2018 VCE VET Laboratory skills written examination report

General comments

Section A of the examination comprised 20 multiple-choice questions, worth a total of 20 marks. Section B comprised short- and extended-answer questions, worth a total 80 marks. Questions in Section B asked students to develop answers from the situations provided; this required the application of underpinning knowledge when formulating responses. Chemical calculations were done well and the majority of students gave units of measurement with their answers.

Students need to take care in reading the instructions for each question before answering. For example, in Section B, Question 6a. asked for a laboratory work task that would be included in an audit. Many students answered generally for the work task (e.g. streak plating) rather than listing an auditable work task such as calibration of equipment.

Question 4a. asked for a reason for using primary standards in laboratory work but many students gave a definition of a primary standard rather than the reason for use (e.g. calculating the concentration of an unknown solution).

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	% No answer	Comments
1	0	1	3	96	0	
2	44	16	31	8	1	Stage clips (that hold a slide in place) can be adjusted. Adjusting the coarse focus while using a high power objective can result in damage to the lens/slide due to the small margin of error with the slide and lens close together.

Question	% A	% B	% C	% D	% No answer	Comments
3	9	4	86	1	0	
4	88	1	6	5	0	
5	6	18	73	4	0	
6	0	3	6	91	0	
7	8	0	83	9	1	
8	99	1	0	0	0	
9	5	76	18	1	0	
10	11	28	39	23	0	For a compound light microscope, light intensity decreases as magnification increases. The light intensity needs to be increased as the numerical aperture (lens opening) is smaller on higher magnification. The working distance is fixed for each lens so cannot be increased.
11	46	6	1	46	0	Testing the sample immediately reflects the urgent nature of the situation with assurance that information/direction could be gained from referring to the test specification. Waiting for a supervisor to assign work could delay an urgent request.
12	1	13	74	13	0	
13	3	65	25	8	0	Confluent growth is where bacterial growth is continuous on a plate and isolated single colonies cannot be identified. Confluence is not a form of contamination.
14	10	25	24	40	1	The stem of the question mentioned solid materials requiring autoclaving. This implies the selection of 'mixed load' with appropriate settings. Options B and C were incorrect because 'must only' refers to fluid items, not solid. Fluids cannot be autoclaved on a dry cycle as the fast release of pressure may cause the items to boil over.
15	66	19	4	11	0	Returning decanted solution back to the working chemical solution bottle may introduce contaminants from the glassware that contribute to a shorter shelf life of the chemical.
16	4	4	6	86	0	
17	20	10	33	38	0	The correct colour for starch granules stained with iodine is blue/black. The iodine stain is a brown colour.
18	4	4	1	91	0	
19	3	88	10	0	0	
20	71	18	8	4	0	$C_1V_1 = C_2V_2$ $50 \times V_1 = 1 \times 200$ $V_1 = 1 \times 200/50$ $V_1 = 4$ mL

Section B – Short-answer questions

Question 1a.

Marks	0	1	2	3	Average
%	1	6	31	62	2.6

Possible answers included (any three of):

- name of veterinary surgeon
- business contact, details, address, phone number
- tests required
- sample identification
- patient details
- date of collection
- date/time of call

Question 1b.

Marks	0	1	Average
%	26	74	0.8

Gram stain

Question 1c.

Marks	0	1	2	Average
%	38	7	55	1.2

The two possible results were Gram positive purple and Gram negative pink.

The identifying characteristic required was stain colour.

Question 2a.

Marks	0	1	Average
%	15	85	0.9

Possible answers included (any one of):

- calibrate the balance
- check the SOP
- use another balance
- tag balance ‘Do not use’ and report to supervisor
- stop using the balance and investigate the issue

Question 2b.

Marks	0	1	2	Average
%	5	46	49	1.5

Possible answers included (any two of):

- time wastage due to rework
- materials/resource wastage
- wasting company money through increased wages from rework or consumables being used
- wasting customers time due to delay of accurate results

Some students suggested wastage of electricity but the electricity use of a balance is negligible.

Question 3

Marks	0	1	2	3	Average
%	1	10	6	82	2.7

Laboratory item	Appropriate cleaning or disposal method
glass cell-counting chamber or haemocytometer	1% hypochlorite solution
plastic flask of cell culture media	biohazard waste bin
used scalpel blades from biological dissection	sharps container

Question 4a.

Marks	0	1	Average
%	80	20	0.2

Possible answers included (any one of):

- used to calibrate equipment
- used to calculate the concentration of an unknown solution
- used to standardise a secondary standard

Some students answered using the definition for primary standard but the stem of the question asked for a reason for use in laboratory work.

Question 4b.

Marks	0	1	2	Average
%	5	42	53	1.5

Possible answers included (any two of):

- ask the supervisor
- read the SOP
- observe other experienced technicians

Question 4c.

Marks	0	1	2	Average
%	25	31	44	1.2

A known mass of solute is transferred.

Possible answers for reason for importance included (any one of):

- increases accuracy
- reduces errors
- provides more reliable results/data

Question 5a.

Marks	0	1	2	Average
%	5	15	80	**1.8**

Possible answers included (any two of):

- lenses are clean
- electrical safety tag on the microscope is in date
- no fraying on electrical cord
- stage is clean

Question 5b.

Marks	0	1	Average
%	33	68	**0.7**

100× or oil immersion lens

Question 5c.

Marks	0	1	2	Average
%	23	36	42	**1.2**

Slide A

Possible reasons for choosing this slide included (any two of):

- the lens should be touching the oil
- lens for Slide B is too distant from the slide
- to minimise light refraction and provide optimum magnification and resolution

Question 5d.

Marks	0	1	2	Average
%	19	70	10	**0.9**

Possible answers included (any two of):

- immersion oil reduces refraction of light so more light passes through the objective lens
- use of oil allows greater resolution at higher magnification
- immersion oil has the same refractive index as glass

Question 6a.

Marks	0	1	2	Average
%	19	44	37	**1.2**

Possible answers included (any two of):

- correct calibration of equipment
- accurate recording of test results
- the reporting of non-conformances
- examples of laboratory methods
- culture media quality control

Students needed to demonstrate some knowledge of what work tasks are audited in a laboratory for full marks.

Question 6b.

Marks	0	1	2	3	Average
%	3	19	44	35	2.1

Possible answers included (any three of):

- to demonstrate quality of the service
- to demonstrate good practice and skills within the technical team
- to gain a nationally/internationally recognised endorsement for competence and reliability
- to meet regulatory requirements
- continuous improvement of services and procedures
- to demonstrate good management

Quality audits are not focused on safety and environmental concerns, more on the quality systems in a workplace.

Question 7

Marks	0	1	2	3	4	Average
%	42	16	36	6	1	1.1

Possible answers included:

- Step 1: sterilise the agar in an autoclave with autoclave tape or temperature strip.
  Reason: to ensure correct sterilisation parameters and time have been met.
- Step 2: after pouring the agar, place a plate in the 37 °C incubator.
  Reason: sterility check to ensure no growth.

The question asked for quality-control steps. Quality control has recordable outcomes. Aseptic techniques are good practice but are not quality control steps.

Question 8a.

Marks	0	1	2	Average
%	22	61	16	1

Possible answers included (any two of):

- different size colonies
- different colour colonies
- presence of other types of organisms
- growth on areas not streaked

Question 8b.

Marks	0	1	2	3	4	Average
%	1	5	15	40	38	3.1

Possible answers included (any four of):

- washing hands before and after bench work
- swabbing bench with 70% v/v ethanol before and after bench work
- work with correct aseptic technique
- minimise clutter/contamination around work area
- personal hygiene procedures such as: hair tied back; minimise jewellery; no eating, smoking or drinking in laboratory; keep nails short and clean; no loose/hanging clothing

Answers that included a ‘sterilised/sterile work area’ were not awarded marks. The words ‘sterile’ and ‘aseptic’ are not equivalent or interchangeable. Aseptic is the removal of most bacteria/pathogens, while sterile is total removal of all organisms. Sterilisation of a work bench/room is not practical. Disinfection/sanitisation are appropriate words to use in this situation.

Question 9a.

Marks	0	1	2	Average
%	4	59	38	**1.4**

Possible answers included (any two of):

- wear a face mask
- read SOP/SDS for specific hazards/health effects
- avoid creating/generating dust
- wear gloves

Question 9b.

Marks	0	1	Average
%	60	40	**0.4**

Possible answers included (any one of):

- avoid contact with skin and eyes
- dissolve slowly to avoid frothing
- adjust final pH then bring to volume
- check calibration of pH meter
- care when using corrosive HCl/NaOH to adjust pH
- check condition of pH meter and electrode

This question asked for a precaution, so reasonable answers involving measures taken to prevent danger or secure a good result were acceptable.

Question 9c.

Marks	0	1	2	Average
%	11	34	54	**1.5**

Possible answers included (any one of):

- infection – avoid exposure to BSA by using PPE to prevent inhalation or contact
- dust powder inhalation – avoid inhaling dusts and powders
- skin irritation – avoid exposure/contact with skin

Question 10

Marks	0	1	2	3	Average
%	13	44	34	9	**1.4**

Hazard: Displacement of oxygen in enclosed space or extreme cold.

Item of PPE: Insulated gloves or apron (impervious plastic or rubber) or goggles/face shield.

Risk: Asphyxiation or burns.

Question 11

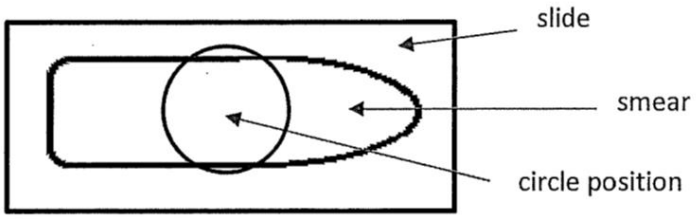
Marks	0	1	2	Average
%	3	28	70	1.7

Possible answers included (any two of):

- contact laboratory supervisor/experienced colleagues for advice
- see if another laboratory with a biosafety cabinet could be used instead
- check the maintenance log
- contact the testing contractors to determine when the laboratory is available for use
- post a notice on the laboratory door
- check if the cell culture procedure can be postponed until the laboratory is available

Question 12a.

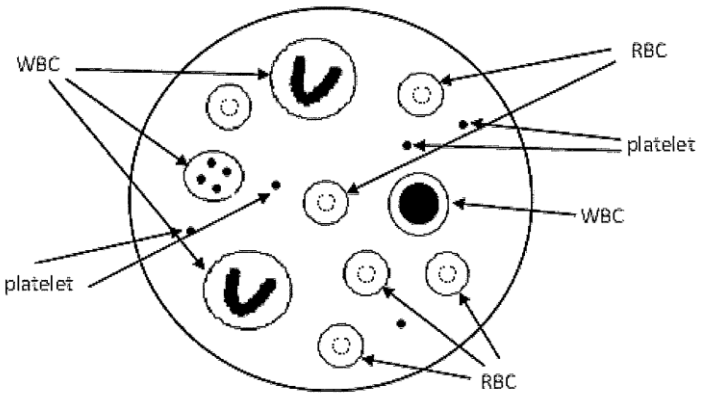
Marks	0	1	Average
%	85	15	0.2



A circle where the tapering begins is the appropriate position for viewing. The circle could not include the point of the smear as the cell numbers would be too low in this area.

Question 12b.

Marks	0	1	2	3	Average
%	36	35	6	23	1.2



Question 12c.

Marks	0	1	Average
%	75	25	**0.3**

Compare blood-stained slide with control slide.

Question 13a.

Marks	0	1	2	3	4	Average
%	36	3	4	1	56	**2.4**

n = CV

m/FW = C × V

Mass of $CaCO_3$ = C x V x FW

= 0.4 × 350/1000 × 100

= 14 g

Mass of KCl = C× V × FW

= 0.5 × 100/1000 × 74

= 3.7 g

Question 13b.

Marks	0	1	Average
%	41	59	**0.6**

Schott bottle or glass-stoppered bottle or reagent bottle

Question 13c.

Marks	0	1	2	Average
%	6	21	73	**1.7**

Possible answers included (any two of):

- date solution prepared
- name of analyst preparing solution
- appropriate safety information

Question 14a.

Marks	0	1	2	Average
%	1	38	61	**1.6**

They assist the laboratory in any two of the following ways:

- producing quality data or results
- meeting regulatory requirements
- accuracy and precision of results
- performing efficiently
- mitigate company losses or save money

Question 14b.

Marks	0	1	2	Average
%	18	15	66	**1.5**

Actual volume V = (0.900/1.000) × 1000

= 900 μL or 0.900 mL

Question 14c.

Marks	0	1	2	Average
%	57	4	39	**0.8**

Acceptable answers were between a lower limit of 0.995 grams and an upper limit of 1.005 grams.

The calculated range of values delivered by the inaccurate pipette is 0.906 – 0.898g = 0.008 g. When operating correctly at 1.000 gram the range would be a lower limit of 1.000 – 0.004 = 0.996 g and an upper limit of 1.000 + 0.004 = 1.004 g.

While significant figures were not a deciding factor in assessing this question, students are encouraged to pay attention to the use of significant figures in laboratory work.

Question 15

Marks	0	1	2	3	Average
%	29	27	20	24	**1.4**

Possible answers included:

Step number	Procedure
5	Aseptically select one colony from the agar plate.
6	On opening the nutrient broth, flame the mouth of the container and place the inoculating loop below the surface of the broth to inoculate.
7	Flame the mouth of the container on closing and resterilise the inoculating loop.

A number of students misread the question and listed SOP steps for a streak dilution from a broth to an agar plate.

Question 16a.

Marks	0	1	2	Average
%	40	60	0	**0.6**

n = CV

m/FW = C × V

Mass of $CuSO_4$ = C × V × FW

m = 0.10 × 250/1000 × 249.68 g

Mass of $CuSO_4$ = 6.242 g

As the side label had an assay of 98.0% the final mass of $CuSO_4$ for an accurate preparation is

6.242 g × 100/98 = 6.369 g

Question 16b.

Marks	0	1	2	Average
%	45	6	50	**1.1**

Possible answers included:

- The mass calculated would not be accurate as there is a difference in the formula weight of anhydrous and hydrated forms of $CuSO_4$ due to the presence of water molecules in the hydrated form.
- The hydrated salt has a higher formulae weight so a larger mass would need to be weighed out than the anhydrous form for the same concentration.

Question 17a.

Marks	0	1	Average
%	28	73	**0.8**

21.5 °C

Question 17b.

Marks	0	1	2	Average
%	77	22	1	**0.3**

11.30 am–12.00 pm

The temperature was non-conforming at 11.30 am and not measured and in range until 12.00 pm, which accounts for the time period.

3.30 pm–5.00 pm

3.30 pm onwards is not a suitable answer as the graph does not have information after 5.00 pm so it is not possible to extrapolate further.

The question asked for a time period, so a time frame was required for the final answer.

Question 17c.

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

Possible answers included (any one of):

- technicians opening the door to add in more cultures
- technicians opening the door to remove culture plates
- a number of cold plates have been placed in the incubator

Question 17d.

Marks	0	1	2	Average
%	54	23	23	0.7

Possible answers included (any one of):

- Cells were not incubated at the optimum temperature range for that culture; temperatures below optimum can slow down cell division and growth rate. A solution would be to incubate the cultures at their optimum growth temperature.
- Not enough culture used for initial inoculation. A solution would be to re-inoculate the culture media with more culture.
- Incorrect culture media used with the culture. A solution would be to repeat test with culture media suitable for the culture.
- Culture was more than 24 hours old and nutrient levels in media were becoming exhausted. A solution would be to transfer a sample of culture to fresh culture media.