



VCE VET Laboratory Skills

Written examination – November

Examination specifications

Overall conditions

The examination will be sat at a time and date to be set annually by the Victorian Curriculum and Assessment Authority.

There will be 15 minutes reading time and 90 minutes writing time.

VCAA examination rules will apply. Details of these rules are published annually in the *VCE and VCAL Administrative Handbook*.

The examination will be marked by a panel appointed by the VCAA.

The examination will contribute 34 per cent to the Study Score.

Content

The examination will be based on the following units of competence from Units 3–4 of the VCE VET Laboratory Skills program.

The examination paper will address all the core units of competence and electives.

These units of competence are

Core units

CODE	TITLE	NOMINAL TRAINING HOURS
PMLQUAL300B	Contribute to the achievement of quality objectives	30
PMLTEST305B	Perform aseptic techniques	40
PMLTEST303B	Prepare working solutions	50

Electives Select two from the following

CODE	TITLE	NOMINAL TRAINING HOURS
PMLTEST308A	Perform microscopic examination	40
PMLTEST409A	Capture and manage scientific images	40
PMLTEST304B	Prepare culture media	30
	Subtotal	190–200

The examination items focus on the underpinning knowledge and skills identified in the above units of competence.

Format

The examination will consist of

Section A – Core units – Multiple-choice questions

Students will be required to mark their responses on a multiple-choice answer sheet. All questions in this section are compulsory.

Section B – Core units – Short answer questions

Students will be required to provide answers to this section within the spaces allocated on the paper. The number of lines provided after each question, together with the number of marks allocated, will indicate the appropriate length of the response. All questions in this section are compulsory.

Section C – Electives

Students will select two of the three electives. All questions within the electives are compulsory. All electives will consist of short answer questions. Students will be required to provide answers to the electives within the spaces allocated on the paper. The number of lines provided after each question, together with the number of marks allocated, will indicate the appropriate length of the response.

The examination paper may include items which refer to stimulus material such as newspaper articles, extracts from reports or case study materials which are related to the units of competence.

The examination will be presented in a question and answer book.

Approved materials and equipment

- Pencil (and eraser) to use on multiple-choice answer sheet
- Scientific calculator

Advice

Until the next review of the VCE VET Laboratory Skills program, examinations will be prepared according to the Examination specifications above. Each examination will be an interpretation of these specifications and will test a representative sample of the underpinning knowledge and skills.

The following sample examination has been prepared in order to provide an illustration of how VCE VET Laboratory Skills might be examined.



Victorian Certificate of Education 2007

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Figures

Words

Letter

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VCE VET LABORATORY SKILLS

Written examination

Day Date 2007

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 – Core – multiple choice	20	20	20
B – Core – short answer	8	8	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 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 – 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** 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

What volume of 10.0 M NaOH is required to make 1.5 L of 0.50 M NaOH solution?

- A. 75.0 ml
- B. 30.0 ml
- C. 13.3 ml
- D. 333 ml

Question 2

The pH of a solution is 3.

The hydronium ion concentration, in mol L⁻¹, is

- A. 10⁻¹
- B. 10⁻³
- C. 10³
- D. 10¹

Question 3

The volume of water required to dilute 100 ml of 2.00 M HNO₃ to 0.100 M is

- A. 2000 ml
- B. 1100 ml
- C. 1900 ml
- D. 1000 ml

Question 4

The term aliquot means

- A. an accurately weighed sample used in gravimetric analysis.
- B. an accurately measured volume used in a titration.
- C. a precipitate collected during filtration.
- D. the remaining solution after the precipitate is removed.

Question 5

A commonly used piece of equipment in titrations is

- A. a burette.
- B. a Ford Cup.
- C. a thermometer.
- D. a bunsen burner.

Question 6

A pH meter can be made inaccurate (or go out of calibration) by

- A. failure to set the correct temperature at calibration.
- B. calibrating the pH meter at a different time of the day.
- C. rinsing the electrode with distilled water before placing it in the low buffer solution.
- D. calibrating the instrument with buffers with different pH values.

Question 7

Physiological saline solution is 0.9% aqueous weight by volume (w/v) sodium chloride.

To prepare this solution, 4.5 gram of pure sodium chloride is added to a small amount of water then made up to

- A. 50 ml
- B. 100 ml
- C. 500 ml
- D. 1000 ml

Question 8

10 ml of a 5 g/L solution is diluted to 100 ml.

The final concentration of this solution is

- A. 0.5 g/L
- B. 0.05 g/L
- C. 5 g/L
- D. 0.005 g/L

Question 9

When handling unfamiliar chemicals, what is the first thing a technician should do?

- A. ensure they are wearing safety glasses
- B. prepare the fume hood
- C. check the MSDS to become familiar with safety and handling information
- D. check their logbook

Question 10

Which of the following is a liquid medium?

- A. broth
- B. deep
- C. slope
- D. agar plate

Question 11

If the sterilisation temperature is decreased, the sterilisation time needs to

- A. decrease.
- B. increase.
- C. stay the same.
- D. be doubled.

Question 12

Autoclaves are used to _____ equipment.

- A. disinfect
- B. sanitise
- C. sterilise
- D. dissolve

Question 13

Alcohol, used for disinfecting benches and biohazard cabinets, is

- A. flammable.
- B. corrosive.
- C. oxidising.
- D. poisonous.

Question 14

Class 2 biohazard cabinets

- A. protect the operator from infection.
- B. protect the samples from cross contamination.
- C. protect both the samples and the operator.
- D. protect neither the sample nor the operator.

Question 15

Which of the following is **not** a suitable method of disposal for used plastic petri dishes?

- A. incineration
- B. autoclaving
- C. recycling
- D. biological waste disposal collection

Question 16

Glucose, used in tissue culture medium, is sterilised using

- A. a membrane filter.
- B. an autoclave.
- C. radiation.
- D. boiling.

Question 17

An example of a transposition error is when 11.81 g/L is recorded as

- A. 11
- B. 11.18
- C. 11.2
- D. 11.28

Question 18

Which of the following is a systematic variation?

- A. fluctuation of air currents that affect balance readings
- B. estimation of the colour change of an indicator at the end point of a titration
- C. a thermometer which consistently measures 0.5°C too low
- D. sometimes reading the top of the meniscus instead of the bottom

Question 19

For bacteria to grow in an incubator the temperature must be 37°C plus or minus 0.5°C.

Which of the following is an example of a non conformance?

- A. 36.8
- B. 37.2
- C. 37.4
- D. 37.6

Question 20

Which of the following causes of variation of a laboratory results is a random effect?

- A. fluctuation of air currents that affect balance readings
- B. a pipette calibrated at 20°C but used at 30°C
- C. a thermometer which consistently measures 0.5°C too low
- D. a thermometer which consistently measures 0.5°C too high

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

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

Question 1

Kristie uses a special 37°C incubator to grow cells. There is a carbon dioxide cylinder attached to it that slowly releases the gas into the interior of the incubator to keep the correct acid/base levels for cell growth, and a water tray at the bottom to keep the interior atmosphere moist.

List **three** important incubator checks that would be performed daily.

3 marks

Question 2

Fluoride concentrations can be measured simply and rapidly in a wide range of natural water using an ion selective electrode. A technician is required to determine the concentration of fluoride (F⁻) in drinking water.

The following test results were obtained.

Standards (ppm)	Potential (mV)
5	50
10	102
15	155
Sample	
tap water	75 ppm

- a. Plot a calibration curve of observed potential versus F⁻ (ppm) on the grid below.

b. Determine the concentration of F⁻ in the tap water.

c. If the above was a weekly analysis that a technician had to undertake as part of their job, where would such results be recorded in a laboratory?

3 + 2 + 2 = 7 marks

Question 3

a. What is an aerosol?

b. Give **one** example of when aerosol is produced in microbiological laboratories.

1 + 1 = 2 marks

Question 4

Define the following terms.

Anerobic _____

Disinfectant _____

Sterilisation _____

3 marks

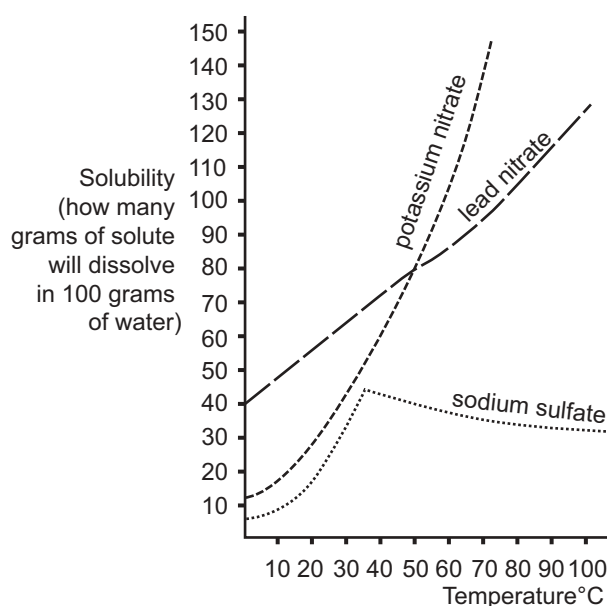
Question 5

What **four** precautions should you take when culturing human blood or body fluids?

4 marks

Question 6

Look at the graph showing the solubility of three different substances at different temperatures. The vertical scale shows how much of the substance will dissolve in 100 grams of water and the horizontal scale shows the temperature. Use the graph to answer the following questions.



a. How much potassium nitrate would you expect to dissolve in 100 grams of water at 60°C?

b. Which of the **three** substances is most soluble at 20°C?

c. At what temperature is the solubility of potassium nitrate and lead nitrate the same?

d. How much of either would dissolve in 100 grams of water at this temperature?

Two students wanted to see how much sodium sulfate would dissolve in 100 grams of water. After adding three teaspoons, no more would dissolve. The students decided to heat the water to dissolve more sodium sulfate.

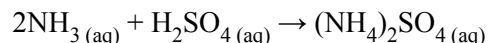
e. What advice could you give them after looking at the graph?

1 + 1 + 1 + 2 + 2 = 7 marks
SECTION B – continued

Question 7

In a chemical analysis a 25.0 ml aliquot of cloudy ammonia ($\text{NH}_3(\text{aq})$) was analysed by titration with 0.200 M sulfuric acid. To reach the end point, an average titre of 26.73 ml was required.

The equation for the reaction is



- a. Define the term 'end point'.

- b. What reagent is added to the aliquot to identify the end point?

- c. Explain why average titres are used in titrations.

- d. What laboratory equipment would be used to measure out the 25 ml aliquot of cloudy ammonia?

- e. What laboratory apparatus would be used for the sulfuric acid during the titration?

- f. List **two** items of personal protective equipment that would be required for this experiment.

1 + 1 + 2 + 1 + 1 + 2 = 8 marks

Question 8

Kevin's class measures the time it takes for a tablet of aspirin to dissolve in 250 ml of water at room temperature. Each student has a stopwatch and records the following times (in seconds).

2.21	2.31	2.24	2.19	2.26	4.21	2.25	2.18	2.22	2.30
------	------	------	------	------	------	------	------	------	------

- a. Provide **three** reasons why the results may vary.

- b. Should any of these results be discarded?

- c. What is the average time taken for the aspirin to dissolve?

3 + 1 + 2 = 6 marks

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**

A hospital laboratory technician is required to prepare and stain patient tissue samples for microscopic examination using visible light microscopy. Using the table below arrange the following procedural steps in order from 1–5 (1 being the first step).

Procedure of steps	Order of steps (1–5)
Place the sample correctly on the microscope stage	
Set up and align the light path	
Examine the sample	
Select and adjust the appropriate objectives for the sample being examined	
Ensure the lenses are clean	

4 marks

Question 2

Light microscopes commonly use three types of objective lenses; low power (10 X), high power (40 X), and oil immersion lenses (100 X), for specific purposes or applications.

Assign the most suitable objective lenses for each of the following specimens.

Sample	Objective
overall or gross appearance of a smear of unclotted whole blood, to examine a red blood cell	
to try to identify some of the internal features of a stained human red blood cell	
to examine a blood smear for possible bacteria present	

3 marks

Question 3

When using an oil-immersion lens, oil is used to enhance the visible images seen on slides making examinations easier.

This oil is known to be a hazardous substance.

- a. What important laboratory document could be referred to when obtaining information on the health and safety aspects for this oil?

- b. If this document specified that the oil was hazardous by skin contact, or inhaling the mist or heated vapours, list **two** important items of protective equipment that laboratory workers should adopt when using the oil.

- c. If the oil was spilt on the laboratory bench and/or floor, describe **two** important steps that a technician would immediately perform.

1 + 2 + 2 = 5 marks

Question 4

Jim is a laboratory technician in charge of a cell culture facility (a mixture of cells in a liquid medium), where cells are incubated in flasks of sterile liquid media in a special very clean 37°C incubator. If his incubated cells are healthy their media has a clear orange-red appearance, and they stick firmly to the bottom of the plastic flasks. One morning when Jim checks the incubator, he notices the outer and the inner doors are both slightly open, some of the flasks have a distinctly red and cloudy appearance, and some of the cells are now floating in the media.

- a. What type of microscope should Jim use to examine his flasks of cells?

- b. If Jim wanted to check his flasks for a fungal or bacterial contamination, what type of microscope would be suitable?

- c. Explain why Jim should not proceed with an important experiment planned for the cells.

1 + 1 + 1 = 3 marks

Question 5

One of a technician's tasks is to assess the health or 'viability' of a cell culture. By mixing a small sample of the cells with a blue dye that will stain dead or unhealthy cells a blue, but will not stain healthy or viable cells, the technician can assess the proportion of healthy cells in the original culture using the light microscope.

- a. What are **two** important things the technician should do to ensure that the results obtained are reliable?

- b. If the technician measures the viability of a cell culture, and obtains mostly blue cells, does this result indicate a good cell culture or a poor one?

The hospital laboratory has many patients' samples to analyse each day. Some of these samples, technicians have to keep for several days or more for examining.

- c. What are **two** important things the technician needs to know about each sample examined?

2 + 1 + 2 = 5 marks

Total 20 marks

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

Kelly is employed by an environmental company performing site analyses of contaminated soils. Her job involves assisting the drilling team, taking soil core samples at specified locations, returning the samples to the laboratory for further testing, and preparing reports for clients. In an effort to attract more business to the company, her supervisor has asked her to assist in designing a website and brochure outlining the company's services, and its advantages over other similar companies.

- a. What are **three** important images Kelly should include in the website or brochure?

Kelly's supervisor resists her suggestion of purchasing a digital camera, which would make collecting images of her work easier.

- b. Give **two** possible reasons Kelly might use to persuade her employer.

As there can be wide variation in the soil type and contamination and in the number of samples collected at each site, each soil sample must be located to a specific location using a site map. To do this Kelly's team uses a grid numbering system, similar to a street directory; that is site 33, E4, together with a photograph of each sample taken.

- c. What information should Kelly then include in each photograph? List **three** examples.

3 + 2 + 3 = 8 marks

Question 2

Deoxy ribonucleic acid (DNA) samples are analysed using a water-based semi-solid gel to separate fragments of DNA into bands, that are then stained with chemicals to make them visible. As the gel is mostly water, the DNA tends to disperse or spread out if left too long, making it difficult to detect the bands.

- a. How could the use of digital or other image-making techniques assist in keeping records of these gels?

In the past scientific workers trying to measure and trace DNA and other substances used radioactive isotopes, then exposed samples to photographic plates, so recording some image. Today we can often use chemical stains to see if certain substances are present.

- b. What are the **three** benefits of this new process?

- c. What are **two** important steps a technician would take to ensure that the results obtained could be easily retrieved?

1 + 3 + 2 = 6 marks

Question 3

Olga is a technical assistant in a university department research laboratory and has been asked by her supervisor to assist in preparing posters for several post-graduate students to display at a conference. Each of these students have different requirements for photographs of their research work. These must be taken in the department's busy darkroom using special lighting, cameras and other equipment, all of which must be booked in advance. Olga decides to take all of the photographs first, then complete the insertion onto posters.

- a. Give **three** important requirements she would need to arrange in advance.

Olga decides to take only one of the students' photographs and complete the insertion onto the poster. This is then repeated for the other students.

- b. Suggest **three** important requirements she would need to arrange first.

3 + 3 = 6 marks

Total 20 marks

END OF ELECTIVE 2
SECTION C – continued

Elective 3 – PMLTEST304B Prepare culture media

Question 1

Using the table below arrange the steps for the preparation of nutrient agar plates in order from 1–5 (1 being the first step).

Steps	Order of steps
Weigh ingredients	
Sterilise plates	
Pour agar plates	
Boil to dissolve agar	
Check pH	

4 marks

Question 2

The testing laboratory of a food company has ordered 10 nutrient agar plates for their testing on Monday. Nutrient agar contains the following ingredients in grams per litre.

Nutrient broth 28 gram

Agar 10 gram

Your quality control procedures require each plate to contain between 15 ml and 18 ml of agar per plate. For this batch size two plates are required for quality control purposes.

a. What is the minimum volume of medium you would prepare?

b. How much nutrient broth would you weigh out?

c. How much agar would you weigh out?

d. What size and type of container would you use to sterilise the nutrient agar?

Size _____

Type _____

1 + 1 + 1 + 2 = 5 marks

Question 3

When making nutrient agar you may encounter some problems. Suggest **one** probable cause for each of the following.

- a. Agar boils over in the autoclave.

- b. Plates do not set after they are poured.

- c. Poured plates grow bacteria during test incubation.

- d. Test strains will not grow on the plates.

1 + 1 + 1 + 1 = 4 marks

Question 4

Culture media is normally stored at 4°C in the dark.

What may happen if agar plates are accidentally left on the bench for several days after being prepared?

1 mark

Question 5

What is meant by the following terms in culture medium preparation?

Indicator (differential) medium

Selective medium

Enriched medium

Haemolysis

Carbohydrate fermentation

Agar slope (slant)

6 marks

Total 20 marks