

STUDENT NUMBER           Letter

# VCE VET LABORATORY SKILLS

## Written examination

Wednesday 17 November 2021

Reading time: 9.00 am to 9.15 am (15 minutes)

Writing time: 9.15 am to 10.45 am (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	12	12	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 17 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**

A technician receives a telephone call from a client, asking for the laboratory results for a urine sample that was delivered to the laboratory the previous week.

What action should the technician take next?

- A. Locate the results and read them to the client on the phone.
- B. Consult with the laboratory manager before taking any action.
- C. Release the results to the client, then consult with the laboratory manager.
- D. Record the client's details and inform them that the laboratory manager will phone them back.

**Question 2**

Which one of the following would achieve the most accurate result when measuring a specific volume of liquid?

- A. a graduated beaker
- B. a measuring cylinder
- C. a plastic volumetric flask
- D. a conical flask used in a titration

**Question 3**

A technician is working with ultraviolet light sources in a laboratory.

In addition to a long-sleeved laboratory jacket with sleeves down, which items of personal protective equipment (PPE) will the technician need to wear?

- A. safety goggles and latex gloves
- B. latex gloves and closed-toe shoes
- C. polycarbonate face shield and latex gloves
- D. polycarbonate face shield and closed-toe shoes

**Question 4**

Which of the following organelles in cells can a technician identify using a light microscope?

- A. nucleus, cell wall, ribosome
- B. nucleus, chloroplast, ribosome
- C. nucleus, chloroplast, cell wall
- D. chloroplast, cell wall, endoplasmic reticulum

**Question 5**

A laboratory technician adopts a new structured process that provides faster results without compromising quality and occupational health and safety (OH&S) or using excessive resources or time.

When meeting customer expectations, which one of the following would **not** meet the 'right first time' objective?

- A. sustainable work practice
- B. increased lead times for clients
- C. correct results with reduced costs
- D. increased efficiency and productivity

**Question 6**

After adding 10 mL of 2 M hydrochloric acid, HCl, to 100 mL of aqueous solution without a buffer, a technician then uses a pH meter.

The pH meter is likely to indicate

- A. a decrease in pH.
- B. an increase in pH.
- C. a change in colour.
- D. no significant change in pH.

**Question 7**

The black stripes on the autoclave tape that is attached to the equipment being removed from an autoclave indicate that

- A. the autoclave is working effectively.
- B. all the contents of the autoclave have been decontaminated.
- C. the autoclave reached 121 °C for at least one minute.
- D. the autoclave reached the optimum temperature for the full cycle.

**Question 8**

A technician has finished the microscopic examination of a batch of contaminated orange juice samples.

What should the technician do next?

- A. Clean the glass slides after viewing the samples under the microscope, then check the standard operating procedures (SOP).
- B. Report to the supervisor after the examination, send the glass slides for disinfecting and send the samples for disposal.
- C. Report to the supervisor after cleaning the glass slides, check the SOP and throw the glass slides in the glass bin.
- D. Check the SOP, clean the glass slides upon completion of the examination and report to the supervisor.

**Question 9**

How much solute dissolved in water is required to make up a 400 mL solution of 1.5% w/v concentration?

- A. 60.0 g
- B. 6 g
- C. 2.6 g
- D. 0.60 g

**Question 10**

Using an acid-base reaction, a technician is to determine the concentration of dilute potassium hydroxide, KOH, by pipetting a 25 mL aliquot into a conical flask. The conical flask is then placed under a burette containing a standard solution of 0.05 M hydrochloric acid, HCl, and titrated.

Which of the following gives the substance that the pipette and the conical flask should be washed with before they are used?

	Pipette washed with	Conical flask washed with
A.	distilled water	distilled water
B.	distilled water	an acid
C.	an alkali	distilled water
D.	distilled water	an alkali

**Question 11**

Which autoclave cycle is most effective when sterilising wrapped glassware?

- A. pre-vacuum cycle with removal of air
- B. gravity cycle with absence of water
- C. pre-vacuum cycle with air still present
- D. gravity cycle with presence of steam

**Question 12**

The stain used to prepare pollen on a slide is a

- A. crystal violet stain.
- B. safranin O stain.
- C. fuchsine stain.
- D. iodine stain.

**Question 13**

The National Association of Testing Authorities (NATA) inspector requests to see a laboratory's records of test results, calibration techniques and reporting of non-conformances.

These records should be located in

- A. data for SI units in laboratory systems.
- B. all SOPs.
- C. criteria regularly used for laboratory equipment.
- D. the laboratory audit checklist folder.

**Question 14**

What is the mass, in grams, of sodium bicarbonate,  $\text{NaHCO}_3$ , (molar mass  $M = 84.008 \text{ g/mol}$ ) required to prepare 2 L of a 0.025 M solution?

- A. 4.2 g
- B. 4.8 g
- C. 12.6 g
- D. 22.4 g

**Question 15**

Why is it important for a technician to prevent contamination of the air in the laboratory when using an inoculation culture?

- A. to prevent contamination of the technician's laboratory coat
- B. to prevent contamination of the air and the respiratory tract of the technician
- C. to maintain quality control by ensuring sterility and checking for microbes
- D. to prevent contamination of the sample and to protect the integrity of the sample source

**Question 16**

Which of the following gives the shape and approximate size range of the bacteria *Bacillus*?

	Shape	Size
A.	spiral	approximately 0.8 $\mu\text{m}$ across by 50 $\mu\text{m}$ long
B.	spiral	approximately 8 $\mu\text{m}$ across by 60 $\mu\text{m}$ long
C.	rod	approximately 0.5–1.0 $\mu\text{m}$ across by 1.0–4.0 $\mu\text{m}$ long
D.	rod	approximately 6.0–10.0 $\mu\text{m}$ across by 1.0–3.0 $\mu\text{m}$ long

**Question 17**

A chemical safety cabinet in a laboratory has been relocated by contractors. A technician has been assigned to fill the chemical safety cabinet with a recent delivery of organic solvents.

The technician should first

- A. check if the maintenance log shows defects to the cabinet.
- B. obtain approval for a biosafety cabinet to be used instead.
- C. request that the cabinet be relocated to another laboratory.
- D. post clear signs specifying the contents of the cabinet on the laboratory doors.

**Question 18**

A technician tests a solution with pH indicator paper and records a pH of 6.9

This result shows that the solution is

- A. alkaline.
- B. inconclusive.
- C. weakly acidic.
- D. weakly alkaline.

**Question 19**

An inoculation culture is best described as the

- A. culture medium in the agar.
- B. pure stock in the media broth.
- C. culture that is to be transferred.
- D. client's sample for the laboratory.

**Question 20**

A technician has been instructed to examine a sample of pond water for the presence of live organisms. The technician will not use a stain for this slide.

Which microscope setting will be the most suitable for this examination?

- A. polarised
- B. phase contrast
- C. stereo microscope
- D. compound light microscope with graticule

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

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

**Question 1** (8 marks)

A laboratory technician is implementing sustainability principles across several adjoining testing laboratories that they are in charge of.

- a. List **three** specific sustainability practices that could be implemented. 3 marks

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- b. How can the technician ensure that sustainability practices are adopted across all the laboratories they are in charge of? Give **three** examples. 3 marks

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- c. Suggest **two** ways in which the technician can monitor the implementation of sustainable practices within the laboratories. 2 marks

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**Question 2** (10 marks)

A technician performs a serial dilution with 2.4 M concentrated sulfuric acid,  $\text{H}_2\text{SO}_4$ .

Dilution 1: The technician transfers 25 mL of the 2.4 M concentrated  $\text{H}_2\text{SO}_4$  solution into a 100 mL volumetric flask and adds 75 mL of distilled water to make a 100 mL solution.

Dilution 2: The technician transfers 25 mL of the solution from Dilution 1 into a 100 mL volumetric flask and adds 75 mL of distilled water to make a 100 mL solution.

- a. The safety data sheet (SDS) and the stock bottle label both show the 'Hazchem' sign below.

Fill in the missing word, indicated by the asterisk (\*) on the 'Hazchem' sign, in the space provided.

1 mark



- b. Which **three** items of personal protective equipment (PPE) must the technician wear?

3 marks

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- c. What is the molar concentration of the final solution? Show your working.

5 marks

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- d. How many elements are there in sulfuric acid?

1 mark

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**Question 3** (4 marks)

A technician receives a batch of sample animal feeds to test for the presence of salmonella.

Describe the four steps in the daily cleaning procedure that should be carried out in the technician's laboratory before any work can start. The technician is already wearing PPE.

Step 1 \_\_\_\_\_

Step 2 \_\_\_\_\_

Step 3 \_\_\_\_\_

Step 4 \_\_\_\_\_

**Question 4** (8 marks)

a. Explain the function of each of the parts of a light microscope given in the table below.

One row has been completed as an example.

4 marks

<b>Part of light microscope</b>	<b>Function</b>
focus control dial	<i>used to adjust the area to be viewed and sharpen the image of the field of view</i>
objective lens	
stage with stage clips	
diaphragm or iris	
eyepiece	

b. Many light microscopes have three objective lenses.

What is the magnification size of each objective lens?

3 marks

Objective lens 1 \_\_\_\_\_

Objective lens 2 \_\_\_\_\_

Objective lens 3 \_\_\_\_\_

c. Explain how the objective lens will change the technician's view.

1 mark

\_\_\_\_\_

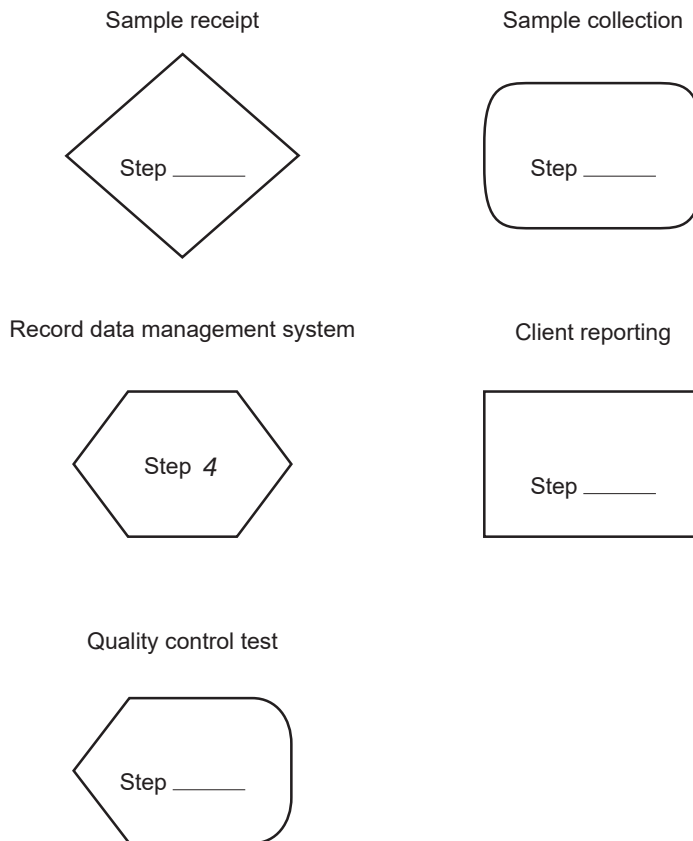
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**Question 5** (9 marks)

An environmental testing laboratory is required to determine the amount of potassium nitrate,  $\text{KNO}_3$ , in a sample of fertilisers.

- a. The laboratory uses the workflow diagram below to perform the required test. The testing process has been divided into five steps. These steps are not shown in the correct order in the workflow diagram.

Label each step according to its order of completion by writing the numbers 1, 2, 3 or 5 in the space provided in each shape. Step 4 has been completed for you as an example. 4 marks



- b. Give **two** benefits to the client if the laboratory is accredited. 2 marks

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- c. The results show that a 1.50 kg bag of fertiliser contains 855 g of  $\text{KNO}_3$ .

What is the percentage w/w of  $\text{KNO}_3$  in the fertiliser? Show your working. 3 marks

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**Question 6** (11 marks)

A trainee technician was asked to perform one of the laboratory's quality assurance procedures to verify the concentration of sulfuric acid,  $\text{H}_2\text{SO}_4$ .

- a. The standard operating procedure (SOP) below was followed to determine the concentration of  $\text{H}_2\text{SO}_4$  using an acid-base titration.

Write the missing words for each step of the procedure in the spaces provided. Step 8 has been completed as an example. 6 marks

Step 1: A trainee laboratory technician accurately weighs 6 g of potassium hydroxide, KOH, as it is to be used as a \_\_\_\_\_ solution.

Step 2: The KOH is placed into a \_\_\_\_\_ flask, and is then stoppered and shaken with approximately 100 mL of deionised water until all solid KOH dissolves.

Step 3: More water is added to make the solution up to a volume of exactly 200.0 mL.

Step 4: A \_\_\_\_\_ is then filled with the KOH solution.

Step 5: An aliquot of 10.00 mL of 0.01 M  $\text{H}_2\text{SO}_4$  is taken by using a \_\_\_\_\_, which is then placed into a \_\_\_\_\_ flask.

Step 6: Three to four drops of indicator are added and the  $\text{H}_2\text{SO}_4$  solution is titrated against the KOH solution until the \_\_\_\_\_ is detected.

Step 7: The top of the meniscus is then read and a titre is recorded.

Step 8: The *titration* is repeated until three concordant results are achieved.

- b. What is another name for an acid-base reaction? 1 mark

\_\_\_\_\_

- c. The calculated concentration of the acid is lower than expected.

Explain why this has occurred. 2 marks

\_\_\_\_\_

\_\_\_\_\_

- d. Complete the following reaction. 1 mark

acid + base  $\longrightarrow$  \_\_\_\_\_

- e. 20 g of KOH is dissolved in water to make up a 700 mL solution.

What is the percentage w/v of the KOH solution? Show your working.

1 mark

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**Question 7 (6 marks)**

For each of the following sterilisation techniques, give one advantage, one disadvantage and an example of the use of the technique in a laboratory.

- Autoclaving

Advantage \_\_\_\_\_

\_\_\_\_\_

Disadvantage \_\_\_\_\_

\_\_\_\_\_

One example of use in a laboratory \_\_\_\_\_

\_\_\_\_\_

- Membrane filtration

Advantage \_\_\_\_\_

\_\_\_\_\_

Disadvantage \_\_\_\_\_

\_\_\_\_\_

One example of use in a laboratory \_\_\_\_\_

\_\_\_\_\_

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**Question 8** (9 marks)

A technician has received a yeast sample for testing from a yeast production company in the food manufacturing industry. The yeast sample needs to be tested for cell viability and cell density.

The sample was diluted 1:10, stained with methylene blue, mounted in a counting chamber and counted. The results were recorded.

The acceptable percentage viability count is 85%.

The acceptable cell density count is 8000 yeast cells per millilitre.

The results of the counting chamber readings are shown in the table below.

Identification of counted square	Live cell numbers	Dead cell numbers
Square A	6	3
Square B	9	1
Square C	7	2
Square D	9	0

The formulas for percentage cell viability and cell density are given below.

$$\text{percentage cell viability} = \frac{(\text{number of viable cells})}{(\text{total number of viable and dead cells})} \times 100$$

$$\text{cell density} = \frac{(\text{number of viable cells}) \times 10^4 \times \text{dilution factor}}{(\text{number of corner squares counted})} \text{ in cells per mL}$$

- a. How can the technician determine the difference between the live cells and the dead cells on the counting slide? 2 marks

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- b. Calculate the percentage cell viability of the yeast sample using the chamber slide results. Show your working. 2 marks

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- c. Calculate the cell density of the yeast sample. Show your working and include units. 2 marks

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- d. Referring to your calculated results for percentage cell viability and cell density, list **three** pieces of feedback that the technician would give to their supervisor. 3 marks

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**Question 9** (2 marks)

During atomisation of a blank control when using atomic absorption spectroscopy (AAS), a technician notices that the blank sodium solution has a reading suggesting the presence of sodium. The technician checks the stock date for the blank solution and finds that it has not expired. The technician reports their findings to their supervisor.

Identify **two** steps that the supervisor would instruct the technician to take.

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**Question 10** (8 marks)

A new technician has been given a bacteria media from a yoghurt sample and has been asked to prepare media plates. The technician is keen to follow the laboratory's established procedures. This includes finding the SOP for aseptic technique.

In the past, the laboratory has been staffed with very experienced, long-term employees. This has meant that some of the SOPs have not been updated for some time.

The technician reads the SOP and finds some important details missing. Missing details in the SOP can lead to potential areas of contamination in the laboratory.

The technician creates a list of five important points to discuss with their supervisor, connected to five laboratory procedures. These procedures are listed in the table below.

Complete the table by identifying a potential area of contamination for each laboratory procedure listed and by providing an example of good practice. The first row has been completed for you.

Laboratory procedure	Area of contamination	Example of good practice
A. Wearing appropriate PPE	<i>Aerosols and fragments of dust from the technician's clothes and fingers may be potential sources of contamination.</i>	<i>wear goggles and gloves, roll up laboratory jacket sleeves</i>
B. Housekeeping at workstation		
C. Leaving lit Bunsen burner standing on bench		
D. Removing media bottle and Petri dish lid		
E. Sterilising loop in Bunsen burner flame		



**Question 11** (3 marks)

A technician is about to begin training in testing canned tuna for mercury.

The technician has recently learnt that it is important to have standards of a known concentration when determining the concentration of mercury in a food sample.

Explain why it is important to have standards of a known concentration of mercury when completing this test.

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**Question 12** (2 marks)

A calibration curve is determined by a technician using AAS for lead, Pb, standard solutions.

However, one of the standard vial solutions was contaminated with additional lead, making the calibration curve overestimated.

- a. What should the technician do next? 1 mark

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- b. Will the Pb sample that was tested be overestimated or underestimated? 1 mark

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