



Victorian Certificate of Education

2007

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Letter

Figures

Words

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VCE VET LABORATORY SKILLS

Written examination

Thursday 22 November 2007

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 20 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

Sustainable energy principles and work practices may include

- A. reducing any procedures in the laboratory that use electricity.
- B. switching off equipment when not in use.
- C. asking staff to dress appropriately for the weather conditions.
- D. purchasing cheaper products to use in the laboratory.

Question 2

Calibration of equipment in a laboratory should take place

- A. weekly, depending on workloads of the laboratory.
- B. when poor results indicate it is necessary.
- C. when specified by operating procedures and manufacturers.
- D. when small numbers of samples need to be processed.

Question 3

Laboratory technicians can contribute to continuous improvement in their laboratory work by

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

Question 4

An example of a random effect is estimating the colour change of an indicator at the end point of a titration. What would you expect the results to be each time you recorded them?

- A. always the same
- B. increase with time
- C. decrease with temperature
- D. sometimes higher and sometimes lower

Question 5

The moisture content of a sample of oats was 12.45.

Which of the following is a transposition error?

- A. 12.54
- B. 12
- C. 13
- D. 12.5

Question 6

Bottles of tissue culture medium should be labelled before autoclaving using

- A. a water-based marker.
- B. a permanent marker.
- C. self adhesive labels.
- D. paper labels.

Question 7

If an autoclave is not available to sterilise instruments, a water-bath can be used for one hour at which one of the following temperatures?

- A. 37°C
- B. 56°C
- C. 80°C
- D. 100°C

Question 8

The only certain way to obtain single colonies of bacteria is to use

- A. an agar deep.
- B. an agar slope.
- C. an agar plate.
- D. a broth medium.

Question 9

Which of the following would you use to aseptically add 10 ml of serum to a culture medium?

- A. a 100 ml measuring cylinder
- B. a sterile 100 ml measuring cylinder
- C. a plastic pipette of appropriate volume
- D. a sterile plastic pipette of appropriate volume

Question 10

Sheep blood is used in enrichment medium to grow pathogenic bacteria.

Which of the following methods is used to ensure that the sheep blood is sterile?

- A. autoclaving
- B. membrane filtration
- C. radiation
- D. collection under aseptic techniques from a healthy sheep

Question 11

Pipettes used to transfer samples submitted for salmonella testing should be discarded into

- A. autoclave receptacles.
- B. a normal rubbish bin.
- C. a laboratory dishwasher.
- D. a pipette washer.

Question 12

Ultraviolet light is used in biohazard cabinets

- A. to sterilise culture medium prepared in the cabinet.
- B. to sterilise the work surfaces.
- C. to decontaminate the work surfaces.
- D. to sterilise the air in the cabinet.

Question 13

The solution concentration is a measure of

- A. the amount of solute per volume of solution.
- B. the amount of solvent per volume of solution.
- C. the acidity of a solution.
- D. the alkalinity of a solution.

Question 14

What concentration in g/L is obtained when 1.5 g of solute is dissolved in 300 ml of solution?

- A. 10 g/L
- B. 8 g/L
- C. 5 g/L
- D. 6 g/L

Question 15

When preparing a solution of 2.00 M hydrochloric acid (HCl) for standardising, the most appropriate glassware for transferring concentrated HCl to the standard flask is

- A. a beaker.
- B. a graduated pipette.
- C. a conical flask.
- D. a measuring cylinder.

Question 16

What volume of a 5 M stock solution is required to prepare 2.00 litres of 0.1 M solution?

- A. 40 ml
- B. 45 ml
- C. 50 ml
- D. 55 ml

Question 17

A primary standard is

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

Question 18

A standard solution is a solution

- A. that is also known as a positive control.
- B. that contains a known concentration of a particular substance.
- C. that has a neutral pH.
- D. that has a known volume.

Question 19

In a laboratory, inorganic acids should be disposed of

- A. down the sink with plenty of water.
- B. in a separate organic waste bottle.
- C. by neutralising them with a base and then down the sink with plenty of water.
- D. in the biological waste containers.

Question 20

A fume hood should be used

- A. when a chemical reaction gives off heat.
- B. to make better use of the laboratory space.
- C. when there is a change in pH during a chemical reaction.
- D. when chemicals give off hazardous gases or vapours.

SECTION B – Core units – Short answer questions

Instructions for Section B

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

Question 1

Jack works in the front office of a busy quality control laboratory with a team of six technicians. He is responsible for receiving calls and queries from customers. However, due to workload in the company, Jack is not always available to receive calls or attend to visiting customers.

The company laboratory is adjacent to reception and the laboratory technicians realise they could improve customer relations.

- a. What **two** changes can be implemented by the technicians to improve the situation?

A new laboratory technician begins work and is inexperienced in quality control procedures.

- b. List **three** ways the staff in the laboratory can make the new employee become more proficient in these procedures.

2 + 3 = 5 marks

Question 2

Mary works in a busy laboratory. One of her first tasks each morning is to check the pH of water coming out of the membrane filtration unit. One morning, after using a freshly prepared buffer solution, she finds that the pH of the water is much lower than normal.

List **three** checks Mary can do to verify the result.

3 marks

Question 3

What is meant by a 'quality service' or 'quality product'?

2 marks

Question 4

The number of bacteria in a drinking water sample can be determined by making serial dilutions of the water in buffered peptone water then adding 1 ml of each dilution to a 9 ml deep of agar, mixing and pouring the mixture into a petri dish. Each sample is tested in duplicate. Tenfold dilutions are used starting with undiluted water and ending at a dilution of 1:10 000.

- a. List **three** pieces of equipment essential for this testing.

- b. How could you be sure that the agar did not contain any bacteria before being used for testing?

- c. Showing your calculations, explain how many agar deeps are required for this testing without positive or negative controls.

- d. Describe how a technician would aseptically transfer a 1 ml sample to the agar for testing.

- e. List **three** essential labelling items required on each petri dish.

3 + 1 + 2 + 5 + 3 = 14 marks

SECTION B – continued

Question 5

Prior to checking the acetic acid content of some vinegar, a quality control technician prepared a standard solution of sodium carbonate (Na_2CO_3) by weighing 1.29 g of the analytical grade anhydrous sodium carbonate, dissolving it in distilled water, and making the total volume of the solution up to 250.0 ml in a volumetric flask.

- a. Explain the term 'anhydrous'.

- b. List **two** important pieces of Personal Protective Equipment (PPE) that the technician should be using.

- c. If the technician is unsure about the safety of the final solution, where could further information be found?

- d. If the formula weight of Na_2CO_3 is 106.20 g/mol, calculate the number of mole of the substance.

- e. Calculate the concentration of the final solution produced.

- f. List **four** important items of information that should be listed on the manufacturer's label of the sodium carbonate.

1 + 2 + 1 + 2 + 2 + 4 = 12 marks

Question 6

There are a number of units used when determining the concentration of a solution.

- a. Describe the meaning of the abbreviation % w/w.

- b. What concentration (in % w/w) is obtained by dissolving 3 g of solute in 500 g of total solution?

- c. Where should the calculated value of the concentration be recorded if this data is required in a laboratory setting?

1 + 2 + 1 = 4 marks

Total 40 marks

END OF SECTION B

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**

A laboratory technician, working in a cell culture facility, has been asked by the supervisor to prepare some media to store a new type of cell line. The new media procedure provided to the technician specifies an additive the technician finds is classified as a hazardous substance.

- a.** List **two** possible resources the technician may have used to determine if the additive was hazardous.

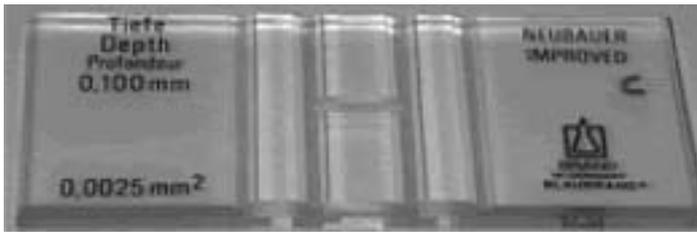
The technician also finds there is an effective non-hazardous alternative to the substance that could be used.

- b.** What improvement to the procedure could the technician suggest to the supervisor?

The technician is required to use a biosafety cabinet to sterilise the prepared media by filtering it through a special membrane filter, but discovers that the annual National Association of Testing Authorities (NATA) quality check is overdue.

- c.** Should the technician proceed with the preparation? Explain why or why not.

The technician must examine the cells in the prepared media, before using them, using a counting chamber slide (shown below) and a microscope.



d. What is the purpose of examining the cells in this equipment?

2 + 1 + 1 + 1 = 5 marks

Question 2

A microbiology technician, working for a company manufacturing 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 media prepared from these batch samples.

a. What is meant by the term ‘gram stain’?

The technician must use an oil immersion lens for examining the gram stain.

b. What are **two** important steps the technician would routinely do when setting up the oil immersion lens for microscopy?

c. If the media samples were examined for presence of yeast or fungi but not bacteria, using a ×10 eye-piece on the microscope, what magnification objective lens would be suitable?

2 + 2 + 1 = 5 marks

Question 3

The functions of some important parts of a typical laboratory microscope are listed below.

- A** – Magnifies the image of the object typically by $\times 4$, $\times 10$, $\times 25$, $\times 40$, $\times 100$
- B** – Concentrates the visible light from the lamp onto the object
- C** – Provides a stable platform for holding slides of the sample object
- D** – Magnifies the image again to be detected by the user's eye
- E** – Makes the image clearer

- a. In the table below, place the appropriate letter (**A to E**) in the function column which best describes the microscope part.

Microscope part	Function
Condenser	
Stage	
Objective lens	
Ocular lens	
Focus controls	

- b. A common formula can be used to calculate the total magnification of a light microscope.
- i. Calculate the total magnification of a microscope using a $\times 10$ ocular and a $\times 40$ objective lens. Display all your workings.

- ii. What magnification objective lens would be suitable for examining bacteria?

- iii. List **three** essential tasks that should be carried out after each use of a laboratory microscope.

$5 + (1 + 1 + 3) = 10$ marks

Total 20 marks

**END OF ELECTIVE 1
SECTION C – continued
TURN OVER**

Elective 2 – PMLTEST409A – Capture and manage scientific images**Question 1**

The subject matter commonly studied using scientific imaging, for example biological specimens, is varied.

- a. Circle the **two** subjects from the list below which would be considered to be of a scientific nature, if images were collected.
- i. a children's birthday party
 - ii. forensic crime scene evidence
 - iii. a river environmental monitoring site
 - iv. promotional media for a rock concert

Scientific images may include different types of media or formats; for example, still photographs.

- b. What other formats could be used?

Scientific images may also be recorded using non-visible light sources.

- c. Provide **one** example of another type of light source that may be used.

2 + 2 + 1 = 5 marks

Question 2

Deoxy Ribonucleic Acid (DNA) samples are commonly analysed in bioscience laboratories. These samples are often analysed using gels to separate different DNAs into bands that will break down if left for too long.

- a. Using the information above, explain why it is important that DNA gel images are recorded very soon after experiments are completed.

In the past DNA gels were treated with a hazardous substance to make the DNA bands visible when exposed to a special light that is also hazardous. New dyes that stain the DNA directly and are visible under ordinary light are equally effective and far less hazardous.

- b. Provide **two** valid reasons the new staining method should be specified.

2 + 2 = 4 marks

Question 3

Biopsy samples are used to identify many diseases. Biopsy material is prepared on a microscope slide and stained. These glass slides are fragile, may deteriorate with time, and are difficult to store.

A modern computer may provide advantages in keeping records of previous biopsy slides.

- a. Give **one** example of an advantage.

Computer software, such as Adobe Photoshop, can be of assistance in keeping and managing records of scientific images.

- b. Provide **two** examples of how such an image software program can assist.

Susan has stored the images of biopsy samples in specific areas of her computer system. Maalek has enhanced the contrast in some images of biopsy samples to make certain features appear more prominent.

- c. i. Which worker managed the images?

- ii. Which worker has manipulated the images?

1 + 2 + (1 + 1) = 5 marks

Question 4

A university research assistant is requested to produce images of a student's research results for a seminar using a Microsoft PowerPoint presentation, and for the student's thesis submission.

- a. What **two** things should the assistant establish before collecting any images?

The student's results consist partly of delicate cells growing in sterile media that must be kept at 37°C in a humid atmosphere. These cells must be imaged using a digital camera mounted on a microscope. The camera is also connected to a computer with software to process the images.

- b. Assuming the assistant had not previously used the camera and its software, arrange the following procedural steps into the correct order from 1–4 (1 being the first step).

Procedural steps	Order of steps 1–4
Remove cells from incubator to microscope for recording images	
Check with student on important aspects of the cells to record	
Become familiar with camera operation	
Become familiar with software operation	

2 + 4 = 6 marks

Total 20 marks

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

Describe **three** items of Personal Protective Equipment (PPE) which must be worn by a technician when removing bottles of molten agar from an autoclave.

3 marks

Question 2

Labelling agar plates

- a. List **two** items which should appear on the label of an agar plate.

- b. Should this label be on the bottom of the plate containing the agar or on the lid? Explain.

2 + 2 = 4 marks

Question 4

Tom is autoclaving 10 bottles of nutrient agar. Each bottle contains 300 ml of agar.

- a. Should the caps on the bottles be tight or loose in the autoclave? Explain.

- b. Where in the load should he place the sterilisation indicator?

- c. If the indicator has not changed colour at the end of the autoclave cycle, what should Tom do?

2 + 1 + 2 = 5 marks

Total 20 marks