THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL OF TANZANIA

ADVANCED CRTIFICATE OF SECONDARY EDUCATION EXAMINATION

134/3 **AGRICULTURE 3**

(For Both School and Private Candidates)

Time: 3 Hours. **ANSWER** **Year: 2020**

Instructions

1. This paper consists of **three (3)** questions.
2. Answer **two (2)** questions.
3. Cellular phones and unauthorized materials are **not allowed** in the examination room.
4. Write your **Examination Number** on every page of your answer booklet(s).

1. You are provided with specimens S_1 for experiment I and S_2 for experiment II, two 250 cm^3 measuring cylinders, two 100 cm^3 beakers and a wall clock. Perform the following procedures and answer the questions that follow:

Procedures
Experiment I
(i) Put 100 cm^3 of water in a 250 cm^3 measuring cylinder.
(ii) Using a 100 cm^3 beaker, put specimen S_1 up to the 100 cm^3 mark.
(iii) Empty specimen S_1 into the measuring cylinder at step (i) and shake well.
(iv) Let the mixture stand for ten minutes while observing what happens in the mixture and record the final reading of the mixture in the measuring cylinder.

Experiment II
Repeat the same procedures of Experiment I for specimen S_2 using another set of apparatuses.

Questions
(a) What have you observed after shaking well the mixture in experiments I and II?
In experiment I, air bubbles rose to the surface and the mixture settled with a clear reduction in total volume, showing pore spaces.
In experiment II, little or no air bubbles were observed and the final volume remained nearly the same as the combined volumes.

(b) What is the inference of your observation in experiments I and II?
Specimen S_1 has a higher percentage of air space due to its coarse texture.
Specimen S_2 has a low percentage of air space due to its fine texture and compact structure.

(c) Giving a reason, comment on the volumes of the mixture in experiments I and II after shaking well the mixture and letting it to stand for 10 minutes.
In S_1 the final volume is less than the sum of the initial water and soil volumes because air spaces were displaced by water.
In S_2 the final volume is almost equal to the sum of water and soil volumes because the soil has fewer air spaces.

(d) Calculate the percentage of air composition in each of specimen S_1 and S_2.
Specimen S_1: Initial water volume = 100 cm^3, soil volume = 100 cm^3. Final mixture reading = 180 cm^3.
Air volume = (100 + 100) – 180 = 20 cm^3.
Percentage air = (20 ÷ 100) × 100 = 20%.

Specimen S_2: Initial water volume = 100 cm^3, soil volume = 100 cm^3. Final mixture reading = 198 cm^3.
Air volume = (100 + 100) – 198 = 2 cm^3.
Percentage air = (2 ÷ 100) × 100 = 2%.

(e) Based on the percentage of air composition calculated in part (d), suggest the type of soil in each of specimens S_1 and S_2. In each case give a reason for your suggestion.
Specimen S_1 is sandy soil because it has large pores and therefore a higher proportion of air.
Specimen S_2 is clay soil because it has very small pores and therefore retains water with little air space.

(f) Referring to the percentage of air composition in each of specimens S_1 and S_2, briefly describe air–water relationship in the two specimens.
In sandy soil (S_1), the high percentage of air means more aeration but low water retention.
In clay soil (S_2), the low percentage of air means poor aeration but high water retention.

2. You are provided with specimens E_1 and E_2 in the 250 cm^3 pyrex beakers, two bunsen burners, two tripod stands, a match box, two wire gauzes and two thermometers. Perform the following procedures and then answer the questions that follow:

Procedures
- Put each of the wire gauze on top of the tripod stand.
- Place tripod stands over the bunsen burners.
- Place each of the beakers containing specimens E_1 and E_2 on wire gauze on the tripod stands.
- Immerse thermometers in each of the beakers containing specimens E_1 and E_2.
- Light the bunsen burners and heat specimens E_1 and E_2. Take records of the temperature for each of the specimens after 2 minutes of heating.
- Switch off the bunsen burners and remove beakers from the source of heat to let specimens E_1 and E_2 cool. Take records of temperature for each of the specimens after 5 minutes of cooling.

Questions
(a) Record the results of the experiment as shown in the following table:

Specimens	Temperature after 2 minutes heating (°C)	Temperature after 5 minutes cooling (°C)
E_1	45°C	30°C
E_2	55°C	40°C

(b) From the results of the experiment, suggest which specimen can be best used than the other as a coolant in a tractor engine. Give two reasons for your suggestion.
Specimen E_1 is better because it gained less heat when heated and lost heat more rapidly when cooled. This shows higher specific heat capacity and faster cooling efficiency.

(c) Briefly describe the mechanism of cooling the tractor engine using the specimen that you have suggested.
When circulated through engine jackets, specimen E_1 absorbs excess heat from metal parts due to its high heat capacity. It then transfers the heat to the radiator, where air flow removes heat, lowering the coolant temperature before it re-enters the engine.

(d) Account for two limitations of a tractor engine cooling system that uses the specimen you have suggested.

Leakage from hoses or radiator may lead to coolant loss and overheating.
Freezing under low temperature conditions can damage pipes and radiator without antifreeze.

(e) Briefly explain four reasons for engine overheat in a cooling system using the selected specimen.
Blocked radiator fins prevent heat dissipation.
Faulty water pump reduces coolant circulation.
Low coolant level due to leaks causes insufficient heat absorption.
Thermostat failure prevents coolant flow into the radiator.

3. You are provided with specimens L_1, L_2, a measuring cylinder and a beaker. Perform the following procedures and then answer the questions that follow:

Procedures
- Measure 25 cm^3 of specimen L_1 and pour it into a beaker.
- Squirt few streams of L_2 into specimen L_1 and observe carefully.

Questions
(a) What is the aim of the experiment?
The aim of the experiment is to test for the presence of abnormal components in milk such as mastitic clots.

(b) Briefly explain your observations in the experiment. Give three reasons to support your observations.
White clots appeared and floated on the surface of specimen L_1 when mixed with specimen L_2.
This indicates the presence of mastitis in the animal.
Clots form because somatic cells and proteins leak into milk from infected udder tissue.
Specimen L_2 contains reagents that react with DNA and proteins, causing clotting if infection is present.

(c) What conclusions can you make from the experiment?
Specimen L_1 is mastitic milk.

(d) Account for five predisposing factors for what has been diagnosed in the experiment.
Poor sanitation of the milking environment encourages pathogen entry into teats.
Improper milking techniques that cause teat injury increase risk of infection.
Failure to dry teats properly after milking promotes bacterial survival.
Weak immune system of the cow makes it susceptible to udder infections.
Use of contaminated equipment spreads pathogens from one cow to another.

(e) As a livestock scientist provide an advice to the livestock keepers on five measures to be taken in order to obtain clean and normal specimen L_1.
Maintain strict hygiene of the milking shed and equipment.
Adopt proper milking methods that avoid teat injury.
Use teat dips or antiseptics before and after milking to kill pathogens.
Provide balanced nutrition to improve immunity of the animals.
Isolate and treat infected animals promptly to prevent spread of infection.