REPRODUCTION IN HUMAN BEINGS

Fertilization
Fertilization is the fusion or union of the nuclei of the ovum and the sperm in the oviduct/fallopian tube.

Types of fertilization.
There are two types of Fertilization that takes place in the female's body. Namely;

- Internal fertilization - Which takes place inside the female's body, mainly in human beings, birds and reptiles.
- External fertilization - Which takes place outside the female's body, mainly amphibians and fish.

Process of Fertilization in human beings
During sexual intercourse/coitus/copulation, sperms are introduced in the vagina by the penis. Sperms swim in the semen using their tails until they reach the oviduct where they meet a mature ovum. Many sperms surrounds the ovum but only one penetrates the ovum, the nuclei of the sperm and the ovum fuse to form a Zygote.

After fertilization a woman becomes pregnant and this is called conception. NB: The sperms which do not penetrate the ovum are killed.

The zygote then undergo cell division, travels down to uterus and attaches itself on the uterine walls, this is called implantation.

After implantation, the zygote is called embryo.

Foetal development.
After implantation, the embryo develops a disc-shaped organ called placenta which joins the embryo to the mother.

At 6 weeks the embryo has formed most of the important body organs such as the lips, nose, arms, ears, eyes, feet and toes.

At 8 weeks (2 months), the embryo is called foetus. The foetus is surrounded by the amnion which contains a fluid called amniotic fluid.

Functions of the placenta
- Exchange of carbon dioxide and oxygen between the mother and the foetus.
- Supply food from the mother's blood to the foetus.
- Production of hormones that maintains pregnancy.
- Facilitates transfer of waste products from the foetus to the mother's blood.
Functions of the umbilical cord.
- Joins the foetus to the placenta.
- It is a passage for oxygen, food and carbon dioxide.

Functions of the amniotic fluid.
- It acts as a shock absorber to protect the foetus against physical injuries.
- It keeps the foetus warm.
- It prevents the foetus from drying.
- It lubricates the foetus for easy movement.

NB: Gestation period takes nine months or 36 to 40 weeks or 280 days in human beings, this is the period between conception and birth.

Signs of pregnancy.
- Menstruation stops.
- The breast becomes larger, tender and sensitive.
- Increased frequency of urination.
- Craving for some foods.
- In later stage, expectant mothers experience some slight backaches.
- Heartburns.
- The abdomen enlarges.
- Breathlessness, tiredness and increased pulse rate.
- Movement of the foetus is felt.
- Morning sickness or nausea.

Birth process.
It is also called parturition.

When the foetus is fully developed, the head faces downwards and is positioned directly above the cervix.

Stages in the birth process.
- The uterus walls contract causing labor pain.
- The cervix widens.
- Amnion burst and amniotic fluid flows out of the vagina.
- The baby is pushed out through the vagina with the head first.
- Breathing is induced by pinching of patting the baby.
- The umbilical cord is tied and cut, this prevents loss of blood from the mother and the baby also separates the baby from the mother.
- The placenta is expelled from the body. The expelled placenta is called afterbirth.
**Excretion**

This is the removal of waste products from the body.

**Excretory organs (SKIL)**

There are 3 main excretory organs, namely:

- Skin
- Lungs
- Kidneys.

Waste products removed by these organs are:

- Excess water.
- Excess salt.
- Urea.
- Carbon dioxide.
- Lactic acid.

**Water, salt, urea and lactic acid forms sweat**

**Water, urea and salt forms urine.**

<table>
<thead>
<tr>
<th>Excretory organs.</th>
<th>Excretory waste removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Excess water, salt, urea, lactic acid.</td>
</tr>
<tr>
<td>Lungs</td>
<td>Excess water, carbon dioxide.</td>
</tr>
<tr>
<td>Kidneys</td>
<td>Excess water, urea, salt.</td>
</tr>
</tbody>
</table>

**Order of urine.**

*Kidney----->Ureter----->Bladder----->Urethra.*
# HEALTH EDUCATION

**Sexually Transmitted Infections (STIs)**

These are diseases which are passed from one person to another person through sexual contact.

They are also called *sexual transmitted diseases (STDs)*

<table>
<thead>
<tr>
<th>STI</th>
<th>Cause and transmission</th>
<th>Signs and symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syphilis</td>
<td>Caused by bacteria.</td>
<td>Painless sore (chancre) on genitals.</td>
</tr>
<tr>
<td></td>
<td>Transmitted through:</td>
<td>Chancre is irregular in shape.</td>
</tr>
<tr>
<td></td>
<td>i. Sexual intercourse.</td>
<td>Sores in the mouth, lips, anus, fingers.</td>
</tr>
<tr>
<td></td>
<td>ii. Infected mother to child at birth.</td>
<td>Painful rash all over the body after several weeks.</td>
</tr>
<tr>
<td></td>
<td>iv. Sharing of person items.</td>
<td>Loss of hair.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cause paralysis and heart disease.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Madness and death if not treated.</td>
</tr>
<tr>
<td>Gonorrhea</td>
<td>Caused by bacteria.</td>
<td>Pain when passing out urine.</td>
</tr>
<tr>
<td></td>
<td>Transmitted through:</td>
<td>Yellowish or greenish discharge from penis.</td>
</tr>
<tr>
<td></td>
<td>i. Sexual intercourse.</td>
<td>Pain in the lower abdomen in females</td>
</tr>
<tr>
<td></td>
<td>ii. Infected mother to child at birth.</td>
<td>Swelling of testicles.</td>
</tr>
<tr>
<td></td>
<td>iii. Contact with an infected person's fluids or genitals.</td>
<td>Knees and other body joints swell</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Infertility if not treated.</td>
</tr>
<tr>
<td>Chancroid</td>
<td>Caused by bacteria.</td>
<td>Painful regular sore with a red border(bubo)</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>----------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>i. Sexual intercourse</td>
<td></td>
<td>Painful and swollen lymph glands.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sore on hand sand thighs.</td>
</tr>
</tbody>
</table>

**NB:** *Genital herpes and HIV/AIDS are other STIs caused by virus.*

## PLANTS

### Adaptations of plants to their environment.

Adaptations are mechanisms that enable a plant to survive in a habitat. Plants habitats include:

- Dry areas
- Wet areas.
- Normal soil and water condition

### Planted adapted to dry area.

Plants that are able to survive in dry area are called *xerophytes*.

Examples include: Cactus, acacia, euphorbia, baobab, sisal, marram grass, prickly pears, desert shrubs, sun dune grass, jacaranda, thorn tree, cassava, casuarinas and candelabra.

### Characteristics of xerophytes.

1. They have deep and widespread root system to obtain water from a wider area.
2. They have stems that can store water; their stems are thick, fleshy and succulent. They also have waxy cuticle to reflect sunlight which may cause overheating.
3. They have needle-like leaves which reduces water loss by transpiration and evaporation.
4. Some have few leaves to reduce water loss like acacia.
5. Some shed leaves in dry seasons to reduce water loss eg jacaranda.
6. Some fold their leaves to trap moisture for the plant eg sun dune grass.
7. Some are covered with a thick waxy cuticle which reduces water loss through evaporation eg sisal.
8. Some become inactive during dry seasons.
9. Some have sunken stomata that are hidden in small depression.
10. Some have reversed stomatal rhythm i.e. open their stomata during the night and close during the day.

11. Some have more stomata on the lower surface than on the upper surface to reduce water loss through evaporation.

**Plants adapted to wet areas.**

They are called hydrophytes

Most they grow in equatorial forests, swamps, marshes, lakes and rivers.

They include: water lily, butter cup, mangroves, bladderwort, water lettuce, duck weed, aquatic ferns, rice plants and water hyacinth.

**Adaptations of hydrophytes.**

1. They have broad or wide flat leaves which enables them to float on water and encourages water loss by transpiration eg water lily

2. They have shallow roots which reduce the rate of absorption

3. They have leafy shoots which encourages water loss by transpiration, they also have more stomata on the upper surface than on the lower surface

4. They have numerous stomata which remain open to allow gas absorption for photosynthesis.

5. They have flexible stems that cannot be broken by water currents.

6. They have thin cuticle to encourage water loss through transpiration.

7. They have air sacs to enable them to float on water.

8. They have waxy and hairy leaf surface to prevent water from standing on the leaf surface.

9. They have floating flowers to allow for the cross pollination by small animals.

**Adaptations to normal soil and water conditions.**

Plants which grow in normal soil and water conditions are called *mesophytes.*

They includes maize, beans, potatoes and bananas.

**Signs of unhealthy crops.**

1. Leaf discolouration.

2. Stunted or stranded growth.

3. Curled leaves.

4. Spots or streaks

5. Wilting.

**Effects of crop diseases**

1. Lower yields.

2. Reduces quality of produce.

3. Reduces income or economic loss.
**ANIMALS**

Adaptations of animals to their environment

**Feeding habitats in mammals.**

**Herbivores.**

These are mammals that feed on plants eg cow, buffalo, antelopes, elephants etc

They are classified into two, namely;

- Grazers - They feed on grass eg cattle, buffalo, hippopotamus
- Browsers - They feed on twigs and leaves eg antelopes, giraffes, goats

<table>
<thead>
<tr>
<th>Part</th>
<th>Adaptation</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Diastema</td>
<td>Toothless gap between</td>
<td>For turning vegetable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incisors</th>
<th>They have incisors on the lower jaw which are sharp, flat and chisel-shaped.</th>
<th>Biting, holding, nibbling and cutting food.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molars and premolars.</td>
<td>Present in both jaws. Same size and shape. Large, flat and ridged.</td>
<td>For grinding, crushing and chewing food</td>
</tr>
<tr>
<td>Continous replacement of molars and premolars</td>
<td>Molars and premolars replace continuous throughout their life.</td>
<td>To replace the worn out ones due to constant grinding of food materials.</td>
</tr>
<tr>
<td>Cow's tongue</td>
<td>Long and rough.</td>
<td>Long to reach out and grip grass. Rough to avoid injury by hard vegetation.</td>
</tr>
<tr>
<td>Horse and rabbit's caecum</td>
<td>Large, has certain bacteria.</td>
<td>Used for digesting tough plants materials called cellulose.</td>
</tr>
</tbody>
</table>
Carnivores.
These are mammals that feeds on flesh only. They include;
lions, dogs, cats, leopard, etc

Adaptations of carnivores.
1. They have sharp and pointed incisors for catching and holding their prey.
2. They have long pointed and strong canines for tearing off pieces of flesh from bone, they also penetrate flesh, holding and killing the prey.
3. They have ridged, flattened premolars and molars which fit well into each, saw like on both jaws for crushing bones and flesh into small portions.
4. They have strong scissor like carnassial teeth on both jaws for slicing into flesh and cracking bones.
5. They have well spaced teeth to prevent flesh from getting stuck between teeth.

Feeding adaptations in birds.

Grain eaters.
These are birds which feeds on grains or seeds.
They include; chicken, doves, Turkey, pigeons, Weaver bird and quelea birds. They have a strong, short, straight, thick, blunt and cone shaped beaks for picking grains.
Their claws are adapted to scratching.

Flesh eaters.
They are know us birds of prey.
They include Hawks, eagles, kites and falcons
They have short, thick, sharp and hooked(curved) beaks for cutting and tearing flesh.
They have a sharp eyesight for spotting their prey from far.
They have strong, sharp and curved claws called talons for holding and tearing their prey.

Nectar feeders.
They feed on nectars.
Examples include; sunbird and humming bird.
They have a long slender and slight curved beak for sucking nectars from a flower.

Filter feeders.
These birs filters their foods from mud.
They include; ducks, sea gulls, swans, geese, pelican and flamingo.

They have a flat, broad, strong and serrated (v-shaped) beaks for sieving or filtering their foods.

Their feet are webbed.

**Adaptations of animals to movement.**

**Reasons for movement.**

1. To search for food (prey).

2. To search for shelter.

3. To escape from predators.

4. To search for favouble climatic condition.

5. To seek mates for reproduction.

**Adaptations to flying.**

a) They have wings which has feathers to increase surface area for flapping against air.

b) They have hollow bones to make them light so that they can float on air.

c) They have streamlined bodies to enable them move quickly, smoothly and easily through air.

**Adaptations to flying.**

i. They have fins (pelvic, pectoral, caudal, dorsal and anal fins) which help them to move in water.

ii. They have swim bladder (air bladder) which help them to control their depth during swimming.

iii. They have webbed feet which act as oars for propelling them in water.

iv. They have streamlined body which help them to move smoothly in water.

v. They have scales pointing backwards and covered with slimy substance to minimise water resistance.

**Adaptations to hopping and leaping.**

They have a powerful hind legs to enable them move forward. Some have a short fore legs and strong hind eg kangaroo. Some also have tails for balancing.

They include; amphabians, grasshopper, locust and kangaroos.

**Signs of ill health in livestock.**

- Stunted or retarded growth.
- Loss of weight.
Reduced yields.
Rough coat.
Coughing.

Blood or worms in stool.
Inactive.

Effects of livestock diseases.
- Lowers yields.
- Lowers quality of the product.
- Diseases can be passed to human being.
- Can cause death to animals.

WATER

Hard and soft water.

Hard water is water which contains dissolved salts ie magnesium and calcium. Mainly from sea, oceans, boreholes, lakes and dams.

Soft water is water with no or little dissolved salt in it. Mainly rain water.

Advantages of hard water.
- Contains dissolved minerals which are good for our health.
- It has a good taste to drink.
- It is good in brewing industry.

Disadvantages of hard water.
- Wastes a lot of soap because it does not lather easily.
- It discours teeth when drank.
- It stains clothes.
- It causes clogging and blocking of pipes.
- It forms scales or fur on boilers and hot water pipes.
- Wastes a lot of time and energy during laundry.
Advantages of soft water.

- Does not stain teeth.
- Best in laundry.

Disadvantages of soft water.

- Does not have a good taste.
- Has no minerals required by the body.

Types of water hardness.

There are two types of water hardness, namely:

- Temporary water hardness.
- Permanent water hardness.

Temporary water hardness can be removed by boiling or distillation. Permanent water hardness can be removed by adding chemicals.

NB: The process of removing the dissolved minerals from hard water is called softening.

ENVIRONMENT

The Meaning and Effects of Soil Pollution.

Soil pollution is the presence of substances that affect the quality of the soil also known as land pollution. It affects the usual use of soil and is dangerous to the health of human beings, other animals and plants. In other words, soil pollution means making soil impure. We say that when certain substances are present in the soil they pollute it. Substances that make soil or other components of the environment impure are called pollutants (contaminant). Some of examples of such pollutants are plastics, polythene papers, fertilizer, pesticides and herbicides.

NB: Pesticides kill pests while herbicides kill weeds.

If oil is spilled on the soil it pollutes it. The following are some causes of soil pollution:

- Domestic waste disposal improperly
- Improper disposal of raw industrial waste
- Excess use of fertilizers, herbicides and pesticides in the activities of poor agriculture
- Spilling oil on the soil
- Mining activities destroys the soil structure and leave excess minerals on the top soil.

Effects of Soil Pollution

When soil is polluted, its fertility is affected and this too affects the soil productivity leading to the living components of the environment i.e. plants and animals getting affected as well.

Effects of soil pollution on plants

Dumping

Most materials such as plastics and polythene papers do not decay. If such materials are not properly dumped, they may cause damage to leaves and
stems of plants when deposited on the soil as they decay. Through this way, they interfere with growth of the plants as follows:
Absorption of water and mineral salts.
Growth of roots of the plants since they block the roots.
Air circulation in the soil.

**Negative Effects of Soil Pollution on Animals.** Soil being homes of many small animals, such as worms, ants and termites, they are negative affected when soil is affected (polluted). Some small animals like bacteria make soil to be rich by decomposing dead vegetable and animal materials. This is the way humus is added into the soil making it more productive. Other small animals like earthworms and millipedes dig in the soil and this allows air and water circulation in the soil. The improved soil aeration and drainage of the soil allows the roots of the plants to penetrate into the soil easily.
The presence of oil, chemicals in the soil such as herbicides and pesticides and other harmful pollutants make it difficult for the small animals to survive and when they die the soil loses its quality and lowers productivity.

NB: Small animals in the soil improve soil air aeration and drainage.

**Methods of Soil Conservation.**
Animals and plants depend on soil. Plants grow on the soil while animals feed on the plants hence they need to conserve soil. To conserve soil means to protect it from losing its natural properties and productivity. There are various methods of conserving soil. This section briefly discusses these methods.

*Methods used in soil Conservation*

*a) Control use of agricultural chemicals*
Agricultural chemicals include the following: fertilizers, pesticides and herbicides. If used uncontrollably they can lead to soil pollution and even water pollution. Their use can also be harmful to crops and those who consume the crop which include animals and human beings.
Farmers should strictly follow the manufacturer’s instructions while using the agricultural chemicals. The instructions which come with agricultural chemicals clearly advise on the following:
- Type of the chemical to use.
- Purpose of the chemical.
- Precautionary measures to observe.

*b) Ensuring proper disposal of waste*
A lot of waste is produced by domestic and industries. Both wastes can be harmful or useful. So that soil is not polluted by these wastes it is important to have good ways of disposing them. This is called waste management.
### i) Domestic Waste

Domestic waste means the garbage people discard from their homes. This may be of organic refuse or inorganic refuse.

**Organic refuse:** This refers to those that can rot and includes food remains, vegetables, and fruit peelings.

**Inorganic refuse:** This does not rot and some may take long time to decay. Examples of such are plastics, broken glasses, metal parts and cans. Domestic waste should not be dumped on the soil surface.

#### Methods of disposing domestic waste

**Converting waste into compost manure**

A compost pit should be dug at home for all garbage that can rot e.g. food leftovers. This can be made into compost manure

**Using local authority service**

Waste in urban areas is deposited into the garbage bins provided by the local authorities who arrange for its collection and thereafter proper disposal.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incinerator</td>
<td>this is burning the inorganic refuse at very high temperatures in a machine</td>
</tr>
<tr>
<td>Recycling</td>
<td>This is the most effective method. It involve collecting waste e.g. papers, plastics, broken glasses and food cans, treating them with chemicals and reusing them to make more of the same products</td>
</tr>
<tr>
<td>Depositing in pit latrines</td>
<td>Inorganic waste should be thrown into a pit latrine or buried deep in the soil. Also it can be burnt in an improvised incinerator as shown below.</td>
</tr>
<tr>
<td>Reusing</td>
<td>Reusing means using an item more than once or for a different function from the one it was meant for at the beginning. Many such as cooking fat and oils, honey and jam are packed in reusable jars and cans. These can be used at home to store other products e.g. salt, sugar or small foods. Honey jars can be used as drinking glasses.</td>
</tr>
</tbody>
</table>
**ii) Industrial Waste**

A lot of waste is produced in the industries. Such wastes include oil, contaminated acids and metal waste. Water is contaminated with chemicals, waste rubbers and waste papers. Some of these chemicals are not only hazardous to the soil but to the living components in the environment.

### Various ways to manage industrial waste

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>where it is produced. This in turn reduces the danger of polluting</td>
</tr>
<tr>
<td>process to the point</td>
</tr>
<tr>
<td>than once or for different function from the initially meant for e.g. commercial</td>
</tr>
<tr>
<td>to dry clean</td>
</tr>
<tr>
<td>reused.</td>
</tr>
</tbody>
</table>

**Recycling**

<table>
<thead>
<tr>
<th>broken bottles away</th>
</tr>
</thead>
<tbody>
<tr>
<td>but recycle them to make new ones. There are other companies</td>
</tr>
<tr>
<td>make tissues e.g. toilet</td>
</tr>
</tbody>
</table>

**Programme**

| may be needed by another industry for its raw materials. This can be considered as useful waste. To explain this lets look at furniture manufacturer where the saw dust is produced and wood shaving as waste products. These can be used by a company that manufactures papers. |

**Treating hazardous waste**

This is where the new methods are used to treat hazardous waste to make them non-hazardous. Harmful pollutants are destroyed so that they do not pose any danger to the environment.

**Substituting raw**

This is the process where the raw materials that produce harmful
<table>
<thead>
<tr>
<th>materials</th>
<th>wastes are replaced with other that produces less harmful waste.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing</td>
<td>A process or stage which produces waste during the manufacturing process may be changed or eliminated so that the waste is no longer produced.</td>
</tr>
<tr>
<td>Incineration</td>
<td>This is the process of burning waste using machines such as incinerators and furnaces.</td>
</tr>
<tr>
<td>Reducing its generation</td>
<td>This is the best method of reducing waste. It involves simply preventing waste generation.</td>
</tr>
<tr>
<td>Government</td>
<td>In this, government has put in place laws to control the disposal of harmful waste.</td>
</tr>
</tbody>
</table>

**c) Avoid burning vegetable cover**

When we want to clear land for farming, we should slash or uproot the unwanted vegetation but not burning them. This is because cleared vegetation left to rot increase humus and adds nutrients to the soil.

NB: Vegetation cover guards soil against exposure to the agents of soil erosion.

When we burn vegetation, we kill the living organisms in the soil and no humus goes into the soil. Vegetation cover also prevents soil from agents of soil erosion such as wind, water and animals.

**d) Mulching**

This is covering the soil with dead plant materials such as dry grass and leaves. This prevents excess loss of water from the soil through evaporation. This also reduces splash erosion. The mulch decays afterwards and adds humus to the soil.

**e) Planting ground cover**

It is advisable to plant ground cover since land should not be left bare. Ground cover may include ground cover crops that spread out over the soil surface and cover it. Examples of such cover crops include grass and sweet potatoes. These crops or plants hold the soil firmly with their roots helping or preventing the soil from being carried away by agents of soil erosion such as wind and rain. Cover crops also trap soil as water flows through the garden thus conserving soil.

**f) Terracing**

Terraces dug along the contours on the slopes reduce the speed of run-off water. This reduces soil erosion and this way soil is conserved.

**g) Planting trees**

Planting of trees can be either afforestation or re-afforestation.

**h) Afforestation**

This is planting of trees in areas where none has been planted.
i) **Re-afforestation**
This is planting trees where forests have been cleared. Trees are important in preserving soil:
- Reduce wind erosion by breaking the wind.
- The roots hold soil particles firmly together. This helps the soil from being carried away by agents of soil erosion.
- They provide shade thus reducing the amount of water evaporation.
- They reduce the speed of running water. This reduces the strength of water to erode the soil.
- The leaves fall off and decompose thus increasing the amount of humus in the soil.

j) **Contour farming**
In this crops are planted along the contours on ridges. This helps reduce soil erosion thus conserving the soil.

k) **Building gabions**
As already known, gulley erosion where running water forms V or U-shaped channels. These gullies can be blocked by building structures called gabions across them. Gabions are heavy boxes made of wire mesh that are filled with stones. As water flows through the gabion, soil is trapped thus reducing soil erosion and repairs the soil structure.

l) **Proper stocking or controlled grazing**
Farmers should keep livestock that a piece of land can hold. This is called proper stocking which leads to soil conservation. When animals overgraze they uproot the vegetable cover e.g. grass. This way the soil becomes exposed to agents of soil erosion such as wind and water.
- Poisonous gas as it interferes with the ability of the blood to transport oxygen to the body organs. Smoke from cigarettes does not only affect the active smoker but also the passive smoker i.e. any one who inhales the cigarette smoke (polluted air) unintentionally.

b) **Burning tyres and plastic materials**
The combustion of tyres and plastic materials produces harmful emissions and poisonous gases and especially when they do not completely burn. Incomplete combustion produces gases such as carbon monoxide which poses threat to humans health and to the survival of animals and plants. Similarly, carbon dioxide is a product of incomplete combustion. As we already know the normal carbon dioxide in the air is 0.03% excess carbon dioxide in the air as pollutant. Other pollutants from combustion are tiny particles of smoke and soot.
- Rubber and plastics when burnt produces black sooty flame and emits smoke that makes the air smoggy and also emits a foul smell. Charcoal burning is also a threat to the environment.

c) **Emission of Gases from Vehicle Exhaust**
Vehicles use fuels like petrol and diesel to run. The combustion of these fuels in the engine of the vehicles produces harmful gases e.g. carbon dioxide, carbon monoxide and other gases. These gases produced by vehicles contain poisonous gases then contribute to pollution of the air. Exhaust gases from vehicles thus contribute to pollution of air and especially in cities and big towns where traffic is heavy.
- Another harmful substance that may be contained in burning fuels is lead which is dangerous to human health.

d) **Spraying Farm Chemicals**
Agricultural or otherwise farm chemicals include the following: Herbicides, Acaricides and Pesticides
Farm chemicals are dissolved in water and sprayed to either crops or animals using a sprayer. As spraying farm chemical is done, wind blows some of the chemicals thus polluting the air. The person spraying the chemicals should take the following precaution measures to avoid inhaling the chemicals:

1. Wearing protective clothes such as gas mask, gloves and protective coats.
2. Spraying in the same direction the wind is blowing to and not against the wind.

3) Aerosol sprays
These are packed in cans or other containers from which liquid is forced out in form of a fine mist. The perfume or pesticide is dissolved in solvent which remains in the atmosphere after spraying and pollutes it. The solvent may contain harmful chemical substances which interfere with the ozone layer.

**NB:** Ozone is a gas in the upper part of the atmosphere. It forms a protective blanket known as the ozone layer which protects the earth from harmful rays from the sun. Harmful gases result in thinning of the ozone layer. When this is depleted, the survival of human being, animals and plants is at a threat.

4) Industrial Waste Gases
Most industries release waste gases into the air which may be harmful. Some of these industries produce excess carbon dioxide which can pollute the air. Some other industries produce a gas called sulphur dioxide which is also harmful. Other industries too produce dust and small particles which are harmful. These waste industrial gases must be treated so that they are made safe.

**Ways of Controlling Air Pollution**
Air pollution is controlled in several ways: These include

- a) Avoiding smoking cigarettes
- b) NOT burning tyres and plastic materials

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**FOOD AND NUTRITION**

**Nutritional requirements for special groups**

**Nutritional needs for a pregnant/expectant mother.**

- Should be rich in proteins for proper growth of baby.
- Should have carbohydrates for proper functioning of baby’s organs and providing the mother with enough energy.
- Should be rich in vitamin D and calcium for strong bones and teeth of the baby and formation of blood cells.
- Should be rich in iron for healthy blood of the mother and foetus.
- Should have fibres to improve the mother’s digestion and prevention of constipation.
Should have plenty of fluids for good production of milk and maintenance of proper level of amniotic fluid.

**Nutritional needs of lactating/breastfeeding mother.**
- Should be rich in irons to replace the blood lost during birth.
- Should be rich in calcium, magnesium and phosphorus for recovery and strengthening of teeth and bones.
- Should have extra fluids for production of milk.
- Should have vitamins to protect the mother against infection.

**Nutritional needs of infants**
Infants are children below 2 years.

The best food for them is breast milk as it is wholesome ie it contains all the nutrients required by the body.

**Advantages of breast milk**
- It is wholesome.
- It has colostrum that gives natural immunity.
- It is readily available in the right form and right temperature.
- It is free from diseases.
- It does not cause allergies.
- It is easy to digest.
- It strengthens mother-child bond.

**Advantages of bottle feeding.**
- Convenient when the mother has little or no milk.
- Someone else can feed the baby when the mother is away.
- Children born to HIV/AIDS mother cannot be infected through bottled milk.

**Disadvantages of bottle feeding.**
- Might lack some nutrients.
- Lacks colostrum.
- Not readily available.
- Children might develop allergies.
**Weaning.**

This is the gradual introduction of semi solids foods to an infant. It is done at the age of 4-6months.
Breast feeding should continue upto 2 years. Introduce one food item at a time.

**Food Poisoning.**

This is an illness of the stomach caused by eating foods containing harmful substances.

Agents of food poisoning.
- Micro-organism.
- Chemicals.

**Symptoms of food poisoning.**

- Violent vomiting.
- Severe headache.
- Diarrhoea.
- Fever.
- Feeling weak and dizzy.
- Severe abdominal pain.
- Nausea
- Muscle paralysis.
- Constipation.

**Methods of prevention food poisoning.**

- Proper storage of food to avoid contamination.
- Proper preservation of food.
- Proper sanitation and disposal of garbage.
- Hygienic handling of food.
- Proper cooking of food.
- Thorough washing of hands before handling food.
- Avoid buying damaged fruits and canned foods.
- Proper washing of utensils and dishes used for food.
Energy transformation.

The law of energy conservation states that, energy cannot be created or destroyed but can be changed to other forms of energy.

<table>
<thead>
<tr>
<th>Form of energy.</th>
<th>Sources.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential energy (stored)</td>
<td>Possessed by objects at rest. Found in fuels, dammed, water, elastic rubber.</td>
</tr>
<tr>
<td>Kinetic energy (motion)</td>
<td>Possessed by moving objects. Found in running water, wind, moving stone, moving car etc.</td>
</tr>
<tr>
<td>Chemical energy</td>
<td>Found in chemicals, fuels, food, car battery, dry cells, candle wax and all fuels</td>
</tr>
<tr>
<td>Heat energy</td>
<td>Main source is sun. Other sources include; friction, burning fuels, electricity and food.</td>
</tr>
<tr>
<td>Light Energy</td>
<td>Main source is sun. Other sources include; stars, electricity, lamps etc</td>
</tr>
<tr>
<td>Magnet energy</td>
<td>Found in magnets, loadstones and electromagnet</td>
</tr>
<tr>
<td>Sound energy.</td>
<td>Produced when objects vibrates. Sources include; pianos, guitars, drums etc</td>
</tr>
<tr>
<td>Mechanical Energy</td>
<td>Produced as a result of potential energy and kinetic energy. Examples include; rotating turbines, hammer striking a gong, between a bicycle and road</td>
</tr>
<tr>
<td>Elastic potential</td>
<td>Found in stretched rubber band or compressed spring.</td>
</tr>
</tbody>
</table>

Energy Conservation.

Energy conservation means protecting, preserving, restoring and managing energy resources.

Ways of conserving energy.

1) Using energy sparingly by:
   a. Switching bulbs off when not needed.
d. Using vehicles with low fuel consumption.
e. Using thermos flask and hot pots to keep food hot.
f. Using energy saving bulbs.

2) Using energy efficient devices.
   a. Modern jiko/improvised jiko
   b. Clay cookers.

3) Using renewable forms of energy.

Renewable forms of energy refers to forms that are inexhaustible like wind, water, sunlight, food, biogas and forests.

Non-renewable sources of energy are those that can get exhausted when use like petrol, diesel, kerosene, natural gas

**Advantages of renewable energy.**

- Are cheap.
- Do not pollute the environment.
- Help to conserve non renewable forms of energy.
- Readily available and in abundance.

**MAKING WORK EASIER**

**Inclined planes.**

These are tools that make work easier by increasing the effort distance.

Load

Distance.  Effort distance
Examples of inclined planes.

- Screw
- Screw driver.
- A road winding up a hill.
- Ladder.
- Staircase, escalators, ramps.
- Wedge

Single fixed pulley.

These are simple tools that make work easier by changing the direction of the force.

They are used to lift or raise load on higher surfaces.

A rope or string is put along the groove. The groove prevents the rope from slipping off.

Properties of a single fixed pulley.

- Makes work easier by changing the direction of the force.
- The effort distance and the load distance are equal.
- The effort force and load force move in opposite direction.
- The effort force and load force are equal.

Uses of pulleys

1. Hoisting the flag.
2. To load or offload cargo at the ports.
3. Used in cranes.