

**Victorian Certificate of Education**  
**Year**

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER           Letter

**VCE VET LABORATORY SKILLS**  
**Written examination**

Day Date

Reading time: \*.\* to \*.\* (15 minutes)

Writing time: \*.\* to \*.\* (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 16 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** for 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 streak plate is used to

- A. maintain cultures for long periods.
- B. count the number of bacterial cells.
- C. ensure the bacteria are spread evenly.
- D. isolate single colonies for identification.

**Question 2**

In a titration, a burette is used to

- A. accurately add the indicator.
- B. accurately add the standard reagent.
- C. measure the mass of the unknown sample.
- D. measure the concentration of the unknown sample.

**Question 3**

Which one of the following is an example of a systematic error?

- A. measuring either the top or the bottom of the meniscus
- B. ignoring a small amount of a sample that has been spilt on the bench
- C. using two different watches to take measurement times in a chemical experiment
- D. using an incorrectly calibrated digital thermometer to measure the temperature of an incubator

**Question 4**

To focus a light microscope at high magnification (400×)

- A. use the coarse adjustment, then the fine focus.
- B. open all diaphragms to allow more light into the lens.
- C. make sure the objective lens is as close as possible to the slide.
- D. focus at lower magnification before attempting to focus at higher magnification.

**Question 5**

A colony on an agar plate is a

- A. group of bacterial cells that appear similar.
- B. group of identical bacterial cells that form a clump.
- C. mixed group of bacterial cells that are growing together.
- D. group of bacterial cells that are derived from a single original cell.

**Question 6**

To prepare a standard solution of sodium carbonate, what glassware should be used?

- A. measuring cylinder, dropper pipette and beaker
- B. volumetric pipette, small funnel and conical flask
- C. volumetric flask, small funnel and dropper pipette
- D. measuring cylinder, dropper pipette and conical flask

**Question 7**

Disinfection is a process used by laboratory workers to

- A. handle microbes safely.
- B. clean laboratory work areas.
- C. reduce the number of pathogenic microbes on surfaces.
- D. remove all bacteria from glassware and instruments before use.

**Question 8**

How many grams of NaCl would be required to prepare 200 mL of 5% (w/v) sodium chloride solution?

- A. 5
- B. 10
- C. 15
- D. 20

**Question 9**

The production of waste is a problem for all laboratories.

The amount of waste produced will increase if

- A. spillages are kept to a minimum.
- B. standard operating procedures (SOP) are followed.
- C. poor quality materials that produce unreliable results are used.
- D. the correct quantity of chemicals is used when undertaking a process.

**Question 10**

A buffer solution is prepared according to the method specified by the laboratory's SOP manual.

Which one of the following tests would be helpful in determining that the solution is suitable for use?

- A. Measure the pH of the solution.
- B. Titrate against a standard solution.
- C. Incubate a sample of the solution at 36 °C overnight.
- D. Heat a sample of the solution to determine its boiling point.

**Question 11**

Resolution can be defined as

- A. how large a specimen appears.
- B. how clear and sharp a specimen appears.
- C. the distance between the objective lens and the slide.
- D. the relationship between the cone of light and the size of the lens.

**Question 12**

A primary standard is

- A. a substance dissolved in a known volume of water.
- B. the mass of a substance dissolved in a known volume of water.
- C. a substance that is reacted with a substance whose concentration is known accurately.
- D. a pure substance that can be used to determine the concentration of other substances.

**Question 13**

A laboratory wants to employ staff who are focused on responsibility and accuracy.

Which one of the following would be most consistent with this objective?

- A. maintaining an attitude of 'right first time'
- B. sharing information with friends and colleagues
- C. changing SOP in order to accelerate result times
- D. working independently and limiting communication with other members of the team

**Question 14**

Which one of the following is an example of a good aseptic technique?

- A. opening all containers before commencing work
- B. working in a fume cupboard to avoid toxic fumes
- C. flaming the lids of Petri dishes after streaking a plate
- D. sterilising all equipment before carrying out a procedure

**Question 15**

A chemical that has a 'dangerous goods' classification

- A. can be stored anywhere in the laboratory.
- B. is safe to use in most laboratory situations.
- C. can be immediately dangerous to a person or the environment.
- D. can be hazardous to a person's health over a long period of time.

**Question 16**

Before discarding wastes containing spore-forming bacteria, the wastes should be

- A. treated with 0.01% hypochlorite solution.
- B. treated with 80% ethanol for several minutes.
- C. exposed to ultraviolet light in a biosafety cabinet.
- D. autoclaved at the correct temperature and pressure for the required time.

**Question 17**

Which feature of a microscope enables the user to switch from one objective to another without altering the focus?

- A. bifocal lens
- B. parfocal lens
- C. multifocal lens
- D. astigmatism

**Question 18**

Flaming is a technique used to

- A. clean instruments after use.
- B. sterilise glassware before use.
- C. remove inoculum from a loop.
- D. clean hands after working with bacteria.

**Question 19**

A chemical has been spilt on the floor of a laboratory.

What is the first action that should be taken?

- A. Report the spill to the supervisor as they will know what to do.
- B. Wipe up the spill immediately with a paper towel and discard the paper towel in the bin.
- C. Alert other staff in the area and read the material safety data sheet (MSDS) before cleaning up the spill.
- D. Spread disinfectant on the spill and leave it for 20 minutes before wiping it up with a paper towel and discarding the paper towel in a biohazardous waste bin.

**Question 20**

The decolourising step in the Gram stain technique is used to

- A. adjust the pH of the stain to make it a direct stain.
- B. preserve the cells' structure and adhere cells to the slide.
- C. maintain osmotic pressure in a solution to prevent cell lysis.
- D. break down a cell wall to allow the counter stain to penetrate the cell wall.

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

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

**Question 1** (9 marks)

Jo has recently commenced work as a laboratory technician in the quality control department of a large pharmaceutical company. As part of her company induction program, Jo is asked to become familiar with the quality manual.

- a.** List three documents Jo would find in the quality manual. 3 marks

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

As part of her duties, Jo is required to calibrate the thermometers that are used to monitor the temperature of incubators in the microbiology laboratory.

- b. i.** Why does Jo need to calibrate the thermometers? 1 mark

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- ii.** Describe how Jo would calibrate the thermometers. 1 mark

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- iii.** Where should Jo record the results of her calibration work? 1 mark

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- c. In addition to checking the temperature of the incubators on a daily basis, Jo must graph the data collected.

Her daily recordings for the 36 °C or 2 °C incubator readings are shown below.

Day	1	2	3	4	5	6	7	8	9	10
Temperature (°C)	36.0	36.6	36.4	37.0	36.5	37.5	39.0	39.4	38.0	38.5

- i. Prepare a trend graph of the data on the axes provided below.

2 marks



- ii. What could be added to the graph to make non-conformances more readily identified?

1 mark

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**Question 2** (7 marks)

A quality system must include steps towards continuous improvement and require that non-conformances be identified and acted upon.

- a.** Define the term ‘non-conformance’. 1 mark

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- b.** Describe **two** ways in which non-conformance may be detected. 2 marks

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- c.** Describe the benefits of continuous improvement in laboratory practice. 4 marks

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**Question 3** (9 marks)

Maree, the laboratory technician in a meat-processing plant, takes 10 small pieces of meat from each batch of sausages produced, purees them in a blender with a sterile buffer solution and then transfers a 1 mL sample aseptically onto sterile agar plates.

- a.** List the three essential components of the plate media that will allow bacteria to grow. 3 marks

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

- b.** Maree has prepared the plate count media from a dried powder mix.

Briefly describe what she should do to sterilise the media and maintain the sterility of the poured plates.

2 marks

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- c.** What tests would Maree need to undertake as part of the media preparation procedure to ensure that the media is suitable for use?

2 marks

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- d.** Describe the steps that Maree should take if the media is found to be unsuitable for use.

2 marks

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**Question 4** (4 marks)

Some bacterial cultures are considered hazardous and can cause serious illness.

List four ways to reduce the risk to a technician when they handle bacterial cultures.

1. \_\_\_\_\_

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2. \_\_\_\_\_

\_\_\_\_\_

3. \_\_\_\_\_

\_\_\_\_\_

4. \_\_\_\_\_

\_\_\_\_\_

**Question 5** (7 marks)

Peter follows a standard operating procedure (SOP) to count the number of bacteria in a water sample. He commences by making serial dilutions of the water in sterile buffered diluents, adding 1 mL of each dilution to a 9 mL sterile agar deep, then mixing and pouring the mixture into a sterile Petri dish. Each sample is tested in duplicate.

Tenfold dilutions are used, starting with undiluted water and ending at a dilution of 1:1000.

A negative control is also included, which is prepared by adding 1 mL of buffered diluent to a 9 mL sterile agar deep.

- a.** Name three pieces of equipment that Peter would need to select before he commences the procedure. 3 marks

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

- b.** How could Peter maintain the sterility of the buffered diluents? 1 mark

\_\_\_\_\_

\_\_\_\_\_

- c.** Name two essential items of labelling that would be required on each Petri dish. 2 marks

1. \_\_\_\_\_

2. \_\_\_\_\_

- d.** What is the function of the negative control? 1 mark

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\_\_\_\_\_

**Question 6** (10 marks)

A water-testing laboratory uses an analytical procedure to determine the level of copper in drinking water. The test requires a series of copper standard solutions to be prepared and the absorbance is measured at the optimum wavelength of 580 nm on a calibrated visible spectrophotometer.

To prepare the standard solutions, the technician places copper metal in a 250 mL beaker to which 20 mL of 5 M nitric acid,  $\text{HNO}_3$ , is added. This is heated gently until the copper is fully dissolved and then 50 mL of deionised water is added. The solution is stirred, cooled and transferred into a 1 L volumetric flask; deionised water is added and made up to the 1 L mark. This stock solution is then diluted to make up the various concentrations of the other standard solutions.

- a. List two safety measures that should be taken when dissolving the copper in the nitric acid solution. 2 marks

1. \_\_\_\_\_

2. \_\_\_\_\_

- b. If the stock solution needs to have a concentration of 0.2 mg/mL, what mass of copper, in grams, is required to be dissolved to prepare the 1 L of stock solution? Show your calculations. 2 marks

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\_\_\_\_\_

\_\_\_\_\_

- c. The results of the measurement of the absorbance of the copper standards in a visible spectrophotometer are shown in the following table.

Copper concentration (mg/mL)	Absorbance
0.000	0.000
0.004	0.110
0.010	0.301
0.020	0.600

Plot the graph of absorbance (A) versus concentration of copper (Conc) on the axes provided below. 3 marks



- d. The technician then tests a water sample from a reservoir and the absorbance reading is 0.350  
What is the concentration of copper in the sample? 1 mark

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- e. What is the concentration of nitric acid in the 1 L copper standard flask? Show your calculations. 2 marks

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**Question 7 (9 marks)**

A 25 mL aliquot of vinegar (which contains acetic acid,  $\text{CH}_3\text{COOH}$ ) was analysed by titration with standardised 0.110 M sodium hydroxide, NaOH. Three drops of phenolphthalein were added to the vinegar before it was titrated. An average titre of 18.35 mL was required to reach the end point.

- a. Why was phenolphthalein added to the vinegar? 1 mark

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- b. Define the term 'equivalence point'. 1 mark

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- c. List three pieces of equipment needed to perform this analysis. 3 marks

1. \_\_\_\_\_

2. \_\_\_\_\_

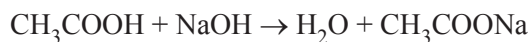
3. \_\_\_\_\_

- d. Explain why an average titre is used in titrations. 1 mark

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- e. The equation for the reaction is



The molar mass of acetic acid is 60.00 g/mol.

Calculate the mass, in grams, of acetic acid in the 25 mL sample of vinegar. Show your working.

3 marks

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**Question 8** (4 marks)

A technician in a quality-testing laboratory is testing food samples and is required to check the pH of a buffer solution.

- a. What is meant by the term ‘buffer’?

1 mark

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- b. The pH of the buffer solution was measured at 5.6, but it should be neutral.

Explain how the technician would change the pH of the solution so that it is neutral.

2 marks

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- c. After adjusting the buffer solution’s pH, the technician notices a white fluffy precipitate in the buffer stock bottle.

What action should the technician take?

1 mark

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**Question 9** (2 marks)

List two things a technician would need to check in order to ensure the chemicals in a storage room are suitable for use.

1. \_\_\_\_\_
2. \_\_\_\_\_

**Question 10** (12 marks)

The microbiology technician in a teaching laboratory has been asked to prepare some demonstration slides of bacterial cultures for students to examine in a practical class.

- a. Name the staining technique that would be most suitable for this purpose. 1 mark

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- b. What must be done to a smear before it is stained and why is this required? 2 marks

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- c. Describe the steps used in the staining technique. 5 marks

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- d. What type of microscope and magnification would be best for this task? Give **one** reason for your answer. 2 marks

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- e. Describe **two** possible results of the staining technique used. 2 marks

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**Question 11** (3 marks)

A slide is being examined under a microscope and a black mark is noticed in the field of view. The black mark does not move when the slide is moved up or down, left or right.

- a. What is the most likely explanation for this observation? 1 mark

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- b. How would this problem be corrected? 2 marks

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**Question 12** (4 marks)

A technician in a haematology laboratory has been asked to perform a manual count of red blood cells (RBC) in a sample taken from a patient.

- a. In addition to a bright field microscope, what piece of specialised equipment would the technician need to perform the count? 1 mark

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- b. Name **one** occupational health and safety feature of the work station that the technician needs to ensure is correct before commencing the counting procedure. 1 mark

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- c. A sample of blood is counted and the result is recorded as  $5.25 \times 10^8$  RBC/ $\mu$ L.  
How many red blood cells would there be in a litre of blood from this patient? Show your calculations. 1 mark

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- d. After performing the count, how should the technician clean the equipment used? 1 mark

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**Answers to multiple-choice questions**

<b>Question</b>	<b>Answer</b>
1	D
2	B
3	C
4	D
5	D
6	C
7	C
8	B
9	C
10	A
11	B
12	D
13	D
14	D
15	C
16	A
17	A
18	B
19	C
20	D