

STUDENT NUMBER Letter

VCE VET LABORATORY SKILLS

Written examination

Wednesday 2 November 2022

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	11	11	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 19 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

When the technician increases the magnification of the lens of a light microscope, the field of view will always

- A. decrease.
- B. increase.
- C. remain the same.
- D. require the technician to re-centre the image.

Question 2

You are a technician working in a laboratory. You have been asked to set up the microscope for a scientist to use to view prepared blood smear slides.

You should check the

- A. light turns on, all the lenses are clean and the immersion oil is nearby.
- B. light is turned off, the stage is lowered away from the objective and the lenses are clean.
- C. light is centred, the stage is clean and the objective lens is turned to the highest magnification.
- D. light path is aligned correctly, all the lenses are clean and the lowest magnification lens is above the stage.

Question 3

What type of microscope is shown in the image above?

- A. phase contrast inverted microscope
- B. stereo or dissecting microscope
- C. scanning electron microscope
- D. brightfield light microscope

Question 4

A haemocytometer is referred to in a laboratory standard operating procedure (SOP).

What is this piece of equipment routinely used for?

- A. measuring blood volume
- B. counting cells under a light microscope
- C. counting chromosome numbers in a cell
- D. measuring cell size in an electron microscope

Question 5

A technician in a laboratory is asked to examine several blood smear slides to check the quality.

What properties would the technician be looking for in the smear on each slide?

- A. It is in the central two-thirds of the slide, and has a straight lateral border and short tongue-shaped tail.
- B. It covers the slide thickly, is spread evenly and has a straight end.
- C. It is a circular spot, in the centre of the slide, with no tail or drips.
- D. It starts thinly, increases in thickness and covers all the slide.

Question 6

A laboratory technician needs to follow SOPs in order to

- A. prevent data transcription errors.
- B. obtain the results the client expects.
- C. streamline the workflow in the laboratory.
- D. comply with the company's equal opportunity policies.

Question 7

A customer calls the testing laboratory of a company and makes a complaint.

What should the technician who answers the call do?

- A. Ask the customer to refer to the complaints policy on the company's webpage and send an email.
- B. Give the customer time to talk about the issue and ask them to call again if they have a similar problem.
- C. Listen carefully, make detailed notes and refer the complaint to the correct person or department or, if possible, act on it themselves.
- D. Explain to the customer that the company does everything to ensure accurate results and it would be unusual for a problem to occur.

Question 8

A testing laboratory carries out specialised tests on automated machines that use expensive reagents. The testing laboratory's customers expect same-day results.

Which one of the following is the most sustainable practice, minimising waste and achieving the desired outcome for the customer?

- A. Test each sample as it arrives at the laboratory.
- B. Ask customers to send samples only at the beginning of the day.
- C. Collect samples in batches on the same day and report results on the next day.
- D. Ask customers to send samples to the laboratory only when they have enough for a full machine load.

Question 9

A technician successfully trials a more efficient SOP for a chemical food test.

Before proceeding to use the alternative test, the technician should first

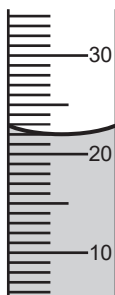
- A. locate the laboratory standards.
- B. check with their colleagues and supervisor.
- C. advise the clients about the change in the SOP.
- D. check the safety data sheet (SDS) of the food samples.

Question 10

After using a 25 mL volumetric pipette, a technician noticed a tiny, insoluble, gel-like particle inside the bulb of the pipette.

After the technician used the pipette several more times, the volume delivered was

- A. precise at 25.05 mL
- B. accurate at 25.05 mL
- C. precise at 24.95 mL
- D. accurate at 24.95 mL

Question 11

The volume of liquid indicated on the measuring cylinder above is closest to

- A. 21.5 mL
- B. 22.0 mL
- C. 23.0 mL
- D. 24.0 mL

Question 12

A laboratory technician has been asked to heat glucose in a crucible until it undergoes complete combustion.

Which one of the following lists the best safety controls to apply during this procedure?

- A. Wear safety goggles, nitrile gloves and a laboratory coat.
- B. Use tongs to move the crucible and wear a laboratory coat and face shield.
- C. Use a fume cupboard and wear safety glasses, heat gloves and a laboratory coat.
- D. Wear a face mask and safety glasses, use a heat mat to protect the bench, and stand well back.

Question 13

1.300 g of glucose ($M = 180.0 \text{ g/mol}$) undergoes complete combustion in a crucible. The number of moles of glucose required for this reaction is

- A. 0.0072
- B. 0.0720
- C. 0.7200
- D. 7.200

Question 14

Why is an acid or base indicator used during an acid-base titration?

- A. to accurately identify the end point
- B. to detect the pH of the solution
- C. to show that a chemical reaction is occurring
- D. to signal to the technician that the solution is neutral

Question 15

When flaming an inoculating loop using a Bunsen burner, it is best practice to

- A. place the inoculating loop into the yellow part of the flame.
- B. move the inoculating loop quickly in and out of a blue flame.
- C. heat the tip of the inoculating loop but remove it before it glows red.
- D. place the inoculating loop at a 60° angle into the blue part of the flame and heat until the wire glows red.

Question 16

The laboratory supervisor in a food testing laboratory instructs a technician to aseptically transfer some orange juice samples for microbial evaluation.

Transferring aseptically in this situation would **best** be achieved by

- A. autoclaving each sample.
- B. adding bleach to each sample before testing.
- C. working with cultures on an open laboratory bench.
- D. swabbing surfaces with 80% v/v ethanol and working near a Bunsen burner.

Question 17

A technician is required to make 200 mL of 0.5 M potassium hydroxide, KOH ($M = 56.11 \text{ g/mol}$).

What mass of KOH is needed?

- A. 0.1 g
- B. 1.0 g
- C. 2.8 g
- D. 5.6 g

Question 18

A series of standard solutions is prepared from a stock solution of 1.5 M hydrochloric acid, HCl. Initially 50 mL of HCl is added to a volumetric flask and 50 mL of distilled water is added. Then 50 mL of this solution is pipetted into another volumetric flask and 50 mL distilled water is added.

What is the concentration of the resulting solution?

- A. 0.125 M
- B. 0.325 M
- C. 0.375 M
- D. 0.750 M

Question 19

An agar slope is generally used to

- A. count the number of bacterial cells.
- B. maintain cultures for longer periods.
- C. isolate single colonies for identification.
- D. spread bacteria onto the whole surface evenly.

Question 20

A technician working with water samples from a sewage treatment plant accidentally spills a small amount of one sample onto a bench.

Which one of the following would be the most appropriate response from the technician?

- A. Use a sponge to wipe it up and inform the supervisor.
- B. Evacuate the area, call for assistance and read the SDS before cleaning up the spill.
- C. Wearing gloves, use paper towel to wipe up the spill and dispose of the paper towel in the biohazard waste bin.
- D. Wearing personal protective equipment (PPE), spray the spill with a disinfectant solution, leave for 20 minutes, use paper towel to wipe up and then dispose of the paper towel in the biohazard waste bin.

SECTION B – Short-answer questions**Instructions for Section B**

Answer **all** questions in the spaces provided.

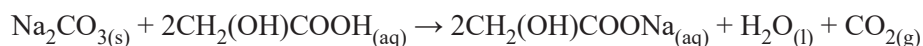
Question 1 (5 marks)

When preparing a saturated solution of glycolic acid, a technician spills 100 mL onto the bench in the laboratory.

The technician decides to use sodium carbonate powder to neutralise the acid before cleaning up the spill.

The molar mass of sodium carbonate is $M(\text{Na}_2\text{CO}_3) = 106 \text{ g/mol}$.

The equation for the reaction is



- a. Calculate the minimum mass, in grams, of sodium carbonate required to neutralise the spill. Show your working. 3 marks

- b. The technician cannot locate any sodium carbonate in the chemical store.

Describe **two** alternative methods the technician could use to clean up the spill. 2 marks

Question 2 (4 marks)

A technician is about to test for *Salmonella* bacteria in a new batch of airline food samples by inoculating agar plates. The technician puts on appropriate personal protective equipment (PPE).

Describe the four missing steps in the procedure the technician would use to prepare for and complete the transfer of the sample. Step 1 has been completed for you.

Step 1 *Spray the work area with 70% alcohol and wipe down bench.* _____

Step 2 _____

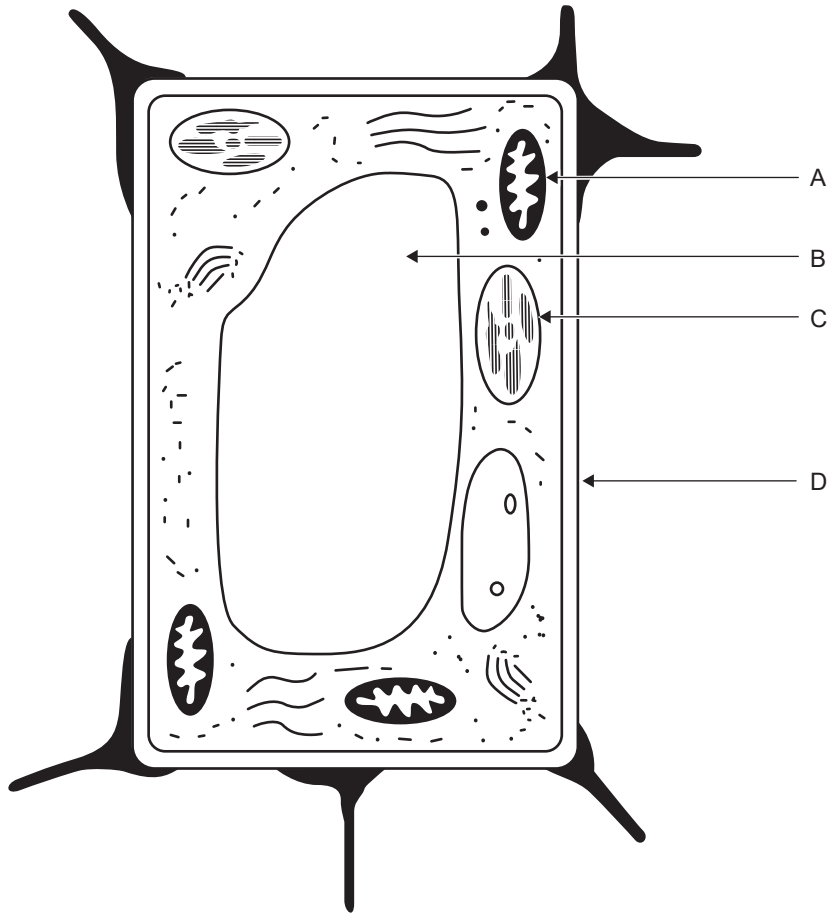
Step 3 _____

Step 4 _____

Step 5 _____

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Question 3 (5 marks)



a. Identify the cell type shown in the diagram above. 1 mark

b. Complete the table below by identifying the four cell structures labelled A to D in the diagram above. 4 marks

Label	Cell structure
A	
B	
C	
D	

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Question 4 (8 marks)

A technician has been asked to test a batch of ammonia-based cleaning solution that has been taken from a production line. The test that the technician will use is from a commercially produced kit, which consists of three reagents: ammonium chloride standard, Reagent A and Reagent B.

The kit instructions are given below.

Kit instructions

Use the provided stock ammonium chloride standard solution to prepare a fresh series of the ammonium chloride standards according to Table 1, below.

Each ammonium chloride standard and sample should be assayed in duplicate or triplicate.

A freshly prepared standard curve should be used each time the assay is performed.

Table 1. Preparation of ammonium chloride standards

Tube	Volume of 80 mM ammonium chloride standard (μL)	Volume of deionised water (μL)	Final ammonium chloride concentration (μM)	UV/Vis spectrophotometer optical density reading at 630 nm
1	5	495	800	0.75
2	250 of Tube 1	250	400	0.98
3	250 of Tube 2	250	200	0.54
4	250 of Tube 3	250	100	0.29
5	250 of Tube 4	250	50	0.18
6	250 of Tube 5	250	25	0.07
7	250 of Tube 6	250	12.5	0.03
8	0	500	0	0.00

Source: adapted from Cell Biolabs, Inc., *Ammonia Assay Kit* product manual, San Diego, California, 2017–2018, pp. 3 and 4, <www.cellbiolabs.com>.

- a. According to Table 1 in the kit instructions above, what type of dilution procedure should be used to prepare the standard curve?

1 mark

- b. According to the kit instructions above, each sample should be assayed in duplicate or triplicate.

Explain why this is recommended.

2 marks

- c. A sample from the sample batch of cleaning solution has an optical density (OD) reading of 2.35 at 630 nm.

Suggest a way to prepare this sample so that it would achieve a reading within the range of the standards, without changing the standards used.

2 marks

d.

Assay procedure

1. Add 100 μL of the ammonium chloride standards or samples to the wells of a multi-well plate.
2. Add 80 μL of Reagent A to each well, using an auto-pipette with a new tip. Mix the solution thoroughly and carefully to avoid foaming in the well.
3. Add 40 μL of Reagent B to each well, using an auto-pipette with a new tip. Mix the solution thoroughly and carefully to avoid foaming in the well.
4. Incubate for 30 minutes at 37 °C.
5. Place the multi-well plate in the UV/Vis spectrophotometer at 630–670 nm.

Source: adapted from Cell Biolabs, Inc., *Ammonia Assay Kit* product manual, San Diego, California, 2017–2018, p. 4, <www.cellbiolabs.com>.

Referring to the assay procedure above, give an example of a source of an error that might occur during this assay and explain how this error would affect the results.

2 marks

- e. Once the technician has performed the testing, all the standards and samples must be disposed of.

Give **one** disposal procedure that is appropriate for this chemical and avoids damage to the environment.

1 mark

Question 5 (10 marks)

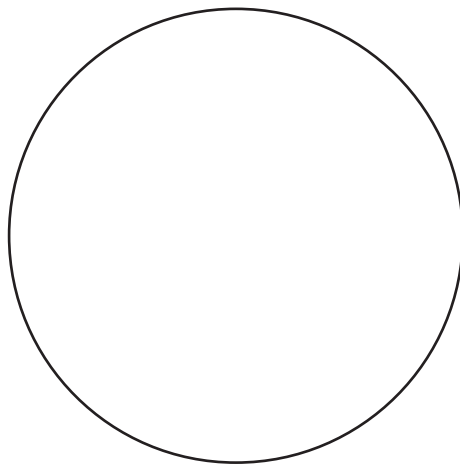
A technician has been asked to subculture a pure bacterial culture from one agar plate to another.

- a. Name the procedure used for the isolation of single colonies. 1 mark

- b. A diagram representing an agar plate is shown below.

- i. On the diagram, draw the location of the culture after 24 hours of incubation time. 2 marks

- ii. On the diagram, label **three** features of an ideal agar plate. 3 marks



- c. After the incubation period, the bacteria has spread all over the plate and no single colonies are visible.

Suggest a modification to the technician's technique and explain why this modification would improve their results. 2 marks

- d. After reviewing the culture on the plate, the laboratory supervisor suggests two possible disposal methods:

- Method 1 – Place contaminated bacterial culture plates into an autoclave bag and autoclave, and then dispose in the regular waste.
- Method 2 – Place contaminated bacterial culture plates in a biohazardous waste bin for collection by a registered waste disposal company.

Provide an advantage for each method. 2 marks

Method 1 _____

Method 2 _____

Question 6 (10 marks)

A technician prepares a solution of copper sulfate, CuSO_4 , ($M = 159.06 \text{ g/mol}$) and adds it to ethanol, $\text{CH}_3\text{CH}_2\text{OH}$. The technician finds the copper sulfate will not dissolve in ethanol; however, if they add the copper sulfate to water it does dissolve.

- a. What name is given to a liquid substance that disperses another substance in it? 1 mark

- b. Give a reason why the copper sulfate would not dissolve in ethanol. 1 mark

- c. One way to measure the concentration of a solution is to measure parts per million (ppm). The technician prepares 1 L of 0.1 M CuSO_4 by dissolving 15.906 g in 1 L of distilled water. Calculate the ppm of CuSO_4 in the solution. Show your working. 2 marks

- d. Describe a way the technician might increase the solubility of a substance without increasing the amount of liquid. Explain why this would work. 2 marks

- e. Name a document that the technician would refer to before preparing this solution and describe what information this document would provide. 2 marks

- f. Give an example of a safety precaution the technician should take when preparing this solution. Explain why this precaution should be applied. 2 marks

Question 7 (9 marks)

A testing laboratory receives a sample of water to test for *Escherichia coli* bacteria.

The following day the *E. coli* in the sample is counted by using the pour plate technique, which is repeated once. The plates are incubated overnight and the colonies are counted the next day. Test results show differences in bacteria count across the two duplicated sets of plates.

- a. Give **three** possible reasons why non-conformance has occurred. 3 marks

- b. Other than by bacterial count, explain **two** means by which laboratories can generally identify non-conformance. 4 marks

- c. A laboratory technician observes the non-conformance.
Explain what the technician could do to improve the results. 2 marks

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Question 8 (5 marks)

As the technician working in a research laboratory, you have been asked to select and set up a microscope that will be used to examine geological samples at least 2 cm in size, to identify large crystals.

- a. Name the type of microscope that you think is best to use to identify large crystals. 1 mark

- b. Give **two** reasons why you have selected this type of microscope. 2 marks

- c. The microscope that has been used to examine the geological samples is stored in a cupboard. Describe **two** steps you would take to put away the microscope after use. 2 marks

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Question 9 (6 marks)

Recently there has been a recall of butter products produced at a local dairy. The dairy company has sent several samples to a laboratory for microscopic analysis. As a laboratory technician, you have been asked to prepare microscope slides of the butter samples and examine these for microbial contamination.

- a. When the samples arrive at specimen reception, staff enter three identifiers into the laboratory management system (LMS) as the first step of the testing process.

What is **one** possible identifier?

1 mark

- b. Name the technique you would use to prepare the samples for examination under a light microscope.

1 mark

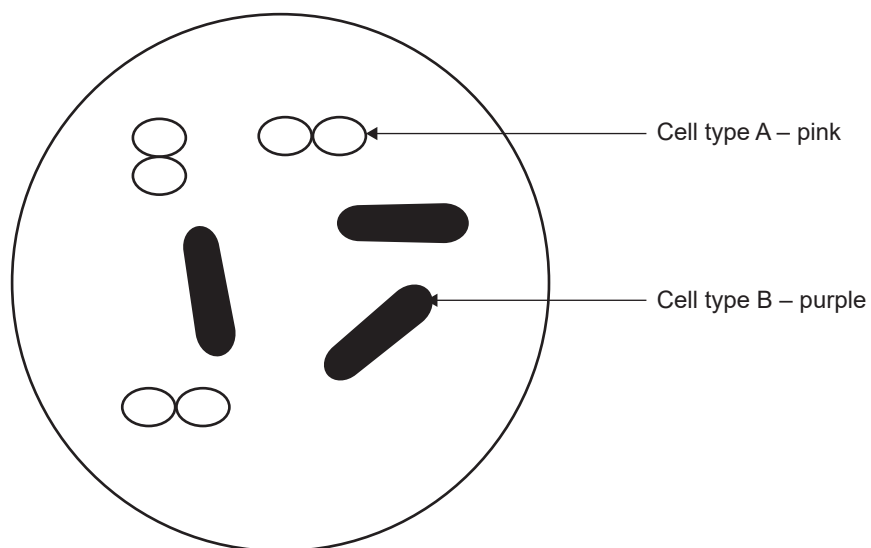
- c. At what magnification would it be best to make your observations? Give **one** reason for your response.

2 marks

- d. Below is a drawing of what you observed under the microscope.

Name the two cell types that have been labelled on the drawing below. Use correct scientific terminology.

2 marks



Cell type A _____

Cell type B _____

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Question 10 (8 marks)

A laboratory technician has recently started working in the quality control department of a large pharmaceutical company. All new staff are required to complete an induction program focusing on the company’s quality manual.

- a. Describe **three** types of information the laboratory technician would find in the quality manual. 3 marks

As part of their weekly tasks, laboratory technicians are required to calibrate the $-10\text{ }^{\circ}\text{C}$ to $110\text{ }^{\circ}\text{C}$ thermometers that are used to monitor the temperature of incubators in the microbiology laboratory.

- b. Explain why the thermometers should be calibrated. 2 marks

- c. Describe **one** way in which the laboratory technician could calibrate the thermometers. 3 marks

DO NOT WRITE IN THIS AREA

Question 11 (10 marks)

When working in a microbiology laboratory, you are asked to prepare nutrient agar plates to be used when testing food samples.

- a. What **four** materials and/or equipment would you need to undertake this task? Explain how you would use each of these in the process. 4 marks

- b. Describe **two** hazards you might encounter when preparing media. 2 marks

- c. Suggest **two** quality control steps you could take after you have prepared the nutrient agar plates. Explain why each of these steps is important. 4 marks

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