S. 2 NOTES. SOIL.

THE SOIL

Soil is finely divided material covering the earth crust or surface. It consists of air, water, humus, living organisms, and weathered rocks.

Importance of soil

- It is a medium for plant growth.
- It is a means of water storage, supply and purification.
- It modifies earth's atmosphere.
- Soil is a habitat (home) for many organisms such as earth worms, termites, bacteria fungi and arthropods.
- Soil provides a medium through which man and all other animals dispose of their wastes.
- Soil is an important natural resource which provides construction materials, supports agriculture, craft and art.

SOIL FORMATION

It is formed from parent rocks by the process of weathering. This occurs over several years. The process of weathering takes place in three ways;

1. Physical weathering:

This occurs in the following ways;

i) Alternate heating and cooling of the rocks on exposed mountain sides, causes expansion and contraction which cause the rock to crack and break up.
ii) By water; this is where rivers and streams wear away the rocks over which they flow by rolling pebbles and other hard particles on them.
iii) During sandstorm when wind blows sand against bare rocks
iv) Frosting: frost is weather condition where temperatures fall below 0^0C, water in cracks freezes and expand, causing the rock to break up.

2. Chemical weathering:

This is brought about mainly by the action of water especially rain water on the rocks. As it rains, rain dissolves carbon dioxide in the atmosphere to form weak solution of carbonic acid which when falls on soft rocks for example lime, it dissolves them, this results in the release of mineral elements like calcium, magnesium, Aluminium, etc. which are components of soil.

In hot damp conditions (tropics) the constituency of rocks especially those containing iron, oxidizes very quickly. The oxidized rocks disintegrate to form soil.

3. Biological weathering:

This is brought about by the action and presence of living organisms on rocks. Certain organisms such as lichens are able to grow on bare rock while other small flowering plants are able to grow between the rock fragments. When these die, they form humus which is a component of soil.

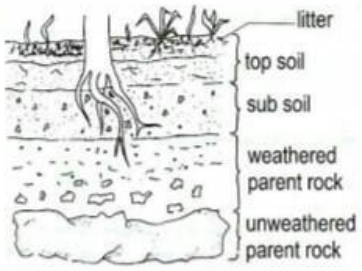
Man contributes to biological weathering through direct splitting of rocks during road and house construction and indirectly through cultivation.

SOIL PROFILE

This is the vertical arrangement of the various soil layers called horizons. It represents the different layers at various stages of soil development.

A soil with distinguished soil layers is known as mature and that without clear profile is immature or young. The profile consists of the following:

i) Top soil
ii) Sub soil
iii) Parent or underlying rock



COMPONENTS OF SOIL

There are basically six components of soil. These are:

i) Inorganic particles,
ii) Humus,
iii) Water,
iv) Air,
v) Mineral salts, and
vi) Soil living organisms

Percentage of air $= \frac{volume\ of\ air}{volume\ of\ soil\ used} \ x\ 100\%$

Percentage of air $= \frac{15}{50} \ x\ 100\%$

Percentage of air $= 30\%$

Exercise:

While analyzing a soil sample, the following results were obtained

Volume of sand = 200cm³

Volume of water = 300cm³

Volume of water and sand after stirring = 450cm³

The percentage of air in the sand was.

3. WATER

Soil water comes from rain. Also some rise up from the ground water by capillary action to replace water lost by evaporation from the surface. It is found as a thin film surrounding the soil particles.

Importance of soil water

i) It moistens soil and keeps it humid/moist, making it favorable for survival of micro-organisms.
ii) It dissolves mineral salts making them available for plants to take.
iii) It dissolves carbon dioxide produced by living organisms to form carbonic acid which causes chemical weathering of rocks.
iv) It is a raw material for photosynthesis.
v) Water absorbed from the soil allows plant cells to be rigid (turgid), and this is very important for support of the plant, particularly herbaceous plants.

Experiment to determine the percentage of water in a soil sample

Apparatus:

Evaporating dish, fresh soil, weighing scale and oven or Bunsen burner.

Procedure:

a) Weigh a clean evaporating dish and record its weigh. *(Let the weight be X g).*
b) Fill the evaporating dish with soil and record the weight of the soil plus the evaporating dish. *(Let the weight be Yg).*
c) Dry the soil by heating it gently over a Bunsen burner flame for about 30 minutes.
d) Heating and weighing is repeated until a constant mass is achieved. *(Take care not to burn the soil to produce smoke).*
e) Re-weigh the soil and the evaporating dish. *(Let it be Z g).*
f) Then calculate the water content in the soil sample as shown below;

Note:

You should cool in a desiccator before weighing. This ensures that no fresh vapour enters the soil.

Results:

Weight of the evaporating dish =X

Weight of soil + evaporating dish = Y

Weight of soil + evaporating dish after heating = Z

Weight of soil sample = Y-X

Weight of water in the soil sample = Y-Z

Percentage of water $= \frac{amount\ of\ water}{amount\ of\ fresh\ soil} \ x\ 100\%$

Percentage of water $= \frac{Y-Z}{Y-X} \ x\ 100\%$

Exercise:

The results of an experiment to determine percentage of water in a sample of soil are shown below:

Mass of crucible= 15g, Mass of crucible + soil = 30g, Mass of crucible + soil after drying = 25g

The percentage of water in the soil sample is?

4. HUMUS

Humus is decaying plant and animal material-the dead bodies of animals, fallen leaves, dead plants and animal droppings. It is a dark brown, rather sticky material that gives soil its dark colour. For the decay process that form humus to work properly plenty of oxygen is needed.

Importance of humus

i) Because humus is dark-coloured, soil rich in humus absorbs more heat, and this warmth is useful for the germination of seeds and helps to speed up decomposition, making more humus.
ii) It has a high absorptive capacity for water.
iii) It forma\s a sticky coat around soil particles and binds several together to form soil clumps. The clumps structure greatly improves the drainage of the soil.
iv) Humus retains moisture and minerals in the top soil and so, greatly reduces the effects of drying and leaching (washing of minerals).
v) It is a source of nutrients used by plants after it is decomposed.
vi) It improves soil aeration.
vii) It leads to improvement of activities of soil organisms by providing them with food and shelter.
viii) It insulates soil against extreme heat and cold temperatures changes.

Experiment to determine the percentage of humus (organic matter) in the soil

Apparatus: Crucible, soil sample, weighing scale, heat source, wire, tripod stand, pipe clay triangle

Procedure:

a) Weigh a clean empty crucible and record its weight *(W g)*.
b) Fill the crucible with soil halfway and record the weight of soil plus crucible on weighing scale *(X g)*.
c) Dry the soil by heating it in an oven at ***105^{0}C*** to constant weight *(Y g) - the loss in weight of soil at this temperature is due to the water driven out by evaporation.*
d) Reweigh the soil and crucible and record the weight.
e) Heat the dried soil on a crucible to ***redness*** in an oven, then weigh the soil after cooling and record its weight. Repeat this till a constant weight is achieved *(Z g)*.

Results:

Weight of crucible = *W* g
Weight of crucible + fresh soil = *X* g
Constant weight of soil + crucible after heating at 105^{0}C = *Y* g
Constant weight of soil + crucible after heating to redness = *Z* g

Treatment of results:

Weight of fresh soil = *X - W*
Weight of humus = *Y -Z*
Percentage of humus $= \frac{amount\ of\ humus}{amount\ of\ fresh\ soil}\ x\ 100\%$
Percentage of humus $= \frac{Y-Z}{X-W}\ x\ 100\%$

Example

The following experiment was done to find out the percentage of humus in a given soil sample. The soil sample weighing 120g was heated in an oven kept at 100^0 C. The dry soil weighed 112g. The soil was then heated slowly to burn away humus. The weight of soil after all humus had burnt was 106g

a) Why was the soil not heated properly at first?
b) What was the weight of humus in the soil?
c) Calculate the percentage of humus in the soil.
d) How many times was water more than humus?

Solution:

a) Because burning the soil strongly will burn the humus containing water.
b) Weight of fresh soil = 120g
Weight of soil after burning humus =106g
Weight of dry soil =112g
Weight of humus =112 – 106 = 6 g

c) *Percentage of humus* $= \frac{amount\ of\ humus}{amount\ of\ fresh\ soil}\ x\ 100\%$

Percentage of humus $= \frac{6}{120}\ x\ 100\%$

$= 5\%$

d) *Weight of water* = 120 – 112 = 8 g

Therefore water is more than humus 2 times (8g – 6g)

Revision questions

1. *A tin of volume 100 cm^3 was completely filled with a certain kind of soil labelled X. the soil was emptied into a measuring cylinder of water raising the level of water from the 600cm^3 mark to the 670cm^3 mark.*
   a) *i) Why did the level not rise to the 700cm^3 mark?*
      ii) What was the percentage of air in soil X? (Show your working).
   b) *The above experiment was repeated with a different kind of soil Y. This time the water level at the end of the experiment was 650cm^3.*
      i) What was the percentage of air in soil Y? (Show your working).
      ii) From the tow experiments, what do you think the soil X and Y were?
      Soil X: ……
      Soil Y: ……
2. *A student carried out two experiments on soil and obtained the following results.*

   Experiment 1

   Volume of soil = 250ml
   Volume of water and soil before stirring = 450ml
   Volume of water and soil after stirring = 375ml

   Experiment 2

   Weight of crucible = 14.5g
   Weight of crucible + soil = 37.0g
   Weight of crucible and dried soil = 32.0g
   Weight of crucible and soil after heating to red hot = 29.5g
   a) *What physical properties of soil was the student studying?*
   b) *Calculate the percentage composition of the physical properties named in (a) above in the soil.*
   c) *What is the importance of these physical properties in the soil?*

Source: Rubahamya, J.B. UCE Biology revision questions for O-Level with answers (2007)

5. MINERAL SALTS

These are chemical elements inform of ions, dissolved in the film of water, surrounding the soil particle.
Some of the mineral elements in soil are; Sulphur, phosphorous, nitrogen, silicon, magnesium, iron and Aluminium ions which results from weathering of rocks.

6. SOIL LIVING ORGANISMS

a) Micro organisms

They include bacteria and fungi. They play an important part in maintaining soil fertility through decomposition of plant and animal remains nitrifying bacteria convert nitrogen into nitrates thus making it available to plants.

b) Macro organisms.

They include roots of higher plants, earth worms and soil arthropods. Earth worms are common in moist soils rich in humus. They dislike dry or acidic soils. They tunnel into the soil by force, thus improving the soil aeration and drainage.

Importance of living organisms

i) They improve fertility of the soil through fixing atmospheric nitrogen by nitrogen fixing bacteria and decomposing litter and other wastes into humus carried out by termites and bacteria.
ii) Some living organisms like earth worms burrow in the soil and this improve soil aeration and drainage.
iii) Some living organisms in soil cause diseases to man and his plants.
iv) Wastes from soil living organisms add fertility to the soil.

Experiment to investigate the presence of living organisms in soil

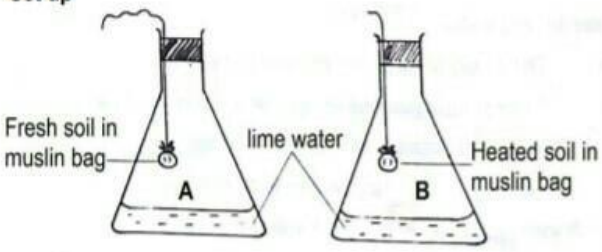
Apparatus

Two conical flasks, Muslin bag, Top soil, two corks and lime water or bicarbonate indicator solution.

Procedure

i) Collect a hand full of fresh top soil and divide it into 2 equal portions.
ii) Sterilize one portion of the soil sample by heating it strongly on a crucible for 30 minutes. Leave it to cool and place it in a muslin bag.
iii) Place the remaining portion of the fresh soil sample in another muslin bag.
iv) Add equal amounts of lime water or bicarbonate indicator in the conical flasks and then suspend the muslin bags with soil in the conical flasks as shown in the set up below.
v) Allow the set up to stand for about 2 days and observe the appearance of lime water or bicarbonate solution.

Set up



Observation

Lime water turns milky or the bicarbonate indicator solution turns yellow in conical flask ***A*** but remains clear in conical flask ***B***.

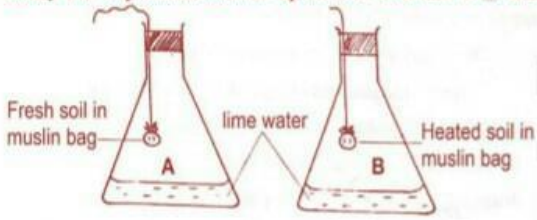
Conclusion

Carbon dioxide was produced in *A* during respiration indicating the presence of living organisms.

Lime water remained clear in *B* because the living organisms were killed by heating the soil.

Revision questions

1. Study the experimental set up below and use it to answer the questions that follow



a) What is:
i) The aim of this experiment?
ii) What is the use of the lime water?
b) Why was the soil in experiment B heated?
c) What results will be obtained in both set ups?
d) What role is played by the soil component being investigated in this experiment?

Source: Rwakasisi, R., Jada C. and Ali G. Fountain revision Biology Questions and Answers for secondary schools (Fountain publishers, 2005)

TYPES OF SOIL

Soil is grouped basing on size and nature of soil particles. On this basis, there are 3 main types of soil namely: Clay soil, Loam soil and Sand soil.

1. **Sandy soils;**
   - Sandy soils contain large space between the particles and these spaces allow water to drain off very quickly.
   - They have a gritty feel when wet and felt between the thumb and figure.
   - They contain only very small quantities of water and they may be deficient in calcium and magnesium
   - They are described as light soils because they are relatively easy to work with.
2. **Clay soil:**
   - They have small fine particles i.e. fine texture.
   - The soil particles in clay are closely parked together leaving very small spaces between them. This causes clay soils to have poor water drainage and also become water logged.
   - They are difficult to work with and therefore described as heavy soils.
   - They have a sticky feel when wet.

   When ***lime is added to clay soil***, the small clay particles aggregate to form larger particles. This helps to improve aeration and drainage, and also reduce the acidity of the soil. This is called ***Flocculation.***

3. **Loam soil:**
   - This is a mixture of sand (about 40%), silt (about 40%), clay (15%) and organic matter (1-4%). It has stable crumb structure and is the best for crop production.

Differences between clay and sand soil

Clay soil	Sand soil
1. Very small air spaces between particles	Large air spaces between particles
2. Rich in dissolved salts	Poorly dissolved salts
3. Has high water retention capacity	Has only very low water retaining capacity
4. Poor drainage i.e. low permeability	Very easy drainage i.e. high permeability
5. Water can rise to high level by capillarity	Water cannot rise to high level by capillarity
6. More than 30% clay and less than 40% sand	More than 70% sand and less than 20% clay

PHYSICAL PROPERTIES OF SOIL

1. **Porosity:**
   - Sandy soil possess large spaces between the soil particles and so more porous.
   - Clay soils possess very small spaces between the soil particles thus less porous.
   - Loam soil is moderately porous.
2. **Air content:**
   - Sand contains a lot of air so it is well aerated. This is because it has large spaces existing between the particles.
   - Clay soil contains little air so it is poorly aerated due to presence of small spaces between the particles.
3. **Drainage of water:**
   - Sand has good water drainage so it allows water to pass through it very quickly.
   - Clay soil has poor drainage of water and this makes clay water logged. This can be improved by adding humus to it.
   - Loam drains water moderately.
4. **Water retention capacity:**
   - This refers to the amount of water soil can hold. Sand soil holds little water so it has a poor water retention capacity. It can be improved by adding humus to it. Humus sticks sand particles together.
   - Clay soil tends to become water logged i.e. it holds a lot of water so has a high water retention capacity.
   - Loam soil holds water moderately but not becoming water logged.

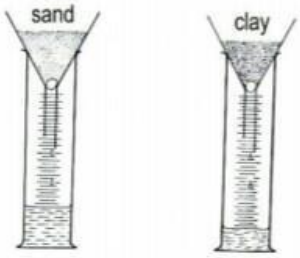
Experiment to compare the drainage and retention of water in sand and clay soils

Apparatus

- filter funnels,
- measuring cylinders,
- filter papers
- Equal volumes of dry sand and dry clay soils,
- Water and
- Beakers

Procedure

i) Measure an equal volume of each soil sample.
ii) Fold filter papers properly and put one in each funnel.
iii) Place clay soil in the filter paper in one funnel and the sand in the other.
iv) Place the funnels with their contents over measuring cylinders, at the same time pour an equal volume of water on each of the soil samples as shown in the diagrams. Observe which soil allows water to drain through quickly.
v) Allow the set up to stand for some time till water stops draining through the soils.



Observation:
Water passes through sand soil faster than clay soil. So much water is collected in the cylinder with sand soil and less water is collected in the cylinder containing clay soil.

Conclusion: Clay soil holds more water than sand soil and sand soils drains water faster than clay.

Explanation: Sand soil has larger air spaces which enable water to drain through more rapidly and on the other hand clay soil retains more water than sand because it has many small particles which can hold more water.

5. Capillarity through different soils:

Capillarity through soil means how well water can rise up in the soil and this depends on the size of air spaces between the soil particles.

Sand soil has the lowest capillarity of water while clay soil has the highest water capillarity and loam soil has medium water capillarity.

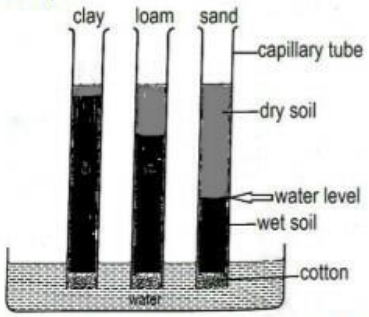
Experiment to demonstrate and compare capillarity through sand, clay and loam soils

Materials: capillary tubes, a glass trough, cotton wool, retort stands, samples of dry sand, clay and loam soils.

Procedure:

i) Put cotton wool at the bottom of the capillary tubes.
ii) Fill one capillary tube with dry sample of sand soil and pack it well ensuring that there are no spaces in the soil.
iii) Repeat this with clay and loam soils.
iv) The capillary tubes are stood vertically with the ends with cotton wool immersed in a glass trough containing enough water. The capillary tubes are supported upright with retort stands and clamps

Set up:



Observation:

Water rises ***faster for a short distance in sand*** soil while ***in clay soil water rises slowly but to higher distances***. In loam soil, water rises moderately to a moderate distance

Conclusion:

Clay soil has the highest capillarity of water.

Sand soil has the lowest capillarity while loam has moderate water capillarity.

Explanation:

Water rises to the greatest height at the nearest stages of the experiment in sand soil because sand has large spaces that enable water to rise more rapidly in the first hours.

Clay soil shows the highest rise of water hence the highest water capillarity because it is composed of tiny soil particles which present the large surface area over which water molecules cling.

Water rises at a slow rate in clay soil because clay has small air spaces between its particles.

Chemical properties of soil

1. Soil colour

This determines the amount of heat that can be trapped in a soil sample. Dark soils retain heat more than light soils.

2. Soil pH

This is the degree of acidity or alkalinity of the soil. Most soils in the tropics are acidic but some are alkaline. Soil pH affects the rate at which mineral salts e.g. nitrogen, phosphorous, iron are absorbed by plant roots. Most plants grow best in slightly acidic or neutral soil.

An experiment to determine the soil pH

Apparatus: Fresh soil sample, Distilled water, Universal solution and Indicator chart.

Procedure:

Place about 3g of soil on petri dish and soak it with universal indicator. Leave it for about 2 minutes.

Tilt the petri dish so that the indicator drains out of the soil and then compare the indicator colour with the indicator chart.

Alternatively: Soak the soil sample with distilled water. Drain off/filter off the water and test it with the universal indicator solution or universal indicator papers.

SOIL EROSION

This is the removal or washing a way of top soil by animals, wind or running water. The extent of soil erosion is dependent upon the intensity with which the rain falls and not the amount of water.

Types of soil erosion

1. **Sheet erosion:** This is where thin uniform layers of soil are eroded over the whole slope.
2. **Rill erosion:** This is where water cuts shallow channels called rills. The channels deepen as volume of water run off increases.

3. **Gully erosion:** This results from rill erosion when the channels deepen and form gullies. Here a lot of soil is carried a way over greater distances. It is enhanced by careless ploughing up and down the slope.
4. **Splash erosion or raindrop erosion:** This occurs when intense raindrops displace soil.
5. **Wind erosion:** In dry conditions, herds of farm animals trample and compact the soil, causing a layer of dust on top. When wind comes, it can blow away the dust.

Causes of soil erosion

1) **Slopes of land:** The deeper the slope the greater the erosion and this is intensified with high amounts of rain. Deeper slopes cause water to flow faster over the soil surface carrying surface soil and weak vegetation cover along with it.
2) **Over stalking:** This is caused by the keeping of many grazing animals on a small area. They finish the grass, i.e. remove the grass cover and open it to water and wind erosion. They trample the soil particles and make them loose, thus making it easy to carry them away.
3) **Over grazing:** feeding grazing animals on the same piece of land for a long time which removes the plant cover to expose the soil surface to agents of erosion.
4) **Deforestation:** this is the cutting down of trees which removes the tree canopy and exposes the soil surface to agents of soil erosion.
5) **Bush burning:** Uncontrolled burning of bushes in dry seasons removes the plant top cover, thus leaving the soil bare and therefore exposing it to agents of soil erosion.
6) **Poor farming methods:** these include ploughing and over-cropping.
   Ploughing: It loosens the soil and destroys its natural structure. Failure to replace humus after successive crops reduces water holding properties like the crump structures which causes the soil to dry up and can easily be blown away. Ploughing up and down a slope accelerates water erosion.
   Over cropping/over cultivation; this is the growing of crops on the same piece of land season after season without rest. Growing or over use of soil depletes fertility, thus plants will not grow which causes loss of plant cover. This leaves the soil bare and so susceptible to erosion.

Methods of reducing (preventing) soil erosion

i) **Contour ploughing:** Ploughing a long contours i.e. across a slope and not up and down. It allows furrows to trap water rather than to channel it a way.
ii) **Strip cropping:** This consists of alternate bands of cultivated and uncultivated soil, following contours. Untilled soil is covered with grass. By alternating the grass and crops each year, the soil is allowed to rebuild its structure while under grass.
iii) **Terracing:** This is cultivation a long contours in horizontal strips supported by stones or walls, so breaking up the step down water rush of the surface run-off. The steeper the slope, the closer the terraces must be.
iv) **Correct crop for soil:** Steep slopes which should not be ploughed are covered with pasture crops, their roots hold the soil
v) **Afforestation:** This is the Planting large areas of land with trees. They act as wind brakes, hold the soil together, and prevent raindrops from hitting the soil directly. They conserve water and control flooding.
vi) **Mulching:** covering of top soil with plant material e.g. banana leaves, maize stems after harvest, cut grass etc. it protects the top soil and conserves the water in the soil. It also adds humus to the soil on decomposition.

Contour ploughing

Terracing

Effects of soil erosion (to farmers)

- Nutrients and soil organisms are carried a way in the top soil.
- The soil left behind is unproductive.
- Fields may be cut into irregular pieces by rill and gully erosion.
- Floods carry a way or submerge and suffocate crops and soil organisms.

SOIL FERTILITY AND CONSERVATION

Soil fertility

Soil fertility refers to the amount of nutrients in the soil that can support the growth of plants. Soil can lose its fertility through the following ways.

i) **Soil erosion**.
ii) **Leaching**; this is the washing down of soluble minerals from topsoil layers to bottom layers where they cannot be accessed by plant roots.
iii) **Soil exhaustion**; this is the depletion/reduction in soil nutrients as a result of monoculture, over cropping, etc.
iv) **Soil compaction**; this is the hardening of soil on the surface due to action of heavy machinery, movement of animals and man on soil, etc. Soil compaction prevents water from penetrating into the soil.

Soil conservation

This is the protection and careful management of soil to maintain its fertility. It includes methods of controlling erosion and others such as:

Intercropping: Here, plants are alternately planted in a systematic or even random manner e.g. coffee, beans, and banana can be intercropped.

Fallowing: Land is left to rest and grow back to bush.

Crop rotation: The farmer carefully rotates his crops season after season, so that the plants make different demands on the soil.

Revision questions

1. *What do you understand by the following terms?*
   - *i) Flocculation*
   - *ii) Soil capillarity*
   - *iii) Leaching*
   - *iv) Soil drainage*
   - *v) Water retention capacity*
   - *vi) Soil erosion*
2. *Under what conditions is sheet erosion likely to occur?*
3. *Describe briefly how tree planting on a steep slope prevents erosion.*
4. *Name three other ways a farmer can use to prevent erosion on a moderate slope.*
5. *Why is it better to water a garden in the evening than in the middle of the day?*
6. *On a certain mountain top the soil is only a few centimeters thick, where as in a forest at the foot of the mountain the soil is about 15metres thick. Suggest reasons for this difference.*
7. *Outline 4 ways in which mulching might be useful in maintain soil fertility.*
8. *Suggest two reasons why it might be necessary to add lime to the soil.*

THE NITROGEN CYCLE

Nitrogen is one of the elements that make up proteins. Nitrogen makes up to 78% of air but it is unreactive so cannot be used by plants and animals in its elemental form. It becomes part of the bodies of organisms in a process called the ***nitrogen cycle***. Nitrogen is in constant circulation between autotrophs, heterotrophs, and the soil in atmosphere.

The changing of nitrogen into more reactive forms is called ***nitrogen fixation***.

Nitrogen fixation takes place during lightening, in the manufacture of artificial fertilizers and in the metabolism of the nitrifying and nitrogen fixing bacteria.

Plants absorb nitrogen as ammonium salts or nitrates.

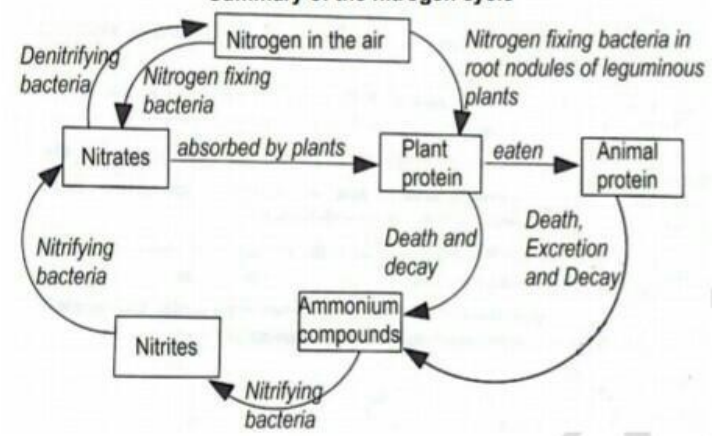
Animals obtain nitrogen they need by eating plants or other animals that have eaten plants.

At death, leaf fall, egestion or excretion (urine) plants and animals are decomposed by the putrefying bacteria into ammonium compounds and then to nitrates by the nitrifying bacteria therefore returning the nitrogen to the soil.

Plants absorb nitrogen inform of nitrates and ammonium salts ***for manufacture or buildup of proteins they require to make new plant parts.***

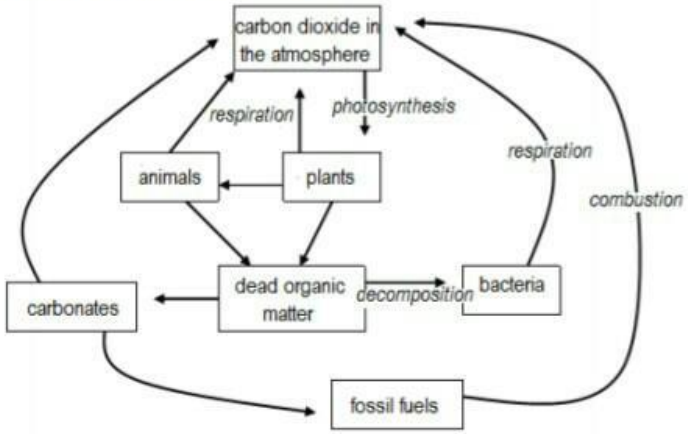
Deficiency of nitrogen in plants causes small sized plants and yellow underdeveloped leaves.

Summary of the nitrogen cycle



THE CARBON CYCLE

Plants get carbon from the atmosphere in the air during the process of photosynthesis. Plants use carbon to make food like starch. Starch is eaten by animals to get energy.



Removal of CO_2 from the atmosphere:

Green plants remove CO_2 from the atmosphere during the process of photosynthesis.

Some of the CO_2 in the atmosphere dissolves in rain water to form carbonic acid. This acid reacts with soil mineral salts to form carbonates.

Addition of CO_2 in the atmosphere:

Combustion (burning): When carbon containing fuels e.g. petroleum, coal, natural gas, fire wood are burnt, CO_2 is released into the atmosphere. Formation of such fuels over millions of years is referred to as ***fossilization***.

Respiration in animals and plants.

Decomposition of organic matter by bacteria and fungi. During this process, CO_2 is released into the atmosphere.