## EXPERIMENTS FOR BIOLOGY

## TOPIC 1: PHOTOSYNTHESIS

### 1. Testing a plant leaf for starch

A. procedure

| Steps | Reason |
|---|---|
| 1. boil the leaf in water for 2-3 minutes | • to kill the cells ,so as to stop any chemical reaction<br>• to break the cuticle and make the leaf more permeable to iodine solution |
| 2. boil the leaf in alcohol | • to remove chlorophyll , so that the leaf turn whitish to make the color easily observed when iodine soln. is put on the leaf |
| 3. dip the leaf in water for 2 minutes | • to soften the leaf so that it can easily spread out. alcohol makes the leaf brittle and hard |
| 4. spread the leaf in a white tile | • the white tile enables the any color change to be easily observed |
| 5. add few drops of iodine soln. | • to test a leaf for starch |

B. results

- ❖ when starch is present ,iodine turns blue black
- ❖ when starch is absent, iodine remains brown

### 2. Is light necessary for photosynthesis?

A. procedure

| Steps | Reason |
|---|---|
| 1. take the potted plant and put it in dark | • to destarch it |

| | |
|---|---|
| for 24hrs | |
| 2. pluck one of its leaves and test it for starch | • to make sure it has been destarched |
| 3. using a piece of folded black paper , cover part of both sides of a leaf on potted plant | |
| 4. leave the plant in the sun for about 5hrs | |
| 5. pluck the leaf and remove the aluminum foil and test the leaf for starch | |

B. results

✓ only the areas which had received the light go blue with iodine

C. conclusion

✓ light is necessary for photosynthesis

NB: a control could be designed ,using transparent material instead of aluminum foil/black paper

**3. Is carbondioxed necessary for photosynthesis?**

A. procedure

| | |
|---|---|
| 1. take the potted plant and put it in dark for 24hrs | • to destarch it |
| 2. pluck one of its leaves and test it for starch | • to make sure it has been destarched |
| 3. put potassium hydroxide or sodium hydroxide soln. in a plastic bag and cover one of the leaves on your plant with a bag | |
| 4. put sodium hydrogen soln. in another transparent plastic bag and cover another leaf on your plant with this bag | |
| 5. leave the plant in a sun for about 5hrs | |
| 6. remove the plastic bag for each leaf and test each leaf for starch | |

B. results

- ✓ leaf A : starch present . sodium hydrogecarbonate supplied carbondioxide
- ✓ leaf B: starch absent. iodine remains brown . sodium hydroxide absorbed carbon dioxed

C. conclusion

- ✓ the fact that starch was made in the leaves which had carbondioxide , but not in the leaves which had no carbondioxide ,suggest that carbondioxide is necessary for photosynthesis

**4. is chlorophyll necessary for photosynthesis ?**

A. procedure

| | |
|---|---|
| 1. pluck one variegated leaf from a plant growing in the open | |
| 2. test the leaf for starch | |
| | |

B. results

- ✓ only the parts that were previously green turn blue with iodine soln. the parts that were white stain brown

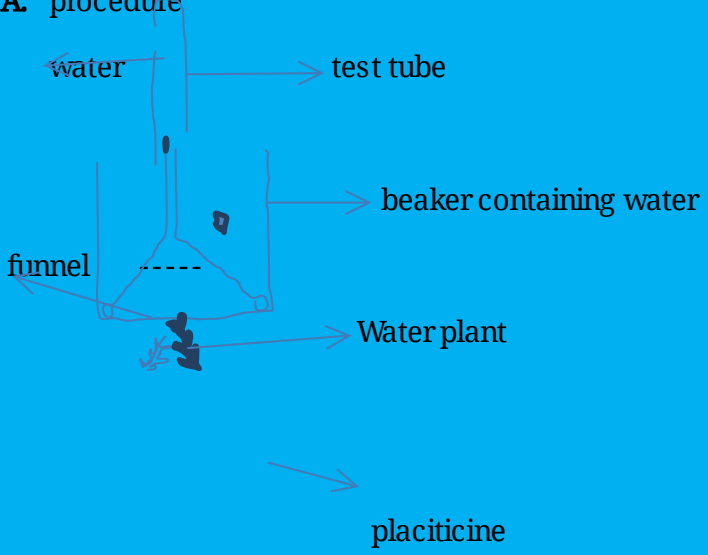
C. conclusion

- ✓ since starch is present only in the parts which originally contained chlorophyll it proves that chlorophyll is needed for photosynthesis

NB: experiment part :non green part. control green part.

5. **Is oxygen produced during photosynthesis?**

**A.** procedure




| | |
|---|---|
| 1. set up the apparatus as above | |
| 2. leave the apparatus in the sun for few days | |
| 3. carefully remove the tube from the top of the funnel ,allowing water to run out but not allowing the gas to escape | |
| 4. carefully lower the glowing splint into the gas in the test tube | |
| | |

**B.** results

- ✓ the flame grows bigger

**C.** conclusion

- ✓ the gas is oxygen

NB: a water plant is used because it photosynthesizes in water

: the experiment is done under water because water traps the gas

:a control , another plant in a similar situation will be placed in the dark, no photosynthesis, hence will be no gas production

6.**seperating pigment in a leaf**

A. materials/requirements

- fresh leaves, motor, pestle, 2 beakers, dry grass stem, ethanol , filter paper and a razor blade

A.Procedure/method

I. collect green leaves from plants in the school compound

II. chop the leaves into the small pieces or crush them using pestle and mortar

III. place the crushed into small grass beaker

IV. .add alcohol to half fill the beaker

V. place the beaker into a large grass beaker half filled with water is called a water a bath

VI. .heat the beaker until the alcohol turns green. this show that pigments in the leaves has dissolved into alcohol

VII. remove the alcohol mixture from the beaker, filter it into another small beaker

VIII. cut the small long strip of 10cm long stick it into a glass rod using a sellotape

IX. suspend the filter paper strip into a container with the coloured alcohol such that the tip of the paper touches the mixture

X. allow the strip to absorb the coloured alcohol for about 30 minutes .observe the colour formed on the strip from the bottom to the top

C.results

- ✓ you would see the ethanol rising in the filter paper and separating the pigments .what was initially green would separate into yellow(xanthophyll), orange(carotens), and green would remain behind and this is chlorphyll

D.Conclusion

- ✓ the results tells that they are three types of pigment in a green plant

**TOPIC 2: HUMAN NUTRITION AND DIGESTION**

Ranges of food substance required: soln. of glucose ,sucrose and starch; ground-up suspension in water of pea, bean , carrot,, and grape; milk, castor - oil beans, and cooking oil; pieces of potato, bread, and boiled white of egg

1.Food test

| No. | Method/procedure | Results | Conclusion |
|---|---|---|---|
| 1. starch | • place about 3cm³of starch soln. in a container<br>• add 2-3 drops of iodine soln.<br>• observe color change | • blue-black color | • presence of starch |
| | | • brown color | • absence of starch |
| 2. protein | • place about 3cm³ of the food solution in a test tube<br>• carefully add 4-5 drops of biuret soln. | • purple color | • presence of protein |
| | | • blue color | • absence of protein |
| | • place about 3cm³ of food soln. in a test tube<br>• add about 3cm³of sodium hydroxide soln. and mix well. Add 1 or 2 drops of copper sulphate soln. ,mix well and observe any color change<br>NB: if the color does not change immediately let the soln. stand for 15minutes and then observe again | • violet color | • presence of protein |

| | | | |
|---|---|---|---|
| 3. lipids | • place a drop of oil/food substance on a piece of paper(filter paper)<br>• examine the paper while holding up against light | • translucent or grease spot | • presence of lipids |
| | | • not transparent | • absence of lipids |
| | • 2 drops of cooking oil are thoroughly shaken with about 5$cm^3$of ethanol in a dry test tube until the fat dissolves.<br>• the alcoholic soln. is poured into a test tubes containing a few water<br>NB: this is an ethanol/emulsion test | • cloudy white emulsion | • presence of fats/lipids |
| | | • if the liquid stay clear | • absence of fats |
| 4.reducing sugar(monosaccharide e.g glucose and maltose) | • place about 3$cm^3$ of the food soln. in a test tube<br>• add about 2 drops of benedict's solution<br>• heat gently for few minutes<br>NB: the mouth of the test-tube must be pointed away from people as the soln. tend to bump out of the tube | • A yellow or orange or brick red color | • presence of reducing sugar |
| | | • blue color | • absence of reducing sugar |
| | • place about 3$cm^3$ of the food soln. in a test tube<br>• Add about 2$cm^3$of Fehling's A soln. followed by the same Fehling's B soln.<br>• heat gently for few | • A yellow or orange or brick red color | • presence of reducing sugar |

| | | | |
|---|---|---|---|
| | minutes | | |
| 5. Non reducing sugar(sucrose) | • place about 3cm³ of the food soln. in a test tube<br>• add few drops of hydrochloric acid<br>• boil the soln. for few minutes<br>• add very small amount of sodium carbonate into the test tube until the effervescence stops<br>• proceed as in steps 2and 3 above | • | • |
| 6. vitamins C | • place 2cm³ of the dye Pheno-indo-2:6-dichlorophenol in a test tube<br>• Add 1% vitamin C soln a drop at a time from a graduated pipette | • the dye decolorizes | • presence of vitamin C |

2.Enzymes

1. an experiment to show that enzymes are sensitive to PH(effect of PH on enzymes activity)

i. action of saliva on starch

A. procedure

| |
|---|
| 1.take 2 test tubes and label them A and B |
| 2.Put saliva in both test tube A and B |
| 3.Add 2 drops of hydrochloric acid in test tube A and wait for few minute to allow the HCL destroy active site of enzymes |
| 4.add starch e.g maize flour in both test tubes A and B and shake them |
| 5.leave the mixture to stand for few minutes |
| 6.add iodine soln. to both test tubes and shake them well |
| 7.leave the mixture to stand for few minutes |

B.Results

- ✓ result would show that iodine will turn blue black in test tube A while brown in test tube B

C.Conclusion

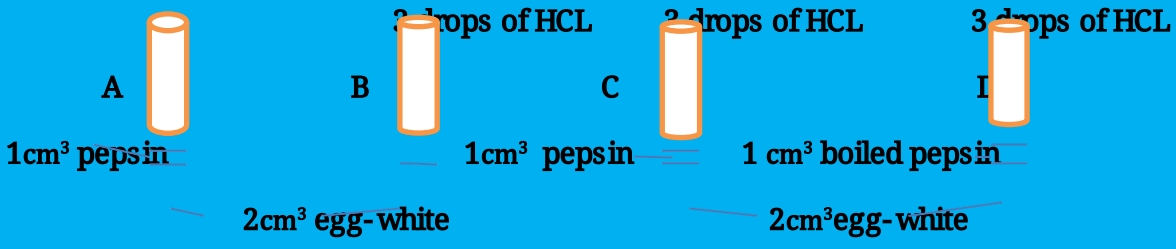
- ✓ the enzymes is sensitive to PH as it was unable to digest starch in test tube A where the condition was acidic

ii. action of pepsin on egg-white protein

A.procedure

- a cloudy suspension of egg-white is prepared by stirring the white of one egg into 500 $cm^3$ 0f tap water
- heat it to a boiling point and filtering it through glass wool to remove the larger particles

- label 4 test tubes A, B, C and D
- place 2cm³ of egg-white suspension in each of them




- then add pepsin soln. and HCL to the test tubes
- place all 4 tubes in a beaker of warm water at $35^0$c for 10-15 minutes

B.results

- ✓ the content of tube C go clear
- ✓ the rest remain cloudy

C.conclusion

- ✓ the change from a cloudy suspension to a clear soln. shows that the solid particles of egg protein have been digested to soluble product
- ✓ the failure of other 3 tubes to give clear solution show that:
  - ➢ in A pepsin wil only work in acidic soln.
  - ➢ in B it is the pepsin not the HCL which does the digestion
  - ➢ in D pepsin is an enzyme, because its activity is destroyed by boiling

iii. An experiment to find the optimal PH of an Enzyme

A. procedure

- mix pepsin and egg white
- pour them in six tubes each placed at different PH from 1 to 6
- set the test tube in $37^0$ water

B. results

- the test tube with clearest mixture is the optimum PH

C. conclusion

- since enzyme work best at optimum PH, therefore , the tube with clearest mxtutre indicate the optimal PH as enzyme has worked effciently

2.an experiment to show the effect of temperature on enzyme activity

A. procedure

i. place 2$cm^3$ of starch soln. in three test tubes labeled A, B and C

ii.to each test tube add 1$cm^3$ of saliva(saliva amylase)

iii. immerse test tube A into a beaker containing cold water with the blocks, using thermometer put the temperature at $0^0c$

iv. put the second test tube in water bath maintained at $37^0c$

v. boil the content of the 3rd test tube

vi. test the contents of 3 test tubes by using iodine solution

B.results

- ✓ the results would show that in test tube A- iodine turns blue black , the enzymes are inactive and unable to digest starch
- ✓ in test tube B- iodine solution will turn brown enzymes have digested the starch,enzymes work best at a temperature of 37 degrees
- ✓ in test tube C- iodine turns blue black , the enzymes were unable to digest starch , since boiling denatured them

C.conclusion

- ✓ the results show that enzymes activity is affected by temperature with 37 degrees as its best temperature

3.experiment of enzyme on germinating bean seed

A. Procedure

1. crush the germinating bean seed in a mortar

2. add water to obtain(enzyme) extract

3.put starch soln. in test tube A and B

4.in a test tube A add extract ,but leave test tube B in intact

5.leave both test tube to stand for some time

6.later add drops of iodine soln. to both test tubes and observe color change

B. results

- ✓ in test tube A-there will be brown color. This show that there's no starch present
- ✓ in test tube B – you will observe blue black color. This change indicate presence of starch

C.conclusion

- ✓ these result lead to a conclusion that the germinating bean seeds contain an enzyme which digest starch

3.experiment on the permeability of the visking tubing

A. procedure

1.tie one end of the visking tubing with a thread

2.pour a mixture of starch soln. and glucose soln. in a visking tubing

3.tie the other end with the thread

4.clear as much as possible the outside of filled viskeing tubing with distilled water to remove any traces of the starch and glucose

5. pour distilled in a beaker

6 .test the distilled water for starch and glucose to make sure that there is no starch and glucose in the distilled water in the beaker at the beginning of the experiment

7. immerse the visking tubing in the distilled water in the beaker
8. leave the apparatus for 20 minutes at 37°c
9. after 20 minutes ,test the distilled water for starch and glucose

B.results

- ✓ there is glucose in the distilled water after 20 minutes-are small enough to pass

across the wall of the visking tubing

- ✓ there is no starch in the distilled water after 20 minutes- are large to pass

C.conclusion

- ✓ this shows that the wall of the visking tubing is semi-permeable (selective)since it allows small molecules of glucose to pass across it but does not allow large molecules of starch to pass across it

NB:

| | | | |
|---|---|---|---|
| o | material | o | representation |
| o | visking tubing | o | small intestine |
| o | water | o | blood |
| o | starch | o | large food particles |
| o | glucose | o | small food particles |
| o | starch and glucose | o | digested food particles |

## TOPIC 3: TRANSPORT AND TROPISM IN PLANTS

1. **experiment of osmosis in a plant cells**

   A. **procedure**

      I. cut three equal stripes of fresh Irish potato each of mass 3g and length 7cm

      II. test the flexibility of of each strip by trying to bend them

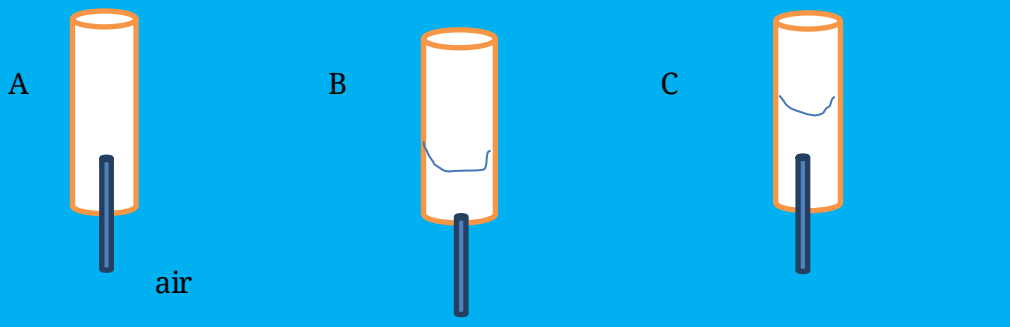
      III. collect three test tube and label them A, B and C

      IV. leave the strips in the test tubes

      V. in test tube A air present

      VI. in test tube B pour 30$cm^3$ of 30% sugar soln.

      VII. in test tube C pour 30$cm^3$ of distilled water. the whole set up should look like this




      VIII. leave the apparatus for 20 minutes

      IX. After 20 minutes test the flexibility of the strip

   B. Results

      - A will be stiff/rigid/tough/less flexible
      - B more flexible and easier to bend

- C very stiff/ very tough

C. conclusion/ interpretation/ explanation

- A will remain the same
- B looses water by osmosis to the sugar soln. because it is less concentrated than sugar soln.
- C the strip has absorbed water by osmosis from the distilled water

NB. now find the mass of each strip by reweighing it on a triple beam balance

**2. WHAT HAPPENS WHEN WATER AND SUGAR SOLUTION ARE SEPERATED BY A PAWPAW PETIOLE**

A. materials

: Glass tube 10% sugar soln., a few pawpaw leaves, beaker, dropper with long fine end, sharp knife, clamp stand.

B. procedure

(i) Collect several leaves by cutting at the semi-petiole junction. make sure that the petiole remain at its base .the closed petiole base will act as a semi-permeable

(ii) cut off the top part of the petiole at least 5cm above the end of the petiole groove

(iii) add a little water inside the hollow and leave the petiole in a beaker of water when being transported to laboratory

**(iv)** Select a pawpaw petiole of right diameter, shake water out and fill it with 10% sugar solution using the dropper. make sure that no air bubbles are trapped in the **hollow**

(v) stand the petiole in a beaker of water using the clamp stand and mark the initial level of solution in the tube

C. results

- water will move from the beaker to the petiole

D. conclusion

- water crosses a semi-permeable membrane to an area of higher solute soln. by osmosis

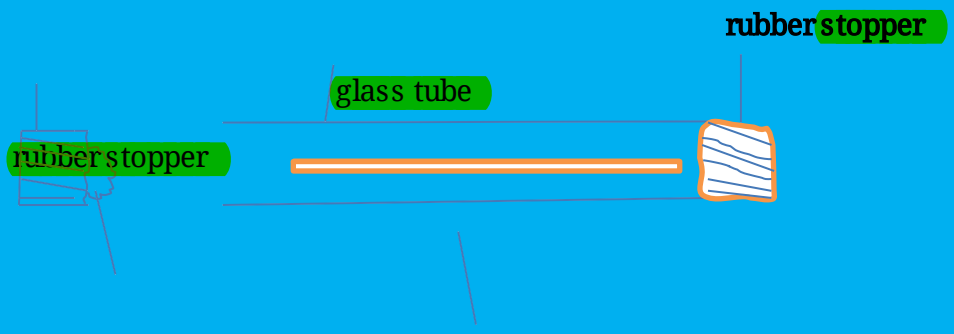
## 3. DEMONSTRATION OF THE MOVEMENT OF THE AMMONIA GAS

A. materials

- a glass tube2.5cm diameter x 60cm long with a rubber , stopper at each end
- a 1 x 50cm strip of blotting paper
- Phenolphthalein soln.
- cotton wool and pith
- ammonia soln.

B. procedure

a. the whole set up should be as below:




cotton wool soaked in ammonia soln.

strip of blotting paper previously dipped in Phenolphthalein soln.

b. dip the blotting paper into Phenolphthalein soln. and insert the glass tube into it.

c. plug one end of the tube with a rubber stopper. plug the other end with a stopper to which is attached to a small ball of cotton wool soaked in ammonia soln. and held in a place with a pin

**C. results**

- the movement of vapour is indicated by the progressive reddening of the paper strip

**D.** conclusion

- this movement of ammonia vapor is called diffusion

**4. DIFFUSSION OF POTASSIUM PERMANGNET**

**A. materials;**

- **a** beaker
- potassium permanganate
- spatula

**B. procedure**

i. fill the beaker with the water

ii. add crystal of potassium permanganate using the spatula

iii. observe what will happen to the color of water

C. **results**

- initially the potassium and permanganate ions will be moving away from the crystal into the surrounding water and eventually the water becomes a uniform pink color. thus the concentration of potassium permanganate in the surrounding water increases . Molecules are moving in all the direction at all the time. this movement goes on until the crystals has all dissolved and there is uniform distribution of potassium and permanganate ions throughout the beaker

## 5. measuring the uptake of water by a plant by means of photometer

A. procedure

a) put a plant shoot and cut it through under water- to avoid air bubbles

b) attach the cut end of the shoot into the photometer, fit exactly into the rubber tubing with no air gaps

c) fill the apparatus with water ,by opening the clip

d) close the clip again and leave the apparatus in a light airy place.

B. Results

- As the plant transpires, the water it loses is replaced by water taken up from the stem in turn it draw water from photometer tube
- record the position of the water meniscus every 2 minutes using the scale
- when the meniscus reaches the end of the scale refill the apparatus with water from the reservoir

C. conclusion

- as the water evaporate from the leaves more water is drawn from the stem in turn it draw water from the photometer tube

NB. the rate of water can be calculated as follows

$$\text{R ate of water uptake} = \frac{\text{distance moved by the bubbles}}{\text{Time taken in minutes}}$$

NB. you can repeat the experiment but with the apparatus in different situations e.g windy, still

air, hot sun or cool air, blowing it with fan, putting it in a cupboard

## 6. MEASURING THE UPTAKE OF WATER BY A PLANT THROUGH ROOT HAIRS

### A. Procedure

1) obtain a bean plant and wash its roots carefully
2) stand it in a measuring cylinder
3) pour water into the measuring cylinder up to the top mark
4) carefully pour a little oil into the measuring cylinder so that it forms a thin layer over the surface of the water. This will prevent evaporation of water from the measuring cylinder
5) weigh the whole set up in a triple beam balance and record the mass
6) leave the apparatus in the open in the laboratory for 24hrs
7) after 24hrs reweigh and record the mass
8) read off the level of water in the measuring cylinder

### B. results

- reduced mass

- lower level of water in the measuring cylinder

**C. conclusion**

- lower level of water shows its uptake through root hairs hence reduced mass

**7. EVIDENCE OF FOOD TRANSPORT THROUGH PHLOEM**

**A. ringing/girdling experiment**

- **procedure**

  i. the phloem in a woody stem are just underneath the bark

  ii. if a ring of bark is taken off the stem, the phloem tube is also removed too, leaving the xylem vessel behind

  iii. in this situation the , food substance cannot get down the stem below the ring

- **results**

  - food substance accumulate above ring
  - bulge above the ring because extra growth occurs in it
  - root dies

- **conclusion**

  - the result shows that food transport through phloem as the ringing of bark indicate that there is no passage of to the roots hence they die

**B. use of aphids**

- procedure

  i. aphids such as green fly ,feed on plant juices , they have special mouth parts called stylets ,they push their stylets into the phloem tubes of a plant and suck up the sap from them

  ii. a feeding aphid can be anathetised and its stylets cut off

  iii. phloem sap keep flowing out of the phloem tubes through the stylets

  iv. the sap can be analysed

- results
  - the sap can be found to contain sugar and many other organic material
- conclusion
  - there is food passing in the phloem tube

8. HOWIS SHOOT GROWTH AFFECTED BY RING-BARKING THE STEM

A. Procedure

i. no treatment(control)

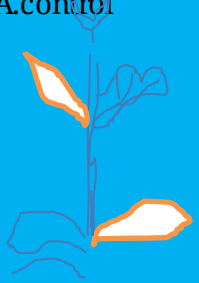
ii. bark removed for 1cm in the 5th internode from the shoot apex(ringed)

iii. leaves removed from nodes above the 5th internode(defoliated)

iv. bark removed in the 5th internode(ringed and defoliated)

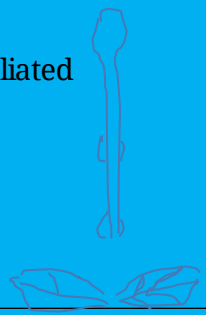
v. the whole set up should look as below:

A.control



B.ringed

C.Defoliated



D.ringed and defoliated

B. results

- A- more food will be produced ;
  - effect: increased growth rate on the shoot
- B- the roots will not get enough food; this will affect the absorption of water and mineral salts negatively affecting food production;
  - effect: there will be low growth rate on the shoot
- C- less food will be produced ;
  - effect: slow growth
- D- food production will be low; the roots will get very small amount of food
  - least growth rate

C. conclusion

- the results show that ring barking affect shoot growth as food production get negatively affected as a results of less absorption of water by the roots

9. **DESIGN AN EXPERMENT TO SHOWTHAT RADICLES (ROOTS)HAVE POSITIVE HYDROTROPISM**

   A. **Procedure**

      i. take a trough and fill it with a soil

      ii. plant maize or bean seed around the edges of the trough

      iii. water the seed regularly until they germinate

      iv. at the center of the trough insert a tin which has a holes at its base

      v. start watering the seedling by putting the water in the tin only for 5 days

      vi. after 5 days observe by uprooting the seedling carefully

   B. **Result**

      - you will see that all the roots were bending towards the center where there was high concentration of water

   C. **conclusion**

      - therefore the results shows that plant roots grow toward the region of high water concentration, which is a positive geotropism

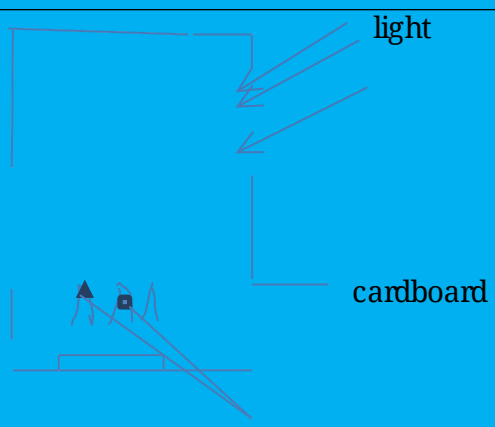
10. **EXPERMENT ON WHICH PART OF THE PLANT RESPOND TO LIGHT**

   A. **procedure**

      i. **obtain a dish containing 3 newly germinated seedlings e.g maize. the shoot should be at least 10mm long . put the seedling in the cardboard**

      ii. **cover the tip of one of the seedling with aluminum foil of any opaque material. cover the middle of the second seedling with aluminum foil .leave the third seedling untampered**

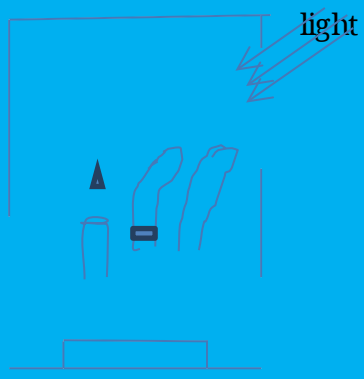
      iii. **light the dish from one side and leave the apparatus for several days. the whole set up should look as follows :**




iv. after leaving the apparatus for several days make state your observation on the 3 seedling

B. **results**

- after leaving the apparatus for several days the apparatus will look as shown bellow




C. **Conclusion**

- **it is the shoot that respond to light**

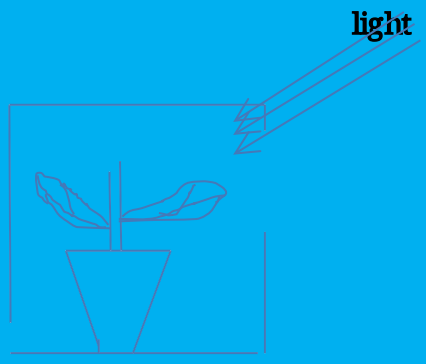
## 11. experiment on the effects of light on the growing shoot

### A. procedure

I. select 2 potted plants of beans of similar size and water them both

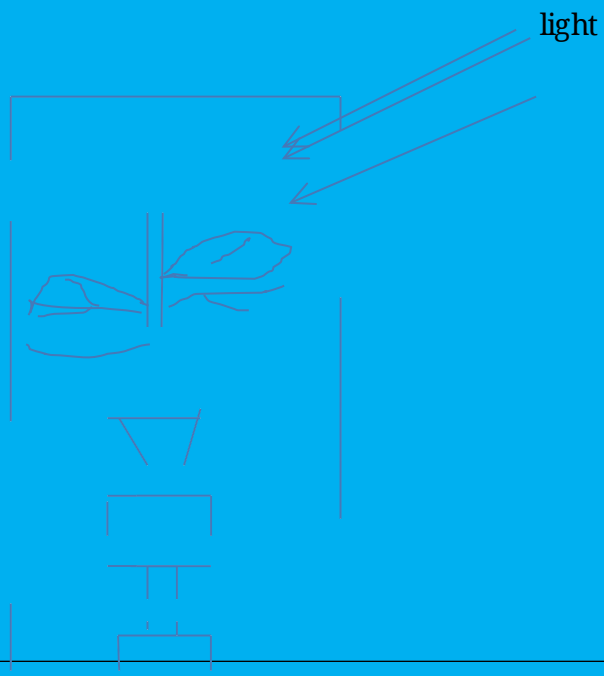
II. place one of them under a cardboard box with a window cut on one side sothat light reaches the shoot from one direction only as follows:

A.




III. place th other seedling in an identical situation but this time on a clinostat as shown below:

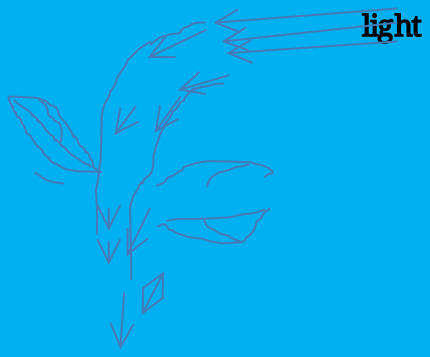
B.



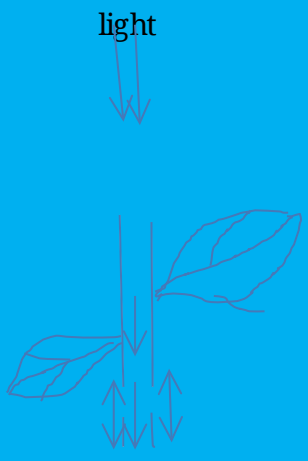
IV. leave the 2 apparatus for 2 days .after tis period compare the 2 seedlings from the boxes and compare their appearance

**B. results**

- in A there will be unequal distribution of auxins




- in B. there will be uniform distribution of auxins



C. conclusion

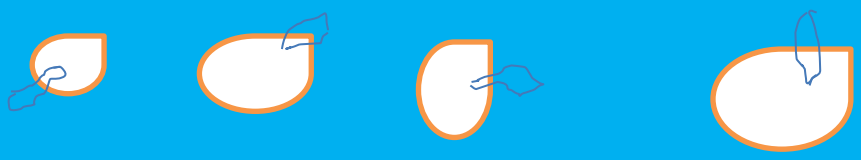
- the results shows that when there is uniform distribution of light on shoot there is uniform distribution of auxins and hence uniform vertical growth. therefore the shoot on the clinostat grow uniformly and vertically. the rotating clinostat exposes the shoot to light equally so that there is uniform distribution of auxins.
- while one sided illumination results in unequal distribution of auxins . the light causes the auxins to diffuse from the illuminated side to the dark side of the shoot thus increasing auxins concentration on the dark side. as a result the dark side of thw shoot grows faster than the illuminated side and so the shoot bend towards the illumnated

**12. EXPERIMENT ON PLANT RESPONSE TO GRAVITY**

**A.Procedure**

a. **obtain 4 bean seedlings whose radicles are just visible**

b. **with pins attach them to a sheet of a cork in various positions as follows;**



A B C D

c. put the cork in a small aquarium tank with a little water at the bottom and put a sheet of at the top

d. cover the tank with a card board box so as to put the seedling on the dark

e. after about the seedling observe the seedling s and sketch their appearance

B.Results

- the roots will grow downwards

D. conclusion

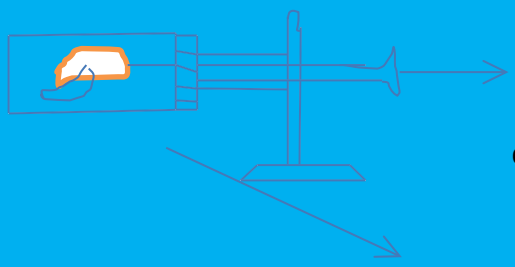
- the results show that the roots is responding to stimulus of gravity

## 13. GEOTROPISM IN ROOTS (EFFECTS OF GRAVITY ON THE ROOTS)

### A. procedure

a. **obtain 2 newly germinated seedlings whose radicles are each about 10mm long**

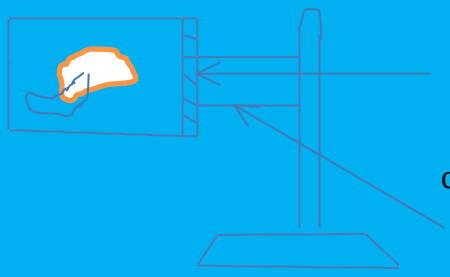
b. **pin one of the seedlings to a cork on a clinostat as follows**



clinostat

cork

c. pin the other seedling to a pin of cork in a beaker as follows



cork

clamp

d. put some moist cotton wool in the clinostat chamber so as to keep the seedling moist

e. cover the clinostat and the beaker with the cardboard boxes and leave the clinostat running for several days

**B. RESULTS**

- the ones on the clinostat will have shown simply growing straight outwards while the ones without clinostat the tips of the roots will have grown downward, toward the direction from which gravity was acting on them

**14. EXPERIMENT TO FIND THE REGION THAT RESPOND TO STIMULUS OF GRAVITY IN BEAN SEEDLINGS**

TOPIC 4: **HUMAN CIRCULATORY SYSTEM**

- **EPERMENT TO FIND OUT THE EFFECT OF PHYSICAL ACTIVITY ON PULSE RATE**

  **A. material**

  - **stop watch**
  - **student**

  **B. Procedure**

  a. **in pairs , place your finger on your partner's wrist**

  b. **count the number of beats you feel I a minute and record in the table below**

| **activity** | **Pulse rate(beats / minutes)** |
|---|---|
| **standing** | |
| **walking** | |
| **running** | |

  c. ask your partner to walk around the school block; take the pulse and record

d. ask your partner to run and record the pulse rate

**C. Results**

- in standing ; lowest pulse rate
- in walking; pulse rate start increasing
- in running , the pulse rate is highest

**D. Conclusion**

- the results show that as the physical activity increases , the pulse rate also increases.

## TOPIC 4: RESPIRATORY SYSTEM

### ❖ INVESTIGATING THE EFFECTS OF EXERCISE ON BREATHING

**A. materials**

- stop watch
- student
- graph paper

**B. procedure**

a. count the number of breaths per minute of a of below student at rest and record the results below

| activity | Breaths / minute |
|---|---|
| At rest | |
| After exercise | |

b. ask your fellow student to jump up and down and find his breathing rate soon after the one minute exercise and record

c. account for any differences in the three rates

**C. results**

- it will be shown that after exercise the number of breathing rate will

0020increase

D. conclusion

- the results show that breathing rate increases with exercise

d

**TOPIC 5: LOCOMOTION**

**1.COMPOSITION OF BONES**

A. Procedure

a) take small pieces of fresh bones and weigh them on a triple beam balance

b) place them in test tube and cover them with HCL

c) fix a delivery tube from this test tube to another test tube containing limewater as shown below.

d) leave the apparatus in a safe place for about two days

e) after two days observe and record any color change in the lime water

f) rinse the bones in water and try to bend them

g) dry the bone in the sun and then reweigh them and fill all your results in the table below

| treatment | results |
|---|---|
| Initial mass of bones | g |
| Final mass of bones after soaking in HCL | g |
| Difference btn the 2 masses | g |
| Flexibility of bones before soaking in HCL | |
| Flexibility of bones before soaking in | |

| | |
|---|---|
| HCL | |

B. expected results

- after 2 days the lime water turns milky. this means the mixture of the HCL and bones in the test tubes produces carbondioxide
- the mass of the bones decreases . this means part of the bones dissolves in the HCL
- the bones are hard before soaking in the HCL.. but after soaking in the acid for 2 days , they become rubbery. thus hard inorganic component dissolves in the HCL

C. conclusion

- therefore ,when the inorganic component is removed from the bone, the bone becomes rubbery .if the soft protein component is removed the bone leaving the hard component behind ,the bone become brittle and hard

**TOPIC : 6 COORDINATION**

**1. knee J erk**

**A. material**

- **a ruler**
- **partner**

**B. procedure**

(i) ask your partner to sit relaxed on a chair with one leg crossed over the other at the knee

(ii) with a ruler , give him a sharp but gentle tap on the knee just below the knee cap

2. **To see if dogs could be induced to produce saliva in the absence food**

   A. **material**

   - dog
   - food
   - bell

   B. **Procedure**

   (i) the original stimulus(food) is presented ,the related response(production of saliva) is made

   (ii) the substitute stimulus(the sound of a bell) is presented together together with the original stimulus(food), the same response is as before is made

   (iii) the substitute stimulus is now presented alone, the same response as before is still made

3. **experiment to find the effect of practice on hitting the target**

4. EXPERIMENT TO FIND THE EFFECT OF TIME OF BDAY ON MEMORISING A LIST OF THE WORDS

TOPIC 7: EXCRETION

- INVESTIGATING DIALYSIS

  A. procedure

  1. warm a beaker full of water to approximately $37^0C$
  2. tie a tight knot at one end of a length of dialysis (visking)tubing . use a syringe to fill the tubing with a mixture of starch and glucose soln. close the other rend of the tubing with a paper clip
  3. rinse the outside of the dialysis tubing with tap waater to remove all traces of starch and glucose.
  4. place the tubing in a large test tube of warm water as shown below:

warm water

5. withdraw some of the water in contact with the with the tubing .
6. test tis water for starch and glucose
7. after 20minutes with draw some more water in contact with tubing and test it for starch and glucose

B. results

- the test shows blue black color because the tubing is selective permeable

NB;

| Material | Representation |
|---|---|
| Dialysis tubing | The tubing in a kidney used to purify blood |
| Glucose/starch soln. | |
| Which part of the does the tubing represent | |

T0PIC 8: ECOSYSTEM

1. ECOLOGICAL METHOD OF STUDYING ECOSYSTEM

1) MARK, RELEASE AND RECAPTURE METHOD

❖ material

- ink
- sweeping net

❖ procedure

a) select a habitat

b) catch the organism using a sweeping anet

c) capture them and mark them using ink

d) release the marked organism, let them mix with the others

e) catch the organisms again , both marked and unmarked ,count them

f) then calculate the population estimate by using the formula below;

$$\text{population} = \frac{\#\text{ of org. in } 1^{st} \text{ catch} \times \#\text{ in } 2^{nd} \text{catch both marked and unmarked}}{\#\text{ of marked organisms recaptured}}$$

2) QUADRANT METHOD

❖ Procedure

a. select an area in which the organism is found

b. estimate the size of the field in square meters

c. throw the quadrant randomly, count and record the number of the org. found per quadrant against the number of throws as below

| Quadrant throws | No. of org./plant |
|---|---|
| 1 | 20 |
| 2 | 50 |
| 3 | 100 |

d. throw the quadrant several times

e. calculate the number of org. in each quadrant as below;

$$\text{average} = \frac{20 + 50 + 100}{3}$$

f. then you calculate the population estimate by using the formula below;

$$\text{Estimated plant popln.} = \frac{\text{average \# 0f plant in a quadrant} \times \text{total area of the field}}{\text{Area of the quadrant}}$$