

2019 VCE VET Laboratory Skills examination report

General comments

The 2019 written examination contained a variety of questions, covering content from the following four units of competency:

MSL933006 Contribute to the achievement of quality objectives

MSL973014 Prepare working solutions

MSL973061 Perform aseptic techniques

MSL973019 Perform microscopic examination

Students performed well in most areas of the exam this year. The questions involving more-complex calculations in chemistry were challenging for some students. Students are encouraged to practise these types of questions.

Students are reminded to choose the best or most correct answer and not look for the answer that they believe reflects the common practice. Common practice in laboratories is not always the best or the safest method to do a procedure.

Understanding the application of each piece of laboratory equipment is essential to perform tasks accurately and efficiently. In some cases, it is a question of safety; in others, it is important for reducing errors.

Students are encouraged to learn about microscopes and the application of types of microscope for different samples.

Specific information

This report provides sample answers or an indication of what answers may have included. Unless otherwise stated, these are not intended to be exemplary or complete responses.

The statistics in this report may be subject to rounding resulting in a total more or less than 100 per cent.

Section A – Multiple choice questions

The table below indicates the percentage of students who chose each option. The correct answer is indicated by shading.

Question	% A	% B	% C	% D	Comments
1	21	29	48	3	Students need to understand which type of microscope is appropriate to use. Large, whole insects will not be visible under a brightfield or compound microscope. A stereo or dissecting microscope is the best choice.
2	13	79	3	5	
3	2	81	11	6	This simple volume calculation was well done.
4	13	3	79	5	
5	2	76	3	19	The primary principle for dealing with accidents in the laboratory is to seek or apply first aid to the injured person.
6	0	6	11	83	A well-answered question; many students demonstrated a good understanding of solution types.
7	3	89	6	2	The principles of equipment safety checks were well understood.
8	24	3	8	65	There are two clear reasons for inverting agar plates.
9	87	6	5	2	This question was well done by students.
10	73	17	2	8	
11	24	10	29	38	Students need to be able to differentiate between random and systematic errors and give examples of these in a laboratory setting. It is an important concept.
12	73	21	3	3	The most appropriate process would be one where the laboratory technician takes ownership of the issue and endeavours to keep the client informed of progress.
13	84	3	6	6	
14	21	6	57	16	It is important to note the change in units of volume from the stem of the question to the answers.
15	44	14	21	21	How to apply the principles of significant figures was not well understood.
16	0	0	21	79	
17	48	2	44	6	Problem-solving when samples do not meet expectations is an important technical skill.
18	90	8	0	2	Most students were well versed in the operation of an autoclave.
19	0	17	8	75	Not all students understood when to apply a formula.
20	8	5	86	2	This simple calculation was well done by most students.

Section B – Short-answer questions

Question 1a.

Marks	0	1	2	Average
%	19	10	71	1.5

The correct answer was 6 mg/mL. Workings were:

$$C1V1 = C2V2$$

$$15 \text{ (mg/mL)} \times 100.0 \text{ mL} = C2 \times 250.0 \text{ mL}$$

$$C2 = 6 \text{ mg/mL}$$

Answers needed to show workings and have correct units for full marks.

Question 1b.

Marks	0	1	2	Average
%	0	8	92	1.9

Answers needed to address the issue of out-of-date stock. Correct answers included two actions from the following (for two marks):

- dispose of the prepared working solution
- remake the stock
- check with experienced colleagues if it could still be used
- label container as 'expired'
- record in logbook
- carry out regular stock checks to prevent these occurrences happening.

Students answered this question well.

Question 1c.

Marks	0	1	Average
%	6	94	1.0

The correct answer was to refer to the safety data sheet for spills advice.

Question 2a.

Marks	0	1	2	Average
%	33	11	56	1.2

The correct answers were:

- Solute: The substance to be suspended or dissolved in the solvent (one mark).
- Solvent: The liquid portion of a solution. The liquid in which the solute is dissolved (one mark).

Question 2b.

Marks	0	1	2	Average
%	75	11	14	0.4

The correct answers were:

- 7.5 g solute per 100 mL of solvent, or
- 7.5 g of calcium carbonate per 100 mL of distilled water/solution, or
- 37.5g of solute per 500 mL of solution.

Responses needed to give a clear description of the mass to volume ratio of solute to solvent.

Question 3a.

Marks	0	1	2	3	4	5	Average
%	2	0	8	27	0	63	4.2

The correct answers were as follows:

Step number	Steps for preparing a wet mount
4 or 5	Pipette two drops of deionised water onto the sample.
3	Place the sample on the slide.
6	Place the cover slip on the sample, minimising any air bubbles.
5 or 4	Stain the sample.
1	Clean the slide with alcohol and a lens tissue.
2	Cut a thin layer of cells from the sample.

Note: Steps 4 and 5 were interchangeable.

This question was well done by most students.

Question 3b.

Marks	0	1	2	3	4	Average
%	8	24	27	29	13	2.2

The correct answers were:

- disposal of cover slip
 - sharps bin or glass bin (one mark)
 - hazard: puncture wounds and cuts from broken glass (one mark)
- disposal of imported weed species sample
 - biohazard bin, incineration, autoclaving (one mark)
 - hazard: potential biological contamination or infection from microorganisms (one mark).

Question 4a.

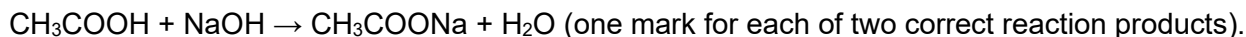
Marks	0	1	Average
%	35	65	0.7

Neutralisation was the correct response.

Question 4b.

Marks	0	1	2	Average
%	46	13	41	1.0

The correct response was



Writing a chemical equation appeared to be challenging for some students. This is an important skill. Recognising the chemical symbols for compounds can assist when searching for a chemical on the shelf or reading notes in a logbook.

Question 4c.

Marks	0	1	2	Average
%	51	16	33	0.9

Acceptable responses were within the range 10.00–10.5 mL volume of NaOH added (one mark for correct volume). The reasoning was that the end point is where the colour changes from colourless (in acetic acid) to light pink (in NaOH) at pH 8.3 (one mark for reasoning).

Students should have some understanding of the titration technique in its simplest form and be able to write a simple chemical equation. The end point is not always at pH 7 (neutral pH) and indicators change colour at different pH. The indicator is chosen because its colour change will occur at the endpoint of the reaction.

Question 5a.

Marks	0	1	Average
%	8	92	0.9

The correct answer was to minimise contamination from non-sample sources (one mark).

Question 5b.

Marks	0	1	Average
%	78	22	0.2

The technician's conclusion was incorrect, as bacteria can grow both on the pour plate surface as well as in the agar itself. The technician should check if the control plate also shows contamination (sterility check). If yes, then the technician would be correct in their assumption (one mark for reasoning).

The physical appearance of growth in pour plates was not well understood by many students. Analysing results and giving a possible cause is a work skill required in laboratories.

Question 5c.

Marks	0	1	2	Average
%	63	29	8	0.5

For two marks, correct answers nominated two variations to the procedure from:

- dilute the sample
- use less sample volume

- count a section of the plate (e.g. one-quarter) and multiply to get a total for that plate.

Students were asked to vary the specific method. Offering completely different procedures or just stating 'ask the supervisor' was not an adequate response to the question.

Question 6a.

Marks	0	1	Average
%	29	71	0.7

The correct answer was autoclaving (one mark).

Question 6b.

Marks	0	1	Average
%	52	48	0.5

Correct answers included (one mark):

- autoclave tape
- monitoring beads
- autoclave recording (check print tape for correct parameters)
- Sterikon/spore strips
- hot plate, microwave or pressure cooker to sterilise.

Question 6ci.

Marks	0	1	Average
%	41	59	0.6

The correct answer was that it is a heat-sensitive component and therefore cannot be autoclaved (one mark).

Question 6cii.

Marks	0	1	2	Average
%	83	6	11	0.3

The technician could use filter sterilisation (one mark). This involves dissolving the antibiotic, then filter sterilising directly into the nutrient media through a 0.2-micron filter. Add after when agar is still warm (about 50 °C) as antibiotic is a sterile component and doesn't require sterilising (one mark).

Question 7a.

Marks	0	1	2	Average
%	11	73	16	1.1

For two marks, responses needed to provide two reasons from the following:

- various components are to be well separated
- spreads the different cells in blood to identify each type
- enables proper counting of each cell type
- provides a smear thickness that is countable

- gives consistency of method/procedure for laboratory quality purposes/following standard operating procedure (SOP).

Question 7b.

Marks	0	1	2	3	4	Average
%	0	11	21	27	41	3.0

Correct answers were:

- Figure 1—Inoculating the loop with sample and flaming entrance of top of test tube, and then sealing the tube.
- Figure 2—Flaming the sample loop.
- Figure 3—Streaking the agar plate
- Figure 4—Flaming the end of the sample tube.

One mark was awarded for each correct answer.

Students are reminded that flaming the opening of a bottle is not sterilising the container. When an inoculation loop is flamed to red hot in a Bunsen burner flame, this is complete sterilisation and can be referred to as sterilising the loop.

Question 8ai.

Marks	0	1	Average
%	11	89	0.9

The correct answer was pH.

Question 8aii.

Marks	0	1	Average
%	19	81	0.8

The correct answer was 24 hours (one mark).

Question 8b.

Marks	0	1	Average
%	25	75	0.8

Pond effluent can be discharged. The pH parameters are within the limits of pH.

No marks were awarded for just 'yes'.

Question 8c.

Marks	0	1	2	Average
%	21	40	40	1.2

An increasing trend can be seen past 16:00 hours (one mark).

The readings are approaching the upper limit of pH parameter or a systematic error has occurred causing the reading to slowly increase over time and eventually cross the upper limit (one mark).

Question 9a.

Marks	0	1	2	3	Average
%	3	6	33	58	2.5

Correct responses included (three marks for three actions):

- refer to SOP
- inform supervisor
- abort cycle
- stop autoclave process
- check monitoring chart
- check autoclave print tape, check monitoring beads or tape
- check autoclave for faults
- record run in logbook as failed
- discard media or label 'do not use for testing not sterile'
- replace or use another autoclave to rerun cycle
- arrange for service of autoclave.

Question 9b.

Marks	0	1	Average
%	14	86	0.9

One mark was given for one consequence of the temperature being 78 °C instead of 121 °C and has not finished the full 60-minute cycle from:

- Media may not be fully sterilised and therefore may affect the results of testing.
- If media was sufficiently sterilised, there may be no effect from the technician's action, depending on the bacteria in the mixed load.
- Spore-forming bacteria need to be sterilised at 121 °C for at least 10–15 minutes, for example, and the technician could not be sure for a shorter cycle that finishes at a lower temperature.
- It could cause error in the testing results.

Question 9c.

Marks	0	1	Average
%	65	35	0.4

The correct answer was (one mark):

- A wet cycle was chosen as there was a mixed load of both apparatus and liquid media.
- Fast dry cycle is not appropriate for liquid media due to boiling over. Slow exhaust is required to prevent boiling over of liquids.

This is an important concept. Many students struggled with this question.

Question 10a.

Marks	0	1	2	3	Average
%	25	19	33	22	1.5

Three marks were awarded for three items of equipment from:

- laboratory oven
- desiccator
- evaporating dish, or watch glass
- analytical balance (precise)
- graduated pipette (and pipette filler not as a separate item)
- volumetric flask
- Schott or reagent bottle.

Students are reminded to use the correct terms for equipment in laboratories (e.g. balance rather than 'scale', which is a piece of equipment used in kitchens). As the question has an SOP step requiring a precise weight of a compound then an analytical balance is the appropriate answer. Measuring cylinders are also not appropriate for this type of procedure where exact volumes are required; a graduated pipette would ensure an accurate measurement of a volume.

Question 10b.

Marks	0	1	Average
%	73	27	0.3

To prepare a standard solution, the technician is required to follow SOP to ensure high purity of reagent used to prepare stock standard solution. An analytical grade reagent is used to ensure accurate results.

Stating AR means analytical reagent was not enough to gain the mark.

Question 10c.

Marks	0	1	2	3	4	Average
%	40	8	2	3	48	2.1

The correct answer was (for one mark each):

- Tube 2—0.5 mg mL
- Tube 3—0.25 mg mL
- Tube 4—0.125 mg mL
- Tube 5—0.0625 mg mL.

Units were not required as they were included as part of the question stem.

Question 10d.

Marks	0	1	2	3	Average
%	3	0	24	73	2.7

Three marks were awarded for three types of label information. The correct answers included:

- name of the solution or sample name (eg NaCl in 0.1 M HCl)
- concentration of the solution or dilution ratio
- date solution was prepared
- name of person who prepared the solution
- solution expiry date.

The addition of a hazard symbol was not required. This is not always a requirement on all solutions. The solution was a very weak one and therefore not hazardous. Adding a hazardous or safety label was unnecessary and did not gain an extra mark.

Question 10e.

Marks	0	1	2	Average
%	6	5	89	1.9

Correct answers were (one mark for one appropriate action):

- check with supervisor
- refer to SOP
- check with colleagues
- carry out a trial run to check the alternatives suitability
- check the chemicals safety data sheet for safety and handling requirements.

A mark was awarded for reasoning that it involves a change to the method that needs to be checked carefully.

Question 11a.

Marks	0	1	2	Average
%	13	62	25	1.2

It is clear the smear was poorly performed from:

- clumps of material are shown
- uneven and dry smear area (one mark).

A mark was given for reasoning the cells need to be dispersed to allow proper identification and more accurate counting.

Question 11b.

Marks	0	1	2	Average
%	2	38	60	1.6

For two marks, students could nominate two actions from:

- identify missing sample through elimination, still performing the test
- prepare a new slide
- refer to supervisor.

Question 11c.

Marks	0	1	2	3	4	5	Average
%	11	24	30	25	10	0	2.0

Type of sample	Microscope option number
pond water sample for protozoa	1 or 4
butterfly	4
yeast culture	2 or 5 or 1
flask of cultured animal cells	3
smear slide of suspected bacteria-contaminated water	7

Five marks were awarded for five correctly assigned option numbers.

There were many incorrect responses to this question. Having a good understanding of microscope types and applications for different samples is a key skill in biological and pathology laboratories. This needs to be demonstrated by students both in practical classes and in assessments.

Question 11d.

Marks	0	1	2	3	Average
%	48	25	14	13	0.9

The distance between lines = reticle division = 0.01 (one mark)

objective lens value 10

$0.01/10 = 0.001$ (one mark)
mm

Scale measurement any of 20, 21, 22 accepted. Multiply $20-22 \times 0.001 = 0.020-0.022$ mm or 20–22um (three marks) (must have units)

There were many incorrect responses to this question. It requires a good understanding of the compound light microscope and practice with these calculations will assist students.

Question 12a.

Marks	0	1	Average
%	16	84	0.9

Responses needed mark a point X clearly on the graph at the point 0.45 on the vertical axis and 2.5 on the horizontal axis (accepted a range of 2.2–2.6)

Question 12bi.

Marks	0	1	2	Average
%	8	10	83	1.8

The correct answer was Test 2. The reason was that it was not concordant or not near Test 1 and Test 2 values (one mark).

Question 12bii.

Marks	0	1	2	Average
%	3	32	65	1.6

For two marks, responses needed to include two actions from:

- inform supervisor
- record results and reasons for concerns in logbook
- repeat test with the same sample solution

- retest with another collected sample.

Question 12c.

Marks	0	1	2	Average
%	10	25	65	1.6

For two marks, responses needed to include two explanations from:

- to minimise error from background absorbance interfering with reading on spectrometer
- to minimise drift from zero
- for calibration of equipment
- to minimise the chance of a systematic error occurring.