BIOLOGY SPIDER

Item 1

In Nyamitanga village, the civilians decided to use the government parish development model money to invest in crop production. They made a community crop farm where they rice and yams. The farm plot had two types of soil samples L and M

When the sunny weeks started, crops in some parts of the field dried up while in other parts they remained healthy. When the village agricultural officer was contacted he told them the drying or not drying of crops was caused by the amount of water in different soil types.

You are provided with samples from the field labeled as; specimens L and M

. You are to investigate the difference in the amount of water the above soil samples and help farmers make an informed decision.

Make a scientific report about your investigation.

Aim of the experiment: **An experiment to investigate the amount of water in sample L and M**

Hypothesis: **Soil sample M contains more water than soil sample L**

Variables in the experiment Independent variable

Dependent variable: **Amount of water collected**

Independent variable: **soil samples L and M**

Controlled variable

- **Volume of water used**
- **Volume of soil used**

Hypothesis: **Soil sample M contains more water than soil sample L**

List of apparatus, reagents, materials and solutions used

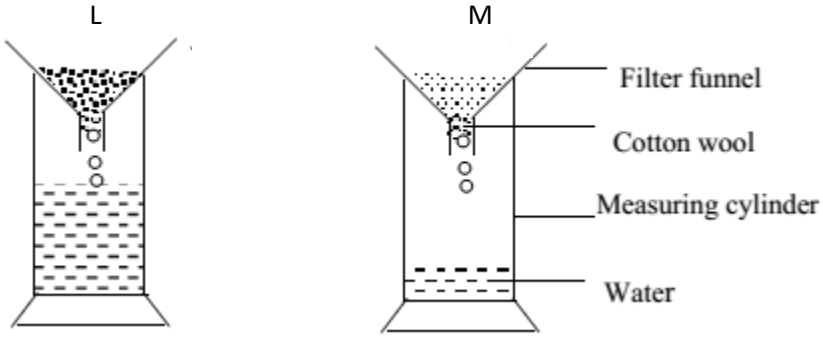
- Two measuring cylinders of 100ml
- Cotton wool
- Filter funnels
- Soil samples L and M
- Water

Procedure

a) $20cm^3$ of soil sample L is measured using a measuring cylinder
b) Cotton wool is then fixed inside the filter funnel and then placed on the neck of the measuring cylinder

c) The soil sample previously measured is poured inside the funnel
d) 100cm^3 of water is measured using a measuring cylinder and poured inside the funnel containing the soil sample
e) The set up was left to stand until no more water drips
f) Volume of water drained is read and recorded
g) Procedure (a) to (f) are repeated for soil sample M

Set up of apparatus



Risks and their mitigation – where necessary

Soil Sample	Volume of soil sample used (cm^3)	Volume of water added (cm^3)	Volume of water Collected
L	40	100	More (60)
M	40	100	Less (10)

Volume of water retained for sample L =100-60

= 40cm^3

Percentage of water retained = $\frac{volume\ of\ water\ retained}{volume\ of\ water}$ x 100

= $\frac{40}{100}$ x 100 =40%

Volume of water retained for sample M =100-10

= 90cm^3

Percentage of water retained = $\frac{volume\ of\ water\ retained}{volume\ of\ water}$ x 100

$$=\frac{90}{100} \times 100 = 90\%$$

Soil sample M contains/retains more water than soil sample L since its soil has small particles with little air spaces which enables it to retain water for some time

Recommendation

The farmers should plant their crops in soil sample M because rice and yams grow well in soils that can retain water for some time even during sunny conditions

Recomendations for sample L

- Addition of organic fertilizers
- Apply mulches to avoid evaporation of water
- Planting cover crops to avoid direct heating of the sun to the soil

Item 2

When planting in a garden, the soil's water holding capacity is crucial for the overall health and success of plants. Soil with high water holding capacity can retain moisture for a long period of time, reducing the frequency of irrigation. This is especially important in areas with limited water resources or during drought conditions. In this practical, you are going to investigate difference in water holding capacity of the two soil samples provided. These are labeled specimens L and M

Ask the laboratory attendant to provide you with the necessary apparatus for your investigation. Make a scientific report about your investigation

Item 3

Mr. Zimbe a farmer from Kasokoso would like to buy land to plant beans on a large scale for sale. A land broker Mr Mayanja has suggested to buy him two plots for him to make a better choice. His bean variety does not grow well in extremely water logged soils

You are provided with soil samples L and M which have been obtained from the two plots of land.

Task

Design and conduct a scientific investigation on the soil samples and suggest a suitable recommendation to Mr. Zimbe

Soil PH determination

Soil PH is the degree of acidity or alkalinity of a soil solution. It affects which plants can survive in in a certain area. In some areas, farmers plant crops without finding out the PH levels of the soils they are using. This greatly affects their produce. Human activities have been found out to alter this crucial property of soil. In this practical, you will investigate the differences in PH of two soil samples provided depending on the activities that occur there. Sample M (picked from a point in school where the refuse

(including ash) from kitchen fire place is dumped) and Sample L(picked from a leached area) and find out which soil sample is good for tea growing

. Make a scientific report about your work

Aim of the experiment : **An experiment to find out the PH of soil samples L and M** for tea growing

Hypothesis: **Soil sample L has acidic PH while soil sample M has alkaline PH**

Variables in the experiment Independent variable

Dependent variable : **changes in the litmus paper**

Independent variable : **Soil samples L and M**

Controlled variable

- **Volume of water used**
- **Volume of soil used**
- **Time taken**

List of apparatus, reagents, materials and solutions used

- Two measuring cylinders of 100ml
- Cotton wool
- Filter funnels
- Soil samples L and M
- Water
- Test tubes
- Litmus paper

Procedure

- $20cm^3$ of soil sample L is measured using a measuring cylinder
- Cotton wool is then fixed inside the filter funnel and then placed on the neck of the measuring cylinder
- The soil sample previously measured is poured inside the funnel
- $100cm^3$ of water is measured using a measuring cylinder and poured inside the funnel containing the soil sample
- The set up was left to stand until no more water drips
- Some drained water about $3cm^3$ was put in at test tube and a red and blue litmus paper inserted inside the test tube
- Changes on the litmus papers was observed
- Procedure (a) to (f) are repeated for soil sample M

Risks and their mitigation – where necessary

Risk

- Soil samples and water pouring in the question paper and working surface

Mitigation: Drying the working surface with a piece of cloth ,
Conducting the experiment far away from the question paper

Risk

- Dirtening of the question paper and the uniforms

Mitigation: Putting on gloves
Washing of hands after mixing the soil sample s
Putting on lab coats

Results

Soil Sample	Red litmus paper	Blue litmus paper	Deduction
L			
M			

Conclusion
The farmers should plant their tea in the position where soil sample …….. was obtained since tea grows well in acidic soils
Recommendation for sample (the sample that will be alkaline)

- Addition of acidic fertilizers
- Addition of organic manures

FOOD TEST

Aim of the experiment: **To investigate the nutrient composition of food sample N**

Hypothesis:

Food sample N does not contain all the food nutrients required for proper growth

Or

Some vital nutrients are lacking in diet / Diet contains only carbohydrates

Variables in the experiment Independent variable : N/A (not be told to the learners)

List of apparatus, reagents, materials and solutions used

- Iodine solution
- Food solution N
- Benedicts solution
- Dilute sodium hydroxide
- Dilute hydrochloric acid
- Test tubes
- Heat source

- Copper (II) sulphate solution

TEST	OBSERVATIONS	DEDUCTION
i) To 1 cm^3 of **N** in a test tube, add 3 drops of iodine solution	Colourless solution turns to a brown solution	Starch absent
(ii) To 1 cm^3 of N in a test tube, add 1 cm^3 of Benedict's solution and boil.	Colourless solution turned to a blue solution and on boiling remained a blue solution	Reducing sugars absent
(iii) To 1cm^3 of N, add 1cm^3 of dilute hydrochloric acid, boil and then cool. Add 1cm^3 of dilute sodium hydroxide solution followed by 1 cm^3 of **B**enedict's solution and boil for1 minute	The colourless solution turned to pale blue solution ,which on boiling turned to green solution to yellow precipitate, then to orange precipitate	Much Non reducing sugars present
To 1 cm^3 of N in a test tube, add 1 cm^3 of dilute sodium hydroxide solution followed by 4 drops of copper (II) sulphate solution	Colourless solution turned to a blue solution	Proteins absent

Conclusion

Recommendation (according to the scenario)

Item 100

Children of ABEK (Alternative Basic Education for Karamoja) Primary School in Nakapiripirit District, have a challenge of poor garbage disposal and management in their School. As a result of this, some insects are often seen flying onto students' food during break and lunch, and currently there is a serious outbreak of cholera in the School.

The specimens Labeled **A (tick), B (Soldier termite), and C(housefly)** collected by their Teacher has one main prime suspect associated with this cholera outbreak.

TASK:

a) As a biology student help the school administrators of Nakapiripirit ABEK Primary School to identify the specimen which is a prime suspect for the spread of Cholera and how the outbreak can be controlled.
   1 Specimen Identity: Specimen C

Classification

1. Kingdom: Animalia :
   Reasons:
   - Possession of Mouth for feeding
   - Possession of Limbs for locomotion
   - Possession of sensory organs like compound eyes and pair of antennae
2. Phylum: Arthropoda :
   Reasons:
   - Has jointed limbs/appendages
   - Has Exo skeleton Has segmented body
3. Class: Insecta:
   Reasons:
   - Possession of three pairs of legs/six legs
   - Possession of a pair of antennae
   - Possession of three main body parts
   - Possession of three thoracic segments(prothorax, mesothorax and metathorax)
4. Order: Diptera:
   Reasons:
   - ✓ Possession of a pair of bristle antennae
   - ✓ Possession of a pair of wings
   - ✓ Possession of compound eyes

Ecology and mode of life

Habitat: Terrestrial mainly in filthy places like toilets, dustbins, heaps of rotting organic matter, pit latrines.

Adaptations to the habitat

- ✓ Has a segmented body for increased flexibility during locomotion :
- ✓ Has a pair of hairy antennae for increased sensitivity:
- ✓ Has a pair of large oval-shaped compound eyes for a wide of field of view:
- ✓ Has a pair of hairy maxillary palps for tasting food.:

Habits:

1. **Feeding**: Feeds on liquid substances/food by means of sucking proboscis by action of pumping organ in the head.:

2. **Locomotion**: Locomotes by flight/flying using a pair of wings and walks using 3pairs of jointed limbs :

Diet: Fluids.:

Reason: Has spongy proboscis expanded at the tip for sucking fluids

Is a vector; This is because it transmits/spreads germs/pathogens:

Adaptations/Adaptability as a vector

- Has a hairy body for attachment of germs.
- Has a pair of wings for quick locomotion by flight to spread germs:
- Has expanded proboscis tip to increase surface area for absorption of germs into saliva :
- Pair of antennae for sensitivity
- Jointed legs for locomotion
- Proboscis for sucking fluids
- Large compound eyes for seeing
- Halters for balancing during flight.
- Hard exoskeleton for protection against physical injuries.
- Claws for moving on rough surfaces.

Symptoms and signs of diarrhea

- ✓ Frequent passage of watery stools: abdominal cramps/pam/discomfort, bloating/swelling of abdomen due to gas accumulation:
- ✓ Nausea and vomiting, thirst, dry mouth, dark yellow urine and reduced urine output; fever; fatigue; loss of appetite; weight loss; flatulence:

How the outbreak can be Controlled/Control measures/Recomendations

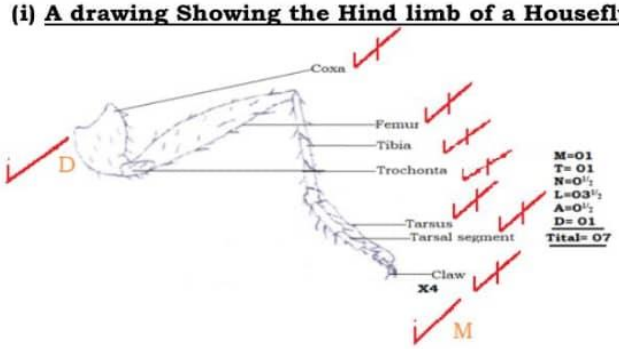
- Spraying the houseflies with insecticides;
- Covering holes of pit latrines/toilets to prevent houseflies from picking germs from the pit latrines/toilets.
- Covering all the food to prevent houseflies from walking on it.
- Boiling drinking water and milk to kill the germs.
- Food eaten in raw form like fruits should be washed first to remove the germs. ;
- Proper disposal of wastes so that houseflies do not reach them by covering them in dust bins.
- Washing hands with clean running water and soap after visiting the latrine and before eating food;

b) Draw the body part of the specimen with features responsible for the spread of cholera disease.

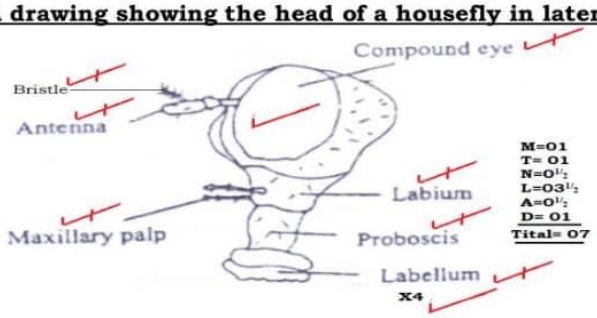
b) DRAWINGS OF PART RESPONSIBLE FOR THE SPREAD OF THE DISEASE

ACCEPT: any hairy body part drawn and labeled like the ones below

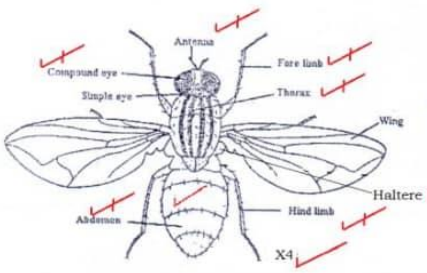
(i) A drawing Showing the Hind limb of a Housefly



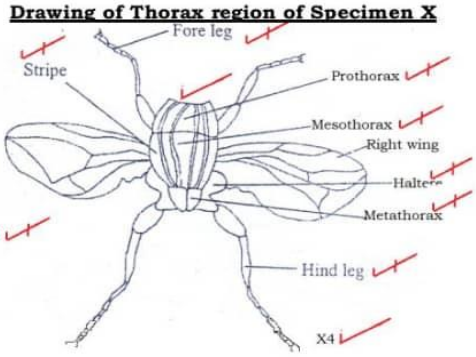
(ii) A drawing showing the head of a housefly in lateral view



(iii) A Drawing of Specimen X



Drawing of Thorax region of Specimen X



IDENTIFICATION OF THE SPECIMEN THAT DAMAGES CROPS FOR FARMERS

Specimen B

Reasons

- It has hard mandibles for cutting the crops
- Has three pairs of legs for walking/ locomotion and find the crops
- Has a pair of antennae for sensing the crops

Classification of specimen B

Phylum: Arthropoda :

Reasons:

- Has jointed limbs/appendages
- Has exo skeleton Has segmented body

5. Class: **Insecta:**

   Reasons:
   - Possession of three pairs of legs/six legs
   - Possession of a pair of antennae
   - Possession of three main body parts
   - Possession of three thoracic segments(prothorax, mesothorax and metathorax)

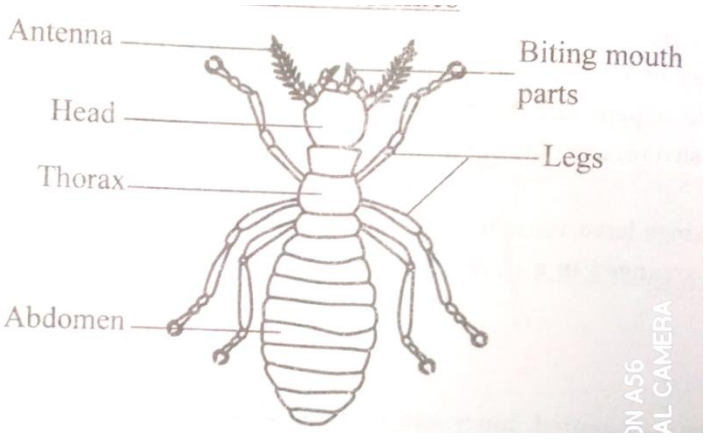
6. Order: **Isoptera**:

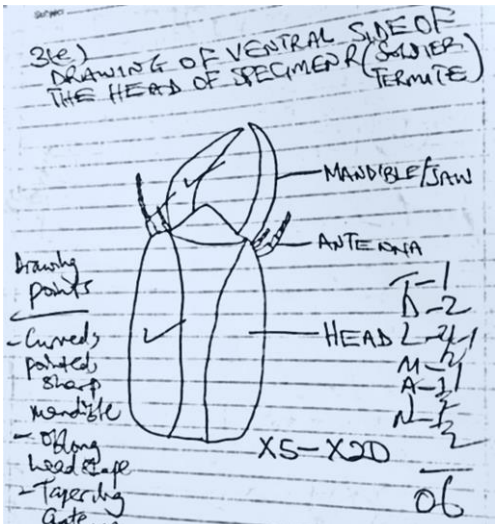
   Reasons:
   - ✓ Wingless
   - ✓ Sharp hard mandibles

Adaptation of specimen B to its role in the territory (Defence of the territory)

- Sharp/ hard/large mandibles for cutting predator s during protection/ defence ; ✓
- Big/ large head to support the mandibles during protection/ defence; ✓
- Jointed antennae for flexibility to sense danger / predator ; ✓
- Brightly coloured head to scare predator s ; ✓
- Red/ brown/ brightly coloured head to camouflage in preparation to attack predator; ✓
- Jointed legs for flexibility during locomotion or movement

A drawing showing the dorsal view of specimen B





Differences between specimen B and C

Specimen C	Specimen B
Hairy body	Not hairy body

Has large compounds	No compound eyes
One pair of membranous wings	No wings
Has Proboscis	Has sharp serrated mandibles

Differences between a specimen A and C

Specimen A	**Specimen C**
4 pairs of legs	3 pairs of legs
No antennae	A pair short antennae
No wings	One pair of membranous wings
Two body parts	Three body parts
Not hairy body	Hairy body

Identification of the specimen that lowers the yield of milk/the quality of meat/ quality of skin hides/increases farmers expenditure on cattle through buying acrides

Classification of specimen A

Phylum: Arthropoda :

Reasons:

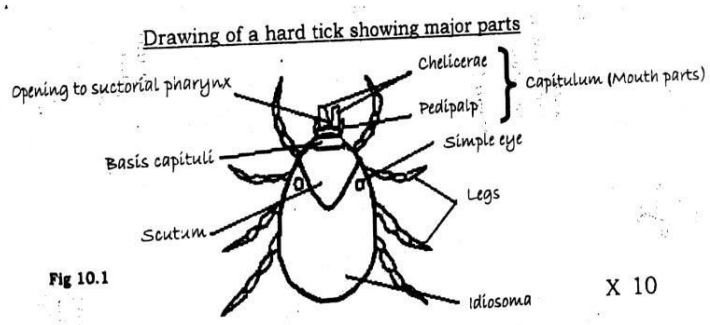
- Has jointed limbs/appendages
- Has exo skeleton
- Has segmented body

Class: **Arachnida:**

Reasons:

- Possession of four pairs of legs/ eight legs
- No antennae
- Possession of two main body parts

Order: **Acarina**:



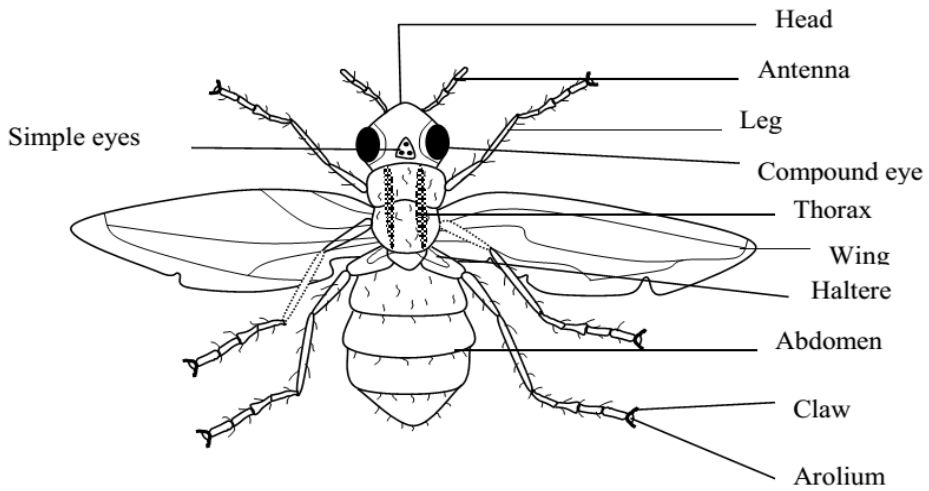
Adaptatation

- ✓ Has small flat body for easy hiding in host's hair
- ✓ ***Has 4 pairs of legs for movement host's hair.***
- ✓ ***Legs have claws for grip/attachment to the host***
- ✓ ***Has dull colour for camouflaging***
- ✓ ***Has a hard/tough cuticle to protect from***
- ✓ ***Has sharp pointed mouth parts for sucking blood.***
  Has eyes for seeing/searching the host.

Control measures

- ✓ Regular dipping and spraying with acaricides
- ✓ Fencing/ isolating of animals
- ✓ Spraying the animals with recommended acaricide
- ✓ Hand picking and killing of ticks.
- ✓ Dipping the animal using recommended acaricide.
- ✓ Controlled burning of pastures during dry season
- ✓ Double fencing with a clear area
- ✓ Hand dressing animals with py-grease/smear with tick jelly

A DRAWING SHOWING THE DORSAL VIEW OF SPECIMEN C



ALL THE BEST FROM

Tr . Joseph Mayanja