2015 VCE VET Laboratory Skills examination report

General comments

The 2015 VCE VET Laboratory Skills examination was completed well by the majority of students. Questions involving calculations were generally answered well where they were attempted.

Students had difficulty with reading and following the instructions given in the questions. Careful reading of the question will assist students in achieving the best results.

Students should be able to use the scientific and technical terminology commonly used in laboratories. For example, when describing the formation of a solid in a solution, 'precipitating' and 'recrystallising' are better terms than 'coming out' of a solution.

Specific information

Note: Student responses reproduced in this report have not been corrected for grammar, spelling or factual 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	100	0	0	0	
2	3	59	14	24	
3	93	0	7	0	
4	21	79	0	0	
5	14	17	31	38	The sampling plan is specifically applied to test either the composition of the food product or the possible contamination of the food by microorganisms or unwanted physical or chemical substances. Good manufacturing practice (GMP) involves more than that, as it might include the monitoring of the process time, temperatures of manufacture or storage, and package types. Sampling is only one of many processes needed to ensure adherence to GMP.

Question	% A	% B	% C	% D	Comments
6	0	52	24	24	
7	0	7	83	10	
8	79	0	0	21	
9	48	17	31	3	Once decanted, stock solutions should be used as soon as possible or discarded appropriately. Returning stock solution to the bottle is a potential source of contamination and not good laboratory practice. Many students answered this question correctly; however, some incorrectly thought that sodium chloride was a toxic solution requiring a special collection container for disposal. Even a concentrated NaCl solution can be diluted with water satisfactorily for disposal down the sink.
10	0	0	45	55	Students seemed unsure of which item they were asked to dispose. The stock cultures used to prepare streak plates are generally liquid media; for example, glycerol stock cultures.
11	0	86	10	0	
12	0	17	17	66	
13	66	3	17	14	
14	10	0	38	52	
15	0	76	0	24	
16	3	3	48	45	The established method for inoculating an agar deep is using an inoculation needle and not a loop. A deep, if correctly inoculated, provides both aerobic and anaerobic growth environments for bacteria. Using a needle ensures that the agar closes back around the inoculation point. If a loop is used the agar would be left with a large hole, which would allow oxygen to come into contact with the bacteria and prevent strict anaerobes from growing.
17	0	17	0	83	
18	41	10	31	17	The well-established protocol for undertaking cell counts on a counting chamber is to include cells on the line on only two sides of each grid to be counted; for example, the top and right sides. This prevents counting some cells twice if there is more than one grid in the chamber.
19	14	28	59	0	
20	3	0	3	93	

Section B – Short-answer questions

Question 1a.

Marks	0	1	2	Average
%	54	7	39	**0.9**

50 × 15 mL = 750 mL of molten agar required

750/1000 × 40 g = 30 g nutrient agar powder

Some students mistook the 15 mL that each agar plate required to be filled correctly as the weight of the media required to make 1 L.

Question 1b.

Marks	0	1	Average
%	43	57	**0.6**

As a gelling agent. To solidify the media without providing another nutrient source.

Question 1c.

Marks	0	1	2	Average
%	7	41	52	**1.5**

Beef extract and peptone

Question 2

Marks	0	1	2	3	4	Average
%	0	3	15	43	39	**3.2**

1. conical or Erlenmeyer flask
2. volumetric flask
3. centrifuge
4. tongs

Question 3a.

Marks	0	1	Average
%	62	38	**0.4**

A buffer solution is a solution that is able to resist change after small additions of acids or bases. It is a mixture of a weak acid and its conjugate base (or vice versa).

Question 3b.

Marks	0	1	Average
%	31	69	**0.7**

A buffer solution is used to keep pH relatively constant in a chemical reaction and to calibrate pH meters or other equipment. In culture media a buffer solution is used to select a specific pH range for organisms to either grow or not grow.

Many students understood when a buffer might be used but were not able to define what a buffer did. A high-scoring definition of a buffer that demonstrated a very clear understanding was, '*a solution which controls the pH of another solution keeping it within a certain range*'.

Question 4a.

Marks	0	1	2	Average
%	28	5	67	**1.4**

Diagram B – Poor accuracy, good precision

Diagram B showed poor accuracy as the dots were not close to the centre, but good precision as all the dots were located close together.

Question 4b.

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

If an instrument is not calibrated properly results may be very close to each other but not correct. Follow the SOP to avoid damage.

This question was well answered.

The following is an example of a high-scoring response.

> *The result does not show the preferred outcome, however it displays the consistency which the result would be the same if repeated.*

Question 5a.

Marks	0	1	2	3	Average
%	0	13	30	57	**2.5**

Cleaning solution (e.g. 70% ethanol) and lens tissue, record book or logbook, cover, storage box

Question 5b.

Marks	0	1	2	3	Average
%	2	11	36	51	**2.4**

Any three of:

- Ensure the microscope is in the correct position, that is,away from the edge of the bench or near a sink or sources of heat, with the cord out of the operator's way and not dangling across the work area. Ensure the bench height is correct for the operator to use the microscope without injury. If the operator is to be seated then under-bench leg room and an adjustable chair should be provided.
- Check that the power cord is in good working order and has been lead tested within 12 months.
- Ensure all waste is disposed of correctly.
- Be careful of broken slides and wear appropriate PPE.

Question 6a.

Marks	0	1	2	Average
%	0	13	87	**1.9**

Answers could have included (two of):

- reusing materials where appropriate
- using minimum quantities of reagents
- following SOPs
- clean and reuse equipment where applicable
- buying laboratory equipment that can be reused
- batch samples to run large numbers.

Question 6b.

Marks	0	1	Average
%	3	97	**1**

Bin 1

Question 7a.

Marks	0	1	2	Average
%	33	7	61	**1.3**

M(KCl) = 39.1 + 35.5 = 74.6 g/mol

V = 500 mL = 0.500 L

c = 0.500 M

M = c × V × M = 0.50 × 0.5 × 74.6 = 18.7 g

Question 7b.

Marks	0	1	Average
%	20	80	**0.8**

500 mL volumetric flask

Question 7c.

Marks	0	1	2	Average
%	2	33	66	**1.6**

0.500 M potassium chloride

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Question 8a.

Marks	0	1	Average
%	36	64	**0.7**

The culture will not grow as it will have been killed at 70 °C.

Question 8b.

Marks	0	1	Average
%	15	85	0.9

The culture will begin growth again.

Question 9

Marks	0	1	2	3	4	Average
%	3	8	33	33	23	2.7

- Pus from a wound
  Slide preparation and staining procedure (if required): Use a sterile loop to place a drop of pus on a slide, smear and dry over a Bunsen flame. Stain with Gram stain. Examine under a compound light microscope.
  Possible results: Gram positive (blue) and Gram negative (pink) bacterial cells. With some white blood cells, blue coloured. A description of cell types was also acceptable.
- Water from a river
  Slide preparation and staining procedure (if required): Spin water gently, or just take a drop from the bottom of the container and put it on a (cavity) slide, cover with coverslip (wet prep) and examine under a phase contrast or compound light microscope.
  Possible results: Any of the following cell types: protozoan, multicellular eukaryotes (plants and animals) and some bacteria.

Question 10a.

Marks	0	1	Average
%	39	61	0.6

It must be poured into the toxic waste bottle (heavy metals, e.g. lead compounds) in the fume cupboard or for use in another test procedure. Never return to the original stock bottle.

Question 10b.

Marks	0	1	Average
%	15	85	0.9

The pipette might contaminate the stock solution.

Students needed to show an understanding of the important concepts in solution preparation, to decant the solution from the stock bottle into a beaker then to pipette from the beaker. Once decanted, solutions should not be returned to the stock bottle as this might cause contamination by the introduction of unwanted chemicals or microorganisms to the stock solution.

Question 11a.

Marks	0	1	2	Average
%	48	34	18	0.7

Sterile graduated pipette, 10 mL and 1 mL. The graduated pipette can accurately add the volume required and must be sterile to prevent unknown contaminants altering the results. Auto pipettes with disposable sterile tips could be used (but are not generally used for large volumes over 1 mL). Could use auto pipette and sterile tips for 0.1 mL.

Question 11b.

Marks	0	1	Average
%	44	56	**0.6**

By repeating the dilutions this ensures the accuracy of the results and reduces the variation due to poor sampling.

Question 11c.

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

49 bacteria per 100 mL

Question 11d.

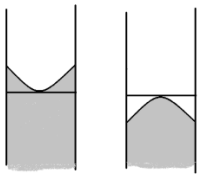
Marks	0	1	2	Average
%	8	38	54	**1.5**

This is not acceptable as there would be growth in the 10 mL tubes as growth was recorded in the more dilute tubes. Peter has not added any sample to the 10 mL tubes. Incorrect volume of sample added. Incorrect labelling on tubes.

When transferring a large volume of inoculum, a loop will not be used as the volume is too small. It is important that students be able to read and follow instructions.

Question 12

Marks	0	1	2	Average
%	3	48	49	**1.5**



The concave (or convex) upper surface of a column of liquid; the curve is caused by surface tension.

Some students mistook the meniscus to be the point at which a reading of volume is taken and not the curve at the top of the liquid contained in a flask, pipette or measuring cylinder. Neither is it the line drawn on the glassware to which it is filled for an accurate amount of a solution to be measured, as some students indicated.

Question 13a.

Marks	0	1	Average
%	77	23	**0.3**

Base in flask, hence high pH to low pH. Pink to colourless

This question was not answered well by many students as they misread the table in the question and chose pink, which was the starting colour at the beginning of the titration.

Question 13b.

Marks	0	1	2	Average
%	49	18	33	**0.9**

n(NaOH) = 25.0 × 0.232 = 0.00580 mol

1000

Hence, n($H_2C_2O_4$) = 0.5 × 0.00580 = 0.00290 mol

$$[H_2C_2O_4] = \frac{0.00290 \times 1000}{26.2} = 0.111 \text{ M}$$

Question 13c.

Marks	0	1	2	Average
%	28	44	28	**1**

End point is the point where the indicator changes colour.

Equivalence point is when the reaction is complete.

Question 14

Marks	0	1	2	3	Average
%	2	3	48	48	**2.4**

Possible answers included (three of):

- date of preparation or expiry date
- any signs of contamination
- any packaging changes, breakages or leaking containers
- dehydration of agar plates
- temperature of the refrigerator
- oldest batches closest to front of the fridge.

Question 15

Marks	0	1	2	3	4	Average
%	2	36	36	25	2	**1.9**

- Cotton swabs to be used for sample collection: wrapped in paper, autoclave on ‘dry’ setting
- Clean conical flasks: autoclaved on either setting with foil over open necks
- Used micro-pipette tips: dispose in biohazard bag for later collection and autoclaving or incineration
- Used scalpel blades: place in waste biohazard sharps bins, for later incineration

Students must read each question carefully. This question asked for methods to sterilise equipment and dispose of biohazardous waste materials, but most answers dealt only with disposal.

Question 16a.

Marks	0	1	2	Average
%	3	31	66	**1.6**

- ensures correct results
- reduces waste
- avoids re-testing

Question 16b.

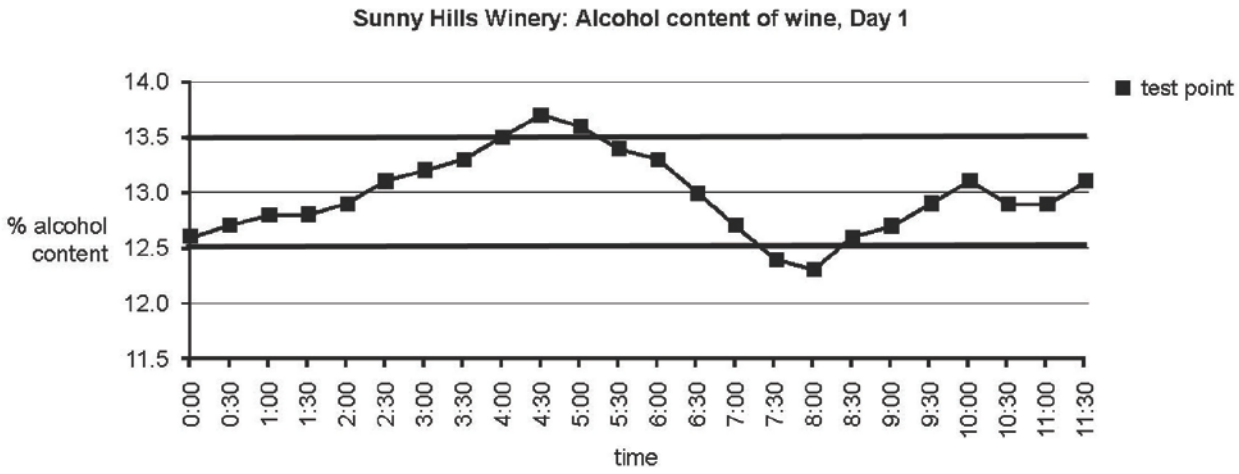
Marks	0	1	2	Average
%	3	7	90	**1.9**

Yes, because this will help to:

- improve workplace practices
- reduce costs
- make the workplace safer.

Question 17a.

Marks	0	1	Average
%	3	97	**1**



Question 17b.

Marks	0	1	2	Average
%	16	13	70	**1.6**

4:30, 5:00, 7:30, 8:00

Question 17c.

Marks	0	1	2	Average
%	7	48	46	**1.4**

Possible answers included:

- to ensure the flavour of the wine remains constant
- to comply with labelling regulations

- so that consumers know how much alcohol they are consuming.

Question 18a.

Marks	0	1	Average
%	36	64	0.7

If a bacterial cell is placed into a hypertonic solution, water will move from where it is in higher concentration (inside the cell) to where it is in lower concentration (outside the cell).

Water moving out from the cytoplasm causes the plasma membrane to pull away from the cell wall – this is called plasmolysis.

Question 18b.

Marks	0	1	Average
%	62	38	0.4

- Morphology refers to the appearance (shape) of an individual bacterium.
- Arrangement refers to how bacterial cells are grouped together.

Question 18c.

Marks	0	1	2	Average
%	36	34	30	1

An agar plate: a drop of water is added to the slide when bacteria are taken from a solid culture.

A broth culture: a loop full of culture is applied directly to the plate as with the liquid culture the bacteria are already in fluid.

Many students had difficulty distinguishing between bacterial morphology and arrangement as seen under the microscope, and the colony appearance and description of growth patterns on agar plates. Bacteria are not visible to the naked eye, so the word ‘bacterial’ refers to the cellular level description. If the question required a description of the appearance of growth on agar plates it would ask for ‘colony’ appearance or morphology.

Question 19a.

Marks	0	1	2	3	Average
%	7	15	36	43	2.2

1. condenser

2. objective

3. eyepiece or ocular lens

Question 19b.

Marks	0	1	Average
%	54	46	0.5

Köhler illumination

Question 19c.

Marks	0	1	2	Average
%	10	8	82	**1.7**

Reasons:

- dirt on the objective, eyepiece, condenser lens or the light source glass cover
- scratches on lenses.

Suggestions to rectify problem:

- Clean all optical surfaces in the light path with either distilled water or 70% ethanol.
- Buy another lens or replace.

Question 20a.

Marks	0	1	Average
%	21	79	**0.8**

Within the range 102 g to 104 g

Question 20b.

Marks	0	1	Average
%	62	38	**0.4**

47–48 °C

Question 20c.

Marks	0	1	2	Average
%	67	10	23	**0.6**

150/134 × 100 = 112 g of water needed

Question 20d.

Marks	0	1	Average
%	16	84	**0.9**

Some of the potassium nitrate would precipitate or crystallise out of solution – a solid forms.