VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

# Victorian Certificate of Education 2008

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

**STUDENT NUMBER**

| | | | | | | | | | Letter |
|---|---|---|---|---|---|---|---|---|---|
| Figures | | | | | | | | | |
| Words | | | | | | | | | |

# VCE VET LABORATORY SKILLS

# Written examination

**Thursday 20 November 2008**

**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**

| *Section* | *Number of questions* | *Number of questions to be answered* | *Number of marks* |
|---|---|---|---|
| A – Core – multiple choice | 20 | 20 | 20 |
| B – Core – short answer | 6 | 6 | 40 |
| | *Number of electives* | *Number of electives to be answered* | |
| 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**

In a food laboratory, test results may vary due to

**A.** the time of day.

**B.** a repeat of the testing.

**C.** the calibration of equipment by a different technician.

**D.** changes in the processing conditions.

**Question 2**

The result of moisture content in a food sample is required to be reported to two decimal places. The test result is calculated as 10.3761%.

This sample should be reported as

**A.** 10.3%

**B.** 10.37%

**C.** 10.38%

**D.** 10.376%

**Question 3**

A laboratory is keen to employ staff who are focused on job ownership with an objective of ‘right first time’.

Which of the following behaviours best reflects this objective?

**A.** working independently and not communicating with other members of the team

**B.** putting the customer first

**C.** sharing information with friends among your colleagues

**D.** adopting procedures which are not in line with standard operating procedures

**Question 4**

The purpose of documenting a procedure is to

**A.** minimise transcription errors.

**B.** make sure the same equipment is used.

**C.** ensure the operator is within range.

**D.** allow results to be compared with those of other laboratories.

**Question 5**

Calibrating the level of liquid to a calibration line on a volumetric flask is an example of a random effect.

What would you expect the result to be?

**A.** the same each time

**B.** an increase with an increase in temperature

**C.** a decrease with an increase in temperature

**D.** sometimes higher and sometimes lower

**Question 6**

Which of the following items of equipment could be used to sterilise bottles of culture medium containing agar?

**A.** an autoclave

**B.** a membrane filter

**C.** a biohazard cabinet

**D.** a Bunsen burner

**Question 7**

What is the normal temperature for incubating culture media to isolate human pathogenic bacteria?

**A.** 37°C

**B.** 56°C

**C.** 80°C

**D.** 100°C

**Question 8**

Which of the following types of culture medium does **not** have agar as one of its ingredients?

**A.** deep

**B.** slope

**C.** plate

**D.** broth

**Question 9**

Which of the following would you use to decontaminate a bench before preparing agar plates?

**A.** absolute alcohol (ethanol)

**B.** 70% alcohol (ethanol)

**C.** 50% alcohol (ethanol)

**D.** 25% alcohol (ethanol)

**Question 10**

Bottles of tissue culture medium can best be checked for sterility by

**A.** examining a drop of solution under the microscope.

**B.** examining the bottle of medium using an inverted microscope.

**C.** test incubating a representative sample of the medium.

**D.** plating a sample of the solution onto a nutrient agar plate.

**Question 11**

Glass bottles containing *Escherichia coli* should

**A.** have the agar removed then washed in the dishwasher.
**B.** be placed in a normal rubbish bin.
**C.** be washed then autoclaved before recycling.
**D.** be autoclaved then washed before recycling.

**Question 12**

When processing samples which may contain pathogenic bacteria, a Class 2 biohazard cabinet is used to

**A.** prevent the sample from contamination.
**B.** protect the laboratory assistant from infection.
**C.** prevent the bacteria from escaping into the environment.
**D.** protect the operator, the sample and the environment.

**Question 13**

An anhydrous substance is one in which

**A.** water molecules have been added to the compound.
**B.** water molecules have been removed from the compound.
**C.** water has been added to an existing solution.
**D.** water has been removed from a diluted solution.

**Question 14**

The formula weight of a substance is

**A.** the mass of the atoms that make up the substance.
**B.** the sum of the atomic weights of all atoms in the molecule.
**C.** the simplest ratio of numbers of elements in a compound.
**D.** the average mass of naturally occurring atoms of an element.

**Question 15**

A titration is performed in a laboratory to determine

**A.** the amount of one of the reactants present.
**B.** the chemical composition of one of the reactants present.
**C.** the volume of one of the reactants present.
**D.** the concentration of the standard being used in the titration.

**Question 16**

What concentration is obtained when 3 g of solute is dissolved in 500 ml of solution?

**A.** 10 g/L
**B.** 12 g/L
**C.** 6 g/L
**D.** 5 g/L

**Question 17**

In a titration, a burette is used to

**A.** accurately add the standard reactant.

**B.** accurately add the indicator.

**C.** measure the mass of the unknown sample.

**D.** measure the concentration of the unknown sample.

**Question 18**

The accuracy of a pH meter can be affected by

**A.** the time of day the calibration takes place.

**B.** moving the pH meter before calibration.

**C.** contamination of the buffer solution.

**D.** continuously repeating an experiment.

**Question 19**

Laboratory organic flammable waste materials should be disposed into

**A.** the sink, with plenty of water.

**B.** the sink, following treatment with a neutralising agent.

**C.** the organic residue container.

**D.** the biohazards bin.

**Question 20**

A 20% w/v solution contains

**A.** 2000 g per litre of final solution.

**B.** 20 g per 100 ml of added solvent.

**C.** 20 g per litre of solution.

**D.** 20 g per 200 ml of solution.

**END OF SECTION A**
**TURN OVER**

## SECTION B – Core units – Short answer questions

### Instructions for Section B

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

**Question 1**

List **three** important requirements of a quality product.

3 marks

**Question 2**

Relevant, Representative, Readable and Reliable are qualitative terms for data, used for making decisions. Enter these terms in the table below beside the correct definition.

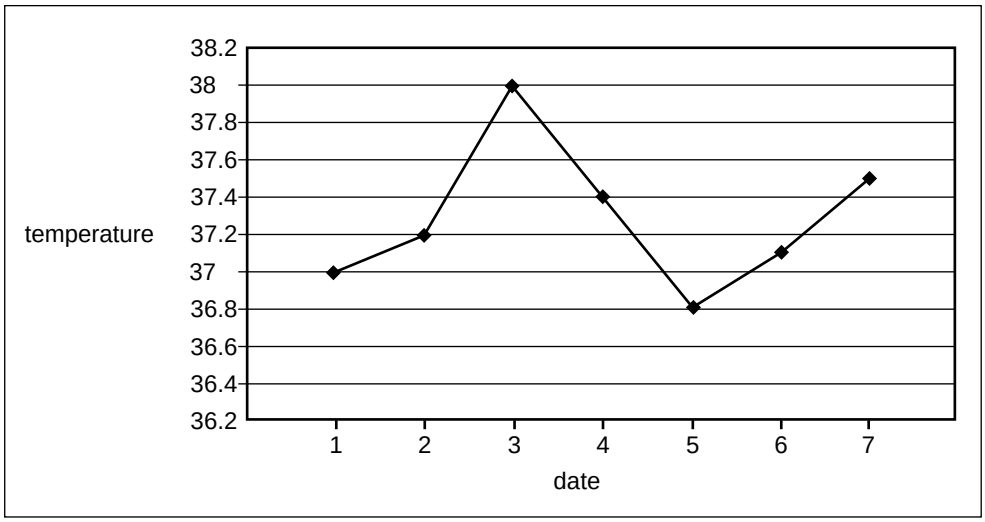
| Term | Definition |
|---|---|
| | data collected in the approved way and error free |
| | data about the things that most affect what needs to be changed or improved |
| | data that people making the decisions can interpret |
| | data without bias that might distort the results and lead to poor conclusions |

4 marks

**Question 3**

The following is a daily run chart of effluent temperature. It is an Environmental Protection Agency (EPA) requirement that discharge from this plant to sewer must be at 37°C plus or minus 0.5°C.

**Daily effluent temperature run chart for April 2007**




**a.** Record any date where a nonconformance has occurred.

_____

1 mark

**b.** What could be added to the above chart to enable nonconformances to be more easily identified?

_____

1 mark

**Question 4**

The number of bacteria in a milk sample can be determined by making serial dilutions of the milk in buffered peptone water, adding 1 ml of each dilution to a 9 ml agar deep, then mixing and pouring the mixture into a Petri dish. Each sample is tested in duplicate. Tenfold dilutions are used starting with undiluted milk and ending at a dilution of 1:1000. A negative control is also included, which is prepared by adding 1 ml of buffered peptone water to a 9 ml agar deep.

The following equipment is required for this testing.

**a.** What is the purpose of each?

**i.** Autoclave _____

_____

_____

_____

**ii.** Sterile 1 ml pipettes _____

_____

_____

_____

**iii.** Bunsen burner _____

_____

_____

_____

3 marks

**b.** List in sequence the **six** steps you would undertake to prepare the serial dilutions of milk using aseptic techniques.

6 marks

**c.** How many agar deeps are required for this testing?

2 marks

**d.** List **two** essential items of labelling which would be required on each Petri dish.

2 marks

**e.** What is the function of the negative control?

1 mark

**Question 5**

A laboratory technician is required to prepare a working solution of 1.5 M $Na_2CO_3$ by diluting a 5 M stock solution of $Na_2CO_3$.

**a.** Describe the term stock solution.

1 mark

**b.** Identify **two** items of equipment that the technician will need to complete the dilution.

2 marks

**c.** What Personal Protective Equipment (PPE) would the technician need to wear during the dilution?

2 marks

**d.** If the technician is required to prepare 250 ml of the working solution, what volume of the stock solution is required? Show the necessary calculation.

2 marks

**Question 6**

A laboratory technician is required to determine the level of copper in drinking water. The EPA states that a safe level of copper present in drinking water should be below 1.3 ppm.

The laboratory technician uses Atomic Absorption Spectroscopy (AAS) to analyse the sample.

A standard solution of copper is required to calibrate the instrument.

In a fumehood, the technician places copper in a 250 ml beaker to which 20 ml of 5 M nitric acid ($HNO_3$) is added. This is heated carefully until the copper dissolves and then 50 ml of deionised water is added. The solution is stirred, cooled and then transferred to a 1 litre volumetric flask, deionised water is added and made up to the 1 litre mark. This stock solution is then used to make up the diluted samples of various concentrations.

**a.** Why is the fumehood used when the copper is dissolved in nitric acid?

1 mark

**b.** If the technician is unsure of how to handle nitric acid, where could this information be found?

1 mark

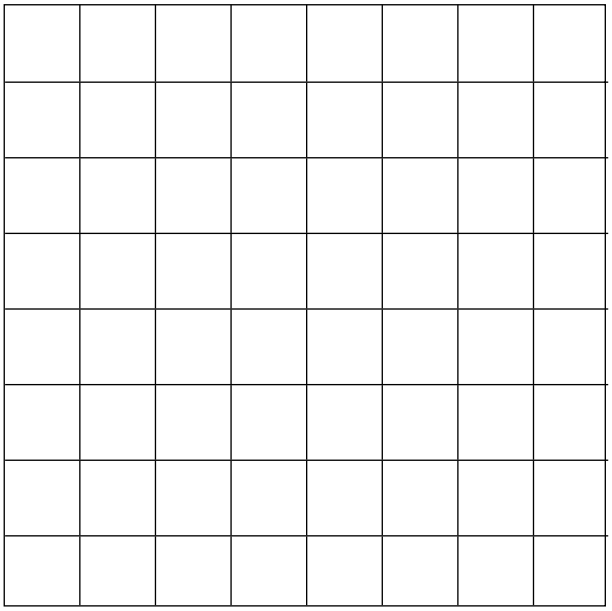
**c.** If the stock solution has a concentration of 50 ppm copper, what mass of copper (in grams) is required to be dissolved to prepare the 1 litre of stock solution? Show the necessary calculations.

2 marks

**d.** The following results for the water analysis were obtained using AAS.

| Cu (ppm) | Absorbance |
|---|---|
| 0 | 0 |
| 5 | 0.20 |
| 10 | 0.41 |
| 15 | 0.63 |
| Domestic water sample | 0.25 |

**i.** From the table above construct a graph of absorbance versus Cu (ppm) using the grid below.



**ii.** From the graph, determine the level of Cu in ppm in the domestic water sample.

_____

3 + 1 = 4 marks

**e.** Does the sample result fall within the EPA guidelines for safe drinking water?

_____

1 mark

**f.** In a laboratory, where should the result for the domestic water sample be recorded?

_____

1 mark

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**

Visible light microscopes may come in a number of basic formats.

**a.** List **two** examples.

_____

_____

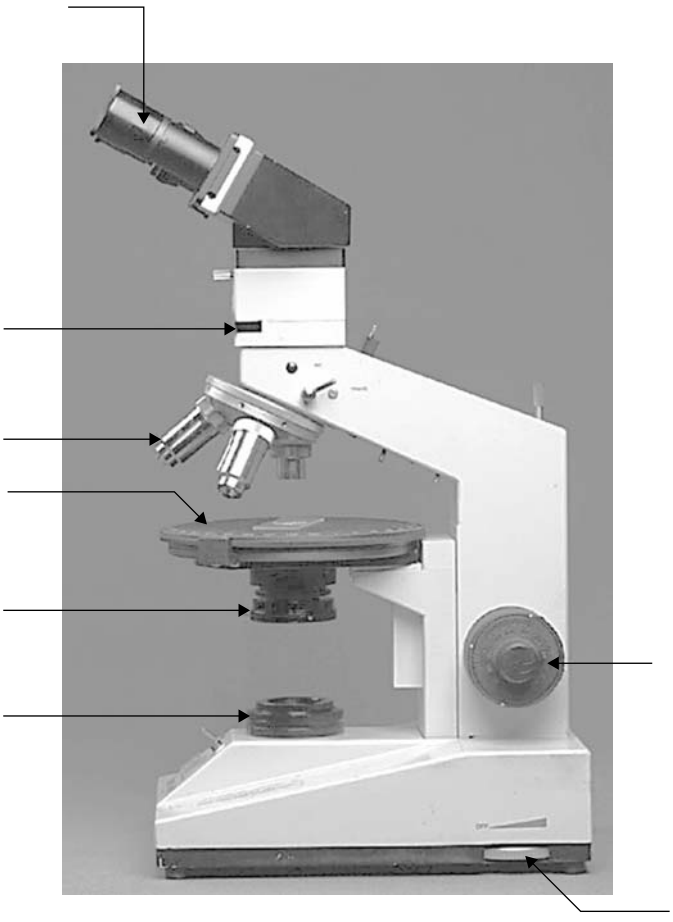
2 marks

**b.** A schematic diagram of a typical laboratory light microscope is shown below.

Using the list below (A.–F.), label the correct components on the diagram.

**(Note: not all arrows will be required.)**

**A.** eye-piece lens
**B.** stage
**C.** condenser
**D.** light source
**E.** coarse focus knob
**F.** objective lenses



6 marks

**c.** The proper care and use of microscopes is important in laboratories.
List **two** essential tasks that must be performed on a microscope after every use.

2 marks

**Question 2**

**a.** Typical laboratory microscopes employ a number of lenses that can be altered to provide suitable magnification for examining specimens.

**i.** Calculate the total magnification of a microscope using a × 5 ocular and a 10 × objective lens.
Display all your workings.

**ii.** What magnification objective and ocular lenses would be suitable for the gross examination of a yeast cell?

**iii.** When using a microscope, an oil immersion lens may be used. Briefly outline the purpose of adding this oil onto a clean lens.

3 + 2 + 2 = 7 marks

**b.** Bacteria can be classified into gram positive or gram negative organisms.

**i.** What technique is used by microscopists to determine what group a bacterium belongs to?

_____

**ii.** What colour would you expect to observe if a bacterium was determined to be gram positive?

_____

1 + 1 = 2 marks

**c.** Identify a piece of equipment used in conjunction with a microscope to count red blood cells.

_____

1 mark

Total 20 marks

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

## Elective 2 – PMLTEST409A – Capture and manage scientific images

**Question 1**

Glenn is a technician working in a laboratory. His supervisor has collected a large number of film-based 35 mm slides of research results. These slides are beginning to show signs of deterioration.

**a.** What is one thing that Glenn could do to prevent losing these important results?

1 mark

The slide collection consists of a number of slide holders each relating to separate aspects of the research work. While these are well labelled and can be read, they are fading and only accessible to people in the laboratory.

**b.** What **two** suggestions could Glenn make to his supervisor to overcome this?

2 marks

Recording images using silver emulsion-based films involves processing with hazardous chemicals, significant amounts of clean water, and disposing of the wastes.

**c.** List **two** other reasons why Glenn would make the suggestions in **part b.** other than the deterioration of the slides.

2 marks

**Question 2**

Kelly is a police officer intending to specialise in crime scene examination and forensic photography.

**a.** List **three** possible light sources Kelly may employ while photographing a crime scene.

3 marks

There are many possible types of evidence that could be present at a crime scene. This evidence may need to be photographed or imaged and collected for a variety of purposes.

**b.** Identify **two** factors that Kelly would need to consider when processing a crime scene.

2 marks

Kelly's crime scenes sometimes contain body fluids that may not always be obvious.

**c.** List **two** health and safety procedures she would need to follow.

2 marks

**Question 3**

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

**a.** What **three** important images should Jany include in the website and brochure?

3 marks

**b.** Jany's supervisor is old fashioned and resists his suggestion to purchase a digital camera to collect images of his work.

Provide **two** possible benefits Jany might use to persuade his supervisor.

2 marks

**c.** There can be wide variation in the soil type, 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 Jany's team uses a grid numbering system, similar to a street directory, for example 33, E4, together with a photograph of each sample taken.

What useful information would Jany also include with each photograph he takes of the samples collected?

2 marks

**d.** Jany must use a 35 mm film, Single Lens Reflex (SLR) camera, with interchangeable lenses to record these sites in all weather conditions, for a given film speed.

Which of the following would be adjusted to photograph the site locations on a very overcast day?

Tick (✓) the appropriate box.

shutter speed ☐

focal length ☐

F – Stop ☐

camera flash unit ☐

1 mark

Total 20 marks

**END OF ELECTIVE 2**

## Elective 3 – PMLTEST304B – Prepare culture media

**Question 1**

John has been instructed to prepare a batch of 45 nutrient agar deeps by his supervisor. Each deep requires exactly 10 ml of agar.

The bottle label states that 40 g of Nutrient Agar Base is required to be added to 1 litre of distilled water to prepare 1 litre of nutrient agar.

**a.** List **six** sequential steps, showing quantities, that John must perform to prepare these deeps.

6 marks

**b.** When John is assembling his materials he finds bottles with a capacity of 10 ml, 25 ml and 100 ml.
Which size would be the most appropriate for these deeps?

1 mark

**c.** If John is not sure of the sterilisation temperature, where can he find this information?

1 mark

**Question 2**

Alice has some bacteria which will not grow without the presence of serum in the culture medium. She needs to prepare 4 agar plates containing 10% serum, with each plate containing 25 ml of serum agar.

**a.** What volume of agar base does she need?

1 mark

**b.** What volume of serum does she need?

1 mark

**c.** Describe the **six** steps Alice would undertake to prepare these plates.

6 marks

Alice has some serum in the refrigerator but is not sure if it is sterile.

**d.** What could she do to make sure it is sterile before use?

1 mark

**e.** What information is required on the labels of these agar plates?

3 marks

Total 20 marks

**END OF QUESTION AND ANSWER BOOK**