

STUDENT NUMBER  Letter

# VCE VET LABORATORY SKILLS

## Written examination

Wednesday 1 November 2023

Reading time: 11.45 am to 12.00 noon (15 minutes)

Writing time: 12.00 noon to 1.30 pm (1 hour 30 minutes)

### QUESTION AND ANSWER BOOK

#### Structure of book

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
A	20	20	20
B	15	15	80
			Total 100

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

#### Materials supplied

- Question and answer book of 23 pages
- Answer sheet for multiple-choice questions

#### Instructions

- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- All written responses must be in English.

#### At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

**Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.**

**SECTION A – Multiple-choice questions****Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1; an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

**Question 1**

Which of the following matches the objective of 'right first time'?

- A. running all tests according to Standard Operating Procedures (SOPs)
- B. making mistakes and hoping that nobody notices
- C. rushing to get the results to customers on time
- D. running tests without calibrating equipment

**Question 2**

Which of these media types would be used to grow anaerobic bacteria in air?

- A. broths
- B. deeps
- C. plates
- D. slopes

**Question 3**

A laboratory technician is asked to prepare a 250 mL standard solution, by weighing out 5.00g of solute. The actual weight of the solute the technician measured was 5.08g.

What would be the correct percentage uncertainty?

- A. 1.54%
- B. 1.60%
- C. 0.80%
- D. 0.20%

**Question 4**

A microscope that has a high resolution is one that has a

- A. total magnification higher than 1000×
- B. small distance between the objective lens and the specimen.
- C. large cone of light that enters the aperture of the objective lens.
- D. minimum distance that is visible between two dots on the specimen.

DO NOT WRITE IN THIS AREA

**Question 5**

Technicians can contribute to continuous improvement in their workplace by

- A. identifying possible changes in procedures and bringing this to the attention of their supervisor.
- B. seeking advice from other staff only when they are not sure of an SOP.
- C. following the actions of other staff members.
- D. not recording their data correctly.

**Question 6**

A laboratory technician is asked to quantitatively transfer 20.00 mL of solution multiple times.

Which of the following procedures would give the most precise result and the lowest error?

- A. one volume transferred from a 20 mL bulb pipette
- B. two aliquots transferred from a 10 mL bulb pipette
- C. two aliquots transferred using a graduated 10 mL pipette
- D. one volume of 20.00 mL transferred using a measuring cylinder

**Question 7**

A Class II Biosafety cabinet is used to

- A. prevent contamination of the sample and protect the operator from infection.
- B. protect the operator from hazardous substance fumes, and contain spills.
- C. prevent the bacteria from escaping into the environment via the sinks.
- D. prevent cross-contamination between samples within the cabinet.

**Question 8**

You are examining plant tissue under a stereo dissecting microscope at 40× total magnification.

You would expect to see

- A. chromosomes inside a nucleus.
- B. internal cell structures such as chloroplasts.
- C. leaf surface structures such as hairs or stomata.
- D. whole plant organs such as a leaf, stem or root.

**Question 9**

Why is it important to document all procedures the laboratory technician performs during the day?

- A. to ensure that the laboratory's profit levels are maintained
- B. to make sure that the results are in the expected range
- C. to minimise the likelihood of errors occurring
- D. to impress the supervisor

**Question 10**

A technician can contribute to good customer relationships if they have no direct contact by

- A. obtaining results the customer would expect.
- B. operating under strict health and safety requirements.
- C. scheduling tests, where possible, according to customer requirements.
- D. maximising the number of tests to make it more profitable for the company.

**Question 11**

The technique of filtration removes a solid impurity from a solution.

The solution that is found at the bottom of the flask is called the

- A. residue.
- B. solution.
- C. mixture.
- D. filtrate.

**Question 12**

When moving a microscope from a cupboard under the bench, the technician should always

- A. lift the microscope by the turret and place it near the edge of the bench.
- B. use one hand to lift the microscope out of the cupboard and the other to close the door.
- C. squat down and lift the microscope with one hand under the base and the other on the arm of the microscope.
- D. slide the microscope out onto the floor before lifting the microscope onto the stool and then onto the bench.

**Question 13**

Which liquid is commonly referred to as the ‘universal solvent’?

- A. water
- B. ethanol
- C. ethylene
- D. sodium chloride

**Question 14**

15.0 mL of 10.0 M HCl is diluted to 75.0 mL.

What is the concentration of the diluted acid?

- A. 0.500 M
- B. 2.00 M
- C. 2.50 M
- D. 3.33 M

**Question 15**

Which parts of a microscope would be used to increase the light intensity?

- A. the brightness adjustment, eyepiece and condenser
- B. the coarse focus, field diaphragm and iris diaphragm
- C. the fine focus, condenser, and stage adjustment knobs
- D. the brightness adjustment, field diaphragm and iris diaphragm

**Question 16**

What can be used to accurately measure the sizes of cells under a light microscope?

- A. an eyepiece graticule disc with 100 divisions placed in the eyepiece
- B. a clear plastic ruler placed over the slide on the stage under low power
- C. an eyepiece graticule disc that has been calibrated with a stage micrometer
- D. a stage micrometer with an accurate scale in micrometres

**Question 17**

Which one of the following is an example of correct aseptic technique when preparing to inoculate agar plates?

- A. preparation of the petri dishes in a dust-free atmosphere for pouring of agar plates
- B. working in a fume cupboard to prevent exposure to microorganisms and toxic fumes
- C. lifting the lid slightly on the petri dishes to allow the entry of bacteria onto the agar
- D. flame sterilisation of inoculation equipment to destroy microbes and prevent contamination

**Question 18**

The technician is required to select the correct personal protective equipment (PPE) when performing an inoculation of agar plates with a broth culture.

Which of the following would be correct?

- A. gloves, closed-toe shoes, a laboratory gown and eye protection
- B. closed-toe shoes, latex gloves, a laboratory gown and a hair cap
- C. eye protection, nitrile gloves, a face mask and closed-toe shoes
- D. a laboratory gown, insulated gloves, a face mask and eye protection

**Question 19**

Before leaving the laboratory, handwashing is

- A. performed to reduce the risk of contaminating the technician and the surrounding environment.
- B. performed to prevent the technician from developing skin-related issues such as dry skin.
- C. used to completely remove all bacteria and viruses from the technician's skin.
- D. not necessary if gloves were worn during the procedure.

**Question 20**

An environmental scientist collecting water and soil samples from a river near a contaminated land area should

- A. use clean sampling equipment for each sample to prevent cross-contamination.
- B. wipe clothes and skin with a towel if they have come into contact with the water or soil.
- C. have no need to wear protective equipment as environmental samples are generally safe to handle.
- D. collect samples from the site in any container with a lid and place these in a cardboard box to be transported to the laboratory.

**SECTION B – Short-answer questions**

**Instructions for Section B**  
 Answer **all** questions in the spaces provided.

**Question 1** (6 marks)

Bacteria can live in many types of environments and have varying requirements for growth. Selective and enrichment methods are sometimes used to isolate specific bacterial species. An example of a selective method would be to separate obligate (strict) aerobes from obligate anaerobes.

A technician prepares agar tubes by adding molten agar to the tubes and then pipetting the bacterial sample to be tested into the cooling molten agar at 45–50 °C. Once the agar is set, the tubes are incubated at 37 °C.

- a. Describe **three** steps the technician would take to prevent contamination during the preparation of the agar. 3 marks

---

---

---

---

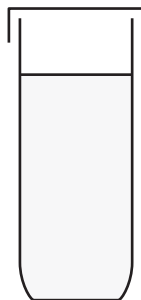
---

---

---

- b. On the diagrams below and on the following page, shade the area where you would expect to see growth in the tubes for each bacterium type listed. State the reason for your choice.

- i. Obligate (strict) aerobes 1 mark



Reason \_\_\_\_\_

---



---

ii. Obligate (strict) anaerobes

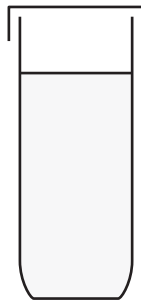
1 mark



Reason \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

iii. Facultative aerobes

1 mark



Reason \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DO NOT WRITE IN THIS AREA

**Question 2** (7 marks)

A technician has been asked to prepare for the day's testing in a water quality laboratory. Part of the testing procedure requires the microscopic examination of water samples taken from a sewage treatment facility.

- a. List **three** items of personal protective equipment (PPE) the technician should wear. 3 marks

---



---



---



---

- b. Identify **two** pieces of equipment or materials, other than PPE, required by the technician. Give an explanation for your choice. 4 marks

Name of equipment or material	Explanation

**Question 3** (3 marks)

In a laboratory, pH meters are commonly used to measure the acidity or alkalinity of solutions.

- a. Identify **one** adverse outcome if the meter has not been properly calibrated. 1 mark

---



---

- b. Explain how this outcome will affect the technician's work in the laboratory. 2 marks

---



---



---



**Question 4** (4 marks)

Good Laboratory Practice (GLP) and sustainable work practices are requirements of all laboratories. These practices include the appropriate cleaning, recycling and disposal of harmful or hazardous wastes.

Match the laboratory waste material with the most appropriate disposal method by placing a letter in the table below. Each letter is only used once.

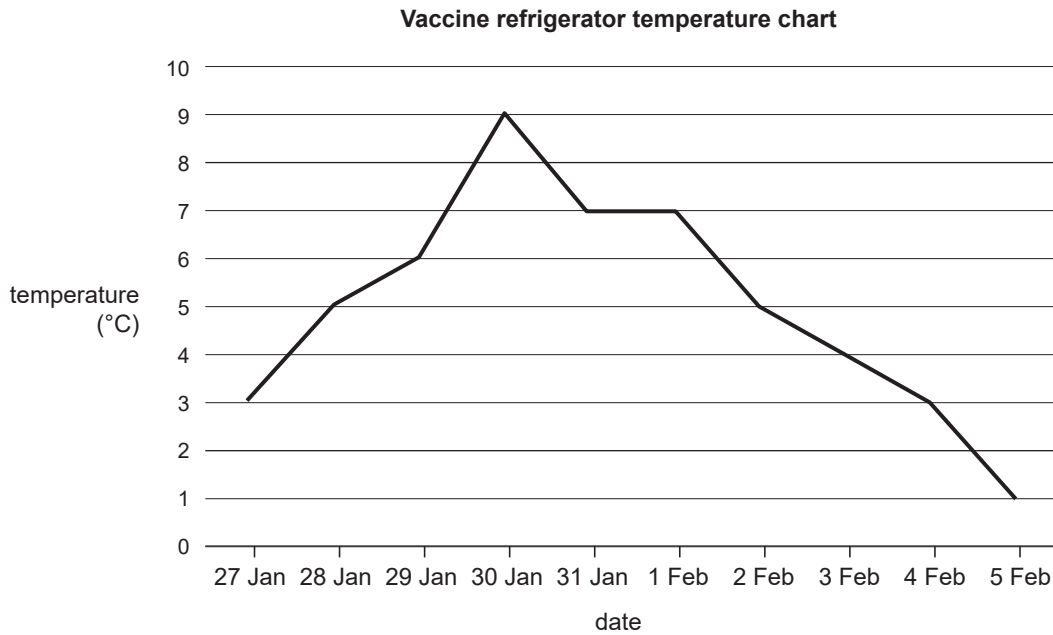
- A. Transfer to a sharps waste container for later collection by a waste disposal company.
- B. Heat in microwave or water bath to remelt and pour out waste, wash and store equipment in cupboard for later use.
- C. Autoclave on wet cycle for 40 minutes to completely sterilise, then discard in the normal waste.
- D. Decant the solution into an appropriate waste container, then rinse equipment in water, dry and reuse.

Category of laboratory waste material	Option A, B, C or D
Microscope slides with bacteria in a beaker of 1% hypochlorite solution	
Used disposable gloves, contaminated plastic tubes and caps, pipettor tips in a plastic biohazardous waste bag	
Scalpel blades, razor blades and syringe needles in a beaker	
Glass bottles containing unused agar	

DO NOT WRITE IN THIS AREA

**Question 5** (4 marks)

A vaccine refrigerator must be maintained between the temperatures of 2 °C and 8 °C. Below is a chart for the vaccine refrigerator showing the temperature recorded over the last 10 days.



- a. Referring to the chart, list the dates where the out-of-range temperatures occurred. 1 mark

---



---

- b. State **one** reason why the refrigerator is not maintaining a stable temperature. 1 mark

---



---

- c. Suggest **two** possible actions that should be taken by the technician when an out-of-range temperature occurs. 2 marks

---



---



---



---

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**CONTINUES OVER PAGE**

**SECTION B – continued**  
**TURN OVER**

**Question 6** (12 marks)

A laboratory technician is required to perform an acid-base titration using hydrochloric acid (HCl) and sodium carbonate ( $\text{Na}_2\text{CO}_3$ ). The first step is to prepare a standard solution of 250.0 mL 0.0200 M  $\text{Na}_2\text{CO}_3$  that will then be used to determine the exact concentration of a solution of HCl.

- a. Calculate the mass of  $\text{Na}_2\text{CO}_3$  required to prepare the standard solution. The label on the bottle indicates the molar mass of  $\text{Na}_2\text{CO}_3$  is 105.99 g/mol. Show your working. 2 marks

---



---



---



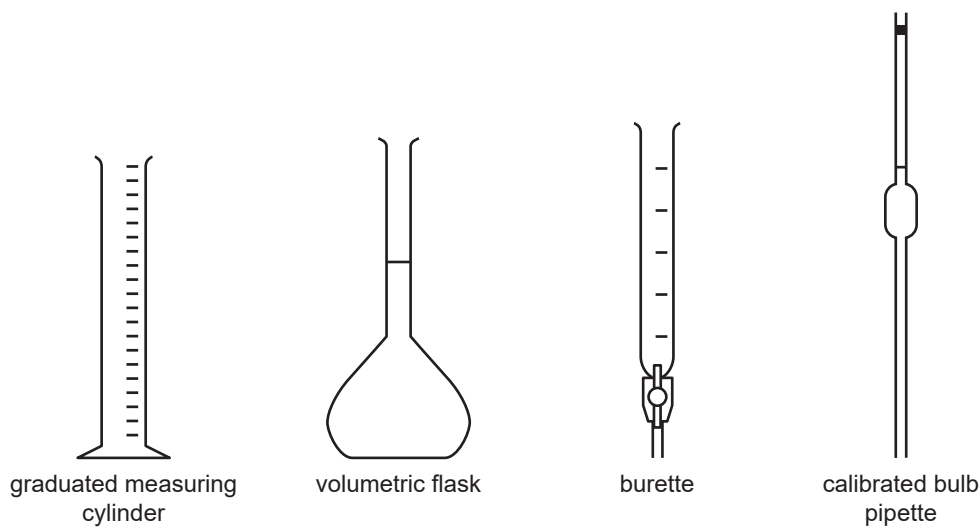
---



---

- b. The technician will be required to use specific glassware to accurately prepare and then transfer the standard solution into each of the flasks for titration.

Select the **two** most appropriate items of glassware from the options below. Give a reason for each of your selections. 4 marks



Source: Created with Chemix <chemix.org>

Item of glassware 1 \_\_\_\_\_

Explanation \_\_\_\_\_

---



---



---



---

Item of glassware 2 \_\_\_\_\_

Explanation \_\_\_\_\_

---



---



---



---

The technician aliquots 25 mL of the standard solution of  $\text{Na}_2\text{CO}_3$  and begins the titration with HCl in the burette. The technician carries out a trial titration, followed by three further titrations. Figure 1 below shows the initial and final burette readings for each of the three further titrations.

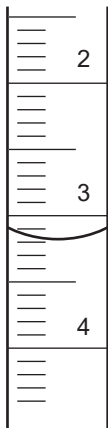
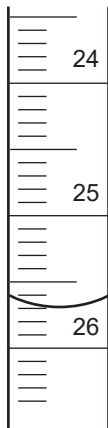
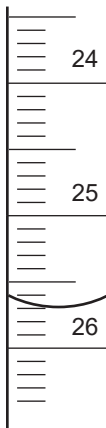
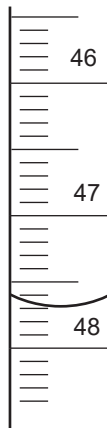
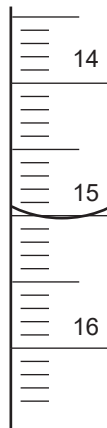
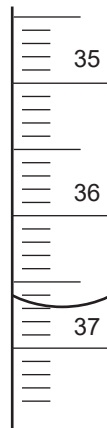
Titration 1		Titration 2		Titration 3	
Initial reading	Final reading	Initial reading	Final reading	Initial reading	Final reading
					

Figure 1

- c. Use the information from Figure 1 above to record the burette readings in the table below. 3 marks

Titration	Trial	Titration 1	Titration 2	Titration 3
Final burette reading mL	22.65			
Initial burette reading mL	0.50			
Titre mL	22.15			

- d. Explain why recording four titration results for the experiment is best practice. 2 marks

---

---

---

---

---

- e. At the start of the experiment, the technician is unsure about waste disposal processes and correct procedures for the handling of acids.

State **one** source the technician could use to find information about how to safely handle and dispose of the solutions used in this procedure.

1 mark

---

---

DO NOT WRITE IN THIS AREA

**Question 7 (4 marks)**

The production of waste and overuse of resources is a problem in many workplaces. During a meeting, the laboratory manager has asked for some ideas on how the laboratory can reduce costs.

- a. Suggest **two** ways that you, as a technician, could reduce waste and the use of resources in your own area. 2 marks

---

---

---

---

---

---

---

- b. Explain how both suggestions could reduce costs. 2 marks

---

---

---

---

---

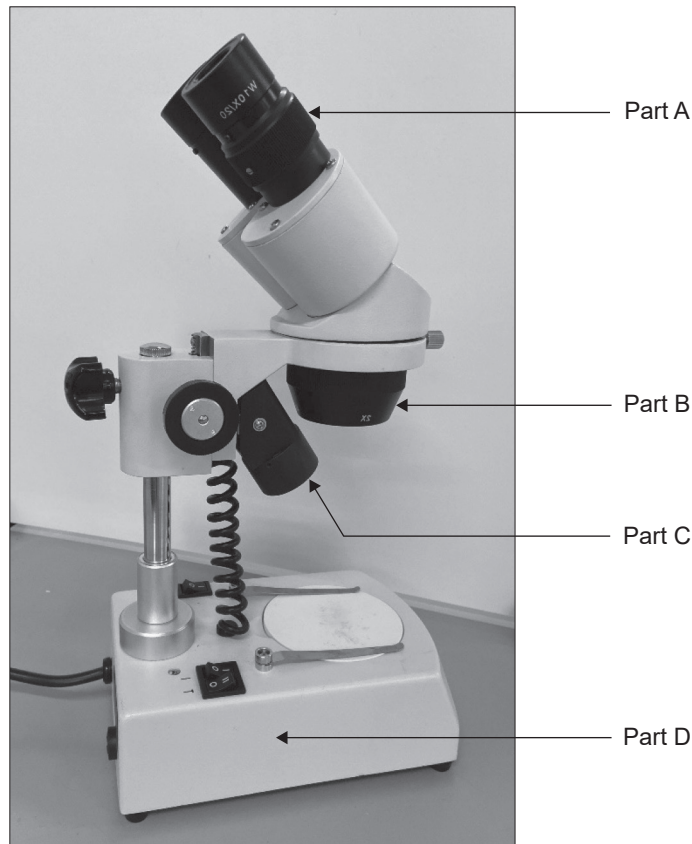
---

---

DO NOT WRITE IN THIS AREA

**Question 8** (7 marks)

A technician working in a forensics laboratory is required to undertake microscopic examination of various samples from crime scenes under a stereo dissecting microscope.



- a. Name and state the function of each part labelled on the image of the microscope above. 4 marks

	Name	Function
Part A		
Part B		
Part C		
Part D		



- b. Describe **three** checks that should be performed before using the microscope. 3 marks

---

---

---

---

---

---

---

**Question 9** (4 marks)

A new piece of equipment is being delivered to the laboratory. Your team leader has offered to train you to use this equipment, even though it is not directly related to the tasks you are doing in the laboratory.

- a. Suggest **three** reasons why it might be a good idea to learn how to use this equipment. 3 marks

---

---

---

---

---

---

---

- b. Your team leader asks you to write a Standard Operating Procedure (SOP) for the new equipment.

Other than the instructions your team leader has given you, suggest a source of information you might use to prepare the SOP.

1 mark

---

---

**Question 10** (4 marks)

A technician in an analytical laboratory has been asked to prepare a working solution of 0.1 M acetic acid ( $\text{CH}_3\text{COOH}$ ). In the SOP, it states that the 0.1 M solution is prepared from the dilution of a 1 M  $\text{CH}_3\text{COOH}$  standard solution.

Upon checking in the storeroom, it seems there is no stock of 1 M  $\text{CH}_3\text{COOH}$ . There are 2 M, 0.5 M and glacial  $\text{CH}_3\text{COOH}$  solutions present; however, the 0.5 M solution's label shows it is out of date by one week.

a. Define the terms below:

i. working solution 1 mark

---

---

ii. standard solution 1 mark

---

---

b. Which of the three solutions in the storeroom should the technician use to create the 0.1 M solution? Justify your selection. 2 marks

---

---

---

---

---

**Question 11** (6 marks)

A technician was asked to prepare a solution of 40% w/v ethanol and store it in a labelled glass bottle. The laboratory supervisor asked the technician to add the concentration to the label in two ways.

Convert the 40% w/v concentration of ethanol (molar mass 46.07 g/mol) into mol/L and ppm. Show all your working.

- a. mol/L 2 marks

---

---

- b. ppm 2 marks

---

---

- c. State **two** other items that should be included on the glass bottle label. 2 marks

---

---

DO NOT WRITE IN THIS AREA

**Question 12** (3 marks)

A laboratory technician is asked to prepare a solution of 2 M nitric acid using concentrated nitric acid. When gathering the equipment required, the technician notices that the label on the concentrated nitric acid bottle is faded and the information is hard to read. The symbols shown below are still visible, but the bottle is almost empty, so the technician decides to carefully tip the contents down the sink and place the bottle in the waste bin.



**Symbol A**



**Symbol B**

Source: Safe Work Australia <[safeworkaustralia.gov.au](http://safeworkaustralia.gov.au)>

- a. Identify a hazard associated with **one** of the symbols displayed on the nitric acid bottle. 1 mark

Symbol \_\_\_\_\_

Hazard \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- b. Evaluate the disposal process the technician has undertaken and suggest an alternative. 2 marks

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

DO NOT WRITE IN THIS AREA

**Question 13** (6 marks)

A technician has been asked to prepare banana cell slides for the Year 11 Biology class to observe any starch present. The technician has been asked to follow the SOP below.

**SOP: Preparation of banana cell slides****Materials**

Toothpick	Microscope slide	Coverslip
Pasteur pipette	Unripe banana	Tissue
Iodine solution		

**Procedure**

1. Using the toothpick, smear a little of an unripe banana on a microscope slide and rub the cells apart.
2. Place a drop of iodine solution on top of the banana smear.
3. Place a coverslip on top and remove the excess solution with a tissue.

After undertaking this procedure, the technician examines one or two of the prepared slides to check that they are suitable. The slides are weakly stained and the individual cells are hard to distinguish.

- a. Describe **two** ways the technician could change their technique to improve results for the class. 2 marks

---



---



---



---

- b. State the total magnification you would use to view the banana cell slides. Explain why this would be suitable. 2 marks

Magnification

Explanation

---



---



---

- c. Explain why the iodine solution was used to prepare the banana slides. 2 marks

---



---

**Question 14** (6 marks)

Pure culture techniques and aseptic transfer are critical for the successful microbiological investigation and correct interpretation of laboratory results.

Identify two reasons why this is the case and give an explanation of each reason.

Reason 1 \_\_\_\_\_  
\_\_\_\_\_

Explanation \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Reason 2 \_\_\_\_\_  
\_\_\_\_\_

Explanation \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DO NOT WRITE IN THIS AREA

**Question 15** (4 marks)

The laboratory technician in a meat processing factory is required to prepare agar plates for the microbiological testing of sausages from the factory.

- a. Identify **two** essential components that will allow bacteria to grow on the plate media. 2 marks

---

---

---

---

- b. After the media have been prepared and the plates poured, identify **two** tests the technician would need to do to ensure suitability for use. 2 marks

---

---

---

---

---

---

DO NOT WRITE IN THIS AREA

