2014 Examination Report

2014 VCE VET Laboratory Skills: GA 2 Examination

GENERAL COMMENTS

The majority of students performed well in most areas of the 2014 exam; however, the questions involving calculations in chemistry were poorly done by some students. Students should be encouraged to practise these types of questions.

Students should always choose the correct answer and not look for the answer that they believe reflects the common practice.

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

The different types of microscopes can cause confusion; for example, a 'stereo' and 'scanning' electron microscope are very different types of microscopes, but some students confused the two.

The use of different stains to help identify cells is another poorly understood area for some students.

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	0	97	3	0	
2	5	3	3	89	
3	3	13	68	16	Students must have a good grasp of the correct technical procedures.
4	0	5	0	95	
5	76	8	13	3	
6	32	5	50	13	Many students selected option C; however, when adding a repeated volume to the same flask a burette would reduce the errors that occur when filling and emptying a pipette. Option A was therefore the best method to give the most accurate results.
7	47	42	3	8	Swabbing the surface with ethanol would be done after preparing the slide and not beforehand, as the issue is not the contamination of the slide by the surface but the contamination of the worker by the sample. The best answer was to wear appropriate PPE. Face masks are recommended as well as gloves, goggles or safety glasses, and laboratory gowns or coats.

Question	% A	% B	% C	% D	Comments
8	21	21	24	34	Many students selected option D, which may have seemed logical but was not the best answer. The reason for using 70% w/v ethanol is that it works well as a disinfectant. It remains in contact with a surface for a long enough time to kill many of the pathogens; whereas, 95% w/v ethanol evaporates too quickly.
9	50	0	37	13	It is important for students to understand what information must be written on the label of a solution prepared by a technician in a laboratory.
10	0	0	100	0	
11	53	0	37	11	The technical terms and their practical application when using a microscope are extremely important for laboratory workers. Understanding these will help trouble-shoot faults when using a microscope. Students failed to demonstrate this understanding.
12	42	37	11	11	Students seemed to confuse the highest level of control and the appropriate level of control, believing the highest was the best method when a Class II biosafety cabinet would offer a sufficient level of protection; a Class III cabinet would also be a choice but only if it was available, as they are usually only found in the highest level biosecurity laboratories.
13	0	13	11	76	Students need to have a working knowledge of the autoclave and its uses.
14	0	95	0	5	
15	11	76	8	5	
16	8	0	79	13	
17	13	0	61	26	Many students thought only the best staff would be asked to perform testing; however, the reality in a laboratory situation is that most testing is performed by less experienced and less qualified staff. The supervisors and laboratory managers will offer training and advice when required. If testing occurs promptly after receiving the sample then the best results will be achievable, i.e. out-of-specification results will be detected.
18	11	11	68	11	
19	8	61	24	8	Knowledge of cell structure, cell types and the classification of organisms is important.
20	13	84	0	3	

Section B – Short-answer questions

Question 1a.

Marks	0	1	2	3	Average
%	0	5	32	63	**2.6**

Any three of:

- explanation of health and safety policies
- explanation of dress requirements
- explanation of workplace policies (e.g. bullying) and reporting and responsibilities
- what to do if injured and injury reporting
- explanation of manual handling
- explanation of known hazards
- explanation of the person's role
- describing reporting lines
- identifying MSDS or SOP
- meeting key personnel in the organisation.

Question 1b.

Marks	0	1	Average
%	33	67	**0.7**

'Right first time' means that when performing a task, it is better to do the task correctly the first time rather than have to do it again in order to correct mistakes. The objective is to achieve the desirable outcome on the first try.

Question 1c.

Marks	0	1	2	Average
%	0	34	66	**1.7**

Any two of:

- use resources carefully
- plan activities to prevent overuse of materials
- reuse equipment if safe to do so
- do as many tests as possible in the one run of a machine.

Question 1d.

Marks	0	1	2	Average
%	1	11	87	**1.9**

Possible answers included (any two of):

- tell the co-worker not to do it
- report it to the supervisor
- explain to the co-worker the safety issues of water on surfaces (accidental spills, etc.)
- explain experimental inaccuracies that might occur if the water was to contaminate samples
- wash water from eyes to prevent infection.

Question 2a. and 2b.

2a.

Marks	0	1	2	3	Average
%	1	3	19	77	**2.7**

2b.

Marks	0	1	2	3	Average
%	4	25	30	41	**2.1**

1.
What it indicates: emergency eye wash; indicates the presence of a basin fitted with eyewash sprays
Where it is located: situated above the eyewash station, visible to all in the laboratory

2.
What it indicates: safety goggles; indicates that everyone should wear safety goggles
Where it is located: outside all entrances to laboratories where safety goggles are required

3.
What it indicates: non-flammable gas; indicates the presence of a gas under pressure, Dangerous Goods Category 2
Where it is located: on the gas cylinder or where the gas cylinder is stored

Question 3a.

Marks	0	1	Average
%	73	27	**0.3**

The resulting solution would have a volume greater than 1.0 L because the KCl takes up some space itself.

Question 3b.

Marks	0	1	Average
%	66	34	**0.4**

Dissolve 74.5g of KCl in water, quantitative transfer to a 1 L volumetric flask and make up to the mark.

A number of students confused KCl (potassium chloride, a salt) with an acidic solution; however, the question was not asking about the properties of the chemical but asking students to review the procedure outlined in the SOP.

Question 4

Marks	0	1	2	3	4	5	Average
%	0	5	10	5	38	42	**4**

A. mitochondria
B. Golgi apparatus
C. nuclear membrane/nucleus
D. cell/cytoplasmic membrane

Cell type: either animal or eukaryotic

Some students confused 'cell type' with classification kingdom.

Question 5

Marks	0	1	2	3	Average
%	1	3	11	85	**2.8**

Any three of:

- the identity of the chemical
- health hazards that the chemical represents
- how to handle and store the chemical safely
- what to do in the case of an emergency involving the chemical
- how to dispose of the chemical.

Question 6

Marks	0	1	2	Average
%	38	6	56	**1.2**

2.6 M × 68.3 mL/1000 × 58.5g/mol = 10.388 g
Answer: 10.4 g

Question 7a.

Marks	0	1	Average
%	6	94	**1**

Diagram B

Question 7b.

Marks	0	1	2	Average
%	9	54	37	**1.3**

Diagram A: Nothing can be done to correct the reading as too much water has been added.
Diagram B: Water can be added by drops until the required reading is reached.

Many students incorrectly believed the correct dilution of the solution could be achieved by removing some of the diluent once it had been added to the volumetric flask; however, this action would alter the concentration of the solution and it would not be suitable to use.

Question 8a.

Marks	0	1	2	3	Average
%	6	34	30	29	**1.8**

1. blood-borne diseases, such as hepatitis C and HIV (source from sample)
2. sharps, broken slides and needles (materials used to prepare slides)
3. chemicals used to fix and stain slides

Question 8b.

Marks	0	1	Average
%	24	76	**0.8**

Any one of the following types of hazard and control measure.

Type of hazard: biological – blood-borne diseases such as hepatitis C and HIV
Control measure: use appropriate PPE (gloves, face mask and lab coat) and a Biohazard Cabinet Class II.

Type of hazard: physical – sharps, broken slides and needles
Control measure: dispose of these correctly in biohazard sharps waste containers; clean up broken slides and dispose of them correctly

Type of hazard: chemical – chemicals used to fix and stain slides
Control measure: read MSDS for chemicals and use in a safe manner; in fume cupboard, wear appropriate PPE; follow SOP

When asked for a 'hazard' in a question about OH&S, students would be expected to define a hazard as being one of several classes – for example, physical hazards (light, noise), biological (plants, viruses), mechanical/electrical (slips, trips/falls, electrical equipment), chemical (dusts, poisons), psychological (bullying, fatigue). Many students confused hazards with sources of contamination (such as cross-contamination) or sources of error (such as incorrect equipment used to carry out a task).

Question 9

Marks	0	1	2	3	4	Average
%	3	0	10	30	57	**3.4**

Any four key steps, which could include but are not limited to:

- identify samples for testing
- check samples are not abnormal in any way or do not appear to be compromised
- assemble/collect necessary equipment/reagents/materials/waste disposal for the testing procedure
- identify specific OH&S and PPE required for conducting the testing
- organise equipment to minimise contamination during testing
- prepare the work area for testing
- identify typical positive or negative results or ranges of values or similar that might be achieved, or indicate out-of-specified range or typical values obtained
- identify where or how results should be recorded
- identify who should be contacted for reporting results
- identify clean-up/disinfection steps and waste disposal
- identify response steps should a spill or similar accident happen
- prepare the storage of residual unused samples and any physical tested samples required.

Question 10

Marks	0	1	2	Average
%	23	38	39	**1.2**

Answers could include the following points.

- Swabbing: when the surface is wiped with a moist, sterile swab and then wiped or streaked onto agar or other media surface, or placed into broth.
- Press plate or contact plate: the agar plate is pressed directly onto the sample surface to be tested.

Question 11a.

Marks	0	1	Average
%	47	53	**0.6**

A working solution is the solution used in a test procedure.

Question 11b.

Marks	0	1	Average
%	58	42	**0.4**

A stock solution

This question was not answered well by students. Many students confused a 'standard' solution with a 'stock' solution.

Question 11c.

Marks	0	1	Average
%	39	61	**0.6**

'×10' indicates Solution B has a concentration ten times greater than the working solution buffer A.

Question 11d.

Marks	0	1	Average
%	30	70	**0.7**

25 mL

Question 12a.

Marks	0	1	Average
%	35	65	**0.7**

One of:

- put on appropriate PPE, gloves, glasses and lab coat to avoid contamination/for personal safety
- enter the patient's details and test types into the laboratory computer database (LIMS) or patient data system.

Question 12b.

Marks	0	1	2	3	4	5	Average
%	29	20	8	6	14	23	**2.3**

- Step 2: light Bunsen burner and flame to sterilise the loop, marking slide with a circle
- Step 3: open sample container and flame open mouth (hold lid in fingers)
- Step 4: insert cool inoculation loop into sample and take a small part of the stool, flame, and close sample container
- Step 5: place sample onto slide and circle the loop around to make a 1-cm circle
- Step 6: carefully flame loop to re-sterilise

Some variation in answers was accepted; for example, just 'flame to sterilise inoculation loop' was acceptable as Step 2. Steps needed to be sequential and logical and include an appropriate amount of detail.

Question 12c.

Marks	0	1	2	Average
%	30	29	41	**1.1**

Magnification: low power, 40 ×

Acceptable reasons included the following.

- You should always focus at low power first, as the depth of field is greatest at low power, therefore you can achieve focus more easily.
- At high power, the objective lens might touch or even break the slide. It is easier to focus at low power.

Question 13

Question 13 was very well answered and students demonstrated the ability to interpret information presented in a chart format that may not have been familiar to them.

Question 13a.

Marks	0	1	Average
%	8	92	**0.9**

Planning meeting in the first week

Question 13b.

Marks	0	1	Average
%	24	76	**0.8**

12 weeks

Question 13c.

Marks	0	1	Average
%	61	39	**0.4**

13 weeks

Question 13d.

Marks	0	1	Average
%	27	73	**0.8**

Allows for overrun and any problems/issues in production, etc.

Question 13e.

Marks	0	1	2	Average
%	6	35	58	**1.5**

Any two of:

- some tasks require either part or full completion of previous tasks, so there are at least part sequences for most tasks; only some tasks can be simultaneously conducted
- labour or materials availability
- approvals from management or regulators.

Question 14

Students generally selected the correct approach to calculating the volume of solution required; however, when it came to selecting the correct type of glassware required to accurately prepare a solution of known concentration, not all students chose volumetric glassware to carry out this task. Students should be aware of the correct techniques for washing and the appropriate storage conditions of volumetric glassware.

Question 14a.

Marks	0	1	2	Average
%	39	3	58	**1.2**

$C_1V_1 = C_2V_2$

$0.5 \times V_1 = 0.05 \times 500$

$V_1 = \dfrac{0.05 \times 500}{0.5}$

$V_1 = 50$ mL

Question 14b.

Marks	0	1	Average
%	42	58	**0.6**

Final volume is made up of 50 mL of stock solution and 450 mL of distilled water

Question 14c.

Marks	0	1	Average
%	66	34	**0.4**

Volumetric pipette, a volumetric flask, funnel

Question 14d.

Marks	0	1	Average
%	58	42	**0.4**

Glassware should be rinsed and put through an industrial dishwasher, or rinsed three times in distilled water and returned to the nominated area in the lab.

Question 15

Marks	0	1	2	Average
%	48	24	28	**0.8**

Any two pairs of the following.

Brightfield microscope	Stereo microscope
light source is under the stage	light source is above the stage
the sample must be thin enough for the light to pass through it	the sample can be large and opaque; only the surface is examined
short working distance between objective lens and stage	large working distance between objective lens and stage
a wide range of magnifications, e.g. 40× to 1000× (oil)	smaller range of magnifications/low magnifications, e.g. 20× to 100×
has a condenser under the stage	no condenser

This question asked students to compare two commonly used microscopes. It was not well answered by many students.

The microscope is a key piece of equipment used in many laboratory settings. It is important to have an understanding of its parts and their functions. It is also necessary to be familiar with a variety of microscopes and the applications of these instruments in a laboratory.

Question 16a.

Marks	0	1	2	3	Average
%	14	9	28	49	**2.1**

Any three of:

- moist heat is more effective than dry heat
- the temperature and time: temperature and time are inversely proportional; as temperature increases the time taken decreases
- the number of microorganisms: the more the number of microorganisms, the higher the temperature or the longer the duration required
- the nature of microorganism: depends on the species and strain of the microorganism; sensitivity to heat may vary
- spores are highly resistant to heat
- the type of material: articles that are heavily contaminated require higher temperature or prolonged exposure
- the presence of organic material: organic materials such as protein, sugars, oils and fats increase the time required
- the maintenance of equipment
- the packing of items
- the filling of the autoclave with water.

Question 16b.

Marks	0	1	2	Average
%	32	27	42	**1.1**

- Charts should be kept for temperature and pressure achieved in a cycle. Autoclave tape can be an indicator of a failure to reach the correct temperature. Test vials of culture can be plated out to check for growth after sterilising. Further information:
    - Physical methods including a temperature chart recorder.
    - Chemical methods including autoclave tape; if the process has been satisfactory, dark brown stripes will appear across the tape.
    - Biological method includes a paper strip containing spores of *Geobacillus stearothermophilus*.

Question 17a.

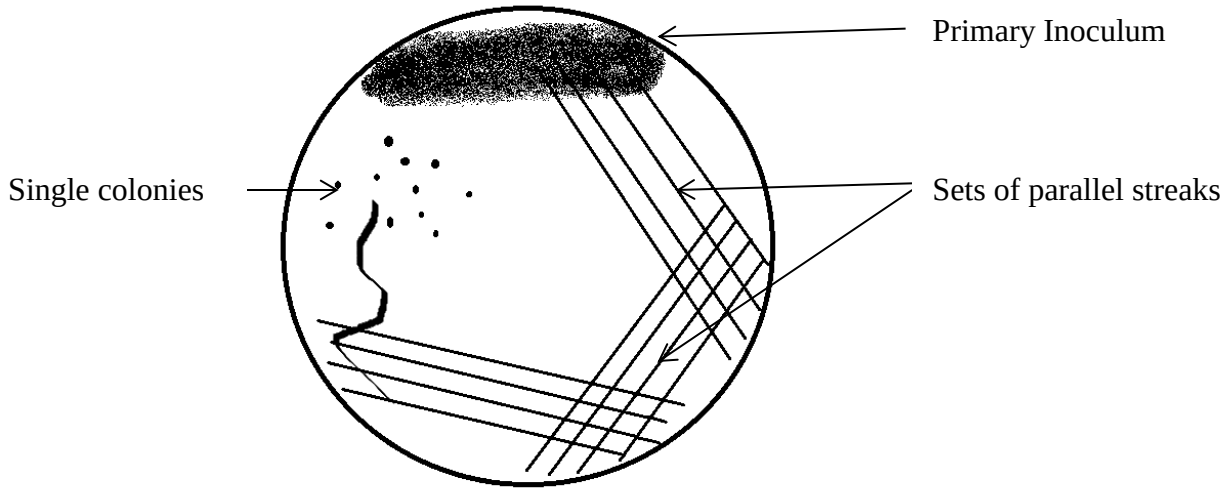
Marks	0	1	Average
%	15	85	**0.9**

Streak or dilution plate

Question 17b.

Marks	0	1	2	Average
%	25	34	41	**1.2**

Students were asked to draw and label an ideal agar plate and show the location of the culture after 24 hours of incubation time. Three sets of parallel streaks should be clearly separated, with single colonies at the end of the last single streak. Labels might include primary inoculum, set of streaks, single colonies and other descriptive terms.



Question 17c.

Marks	0	1	Average
%	33	67	**0.7**

One of:

- flame between sets of streaks
- use less inoculum for primary inoculum
- use the side of the inoculating loop for streaking.

Question 18

Question 18 assessed students' ability to count correctly and perform a set of calculations based on that count. A viability stain is used to determine the number of living cells in a sample; one example is Trypan blue stain, which stains the non-viable cells blue.

Question 18a.

Marks	0	1	2	Average
%	5	28	67	**1.6**

- a haemocytometer/counting chamber
- a compound, light microscope

Question 18b.

Marks	0	1	Average
%	63	37	**0.4**

A viability stain that shows the dead cells as stained (e.g. Trypan blue)

Methylene blue is not a viable stain; students needed to state a 'viable' stain, not a specific stain.

Question 18c.

Marks	0	1	2	Average
%	42	19	39	**1**

26 clear cells per 10^{-4} mL, so multiply by 10 000 to give 2.6×10^5 per 1 mL (260 000 per 1 mL)

Question 18d.

Marks	0	1	Average
%	38	62	**0.6**

$26/49 \times 100 = 53\%$

Question 18e.

Marks	0	1	Average
%	30	70	**0.7**

The total number of viable cells is less than 1 million per 1 mL, so the yeast is not ready to be used and the brewer should incubate it for another day or prepare a fresh culture.