Agricultural Science
Leaving Certificate

Experiments

Name:_____

Exam Number:_____

List of experiments to completed with the aid of this booklet:

Writing up a laboratory experiment:

You must include the following headings for each write up, marks are awarded for clear step by step instructions and descriptions.

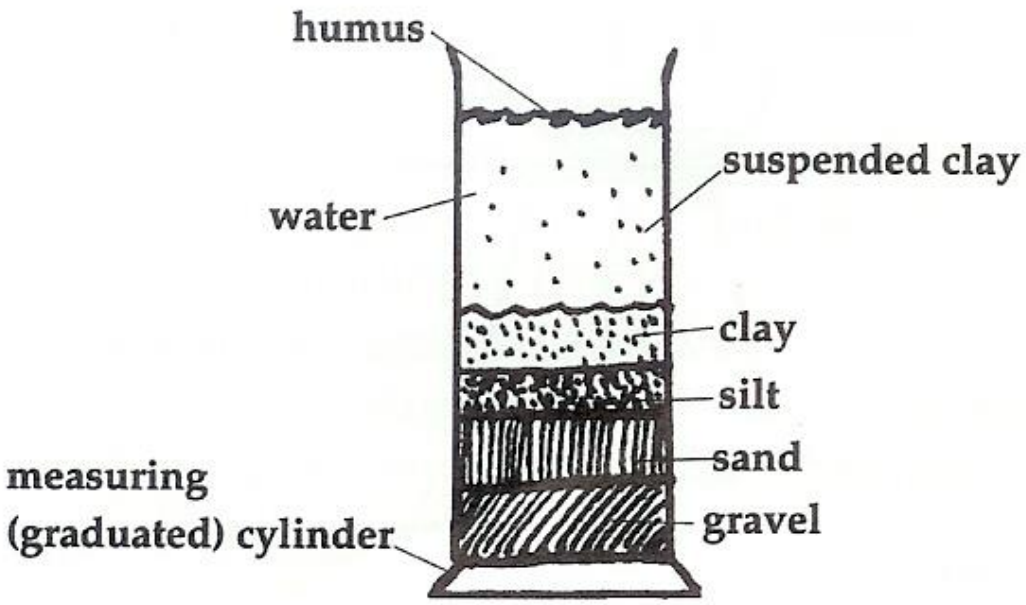
1. Title/Aim
2. Apparatus
3. Chemicals
4. Method
5. Results
6. Conclusion
7. Diagram

Soil Science

10 Marks

Experiment 1 – To Determine Soil Texture by Sedimentation

Apparatus: Sample of soil; 250ml Graduated cylinder; Water; Stopper.



Method

1. Collect a sample of soil.
2. Place 50cm^3 of the soil into the graduated cylinder.
3. ¾ fill the cylinder with water, stopper the cylinder and shake well.
4. Allow the soil to settle (sediment) overnight.
5. Examine and measure the volume of sand, silt, clay and humus.
6. Calculate the % of each in the soil sample.

Experiment 1 – To Determine Soil Texture by Sedimentation

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Apparatus Diagram:

Procedure / Method:

……

……

……

……

Results

Vol of Sand = _____	% Sand = _____
Vol of Silt = _____	% Silt = _____
Vol of Clay = _____	% Clay = _____

Conclusion:

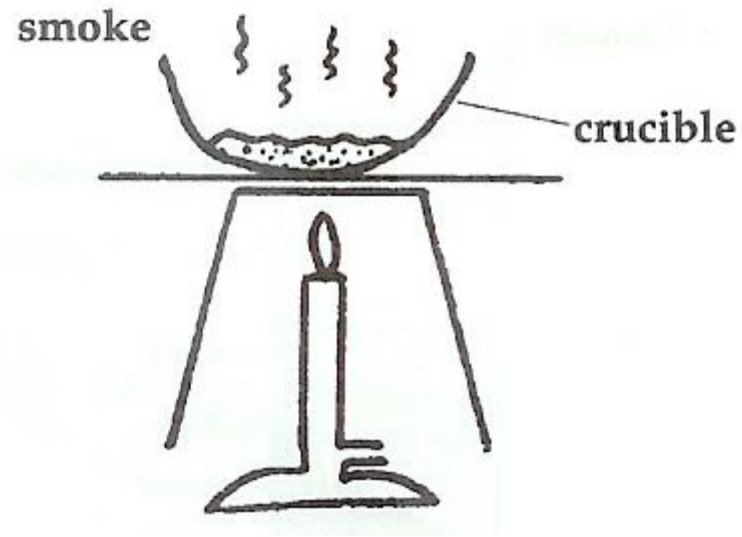
……

……

……

Experiment 2 – To Determine the % Humus (Organic Matter) in Soil

Apparatus: Sample of dry soil; Evaporating basin; Electronic balance; Bunsen burner; Tripod stand; Tongs; Wire gauze.



Method:

1. Obtain a sample of dry soil (place soil in an oven at 100^{O} C for 48 hours)
2. Weigh an empty evaporating basin.
3. Place the sample of soil into the evaporating basin and re-weigh.
4. Calculate the weight of the dry soil.
5. Place the evaporating basin on a wire gauze on a tripod over a bunsen flame.
6. Heat the sample of soil strongly.
7. Note the smoke and smell.
8. After five minutes, cool the sample and reweigh.
9. Continue heating in 5 minute intervals and re-weighing to a constant weight.
10. Calculate the % humus in the soil.

Experiment 2 – To Determine the % Humus (Organic Matter) in Soil

Date: ……

Materials / Apparatus:

……

……

……

……

……

……

……

……

Procedure / Method:

Apparatus Diagram:

……

……

……

……

……

……

Calculations / Results:

Percentage Organic Matter: $\frac{Loss\ in\ Weight}{Weight\ of\ Sample} x\ 100$ = $\frac{\text{.....}}{\text{.....}} x\ 100$ = ... %

Percentage Inorganic Matter: $\frac{Weight\ Remaining}{Weight\ of\ Sample}\ x\ 100$ = $\frac{\text{.....}}{\text{.....}} x\ 100$ = ... %

Conclusion:

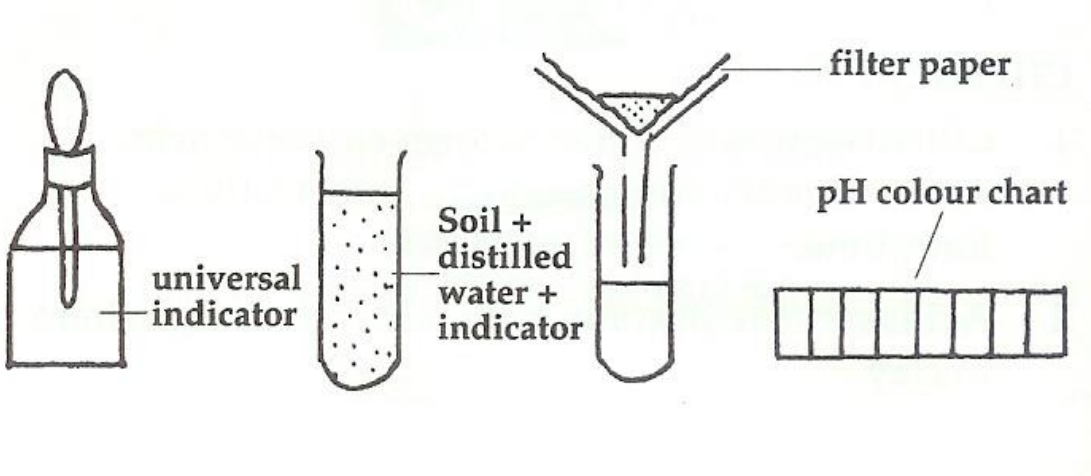
……

……

……

Experiment 3 – To Measure the pH of Soil

Apparatus: Test tube; Test tube rack; Deionised water; Funnel; Filter paper; Beaker; Glass rod; Universal Indicator



Method:

1. Obtain a sample of soil.
2. In a beaker, mix some of the soil with deionised water and stir well.
3. Filter the soil solution into a test tube through filter paper.
4. Add 2-3 drops of Universal Indicator to the filtrate.
5. Compare the colour of the solution with the colour chart to determine the pH of the soil.

Experiment 3 – To Measure the pH of Soil

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Apparatus Diagram:

Procedure / Method:

……

……

……

……

……

……

……

Observations / Results:

……

……

……

Conclusion:

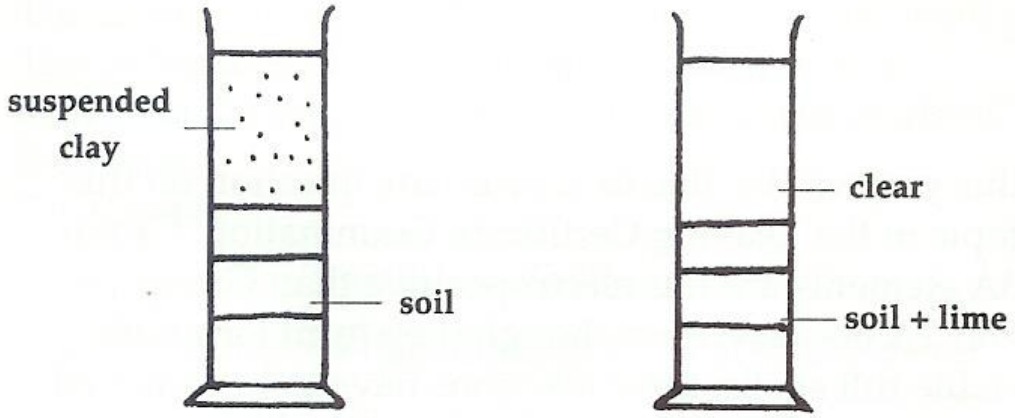
……

……

……

Experiment 4 – To Show Flocculation in Soil

Apparatus: Graduated Cylinders; Soil Sample + Calcium Carbonate (Lime)



Method:

1. Label 2 test tubes A and B.
2. Place 10cm^3 of soil into the 2 test tubes.
3. Place 2cm^3 of lime into tube A.
4. ¾ fill each test tube with water.
5. Cover the tubes and shake for 1 minute.
6. Observe both tubes for 3-5 minutes.
7. Note what happens in each tube.

Experiment 4 – To Show Flocculation in Soil

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Procedure / Method:

Apparatus Diagram:

……

……

……

……

……

……

……

Observations / Results:

……

……

……

Conclusion:

……

……

……

Experiment 5 – To Show The Activity of Earthworms in the Soil

Apparatus: Wormery, Earthworms, Gravel, Sand, Clay, Chalk, Organic Matter (leaves)

Method:

1. Set up wormery by placing material such as sand, clay, and chalk in different layers.
2. Add worms and organic matter (leaves). Cover with a light proof material and leave in a cool dark place. Do not disturb it.
3. Moisten the wormery every few days with a little water.
4. Leave for 7 – 10 days and observe the changes
5. In the control, set up the same apparatus as above but do not add the earthworms.

Experiment 5 – To Show The Activity of Earthworms in the Soil

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Apparatus Diagram:

Procedure / Method:

……

……

……

……

……

……

……

Observations / Results:

……

……

……

Conclusion:

……

……

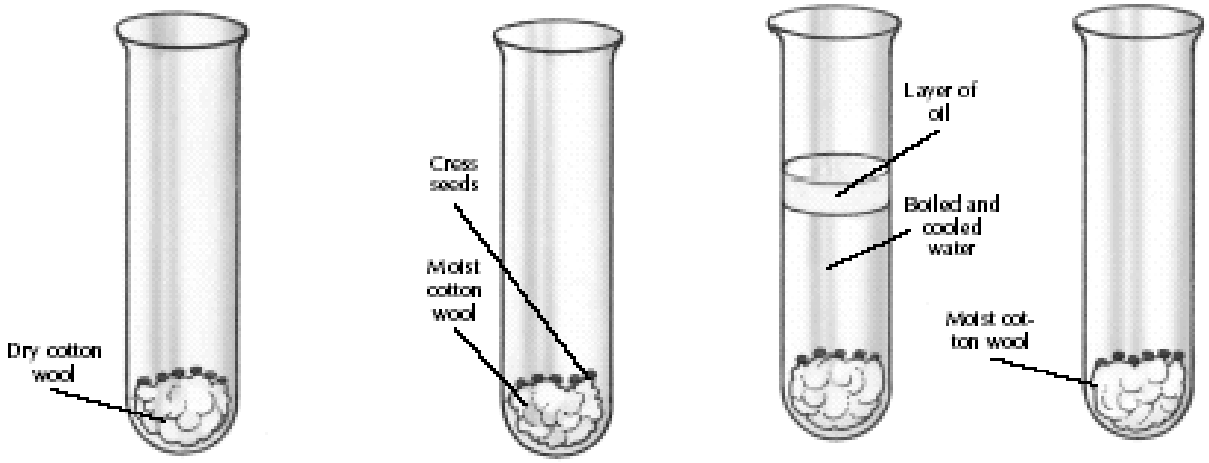
……

Plant Physiology

10 Marks

Experiment 6 – To Investigate the Factors Necessary for Germination

Apparatus: 4 Test tubes; Cotton wool; Cress seeds; Water; Test tube rack; Cool boiled water; Oil; Refrigerator



Method:

1. Place cotton wool in each of four test tubes and label A, B, C and D.

2. Place 10-12 seeds on top of the cotton wool in each of the test tubes.

3. Set up each of the test tubes as follows:

A Leave the cotton wool dry (*without water*)

B Moisten the cotton wool and place the test tube in the refrigerator (*without the correct temperature*)

C Cover the seeds and cotton wool with a layer of cool boiled water. Pour a thin layer of oil over the water (*without oxygen*)

D Moisten the cotton wool (*water + oxygen + correct temperature*)

4. Place test tubes A, C and D in a warm room and leave for 3 – 4 days.

5. Record which seeds germinated.

Experiment 6 – To Investigate the Factors Necessary for Germination

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Apparatus Diagram:

Procedure / Method:

……

……

……

……

……

……

……

Results:

Test Tube	Germination
A (without water)	
B (without correct temperature)	
C (without oxygen)	
D (control)	

Conclusion:

……

……

……

Experiment 7 – To show that Light is Necessary for Photosynthesis

Apparatus: Potted plant; Tin foil; Lamp; Leaf; Boiling water bath; Beaker; Warm water bath; Warm Alcohol; White tile; Iodine; Dropper; Forceps

Method:

1. Place a potted plant in the dark for 48 hours to de-starch it.
2. Cover some of the leaves with a layer of tinfoil.
3. Place the plant close to the lamp and switch the lamp on.
4. Leave the plant to photosynthesise for up to 6 hours.
5. Remove some of the leaves from the plant and test the leaves for starch.
6. Draw a diagram of the leaves showing the areas containing starch.

Experiment 7 – To show that Light is Necessary for Photosynthesis

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Apparatus Diagram:

Procedure / Method:

……

……

……

……

……

……

……

Observations / Results:

……

……

……

Conclusion:

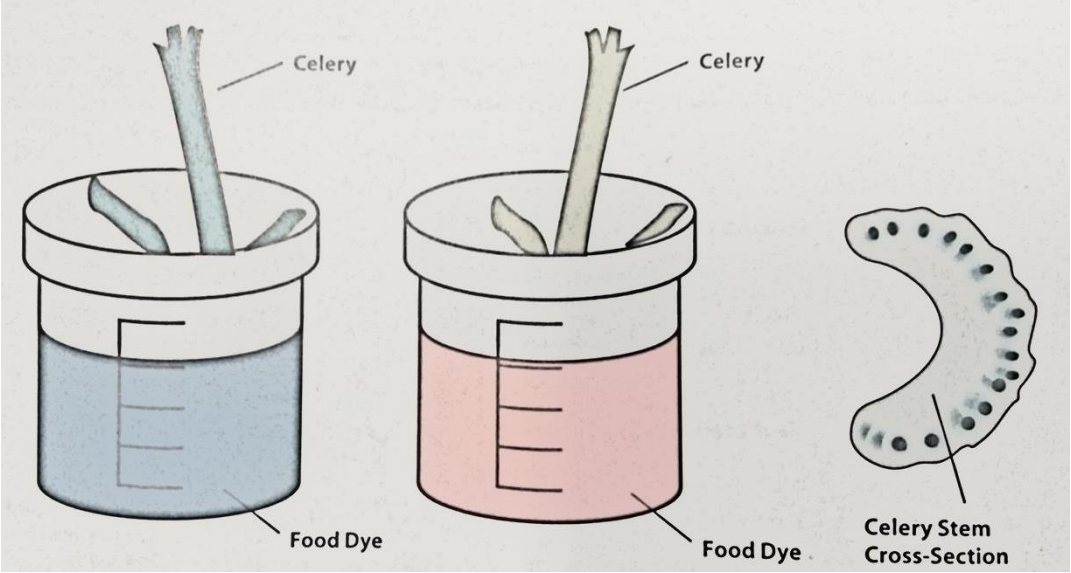
……

……

……

Experiment 8 – To show capillarity in a plant stem

Apparatus: Two beakers, scissors, celery sticks, food dye



Method:

1. Place a few drops of food dye into two beakers of water.
2. Place a celery stick without leaves, into one of the beakers.
3. Use the other beaker as a control.
4. Leave for 30minutes.
5. Cut across the stem of celery and observe results.

Experiment 8 – To show capillarity in a plant stem

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Apparatus Diagram:

Procedure / Method:

……

……

……

……

……

……

……

Observations / Results:

……

……

……

Conclusion:

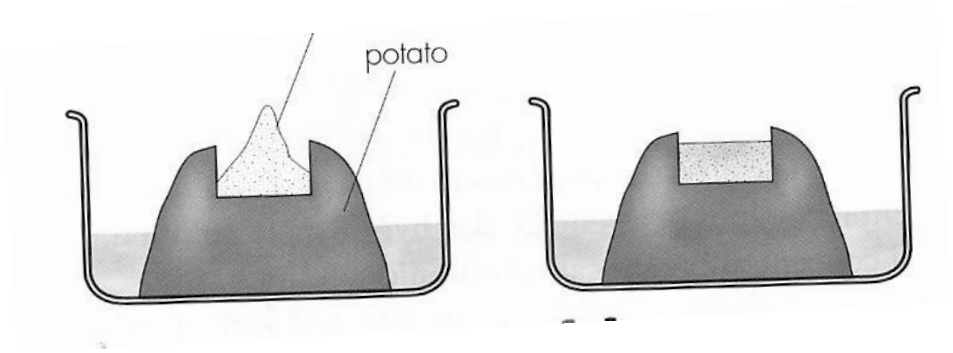
……

……

……

Experiment 9 – To Demonstrate Osmosis in a Potato Plant

Apparatus: Potato; Knife; Salt; Petri dish; Water



Method:

1. Cut a potato in half.
2. Place the cut end facing downwards in a petri dish of water.
3. Scoop out a hollow in the top of the potato.
4. Fill the hollow with salt.
5. Leave the potato for 24 hours and record any changes.

Experiment 9 – To Demonstrate Osmosis in a Potato Plant

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Apparatus Diagram:

Procedure / Method:

……

……

……

……

……

……

……

Observations / Results:

……

……

……

Conclusion:

……

……

……

Experiment 10 – To Show the Dry Matter in a sample of Silage

Apparatus: Balance, Oven, Silage Sample, Beaker

Method:

1. Weigh the empty beaker and record the weight.
2. Place the silage in the beaker, weigh and record.
3. Subtract the weight of the beaker from the total weight to determine the weight of the silage before drying
4. Thoroughly dry the feed in an oven heated to 105^{o}C. Remove every 10 minutes to weigh (repeat until there is no change in weight).
5. Weigh and record the beaker and feed weight immediately after drying.
6. Subtract the weight of the beaker (step 1) from the total weight (step 5) to determine the weight of the feed after drying.
7. Divide the weight of the dry feed (step 6) by the weight of the wet feed (step 3).
8. Multiply by 100 to get a percentage.

Experiment 10 – To Show the Dry Matter in a sample of Silage

Date: ……

Materials / Apparatus:

……

……

……

Procedure / Method:

……

……

……

……

……

……

……

……

……

Observations / Results:

1. Beaker Weight _____ g
2. Beaker and Sample before drying _____ g
3. Wet sample weight (Step 2 – step 1) _____ g
4. Beaker and Sample after drying _____ g
5. Dry sample weight (Step 4 – Step 1) _____ g

Dry Matter (Dry Sample Weight (step 5) / Wet Sample Weight (Step 3) x 100 / 1) _____ %

Conclusion:

……

……

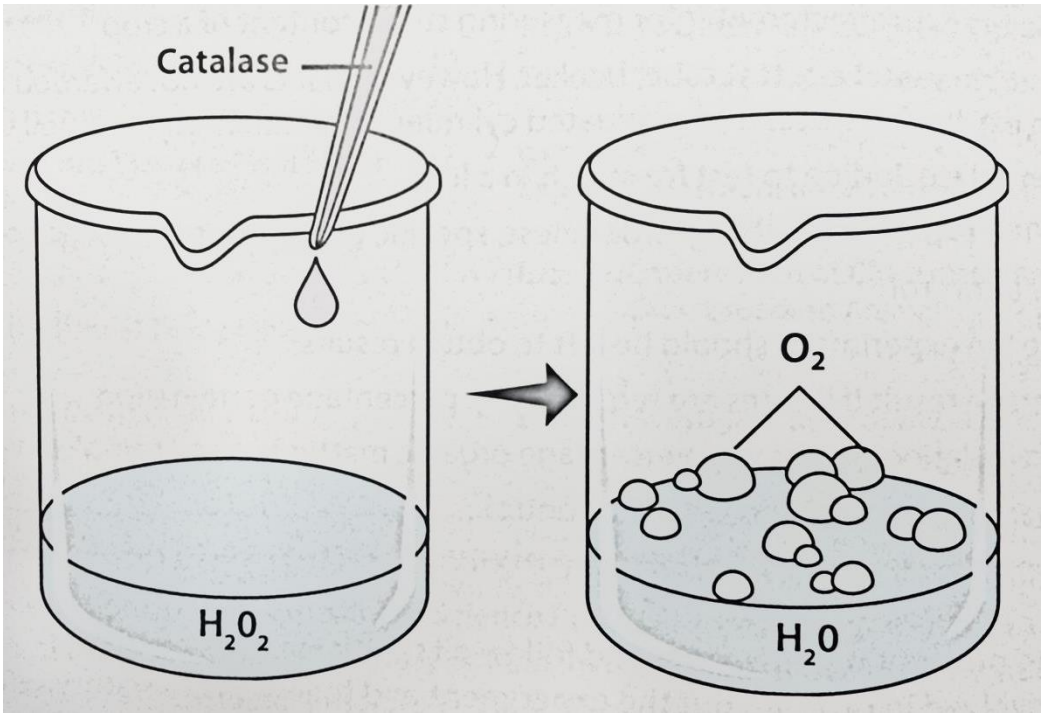
……

Animal Physiology

5 Marks

Experiment 11 – To demonstrate the activity of liver enzyme: catalase

Apparatus: Fresh liver; pestle and mortar; sand; stop watch; two large boiling tubes; hydrogen peroxide; washing up liquid



Method:

1. Cut up some fresh liver. Using a pestle and mortar, make a liver puree by grinding it with some sand.
2. Pour 10mls of hydrogen peroxide into each one of the boiling tubes.
3. Throughout the experiment, maintain a constant temperature (37^{o}C) and pH (7).
4. Add 3mls of washing up liquid into each tube.
5. Finally, add the liver puree to one tube but do not add it to the other.
6. Observe and compare the height of the foam produced in each tube.

Experiment 11 – To demonstrate the activity of liver enzyme: catalase

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Procedure / Method:

Apparatus Diagram:

……

……

……

……

……

……

……

Observations / Results:

……

……

……

Conclusion:

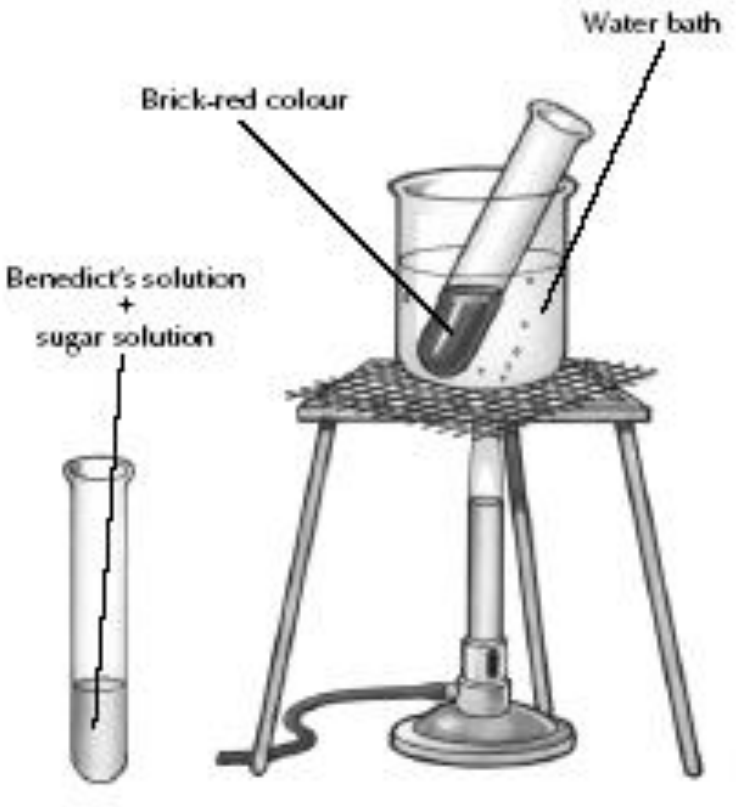
……

……

……

Experiment 12 – To show the presence of Lactose in milk

Apparatus: Water bath (80^{O}- 100^{O}C); Glucose solution; Water; 2 Test tubes; Dropper; Benedicts solution; Test tube rack; Test tube holder.



Method:

1. Label two test tubes A and B.
2. Into tube A, place 2ml of milk solution.
3. Into tube B, place 2ml of water.
4. Using a dropper, add 2ml of Benedicts solution to each test tube and swirl.
5. Place both test tubes in the water bath and heat for 5 minutes.
6. Remove the test tubes from the water bath and record any colour changes.

Experiment 12 – To show the presence of Lactose in milk

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Apparatus Diagram:

Procedure / Method:

……

……

……

……

……

……

……

Results:

Solution	Initial Colour	Final Colour
A – Milk		
B – Water		

Conclusion:

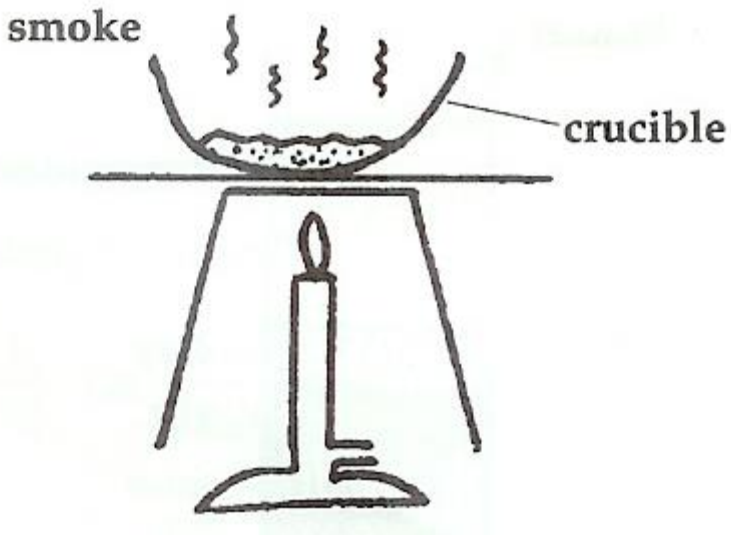
……

……

……

Experiment 13 – The Percentage of Water and Solids in a sample of Milk

Apparatus: Evaporating basin; Electronic balance; Bunsen burner; Tripod stand; Tongs; Wire gauze; Sample of Milk



Method:

1. Using the balance, find the mass of an empty evaporating dish
2. Place the sample of milk into the dish and re-weigh
3. Calculate the weight of the milk by subtracting the weight of the dish.
4. Boil the milk until all the water has evaporated and weigh. (By subtracting this figure from the weight of the milk, the weight of water in the sample is found: Step 3 – Step 4)
5. The remaining weight minus the weight of the dish is the weight of the solids

Experiment 13 – The Percentage of Water and Solids in a sample of Milk

Date: ……

Materials / Apparatus:

……

……

……

……

……

……

……

……

Procedure / Method:

Apparatus Diagram:

……

……

……

……

……

……

Calculations / Results:

Percentage Water: $\frac{Weight\ of\ water}{Weight\ of\ milk\ Sample} x\ 100$ = $\frac{\text{.....}}{\text{.....}} x\ 100$ = ... %

Percentage Solids: $\frac{Weight\ of\ solids}{Weight\ of\ milk\ Sample} x\ 100$ = $\frac{\text{.....}}{\text{.....}} x\ 100$ = ... %

Conclusion:

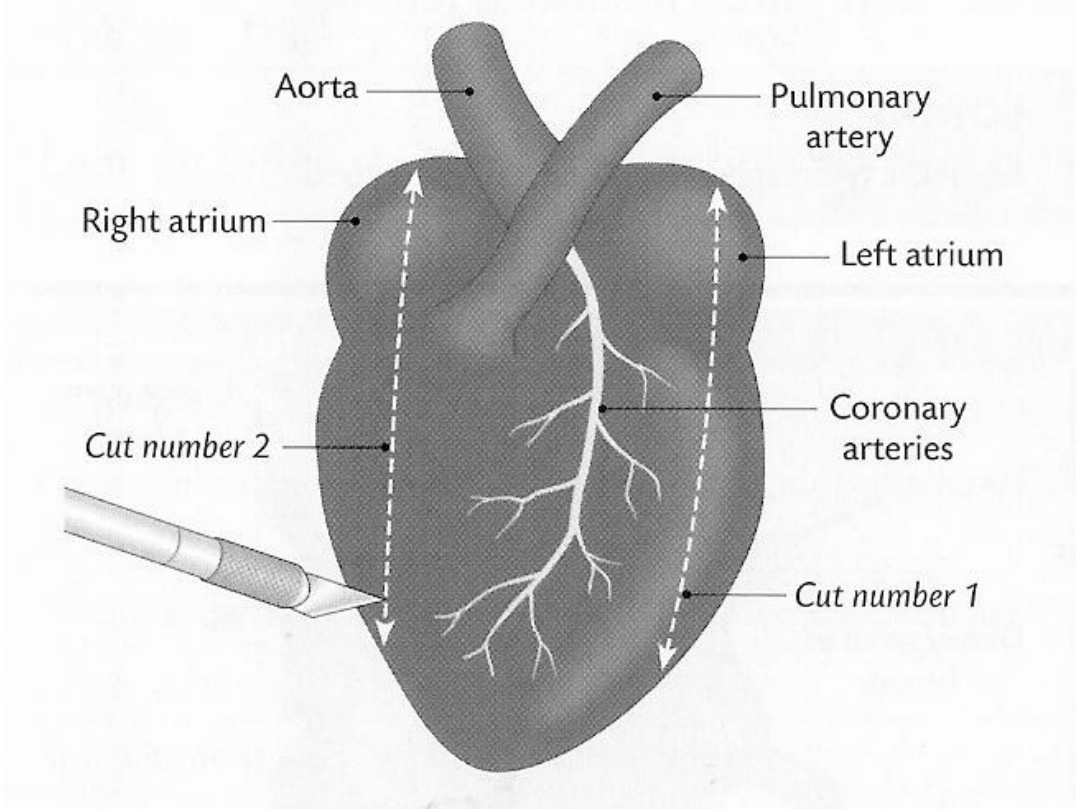
……

……

……

Experiment 14 – To Dissect a Sheep Heart

Apparatus: Sheep heart; dissecting board; scalpel, scissors, forceps, pins, seeker, dropper, green food dye



Method:

1. Place the sheeps heart on the dissecting board.
2. Distinguish between the front and the back of the heart by finding the coronary artery – this is running diagonally across the front of the heart.
3. Locate the major blood vessels attached to the heart and identify them – the aorta, pulmonary artery, the vena cava and the pulmonary vein.
4. Note the location of the fat deposits surrounding the heart.
5. To begin dissecting the heart, make a cut using the scalpel down the left side of the heart through the ventricles. Make the same type of incision down the right side of the heart.
6. Once the ventricles are opened, notice the thickness of the walls of the ventricles. Locate the tricuspid and bicuspid valves.
7. Continue using the scalpel to cut through the walls of the atria – notice the thickness of the atria walls and compare them to the walls of the ventricles.
8. Identify the semi-lunar valves.
9. Locate the septum separating the left from the right side of the heart. Compare the thickness of the septum with the other walls of the heart.
10. Locate the opening to the coronary artery – found at the base of the aorta. Fill a dropper with green food dye and pump the dye into the coronary artery to follow the path of blood flow through the vessel.
11. Make a labelled diagram of the dissected heart.

Experiment 14 – To Dissect a Sheep Heart

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Apparatus Diagram:

Procedure / Method:

……

……

……

……

……

……

……

Observations / Results:

……

……

……

Conclusion:

……

……

……

Genetics

5 Marks

Experiment 15 – To Variation in Inherited Characteristics in a Classroom

Apparatus: Sample of pupils

Method:

1. Select five genetically inherited characteristics.
2. Carry out a survey of the class to determine the numbers of pupils with each allele.
3. Make a record of the results.
4. Within each characteristic, determine which allele is dominant and which is recessive.

Number of respondents:.....

	Trait	**Observation**
1	Male or Female	
2	Hair Colour	
3	Hair: Wavy/Curly or Straight	
4	Straight Hairline vs. Widows Peak	
5	Left Hand or Right Hand	
6	Hand Clasping (Left over Right or Right over Left)	
7	Arm Folding (Left over Right or Right over Left)	
8	Freckles (Yes or No)	
9	Dimples (Yes or No)	
10	Ear Lobes (Attached or Unattached)	
11	Thumb (Straight or Hitchhikers)	
12	Baby Finger (Straight or Curved)	
13	Ear Wax (Dry or Wet)	
14	Eye Colour	
15	Colour Blind (Yes or No)	

Experiment 15 – To Variation in Inherited Characteristics in a Classroom

Date: ……

Materials / Apparatus:

……

Procedure / Method:

……

……

……

Observations / Results:

Number of respondents:……..

Characteristic	Number of people with trait	Percentage
1.		
2.		
3.		
4.		
5.		

Conclusion:

……

……

……

Experiment 16 – Observation of characteristics from crossbreeding animals

Method:

1. On a farm visit, identify different breeds of sheep or cattle.
2. Observe the characteristics of the sire.
3. Take note of the confirmation – hindquarters, shoulders, torso and back.
4. Compare these characteristics with those of the dams.
5. If offspring are present, record their characteristics.
6. Note the characteristics inherited from the sire and dam.

Results:

Describe the breeds and crosses seen. Record the main differences between the sire and dam.

Conclusion:

Different characteristics are evident in the sire and dam. Confirmation characteristics are inherited from the sire.

"On a farm visit, a Hereford stock bull was observed for the following characteristics: hindquarters, shoulders, torso and back. The Hereford is a good beef breed, with excellent confirmation. On the farm the farmer keeps a number of Friesian heifers for milking. The Friesian is a great milk producer with a high yield and easy calving characteristics. The stock bull sires a number of Hereford x Friesian crosses known as Black Whiteheads. These are dual purpose cattle which are good at producing milk and have good beef confirmation."

Experiment 16 – Observation of characteristics from crossbreeding animals

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Apparatus Diagram:

Procedure / Method:

……

……

……

……

……

……

……

Observations / Results:

……

……

……

Conclusion:

……

……

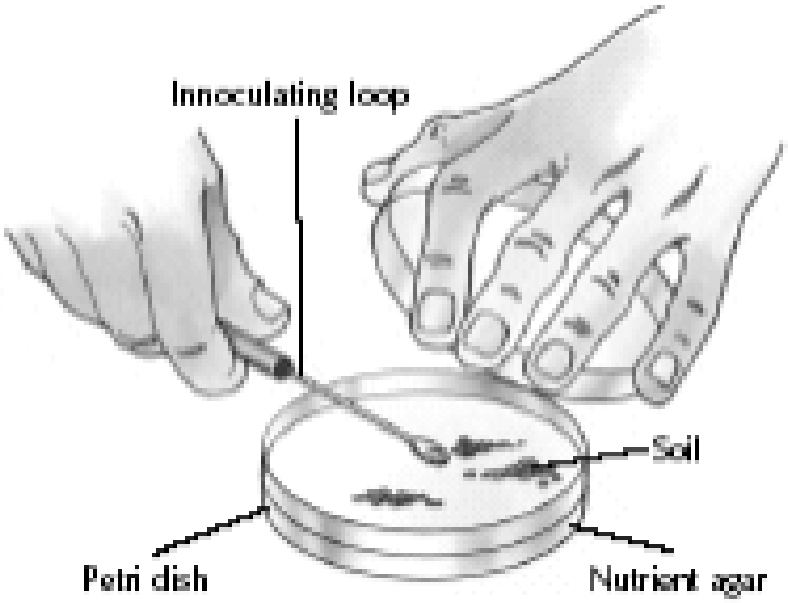
……

Microbiology

5 Marks

Experiment 17 – To show how to grow a bacteria culture

Apparatus: 2 Pre-poured agar plates; Disinfectant; Methylated spirits; Bunsen burner; Inoculating loop; Sample of soil; Incubator or oven; Parafilm.



Method:

1. Sterilise all equipment and surfaces before the experiment by swabbing with disinfectant.
2. Take 2 sterile agar plates and label them A and B.
3. Sterilise an inoculating loop by dipping it in methylated spirits and flaming in a bunsen burner until the loop turns red.
4. Allow the inoculating loop to cool down by holding it just outside the bunsen flame for up to 30 seconds.
5. Dip the inoculating loop into the sample of soil.
6. Open the lid of the petri dish labelled A at a 45^{O} angle.
7. Streak the inoculating loop across the surface of the agar.
8. Replace the lid as quickly as possible.
9. Sterilise the inoculating loop by flaming until it is red.
10. Leave plate B unopened to act as a control.
11. Seal both plates using parafilm.
12. Write your initials and the date on the underside of the petri dish.
13. Turn the petri dish upside-down and incubate in an oven at $30^{O}C$ for 24 hours.
14. Observe the growth of bacteria and fungus.
15. Draw a diagram of the plates showing the growth of bacterial and fungal colonies.

Experiment 17 – To show how to grow a bacteria culture

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……

Apparatus Diagram:

Procedure / Method:

……

……

……

……

……

……

……

Observations / Results:

……

……

……

Conclusion:

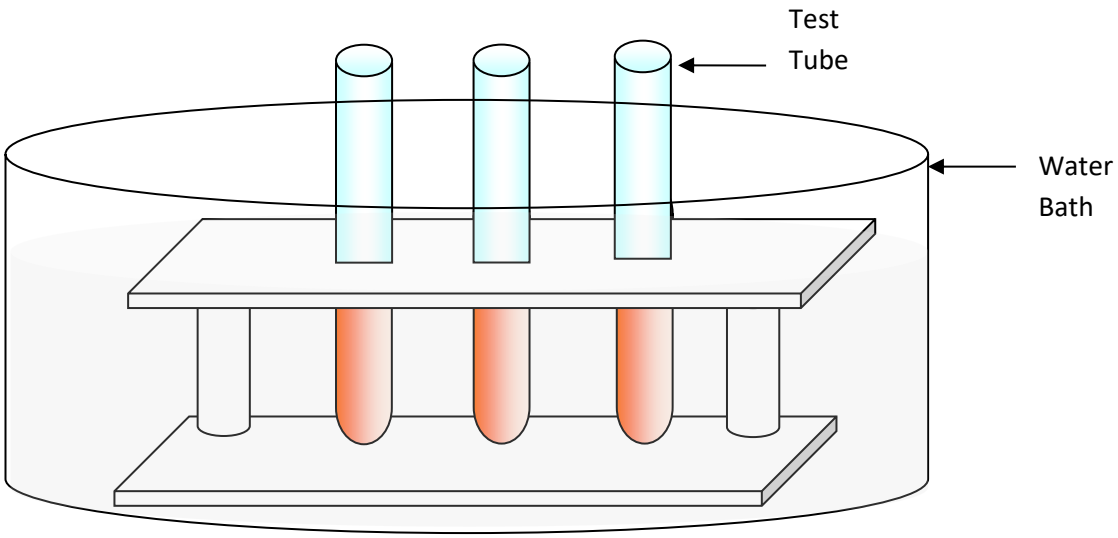
……

……

……

Experiment 18 – To Assess the Bacterial Quality of Milk (The Resazurin Test)

Apparatus: 3 Test tubes; Test tube rack; 10ml Graduated cylinder; Samples of milk – fresh unpasteurised, fresh pasteurised, stale pasteurised; Water bath at 37^{O}C; Resazurin solution; Dropper.



Method:

1. Label three test tubes A, B and C.
2. Place 10ml of fresh unpasteurised milk into tube A.
3. Place 10ml of fresh pasteurised milk into tube B.
4. Place 10ml of stale pasteurised milk into C.
5. Place the three test tubes into the water bath.
6. Into each of the test tubes, add 1ml of Resazurin.
7. Record the initial colour in each tube.
8. Leave the test tubes for 10 minutes and record any colour changes.

Experiment 18 – To Assess the Bacterial Quality of Milk (The Resazurin Test)

Date: ……

Materials / Apparatus:

……

……

……

……

……

……..

……

……..

Apparatus Diagram:

Procedure / Method:

……

……

……

……

……

……

……

Results:

Test tube	Initial Colour	Final Colour
A – Fresh Unpasteurised		
B – Fresh Pasteurised		
C – Stale Pasteurised		

Conclusion:

……

……

……