

NAME.....INDEX NUMBER.....

DATE.....

SIGN.....

231/2

BIOLOGY

PAPER 2

(THEORY)

MARCH/APRIL 2023

TIME: 2 HOURS

SUKELLEMO JOINT PREMOCK 2023
FORM FOUR EXAM
Kenya Certificate of Secondary Education. (K.C.S.E)

INSTRUCTIONS TO CANDIDATES

- ❖ -Write your name, date of exam, index number and sign in the spaces provided above.
- ❖ -Answer all questions in the spaces provided.
- ❖ -This paper consists of Question 1 to 8
- ❖ Answer all questions in section A. Question 6 is compulsory, then choose either question 7 or 8.
- ❖ -Students should check the question paper to ascertain that all the pages are printed as indicated and no questions are missing.

FOR EXAMINER'S USE ONLY

Question	Maximum Score	Candidate's score
1	8	
2	8	
3	8	
4	8	
5	8	
6	20	
7	20	
8	20	
TOTAL	80	

SECTION A (40 MARKS)

ANSWER ALL THE QUESTIONS IN THE SPACES PROVIDED.

1. a) Describe how turgor pressure builds up. (3mks)

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b) What is meant by the term wilting? (1mk)

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c) What would happen to an animal cell if placed in a hypertonic solution? (2mks)

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d) A student drew an 8cm long diagram of an insect wing. If the actual length of the wing was 16cm, calculate the magnification of the drawing made by the student and show your working (2mks)

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2. a) What is meant by the term Sex-linkage? (1mk)

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b) In *Drosophila melanogaster*, the inheritance of eye colour is sex-linked. The gene for red eye is dominant. A cross was made between pure breed of red eyed female and a white eyed male. Work out the phenotypic ratio of F1 generation. (use R to represent the gene for red eye) (5mks)

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c) Explain the need for genetic counselling in present day health facilities. (2mks)

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3. A food sample was made into a suspension and divided into two samples each 2ml. The two samples were put into two test tubes, A and B and treated as follows.

- In test tube A nothing was added.
- In test tube B 1ml of a suspension of ground germinating millet grains was added.

The two test tubes were put in a water bath with temperature maintained between 35⁰C and 37⁰C for 30 minutes. Iodine and Benedict's tests were performed on portions from both tubes. The results were as shown below:

Test tube	Iodine test	Benedict's test
A	Positive	negative
B	negative	Positive

a) What is a positive iodine test and what does it show? (2mks)

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b) Explain why the iodine test was negative in test tube B. (2mks)

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c) What is positive Benedict's test and what does it show? (2mks)

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d) State two other factors that affect the activity of enzymes (2mks)

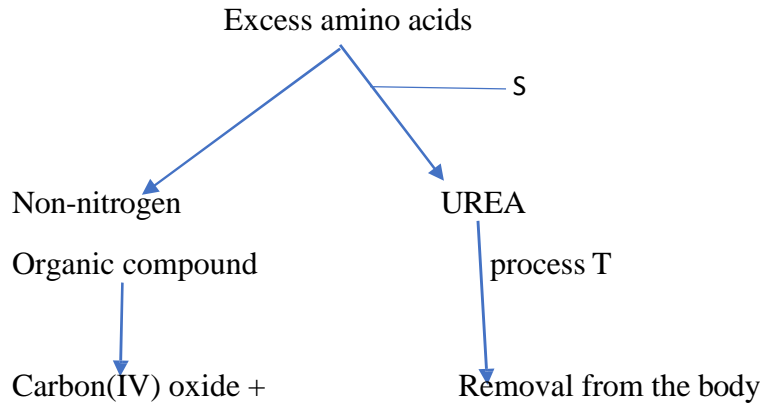
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4. Proteins are present in a balanced diet. They are broken down into amino acids and excess cannot be stored in the body. Its metabolism is as shown below.



- a) Describe how urea is transported to the site of removal from the body (2 mks)

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- b) Name the process S and T, stating the organ in which each occurs (4 mks)

PROCESS	NAME OF PROCESS	ORGAN WHERE IT OCCURS
S		
T		

- d) Give any **TWO** uses of amino acids in the body (2 mks)

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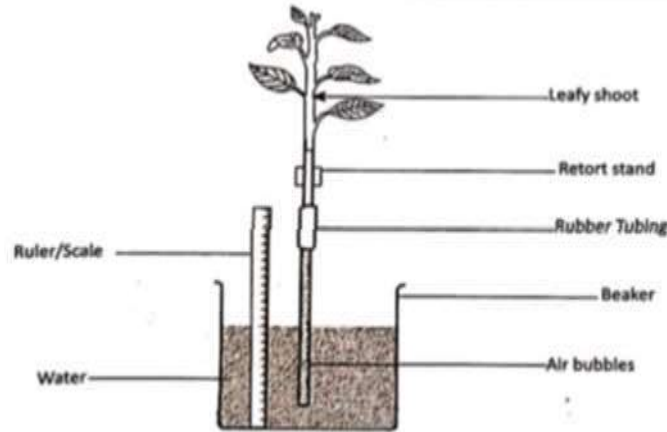
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5. The diagram below represents a model used to investigate a certain physiological process in plants. Study it carefully and answer the questions that follow.



a) Name the physiological process under investigation. (1mk)

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b) What is the function of the rubber tubing in the set up? (1mk)

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c) Describe how the air bubble was introduced into the tubing. (1mk)

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d) State the adjustment that can be made on the set up's glass tubing to enhance its efficiency. (1mk)

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e) Explain what would happen if the set up was placed under the following conditions.

i) in bright light (2mks)

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ii) on a mountain (2mks)

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SECTION B (40MARKS) ANSWER QUESTION 6 AND EITHER QUESTION 7 OR 8.

6. An experiment was carried out to investigate the population growth of mice under laboratory conditions. The procedure was as follows:

Twenty young mice were placed in a cage. The amount of food available to the mice each day was kept constant. The results obtained are as shown in the table below:

Time in months	0	2	4	6	8	10	12	14	16	18
Number of mice	20	20	65	115	310	455	450	190	145	160

a) In the grid provided, using a suitable scale plot a graph of number of mice against time. (6mks)

b) With reference to the graph account for the changes in mice population between:

i) 0- 2 months (1mk)

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ii) 2-10 months (1mk)

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iii) 10-12 months (1mk)

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iv) 12-16 months (1mk)

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c) i) Between which two months was the population change greatest? (1mk)

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ii) Calculate the rate of population change over the period you have given in (c)(i) above. (3mks)

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d) What population changes would be expected if the investigation was continued for further 24 months? (2mks)

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e) Assuming that the human population growth rate in Kenya does not decrease over the next 40 years, suggest four socio-economic problems that the society may face. (4mks)

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- 7. a) Distinguish between mutations, mutants and mutagens. (3mks)
- b) Give two causes of mutations (2mks)
- c) Describe the causes and effects of chromosomal mutations (15mks)

8. Discuss the various ways in which anaerobic respiration is utilized in industries and homes. (20mks)

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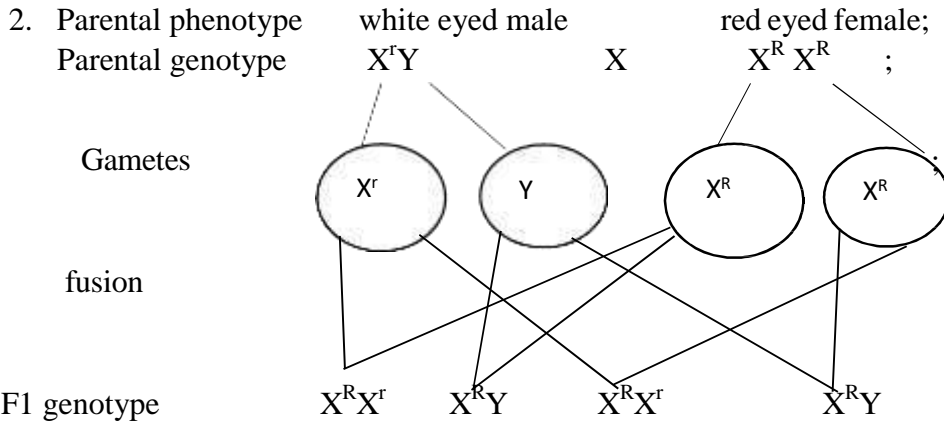
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MARKING SCHEME.

- As the (plant) cell gains water by osmosis; the sap/cell vacuole enlarges; pushing the cytoplasm outward; exerting pressure on the cell wall; (total 4mks max.3mks)
 - wilting is when the rate of water loss is more than the rate of absorption and the plant droops;(drooping must be present to score)
 - magnification = $\frac{\text{drawing length}}{\text{actual length}} = \frac{8\text{cm}}{16\text{cm}} = X0.5$; (rej. Answer alone without working)

;



Phenotypic ratio 2red eyed males : 2red eyed females;
 1 red eyed male : 1 red eyed female;

	X^r	Y
X^R	$X^R X^r$	$X^R Y$
X^R	$X^R X^r$	$X^R Y$

B) Sex linkage; refers to genes located on the sex chromosome: and are transmitted along those determining sex;(acc. Contained on the sex chromosome) rej. Genes inherited in the same chromosome.

c) – provides information/advice to individuals/families/communities on possible risks of genetic disorders.

- provides supportive services/serves as patient advocates/refer individuals /families to relevant health professionals
- -helps identify/advice/test families /communities on possible risks of genetic disorders:

3. a) the dark blue/blue-black/black colour; indicates the presence of starch;

b) starch; in the food sample had been hydrolyzed by enzymes in the germinating millet into reducing sugar;

c) a positive Benedict’s test gives an orange precipitate; showing the presence of reducing sugars

d)- use of boiled ground germinating millet suspension

- -use of ground dry millet suspension
- f) Factors affecting enzyme activity
- substrate concentration;
- enzyme co-factors;
- enzyme inhibitors:
- change in pH

4.) Urea is transported from the liver via the hepatic vein to the heart via the vena cava; and out of the heart via the aorta to the kidneys via the renal artery;

b)

PROCESS	NAME	ORGAN
S	DEAMINATION;	LIVER;
T	EXCRETION;	KIDNEY;

d) uses of amino acids

- used to release energy under extreme starvation
- form components of contractile tissue e.g. actin and myosin found in muscles
- form part of supportive tissues in the body e.g. cartilage, bone and connective tissue (collagen, keratin & elastin)
- formation of hormones e.g. insulin
- form transport proteins e.g. haemoglobin for oxygen transportation
- formation of antibodies
- formation of enzymes (any 2 x1) = 2mks

5 a) rate of transpiration (in a leafy shoot)

b) to adjust the position of the air bubble.

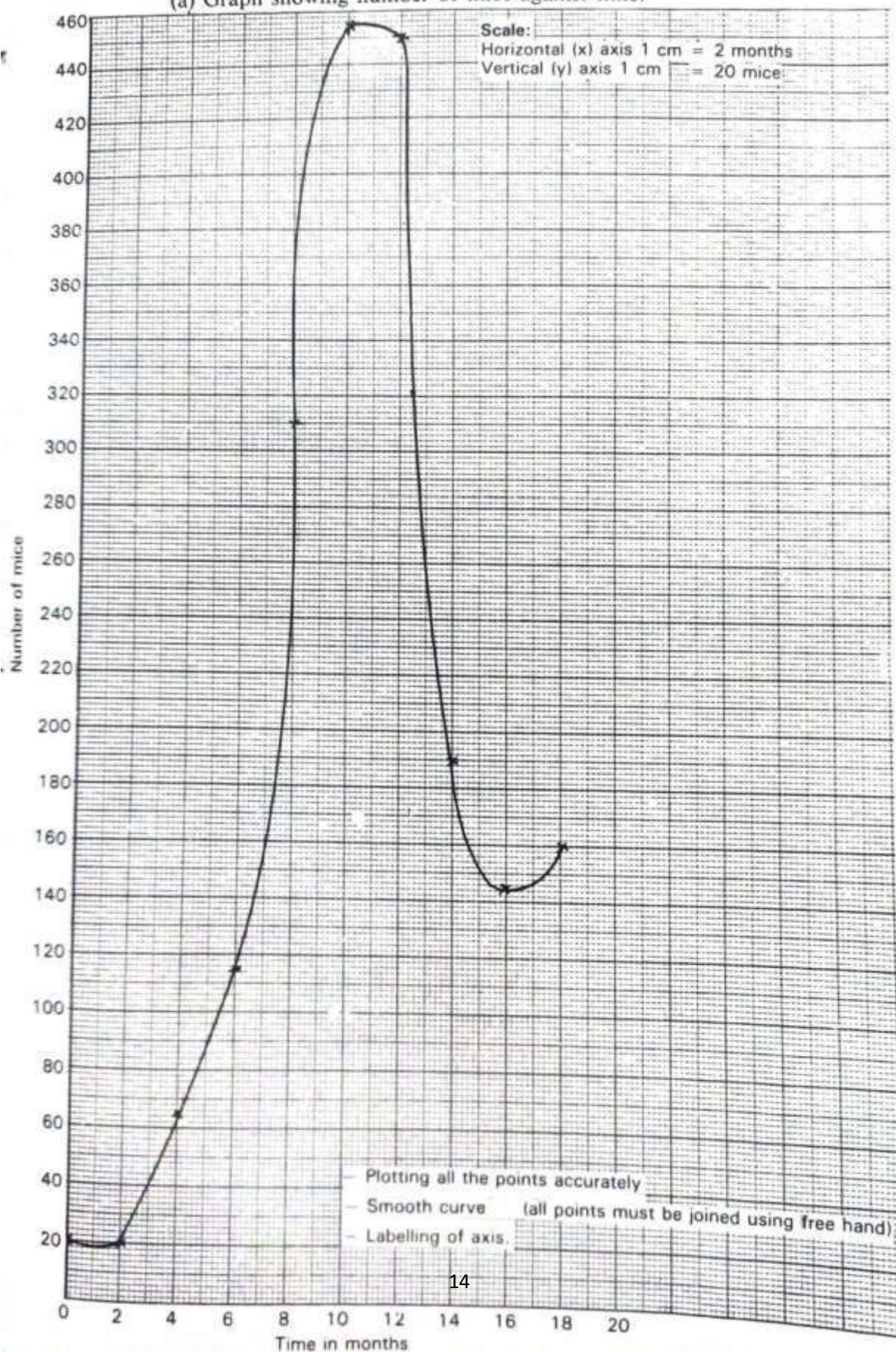
c) by pulling/lifting the capillary tubing out of the water for few seconds;

d) using a narrower capillary tube;

e) i) in bright light, (due to high light intensity) the rate of photosynthesis increases, opening the stomata hence increased rate of transpiration causing the air bubble to rise higher in the capillary tube;

ii) on the mountain- increase in altitude causes a decrease in atmospheric pressure which increases the rate of transpiration hence the air bubble will rise higher in the capillary tube;

(a) Graph showing number of mice against time.



Q6 b) i) 0-2 months- no change in population/mice are growing and maturing

ii) 2-10 months (1mk) the number of mice reproducing is high, hence the rise in the population is exponential as conditions like food and space are available and favourable;

10-12 months (1mk) the population has reached maximum i.e peak because/since food and space become limiting;

12-16 months (1mk) population is declining rapidly because of environmental stress as food and space become exhausted/ there are more deaths than births;

c)i) 12 and 14 months

ii) 12th month = 450 14th month = 190; $(450-190) = 260/2$; this means death occurred.

d) The population would rise and then fall.

e) Inadequate food supply; housing; transport(communication); low medical supplies; unemployment; high rate of crime; (any four correct 1 x 4mks) total 4 marks.

Q7a) mutations are sudden, spontaneous and permanent changes in an individual's genetic material; mutants are individuals who develop and exhibit unusual characteristics that were not previously present in the population due to mutations; mutagens are factors in the environment that cause the mutations to occur; (3mks)

b) causes of mutation

- radiation such as gamma rays and ultra violet rays;
- chemical substances such as mustard gas and other heavy metals (mercury, lead, asbestos);
- sudden extreme high or low temperatures;

c) Deletion; refers to the absence of a portion of a chromosome; it results from breakage and falling off of a portion of a chromosome; leading to loss of a group of genes that may have a disastrous effect on the development of an organism;

- Inversion; refers to reversal of normal sequence of genes in portion of a chromosome; occurs when a middle portion of a chromosome breaks, turns or rotates (inverts) through 180o and joins up again; this does not change the genetic constitution of the organism; but may bring into close proximity genes whose combined effects to an organism produce a beneficial effect to an organism; or cause disadvantages to the organism;
- Translocation; attachment of a portion of a chromosome to a non-homologous chromosome; occurs when a chromosome breaks and the portion joins another non-homologous chromosome; this may lead to serious consequences, even death depending on what genes are missing;

- Duplication; situation where a set of genes is represented twice in a chromosome; a part of a chromatid formed during cell division may replicate further to form an extra piece; which may attach onto the same or another chromatid; resulting to traits controlled by some genes being excessively expressed;
 - Non-disjunction; this is failure of a pair of homologous chromosomes to separate during the first stage of meiosis; resulting in one of the daughter cells formed after division of the cell having two of one kind of a chromosome; while the other cell has less or none; diseases or disorders known as syndromes are known to result from this aberration e.g. Down's Syndrome (Mongolism), Turner's Syndrome, Klinefelter's Syndrome; Polyploidy; this is the presence of more than two sets of chromosomes in a cell; occurs due to a failure of a cell to divide after the first stage of meiosis or after the chromosomes have replicated in mitosis; common in plants than animals; in plants, it causes some improvements such as resistance to drought, certain diseases and pests, improved yields and early maturity;
- TOTAL 20 mks MAX. 15 MKS)**

8. **Bread making;** yeast is used to ferment sugar in wheat flour into carbon (IV) oxide and energy; the carbon (IV) oxide is produced in form of bubbles that causes the dough to rise and become porous; **Beer making;** yeast is used to ferment sugars in malt/grapes/fruits; to form beer, wines and spirits; **Sewage treatment;** anaerobes break down raw sewage and harmful industrial effluents; to harmless products of water, energy/heat and carbon (IV) oxide; **Silage formation;** vegetation is fermented by bacteria to produce nutritious and good-scented/flavoured animal feed that increases production/yields; **Production of acids and strong liquors;** special bacteria and fungi ferment food products; to produce acids such as citric acid, oxalic acid and vinegar; the products are used as food preservatives and flavouring agents; **Manufacture of dairy products;** under controlled environments; anaerobes help in fermentation hence manufacture of milk products such as butter, cheese, ghee and yoghurt; **Production of fuels such as biogas; and gasohol;** cane sugar is fermented by yeast; to produce gasohol for running engines or operating machinery; **animal wastes such as guano and cow dung;** can be used to produce a mixture of methane and carbon (IV) oxide gas; by exposing it to fermentation agents; methane is used to run simple machines such as water pumps and for cooking; Production of **fermented porridge and milk;** maize or wheat flour and milk is exposed to microbes in the air which ferment it; to produce sour and sweet tasting porridge or milk; **production of compost** manure in agriculture microorganisms breakdown organic matter to release nutrients for crops; **pharmaceutical industry;** utilizes anaerobic respiration to produce drugs such as penicillin **Max. 20 mks**

Practical Activity 5

To investigate the rate of transpiration by a leafy shoot using a photometer

- (i) The procedure of the experiment has been described in the Students' Book. This is an opportune moment to introduce the students to the correct steps of performing an experiment. These are:
1. Aim/hypothesis.
 2. Requirements.
 3. Procedure.
 4. Data collection, recording and analysis.
 5. Conclusion.
- (ii) The school should make every effort to purchase a photometer, but in the event that the teacher does not have one in school, measuring the rate of transpiration can be done by:
1.
 - Weight measurement of a potted leafy plant that is well watered.
 - Take the weight of a plant at intervals within a specified period, for example, from 7 a.m. to 6 p.m. and record the data.
 - Alternatively fix the potted plant to a spring balance and take the weight readings at specified intervals.
- Note:** Ensure that the soil in the pot is well covered with a polythene paper to prevent water loss by evaporation from the soil as this will interfere with the expected results.
2. Use of improvised photometers. An example is shown in figure 1.5. In this set-up, the rubber tubing is used to adjust the position of the air bubble by squeezing. The diameter of the glass tube may limit the rate of bubble movement. Therefore, to increase the efficiency of the apparatus, select a glass tubing of narrow diameter otherwise the set-up is functional.

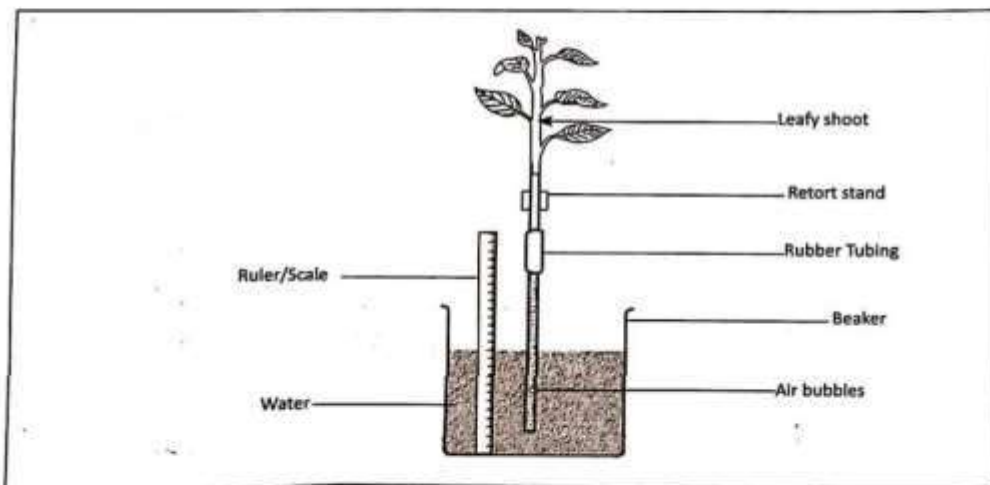


Fig. 1.5: An improvised photometer

