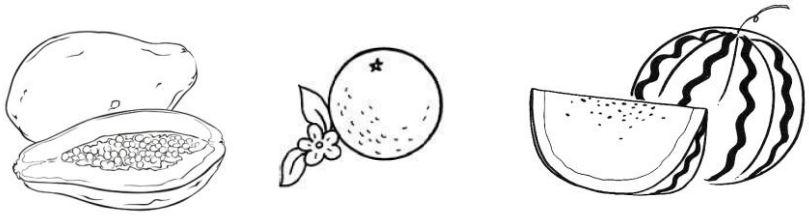
No.		Questions	Marks	Student notes
1.		Diagram 2 shows three types of fruits.  Papaya *[Betik]* Orange *[Oren]* Water melon *[Tembikai]* Diagram 2 Plan a laboratory experiment to investigate the percentage of vitamin C content in each fruit. DCPIP (dichlorophenolindophenol) 0.1% solution is used to test the presence of vitamin C in the fruit juices. You can use the common chemicals and science apparatus that can be found in the laboratory. The planning of your experiment must include the following aspects: • Problem statement • Hypothesis • Variables • Apparatus and materials • Procedures • How data is communicated [17 marks]		
		Problem statement: Able to state the problem statement of the experiment correctly that included criteria: • Manipulated variable • Responding variable • Relation in question form and question mark (?) ***<u>Sample Answer</u>*** ***1. What is the percentage / concentration of vitamin C in watermelon, orange and papaya?*** ***2. Which fruit juice has the highest percentage / concentration vitamin C?*** ***3. Does the percentage/concentration of vitamin C in watermelon, orange and papaya are same?*** ***4. Does orange juice contain higher percentage / concentration vitamin C than papaya and water melon?***		

		Hypothesis: Able to write a suitable hypothesis correctly base on the 3 criteria: • Manipulated variable • Responding variable • Relationship of the variables ***<u>Sample Answer</u>*** ***1. Orange juice has the highest percentage / concentration of vitamin C compare to other fruits.*** ***2. Watermelon has the lowest content of vitamin C than orange juice and papaya juice.***		
		Variables: Able to identify **all** the three variables correctly ***<u>Sample Answer</u>*** • ***Manipulated variable : type of fruit juice*** • ***Responding variable : percentage of vitamin C*** • ***Fixed variable : concentration of DCPIP / volume of DCPIP / concentration of ascorbic acid***		
		Material and Apparatus: Able to state material and apparatus: Compulsory to use in : MV, RV and FV ***Materials (M) : 1. <u>DCPIP solution</u>*** ***2. 0.1 % Ascorbic Acid*** ***3. <u>Fruit juices</u> / watermelon juice/orange juice/papaya juice*** ***Apparatus (A) : 1. Beakers*** ***2. Measuring cylinder*** ***3. Syringe <u>with needle</u>*** ***4. Specimen tube <u>with cap</u>***		
		Procedures: Able to write **five** procedures P1. P2, P3, P4 and P5 correctly. **P1 :** Steps to set up the apparatus (at least three P1) **P2 :** Steps to handle the fixed variable (one P2) **P3 :** Steps to handle the manipulated variable (one P3) **P4 :** Steps to record the responding variable (one P4) **P5 :** Precautionary steps / steps taken to get accurate results / readings (one P5)		
		1. Three specimen tubes are labeled as A1, A2 and A3.		
		2. Filled each specimen tubes with 1 ml of 0.1% DCPIP solution		

		3. Use a syringe to take 10 ml of 0.1 % ascorbic acid		
		4. Place the syringe needle into the DCPIP solution and release the ascorbic acid drop by drop into the DCPIP solution in A1		
		5. Observe the change of DCPIP colour and stop releasing the ascorbic acid when the DCPIP become colourless		
		6. Record the volume of ascorbic acid used to dicolourised the DCPIP using syringe.		
		7. Repeat step 3 – 6 for A2 and A3 and calculate the average volume.		
		8. Repeat the step 2 – 7 by using fruit juices to replace the 0.1 % ascorbic acid.		
		9. Do not shake the bottle to prevent from DCPIP is oxidized.		
		10. Record the volume of watermelon juice, papaya juice and orange juice that discolourised the DCPIP in the table and calculate the average volume		
		11. Calculate the percentage/concentration of vitamin C in each of the fruit juice using the formula below: Percentage of vitamin C in fruit juice = $\frac{\text{volume of 0.1\% ascorbic acid}}{\text{volume of fruit juice}} \times 0.1\ \%$ Concentration of vit. C in fruit juice = $\frac{\text{volume of 0.1\% ascorbic acid}}{\text{volume of fruit juice}} \times 1.0 \text{mgcm}^{-1}$		
		Results: Able to draw a complete table to record the relevant data base on the 3 criteria: • Type of juices • Juice volume (ml //cm^3) • Percentage of ascorbic acid in juices (%)		

Sample Answer

Type of juices	Volume of Juice to decolourise 1 ml DCPIP (cm^3)	Percentage of ascorbic acid injuices (%) // Concentration of vitamin C in juice (mg/cm^3)
0.1 % Ascorbic Acid		
Papaya juice		
Orange juice		
Watermelon juice		

No.		Questions	Marks	Student notes
2.		A group of students did a study on the function of enzymes as an organic catalyst that can regulate and increase the rate biochemical reactions in the cell. Enzymes are very sensitive to a change in temperature and functions efficiently at an optimum temperature. Design an experiment to study the effect of different temperatures on the activity of salivary amylase on starch. The planning of your experiment must include the following aspects: • Statement of identified problem • Hypothesis • Statement of variables • List of materials and apparatus • Experimental procedure • Presentation of data **[17 marks]**		
		Sample Answer: **Problem Statement:** ***What is the effect of different temperatures on the activity of salivary amylase on starch?*** **Variables:** ***Manipulated variables: Temperature.*** ***Responding variables: Rate of reaction.*** ***Controlled variable: pH /enzyme concentration/ substrate concentration.***		

Hypothesis:

The rate of reaction of salivary amylase on starch increases when the temperature increase until it reaches the optimum temperature.

Apparatus:

Test tube, a dropper, a stopwatch, beakers, a thermometer, a white tile, a Bunsen burner, a tripod stand, test-tube rack, a wire gauze.

Material:

1 % starch solution, salivary amylase solution, ice cubes, distilled water, iodine test solution.

Procedure:

1. ***Collect 5 ml of saliva and dilute it with 5 ml of distilled water and labeled test tube X.***
2. ***Put 1 ml saliva in each test tube labeled P, Q, R, S and T.***
3. ***Pour 5 ml of 1 % starch solution into each test tube labeled P, Q, R, S and T. .***
4. ***Immerse test tube P and X, in water bath where the temperature is fixed at 5℃ and leaves it for 10 minutes to maintain the temperature.***
5. ***Prepare a piece of white tile and drop iodine solution on it.***
6. ***After 5 minutes pour 2ml of saliva from test tube X to the starch solution in test tube P. Start the stop watch.***
7. ***Take out the mixture and drop into iodine solution on white tile.***
8. ***Repeat the iodine test for the mixture from test tube P at intervals of 1 minute using stopwatch.***
9. ***Record the time taken for the mixture from P to change in colour of iodine solution until it does not change.***
10. ***Repeat steps 4 to 8 for test tubes Q, R, S and T with water temperatures fixed at 28ºC, 37ºC, 45ºC and 60ºC respectively.***
11. ***The results are recorded in a table.***

Presentation of data:

Test tube	**P**	**Q**	**R**	**S**	**T**
Temperature(ºC)	**5**	**28**	**37**	**45**	**60**
Time taken for the iodine to change from yellowish brown to blue black (minute)					
Rate of reaction (1/minute)					

No.		Questions	Marks	Student notes
3.		Human needs energy to maintain the body temperature at 37ºC and to carry out daily activities. The energy is gain from oxidation of food in body cell respiration. Energy value is measured in Joule per gram unit. Base on the information; design a laboratory experiment to investigate the energy value in three types of food samples. Your experimental design should include: • Problem statement • Variables • Hypothesis • Material and apparatus • Procedures • Presentation of data [17 marks]		
		Problem statement: ***Which of the food samples contains higher energy value?***		
		Variables: ***Manipulated: type of foods*** ***Responding: energy value// final water temperature.*** ***Control : volume of water.***		
		Statement of hypothesis: ***Cashew nut has highest energy value compare to peanut and dried bread***		
		List of materials: ***Dried bread, peanut, cashew nut // any suitable foods, distilled water, plasticine.*** **List of apparatus:** ***Boiling tube, pin, matches, Bunsen burner, electronic balance, retort stand and thermometer.***		
		Experimental procedure: ***1. Weight bread, peanut and cashew nut by electronic balance and record.*** ***2. Fill in boiling tube with 20ml of distilled water and clamp to a retort stand.*** ***3. Record the initial temperature of distilled water***		

		4. Use pin to hold the food ***5. Burn the food and place it under the boiling tube*** ***6. Place the windshield to prevent heat lost to the surrounding*** ***7. Record the final temperature of distilled water by thermometer.*** ***8. Repeat the experiment by using different type of food// cashew nut, bread.*** ***9. All data is tabulated.***		
		Presentation of data: ***Type of food*** | ***Mass of food (g)*** | ***Initial temperature (^{0}C)*** | ***Final temperature (^{0}C)*** | ***Energy value (Joule/g)*** ***Bread*** | | | | | ***Peanut*** | | | | | ***Cashew nut*** | | | | |		

No.		**Questions**	**Marks**	**Student notes**
4.		**The activity of microorganisms is affected by abiotic component in habitat.** Based on the above statement, plan an experiment to study the effect of light intensity on the activity of yeast. The planning of your experiment must include the following aspect: • Problem statement • Hypothesis • Variables • List of apparatus and material • Experimental procedure or method • Presentation of data **[17 marks]**		
		Sample Answer: **Problem statement:** ***Does the light intensity affect the activity of yeast?*** ***What is the effect of light intensity on the activity of yeast?*** **Hypothesis:** ***The higher the light intensity, the lower the activity of yeast.***		

Variables:

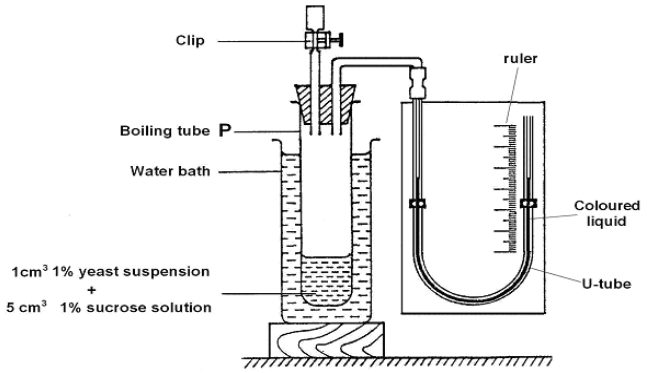
1. ***Manipulated : light intensity***
2. ***Responding : Height of coloured liquid in manometer***
3. ***Constant : Volume of yeast suspension/ temperature.***

Apparatus and material:

****Yeast suspension, glucose solution, distilled water // coloured liquid (manometer)***

Boiling tube, test tube, glass tube, clip, retort stand, rubber stopper, (manometer tube), *lamp , rubber tubing.

Procedure:



1. ***Set-up an apparatus as shown in the diagram.***
2. ***The boiling tube is filled with 1 ml yeast suspension and 5 ml glucose solution.***
3. ***The boiling tube is allowed to stand in water bath at room temperature.***
4. ***A light source is set up. Place the apparatus 50 cm from the light source.***
5. ***After 10 minutes, observe the height of coloured liquid in manometer.***
6. ***Record the height of coloured liquid in table provided.***
7. ***Repeat an experiment with different distance that are 40, 30cm, 20 cm and 10 cm.***
8. ***Make sure that all the connection of apparatus is tied tightly.***

Data:

Distance from light sources (cm)	*Height of coloured liquid (cm)*
10	
20	
30	
40	
50	

No.		Questions	Marks	Student notes
5.		During vigorous exercise such as running, more sweat but less urine is produced by an individual. Design an experiment to study the effect of time of vigorous exercise on the volume of urine produce by a group of students. They are given the same amount of water to drink before the exercise. Your plan must include the following aspects: • Problem statement • Statement of hypothesis • Variables • List Material and Apparatus • Experimental Procedure • How data communicated **[17 marks]**		
		Problem statement: ***Does time of vigorous exercise affect the volume of urine produce?***		
		Variables: ***Manipulated: Time of vigorous exercise.*** ***Responding: Volume of urine produced.*** ***Control : volume of drinking water***		
		Statement of hypothesis: ***The volume of urine produce decreases when the time of vigorous exercise increases.***		
		List of materials: ***(5) students, drinking water*** **List of apparatus:** ***Stopwatch, measuring cylinder, beaker, cup.***		

Experimental procedure:

1. ***5 boys at same age, gender and same body weight are selected.***
2. ***They are asking to empty their bladder before the experiment.***
3. ***They are given 1 litre of drinking water to drink.***
4. ***Each of the boy is asked to do exercise as follow:***

   Boy A – no exercise is done
   Boy B – run on the spot for 5 minutes
   Boy C – run on the spot for 10 minutes
   Boy D – run on the spot for 15 minutes
   Boy E – run on the spot for 20 minutes

5. ***After the exercise they were asked to rest for a while, and then the urine produce are collected, measured and record by using measuring cylinder.***
6. ***The data collected are recorded in a table.***

Presentation of data:

Data is presented in a table with the right units for

- ***Time of exercise***
- ***Volume of urine produced***

Time of exercise (minutes)	Volume of urine produced (ml)
0	
5	
10	
15	
20	

No.		Questions	Marks	Student notes
6.		The rate of photosynthesis is influenced by different environment factors. Base on the above situation; plan a laboratory experiment to determine the effect of light intensity on the rate of photosynthesis. The planning of your experiment must include the following aspects: • Statement of identified problem • Variables • Statement of hypothesis • List of materials and apparatus • Experimental procedure • Presentation of data **[17 marks]**		

		Problem statement: ***1. Does light intensity affect the rate of photosynthesis?*** ***2. What is the effect of different light intensity on the rate of photosynthesis?***		
		Variables: ***Manipulated: light intensity/distance of Hydrilla sp. to sources of light.*** ***Responding: Number of gas bubbles that are release in 1 minute/ rate of photosynthesis.*** ***Control : Concentration of carbon dioxide/temperature of water.***		
		Statement of hypothesis: ***The rate of photosynthesis increase when the light intensity is increase.***		
		List of materials: ***Hydrilla plant, 0.3 % sodium hydrogen bicarbonate, plasticine,*** ***List of apparatus:*** ***60 W electric bulb, 500 ml beaker, a glass funnel, test tube, stop watch, razor blade, thermometer, meter ruler***		
		Experimental procedure: ***1. The apparatus setup as diagram above.*** ***2. The temperature of water in beaker is maintained at 28^{o}C.*** ***3. A few strands of Hydrilla sp. is chosen and the stem end is cut obliquely with a sharp razor blade under water to avoid bubbles in the xylem.*** ***4. The strands of Hydrilla sp. S is placed inside a glass filter funnel.*** ***5. The funnel is placed upside down in a 500 ml beaker.*** ***6. The beaker is filled with 400 ml of 0.3 % sodium bicarbonate.*** ***7. The beaker is placed at a distance of 50 cm from the 60 W bulb as a light source.*** ***8. The number of gas bubbles released in one minute are counted and recorded in a table. This step is repeated twice.*** ***9. Step 7 is repeated by placing the apparatus at distance 40 cm, 30 cm, 20 cm and 10 cm from the light sources.*** ***10. The results are recorded in a table.*** ***11. The graph of the rate of photosynthesis against the light source is plotted.***		
		Presentation of data: ***Data is presented in a table with the right units for*** - ***Distance of light sources.*** - ***Number of gas bubbles.*** - ***The rate of photosynthesis (number of bubbles/time)***		

Distance of light source (cm)	*Number of gas bubbles*	*The rate of photosynthesis (number of bubbles/time)*
50		
40		
30		
20		
10		

No.		Questions	Marks	Student notes
7.		Rats can be found in urban and rural area. The population size of rats in these places is different. Based on the above statement, plan experiment to estimate the number of rats in urban and rural area. The planning of your experiment must include the following aspects: • Problem statement • Hypothesis • Variables • List of apparatus and material • Experimental procedure or method • Presentation of data **[17 marks]**		
		Sample Answer: **Problem statement:** ***What is the population size of rats in urban and rural area?*** **Hypothesis:** ***The population size of rat in urban area is higher than in rural area.*** **Variables**: ***Manipulated: area*** ***Responding: size of population*** ***Fix: type of organism*** **Apparatus & material:** ***Rat, cage trap , paint***		

Procedure:

1. ***Habitat of rat in urban area is selected. The area is fixed as a research area.***
2. ***Place 10 cage traps at strategic area.***
3. ***A number of rats are caught (assume as X number).***
4. ***The backs of rats are marked with white paint.***
5. ***Make sure that the marked is small / permanent.***
6. ***Release all the rats in 1st capture to their habitat / original place.***
7. ***After 3-7 days, a second capture is carried out at random in the same habitat to the 1st capture.***
   (A second capture is assumed as Y number).
8. ***The number that is marked is counted (assume as Z number)***
9. ***The size of population is calculated by using the formula below:***

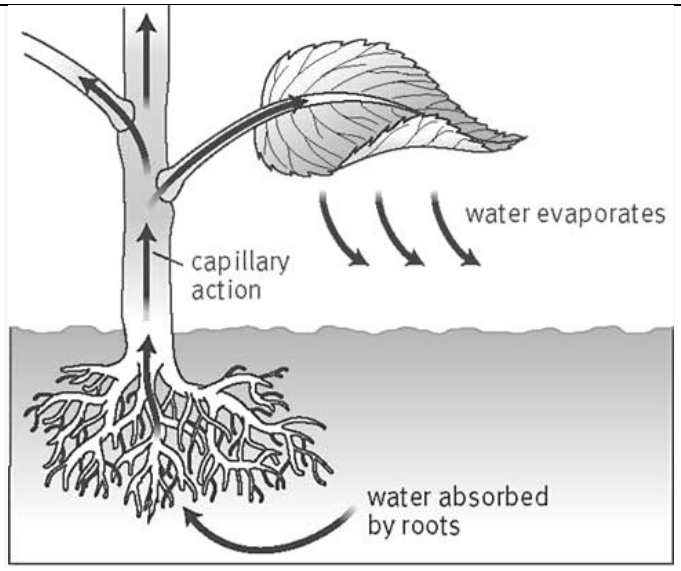
$$\frac{\text{Number of 1st capture} \times \text{Number of 2nd capture}}{\text{Number of marked in second capture}}$$

10. ***The experiment is repeated in rural area.***

Data:

Area	***Urban***	***Rural***
Number of rats in 1st capture		
Number of rat in 2nd capture		
Number of marked rat in the second capture		

No.		Questions	Marks	Student notes
8.		Transpiration is the lost of water vapour from plants, especially from the leaves. Transpiration occurs 90 % through the stomata. The amount of water lost depends on its size, surrounding light intensity, temperature, humidity and air movement.		



Base on the information; design an experiment to be conducted in the laboratory to investigate the effect of number of leaves on the rate of transpiration in hibiscus plant.

The planning of your experiment must include the following aspects:

- Problem statement
- Hypothesis
- Variables
- Apparatus and materials
- Procedures
- How data is communicated

[17 marks]

Problem Statement:

1. ***What is the relationship between the number of leaves and the rate of transpiration in hibiscus plant?***

Hypothesis:

1. ***As the number of leaves increase the rate of transpiration is increase.***
2. ***The higher the number of leaves the higher the rate of transpiration***

Variables:

- ***Manipulated variable : number of leaves***
- ***Responding variable : distance travelled by air bubble // the rate of transpiration***
- ***Fixed variable : hibiscus / type of plant // light intensity // surrounding temperature***

		Material and Apparatus: ***Materials : 1. <u>Hibiscus shoot/plant</u>*** ***(M) 2. <u>Water</u>*** ***3. Vaseline*** ***Apparatus : 1. <u>Ruler</u>*** ***(A) 2. <u>Capillary tube + rubber tubing // potometer</u>*** ***3. <u>Stopwatch</u>*** ***4. Beakers*** ***5. Basin*** ***6. Sharp knife / cutter*** ***7. String / marker*** ***8. Tissue paper***		
		Procedure: **1.** ***Obtain a hibiscus shoot and immediately immerse in the water*** **2.** ***By using the sharp knife, cut 4 cm of the hibiscus stem under water.*** **3.** ***Fill in the capillary tube with attached rubber tubing / photometer with water.*** **4.** ***Fix the stem of the hibiscus shoot into the rubber tubing / photometer.*** **5.** ***Make sure no air bubble trapped.*** **6.** ***Immerse the capillary tube / photometer in a beaker of water.*** **7.** ***Count the number of leaves to 5 leaves.*** ***Wipe dry the leaves with tissue paper.*** **8.** ***Leave the setup for 5 minutes for the plant to adapt with the environment*** **9.** ***Lift the capillary tube from the water to trap a column of air bubble // trap an air bubble in the capillary tube.*** **10.** ***Tie a string on the capillary tube to mark the initial position of the air bubble.*** **11.** ***Start the stopwatch*** **12.** ***After 5 minute tie another string to mark final position of the air bubble.*** **13.** ***Repeat step 12 to get another reading.*** **14.** ***Measure both distances by using a ruler.*** ***Calculate the average distance travelled by the air bubble in 5 minute.*** ***Record in a table.*** **15.** ***By using the same plant, Repeat steps 7 to 13 by removing 1-2 leave each time.*** **16.** ***Calculate the rate of transpiration:*** Rate of transpiration = <u>distance traveledl by air bubble</u> (cm) Time taken (minutes)		

Data:

Number of leaves	*Distance travelled by air bubble in 5 minutes (cm)*			*Rate of transpiration (cm minutes^{-1})*
	1	*2*	*Average*	
5				
3				
1				

No.		Questions	Marks	Student notes
9.		Competition is an interaction between organisms which live together in a habitat and compete for the same resources that are in limited supply. The competition between individuals of the same species is called an intraspecific competition. A farmer doesn't realized his mango trees do not produced high quantity of mangoes because the mango trees are planted too close to each other. Based on the above information and situation, design a laboratory experiment to show to the farmer on how the distance between the plants can affects the growth rate of a named plant. The planning of your experiment must include the following aspects: • Problem statement • Hypothesis • Variables • List of apparatus and materials • Experimental procedures • Presentation of data [17 markah]		
		Problem statement: ***What is / Does the distance of seedlings affects the growth rate of maize plants?***		

Hypothesis:

1. The longer/shorter the distance of seedlings, the higher/lower the growth rate of plants
2. The longer/shorter the distance of seedlings, the higher/lower the heights of seedlings
3. The longer / shorter the distance of seedlings the heavier / lighter the mass of seedlings
4. The longer /shorter the distance of seedlings, the more / lesser number of leaves.

Variables:

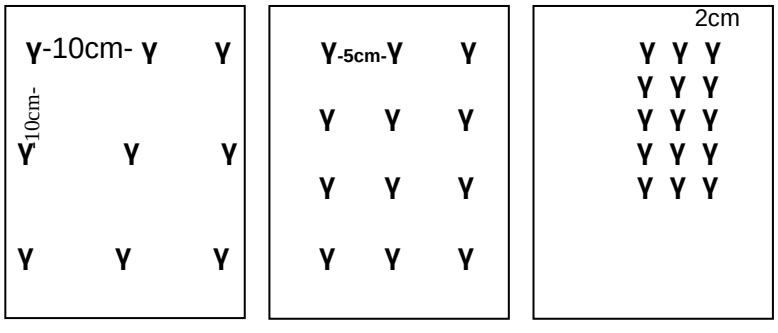
P1- manipulated variable: Distance of seedlings
P2-responding variable:
The growth rate of plants (maize /paddy / any suitable plants) / the height of seedlings / mass of seedlings/ numbers of leaves
P3-fix variable:
Type of seedlings / types of soil/ amount of water/ light intensity / time taken

Procedures:

1- Three planting trays are prepared and filled with 3 kg of garden soil in each tray.

2- The trays are labeled as A, B and C with waterproof paint .

3- 30 numbers of maize seeds are planted in tray A at a distance of 10 cm intervals, 30 numbers of maize seeds in tray B at a distance of 5 cm intervals and 30 numbers of maize seeds in tray C at a distance of 2 cm intervals as shown below (not in correct scale).



4- Each tray is watered daily with the same amount of water for 10 days
5- After 10 days, 10 maize seedlings are picked randomly from tray A and the root of seedlings

are washed under running water

6- The height of maize seedlings are then measured by using metre rule. The average height are calculated by using formula = $\frac{\text{the total height of seedlings/cm}}{10}$

The growth rate is calculated by using formula = $\frac{\text{the average height of seedlings/cm}}{\text{time taken / day}}$

7- Step 5-6 are repeated for seedlings from tray B and C. The average height and the growth rate of seedlings in tray B and C are measured and calculated separately.

8- The result are recorded in a table.

Material and Apparatus:

MATERIALS (M):

Maize seeds/ Paddy seeds /any suitable seeds
Water
Garden soil

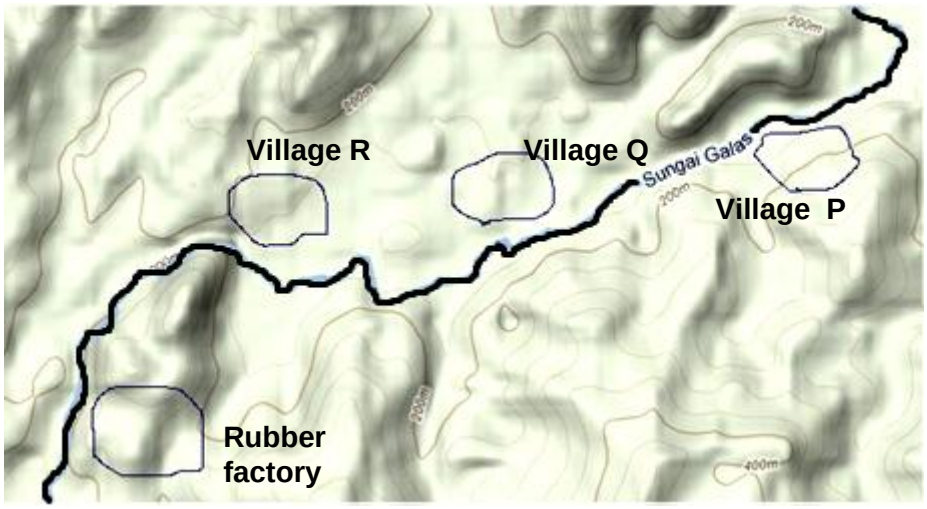
APPARATUS (A):

Metre rule
Tray / Basin / Container
Waterproof paint /marker pen
Spade
*** Beam / electronic / compression balance } mass of seedlings**
*** Oven**

Data:

The distance of seedlings/ cm(Tray)	The height of seedlings / cm										Average heights of seedlings/ cm	The growth rate of plants cm/day
	1	2	3	4	5	6	7	8	9	10		
10(A)												
5(B)												
2(C)												

No.		Questions	Marks	Student notes
10.		Villages P, Q and R are situated along the Galas River as in Diagram 10.1. The village folks depend heavily on the river to earn a living. The river provides them with transport, water for cooking, drinking, washing, etc. They also catch fish from the river. Lately the three villages' folks are complaining about the lower catch		

		from the river. They attribute this problem to a rubber factory built two years ago at the upstream of the river. Village P, Q and R are 10km, 20km and 30km away from the rubber factory respectively.  Diagram 10.1 As an Environment Department officer, you are sent to the site to make a thorough investigation into the matter. Your task is to investigate the effect of the distance of the rubber factory and the villages on the levels of water pollution. Your investigation must include the following aspect: o Problem statement o Hypothesis o Variables o List of apparatus and materials o Experimental procedure or method o Presentation of data [17 marks]		
		Problem Statement: ***1. What is the effect of (different) distance between the rubber factory and the village on the level of water pollution?*** 2. ***Does the (different) distance between the rubber factory and the village affect the level of water pollution?***		
		Hypothesis: ***The longer /further the distance between the rubber factory and the villages (P1), the lower the level of (river) water pollution. (vice versa)***		
		Variables: ***Manipulated : The distance between the rubber factory and the***		

villages.

Responding : The level of water pollution // The time taken for the methylene blue solution to be decolourised.

Fixed: **volume of water**

Material and Apparatus:

Materials:

Water samples, methylene blue solution.

Apparatus:

Reagent bottle, stop-watch, syringe, cupboard

Procedure:

One water sample is taken from the river near the villages P, Q and R using dark bottles.

2. ***Using a measuring cylinder, 100ml of water sample from village P is transferred into the reagent bottle P.***
3. ***Using a syringe, 1ml of 1% methylene blue solution is slowly injected, drop by drop into the water sample P.***
4. ***The tip of the syringe is used to stir the solution slowly.***
5. ***The bottle is capped and placed in a cupboard.***
6. ***Do not shake the reagent bottle.***
7. ***The stop watch / clock is started.***
8. ***The time taken for the methylene blue to decolourised is taken (using stopwatch) and recorded down.***
9. ***Steps 3 to 11 are repeated, replacing the water sample from village P with that of villages Q and R.***

Data:

Water sample	Time taken for methylene blue solution to turn colourless /decolourise (min)	The level of water pollution
P		
Q		
R		