See the diagram below

(Insert 2 pictures)

In Bright Light

In bright light the circular muscles contracts while the radial muscles relaxes. This causes the pupil to constrict, hence allowing less light to enter the eye. See the diagram below.

(Insert a picture)

The Ciliary Body

The ciliary body is the thickened edge of the choroids around the lens. It contains the blood vessels and also secrete aqueous humour. The other function of the ciliary body is to alter the shape of the lens in order to help us see objects clearly and quickly.

Accommodation of the eye

Definition: Accommodation is the adjustment in the shape of the lens in order to focus light from objects on the retina. We can see objects clearly if light from objects falls on the retina. To see objects nearby the lens must be short and thick while when focusing on distant objects the lens must be long and thin.

Looking at nearby objects

When we want to see a nearby object the ciliary muscles contracts. This loosens the suspensory ligaments hence causing the lens to become short and thick, thereby focusing light from nearby objects on the retina. See the diagram below:

(insert picture)

Looking at distant objects

When looking at distant objects the ciliary body relaxes. This causes the suspensory ligaments to pull the lens long and thin. See the figure below.

(insert picture)

Complete the diagram below

	Ciliary muscles	**Shape of lens**
Nearby objects		
Distant objects		
	Circular muscles	Radial muscle
In dim light		
In bright light		

Three dimensional – vision

If you look at the chair, it appears to have depth. In other words you see it in three dimensions. We need two eyes to see objects in three dimensions. Two eyes are also needed for accurate judgement of distances between objects and our eyes. The brain receives two images from the two eyes and combines them to form one image seeing with two eyes is called binocular vision.

Eye defects.

Like all other sense organs, sometimes the eyes may not function properly. Some of the eye defects are associated with the improper focusing of the light from the objects on the retina. Such defects may include short sight, Astigmatism and long sight some other eye defects results from the diseases of the eyes, or even old age.

Below is the list of eye defects associated with focusing light from objects on the retina.

Short sight

Individuals with short sight easily see objects which are nearby but can not easily see the distant objects.

Question:

What are the causes of short sight?

Short sight could be caused by the following defects to our eyes:

i) too strong ciliary muscles
ii) too strong lens (the lens too short and thick)
iii) too long eye ball than normal.

In short sight light from nearby objects focus on the retina while light from distant objects focuses before the retina hence we are not able to clearly see distant objects. Short sight is corrected by wearing spectacles with a concave lens. See the figure below. The concave lenses diverges light from objects further up to the retina.

(Insert picture)

Long sight

A person with long sight is able to see distant objects but can not see nearby objects clearly. This is because light from nearby objects seems to focus beyond the retina, but light from distant objects focuses on the retina.

Questions

What are the possible causes of long sight?

Long sight could be caused by:

i) too weak ciliary muscles
ii) too weak lens (lens too thin)
iii) too short eye ball than normal.

To correct long sight, an individual can wear spectacles with a convex lens. See the diagrams below. The lens converges the light to the retina.

(insert picture)

Astigmatism

This is a defect which results in the cornea to be unevenly curved. Astigmatism may result to the eyes not being able to focus on upright and side ways, lines at the same time. The defect is corrected by wearing cylindrical lens in form of spectacles or contact lens.

Question:

How does the lens correct the defect?

Eye diseases

Cataracts: This is caused by the lens becoming cloudy. This causes unclear visions as the lens is made unclear. To treat this diseases, the lens can be replaced by an artificial one.

Glaucoma: This is the disease caused by excess accumulation of vitreous humour in the eye. The disease can be treated b y removing the excess fluid by operation, or administering drugs which prevents accumulation of excess fluid.

Ulcers: These are wounds on the retina. The disease can be cured by replacing the damaged cornea with undamaged one (corneal graft).

Detached Retina: This is the condition caused by the retina detaching itself from the choroids. It can be treated by sealing the retina back into place by laser beams.

N/B All the eye diseases discussed above if not treated can lead to blindness.

Activity 3

How good is your sight?

Requirements: Ruler, White card, pen.

Method:

1) On a white card draw two parallel lines one millimeter apart. Hang the card on the wall.
2) Gradually back away from the card until the two parallel lines appear as one, then stop.

Question:

1. How far are you from the cards? Compare your distance with that of your friend.
2. Is your sight better than your friends?

THE EAR

In the previous sub unit we looked at the eye, now we area going to look at another sense organ known as ear.

Question:

- What role is played by the ear to your body?
- Do you think it is necessary to have two ears?
- Can you hear with one ear only. Try to close one ear with your finger and see if you can hear?
- Do all animals have ears?

Explanation:

The ear is the sense organ that detects sounds so that hearing is made possible. The ear also is an organ of balance especially when the body is in motion. For sound wave interpretations the human ear is connected to the hearing centre of the brain by the sensory neurons, and motor neurons.

The Structure of a Human Ear.

The diagram below shows the structure of a human ear.

Question:

1) What do you think is the function of the: i) Ear flap (Pinna), ii) Ear canal iii) Ear drum
2) Which parts of the ear in the diagram above are visible to eyes if we take a look at the external structure?

(Insert picture)

The human ear is made up of three parts namely:

i) the outer ear
ii) the middle ear
iii) the inner ear

The outer ear consist of the ear flap (known the pinna) the ear canal, and the ear drum. The middle ear is made up of an air filled cavity which contains three bone i.e. the hammer, (malleus), the anvil (incus) and the stir up (stapes) the cavity is linked to the back of the mouth through a narrow tube known as the Eustachian tube. The Eustachian tube equalizes pressure between the outer eye and the middle ear. For example if you move to a higher altitude a pressure difference between the middle and the inner sides of the ear drum develops. To balance the atmospheric tube opens to expel or allow air in the ear. The three bones in the middle ear transmits sound vibrations from the middle ear to the oval window of the inner ear.

The inner ear consist of the cochlea, which is a coiled tube directly involved in the hearing process. The cochlea has the shape of a snail. It is filled with fluid known as the perilymph, and the endolymph. The inner ear is connected to the brain by the auditory nerve. The inner ear is connected to the brain by the auditory nerve. The inner ear also contains the semi-circular canals which are the balancing apparatus. See the diagram above.

Question:

The ear canal contains hair and wax, what do you think is the function of hair and wax found in the ear canal?

The Mechanism of hearing

When sound is produced it causes the air particles to vibrate the sound vibrations are trapped by the ear flap and directed into the ear canal. From the ear canal the vibrations causes the ear drum to also vibrate. From the ear drum the vibrations are then transmitted to the cochlea by the bones in the middle ear (mallens, incus, stapes). From the oval window the vibrations are set up in the fluid of the cochlea. These vibrations are detected by the sensory cells which send impulses along their fibres in the auditory nerve to the brain. The size of the oval window being smaller than that of the ear drum makes the vibration to reach the oval window amplified more than twenty times.

Once picked, the nerve message from the cochlea is interpreted as sound and this makes us hear.

The diagram below shows the internal structure of the cochlea.

(Insert picture)

The ear and balance

Balancing in animals is accomplished by the semi-circular canals i.e. the urticulus and the sacculus. The three semi-circular canals are filled with a fluid known as the endolymph. The canals are not 90^0 to each other. The semi circular canals contains the receptors which are only stimulated when the body moves. The receptors are mainly sensitive to the movement of the head. When the head is moved, the fluid also moves and this causes a pull or push on the receptors, from the nerve impulse is fired off to the brain. The brain in turn sends the messages to relevant body muscles which responds and balances the body. The fluid in the semi circular canals responds directly to movements of the head.

Activity

- Make body rotations about five of them.
- Stop rotating and see if you can balance.

i) Explain the effect of the rotation of the body on the endolymph.
ii) Explain why people tend to lose balance immediately they stop the rotations.

The diagram below shows a section through the semi-circular canal.

(insert picture)

What causes deafness

Ear defects may be caused due to the injury made to the ear or the disease of the ear. Any of the two effects on the ear will result to hearing impairment. Some of the ear defects can be cured and those which can not be cured lead to deafness, which may be slightly or complete. The ear canal can be blocked with wax and this makes the sound waves not easily reach the ear drum. To correct this defect, the wax can be removed at hospital or clinic. Sometimes the ear ossicles (incus, mellens, stapes) can stick together hence making vibrations difficult. This condition can also be corrected at the hospital. The other cause of hearing impairment could be due to damage of the eardrum especially when it is torn. This also affect transmission of sound vibrations.
Damage to the cochlea, and the auditory nerve causes deafness as well.

Questions:

i) How can you prevent deafness
ii) People working with drills or noisy machinery should wear ear muffs why?

When we get used to listen to sounds which are very loud and of a particular pitch for a long time the vibrations of the cochlea membrane become so much such that the receptor connected to that membrane get damaged, hence leading to deafness. To avoid certain deafness we are to avoid loud sounds, e.g. sounds from head phones, plunging objects into the ear canal as this may damage the ear drum, explosions also damages the ear drum.

The Skin as a sense organ

The skin contains sensory cells which can be stimulated by changes in temperature, and pressure. It also contains some sensory receptors which responds to touch, pair. When stimulated the sensory cells defect the stimulus and sends the message to the specific of the brain and then the brain in turn gives a response, which may be in form of a reflex action.

See the diagram below showing various sensory cells found in the skin.

(insert picture)

Exercise

1. Complete the table below on sense organ and cells.

Organ/Cell	**Sensitive to**	**Biological importance**
The ear The eye Pain receptors The nose The tongue		Communication

2. Describe briefly what happens in your eye when you come out of a dark to a bright environment and you focus your eyes on a distant object.

3. Nocturnal animals, i.e. animals which move at night and sleep during the day, tend to have wider pupils and more rods in their retina. Suggest a reason for this?

4. What jobs do each of the following part of the ear perform:
   (i) Ear drum
   (ii) oval window
   (iii) the receptors in the cochlea

5. Discuss some common diseases of the eye and how they can be controlled?

6. The diagrams below show part of the human eye carefully study it and answer the questions that follow.

   (draw diagrams)

   (a) (b)

a) (i) Name the parts labeled A, B, and C.
   (ii) Label on diagram b the three parts named on diagram a
   (iii) Suggest the function of the liquid secreted by P
   (iv) On diagram a, label with x the muscle which brings about accommodation

b) i) Complete the diagram to show how the pupil would appear in light of very low intensity.

Diagram (c)

(ii) Explain how the changes in the diagram (c) can be brought about.

UNIT 9 LOCOMOTION

Unit 9.1

Objectives:

PSBAT: Describe and state various types of the skeleton. Describe the insect skeleton.

The Skeleton

The skeleton is a frame work of the body. The multi-cellular animal's body is often compact and bulky with cells and tissue that have no rigidity. These can not maintain their shape and under the influence of gravity they would slag into a formless shape. Higher animals such as mammals have skeletons.

There are three types of skeleton and these are:

(i) endoskeleton
(ii) exoskeleton
(iii) hydrostic skeleton

In all the types of the skeletons the skeleton performs the following functions:

(i) Support: The skeleton gives the body its shape and form and provides a frame from much internal organs are suspended. What do you think would be our shapes like without the skeleton.
(ii) Protection: The skeleton protects soft delicates organs of the body.
(iii) Locomotion: The skeleton makes movement possible by providing a series of levers (e.g. the limb bone) to which muscles can be attached..

Lets now look at the types of skeletons we have stated above in details.

Endoskeleton

This type of skeleton is found inside the body of the organism.

Question

(i) List down the types of organisms which have the endoskeleton.
(ii) Man is an example of an animal with an endoskeleton, what is the composition this endoskeleton in man.

Exoskeleton

This is the type of skeleton found outside the body. It encloses its organs inside. The exoskeleton provides effective protection and support for the soft parts of the body.

Question.

Name some of the organisms which have the exoskeleton.
What do you think is the disadvantage of the exoskeleton?

(iii) Hydrostatic: some organisms e.g. earth worms, have hydrostatic skeleton. That is, there are no hard tissues but instead, the main cavity of the body is filled with a liquid under pressure. This liquid in the cavity maintains the shape of the organisms. See the diagram below.

Question:

Name other organisms which have hydro static skeleton.

The Insect Skeleton

Insects and other arthropods are make up of exoskeleton. In insects the exoskeleton is made of a tough polysaccharide called chitin and has a thin water proof outer covering of wax. In exoskeleton there is limitation in the growth of an organism. Organisms grow by ecdysis or moulting. The general functions of the exoskeleton can be summarized as below:

(i) Prevents water loss from insects
(ii) Provides firm sites for muscle attachment
(iii) Provides mechanical protection of the internal organs.
(iv) Facilitates movement in arthropods (e.g. insects).

Movement in a Grasshopper

We are going to look at the details how movement in grass hopper is made possible as facilitated by its skeleton.

To understand this more, lets look at the hind legs of a grass hopper. How does the grass hopper use its hind legs?

A grasshopper uses it hind legs for walking, climbing and leaping.

The diagram below shows the hind leg of the grass hopper.

(insert picture)

Muscles are attached to the inner surface of the exoskeleton. Pairs of antagonistic muscles are responsible for movement of leg segments. The diagrams below shows the flexing and extending the arm.

Bending the limb.

When flexing the arm the flexor muscles contracts while the extensor muscles relaxes. When the flexor muscles contracts they pull the lower limb of the leg.

Diagram of a bent limb of a grass hopper (insert picture)

Extending the arm

When extending the leg the extensors contracts while the flexors relaxes. This causes the leg to straighten. See the diagram.

Unit 9.2 The Mammalian Skeleton

Objectives: Identify the bones of the axial and appendicular skeleton.
Identify different types of joints and state the way skeletal muscles brings about movement.
Describe the structure of a synovial joint
Compare and contrast between the ball and socket joints and the hinge joints.

In this unit we are going to look at the human skeleton.

Question

(i) What are the general functions of the human skeleton
(ii) What is the human skeleton made up of?

The function of the human skeleton can be summarized as follows:

(i) *Support:* The skeleton provides support for the soft tissues of the body. The skeleton also gives shape to our body. How will your body look like if you had no skeleton?

(ii) *Protection*: organs like the brain, the heart, lungs, e.t.c are found inside the bones where they are protected e.g. the brain is protected by the skull.

(iii) *Production of the red blood cells*: The bones contains red bone marrows. The bone marrows produce the Red Blood Cells.

(iv) *Movement:* Some bones in our body are joined in such a way that they allow movement of the body and the limbs. This gives us the ability to the body to bend, turn, or twist.

(v) *Calcium*: The skeleton bones are made up of calcium carbonate and calcium phosphate since bones contains calcium we can therefore say they store calcium.

(vi) *Breathing*: The rib cage plays a significant role in breathing. When there is a movement in the bones of the rib cage there is also the change in the volume of the chest cavity hence causing air to move in and out of the body.

(vii) *Transmission of sounds*: The bones play an important role in the middle ear in the transmission of sounds see unit 8.5.

The diagram below show a human skeleton.

(i) See and count how many bones are in this skeleton
(ii) Apart from bones what other parts makes up our skeleton?
(iii) What role is played by each part of the skeleton you have mentioned.

Explanation

The human skeleton consist of the following tissue, which assist in carrying out all the functions of the skeleton.

(i) Bones
(ii) Cartilage
(iii) Ligaments
(iv) Tendons
(v) Muscles

The Bones

The human skeleton has 206 bones

- What materials makes up the bones
- What role is played by the bones in a human skeleton?

Explanation

Bones consist of calcium carbonate, calcium phosphate deposits, blood capillaries and the nerves. The blood vessels supplies the bone tissue with food and oxygen. This is also an indication that bone consist of living cells. The other sign that tissue is living is the ability the bones to heal when damaged.

The diagram below shows a typical structure of a long bone.

The inner structure of a long bone

In this unit we will look at the spinal vertebrate, the arm and the skull as examples of bones in our body.

The Arm

The arm forms part of the appendicular skeleton (which consist of the scapula, the pelvis, the fore limbs and the hind limbs). The diagram below shows the bones which forms the arm.

Question:

How can you identify the position of the radius and ulna when the arm is positioned differently.

The radius is shorter than the ulna and is always in line with the thumb, while the ulna is longer than the radius and always in line with the small finger. The other unique feature in the ulna is the depression it has at the end where the head of the humorous fit.

Exercise

(i) Hind limb. Draw the leg bones i.e. the pelvis, the tibia and fibula.
(ii) How can you identify the position of the tibia and fibula.
(iii) Which bones of the hind limb is similar to the following bones the fore limb

a) humorous
b) scapula
c) radius
d) ulna

(iv) What are the functions of the tore and hind limbs.

The Skull

The skull is part of the axial skeleton which consist of the skull, the vertebral column, the ribs and the sternum. The diagram below shows the structure of the human skull.

(insert picture)

The human skull is divided in two parts and these are:

(i) The cranium (the brain box) this is the part in which the brain is found.
(ii) The snout. This part forms the face, the lower jaw is known as the mandible while the upper jaw with part of the snout is known as the maxillae.

Question.

What are the general functions of the skull. Refer to the general functions of the human skeleton.

The Vertebral Column

The vertebral column is also known as the back bone. It is made up of thirty three (33) bones and each bone is known as a vertebra. Each vertebra is separated by a compressible disc of cartilage known as intervertebral cartilage. The thirty three vertebrae are classified, into five sections of the spinal column. This classification is according to the shape they have.

What are these five regions of the spinal vertebrae?

(i) Cervical which has seven vertebrae
(ii) The Thoracic – with twelve vertebrae
(iii) The lumbar – with five vertebrae
(iv) The sacral – with five fused vertebrae
(v) The candal – with four fused vertebrae.

The diagram below shows the spinal column with five divisions clearly marked. See if you can identify the different structures of the spinal columns.

(Insert picture)

Question.

What are the general functions of the spinal column.

The generalized structure of a vertebra

All vertebrae in the vertebral column have the same structure i.e. Basic structure. Basically all the vertebra have the following parts; transverse process, neural canal, neural arc, and neural spine. The diagram below shows the generalized structure of the spinal vertebra.

The diagrams below show examples of the structures of the spinal columns listed.

(insert pictures)

Question

(i) What is the similar structures present in all the spinal columns.
(ii) What are the common differences which exist in the columns.

Activity

Look the chicken bones and see if you can identify the bones similar to the following in a human skeleton.

(i) femur
(ii) spinal column,
(iii) humorous
(iv) scapula

Joints

Joints with reference to the skeleton are said to be points or areas in the body where two or more bones meet.
Joints can be moveable, fixed or slightly moveable.

Types of joints

Basically there are three classes of joints namely fibrons, cartilaginous and synovial.

Cartilaginous joints

Cartilaginous (cartilages are formed by the cartilage). These joints allows slight movement. The joint is found in the following parts of your body.

(i) Between the spinal vertebrae
(ii) Between the sternum and the ribs
(iii) The pubic bones

Fibrous joints

The fibrous joints are fixed joints, we also call them sutures. In fixed joints no movement is allowed (i.e. immoveable joints)

Question

In which areas of your body do you have fixed joints.
Think of other parts or bones in addition to the following: the skull, pelvis girdle, tibia and fibula lower ends, sacrum.

Why are the joints listed below known as immoveable joints.

Synovial joints

Synovial joints are moveable joints. In between the bones where the joints are formed, there is a cavity filled with synovial fluid hence the name synovial joint.

The figure below shows an example of a structure of a synovial joint.

(insert picture)

Question

(i) Looking at the figure above name the tissue which forms the synovial joints
(ii) What is the function of each tissue you have named to the joint?

Explanation

- The synovial joints consist of the following tissue;
- Synovial membrane, this membrane produces the synovial fluid and also holds the fluid.
- The synovial fluid. The fluid lubricates and absorbs shocks at joints during movement and this prevents the bones at joints from damage.
- Ligaments: These consist of elastic fibres at joints, the ligaments hold the bone together hence preventing bone dislocation.
- Cartilage. The ends of the bones are covered with cartilage. The cartilage at the ends of articulating bones prevents wearing of bones due to friction during movement.
- Tendons. These are non elastic tough white tissues which joins muscles to bones at the joint.
- Muscles. There are several types of muscle but at the joints are skeletal muscles which facilities the movement of bones at joints they contract or relax. We will look at muscles in details.

Types of synovial joints

Synovial joints may be classified into the following groups e.g.

(i) The ball and socket joint
(ii) The hinge joint.

Lets first look at the ball and socket joint

The ball and socket joint allows movement in all the planes (three planes – 360^0 movement). In human bodies it is found in the hip, and the shoulder. In these joints a round ball like bone (the head) fits into a cup like socket. The figure below shows an example of the ball and socket joint.

(insert picture)

The hinge

This joint is found in the elbow, knee, and the ankle. The hinge joint allows movement in one plane only (i.e. 180^0 movement). In this joint one of the bones at the joint has a convex or round surface while the other has a concave or depression in which the round surface fits. See the figure below:

Question

(i) How do the synovial joints differ from other moveable joints?
(ii) What is the difference between the hinge joint and the ball and socket joint.

Movement in a mammal

Question:

(i) How are various movements in mammals made possible?
(ii) Which parts of your body takes part in your movement and locomotion?

Explanation

In movement bones are pulled by muscles are moveable joints. Now lets look at muscles.

Muscles are contractile tissue which contract and shorten their lengthen when stimulated by nerves. In muscle contraction a lot of energy is used up. For this reason muscles have numerous mitochondria. The muscle cells are spindle shaped i.e. thick at the middle and thin at the edges.

Apart from movement of bones what do you think are other functions of muscles?

Explanation

In our body muscles are used in; breathing – movement of the chest cavity, heart beat, peristalsis, inter connection of the skin, child birth the uterine muscles e.t.c.

There are three types of muscles namely, the skeletal (striated), the viscera (unstraited – smooth) and the cardiac muscles.

The skeletal muscles: These are the muscles of the skeleton which are concerned with movement and locomotion when examined under a microscope they appear to be striped or striated, hence their name striated muscles. The skeletal muscles are also known as voluntary muscles because they are controlled by the voluntary part of the nervous system.

The figure below shows the striated muscle.

(insert picture)

Visceral Muscles

Visceral muscles are smooth muscles, and they are found in organs which are not controlled by the voluntary part of the nervous system. These muscles are also known as involuntary muscles.

There are such muscles found in our body. The visceral muscles line the gut, and the blood vessels. The diagram below shows the structure of the visceral muscles.

(draw diagram)

The muscles are made up of elongated fibres which are bonded by connective tissue. Each tissue is made up a single nucleus and numerous fibres.

The Cardiac muscles

The cardiac muscles are muscles of the heart. They are also controlled by the involuntary part of the nervous system. They consist of inter connected muscle fibres. The fibres are made up of the cells which have one nucleus. Un like the visceral muscles the cardiac muscles contract and relax without being fatigued. The figure below shows the structure of the cardiac muscle.

(insert picture)

Antagonistic effect of the Skeleton Muscles

The movement of the bones in movement and locomotion is made possible by the antagonistic pair of the skeletal muscles. In the antagonistic pair we have flexors and extensors. To bend the limb flexors contracts while extensors relaxes and to straighten the

limbs, the extensors contracts while the flexors relaxes. The figure below shows an example of antagonistic muscles in our arm, illustrating muscle attachment.

(insert picture)

Muscles are usually attached to the moveable part at one end and non moveable part at the other end. The point of muscle attachment on a non moveable part is non as the origin and at the moveable part as the insertion.

The muscles of the arm are known as the Biceps and Triceps. The biceps have two origins while the triceps have three origins hence their names.

Now lets look at how movement of our lower arm made possible by the biceps and triceps.

Question

(i) What type of movement is made by the inner arm?
(ii) Which bones move when the biceps contract
(iii) What type of joints are found at the lower arm?

Explanation

Bending the arm: When bending the arm the biceps contracts while the triceps relaxes. The contraction of the biceps causes the lower arm to be pulled upwards at the insertion. See the figure below.

(insert picture)

Straightening the arm

When straightening the arm, the triceps contracts while the biceps relaxes. This makes the triceps to pull the lower arm at its insertion on the ulna. See the figure below.

(insert picture)

Exercise

1. The diagram below shows the effect of muscles of the legs which move the lower leg.

   (draw diagram)

   a) What shape is attained by muscle when they (a) contract (b) relax.
   b) What are the bones A, B, C and D.
   c) For the movement shown in the diagram above what happened to each of the muscles:
      (i) rectus femoris
      (ii) biceps femoris

   d) Where on the diagram above is the insertion and the origin of the biceps femoris and the rectus femoris attached.
   e) Draw a similar diagram as above but now to show the state muscles when straightening the leg.

2) Give one main difference between endoskeleton and exoskeleton

3) The diagram below show the section taken through a human arm.

(draw diagram)

(i) Name the structures X, Y and Z
(ii) How can you tell that the lower arm will move upwards when referring to the diagram B.
(iii) When straightening the arm what shall happen to X, Y and Z.
(iv) Which part is not represented on the diagram.

4) Give similarities and differences between
a) a ball and socket joint in a hip and shoulder
b) a hinge joint in the knee and elbow.

5) (i) Draw the lumbar vertebra
(ii) How does it differ from the thoracic vertebra.

UNIT 10.0 REPRODUCTION

Welcome to unit 10. In this unit we will look at one of the characteristics of living organisms reproduction. You are going to find it very interesting as well.

Unit 10.1 Asexual reproduction

Objectives:

PSBAT: State different types of reproduction
Describe asexual reproduction, asexual reproduction in fungi, and sexual reproduction in fungi.
Describe asexual reproduction in unicellular organisms.
State the importance of fungi and bacteria in the environment.

Reproduction

Questions

(i) What is reproduction and where does it occur?
(ii) Why do you think reproduction is important to living organisms
(iii) What are the commercial importance of reproduction to farmers

Explanation

Reproduction can be defined as the process by which living organism produce their offsprings.

Reproduction is one of the characteristics of living organisms. Living organisms reproduce differently and reproduction in living organisms can be put in two classes namely, Asexual reproduction and sexual reproduction.

Asexual reproduction

Asexual reproduction is the type of reproduction in which living organisms produce new individuals without using sex cells (gametes). Examples of asexual reproduction include the following, fission, sporulation, budding, fragmentation and vegetative propagation. In this unit we are going to look at fission and sporulation.

Binary fission

In binary fission organisms divides into two identical daughter cells. organisms like bacteria amoeba reproduce by binary fission. Now lets look at details of asexual reproduction in the amoeba (a single cellular organisms) when the amoeba grows to a certain size, under favourable conditions such as suitable temperature and enough food, the process of binary fission starts before the amoeba can divide into two daughter cells. it first produces more cytoplasm and the cell becomes big, at this point the organisms also become immobile.

The cytoplasmic growth of the amoeba is then followed by the duplication of the genetic materials, which eventually leads to formation of two daughter nuclei in the parent amoeba. The parent amoeba with time then completely divides into two daughter cells which are genetically identical as the original parent cells. See the diagram below.

Reproduction in amoeba is rapid, the organisms reproduces in every 20 minutes.

Questions:

(i) What conditions are suitable for rapid in amoeba.
(ii) How many amoeba will be produced from a single amoeba in 24 hours.

Nuclear material

(draw diagrams)

Binary fission in amoeba.

Sporulation

In sporulation organisms reproduce by formation of spores. Such organisms which reproduce by formation of spores include fungi, some bacteria and protista once spores are produced they are dispersal in variation direction by wind animals or water. From their parents. Spores only germinate into individual organisms when they land in a favourable environment.

Question

What are spores?

Now lets look at reproduction by formation of spores in fungi. Fungi such as Rhizopus nigricans and bryophytes such as mosses and liverworts, and some ferns reproduce asexually by spores.

Reproduction in rhizopus

The Rhizopus is known as black mould or bread mould refer to unit 2.0. The organism grows on moist stale bread to form a black mass. These black masses are known as sporangia and are reproductive structures in fungi. The sporangia contains spores see the details of the nutrition of the Rhizopus in unit 2.0.

The diagram below shows some stages in formation of spores.

In each sporangia, there is a large number of tinny rounded spores. Each spore is made up of a resistant wall and contains more than one nucleus. They may under go cell divisions while still inside the sporangium. The spores may divide by neurosis or meiosis. This may result in the spores being haploid or diploid.

The sporangium is made of a thick wall which is brittle. The brittle wall contains a lot of calcium deposits. During formation of spores the sporangium enlarges until it raptures to release spores. Spores are light and therefore, are easily carried by wind. When they reach a favourable environment they germinate into fungi. However, if the conditions are not suitable, the spores remains dormant through out the adverse conditions.

Spores of mosses, liver worts, and ferns are produced by meiotic division hence they are haploid. Spores of mucor and rhizopus result from mitotic cell division, thus they are diploid.

Question

(i) What is the importance of bacterial and fungi in our day to day life.
(ii) What is the harmful effects of the bacteria to your body.

Explanation

Fungi and bacterial are used in decomposition of dead organism. Such fungi and bacteria are known as saprophytes. Without saprophytes dead organisms i.e. Animals and plants will not

be destroyed in the soil. Useful fungi like mushrooms are used as food by animals. Some fungi like penicillium produce penicillin which is an antibiotic used to treat bacterial diseases.

In production of soar milk and yogurt bacteria are used to act on fresh milk.

Some fungi and bacteria are known to cause diseases.

Question:

State three fungal and bacterial diseases.

Unit 10.2 Sexual reproduction in Plants

Objectives:

PSBAT: state the structure of a flower.
State the functions of the various parts of the flower.
Distinguish between self and cross pollination
State the agents of pollination
Fertilisation fruit and seed formation
Fruit/seed dispersal
Describe vegetative propagation.

Activity

Collect different species of flowers. Examine each flower and draw it.

- What do you think is the function of the flower to plants?
- What are the common features in all the flowers you have examined.

The structure of a flower

The reproduction organs of the flowering plants (anglosperms) are the flowers. A flower is part of the shoot modified for reproduction.

- Where is the flavour produced on the shoot. Although flowers may be of different types, they have common basic structures. The two figures below shows the photograph and the drawing of the general structure of the flower.

(insert picture)

Lets look at each part of the flower and what it does to the flower.

The male parts of the flower

The male parts of the flower are known as the stamens. Stamens consist of the anthers, and the filament. Stamens are collectively known as the Androecium. The diagram below shows the structure of the stamen.

(draw diagram)

The filament supports the anthers and provides nutrients to the anthers, while the anthers contain pollen grains which are the male reproductive gametes of the flowers.

The Female parts of the flower.

The female parts of the flower are known as the carpals. They consist of the stigma, the style and the ovary. Carpals are collectively known as the gynoecium. The ovary, the style and the stigma are also collectively known as the pistil. The diagram below is a general structure of a pistil.

(draw diagram)

The Petals

Petals are collectively known as the corolla. They are situated between the sepals and the stamens. In most flowers the corolla are bright coloured and this makes them attract insects for pollination. The other role played by the corolla is to protect the inner parts of the flower.

The Sepals

The sepals are strong in texture and protect the young flower when it is still in the bud. They also contain chlorophyll which makes synthesize food for the flower. In some flowers the sepals may be bright coloured and therefore attracts insects. The sepals are collectively known as the calyx.

The Stalk.

The stalk attaches the flower to the rest of the plant. It also contains the vascular bundles which nourishes the flower.

Pollination

Pollination is the transfer of the pollen grains from the anthers to the stigma between flowers of the same species (variety). Pollination is said to have occurred in the plant when the pollen tube from the pollen grain germinates into the style. They are two types of pollinations and these are:

(i) self pollination
(ii) cross pollination

Self pollination – this is the transfer of pollen grains from the anthers to the stigma between flowers on the same plants.

- What are the characteristics of self pollinated flowers?
- What is the importance of self pollination?
- What are the advantages of self pollination?
- What are the disadvantages of self pollination.

Explanation

In self pollination plants transfer desirable characteristics to their offspring e.g. high resistance to drought, diseases, good fruit yield e.t.c. In self pollination undesirable characteristics may also be transferred from one generation to another e.g. poor fruit yield e.t.c.

- Self pollinated flowers may have the following characteristics
- Short stamens
- Have both carpals and stamens (bisexual)
- Their carpals and stamens mature at the same time
- Have a chemical in the stigma which inhibits cross pollination

Cross pollination. This is the transfer of pollen grains from the anthers to the stigma between flowers on separate plants but of the same species.

Questions

- What are the characteristics of cross pollinated flowers?
- What are the advantages and disadvantages of cross pollination

Explanation

Cross pollinated flowers may be identified by the following characteristics:

- Have long stamens
- Their stigma does not produce the chemical which inhibits cross pollination
- Their mostly unisexual
- Their anthers and stigma mature at different times
- Their pollen grains are inhibited from growing on the stigma of the same flower.

Agents of pollination

There are two main agents of pollination and these includes the following:

(i) wind
(ii) insects

Flowers which are pollinated by insects are described as entomophilous. In insect pollination insects acts as the agents for carrying the pollen grains from one flower to another.

- They have bright coloured petals
- Their carpals and stamens are situated within the petals
- They have large petals
- Their pollen grains are few, large and rough
- They have small firm anthers and short, lobbed stigmas
- They have nectarines

The figure below shows typical of an insect pollinated flower.

Task

Identify some characteristics of an insect pollinated flower listed above from the diagram.

(insert picture)

Wind

Wind is another agent of pollination. The wind assist in carrying pollen from one flower to another. The flowers which are pollinated by wind are known as aneomophilons. Zeamays and many other grasses are examples of anaemophilous.

Characteristics of the wind pollinated flowers includes the following:

- Have small dull coloured petals, mostly green.
- Are not scented
- They have many small, smooth pollen grains
- They have large feathery and sticky stigma
- Their anthers are pendulous and hang outside the petals
- Their stigma hang outside the petals
- Have no nectarines

Question

Why do you think for the wind pollinated flowers it is important for them to possess the following characteristics.

(i) feathery stigma
(ii) numerous light pollen grains
(iii) stigma which hangs outside the petals

Below is the diagram of a wind pollinated flower, can you identify the physical features stated above about wind pollinated flowers.

(insert picture)

Activity

Task one. Collect as many flowers are possible. Group the flowers in the following groups:

(i) self pollination
(ii) cross pollination
(iii) insect pollination
(iv) wind pollination

Question

List down the characteristics which have helped you group the flowers.

Task two.

(i) Which pollen grain is from an insect pollinated and wind pollinated flower.
(ii) Give a reason for answer above.

Fertilisation

Fertilisation is the fusion of the male and female gametes to form a zygote. Once the right pollen grain lands on the right stigma, the pollen develops from the pollen and penetrates through the style to the ovary where the pollen nucleus fuses with ovule nucleus to form a zygote.

N/B the growth of the pollen tube is facilitated by the tube nucleus. See the diagram below.

What happens to the tube nucleus after pollination.

The tube (pollen tube) enters the cavity of the ovary through t he microphyle and then burst to release the male gamete which enters the embryo sac. After fertilisation the ovule becomes the seed while the ovary become the fruit.

The diagram below shows pollination and fertilisation study it.

(insert picture)

Fruit and seed formation

Activity

Collect the following fruits and draw to show their internal structures.

(i) Tomato
(ii) Orange
(iii) Bean pod
(iv) Cucumber
(v) Banana
(vi) Mango (mangifera indica)

Fruits can be classified into fresh fruits and dry fruits.

Task. Name some of the dry and fresh fruits. The diagrams below shows examples of some of the internal structures of the fruits.

(insert picture)

Seeds

Below are some of the seeds. Basically a seed has three main parts i.e. the seed coat (testa), the cotyledon and the embryo. See the diagram (The maize is known as a seed fruit).

(insert picture)

Fruit and seed dispersal

Definition:

- What is to disperse?
- Why is seed dispersal important to plants.

The importance of dispersal in plants

i) It allows plants explore new environments and this allows variation
ii) Reduces over crowding of plants of the same species in one environment. This ensures the health growing plants as competition for nutrients is reduced e.g. light, water, mineral salts.

They are main five methods by which seeds and fruits are dispersed and these are, animal dispersal, water dispersal, self dispersal, chance dispersal. We will look at the details of wind, animal and self dispersal.

Animal dispersal

Animals are the main agents of fruit and seed dispersal. Fruits like mangitera indica, persea gratissima (avocado pear). Psidium guajava (Guava) are examples of animal dispersal fruits.

Characteristics of the animal dispersed fruits are as follows:

(i) Some are fresh fruits
(ii) Some have hard seed coats which are normally indigestible in animal's alimentary canal.
(iii) Some are hooked e.g. black jack.
(iv) Some have coloured epicarps and are scented. (Give a reason) e.g. paw-paw, organs, guavas.

Task

List down other fruits with the characteristics above which could be animal dispersed fruits.

Wind dispersal

In wind dispersal wind the agent of dispersal. Fruits like combretum, sycamore, oleander, etc. are dispersed by wind.

What are the characteristics of wind dispersed fruits?

- They are light fruits and tend to be small, so that they can float in air easily.
- Others have wings e.g. sycamore see the diagram below.
- Some have hairly structures to enable them float in air.
- Others are dry fruits (light)

(insert picture)

Self dispersal

This method of dispersal depends on two factors namely tension and turgidity. For tension, it is confined to fruits whose pods splits into two forcing the seeds to be ejected e.g. beans, and broom have fibroins pods which twists when dry. See the diagram below. In fresh fruits like cucumber the turgor pressure inside the fruit causes the seeds to be detached from the turgid tissues. This results is in the seeds to be ejected with force from one half of the pod as it breaks away from the other.

Task

(i) What are the characteristics of water dispersed fruits
(ii) What role does man play in fruit dispersal?

Vegetative Propagation

Question

(i) What type of reproduction is vegetative propagation
(ii) Give two different examples of vegetative propagation

Explanation

Many flowering plants can produce offsprings by a form of reproduction known as asexual reproduction or vegetative reproduction or propagation. In this form of asexual reproduction offsprings are produced by vegetative parts of the plant e.g. the leaves, stem, buds, roots, bulbs, e.t.c, which are specialized for reproduction.

Basically there are two types of vegetative propagation, these includes:

a) Natural vegetative propagation
b) Artificial vegetative propagation

Task

Observe reproduction in the following plant species.

(i) Sweet potatoes
(ii) Cassava
(iii) Bananas
(iv) Sugar canes
(v) Ginger

Question.

How is each plant species above made to multiply by asexual reproduction?

(i) Describe asexual reproduction in sweet potatoes
(ii) Apart from the runners which other part of the sweet potatoes can reproduces asexually.

Natural vegetative propagation

Stems of some flowering plants if planted can put out roots and grow into a new plant. The stems of such plants contains stored food and information which is used during reproduction. In some plants roots can also reproduce to give rise to a new plants. Examples of plants which have modified stems are rhizomes corns, runners and suckers.

Runners – these are horizontal stems with buds at internodes which develops into shoots and roots. Plants which reproduce by runners includes the following sweet potatoes, strawberry, carpet grass, etc. See the diagram below which shows an example of a runner.

(insert picture)

Rhizomes

A rhizome is said to be a horizontal under ground stem, with a terminal bud that form aerial shoots and lateral buds that develop into lateral branches. See the diagram below.

(insert picture)

Questions:

(i) What is the difference between a runner and rhizome
(ii) What are the similarities between the runner and the rhizome?

Examples of the rhizomes are the Iris, Giner, and Fern. Other forms of natural vegetative propagation includes the following bulbs in which species like onion, and garlic are found, suckers in which we find plants like plantains and bananas.

Task.

Give examples of the plant species which reproduce from the following

(i) a) Stem tubers
b) Root tubers

(ii) What are the local names of the plants you have named above?

Artificial vegetative propagation

To increase his yield in agriculture man has come up with artificial vegetative propration. Examples of such includes: grafting, budding and cuttings.

Cuttings – in this method a cut is made by cutting off part of the stem. Normally the cut stem is first planted in a jar of water until its develops some roots before it is finally planed in the soil. Examples of plants which can be treated in this way are cassava, sweet potatoes, and sugar canes.

Activity

(i) Get a stem of sugar cane and soak it in water for several days.
(ii) Observe what happens to it
(iii) Name the features which has developed on the stem.

Grafting – in grafting the twig (scion) is carefully inserted into the cut stem of another graving plant (the stock) during grafting the vascular bundles of the scion and the stock must be brought in direct contact.

Question

What is the significance of doing this.

Diagram below shows grafting.

(insert picture)

Grafting is normally meant to improve the variety of fruits. Examples, an orange twig can be grafted on the lemon stock. The type of fruits which are produced during grafting are determined by the variety of the scion. Grafting usually is employed in growing plants with good variety but poor root system.

Budding

Budding is not very different from grafting only that in budding a bud of a desired plant is cut and joined to another plant of the same species or related species with a well established root system stem. Examples of plants which can be propagated by budding are, mango, lemons, guavas and oranges.

Advantages of vegetative reproduction

a) New plants are reproduced even when they are no seeds.
b) It helps in maintaining desirable varieties of given plant species
c) It helps in fast plant reproduction

Disadvantages of vegetative reproduction

a) Help in transmitting undesirable characteristics
b) Encourages overcrowding of plants

Question

What are the commercial advantages of vegetative reproduction in Agriculture.

Exercise

1. a) Draw the structure of an insected pollinated flower and label all its visible parts.
   b) What are the functions of the parts you have labeled?

2. Define the following terms:

   (a) Pollination (b) Fertilisation (c) Dispersation
   (d) What is the importance of each of the processes you have defined.

3. Distinguish between asexual reproduction and sexual reproduction in plants?

4. What are the main characteristics of the following:

   (a) Wind dispersed fruits
   (b) Animal dispersed fruits
   (c) Cross pollinated flowers

5. Name the agent of dispersion for mangifera indica, and its characteristics which makes it to be dispersed by the named agent.

6. What is the main advantage of asexual reproduction over sexual reproduction to farmers.

Sexual Reproduction in Mammals

Objectives:

PSBAT: identify the reproductive system in human beings.
State the functions of the reproductive organs
Describe the process of fertilisation and development.
State the dietary needs of a pregnant mother.
Describe some methods of family planning.
Compare and contrast reproductive system in frogs and human beings.

Reproduction in animals like in flowering plants is sexual reproduction. It starts with copulation, followed by fertilisation and then development.

i) Why do you think it is important for animals to reproduce.
ii) Distinguish between fertilisation and development in man, and in other animals like fish, reptiles, frogs.

The Human Reproductive Organs

a) The male reproductive organs

The diagram below shows the front view and the side view of the male reproductive organs. Look at the diagram carefully and identify the individual structure.

(insert picture)

Question

What do you think is the function of the individual structure of the male reproductive organs.

Explanation

The male reproductive organs consist of the following:

i) The penis
ii) The urethra
iii) The sperm duct
iv) The testes
v) Prostate glands
vi) Seminal vesicles glands
vii) The epididymis

The following is a summary of the functions of the various parts of the male reproductive organs.

The Testes - The testes are found in the scrotum spermatozoa (sperms) production takes place in the testes. In the semineferous tubutes. Sperms are produced by the process known as spermatogenesis. See the detailed structure of the testes.

(insert picture)

The Epididymis – this is a long coiled tube which temporally stores sperms before ejaculation.

The Urethra – this is the tube in which urine and sperms are conducted out of the body i.e. during urination and ejaculation respectively.

The Sperm duct – (vas – deferens) this is the tube which carries sperms from the epididymis to the urethra.

Seminal vesicle – these secrete the fluid known as seminal fluid. The fluid nourishes and activates the sperms.

Prostate gland – the gland produces an enzyme and the fluid which activates the sperms.

Cowpers gland – this gland secretes the chemical which neutralizes urine in the urethra.

The Penis – the penis is a muscular organ which deposits sperms in the vagina.

Question

i) How long is the penis of a n average adult when erect?
ii) If the sperm duct is cut and tied what would be an effect on sperm production?
iii) Why do you think the scrotal sac hangs outside the body.

The Female Reproductive Organs

The diagrams below shows both the side and the front views of the female reproductive organs. Look at the diagrams and identify the parts.

(insert picture)

The female reproductive organs consist of the following parts:

- the vagina
- the cervix
- the uterus
- the oviduct (fallopian tube)
- the ovaries

The Ovaries – in females there are two ovaries. At birth females are born with 400,000 immature (primary) follicle which remains dormant until puberty. After puberty only 400 fertile matures. The process by which the ova are made in the ovary is known as Cogenesis. When females reach the age of about 45 years follicle development stops, and a woman is said to have reached menopause i.e. no more child bearing.

The Vagina – the vagina is the muscular tube. It contains the glands which secretes mucus, and the vaginal fluids. The purpose of these fluids is to wet and lubricate the vagina. The vagina is also the birth canal. During copulation sperms are deposited in the vagina. The lower end of the uterus is called the neck or the cervix. The cervix leads into the vagina.

The Uterus (the womb) – implantation and development of the embryo takes place in the uterus. The uterus is surrounded by muscles known as the uterine muscles.

The Oviduct (Fallopian tube) – the fallopian tube leads away from the ovary. The fallopian tube do not connect direct to the ovaries, but have a funnel shaped opening known as the fimbriae near to the ovaries. In the oviduct, that where the ovum can be fertilized.

Study the external structure of the female reproductive system (front view) above.

Question:

What do you think is the function of the clitoris.

Sex cells

Spermatozoa

(draw diagrams)

Complete the table below to show differences between the sperms and the ova.

Characteristics (features)	**Sperm**	**Ova**
Number Relative size Mobility Shape		

Fertilisation and Development

Before fertilisation copulation has to take place during which sperms have to be ejaculated into the vagina. During intercourse the erect penis is moved in and out of the vagina repeatedly and this leads to release of sperms into the vagina. If the ovum is present in the oviduct, it can be fertilized by only one sperm cell. The fertilized ovum is known as the zygote. See the diagrams below which summaries copulation (mating and fertilisation)

(insert picture)

What happens to the fertilized ovum

After the ovum has been fertilized, the zygote divides into a little ball of cells, which at the same time moves down to the uterus to implant. The implanted embryo remains in the uterus for 40 weeks until birth. During its life in the mother's uterus, the unborn child gets its food from the mothers blood and releases its waste products like carbon dioxide, urea, uric acid from its body into its mothers blood. From the mother it obtains food like glucose, salts, vitamins, amino acids and also oxygen.

See the diagram below which shows the link between the mother and the child at the placenta.

(insert picture)

Questions

1. State the functions of the following:
   i) amniotic fluid
   ii) amniotic membrane

2. What is gestation period?

3. What does the umbilical artery and vein carry?

4. What happens to the mammalian glands after fertilisation to birth.

Child birth

A few weeks before birth, the foetus turns upside down with the head lying close to the cervix. See the diagram below. The process of birth begins when the muscles of the uterus start to contract. This is known as labour. The uterine muscle contraction is started by the hormone known as Oxytocin which is secreted by pituitary gland. The cervix during birth dilates until it is wide enough to allow the baby's head to pass through. The amnion raptures and the contraction of the uterus muscles and abdominal muscles pushes the baby out of the uterus, the cervix and the vagina. See the diagram below.

(insert picture)

When the baby comes out the umbilical cord is cut and tied.

Question:

i) Name the organs of the body which actively functions before the baby is born.
ii) Name the organs in the baby which starts working just after its birth.
iii) Why is it important to tie the umbilical cord before it is cut?

In the final stage labour, the uterus further contracts, thereby detaching the placenta and expelling it through the vagina as the after birth.

Sexual Development in Humans

Sexual development in humans beings is controlled by the sexual hormones. The male hormones collectly known as the androgens regulates the development of organs such as the sperm duct, epididymis, testes and the penis. The hormone also maintains the secondary sexual characteristics like; growth of facial and pubic hair deepening of the voice, muscular development, and also production of sperms which begins at puberty.

In females the oestrogens are responsible for the development of organs such as the vagina, uterus, fallopian tube and the clitoris. The oestrogens also maintains the development of the secondary sexual characteristics such as development of mammalian glands, pubic hair, broadening of the pelvic girdle. At puberty female commences their menstruation.

Questions

How does female body differ in shape appearance from that of a male?

The Menstrual Cycle

The menstrual cycle is controlled by the female sexual hormones. The cycle ranges from 23 – 35 days, but an average menstrual cycle takes 28 days. Now lets look at how the hormones control the menstrual cycle. The following are the important days of the menstrual cycle.

i) Day one – the first day of menstruation
ii) Day fourteen – day of ovulation
iii) Day twenty eight – last day of the cycle.

Every menstruation cycle starts with menstruation.

Details of the menstrual cycle

When the female stops her menstruation (discharge of menses) the follicle stimulating hormone (FSH) is produced by the pituitary glands. The FSH stimulates the ovaries to secrete the hormone oestrogen, and also causes the ovary to begin the maturing of an immature follicle (ovum).

Oestrogen prepares the uterus (i.e. it makes the uterus lining – thick). When oestrogen concentration reaches a certain level it inhibits the production of the FSH, but stimulates the

pituitary glands to produce another hormone known as the lentenising hormone (LH) this normally occurs on day 14 of the menstrual cycle. L.H. causes ovulation (release of the mature egg from the ovary). If copulation is allowed to occur during this period of the cycle the woman may conceive.

Higher concentration of L.H. causes the production of another hormone known as progesterone. Progesterone stimulates the growth of uterus lining, and stimulates increased blood supply to the uterine walls. The hormone is produced by the corpus leutem. If fertilisation does occur, the placenta takes over the production of progesterone until birth of the child.
If fertilisation does not occur, the absence of L.H. makes the corpus leutem (the remain of the follicle) to degenerate and production of progesterone stops. This makes the uterine to break the endometrium (the lining of the uterus added due to the effect of the oestrogen and progesterone). The periodic break down of the uterus lining is followed by the discharge of blood and the unfertilised egg (menstruation). Menstruation may last 4 – 5 days.

See the diagram below.

Questions

i) What factors affects menstrual cycles
ii) Why do you think pregnant mothers needs a special diet.
iii) What are the dietary needs for a pregnant mother.
iv) When the concentration of oestrogen reaches a certain level it causes the pituitary gland to stop producing F.S.H (negative feed back) why do you think this is important?
v) What is the life span of the sperms after ejaculation and that of ovum after ovulation.

Methods of family planning

i) What is family planning
ii) Why do you think it is important for the couple to plan their families.
iii) Suggest different methods of controlling child bearing.

Basically there are two categories of family planning methods and these are:

i) Natural family planning
ii) Artificial family planning.

Explanation

Family planning is important as it benefits the families in the following ways:

a) When children are spaced the mother is given enough period recover. So we can say it is for the good health of both the mother and the child.
b) The family which has a small number of children is easy to maintain economically and socially.

Natural family planning methods

In natural family planning methods there are no chemicals involved in controlling conception but instead body symptoms are used to determine ovulation. Natural family methods are mainly based on preventing fertilisation when ever the couple is avoiding to have children.

Below are some of the natural family planning methods, how they work advantages and their disadvantages.

The Withdraw Method

In this method, the penis is withdrawn from the vagina during copulation i.e. before sperms are released. The aim of this method is to avoid ejaculating sperms into the vagina so as to prevent fertilisation.

Advantages

- The method has no side effects
- It is cheap and available

Disadvantages

- The method is unreliable – why do you think this method is not very effective?
- There is no protection against S.T.Ds.

The Rhythm Method (Calendar method)

This method depends on determining the fertile and infertile days of the menstrual calendar of a woman. In the menstrual cycle, ovulation occurs between the day 12 – 14. Copulation may be avoided during these days i.e. if the couple wants to avoid fertilisation.

Advantages

- The method is cheap and available
- It has no medical side effects

- It is reliable

Disadvantages

- It is not very effective as the menstrual cycle varies from time to time.
- It does not offer protection against S.T.Ds.
- It is not always possible for the couple to refrain from copulation during the fertile periods of the cycle.

The Temperature method

The temperature method is used to determine ovulation. At the onset of ovulation the body temperature rises slightly, and does not fall to normal until after ovulation occurs. The period during which there is a rise in temperature is used as the fertile period of the menstrual cycle.

Advantages

- The method does cause medical side effects
- It is available
- It is cheap

Disadvantages

- Does not offer protection against S.T.D.s
- It is not reliable – i.e. any rise in temperature does not mean ovulation, it could be an illness.

Artificial methods of family planning

Artificial methods of family planning can be put under the following:

a) Hormonal
b) Mechanical
c) Chemical

The Pill (Hormonal)

The pill contains a mixture of the hormones oestrogen and progesterone. The two hormones prevents ovulation, thereby preventing fertilisation.

Advantages

- The method is easy to employ
- It is reliable
- It is cheap

Disadvantages

- It may cause heart attack, strokes, thrombosis, etc.
- The pill can cause cancer of the breasts.
- It may cause, nausea, obesity, headache, etc.
- In some women, it causes weight loss.

The Sheath (Condom) – Mechanical

The condom is put on an erect penis before copulation and the female condom is inserted in the vagina long before copulation. The condom acts as a barrier by collecting the sperms/semen so that they do not enter the uterus. The condom functions by preventing fertilisation.

Advantages

- It offers protection against S.T.D.s
- It is very reliable about 97% - 98% effective.
- It is cheap and available.
- It has no medical side effects.

Disadvantages

- The condom sometimes during copulation may be damaged, and sperms may escape into the uterus through the damaged part to cause fertilisation.

The Cap (Diaphragm) – Mechanical

The diaphragm consist of a very thin elastic sheet stretched across a flexible metal rim. The cap is placed on the cervix. This blocks the sperms from crossing into the uterus. This method also prevents fertilisation.

Question

Why do you think both the sheath and the diaphragm can be referred as barrier methods.

Before the diaphragm is inserted in the cervix the device is smeared with the spermicides. The spermicids are meant to destroy the sperms after they are deposited. To ensure that all the sperms are destroyed diaphragm can only be removed after 6 hours.

Advantages

- The method is reliable
- It gives enough time for copulation

Disadvantages

- It is expensive. This is because it can't be used alone but with spermicides.
- It demands high standards of hygiene.

- It leads to cancer of the cervix.

The Intra Uterine Device –Mechanical

The loop (IUD) consist of a coil made of plastic materials with a string attached to it. It is inserted in the uterus through the extended cervix during menstruation. The loop prevents formation of the endometrium and zygote development. Sometimes copper and progesterone may be added to the device in order to make it more effective.

Advantages

- It is long term – if the loop can remain in the uterus for months.
- It is very reliable
- It gives enough days for copulation

Disadvantages

- The menstrual periods are often painful and heavy
- May lead to infertility due to pelvic infection
- May cause cancer of the uterus
- It is expensive
- Does not offer protection against S.T.Ds.

The diagram below shows where the loop and the diaphragm are positioned inside the female's vagina.

(draw diagram)

Sterilisation (Surgical)

In males the sperm ducts are cut and tied. This prevents ejaculation of sperms during copulation and therefore preventing fertilisation. Sterilization in males is known as vasectomy. In females the oviduct is cut and tied (laparatomy). This also prevents the fusion of the ovum and the sperms. This method is commonly practiced by a couple which feels they no longer need any more children.

What do you think are the advantages and disadvantages of this method of family planning.

Spermicides (Chemical)

The spermicides kill sperms. They are available in form of tablets, cream, or foam. They are applied in the vagina before copulation and the application is repeated after every act of copulation. The method is also effective, but in some females and males the sperms causes inflammation of the genitals as well as itching. The cream, tablets/foam is also expensive.

Activity

Visit the pond and observe the frogs mating.

i) In which way is reproduction in frogs different to reproduction in man.
ii) What is the advantage of internal fertilisation and development over the external.
iii) What is similar about reproduction in frogs as compared to reproduction in man.
iv) Why do frogs lay numerous eggs?

Exercise

1) Using specific examples distinguish between the human female sex gametes and the male sex gametes
2) Define the term sexual reproduction as it applies to all living organisms.
3) A female started her menstruation on 23rd August 2005 when is
   a) she likely to have her next menstruation
   b) experience ovulation

4) a) Describe briefly the function of
      i) the human ovary
      ii) the human oviduct
   b) i) Explain the function of the human placenta
      ii) what are the advantages of breast feeding compared to bottle feeding

5. For each of the following methods of family planning below, state how it works, its advantages and disadvantages

   a) The sheath
   b) The Rhythm
   c) Vasecotomy
   d) The loop

6) Why is it important for the government to control reproduction of certain animal species e.g. man, lions, crocodiles, etc..

UNIT 11.0 HEALTH

Unit 11.1 Diseases

Welcome to unit 11.0. In this unit we are going to look at diseases, methods of transmission and where possible treatment.

Objectives:

PSBAT: Define health, diseases
Discuss some common diseases

The term diseases means any condition which changes the normal functioning of the body. Diseases may be a disorderly state of the tissue, organ or the whole system. Most diseases are caused by micro organisms, other are inherited, while diseases like thrombosis hypertension are degerative.

Good health. This is defined as a state of complete physical and mental well being of a human and not just the absence of a disease in the body. This definition encompasses the following: personal hygiene, clean food, water, and clean environment.

Personal hygiene

Questions:

State five ways in which personal hygiene can be practiced. Look at the following:

i) handling of food
ii) keeping of nails
iii) washing of the body, hair, armpits, etc.
iv) the teeth
v) clothing, under wears, sanitary towels, foreskin for the uncircumcised

Food, water and environment

Question

How can we ensure that we are clean, have food, water and environment?

i) Water
ii) Food
iii) Environment

Our health is mainly affected by the diseases.

Task

1) List the common diseases in Zambia
2) Group the diseases under the following topics:

i) Diseases caused by microbes
ii) Inherited diseases
iii) Degenerative diseases

N/B Diseases caused by the microbes are also referred to as diseases which are caused by micro-organisms or pathogens. We will look at the details of some microbes in unit 13.0. We will look at the bacterial, viral and protozoan diseases.

Cholera

Cholera is caused by the bacterium known as Vibro Cholerae. The bacterium is mainly present in vomits, stools of a patient. When in the human body the bacterial affects the alimentary canal.

Method of transmission

The disease is transmitted from one person to another through drinking of contaminated water and eating of contraindicated food.

Signs and symptom

- severe diarrhea without pain
- race-water like stool
- vomiting
- the skin become cold and wrinkled
- sunken eyes

Prevention and treatment

The disease can be prevented by strict personal hygiene, and treatment is by using antibiotics accompanied by replacing lost fluid from the body.

Typhoid

Typhoid is by a bacterium known as Salmonella typhi.

Method of transmission

Like cholera typhoid is transmitted through consumption of contaminated food and water. The bacteria may hide in the gall bladder for months or years before it can cause the disease.

Signs and symptoms

- rise in the body temperature
- increasing headache, drowsiness and aching
- vomiting
- rash may appear on the upper abdomen and on the back as red spots.

Prevention and Treatment

The diseases may be prevented by vaccination, while treatment is also administered by using drugs like chloromphenicol.

Tuberculosis (T.B.)

Tuberculosis (T.B) is the most common communicable disease in the world. Its causative agent is mycobacterium tuberculosis.

Method of transmission

T.B. is an airborne disease. The bacteria is transmitted from one person to another through inhaling of contaminated air. The bacteria affects different parts of the body e.g. the lungs, bones, etc.

Signs and symptoms

- Vigorous coughing
- Bloodish spitum
- General weakness
- Fever and excessive weigh loss

Prevention and Treatment

The disease is treated by using drugs like streptomycin. Prevention in clued RCG vaccine, avoiding over crowding and also proper ventilation.

Malaria

Malaria is a protozoan disease caused by the protozoa known as plasmodium. In human beings plasmodium is found in blood and the liver, while in the female anopheles mosquito it is found in the salivary glands.

Method of transmission

The parasite is transmitted from one host to another by a vector known as the female anopheles mosquito.

Question:

Why is the male anopheles mosquito not a vector of malaria?

Prevention and treatment

Malaria can be prevented by avoiding mosquito bites and also by eradicating mosquitoes.

Task

i) Identify the ways we can use to avoid mosquito bites
ii) State the ways which can be employed to eradicate mosquitoes.
iii) How can malaria be treated.

Sexually transmitted diseases

Gonorrhoea

Gonorrhoea is caused by the bacterium Gonococcus neisseria. The bacteria is transmitted from person to another by sexual intercourse as well as from the mother to unborn child. In the body, the bacteria infects the membrane of the genitals track, rectum, pharynx and eyes.

Signs and Symptoms

- In males, there is a purulent yellow discharge
- In females there may be vaginal discharge
- Infection of the urethra and the rectum.

N/B If treatment is delayed the infections in males spreads to the sperm duct, the epididymis as well as the testes. For female the uterus, oviduct and ovaries eventually become infected.

Treatment and prevention

The disease is treated using antibiotics like penicillin, amphicillin preventions includes practicing safe sex and abstinence.

Syphilis

Syphilis is a chronic infection caused by the bacterium. Treponema palladium syphilis is spread by sexual contact just like Gonorrhoea.

Signs and symptoms

After incubation period of 9 to 90 days, the diseases expresses itself in the following ways:

- A chancre or pimple develops on the site of infection. The chancre is painless and heals on its own.
- 6 to 8 weeks fever and rash appears on the body. The rash is dull red.
- If not treated syphilis results in death

N/B Syphilis can remain in the body even for ten years.

Treatment and prevention

The disease can be treated using penicillin. Prevention involves safe sex and abstinence.

Acquired Immune Deficiency Syndrome (AIDS)

Task

i) What do the letters HIV and AIDS stand for?
ii) How is HIV spread from one person to another
iii) What are the signs and symptoms of AIDS.
iv) What are the social economic effects of AIDS in Zambia
v) How is the disease prevented and treated?

Bilharzia (Schistosomiasis)

Bilharzia is caused by the blood fluke known as Schistosoma. In human beings the adult schistosomes lay eggs (ova). The ova is passed from human beings in form of ova through urine or faeces. In fresh water the ova enter their intermediate host which is the water snail. Inside the snail the eggs produces the large number of larva (cercaine). Another person may have the fluke by contact with water infected with cercaine by wadding, bathing or drinking the water.

Signs and symptoms

- Passing of blood stained urine
- Pain when urinating
- Passing of blood stained faeces.

Task

How can bilharzias be prevented and treated.

Immunity

Explanation

Immunity is the ability of the body to fight diseases. There are two types of immunities and these are:

i) natural immunity
ii) artificial immunity

a) The Natural immunity is the natural ability of the body to fight against diseases. It is normally established after a person has suffered from the disease.
b) Artificial immunity is the immunity introduced in the body by vaccination.

Immunity is also said to be active or passive.

Active immunity. This is when the body is able to produce its own antibodies to fight the antigens examples of such immunity are natural immunity and vaccination.

Passive immunity. In passive immunity, an individual is not able to produce the antibodies. This means antibodies have to be introduced in the body by injection. The immunity in the unborn baby is also said to be passive because the baby gets antibodies from its mother's blood incase of it being infected.

Vaccination (immunization). During immunization a person is injected with killed or modified virus or bacteria. To establish immunity the body responds producing antibodies to fight infections. E.g. to immunize against measles the virus for muscles are treated and injected into the body.

Exercise

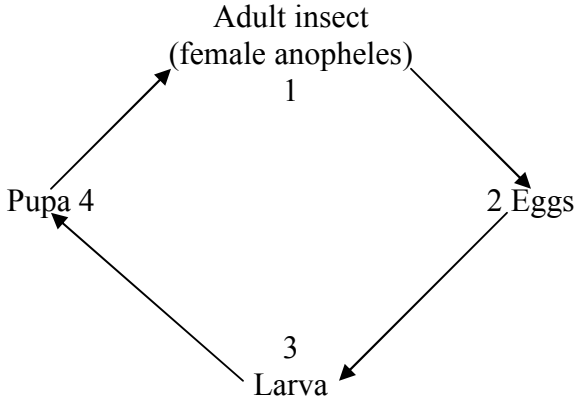
i) Describe how diseases may be caused.
ii) What is immunity
iii) Class the following under passive or active immunity6

a) Natural immunity
b) Injection of serum
c) Vaccination
d) Injection of antibodies
e) Injection of antigens

iv) For each of the following diseases, name its causative agents, method of transmission and treatment.

a) Cholera
b) Typhoid
c) Malaria
d) T.B.

v) Describe the ways in which the leucocytes defends the body against diseases.
vi) a) Name the factors which affects immunity
b) Why is immunity important to our body.
vii) Study the insect cycle below and answer the questions that follow.



a) How can malaria be controlled at each of the stages of the vector in the cycle above.

Stage 1 ……..
Stage 2 ……..
Stage 3 …….
Stage 4 …….

UNIT 12.0

Unit 12.1 Variation

Welcome to unit 12.1. In this unit we are going to look at differences that exist in characteristics of organisms of the same species. You are gong to enjoy this unit.

Objectives:

PSBAT: Define variation
Distinguish between continuous and discontinuous variation
State the factors which causes variation.

Definition

Variation is the study of the differences which exist in characteristics between organisms of the same species.

Activity

Collect the groundnuts seeds. Compare and contrast the characteristics of the seeds.

Question

Do the seeds look the same or different?

- What are the similarities?
- What are the differences?

Compare the male and the female body of human beings.

Questions

i) What are the similarities between the male and the female bodies?
ii) What are the differences between the male and female body?

Types of variations

There are two types of variation namely continuous variation and discontinuous variation.

Continuous variation

In continuous variation organisms do not show sharp differences in characteristics but show a wide range of characteristics expressed between two limits. Examples of continuous variation are: in man, height, weigh, skin colour, in plants we have size of the leaves, height of the plant, size of the fruits.
Lets fore instance take height in man, if we measure height in man we will have the shortest and the tallest man, and in between we will have others with intermediate heights.

- What are the other examples of continuous variation in both animals and plants.
- Why do you think organisms of the same species show continuous variations in their characteristics?

Activity

To observe the length of the mango leaves.

Method

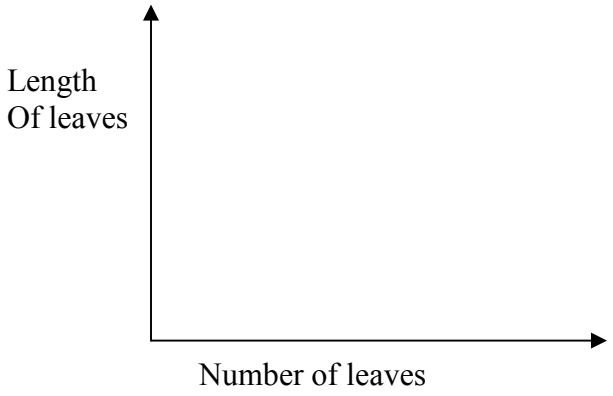
Detach a number of leaves from the mango plant.
Record the length of each leaf
Record your results
Group your results into suitable categories, and then record the number of leaves in each category.
Plot the graph of the number of leaves against length.

Question

What type of variation is the length of leaves in plants?

Explanation

When the graph of the length of leaves in plants is plotted, the following will be observed.



This graph will represent all the characteristics which shows continuous variation.

Causes of continuous variation

There are two main factors which affects variations in both plants and animals i.e. Environmental and non environmental factors.

Environmental factors

- Temperature of the environment
- Light intensity in the environment
- Water availability

- Diet – nutrition
- Type of soil
- Mutations
- Pollution

An organism supplied with all the necessary nutrients for its growth will grow health than the organism taking certain nutrients. Such will lead in variations between organisms.

Task

Using your knowledge on nutrition explain the factors listed above may result in continuous variation.

Non environmental factors
(Genetic factors)

These factors include those inherited from the parent organisms. Organisms reproduced from the same parent may not inherit the same characteristics. This means they may not resemble in every factor.

Discontinuous variation

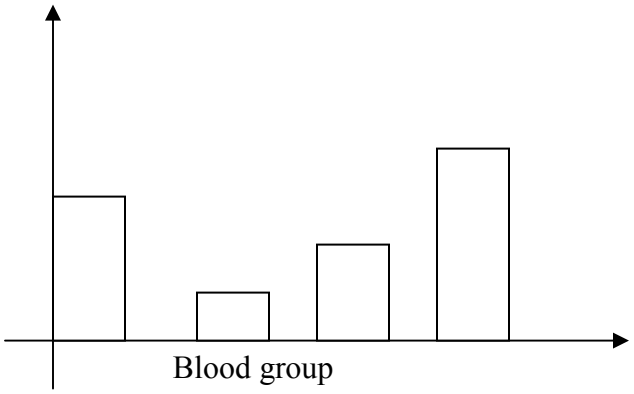
This is the type of variation in which organisms shows a clear cut differences in characteristics between themselves. Examples of discontinuous variation are height in peas, sex, tongue rolling, blood groups inheritance.

Question

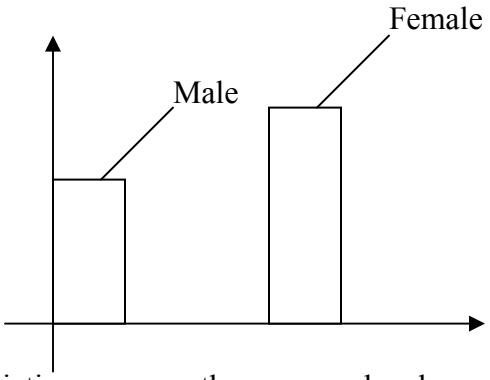
What are the causes of discontinuous variation?

Factors in discontinuous variation are inherited factors (non environmental) and cannot be altered by the environment, e.g. dirty, temperature or light intensity can not change your sex. The graphs below shows discontinuous variation.

Blood group in man



Sex in man



In discontinuous variation, no smooth curve can be observed as in continuous variation but distinct groupings.

Activity

Method

Observe – tongue rolling in your family members
How many members of your family are tongue rollers
How many are non tongue rollers?
What type of variation is tongue rolling?

Exercise

i) Define the following terms
   a) Variation
   b) Continuous variation
   c) Discontinuous variation
ii) Distinguish between continuous and discontinuous variation
iii) What are the major causes of variation in living organisms.
iv) What is the importance of variation in some living organisms.

Unit 12.2 Mitosis and Meiosis

In this unit we are going to look at types of cell division in our body, as well as the bodies of other living organisms. You will enjoy the lesson.

Objectives:

PSBAT: Describe the stages of mitosis and meiosis
Describe a chromosome and a gene
State the importance of mitosis and meiosis.

Mitosis and Meiosis

In living organisms cell divides continuously. The division of cells results in passing of genetic characteristics from one cell to another. There are two types of cell division and these are; mitosis and meiosis. Lets look at mitosis then Meiosis.

Mitosis

In mitosis the cells which results from the division have the same genetical materials as the original parent cell. Mitosis takes place in ordinary body cells (autosomal cells). Mitosis occurs in five stages namely, interphase, prophase, metaphase, anaphase and telephone. In idea of mitosis human cells can be simplified as below:

Now lets look at the details of each stage of mitosis.

Interphase. During interphase there is no activity leading cell division but it is the stage during which the cells grow in order to attain the normal size.

Prophase

In prophase the chromosomes in the cells shortens and become thick. This makes them become visible. The nucleoli disappears and the centrosome duplicates its self and moves to the opposite poles of the cells.

Metaphase

During this stage the chromosomes attaches themselves to the spindle fibres at the centromeres, usually aligned at the equatorial region of the cell. See the diagram below.

Anaphase

During the anaphase chromatids move to the opposite poles of the cell. They separate at the centrometre first and slowly pulled towards the poles by the spindle fibres.

Telophase

This is the final stage of cell division. During this stage, the nuclear membrane forms around the separated chromosomes. Finally the cell cytoplasm separates to give rise to two daughter cells.

The diagram below shows the stages in cell division.

(insert diagram)

Meiosis

During meiosis the cell division that takes place results in halving the number of chromosomes. Meiosis occurs in two stages and these are meiosis one and meiosis two. The diagram below summarises meiosis in human beings:

(draw diagram)

Where does meiosis take place? In animals and plants. Like in mitosis meiosis also takes place in stages; but happens during these stages is different during mitotic stages.

The first meiotic division

Interphase

During this stage the nuclear proteins are synthesized and the chromatids replicates, after they become joined at the centromeres.

Prophase one

During the initial stages of prophase one, the chromosomes start to form matching pairs known as homolons pairs. Each pair consist of one chromosome from the parents i.e. male and female. The matching chromosomes carry similar genetic characteristics of the organisms. In the next stage of prophase 1, the homologous chromosomes shortens and thickens, followed by replication which totals the number of chromatids to four. After

chromosome replication, the chromosomes now separates from their pairs but remain attached at some point called the chiasmata.

Metaphase 1

The nuclear membrane is still disappeared, and the centromere of the two chromosomes of homologons pair lie on either side of the equator.

Anaphase 1

The homologons chromosomes are separated and each is dragged to the opposite pole of the cell.

Telophase

During this stage the chromosomes will arrive at the poles and nuclear membrane will form around them. This then follows the complete division of the cells into two.

Second meiotic division. What happens during meiotic II is the same as what happens during mitosis but during meiotic II there is no interphase.

See the diagram below.

(insert picture)

The importance of mitosis

Mitosis is very important because it leads to the increase in size and the number of cells without alteration in the genetic composition of the cells. Mitosis also helps in replacement of the worn out tissue. In some organisms which reproduces by asexual reproduction mitosis leads the whole process of reproduction e.g. in vegetative reproduction.

The importance of meiosis

In organisms which reproduce sexually meiosis leads to production of sex gametes, and also helps in maintenance of the specific diploid number of chromosomes for specific organisms.

Questions

i) Where does mitosis and meiosis take place?
ii) Name sex gametes in plants and animals where meiosis occurs?

Genes and Chromosomes

Chromosomes

These are thread like structures found in the nucleus of the cells. The chromosomes consist of two strands which are known as chromatids, which are held together at the centromere. Mainly the chromosomes are made of two proteins called histones and the nucleic acid (D.N.A.)

Each species organism consist of a definite number of chromosomes in the nucleus of its cells. in man there are 46, in mouse 40, and the drosphila 8. The chromosomes exist in pairs known as homologons pairs.

See such a pair below

In reproductive cells the number of chromosomes is half the diploid number. This number is known as the haploid number.

Genes

A gene is part of DNA molecule which specifies the type protein to be produced. Genes are responsible for characteristics like colour, sex and the hair texture, tongue rolling, height. The genes which control the same characteristics and occupy the corresponding position on a hothologuns pair of chromosomes are known as alleles, and a pair of a gene is known as an allotemorphic pair. See the diagram below:

In the next unit we shall represent the genes using letters e.g. Tall – T, t = dwarf.

Capital letters are used to represent dominant genes while small letters are used to represent recessive genes.

Unit 12.3 Inheritance

Genetic covers the study of variation and inheritance. As we have earlier discussed in variation you have seen that genetics gives us an explanation why organisms of the same species look similar or show some variations. In this unit, we are going to look at the inherited characteristics which affects variation and how these characteristics are inherited. Enjoy the unit.

Objectives:

PSBAT: Define inheritance
Define some genetical terms
Show monobird crossings
Determine sex in human beings using genetical crossings.
Show inheritance linked characteristics

Some genetical terms

Phenotype:	The outward appearance of all organism
Genotype:	The genetic make up of an organism
Gametes:	Sex cells e.g. sperms, ova, pollen, ovules
Homozygons:	An individual with a combination of identical alleles.
Heterozygons:	An individual with a combination of different alleles a dominant gene and a recessive gene e.g. Tt, Bb,
Progenies:	Offsprings (result of genetical crossing)
Downsydnrome:	An individual with more than the normal diploid number of chromosomes i.e. 47 instead of 46.

The Monobird

We are going to look at the inheritance of the genetical characteristics one by one.

Height in human beings

A homozygons tall man is married to a dwarf woman, given that tallness is dominant over dwarfism. Use the letter T for tallness, and small t for dwarfism. Determine the possible heights of the children born from this couple.

Below is a lay out on how to construct the genetical crossing diagram.

Parent: **Male** **Female**

Parental phenotype: **Tall** **Dwarf**

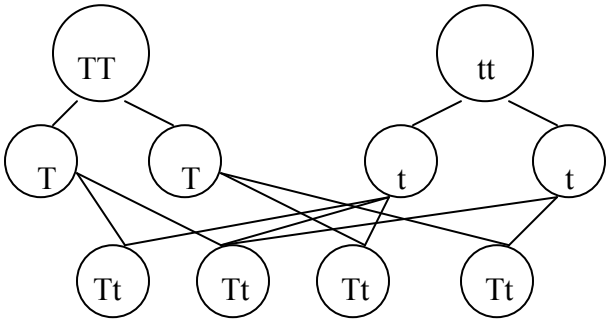
Parental genotype:

Gametes:

Genotypes of F_1 Generation

Phenotypes of F_1 Generation

Phenotypes of F_1 Generation:



All the children will be heterozygons tall.

Question

Suppose in a family of both heterozygons tall parents had 9 children. What are the chances that this child will be: a) Tall b) dwarf.

Again use a genetic diagram like the one above to find your answer to the question.

Genetical ratios

There are two main genetical ratios which you need to known. The ratios will make you determine the phenotype and the genotype of the parents given the phenotypes of the progenies expressed in ratio form.

Example here is the question which you may need to know the genetic ratios.

a) Two mice were produced out of twelve, nine were black and the rest white. What is the phenotype and genotype of their parents.

3 to 1 ratio
This combination is also said to be 75% to 25%, in terms of fraction is it ¾ to ¼.

3 to 1 ratio of the phenotypic combination of the offsprings results from the genotype in which both parents are heterozygons for that characteristic.

Heterozygolis x heterozygons

Lets use the punnet square to explain this:

e.g. height both parents tall (Tt)

Female

	T	t
T	TT	Tt
t	Tt	tt

Results Tall: TT, Tt, Tt = 3
Dwarf: tt = 1
Tall: Dwarf

Ratio 3:1, Fraction Tall ¾, dwarf ¼

Now answer question 'a' above given that black is dominant over white.

ii) 1 to 1 Ratio (50% to 50%)

The genotype of the parents for a 1 : 1 ratio must be as follows:

Heterozygons x Homozygons recessive

Tt x tt

Tall $^{2}/_{4}$
Dwarf $^{2}/_{4}$ or 1 : 1

	T	t
T	Tt	Tt
t	tt	tt

Which of the following genotype of the parent organisms will give the offsprings composition in characteristic of 1500 to 500.

a) 1:1
b) 3:1
c) 2:2

Sex Determination

Question

When is the sex of the child determined and what determines the sex of the child?

Explanation

The sex of the child is determined at the moment of fertilisation by the sex chromosomes in the male gametes. There are 23 chromosomes in a haploid number of chromosomes, and the 23rd chromosome is the sex chromosome – The sex chromosome carry the sexual characteristics of an organism.

The sperm cell carry X or Y sex chromosome while the ovum always carry X, sex chromosome see the diagrams below.

The table below summarises the genotype and the phenotypes of man in terms of sex.

Phenotype	Genotype
Male	XY
Female	XX

Examples

i) Using a genetic diagram prove that at any given fertilisation the chances of having a girl are equal to the chances of having a boy.

ii) In a family there are six girls and one boy. What are the chances that the eighth born can also be a girl.
   a) 50%
   b) 25%
   c) 100%
   d) 75%

Solutions

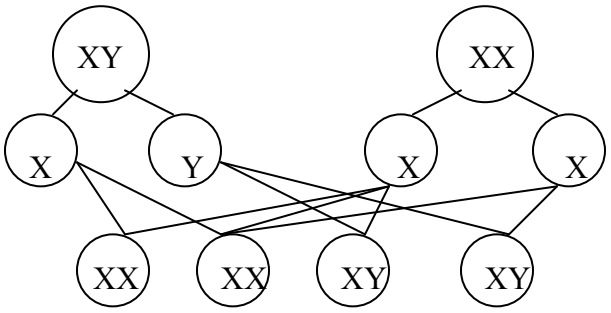
Parent: **Father** **Mother**

Phenotype Male Female

Genotype:

Gametes:

Genotype F1 Generation:



Female **Male**

Phenotype:

F1 Generation:

Chances of Girl $^{2}/_{4}$ (50%)
Boy $^{2}/_{4}$ (50%)

ii) Answer 'a' (50%) explanation. At any given fertilisation the chances of both sex are equal.

Blood Groups

Blood groups are determined by three alleles, that is, the allele I^A, I^B and I^O. The alleles I^A and I^B are dominant while the allele I^O is recessive. Look at the table below which summarises the phenotype and the genotype of various blood groups in man.

Phenotype	**Genotype**
Blood group A	$I^A I^A$, $I^A I^O$
Blood group B	$I^B I^B$, $I^B I^O$
Blood group AB	$I^A I^B$
Blood group O	$I^O I^O$

One can be homozygous for blood group A, and B (I I , I I)or heterozygous (_) for blood group A and B respectively.
Blood group AB is an example of co-dominance where the two different genes are equally dominant. Blood group O is homozygous recessive (I I)
Using the information above, we can determine different blood groups of individuals given the genotypes of the parents.

EXAMPLES

What is the blood group of a child born from the couple in which the mother is homozygous for blood group A and the mother blood group O?

Parents: **Male** **Female**

Phenotype: Blood group A Blood group O

Genotype: $I^A I^A$ $I^O I^O$

Gametes: I^A I^A I^O I^O

F_1 genotypes: $I^A I^O$ $I^A I^O$ $I^A I^O$ $I^A I^O$

F_1 phenotype: A A A A

The child will have blood group A

Exercise

1. Now try to determine the blood groups from the following parental blood groups combinations.

	Male	**Female**
a.	Blood group O	Homozygous blood group B
b.	Heterozygous blood group B	Heterozygous blood group B
c.	Blood group B	Blood group AB
d.	Blood group A homozygous	Blood group B homozygous

2. Brown (B) eyes are dominant over Blue eyes (b). What is the color of the eyes of the child born from the parents who are both heterozygous for brown eyes.

Albinism

Albinism is caused by gene mutation an individual becomes an albino if he or she inherits two recessive genes for albinism. In albinism there is lack of Melanin the skin color pigment in the effects of albinism:

i) Whitish cracking skin
ii) Whitish hair
iii) Poor eye sight

Task

One who carries a gene for albinism does not become an albino but a carrier of albinism. What are the chances of a couple having a child who is an albino when both are carriers of albinism.(use the following genes)

B –normal skin
b - albinism

Sex Linkage

Some chromosomes, apart from carrying genes that determines sexual developments they carry genes which determines other characteristics. These genes are said to be sex linked genes example color blindness is caused by a gene which is found on sex chromosomes, and this gene is only found on the X chromosomes the gene for color blindness is recessive.

Question

Why is color blindness common in females?

- The other sex linked trait is haemophilia (leading to have poor blood clotting).
- Why are sex linked characteristics not common? Consider the statement below to answer the question. The sex linked characteristic results from recessive genes.
- Apart from the sex linked characteristics listed above what are the other sex linked characteristics.

Mutation

Mutation is sudden changes in the structure of the genes or the chromosomes. Mutations once in the body may result in the changes in the phenotype and genotype of an organism.

Types of Mutations

There are two types of mutations and these are;

a. Gene Mutation;- This is the mutation that takes place in the gene.
b. Chromosome Mutation;- These are the mutations which occurs in the chromosomes.

Gene Mutations

Gene mutation occurs when the arrangement of the bases of the DNA molecule(s) is changed. Examples of gene mutation are:

i) Albinism – which causes lack of melanin in the body of an organism
ii) Sickle cell anemia – results in defective hemoglobin which has lower oxygen affinity.
iii) Hemophilia.
iv) Deletion – loss of some information on the chromosome.
v) Cancer – abnormal division of cells in the body organs example lung cancer, cervical cancer.

Chromosome mutation

Examples of chromosome mutations are:

- Downs syndrome – extra chromosome is added to diploid number. E.g. 47 in man from 46.
- Color blindness
- Deletion – where the whole chromosome lack information think of the other examples of chromosome mutation.

Causes of Mutation

Mutations may be caused by the following factors.

i) Excessively high temperature
ii) Exposure to certain chemicals
iii) High energy radiation such as X – rays, Beta and Alpha rays.

The mutations which are normally expressed are those which occur in the sex gametes than those which occur in the ordinary cells. Sex cells are the ones used in reproduction.

Some mutations tend to be useful especially those which lead to advantage the organism. A mutation leading to establishment resistance towards a disease. while others are harmful.

Task

From the mutations described
i) List the harmful mutations and
ii) suggest other useful mutations

Exercise

1. Albinos have no pigment in the skin they are very pale. This condition is caused by a recessive allele. Dave marries Joan, Dave and Joan are both normal but each of them has a parent who is an albino

    a. How likely is it that the first child of Dave and Joan will be an albino? Give a reason why.
    b. Certain individuals in this family are carriers which ones are carriers and what does this word mean.

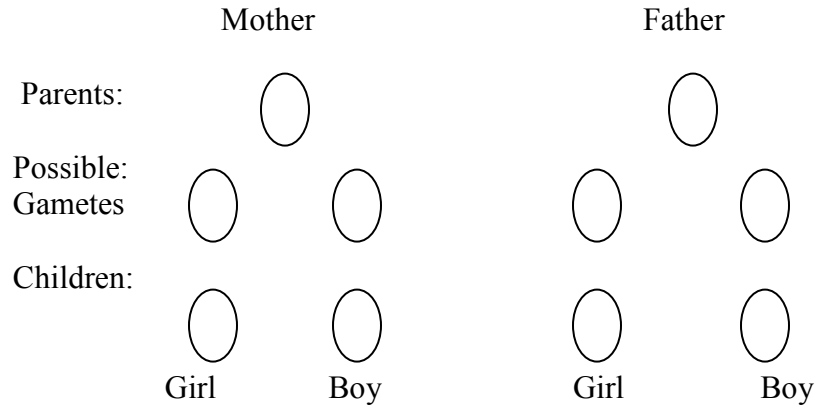
2. a. What is meant by the term co-dominance.
    b. Using a full genetic diagram show how

        i. A father with blood group A and a mother with blood group B can produce a child of blood group O.
        ii. There are approximately equal numbers of boys and born each year.

3. In humans, the gene for wavy hair is dominant to that of straight hair (in your answer use H for wavy hair and h for straight hair)

    a. Explain the meaning of the statement a person with wavy hair may be homozygous or heterozygous for the characteristic.
    b. Explain how a man with straight hair married to a woman with hair wavy hair is unlikely to have a child with straight hair.
    c. By what means of a genetic diagram explain why a man with who marries a woman with wavy hair may have a child with straight hair.

4. Complete the crossing below to show the transfer of sex chromosomes



5. Study the diagram below on variation.

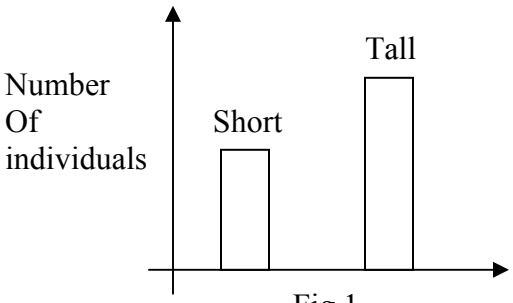


Fig 1

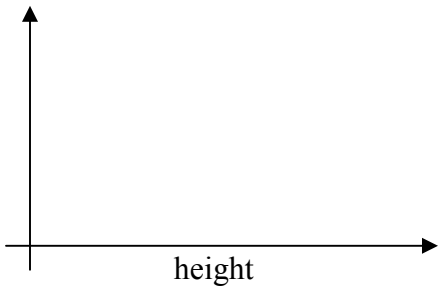


Fig 2.

a. (i) Which graph shows height variation in human beings.
(ii) What type of variation are shown by the two graphs
Graph 1 ……
Graph 2 …….

b. Explain briefly how two types of pollution are caused?

6. Complete the sentences by adding the appropriate words chosen from the following list:

Recessive	**One**	**Offspring**
Dominant.	Two.	Phenotype
Heterozygous.	Three.	Genotype
Homozygous	Four	
Generation	Parent	

Each word may be used once, more than once or not at all.

Two Guinea pigs with ……. Brown coat were mated together and their seven offspring were in the ratio of five brown to two white. The brown parents were of ……Bb, so that the white form must have been the double …… bb If the brown guinea pigs of the F1 ……. Were mated with the white guinea pigs of the F2 ……. Their offspring would be in the ratio of ……..brown to …… white.

7. (i) State the causes of variation in plants.
(ii) What is the significance of variation?

UNIT 13: ECOLOGY

At the end of this unit the learner should be able to:

- Explain the term Ecology.
- Explain the meaning of the terms habitat, Niche, Population, Community.
- Describe a food chain and web.
- Describe the flow of energy along food chains and webs.
- Explain the efficiency of energy transfer between tropic levels.
- Explain how carbon and the pyramid of energy and Biomass
- Explain how carbon and nitrogen are cycled within an ecosystem.
- Describe the water cycle
- Explain the meaning of the Ecosystem.

In this unit you are going to study the relationships of organisms with one another and with their environment. This is what is called Ecology.

Before we go in details studying this topic there is need to understand the meaning of the terms which are commonly used in the tropic.

Habitat

This is the actual place which a community of living organisms occupies

NICHE

This is a way of life which enables a species to occupy a particular place within a community .This "way of life "includes all the things a species does to survive , such as the Type of the food it eats, how it finds its food etc.

POPULATION

Communities consist of many different species liked together in a food web. The Members of each species make up the population.

COMMUNITY

A group of organisms which live in a particular place, such as forest or pond etc is called a community

Every living thing is linked to one another as they eat and are eaten in the food webs of the living world. Living things are also linked to the world of non –livings or world of sunlight, rocks, soil water and air. They depend on it for energy, support, shelter and basic raw materials of life.

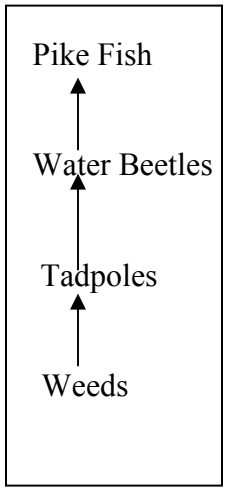
FOOD CHAIN

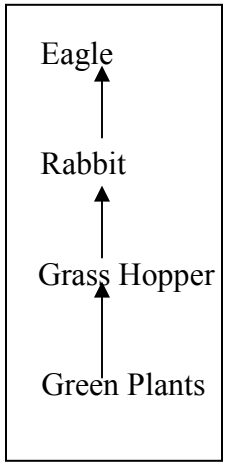
A food chain gives the feeding relationship of living organisms in on ecosystem. It illustrates that the materials and energy needed for life pass from one organism to another the food chain. Each food chain is composed of products and consumers. Producer organisms are always green plants producing food by photosynthesis while consumer organisms consumer plants and each other.

Trophic levels of A Food Chain

The position which an organism occupies on a food chain is called its Trophic level. This position depends on whether it is plant or an animal and in a care of an animal on what it eats.
Green plants the first level of any food chain since they produce the food which supports the whole chain. The second trpohic level is occupied by herbivores. These are called primary consumers, because they eat producers. The third trophic level is occupied by secondary consumers. These are Carnivores which eat herbivores. The fourth trophic level is occupied by Tertiary consumers. These are Carnivores which eat smaller Carnivores, some food chains have the fifth level which is occupied by large carnivores.

Examples of Food Chains

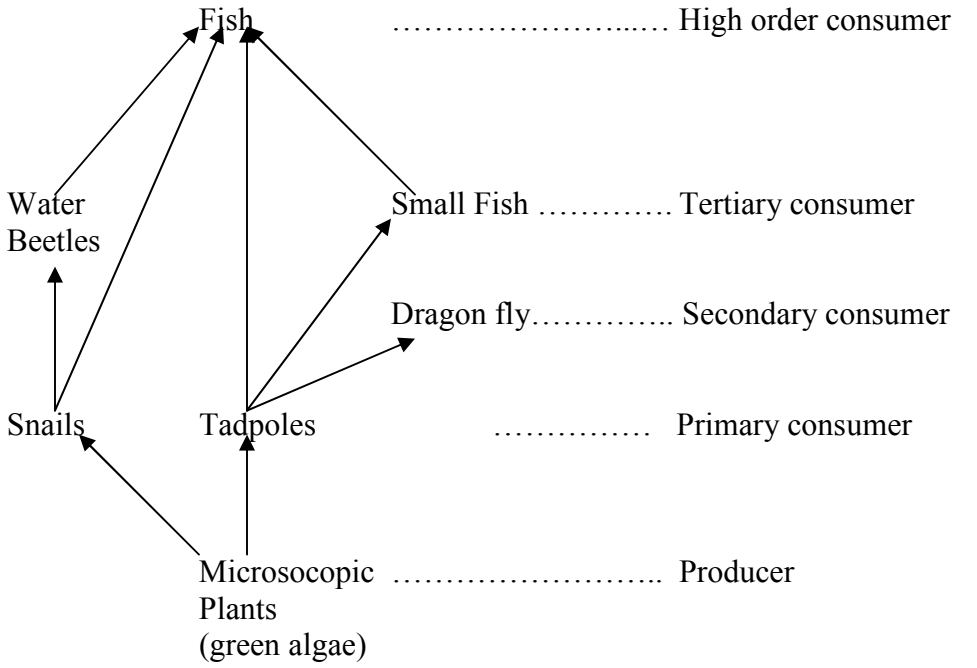


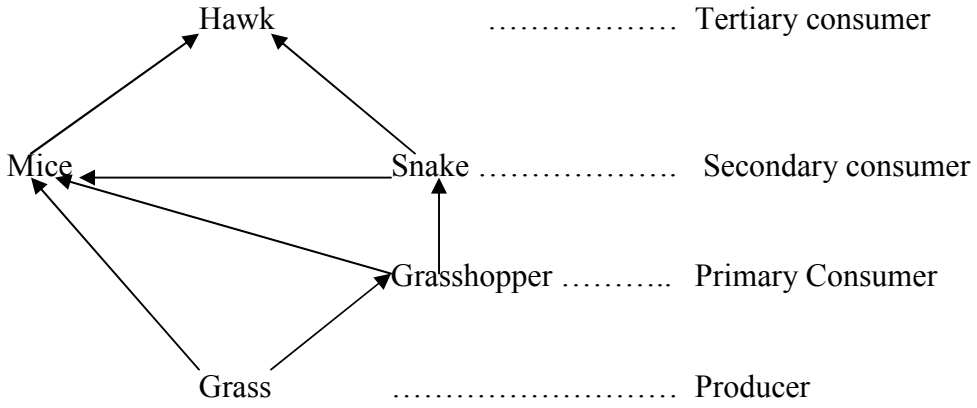


FOOD WEB

A food web is made up of cross links of feeding relationships. It shows several food chains interrelated together.
Food webs exist because consumer organisms rarely depend on only one type of food and often a particular food is eaten by more than one consumer.

Examples of food webs





Food chains and webs are other examples of the balance of nature, since they depend upon a delicate balance between losses and gains .if anything happens to disturb this balance, such

as disease or pollution, which destroys a link even in one food chain, a whole food web can be affected.

Exercise

1. a) Why are green plants known as producer and why are most other organisms known as consumers.
   b) Sort the following into producer, primary and secondary consumers.

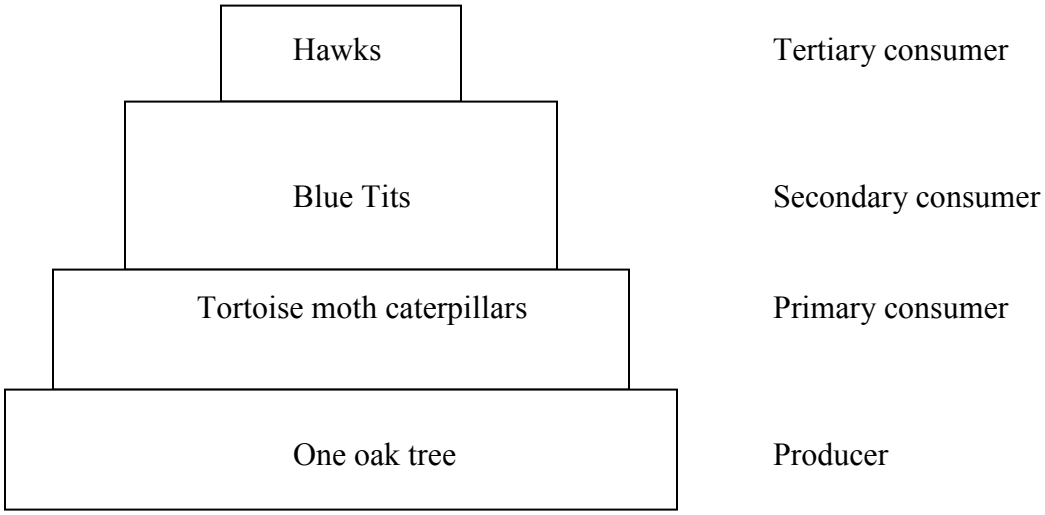
Cows	Grassers
Ticks	Bread moulds
Lions	Earthworms
Spider	Grazellels
Hyenas	Type worms

2. Why is the number of organisms reduces as the food chain progresses.

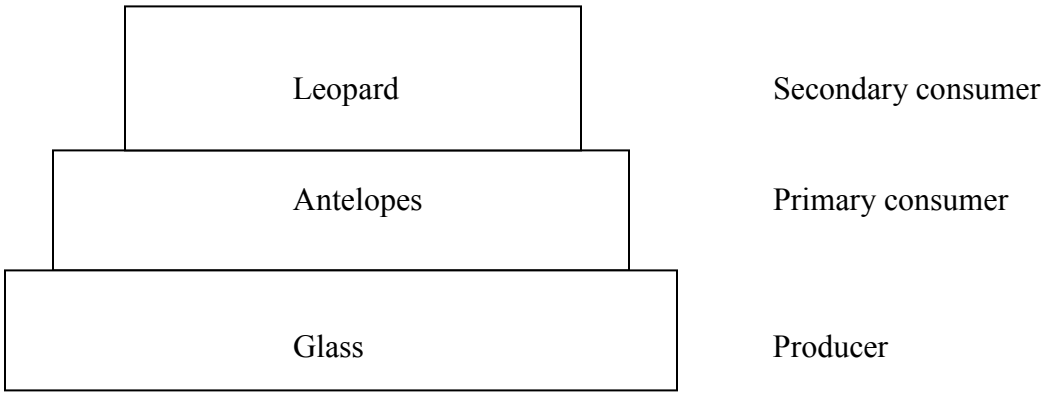
Pyramid of Energy and Biomass

The energy lost of each link in a food chain means that each trophic level can pass on only a fraction of energy to the next trophic level.
If follows, therefore, that a certain number of producers can support fewer primary consumers and so on. This gives to characteristics of certain food chains called *pyramid of numbers*.
The number of organisms at each trophic level of a food chain does not always give a true picture of its structure. A single ork tree for instance, can support a thousand of insects, which would give us on upside down pyramid.
A more accurate understanding of food chain structure is obtained by considering not the total number of organisms at each trophic level but their total weight, or Biomass.

Pyramid of Biomass



Note
A pyramid of biomass is a way of expressing the quantity of plants or animal matter in terms of dry mass at each trophic level.

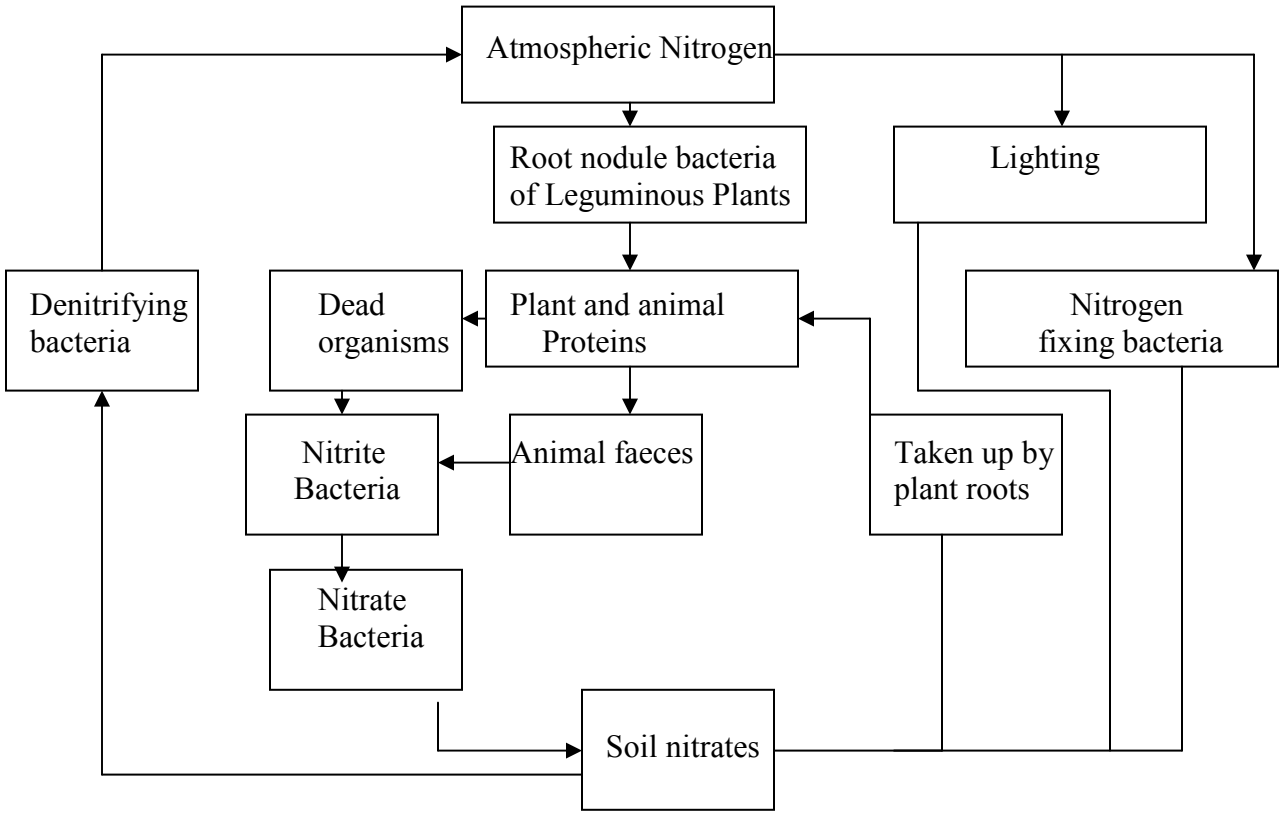


Pyramid of Biomass.

THE NITROGEN CYCLE.

This part is concerned with the continuous exchanges of materials and energy which take place between and within these two worlds. These exchanges occur in cycles, which involve a continuous circulation of substances between organisms and their physical environment. In other words there is a balance of nature in which materials are used and revised over and over again. The Nitrogen cycle is an excellent example of how one element circulate around and through the physical biological worlds.

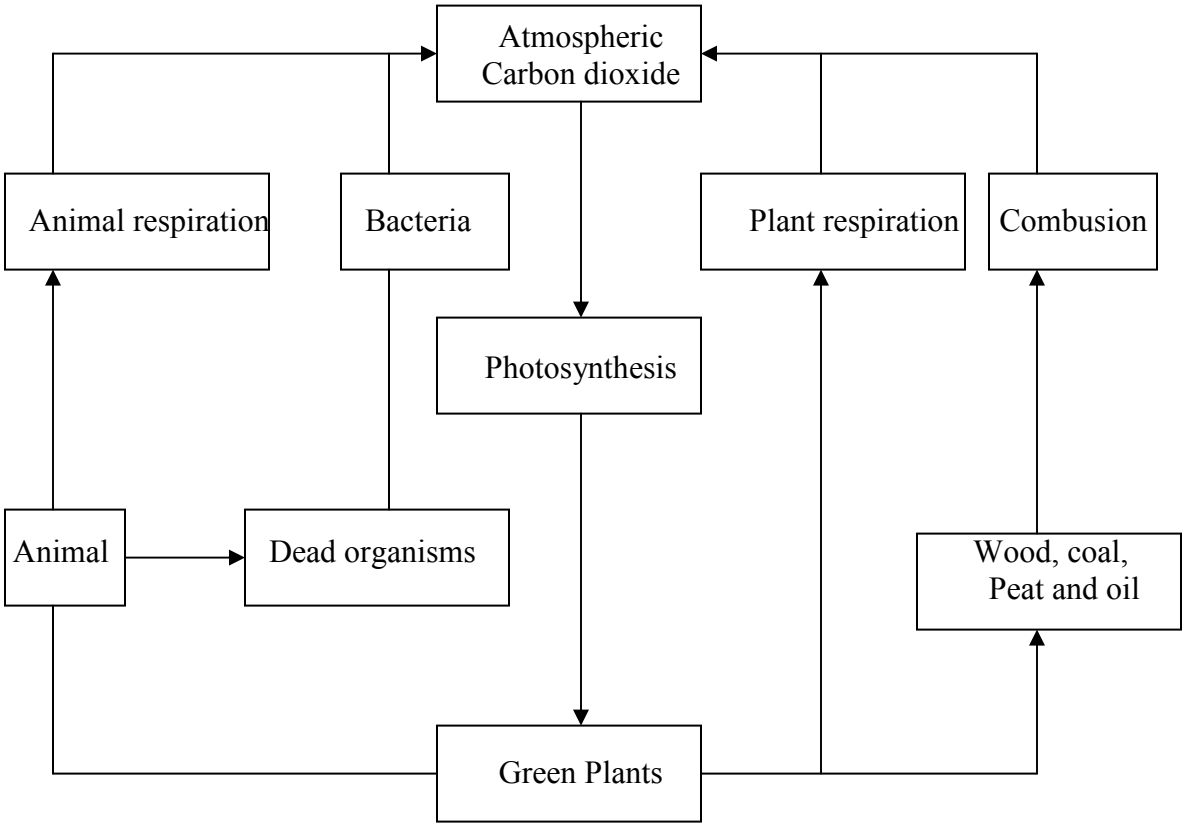
NITROGEN CYCLE



The nitrogen in the atmosphere is of little biological using. During breathing nitrogen goes into living organisms and comes out without playing any significant role. How ever , some micro organisms in the soil example the blue green algae and a few fungi absorb nitrogen gas and combine it with other substances to make compounds. This process is called Nitrogen Fixation. Some nitrogen fixing bacteria are found in root nodules of Leguminous plants like beans, peas and groundnuts. One example of such a bacteria is Rhizobium. These bacteria use carbohydrates made by plants to obtain energy at the same time getting protection from the plants obtain nitrogen containing compounds from bacteria. This relationship therefore benefits both the plants and bacteria and this is called Symbiosis.
The plants convert the nitrogen into plant protein when the plants are eaten by animals the nitrogen in plant protein is converted into animal protein. When the animal defecate, excrete or die the nitrogen in their protein is converted into ammonia in their protein is converted into Ammonia in the soil. Putreying Bacteria breakdown amino acids in protein to ammonia. Nitrifying bacteria then oxidize the ammonia is converted into to Nitrites by the Nitrite bacteria. The process of Nitrification makes available nitrogen, in the form of nitrates to plants.
During the rain season the high temperature in the atmosphere caused by lightening oxidizes the nitrogen to nitrous and nitric acids which combine with the metallic parts in the sol to form the nitrites.
Denitrifying bacteria reduce nitrates in the soil to nitrogen gas which is released to the atmosphere. During this process the bacteria obtain energy.

The Carbon Cycle

Carbon occurs in the atmosphere as carbon dioxide. It is also present in fuels such as coal and plant and animal tissue carbon dioxide is absorbed by green plants during daylight hours as a raw material of photosynthesis. Despite this process the amount of carbon dioxide in the atmosphere remain constant at about 0.033%. This is because it is replaced in a number of ways as fast as it is absorbed by plants.
The cycling of carbon in the biosphere is called the carbon cycle. The diagram below shows the carbon cycle.



Respiration

Some of the carbohydrates produced by photosynthesis is used to build up the plant body, but the remainder is eventually respired for energy. This releases carbon dioxide back into the atmosphere.
Carbon atoms in the carbohydrates, fats and the proteins of plants are transferred to the bodies of herbivores when these animals feed on green plants. Later these carbon atoms may be transferred again if the herbivores are eaten by the Carnivores or Omnivores. As these animals respire some of the carbon atoms are released to the atmosphere as carbon dioxide.

Decay

After death the bodies of organisms are decomposed and absorbed as food by Saprophytic bacteria and fungi. Carbon atoms in this absorbed material are released to the atmosphere as the Saprotrophs respire.

Combustion

Combustion or burning of inflammable material results in the release of carbon atoms as carbon dioxide. Combustion can form part of the carbon cycle in the following ways.
Carbon absorbed by a tree during photosynthesis and used to build a woody tissue in its truck will be returned to the atmosphere if the tree is chopped down and burnt as fuel. The fossils fuels are burned to release the carbon atoms which were trapped by photosynthesis in plants that lived a million years ago.

The Water Cycle

The world has an enormous water supply, it circulates between the oceans, atmosphere and land in an unending water cycle.

Heat from the sun keeps the water cycle operating. It warms up the surface of the sea, lakes and land, causing water vapour to evaporate into water vapour.
Water also evaporates from plants as they transpire, and from living organisms as they respire.

Warm, moist air from all these sources rises into the atmosphere. As it rises it cools and water vapour condenses into billions of water droplets, many of which collect to form clouds. At first these droplets are so light they float on air currents, but some collide, join together and form larger droplet. In time they become heavy enough to fall as rains drops, which starts the cycle all over again.

Exercise

The diagram below shows a simple food chain

Tree → Insect Larva → Small bird → Hawk

(i) Select from the diagram
- a) Primary consumer
- b) The producer
- c) The herbivore

(ii) Apart from chemical substances which else is passed along the food chain.

Ecosystem

An ecosystem is a community of organisms together with the habitat in which it lives. This means that an ecosystem is made up of all the producers and consumers in a community; the parasites, scavengers and decomposers, the rocks, soil, water an air of the physical environment and the community of materials such as nitrogen, carbon, water and oxygen.
The living part of the ecosystem is called Biotic and the non-living part is called Abiotic.

Energy for Ecosystem

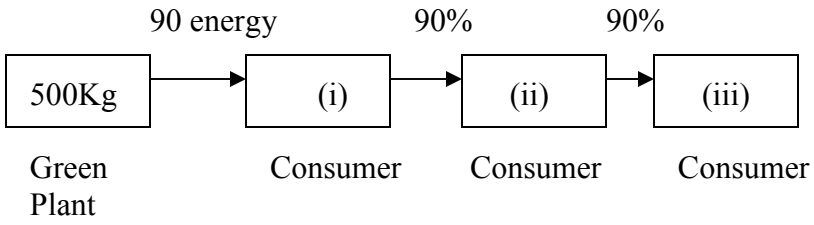
All ecosystems require a constant input of energy. Most of the energy comes from the sun as sunlight which is trapped by green plants during photosynthesis.
Another source of energy in the ecosystem is chemosynthesis. This involves certain types of bacteria such as the iron and sulphuric bacteria.

The bacteria oxidize inorganic compounds like ammonia and hydrogen sulphide and liberate the energy which they utilize. In this example, the energy does not come from the sun,

instead it comes from the breakdown of inorganic compounds. The bacteria are there called Chemosynthetic bacteria.

Exercise

1) Complete the diagram below



2) State one process which results in energy loss.

Unit 13.2 Human effects on the Ecosystem

Objectives:

PSBAT: Describe the effects of the ecosystem
Explain the consequences of deforestation on the soil stability and climate.
State the importance of each physical component of the soil and living organisms in the soil.

Question

i) In the previous unit we looked at the environment. State the ways in which man depends on the environment?
ii) What does man benefit from environment?
iii) How is man harmful to the environment?

Explanation

From time in memorial man has depended on the natural environment for his survival. Man has collected fruits, leaves, root, grass, and he has also hunted animals from the some environment.
In which ways has man used the following for his survival;
i. Fruits
ii. Leaves
iii. Roots
iv. Grass
v. Animal skin
vi. Trees

With high industrialization man has seen an increased need to use the mineral salts, timber, fuel, land for agriculture. This has continued to have a serious effect on the environment.

The Effect of Agriculture on the Ecosystem

Some methods of farming have a devastating effect on the ecosystem. For example in Northern Province if Zambia and other parts of Zambia where Chitemene system is used, land is cleared by cutting down the plants.
Also due to the rise in the world population there is an increased demand for food. As a consequence more and more land is being cleared for Agriculture. This has the following effect on the ecosystem.

i. The soil is exposed to agents of erosion like wind and rain. This results in soil mineral elements being swept away (erosion)
ii. The loss of forest leads to some living organisms losing their habitat.
iii. In large scale farming there is large use of chemicals. This results in the change in the soil structures and PH. Also the use of pesticides does not only affect the pests but destroys even the useful insects like Bees and Butterflies.
iv. The pesticides absorbed by the plants are transmitted to other organisms in the food chain. Therefore the effect does not end on the pests but also animals gets affected
v. Large scale farming leads to clearing a large portion of forest which has an effect on the climatic condition e.g. rain pattern, oxygen and carbon dioxide cycle. Clearing large forest is a risk as it may result in drought, and depletion of the ozone layer. The plants play an important role in reducing the amount of carbon dioxide from the atmosphere. Carbon dioxide leads to the depletion of the ozone layer.

Question

a) What are the effects of depleting the ozone layer of the atmosphere on the environment?

Effects of Game Ranching on Ecosystem and Daily Ranching

Due to demand for meat man has gone into keeping of animals. The ranching of animals employs the use of chemicals like insecticides to kill insects and other pests which may be vectors of deadly diseases like Trypanosomiasis (Nagara). The chemicals also kill useful insects like Bees and Butterflies. The animals are normally kept in large quantities and this may result in over grazing. In game ranging a large portion of virgin land is allocated to a certain species of wild game that are ranged after being removed from their own natural habitat. The effect of this is over grazing as animals which are ranged are normally herbivores e.g. Kudu, Impala, etc which are made to graze in one enclosed area.
Game ranging also disturbs the ecosystem in terms of feeding inter relationships as some organisms are removed from the system to which they naturally belong.

Question

What is the effect of poaching on;

i. The herbivores
ii. Carnivores
iii. How can you prevent the following
    a) Deforestation b) Soil erosion as a result of farming

UNIT 13.3 Pollution

Objectives:

PSBAT: Define Pollution
Discuss different types of pollutions
State ways in which each form of pollution can be reduced

Task

Look at your surrounding.

Do you like every object in your surrounding?
Visit a sewage emptying point.

- What type of environment is it?
- What are the differences between the sewage empty point and an ordinary swampy area?

State three effects of sewage on water? Apart from sewage on water substances, what do you think will make your environment unbearable.

Explanation

Pollution is the contamination of the environment. We can also define pollution as the addition of harmful substances to the environment.
The following environment may be polluted i.e. the water, air and land.

Now lets look at water pollution and the substances which may pollute the water.

Water pollution is as the addition of harmful substances to water. Water can be polluted by the following substances, sewage, oils, fertilizer, solid waste, harmful pathogens.

Untreated Sewage

When untreated sewage from our homes is allowed to drain into the water bodies(lake, river, ponds, etc) it will have the following effects:

i. It may be source of diseases , out breaks of diseases like cholera, typhoid etc.
ii. The aerobic bacteria in the water use oxygen to break down the sewage to nitrates. This depletes oxygen of the water need by the life in water i.e. fish and other aquatic life suffocates.
iii. The nitrates which results from the bacterial action promotes a rapid growth of small water weeds this reduces the habitat for aquatic life.

Chemical Fertilizer

The chemical fertilizer from the farms which may be drained in water as a result of soil erosion, also causes a rapid growth of pond weeds. The fertilizer may also be harmful to some aquatic life. The pesticides and some water insects killers also kills some water living organisms.

Question

How can you prevent water pollution by:

i. Sewage
ii. Chemical fertilizer

Petroleum Oils

Petroleum oils when drained in water forms a layer between the water and the atmosphere. This reduces gas exchange between the water and the atmosphere. The effect of this is suffocation of the aquatic life which gets its oxygen from water.
e.g. fish and tadpoles

Question

How can you prevent water pollution by oil?

Land Pollution

Like water land pollution can be in different forms. Let us look at pollutants of land;

1. Solid waste

Solid waste like polythene and other polythene products are non biodegradable (do not decompose). This makes the environment dirt. Other solid waste includes scrap metal and domestic dirt. What is the effect of scrap metal to our environment?

2. Chemicals

Chemicals such as acids and alkaline oils and pesticides are harmful to the land if not properly disposed off. Chemical like acids and alkaline changes the soil PH and also destroys some soil organisms. Oils on the soil destroy the vegetation of the land.

Question

How can you prevent land pollution by
i. Oils
ii. Fertilizer
iii. Pesticides
iv. Acids and Alkaline

Air Pollution

Like in land pollution air can also be contaminated by adding harmful substances like toxic gases, dust, smoke, etc.
Gases like Sulfur Dioxide, Nitrogen Dioxide when in the atmosphere form acid rain when it is raining the gases dissolve in water to form acid rain. For sulfur dioxides, sulfuric acid is formed and as nitrogen dioxide the nitric acid is formed. What is the effect of these acids to the ecosystem?
When the acid rain reaches the soil it changes the soil PH to become acidic. Some plants and microorganisms in the soil do not tolerate acid soil, so they die. Gases like carbon monoxide from incomplete combustion of carbon reduces absorption of oxygen in animals which pollutants like dust and smoke particles contaminates the air. In plants the dust which settles on the leaves reduces the ability of the leaf to absorb sunlight and gases, while in animals dust and smoke affects the respiratory lining.

Question

How can the pollution by dust be reduced at the road construction site.

Summary

Water pollution by sewage is reduced by treating the sewage before it is drained into the water bodies. As by chemical fertilizer and pesticides farmers have to practice safe methods of farming which have to do with the reduction in the use of such chemicals. In air pollution to avoid pollution by carbon monoxide combustion of carbon has to be done where there is sufficient oxygen. In Zambia and some other identified sites away from the residential areas where they dispose off solid and liquid waste generated by both industries and homes. This helps in reducing pollution. In industries producing gases and smoke, high chimneys are erected so as to eject smoke and gases far from living organisms.
In Zambia the nation has set up environmental department which controls pollution of the land, water, and air. The major cause of pollution is high industrialization where most of the pollutants are generated.

Task

- In your local community identify ways in which environment is being polluted.
- Are they any efforts being employed to control the pollution.
- How is the pollution being controlled
- You as an individual what is your contribution to environmental pollution?

Activity

Visit a damping site and identify different types of solid waste.

Question

Which solid waste is generated in your homes (industrial and domestic wastes)

Conservation

From time in memorial man has depended on the forest and the day to come man will still depend on these products. To avoid denying the future population of the forest and its products i.e. plants and the animals there is need to conserve these.

Questions

- State the ways in which the government has managed to conserve plants and animals.
- Give reasons why you think recycling of materials is necessary. Basing your answer on:
    i. Reduction of pollution
    ii. Sustainable use of resources.

UNIT 13.4 Biodiversity

Welcome to unit 13.4. In this unit we are going to look at Biodiversity, we will look at micro and macro organisms, their general characteristics and also the human effects on such organisms

Objectives:

PSBAT: State the biological importance of Biodiversity.
Describe the characteristics of viruses, fungi, bacteria, insects, fish, Amphibians, reptiles, plants
Describe the impact of mans activities on organisms

Micro Organisms

Bacteria

Bacteria are very small organisms about 0.0001 mm only under high powerful electron microscope. The diagram below shows the generalized structure of a bacterium.

(insert diagram)

All bacterium have the following general properties.

- They are single celled organisms
- They reproduce by binary fission
- They feed some bacteria have green pigment (chloroplast) therefore they are photosynthetic, others feed on already made food from dead organisms saprophytic while others are parasitic
- They have no nucleus but a single chromosomes
- The bacterial sell wall is made of proteins and sometimes contains some fats but not cellulose
- Movement some bacteria have one or more filaments or flagella (singular flagellum used for movement e.g. water or blood) where they live.

Classification

Bacteria can be classified in various ways. A useful simple classification is based on their shape. E.g. Cocci are Spherical, Bacilli are rod shaped and Spirilla and Spirochaets are strongly curved. See the diagrams

(insert picture)

Bacteria can also be put into two other classes based on their effect on other organisms and the environment.

1. Useful bacteria- A large number of bacteria live in the soil. The bacteria known as the decomposers and nitrogen fixers play a very important role in the soil fertility. Some bacteria live in the mammalian where they help in digestion of cellulose.

2. Harmful Bacteria- Bacteria which belong to this group are parasites. The pathogenic parasites cause diseases to their host and hence in the process by bacteria are known as bacterial diseases.

Industrial use of Bacteria

Question

Discuss how the bacteria maybe useful in industries like: sewage and water industry?

Viruses

Viruses are smaller than the bacteria. The viruses can only be seen under the electron microscope.

Shape

The diagrams below shows the different shapes of the viruses.

(Insert picture)

Characteristics of the Viruses

Although viruses are different in shapes, they have common general characteristics which includes the following:

i) They are not cells but parasites of genetic materials (DNA)
ii) Have no nucleus
iii) Have no cytoplasm
iv) Have no cell membrane
v) Viruses however can reproduce using the host material.

Details of reproduction of viruses.

When the virus enters the host cell the nucleic acid (DNA) of the virus takes over from the host nucleus and makes it to make new virus material.
N/B viruses are only active when inside living organisms. Diseases caused by viruses are known as viral diseases. Give some of the examples of viral diseases:

i) In your community
ii) Outside your community.

Fungi

Fungi are multicellular organisms. Fungi can be saprophytes or parasites. See the details of fungus in unit 2.4 in module one.

Question

i) Describe reproduction and feeding in fungi
ii) Fungus like penicillium is important in our day to day life. Describe the function of penicillium.
iii) Some fungi like mushrooms and yeast are important to man. How is mushroom and yeast important to man's life.

Insects

Insects are multicellulars. About 70% of all known animals are insects. Some insects are carriers of organisms which affects man, such insects are known as vectors.

The structure of an insect

(Insert picture)

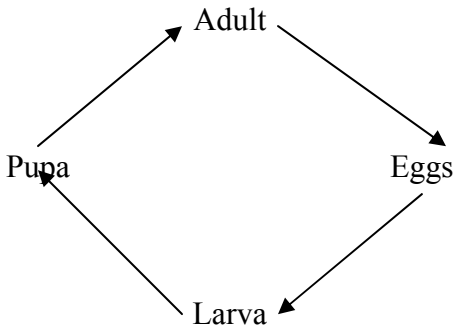
(Insert picture)

Characteristics of insects

- They have three main parts, namely, the head; thorax and the abdomen.
- They have segmented bodies
- Insects have two pair of wings
- Insects have three pairs of legs
- Insects have compound eyes

Life cycle of insects

Insects reproduce by sexual reproduction. The diagram below shows the life cycle of insects which under goes complete changes in its reproduction.



Activity

i) Get a locust, using a hand lens examine it clearly and see if you can see the following parts: antenna, compound eyes, mouth and segments of the body.
ii) What type of nutrition is in locusts/grass hoppers.
iii) Distinguish the structural features of a grass hopper to those of the butterfly.

Amphibians

Amphibians are so called because their life style involves living in both water and the land. In water when the amphibians are in their young stage use gills as the respiratory surfaces while in adult stage they live on the land where they use lungs as the respiratory surface. Examples of amphibians includes the toads unlike the reptiles and fish amphibians have no covering scales.

The structure of the amphibians

The diagram below shows the structure of a frog.

(insert picture)

The body of a toad or a frog consist of a head and a trunk only. The skin is dry and warty in toads and smooth and slim in frogs.

Characteristics

Reproduction. Frogs normally breed in the rain season. During this period the female lays the eggs while the male spreads sperms on them. In frogs there is external fertilisation and development. To increase the chances of fertilisation the frogs lays more eggs.

REPTILES

Reptiles are poikilothermic, air-breathing animals and were the earliest vertebrates to become well adapted to live on land. Reptiles lay eggs with a yolk and a tough shell. The eggs are usually large. Inside the York the embryo develops in miniature adults. In reptiles, fertilisation is internal, while development is external. The following are the characteristic features of reptiles:

i) They are completely covered with dry epidermal scales
ii) Their jaws contain teeth set in socket and all of the same shape

iii) Apart from the snakes, reptiles have two pairs of limbs. The limbs do not support the body free of the ground.
iv) They have claws

Task

i) Give examples of reptiles in your community
ii) What are the economic benefits of some reptiles
iii) How has human activities affected the reptiles, fish, in the ecosystem?
iv) Draw and label a generalized structure of the fish.

Unit 13.6 Population

Welcome to the last sub unit of Unit 13.0. In this sub unit we are going to look at population, and factors which affects population.

Objectives:

PSBAT: Define population
State factors affecting population.

Questions:

i) What do you understand by the term population?
ii) State the factors which affects population changes.

Explanation

Population biologically is referred to the total number of living organisms of the same species living in a defined habitat. E.g. population of humans living in Lusaka city, population of dogs, Mongu, e.t.c.

Characteristics of population

The characteristics of population includes the following:

i) size
ii) migration
iii) maternal (birth rate)
iv) mortality (death rates)
v) sex ratio
vi) age structure
vii) growth form
viii) internal distribution

Population size

Lets look at details of population size. The following are the factors that affects the population size.

Fecundity and Mortality

Fecundity refers to the ability of females to bear offsprings. If it is high, there will be a sharp increase in population. On the other hand mortality which refers to death rate of organism leads to a decline in population of organisms when it is high.

Questions:

i) What factors lead to high fecundity
ii) List down the factors which leads to high mortality rate.

Task

i) Describe population distribution in your country. Compare and contrast between urban and rural population?
ii) What factors affects the population distribution?
iii) What is the effect of immigration and emigration on population distribution.
iv) What is the effect of good medical facilities on population?
v) How does fertility rate affect population.

(Fertility rate is the number of live births of infants in a population per year per 1000 women from reproductive group)

Infant mortality

This is the number of deaths which occur among a population of 1,000 live births within the first year of their life span. The following are the factors which affects infant mortality:

Endogenous causes – These are normally associated with genetic disorders and the birth process. Examples are, asphyxia, failure of lungs to expand, congential diseases like AIDS, syphilis, birth injuries and immaturity of the baby.

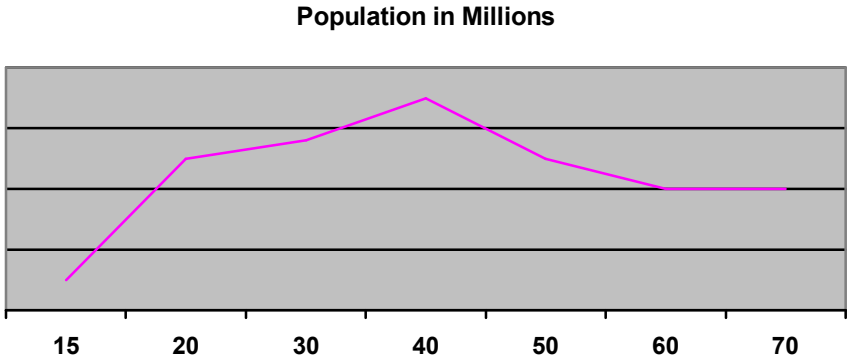
Exogenous causes – These causes are due to pathogenic organisms which causes diseases like measles, influenza, pneumonia, e.t.c.

Maternal mortality – The number of women which lose their lives due to child bearing complication at birth within the period of one year.

Questions:

i) What are some of the causes of maternal mortality?
ii) What is the effect of the following methods of family planning on population growth:
    - withdraw method
    - surgical methods

iii) Study the population growth curve below and answer the questions that follow:



a) What is the average life expectance in the curve above
b) What factors could have led to a rapid increase in population between the age of 15 to 20 years.
c) Why is the life span in female higher than in males.