



Victorian Certificate of Education 2011

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Figures

Words

Letter

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VCE VET LABORATORY SKILLS

Written examination

Wednesday 23 November 2011

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 – Core – multiple choice	20	20	20
B – Core – short answer	6	6	40
	<i>Number of electives</i>	<i>Number of electives to be answered</i>	
C – Electives	3	2	40
			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 white out liquid/tape.

Materials supplied

- Question and answer book of 18 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 – Core units – 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

Laboratory Occupational Health and Safety (OH&S) procedures are required because

- A. there are specific hazards in laboratories.
- B. OH&S laws are much stricter for laboratories.
- C. the consequences of unsafe procedures are less serious.
- D. the *Occupational Health and Safety Act 2004* does not apply to laboratories.

Question 2

Laboratory technicians can contribute to quality objectives in their laboratory work by

- A. working closely with other staff members.
- B. seeking advice when unsure of procedures.
- C. recording all data accurately in relevant logbooks.
- D. identifying and reporting opportunities for improvement.

Question 3

Which of the following behaviours best meets the objectives of ‘right first time’ and job ownership?

- A. remembering the results and recording them later
- B. writing the results immediately on a piece of paper
- C. entering the results into the laboratory information management system
- D. asking another team member to enter the results into the laboratory management system

Question 4

Valid conclusions can be made from scientific experiments when

- A. expected results are obtained.
- B. unexpected results are obtained.
- C. repeated trials provide the same or similar results.
- D. at least one trial provides a result suggesting the expected results.

Question 5

The production of waste is a problem for some laboratories.

The amount of waste produced will increase if

- A. poor quality materials are used.
- B. spillages are kept to a minimum.
- C. standard operating procedures are followed.
- D. the correct quantity of chemicals is used when undertaking a task.

Question 6

When setting up an autoclave or steam steriliser you should

- A. make sure the smoke alarm is switched off.
- B. ensure the probe is plugged into the meter.
- C. check that the water level is adequate.
- D. inspect for dirt on the glassware.

Question 7

Microscopic examination of bacteria is usually conducted using a 100x objective with

- A. oil.
- B. water.
- C. bleach.
- D. alcohol.

Question 8

In a microbiology laboratory, bottles of contaminated liquid waste should be disposed of

- A. in the bin.
- B. after re-sterilisation.
- C. directly down the sink, flushing with plenty of water.
- D. down the sink, following treatment with a neutralising agent.

Question 9

Visible light is used in biohazard cabinets

- A. to see what you are doing.
- B. to purify the air in the cabinet.
- C. to decontaminate the work surfaces.
- D. to sterilise culture medium prepared in the cabinet.

Question 10

Plastic Petri dishes are often sterilised using

- A. X-rays.
- B. autoclaving.
- C. 70% alcohol.
- D. gamma radiation.

Question 11

A 1:10 dilution of E. coli is made by aseptically adding 1 mL of the bacteria to 9 mL of buffered peptone water.

The 1 mL is measured using a

- A. pipette.
- B. sterile pipette.
- C. volumetric flask.
- D. sterile measuring cylinder.

Question 12

Which one of the following may generate bacterial aerosols even when being used correctly?

- A. vortex mixer
- B. biohazard cabinet
- C. autoclave
- D. analytical balance

Question 13

The density of any solid is defined as the mass per unit volume.

If a solid has a mass of 10 g and a volume of 2 cm³ it will have a density of

- A. 0.2 g/cm³
- B. 5 g/cm³
- C. 10 g/cm³
- D. 20 g/cm³

Question 14

2 mL of a reagent diluted with 18 mL of diluent is equivalent to a

- A. 2:18 dilution.
- B. 2:10 dilution.
- C. 1:15 dilution.
- D. 1:10 dilution.

Question 15

Sodium is always stored under a liquid.

Under which liquid is it stored and why?

- A. oil because water evaporates too quickly
- B. alcohol because oil is too hard to remove
- C. oil because sodium reacts violently with water
- D. alcohol because oil and water decompose the sodium

Question 16

Safety filling devices for manual pipettes are used

- A. when the laboratory worker has time.
- B. at all times to ensure workers are protected.
- C. only when the liquid is harmful in some way.
- D. only when the standard operating procedure directs that they should be used.

Question 17

A solution of concentration (%V/V) is prepared by measuring the

- A. mass of a solute and adding solvent to a predetermined volume.
- B. mass of a liquid solute and adding a predetermined mass of solvent.
- C. mass of a liquid solute and adding solvent to a predetermined volume.
- D. volume of a liquid solute and adding solvent to a predetermined volume.

Question 18

Aqueous-based sodium hydroxide solutions need to be standardised regularly because

- A. sodium hydroxide reacts violently with water.
- B. nitrogen dissolves from air, increasing its concentration.
- C. the sodium hydroxide evaporates slowly if containers are continually left open.
- D. carbon dioxide in the air reacts with the sodium hydroxide, lowering its concentration.

Question 19

A laboratory assistant is required to prepare 100 mL of a 10 mg/mL standard solution for an assay using a finely powdered solid.

Select the correct mass that should be weighed out.

- A. 100 mg
- B. 1 000 mg
- C. 100 000 mg
- D. 1 000 g

Question 20

Standard Operating Procedures state that juice prepared for human consumption should be slightly acidic.

Which of the following pH levels would be suitable?

- A. 2.4
- B. 6.8
- C. 7.2
- D. 10.6

SECTION B – Core units – Short answer questions**Instructions for Section B**

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

Question 1

The following table shows the daily temperature recordings for a laboratory incubator for the first 10 days of July 2011. The standard operating procedure for this incubator states that the temperature must be $37.0\text{ }^{\circ}\text{C} \pm 0.2\text{ }^{\circ}\text{C}$.

Date	1/7	2/7	3/7	4/7	5/7	6/7	7/7	8/7	9/7	10/7
Temperature	37.1	37.2	36.9	37.1	37.4	37.1	36.8	37.2	36.7	37.0

- a. On which days did temperature nonconformance occur?

2 marks

- b. How can this data be presented to make these nonconformances more visible? You may use diagrams to answer this question.

2 marks

- c. Currently, the incubator temperature is read once daily on a mercury thermometer.
Explain how this system could be improved.

3 marks

Question 2

Urine samples are tested in the laboratory as soon as possible after arrival. The urine test kits contain unstable reagents which can only be used within 30 minutes of preparation.

The work practices of the laboratory are being reviewed and it has been suggested that samples be held and tested at 3.30 each afternoon.

Would this be a more or less efficient and sustainable practice? Explain your response.

3 marks

Question 3

A technician is preparing to use a biohazard cabinet to dispense sterile culture medium into a number of smaller sterile bottles.

- a. What are the two most important pieces of Personal Protective Equipment (PPE) needed for this task?

2 marks

- b. List three pieces of equipment, other than PPE, needed for this task.

1. _____

2. _____

3. _____

3 marks

- c. List three tasks required before commencing work in the cabinet, other than PPE.

1. _____

2. _____

3. _____

3 marks

- d. What does the technician need to do after the transfers are complete?

2 marks

Question 4

Explain how to transfer 1 mL of an overnight culture of salmonella species to a sterile bottle of nutrient broth.

5 marks

Question 5

Anika is a laboratory assistant. She is following an operating procedure to prepare a 0.500 M copper sulphate solution. The procedure instructs her to dissolve a mass of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (hydrated copper sulphate) in water and make up to 500 mL total volume. When Anika collects the required equipment, the bottle of copper sulphate is labelled 'anhydrous copper sulphate', with formula CuSO_4 . She is uncertain what to do next.

a. Suggest two appropriate actions Anika could take before proceeding.

1. _____

2. _____

2 marks

b. What number of mole of CuSO_4 would be present in 500 mL of a 0.500 M solution?

3 marks

c. If the formula weight of CuSO_4 is 159.61 g/mol, calculate the mass of CuSO_4 required to provide the number of mole calculated in **part b.** above.

3 marks

Question 6

Sodium chloride has a formula weight (molar mass) of 58.44 g/mol and can be used to estimate concentrations of silver ions in solution by first preparing a 0.100 M primary standard solution of sodium chloride.

- a. If 500 mL of 0.100 M sodium chloride solution is prepared, how many mole of sodium chloride is present?

3 marks

- b. To prepare the **standard** solution, what mass of solid sodium chloride must be weighed?

2 marks

- c. What type of glassware should be used to make up the standard solution?

1 mark

- d. Solid sodium chloride can be provided as a technical grade, commercial grade, laboratory reagent or analytical reagent.

For the primary standard solution here, what form of the solid must be used?

1 mark

Total 40 marks

**END OF SECTION B
TURN OVER**

SECTION C – Electives

Instructions for Section C
 Complete **two** electives **only**. Answer **all** questions within the **two** chosen electives in the spaces provided.

Elective 1 – PMLTEST308A – Perform microscopic examination

Question 1

The light microscope has a number of major components with specific functions that are used to adjust images and observe specimens.

Function

- A. used to observe bacteria
- B. moderates light intensity
- C. sharpens specimen image
- D. measures specimen dimensions
- E. collects and directs light

a. Match the component of the microscope with the function above.

Use A–E to indicate your match in the table below.

Microscopic component	Function
graticule	
fine focus control	
condenser	
oil immersion lens	
iris diaphragm	

5 marks

b. i. List two important rules to observe when setting up a microscope before each use.

1. _____

2. _____

ii. Explain what additional steps are required when setting up a microscope before each use.

2 + 3 = 5 marks

c. If you wanted to examine bacteria under the microscope, what combination of objective and eyepiece lenses is required?

2 marks

Question 2

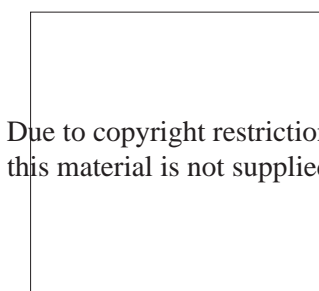


Image 1

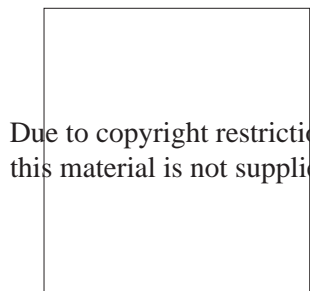


Image 2



Image 3

In the table below match the images above to the method used to collect them. Use 1–3 to indicate your answer.

Method	Image
20x eyepiece and oil immersion lens	
Electron microscope	
10x eyepiece 4x objective lenses	

3 marks

Question 3

A microbiology technician, working for a company manufacturing culture media, is required to perform routine quality control tests on each batch of media prepared. One of these tests is to perform a gram stain on any bacteria growing in the media.

Arrange the following method steps in the correct order from 1–5.

- Place the sample on the microscope stage
- Set up and align the light path
- Examine the sample
- Select and adjust the appropriate objectives
- Ensure the lens is clean

5 marks

Total 20 marks

Elective 2 – PMLTEST409A – Capture and manage scientific images

Question 1

Lisa is a researcher using cultured cells in experiments. These cells can only be left in the open air for short periods. Lisa needs images of the results for her records as these will be used in preparing her thesis.

a. List three types of light source that may be used to produce Lisa’s images.

1. _____

2. _____

3. _____

3 marks

b. The cultured cells only survive out of the warm incubator for about 20 minutes. Lisa has just started an experiment with these cells. She has adjusted her microscope and camera to record the images, when her supervisor calls to suggest she attend an important seminar which is about to begin.

What are **three** essential steps Lisa should do in this situation?

3 marks

c. In order to make parts of the cells more visible, Lisa must sometimes stain the cells and use coloured filters attached to the lens of the recording camera. The available filters are listed below.

- red
- green
- yellow
- blue
- orange

Select the filter that would give the best result if the cell components were

blue _____

green _____

red _____

3 marks

Question 2

Nirvan works for a geotechnical company that collects soil samples from construction sites. These samples are either tested at the site or returned to the company laboratory for further testing. Nirvan uses a camera to record images at these sites, and is responsible for maintaining other records and test results.

- a.** The use of digital or other image-making techniques assists in keeping records of Nirvan's work.

List three important reasons why this is necessary.

1. _____

2. _____

3. _____

3 marks

Sometimes the samples are collected by Nirvan and returned to the laboratory, for others to test, along with his digital images.

- b. i.** List three important things that Nirvan would need to record in his image labels related to each of these samples.

1. _____
2. _____
3. _____

- ii.** Outline what needs to be done in the laboratory to ensure that the results obtained are reliable.

- iii.** The reports to clients prepared on the analyses of these samples may sometimes include Nirvan's images using various software programs to manage them.

List three things that might be done to these images to best present them in the company reports.

1. _____
2. _____
3. _____

3 + 2 + 3 = 8 marks

Total 20 marks

END OF ELECTIVE 2
SECTION C – continued
TURN OVER

Elective 3 – PMLTEST304B – Prepare culture media**Question 1**

Michael needs 45 nutrient agar slopes for a class experiment. The standard operating procedure states that he needs to add 40 g of agar base to 1 litre of water. Each slope contains 10 mL of agar.

- a. i. What would be an appropriate volume of agar to prepare?

- ii. Suggest why this volume is appropriate.

1 + 1 = 2 marks

- b. What would Michael need to do to the agar suspension before dispensing it?

1 mark

- c. i. What is an appropriate sized bottle to obtain a good agar slope?

- ii. Explain why this sized bottle is appropriate.

1 + 2 = 3 marks

- d. How would Michael test the prepared medium to ensure that it is sterile?

1 mark

- e. How could Michael test the media for usability?

1 mark

Question 2

Autoclaves are important in the production of culture media.

- a. How do they work?

2 marks

- b. How are autoclaves monitored?

1 mark

Question 3

Some components of culture media are heat labile and cannot be autoclaved.

- a. Give two examples of a heat labile component.

1. _____

2. _____

2 marks

- b. If heat labile components are to be added to culture media containing agar, circle the most appropriate temperature to add these components.

i. 20°C 50°C 100°C 121°C

- ii. Explain why this is the appropriate temperature.

1 + 2 = 3 marks

c. Where would the finished media be stored?

1 mark

Question 4

One of the quality procedures in a busy microbiological laboratory is to check prepared culture media stocks weekly for conformance.

Outline what should be checked during these procedures.

3 marks

Total 20 marks