VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

2012 VET Laboratory Skills GA 2: Written examination

GENERAL COMMENTS

VCE VET Laboratory Skills is a small program and, therefore, it is difficult to comment on overall trends.

The questions that related to real work situations – particularly in the areas of quality control, safety and good laboratory practices – were poorly answered by many students. Some students struggled with calculations, particularly in the questions relating to the unit MSL973002A Prepare working solutions.

VCE VET Laboratory Skills is a work-related, practical science program. Applied knowledge is critical for all students.

Students must have a working knowledge of the basic structure and function of a cell for the interpretation of results in the unit MSL973004A Perform microscopic examination. Students should also have an understanding of different types of cells, for example, plant, animal and bacterial cells.

SPECIFIC INFORMATION

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	0	50	15	35	Half of the students showed some confusion about where the slides should be discarded. All students understood that the slide posed a biohazard risk. Understanding what to do with waste materials is a critical part of laboratory work.
2	0	95	0	5	
3	75	0	20	5	
4	15	0	85	0	
5	15	5	70	10	
6	5	30	65	0	Laboratory safety and good laboratory practices should be included in the program materials. All units have safety included in their outlines.
7	5	5	85	5	
8	5	20	10	65	Good laboratory practices and ensuring the quality of results are important skills in the workplace. Students should be instructed on how best to achieve these in a laboratory situation.
9	45	55	0	0	This is an example of students not being able to perform calculations accurately. Option B is incorrect by a factor of 10. Dilutions are still not fully understood by students.
10	0	10	0	90	
11	15	10	40	35	This question was difficult for some students. The proper storage and handling of chemicals is not an easily acquired skill. It was good to see that students had some understanding of chemical storage cabinets.
12	5	0	95	0	
13	0	20	5	75	
14	10	80	0	10	

Question	% A	% B	% C	% D	Comments
15	25	10	0	65	The different use of the term 'stock' in this question confused some students. A stock solution in chemistry is one of known concentration, which is further diluted to prepare working solutions. In aseptic or microbiological laboratories, a stock culture is one preserved as a reference point to identify unknown cultures or microorganisms.
16	0	0	0	100	
17	10	0	5	85	
18	15	60	25	0	
19	15	40	20	25	This question assessed basic knowledge and understanding of cell structure and function. This is a fundamental area of microscopic skills and needs to be included in the teaching of this unit of competency.
20	0	20	0	80	

Section B – Short-answer questions

Question 1a.

Marks	0	1	Average
%	53	48	**0.5**

pH control in pond or changes of pH in pond water over 24 hours

Students did not answer this question well. Some students merely repeated the chart's heading and did not name the process being shown.

Question 1b.

Marks	0	1	Average
%	10	90	**0.9**

11:30 and ~17:00 hours

Students performed well on this question and demonstrated the ability to read a chart accurately.

Question 1c.

Marks	0	1	2	Average
%	55	15	30	**0.8**

Add a weak acidic solution to the pond to lower the pH.

The majority of students did not know that to lower the high pH of a solution, a weak acid (any acidic solution was acceptable) is needed.

Question 2

Marks	0	1	2	3	Average
%	8	18	35	40	**2.1**

Possible answers included (any three of)

- turn off electricity or switch off equipment when not in use
- examine work practices that use excessive electricity
- work in bulk where practicable
- recycle and re-use materials where practicable.

Students had difficulty distinguishing between the concepts of correct waste disposal and waste minimisation. Most students gave the first two examples as their answer. The third example could be applied in the laboratory by processing larger batches of samples rather than many smaller lots. The last example could include reducing the laboratory's use of disposable plastic ware and using washable glassware.

Question 3

Marks	0	1	2	Average
%	3	53	45	**1.5**

Any two of

- undertake further study/training
- attend seminars
- participate in teamwork activities
- network
- read relevant publications
- become a member of relevant organisations.

Students generally answered this question well and had a good understanding of the types of professional development opportunities that are available.

Question 4

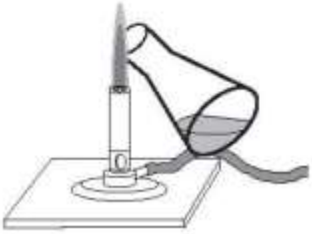
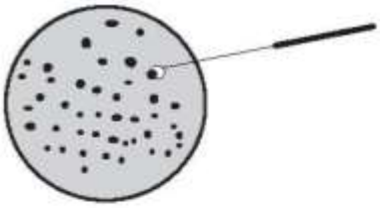
Marks	0	1	2	3	4	5	6	Average
%	3	13	33	20	8	18	8	**3**

Possible answers included

- Look at clients' samples and follow some through from sample reception to reporting. Checking if some error has occurred in the time taken at each stage. Check these against standard laboratory procedures.
- Communicate with the client. Find out what the client's expectations are in terms of the turnaround time for tests and explain how long tests take (e.g. testing for bacteria takes a minimum of 48 hours, so expecting results in 30 minutes is not a practical expectation).
- Look at current laboratory practices and identify areas for improvement in testing and reporting (e.g. sample batch testing, generating reports more regularly, train more signatories).

Question 5

Marks	**0**	**1**	**2**	**3**	**4**	**5**	**Average**
%	3	10	13	38	20	18	**3.2**

Aseptic technique/equipment	Procedures
	Swabbing a work surface to check for microbiological growth
	Flaming the mouth of a culture flask to maintain aseptic conditions
	Transferring colony to loop from an agar plate
	Autoclave used for sterilisation of equipment
	Class II biohazard cabinet or Laminar flow used for the protection of cultures and workers

The first response, swabbing a work surface, was not well done. Some students confused this with culturing bacteria. Students generally named the equipment, but failed to describe (as asked in the question) the procedure used for each.

Question 6

Marks	0	1	2	3	4	5	6	Average
%	10	3	13	18	25	13	20	**3.5**

- Sterilisation: the process of destroying all microorganisms and their pathogenic products. It can be accomplished by any of various methods, including heat (usually wet steam under pressure at 121 °C for 15 minutes in an autoclave to sterilise culture media or a container for culturing bacteria).
- Disinfection: the treatment of surfaces; for example, with a chemical such as hypochlorite, to destroy harmful microorganisms or pathogens.
- Sanitation: to make a work area clean by removing dirt, filth or unwanted substances. An example would be cleaning with detergent and water, thus reducing the bacterial numbers or load.

Some students misread the question and did not explain when the techniques would be applied in a laboratory, but gave a general description of the term.

Question 7a.

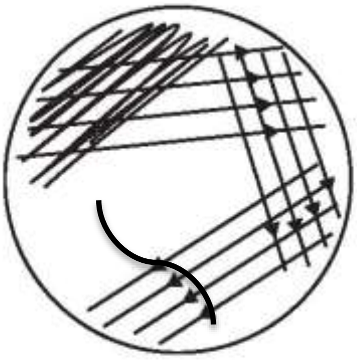
Marks	0	1	2	Average
%	13	13	75	**1.7**

- Name of the common procedure: streak plating, streak dilution, quadrant streaking plate
- Explanation: culture of isolated colonies to provide a pure culture from a single colony

Students generally answered this question well.

Question 7b.

Marks	0	1	2	Average
%	60	13	28	**0.7**



Some students incorrectly added another set of four parallel lines and some crossed into the primary inoculum.

Question 8

Marks	0	1	2	3	4	5	6	Average
%	5	3	18	28	33	5	10	**3.4**

- Scenario 1: This could cause the samples to overgrow/change and alter the results. Samples should be stored correctly at 4 °C. A record of the results should be made in the log.
- Scenario 2: Recording the results is correct. However, Ming should still keep the samples (storing these appropriately at 4 °C) as her supervisor might need to confirm the interpretation of the results before releasing them to clients.

This question was not well understood by students. Some students took the two separate scenarios to be two parts of one story (sequential). Students were asked to evaluate and comment on each separate scenario. Some did one or the other, but not both tasks.

Question 9a.

Marks	0	1	2	Average
%	0	18	83	1.9

Any two of
- microscope
- balance
- test tube
- pipette/dropper
- microscope slide
- coverslip.

Question 9b.

Marks	0	1	Average
%	40	60	0.6

$\frac{1}{25} \times 100 = 4\%$

Question 9c.

Marks	0	1	2	Average
%	35	58	8	0.8

Any two of
- return to a lower magnification (i.e. 10× objectives) and focus, then go back to 40× objective
- clean lenses and check alignment of light path
- close iris diaphragm and check condenser position.

Question 10

Marks	0	1	2	3	4	Average
%	0	3	13	23	63	3.5

Any two hazards with an explanation of how each hazard poses a risk to the operator or microscope was accepted. For example
- incorrect position of microscope on benchtop, as it could fall off onto the legs of the operator and be damaged. The operator is not in an ergonomically sound position – poor posture due to the lack of leg room
- no leg room, ergonomically unsafe, can cause poor posture as the operator is too far away from microscope, possible injury to neck and/or back
- open cupboard door exposes glassware, which could be kicked off shelves and broken, creating a sharps hazard
- chair/stool without adjustable height, which will cause neck and back strain
- power cord is safe but it is too long, creating an electrical hazard if it drapes across the sink, or the cord could be pulled by operator and the gas could be turned on accidentally. Other equipment on the bench could be knocked over and broken
- cluttered area with rubbish, clothes and food items pose a health hazard
- unwashed or used glassware too close to work area and could be knocked off benchtop
- work area could be in a walkway or too close to doors or windows

This question was generally well done by students.

Question 11

Marks	0	1	2	3	4	5	6	Average
%	5	23	28	20	18	5	3	2.5

Sample	Microscope	Method and total magnification used
mineral samples from a quarry	stereo microscope	• examine surface • no particular preparation other than ensuring that the specimen is small enough to fit under the lens and be in focus • low magnification only
bacterial culture for identification	compound light/bright field microscope, with 100× oil immersion lens	• small sample of culture dried and heat-fixed onto slide, then stained by Gram's stain or methylene blue • examined less than 100× oil
cell cultures in flasks for contamination checks	inverted phase contrast microscope in unopened culture flask	• no staining required as phase contrast (if correctly set up) will allow the visualisation of cell structures and bacterial growth • 400× objectives matched to correct phase condenser aperture

Students failed to recognise that a mineral sample might be a large object and that the surface might be of interest. Answers that described a sample being placed on a slide and examined under low magnification on a bright field microscope were also accepted.

Students handled 'bacterial culture for identification' well.

Students failed to identify that cell cultures are examined in their culture flasks. Students need to know the types of microscope and their uses. All answers that were logical were accepted. These included a drop of culture taken aseptically from the flask, stained and examined under a bright field microscope at high magnification.

Question 12a.

Marks	0	1	2	Average
%	35	25	40	1.1

There is a large amount of dust, hairs and dirt on the slide or the lens system of the microscope.

Some students seemed confused by the image.

Question 12b.

Marks	0	1	2	Average
%	45	28	28	0.9

Wipe the slide, lenses (objective and ocular), condenser and light-source glass with lint-free tissue and a suitable cleaning solution, such as 70 per cent ethanol.

Those students who understood what the image was depicting answered the question well.

Question 13

Marks	0	1	Average
%	65	35	0.4

pH = $-\log_{10} 0.01 = 2$

This question was poorly done by students, which was surprising since they just needed to put in the concentration of nitric acid that had been given to them.

Question 14

Marks	0	1	2	Average
%	15	23	63	**1.5**

- left: 44.5 ± 0.1
- right: 2.74 ± 0.01

This question was well done by most students, with the right-hand cylinder being more difficult for some.

Question 15

Marks	0	1	2	3	Average
%	5	5	23	68	**2.6**


flammable


corrosive


toxic

Question 16a.

Marks	0	1	Average
%	85	15	**0.2**

A stock solution is a concentrated solution of known concentration that will be diluted to some lower concentration for actual use. Stock solutions are used to save preparation time, conserve materials, reduce storage space and improve the accuracy with which working solutions are prepared.

This question was poorly answered by most students. Many students thought of stock solutions as working solutions and did not specify that the solution must be diluted before use. Many did not know the standard solutions used in titrations.

Question 16b.

Marks	0	1	2	Average
%	48	10	43	**0.9**

$C_1V_1 = C_2V_2 \rightarrow V_1 = C_2V_2/C_1 \rightarrow V_1 = 0.2 \times 500/5 \rightarrow V_1 = 20$ mL

Students need to be able to quickly calculate dilutions in a laboratory; it is a routine skill.

Question 16c.

Marks	0	1	Average
%	5	95	**1**

Any one of

- measuring cylinder
- beaker
- volumetric flask
- pipette.

Question 16d.

Marks	0	1	Average
%	13	88	**0.9**

Any one of

- concentration
- date prepared/safety information
- oxidiser/DG class
- his name

- name of solution.

Question 16e.

Marks	0	1	Average
%	55	45	**0.5**

It should be stored in a dark glass bottle in the oxidisers' cupboard.

Question 17a.

Marks	0	1	2	Average
%	3	13	85	**1.9**

Any two of
- burette
- volumetric pipette
- conical flask
- volumetric flask.

Question 17b.

Marks	0	1	Average
%	58	43	**0.5**

The purpose of the indicator is to establish the end point of the titration.

Many students confused the end point with the equivalence point. The end point is defined by the choice of indicator as the point at which the colour changes. Depending on how quickly the colour changes, the end point can occur almost instantaneously or take some time. The equivalence point is the point where the number of moles of base equals the number of moles of acid. If the indicator is chosen correctly, the end point will essentially be at the equivalence point.

Question 17c.

Marks	0	1	2	Average
%	60	15	25	**0.7**

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$

This question was not answered well by the majority of students. Students need to understand and practise the skill of writing and balancing simple chemical equations.

Question 17d.

Marks	0	1	2	3	Average
%	65	23	3	10	**0.6**

n(NaOH) = $0.1031 \times 0.0232 = 2.39 \times 10^{-3}$
therefore, n(H_2SO_4) = 2.39×10^{-3} /2 = 1.20×10^{-3}
M (H_2SO_4) = n/V = 1.20×10^{-3}/0.025 = 0.0478M

Students should be able to calculate the concentration of a solution after a titration has been performed.

Question 18a.

Marks	0	1	Average
%	8	93	**0.9**

alkaline

Question 18b.

Marks	0	1	2	Average
%	53	5	43	**0.9**

M = n/v	n = m/fw
1 × 1 = n	1 × 83.995 = mass
1 = n	83.995 g = mass

Many students found this question difficult. Students need further practise in completing simple calculations in chemistry questions. Basic maths skills such as multiplication and division need greater emphasis.

Question 18c.

Marks	0	1	2	Average
%	13	20	68	1.5

No, as the concentration could have decreased or there could have been microbial growth, which may have altered the properties of the solution.

This question was answered well by most students, demonstrating that they had a good understanding of quality control for solutions in laboratories.