



Victorian Certificate of Education 2009

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Figures

Words

Letter

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VCE VET LABORATORY SKILLS

Written examination

Thursday 19 November 2009

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	7	7	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 22 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

Paper towels used for cleaning the bench after microbial testing should be disposed of in

- A. a biohazard bin.
- B. a sharps container.
- C. the paper recycling.
- D. a normal rubbish bin.

Question 2

Which of the following is the solvent in lemonade?

- A. carbon dioxide
- B. lemon
- C. water
- D. sugar

Question 3

Complaints are rare in a good business.

When valued customers make a complaint, to maintain a good relationship you should

- A. listen carefully, take notes and act on the complaint.
- B. ask the customer to fill out paperwork and file it away.
- C. stay calm and get back to the customer when you have a quiet moment.
- D. give the customer a chance to talk about the problem and then make a mental note of the situation.

Question 4

Training is an ongoing process in laboratories.

Staff need to continue to update skills and knowledge for a number of reasons including

- A. the need for a flexible workforce that can quickly adapt to new situations and changes.
- B. attracting outside recruits to positions within the company.
- C. ensuring staff realise the importance of their job.
- D. ensuring that staff have little spare time.

Question 5

If analytical equipment in a laboratory is faulty you should

- A. switch the equipment off, report the fault to your supervisor and document it in a logbook.
- B. leave the equipment switched off to show the supervisor.
- C. continue with the analysis and report it later.
- D. move on to another task.

Question 6

When referring to laboratory analysis, which definition best describes the term relevant?

- A. collected in the approved way and error free
- B. about the things that most affect what we need to change or improve
- C. can be interpreted by people making the decisions
- D. without bias that might distort the results and lead to poor conclusions

Question 7

In laboratories, sterile culture medium is often prepared in large batches and needs to be melted before use. Which temperature is the best to melt agar for this purpose?

- A. 37°C
- B. 50°C
- C. 80°C
- D. 100°C

Question 8

If an untested blood sample has been spilt in a laboratory, which of the following would be the most suitable type of disinfectant?

- A. alcohol
- B. chlorine
- C. aldehyde
- D. quaternary ammonium compounds

Question 9

Which of the following processes destroys all viable organisms including viruses?

- A. sterilisation
- B. sanitisation
- C. disinfection
- D. decontamination

Question 10

The time taken to sterilise instruments in an autoclave can be reduced by

- A. decreasing the pressure.
- B. increasing the temperature.
- C. decreasing the temperature.
- D. increasing the size of the packaging.

Question 11

Pathogenic bacteria should be handled in a

- A. fume hood.
- B. laminar flow hood.
- C. class I biohazard cabinet.
- D. class II biohazard cabinet.

Question 12

Which of the following culture techniques would best obtain isolated colonies of bacteria for identification?

- A. agar slopes
- B. pour plates
- C. broth culture
- D. streak plates

Question 13

Calibration of equipment should take place when

- A. staff availability permits.
- B. out-of-range results become common.
- C. a large number of samples need to be analysed.
- D. specified by manufacturers, audit requirements and operating procedures.

Question 14

How many moles of CH_4 are contained in 96 g of CH_4 (molar mass 16)?

- A. 3 mole
- B. 6 mole
- C. 12 mole
- D. 16 mole

Question 15

How many moles of HNO_3 are needed to prepare 5 L of a 2 M HNO_3 solution?

- A. 2.5 mole
- B. 5 mole
- C. 10 mole
- D. 20 mole

Question 16

When equal volumes of 1 M HCl and 1M NaOH are properly mixed, the resulting solution will be

- A. strongly acidic.
- B. weakly acidic.
- C. nearly neutral.
- D. weakly basic.

Question 17

If the solubility of NaCl at 25°C is 36.2 g/100 ml of H₂O, what mass of NaCl can be dissolved in 50 ml of H₂O?

- A. 18.1 g
- B. 36.2 g
- C. 72.4 g
- D. 86.2 g

Question 18

A 40% v/v ethanol solution refers to

- A. 0.4 ml of ethanol per 400 ml total volume.
- B. 4 ml of ethanol per 100 ml total volume.
- C. 40 ml of ethanol per 100 ml total volume.
- D. 40 ml of ethanol per 400 ml total volume.

Question 19

What volume of 5 M stock solution is required to prepare 5 L of 0.1 M working solution?

- A. 75 ml
- B. 100 ml
- C. 120 ml
- D. 150 ml

Question 20

A volumetric flask is used when preparing a solution of known

- A. pH.
- B. mass.
- C. density.
- D. concentration.

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

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

Question 1

‘Job ownership’ and ‘Teamwork’ are terms commonly used in the workplace.

- a. In order to demonstrate **Job ownership**, describe **two** positive practices that should exist.

2 marks

- b. Define the term **Teamwork** as it applies in a typical laboratory setting.

2 marks

Question 2

Some variation in results from laboratory analysis is acceptable as part of a product or service. However, when variation becomes excessive the product is described as nonconforming and therefore unacceptable to the customer.

- a. Give **two** reasons why product nonconformance may occur.

2 marks

- b. Logbooks should contain important information related to laboratory analysis.
List **three** important features that should be included in the logbook.

3 marks

Question 3

List **three** important items you should check before starting a sampling task.

3 marks

Question 4

- a. The following shows an incomplete Standard Operating Procedure (SOP). Complete the following procedural steps to aseptically transfer a single colony of bacteria from an agar plate to a tube of nutrient broth.

(You may use diagrams to assist in your response in the space between 4 and 13 below.)

1. Wear appropriate Personal Protective Equipment (PPE)
2. Organise equipment
3. Working near a Bunsen burner
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
14. Incubate the broth culture at 37°C

10 marks

- b. Why is it important to only use one colony of the bacteria?

1 mark

- c. How can you avoid generating aerosols when performing the task in **part a.** above?

1 mark

Question 5

- a. Define the term 'contact time for a disinfectant'.

1 mark

- b. Name **two** factors which can reduce the effectiveness of disinfectants.

2 marks

Question 6

Gas chromatography (GC) is a technique for carrying out the separation and measurement of mixtures of materials. The sample must be easily volatilised (evaporated) at low to high temperatures. These results appear as a series of peaks on a computer screen and the area under each peak is calculated.

A technician is required to determine the level of ethanol (alcohol) in a popular beer by using an optimised GC unit.

Method

1. The technician prepares a set of ethanol/distilled water standards in the concentration range of 0%, 2%, 4% and 8% ethanol.
2. A fixed volume of each standard is injected into the GC column and the area of each ethanol peak is measured and recorded.

Results

% Sample of ethanol	Area of peak (cm ²)
0 blank solution	0.0
2	3.3
4	6.2
8	12.4
commercial beer	7.0

- a. Plot a calibration curve of peak area versus % ethanol on the grid below.

4 marks

SECTION B – Question 6 – continued

- b. Estimate the % of ethanol in the commercial beer.

1 mark

- c. If the label on the commercial beer states that the % of alcohol in this beer is **5.0%ALC/VOL**, is the label accurate?

1 mark

- d. List **two** reasons that could cause your result to be different from the manufacturer's claim.

2 marks

- e. Where would the analysis results be recorded in a typical food laboratory?

1 mark

- f. List **two** pieces of PPE that should be used during this analysis.

2 marks

Question 7

Define the following terms.

a. Volumetric analysis

1 mark

b. Reagent

1 mark

Total 40 marks

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 correct and sufficient labelling of samples is an essential requirement in laboratories. Sample labels and codes allow for correct identification.

- a. Name **three** items which should appear on coded labels to allow for correct identification.

3 marks

- b. Hospitals sometimes use the expression, 'label the patient directly and not the bed'. This helps the right patient to get the treatment needed when moved around. Could all samples in laboratories be directly labelled like this?

Circle the correct answer. Yes No

1 mark

- c. A pathology laboratory routinely performs blood grouping and other tests on many samples. Several blood samples delivered to the laboratory on one day are found to be damaged and are leaking.

- i. What should be the first action the technicians take in this situation?

- ii. If the technicians are not sure of what to do, which document should they refer to as a first response?

- iii. Suggest **two** other appropriate actions if the above document cannot be located.

1 + 1 + 2 = 4 marks

- d.** Samples to be examined or tested are not the only source of occupational health and safety hazards in laboratories.

Provide examples of **two** other broad types of hazards typically found in laboratories.

2 marks

Question 2

Ramila is a technician working in a microbiology testing laboratory, routinely performing examinations of human, animal, food and environmental samples. Each of these sample types may have different requirements for their examination and/or testing.

- a. Identify **two** appropriate requirements Ramila needs to identify before testing commences.

2 marks

- b. The image shown below is the laboratory workspace or area used for Ramila's microscopic examinations.



Do you consider this to be a good or a poor example of how a work area should be set up for microscopy?
Provide **two** reasons for your answer.

2 marks

- c. Ramila was asked to perform a test that she has not previously performed. Suggest **two** checks she should do to determine if the current reagents are useable.

2 marks

- d. Ramila is often required to prepare samples for examination. These may vary according to sample type and who they are from. Samples are often 'logged in' by some method before the examination or testing begins.

Name one example of a type of sample logging system.

1 mark

- e. Laboratory samples often need some form of pre-treatment before testing. These include treatment with one of the following.

Sample pre-treatment

1. Strong mineral acid
2. Heparin or sodium acetate or citrate
3. Cold temperature storage (4°C, -20°C, -70°C)

Enter the number of the relevant pre-treatment in the table below against the sample type.

Sample type	Pre-treatment
Whole blood samples	
Biological type samples that decay or change quickly	
Water samples taken from a creek or river	

3 marks

Total 20 marks

Elective 2 – PMLTEST409A – Capture and manage scientific images

Question 1

Jayne is an experienced laboratory worker. She has previously used traditional emulsion-based films to produce images of her work for inclusion in professional publications. The publishers are now requesting that authors submit their work via email and similar media, and so Jayne must now comply with this.

- a. What would be **three** acceptable ways for Jayne to respond to this situation?

3 marks

- b. It is sometimes difficult for Jayne to make clear the important aspects of the images to readers or audiences. She requires considerable time to perfect them.

Suggest **two** other valid reasons for Jayne to adopt the responses described in **part a**.

2 marks

- c. Jayne's workplace has recently purchased a gel imaging system comprising

- an enclosed dark box
- a camera with exchangeable zoom lenses mounted on top that can be used for visible or other forms of photography
- a laptop computer.

What are **two** other methods that her laboratory may be using to record images?

2 marks

- d.** Jayne's supervisor wishes to publish new results ahead of a rival group. Jayne is anxious about producing images in a different way. The junior technician in the group has mastered the use of the gel imaging system and the computer.

Suggest **two** solutions the laboratory team can adopt to resolve this situation.

2 marks

- e.** One technique Jayne uses in her work involves the use of samples containing a radioactive isotope at low levels for producing autoradiograph films. The junior technician is now concerned about learning the radioisotope technique.

List **three** appropriate responses they both can make to this situation.

3 marks

Question 2

A senior educator needs to promote training that is provided to industry clients. As part of the training program, recorded images of previous workplaces are used. The senior educator needs to prepare a brief to begin the task.

- a. Define the term 'brief' here.

1 mark

- b. The training has successfully been completed in a variety of workplaces for existing clients. How can the senior educator use these successful training experiences to complete the promotion?

2 marks

- c. What aspects would the senior educator need to manage sensitively in following the suggestions from **part b.**?

2 marks

- d. Some of the existing and potential clients of the senior educator are members of a professional industry association.

Name **three** examples of the types of promotional material the senior educator may use if invited to address the association.

3 marks

Total 20 marks

END OF ELECTIVE 2
SECTION C – continued
TURN OVER

Elective 3 – PMLTEST304B – Prepare culture media

Question 1

The purpose of culture media is to provide an environment in which microbes within a sample can grow quickly so that their presence can be rapidly detected in a test in the shortest possible time.

- a. List **three** critical properties of culture media.

3 marks

- b. What is the purpose of adding agar to culture media?

1 mark

Question 2

The recipe for making 1.0 L of Plate Count Agar (PCA) media is given in a Standard Operating Procedure as follows.

Materials for Plate Count Agar (PCA)

tryptone 5.0 g

yeast extract 2.5 g

D-glucose 1.0 g

agar 15.0 g

water (distilled, deionised or reverse osmosis water) 1.0 L

Method

PCA is prepared by weighing out 5.0 g of tryptone, 2.5 g of yeast extract, 1.0 g of D-glucose and 15.0 g of agar in separate weighing boats on a suitable balance.

- Using a measuring cylinder, place 1.0 L of pure water in a large beaker or flask.
- Combine the ingredients in the water and heat the mixture in a boiling water bath.
- Stir to completely dissolve the solids.
- Allow the solution to cool to between 50°C and 60°C.
- Check the pH and adjust it so that the pH will be 7.0 +/-0.1 (between 6.9 and 7.1).
- Divide into 100 mL or other suitable amounts and place these into media bottles.
- Sterilise solution by autoclaving at 121°C for 15 minutes.

a. Why are the ingredients weighed separately?

1 mark

b. The laboratory has three different types of weighing apparatus.

- a kitchen scale
- a laboratory balance accurate to two decimal places
- an analytical balance accurate to five decimal places

Which piece of apparatus would be appropriate for this weighing step?

1 mark

c. Why is pure water specified as the type of water to be used?

1 mark

d. What would happen if the culture medium was not autoclaved before use?

1 mark

e. If only 200 ml of plate count agar was required for testing, how much tryptone, yeast extract and glucose would be required? Show your calculations.

3 marks

Question 3

10% v/v serum broth can be prepared by adding 1 ml of serum aseptically to a tube containing 9 ml of nutrient broth using aseptic techniques.

Some bacteria needs the addition of heat labile ingredients, for example serum, to enable them to grow.

- a. Define the term 'heat labile'.

1 mark

- b. The following shows an incomplete Standard Operating Procedure (SOP). Complete the procedural steps of how you would add 1 ml of sterile serum to a tube containing sterile nutrient broth.

1. Wearing appropriate PPE
2. Working close to a Bunsen burner
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
11. Test incubate the serum broth

8 marks

Total 20 marks

