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VCE Biology ¾
Approaching BI34 & Cell Basics [0.1]
Workshop Solutions

Section A: An Introduction to VCE and Biology

Welcome to VCE Biology

- You've already got the Contour introduction, now it's time to introduce you to how VCE works!

But before we do that, let's get to know each other a bit more!

KAHOOT

Discussion: Introduce yourselves to the person next to you! What is their name, what school do they go to, what is their favourite thing to do!

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Sub-Section: Introducing VCE

Is this your first VCE subject?

Are you in year 11 or year 12?

Exploration: How does VCE work? How does scoring work?

- How are ATARs calculated? What are they used for?
- How is a study score calculated? Do SACs matter?

Graded Assessment 3
WRITTEN EXAMINATION
2023

Table of Grade Distribution by Gender

Grade		UG	E	E+	D	D+	C	C+	B	B+	A	A+	NR	Total
Male	n	8	136	247	382	533	615	712	632	588	524	463	3	4,843
	%	0.2	2.8	5.1	7.9	11.0	12.7	14.7	13.0	12.1	10.8	9.6	0.1	100.0
Female	n	9	316	491	664	953	1,157	1,290	1,117	997	832	703	0	8,529
	%	0.1	3.7	5.8	7.8	11.2	13.6	15.1	13.1	11.7	9.8	8.2	0.0	100.0
Gender X	n	0	1	3	8	6	8	15	13	7	7	2	0	70
	%	0.0	1.4	4.3	11.4	8.6	11.4	21.4	18.6	10.0	10.0	2.9	0.0	100.0
Total	n	17	453	741	1,054	1,492	1,780	2,017	1,762	1,592	1,363	1,168	3	13,442
	%	0.1	3.4	5.5	7.8	11.1	13.2	15.0	13.1	11.8	10.1	8.7	0.0	100.0
Score Ranges		0-23	24-54	55-73	74-92	93-114	115-136	137-159	160-177	178-192	193-205	206-240	N/A	Max 240

For privacy reasons, a gender with less than 5 students assessed has been assigned to the category of NR (Not Reported).

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Exploration: What skills are being assessed in VCE Biology?

- We can split this up into 2 categories - content knowledge and application!
- It is also really important to understand WHAT the question is asking you, and the question terms that are used to assess.

COMMAND TERM	DEFINITION	EXAMPLE
DEFINE	Present the **meaning** of a specific term.	"Define the term speciation."
DISCUSS	Present the **advantages** and **disadvantages.**	"Discuss the biological implications of genetic modification of crops."
COMPARE	Present the **similarities** and **differences.**	"Compare the cell-mediated immune response with the humoral immune response."
EVALUATE	Present the **advantages** and **disadvantages** along with a **final opinion.**	"Evaluate the effectiveness of CRISPR-Cas9 as a gene replacement technology."
EXPLAIN	Present the **features** along with **reasoning** or implications.	"Explain how global travel influences the spread of disease."
OUTLINE	Present the **specific features** of a concept.	"Outline one method to measure the rate of photosynthesis."
DISTINGUISH	Present how two concepts **differ** by a **specific feature**.	"Distinguish between anaerobic and aerobic respiration in terms of ATP yield."
DESCRIBE	Present an overview of the **features** of a concept.	"Describe the role of mast cells in the allergic response."
IDENTIFY	Present from **alternative options**.	"Identify, from the electron microscope diagram, where photosynthesis occurs."
JUSTIFY	Present the **advantages** and **significance** of a specific concept.	"Justify the use of face masks as a public health measure for reducing the spread of COVID-19.
STATE	Present in a **simple** manner.	"State one reason why the average brain size of hominins increased over time."

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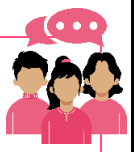
Section B: Study Strategies & How to Study

Story Time: What was my strategy when studying VCE biology?

- My VCE journey began in Year 11 with Biology as my first subject. Initially, my approach to studying was quite inefficient–I spent most of my time writing notes and rereading them, which was essentially my only method of revision. Over time, I realised that practice questions were essential for effective learning and exam preparation. By the end of the year, I had developed a much better system for the final exam: I recorded my mistakes, analysed them, and did plenty of practice questions to consolidate my understanding. Looking back, if I had followed this method consistently throughout the year, I would have been far more prepared. My advice? Focus on practice questions and learning from your mistakes all year long, and you'll be on track for success.



Discussion: What are your current strategies for learning? Do they work?

Here are some strategies that you might want to implement in your own study!

- **Description**: Retrieving information from memory without looking at the material. This strengthens memory and understanding.
- **Application:** After studying a topic, students should practice recalling the information without notes, such as answering questions or explaining the topic out loud.

Spaced Repetition

- **Description**: Reviewing information at increasing intervals over time to combat forgetting and solidify memory.
- **Application:** Use a spaced repetition system or app to plan reviews of material over days, weeks and months.

Interleaved Practice

- **Description**: Mixing different topics or types of problems within a single study session to improve learning.
- **Application:** Instead of focusing on one type of problem or topic per study session, mix up different topics or problem types.

Self-Testing

- **Description**: Continuously testing oneself before the actual exam to assess understanding and areas needing improvement.
- **Application:** Use past exam papers, create quizzes or use flashcards to regularly test understanding.

Elaborative Interrogation

- **Description**: Enhancing understanding by questioning the 'why' and 'how' behind concepts and facts.
- **Application:** Regularly ask and answer 'why' and 'how' questions about the material being studied.

Concept Mapping

- **Description**: Visually organising and relating concepts using diagrams.
- **Application:** Create mind maps or flowcharts to connect ideas and visualise relationships between concepts.

Teaching Others

- **Description**: Explaining material to someone else to improve understanding and retention.
- **Application:** Teach the material to classmates, friends or even an imaginary audience.

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Dual Coding

- **Description**: Using both verbal and visual information to understand and remember concepts.
- **Application:** Combine written notes with diagrams, charts or other visual aids.

Analogical Thinking

- **Description**: Relating new information to known concepts or contexts to better understand and remember it.
- **Application:** Regularly draw parallels between new concepts and familiar situations or previously learned material.

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Section C: Stress Management

- It's incredibly important to be able to keep a lid on stress throughout the year - we don't want anxiety, dread or fear entering our minds (too much) and impacting our performance!

Exploration: Dealing with Anxiety...

Breathing Exercises

- Deep breathing is a simple yet effective method for reducing stress and inducing a relaxation response. The technique involves taking slow, deep breaths through the nose, holding for a few seconds and then slowly exhaling through the mouth.

Misconception

" Stress is bad. "

Truth: There is a GOOD level of stress!

Mindfulness Meditation

- Mindfulness involves maintaining a moment-by-moment awareness of thoughts, feelings, bodily sensations and the surrounding environment. Meditation usually involves focusing on the breath and gently bringing attention back when the mind wanders.

Misconception

" Ignoring stress will make it go away!"

Truth: The goal isn't to numb yourself to stress, rather, minimise and appreciate it for what it is.

Physical Activity

- Regular physical activity is a powerful stress reliever. It not only helps to reduce the body's stress hormones but also releases endorphins, which are chemicals in the brain that act as natural painkillers and mood elevators.

Social Support

- Having a supportive social network can help alleviate stress. Talking about concerns or feelings with friends, family or teachers can provide emotional relief and new perspectives on stressful situations.

Adequate Sleep

- Sleep is essential for cognitive function, mood regulation and overall health. Lack of sleep can exacerbate stress and negatively impact academic performance.

Misconception

" Stress management is useless and takes up more time than its worth."

Truth: It won't take up more than 30 minutes a day --- and the effects are worth it!

Hobbies and Downtime

- Engaging in hobbies and leisure activities can provide a break from studying and a healthy outlet for stress. Downtime is essential for mental health and can improve concentration and productivity.

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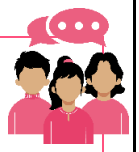
Section D: Quick Recap of Key Experimental Terms

Head Tutor's Comment: Data and measurement

A major aim of science is to develop explanations that are supported by evidence for natural phenomena and events. This involves considering the quality and quantity of evidence and before conclusions are drawn from data, considering questions such as: 'Can I rely on the data I have generated when drawing conclusions?' and 'Does the difference between one measurement and another indicate a real change in what is being measured?'.

When analysing and discussing investigations of a quantitative nature, the following terms require consideration:

- **Accuracy:** The accuracy of a measurement relates to how close it is to the 'true' value of the quantity being measured.
- **Precision**: Refers to how closely a set of measurement values agree with each other. Precision gives no indication of how close the measurements are to the true value and istherefore a separate consideration to accuracy.
- **Repeatability**: The closeness of the agreement between the results of successive measurements of the same quantity being measured, carried out under the same conditions of measurement. These conditions include the same measurement procedure, the same observer, the same measuring instrument used under the same conditions, the same location, and repetition over a short period of time.
- **Reproducibility:** The closeness of the agreement between the results of measurements of the same quantity being measured, carried out under changed conditions of measurement. These different conditions include a different method of measurement, different observer, different measuring instrument, different location, different conditions of use and different time.
- **True value:** The value or range of values, that would be found if the quantity could be measured perfectly.
- **Validity:** A measurement is said to be valid if it measures what it is supposed to be measuring. An experiment is said to be valid if it investigates what it sets out and/or claims to investigate.



Discussion: What about the different types of errors?

- Random
- Systematic
- Personal

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Head Tutor's Comment: Errors, uncertainty and outliers

It is important not to confuse the terms measurement error and personal error. Error, from a scientific measurement perspective, is the difference between the measured value and the true value of what is being measured. For the purposes of VCE Biology, two types of measurement error should be considered when evaluating the quality of data: systematic errors and random errors. Personal errors should be eliminated by performing the experiment again correctly the next time, and therefore do not form part of an analysis of data quality.

- **Personal errors**: Include mistakes or miscalculations.
- **Random errors**: Affect the precision of a measurement and are present in all measurements except for measurements involving counting. Random errors are unpredictable variations in the measurement process and result in a spread of readings. The effect of random errors can be reduced by making more or repeated measurements and calculating a new mean and/or by refining the measurement method or technique.
- **Systematic errors**: Affect the accuracy of a measurement. Systematic errors cause readings to differ from the true value by a consistent amount each time a measurement is made, so that all the readings are shifted in one direction from the true value. The accuracy of measurements subject to systematic errors cannot be improved by repeating those measurements.

Section E: Experimental Design Questions (24 Marks)

Question 1 (1 mark)

A study tested the accuracy of a new blood glucose monitoring device. Researchers used blood samples from individuals with known glucose levels and compared the readings from the device to laboratory results. If the device consistently displays incorrect glucose levels, which factor could lead to a false reading?

A. Not calibrating the device properly before use.

B. Using sterile syringes to collect blood samples.

C. Storing blood samples at the recommended temperature.

D. Using blood samples from individuals with stable glucose levels.

Question 2 (1 mark)

To study the effectiveness of a new fertiliser on plant growth, researchers split 100 plants into two groups. Group A received the fertiliser along with regular watering, while Group *B* received only regular watering. What is Group *B* classified as?

A. Experimental group

B. Variable group

C. Control group

D. Unsupported group

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Question 3 (1 mark)

A study was conducted in 2022 to evaluate the effectiveness of two different brands of sunscreen in preventing sunburn. The study involved 10,000 participants, half using Brand *A* sunscreen and the other half using Brand B sunscreen. The graph below illustrates the percentage of individuals in the sample who developed sunburn after 4 hours of sun exposure.

Brand *A*	**Brand *B***
1%	0.5%

Based on the information given, which one of the following statements is correct?

A. There is a very low chance that individuals using either sunscreen will develop sunburn after 4 hours of sun exposure.

B. Brand *A* is more effective than Brand *B* in preventing sunburn.

C. Brand *B* is twice as effective as Brand *A* in preventing sunburn.

D. The data cannot be analysed because the sample size is too small.

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The following information applies to the two questions that follow.

Lipase is an enzyme that converts the fat in milk into fatty acids (and glycerol). A test for lipase activity can be carried out by measuring the rate of pH change when lipase is added to a set volume of milk. A well-designed experiment was set up where milk samples (all at a pH of 10) were exposed to a variety of temperature conditions and then lipase was added to each milk sample. The time it took for the milk samples to reach a pH of 7 was then measured. Each trial was given 10 minutes maximum to run. If the pH had not changed by that time, a +600 result was recorded. The results are set out in the table below.

	Time taken for the milk to change from pH 10 to pH 7 (seconds)				
Condition (°C)	**Trial 1**	**Trial 2**	**Trial 3**	**Trial 4**	**Trial 5**
10	355	425	325	296	585
20	120	98	110	225	150
30	41	40	35	40	38
40	68	75	55	65	110
50	+600	+600	+600	+600	425

Question 4 (1 mark)

Controlled conditions would include the:

A. Time taken for the pH to change from 10 to 7.

B. Temperature each milk sample was exposed to.

C. Volume of lipase that was added to each milk sampl

D. Time of day the experiment was conducted.

Controlled conditions should remain the same for each trial. In the case of this experiment, the temperature is the factor being changed (independent variable) and the pH changes are measured to determine the rate of enzyme action (dependent variable). If this type of experiment is enclosed and controlled properly then the ambient temperature should not influence the results obtained. Volumes of substrate and enzyme should be kept constant for each trial and so would qualify as controlled variables.

Question 5 (1 mark)

It would be reasonable to say that:

A. The five trials at 30°C were more precise than the

B. The five trials at 20°C were more accurate than th

C. There was more repetition at 10°C compared to 5

D. The results for 10°C would benefit from an additi

Precision relates to how close together the data is, and so the 30°C result (only 6 seconds different from the highest to lowest) has more precision than the 10°C result (289 seconds different from the highest to lowest). Accuracy relates to how close to the theoretical value the data is, and in this situation this cannot be compared. However, with repeated good experimentation these types of values can start to emerge. The repetition is the same for each independent variable and all conditions would benefit from more repetition.

Question 6 (1 mark)

A suitable conclusion based on the data presented wou

A. Optimum pH for lipase is 10.

B. Optimum temperature for lipase is approximately

C. Optimum temperature for lipase is between 20°C a

D. Enzyme is completely denatured at 50°C.

Based on this data it is reasonable to conclude that 30°C is the optimum temperature as this provided the shortest time to change the pH. It may well be that the optimum is between 20°C and 40°C (but not either of those two temperatures), but temperatures within the range other than 30°C have not been tested. A conclusion about denaturation cannot be made for two reasons; firstly, Trial 5 does illustrate activity, and secondly, the time of +600 means the reaction is incomplete, not necessarily non-existent.

Question 7 (1 mark)

Jessie hypothesised that if she increased the amount of fertiliser given to her plants, then this would make them grow faster. She decided to conduct an experiment to test her prediction.

The independent variable in Jessie's experiment would be:

A. The speed of growth of the plants.

B. The amount of light the plants would be exposed to.

C. The type of plant used.

D. The amount of fertiliser given to the plants.

The independent variable is the factor that is changed between groups in an experiment.

Question 8 (1 mark)

If the measurement tool used by Jessie to assess speed of plant growth was faulty and produced consistently incorrect results, this would be an example of a:

A. Random error.

B. Systematic error.

C. Human error.

D. Sample size error.

An error in equipment that produces incorrect results by a consistent amount is a systematic error.

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Question 9 (1 mark)

A measurement is valid if:

Validity refers to results being a true reflection of what an experiment sets out to measure.

A. It measures what it claims to be measuring.

B. Controlled variables have been allowed to change in an experiment.

C. The results are reproducible.

D. All of the above.

Question 10 (1 mark)

Four students carried out an experiment using a thermometer to record the temperature of a solution. The students repeated the experiment four times. Their teacher suggested that their results showed evidence of a systematic error.

A systematic error in biology relates to an error that is not determined by chance but rather is introduced by an inaccuracy inherent in the system pertaining to observation or measurement. A systematic error is an error that is the same each time the experiment is repeated. For example, a pipette with the wrong volume marked on it. This most accurately relates to answer A, where an incorrectly calibrated thermometer would impact the accuracy of measurements for temperature.

A systematic error:

A. May have been caused by using an incorr

B. Will be shown by large variations in the i

C. Can be reduced if the students gathered m

D. Happens when the students take turns rec

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Question 11 (6 marks)

Hydrogen peroxide is a toxic by-product of metabolism in most cells. In small amounts, hydrogen peroxide is lethal to some pathogens (such as bacteria); however, in large amounts, it is toxic to the cell.
The use of cellular catalase to break down hydrogen peroxide into oxygen and water is a way to remove raised levels of hydrogen peroxide.
The activity of hydrogen peroxide can be measured by determining the rate of mass loss of a given solution when exposed to a variety of conditions. The results of a series of experiments are shown below.

Trial	Condition	Rate of mass loss (g/min)
1	1% hydrogen peroxide, pH7, 30°C, 1% catalase.	0.75
2	1% hydrogen peroxide, pH9, 40°C, 1% catalase.	1.12
3	0.5% hydrogen peroxide, pH7, 30°C, 1% catalase.	0.50
4	1.5% hydrogen peroxide, pH7,30°C, 1% catalase.	0.85
5	2% hydrogen peroxide, pH6, 15°C, 1% catalase.	0.65
6	2% hydrogen peroxide, pH7, 30°C, 1% catalase.	0.90
7	4% hydrogen peroxide, pH7, 30°C, 1% catalase.	

a.

i. Which trial(s) (1 - 6) is/are unable to be used to make valid conclusions? (1 mark)

trials 2 and 5 1 mark

ii. Make a valid conclusion using the remaining results. (1 mark)

As the hydrogen peroxide concentration increases, the rate of mass loss increases (up to a point, then levels off). 1 mark

iii. Predict a result for trial 7, placing your prediction in the data table. (1 mark)

0.9 ± 0.05 g/min 1 mark

b. Design an experiment that would test the hypothesis that at a concentration of less than 0.1%, hydrogen peroxide is lethal to bacteria, but not to the cells that produce it. You are provided with a culture of kidney cells that are not producing hydrogen peroxide and have been mixed with a Streptococcus bacterial colony.

Include in your answer evidence of the following aspects of experimental design: (3 marks)

- The independent variable.
- The dependent variables.
- The controlled variables.

Get fifty cultures of kidney cell lines mixed with *Streptococcus* bacteria and divide the cultures into two groups.

- Group 1: Expose the kidney cell culture to all the conditions needed for effective growth as well as 0.1% hydrogen peroxide.
- Group 2: Expose the kidney cell culture to all the conditions needed for effective growth as well as 0.05% hydrogen peroxide.

This means that the variable of hydrogen peroxide is the independent variable. 1 mark

The conditions for effective growth would include temperature (about 37°C), pH (about 7) and the volumes of culture media (small volumes). These are referred to as the controlled conditions. 1 mark

Note: There are many controlled conditions – students should make reference to two.

After some time (two days) the cultures are examined for the presence of bacteria, by counting them in small volumes of the culture media (using a microscope). The number of bacteria would be the dependent variable. 1 mark

Note: There are a variety of methods that could be used to determine bacterial populations.

Worked solution

The hypothesis that the yak's coat provides insulation was supported.

OR

The data provided shows that the yak's temperature was always higher at the surface of the body than halfway through the fibres or at the end of the fibres. This effect occurs due to the insulation provided by the fibres.

Mark allocation: 1 mark

- 1 mark is awarded for identifying the fact that the conclusion is supported, or for any reasonable suggestion, such as the second option presented

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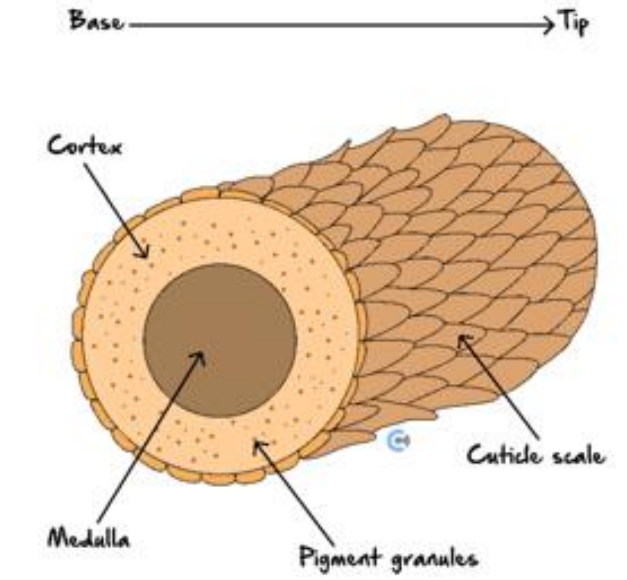
Question 12 (8 marks)

In 2011, a research group conducted a study to determine whether it is better to blow-dry your hair or whether it should be allowed to dry naturally.

The image below shows a cross-section of human hair.



Source : Krome international. Reproduced with permission.

The cuticle scales are made up of hardened keratin. The cell membrane complex (CMC) is made up of lipids and polysaccharides. It acts like a glue and holds the cuticle scales together. The cortex and medulla are made up of softer keratin. The base of the hair is attached to the skull by a follicle.

The research group identified that the main types of damage are damage to the cuticles, which causes roughness and split ends, or damage to the CMC, which may cause loss of hair.
Samples of hair were divided into five groups as follows.

Group	Treatment
1	No treatment
2	Drying without using a hair dryer (room temperature, 20°C).
3	Drying with a hair dryer for 60 seconds at a distance of 15 cm (47°C).
4	Drying with a hair dryer for 30 seconds at a distance of 10 cm (61°C).
5	Drying with a hair dryer for 15 seconds at a distance of 5 cm (95°C).

After treatment, all samples were left in the same environment for 24 hours before being examined using a scanning electron microscope.

a. Group 1 is the control group.

Explain the purpose of using a control group. (1 mark)

Worked solution

A control group is a group of subjects that are not exposed to the independent variable. The purpose of a control group is to provide a baseline of comparison so that any differences in results between the control and treatment groups can be attributed to the independent variable.

Mark allocation: 1 mark

- 1 mark is awarded for providing a complete explanation of the purpose of using a control group in a fair test experiment

b. Each of the groups was exposed to the treatment 30 times.

Explain the purpose of carrying out the treatment multiple times. (1 mark)

Worked solution

Repeating the experiments increases the reliability of the results; any outliers can be identified and it is possible that the experimental process could be improved.

Note: Improved accuracy is not provided by repeating an experiment. An answer relating t accuracy should not be accepted.

Mark allocation: 1 mark

- 1 mark is awarded for providing a logical/valid reason that explains the benefits of carrying out the same experiment multiple times

c. Consider the types of variables used in a fair test experiment.

Identify one way in which this experiment differs from a standard fair test. Use examples to support your answer. (2 marks)

Worked solution

Only a single independent variable is used in a standard fair test experiment. This experiment uses several independent variables: the temperature the hair was subjected to, the length of time the hair was subjected to the treatment and the distance of the hair dryer from the hair.

Mark allocation: 2 marks

- 1 mark is awarded for stating that the standard procedure is to use a single independent variable, while several independent variables are being used in this experiment
- 1 mark is awarded for providing examples of at least two independent variables in this experiment

The results of the experiments are shown in the table below. Three possible areas of damage were examined.

Group	Description of hair surface	Effects on CMC	Effect on cortex
1	No cracks.	No signs of damage.	No signs of damage.
2	No cracks.	Extensive bulging.	No signs of damage.
3	Multiple cracks.	No signs of damage.	No signs of damage.
4	Multiple cracks and some lifting of the cuticle scales.	No signs of damage.	No signs of damage.
5	Multiple cracks and extensive lifting of the cuticle scales.	No signs of damage.	No signs of damage.

d. A student reviewed the article that was written based on these results and stated that the results of the experiment were not valid due to the methods used.

Is this statement accurate? Provide a reason to support your answer. (2 marks)

Worked solution

The statement is accurate. In terms of the design, the experiment has some validity because the method being used to obtain the results (use of the electron microscope) is measuring what it is intended to measure. However, the investigation is flawed because data that has been gathered has been affected by more than one independent variable.

Mark allocation: 2 marks

- 1 mark is awarded for identifying that the statement is accurate
- 1 mark is awarded for explaining why the results of this experiment were not valid

Note: As per the Study Design, 'both experimental design and the implementation should be considered when evaluating validity'.

e. With reference to the purpose of this experiment and the data obtained, identify two conclusions that this group could have made. (2 marks)

Worked solution

Possible examples include:

- Using a hair dryer caused more damage to the surface of the hair than was caused by natural drying.
- Natural drying causes more damage to the CMC than using a hair dryer.
- The least amount of damage is achieved by using a hair dryer to dry your hair. This should be for 60 seconds at a distance of 15 cm from the hair.
- Using a hair dryer may promote split ends and roughness, but natural drying could lead to an increased loss of hair.

Suitable suggestions included:

- There may be more living algal cells trapped in the red algal balls than the green algal balls giving an increase in photosynthesis.
- The phenol red may affect the rate of photosynthesis in green algae more than in red algae
- There may be differences in the rate of cellular respiration between the two types of algae.

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Question 13 (6 marks)

Apple farmers often use artificial environments to ensure their apples are available to consumers all year round. One such method is to accelerate fruit ripening by exposing large quantities of apples to a specific set of conditions.

An experiment was carried out to test the effect of varying the levels of the plant hormone ethylene on apple ripening when exposed to different temperatures. Testing was conducted in aluminium containers that had 100 equally sized unripe apples placed in them. The internal environment of the aluminium containers could be altered by adding or removing factors in the air by an inlet and outlet valve.

The apples were considered ripe when two apples could be consecutively removed and deemed ripe by tasting them for sweetness as well as looking at their colour. The results of such an experiment are outlined in the table below.

Ethylene concentration (*ppm*)	**Temperature** (°C)	**Time taken for apples to ripen (hours)**
0	20	200
1	20	150
2	20	100
50	20	75
150	20	30
500	20	30
500	5	100

a. List one strength in the experimental design. (1 mark)

A variety of ethylene concentrations were used OR many apples used per test.

b. List one weakness in the experimental design. (1 mark)

Tasting only involved two apples OR tasting was open to opinion.

c. Use the experimental results to describe the optimal conditions you would recommend to apple farmers for fast fruit ripening. (2 marks)

150 ppm ethylene (1) at 20 degrees Celsius (1) (not 500 ppm ethylene as 150 provides the same result and so would be cheaper).

d. Describe the accuracy and precision of the data collected. (2 marks)

The data is of low accuracy (1) as the apples were judged as ripe by taste and colour which is a very subjective measure making it difficult to determine how close it is to the true value (1) it is also difficult to be sure that results are consistent [1] so precision is also low (1)

Section F: Q&A

These are some frequently asked questions, but aside from that feel free to ask me whatever you want!

- Can be about Bio, VCE, my other subjects, or even about careers and university!
- **How did you study for the subject?**
- **How did you manage your time effectively?**
- **What resources did you find most helpful?**
- **How did you maintain motivation and focus?**
- **What were your exam preparation strategies?**
- **How did you tackle difficult topics or concepts?**

- Can you share any tips for writing high-scoring responses?

- Did you have a specific routine before or during exams?

- How did you balance extracurricular activities or relaxation with studying?

- What mistakes did you make and learn from during your study journey?

- How did you handle setbacks or poor performance?

- What advice do you have for staying healthy and avoiding burnout?

- How did you decide what was important to focus on for the subject?

- Can you explain your note-taking and revision methods?

- What role did teachers or tutors play in your success?

- Feel free to ask these and more! Anything is on the table.

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VCE Biology ¾

Free 1-on-1 Support

Be Sure to Make The Most of These (Free) Services!

- Experienced Contour tutors (45+ raw scores, 99+ ATARs).
- For fully enrolled Contour students with up-to-date fees.
- After school weekdays and all-day weekends.

1-on-1 Video Consults	Text-Based Support
Book via bit.ly/contour-biology-consult-2025 (or QR code below). One active booking at a time (must attend before booking the next).	Message +61 440 137 387 with questions. Save the contact as "Contour Biology".

Booking Link for Consults
bit.ly/contour-biology-consult-2025

Number for Text-Based Support
+61 440 137 387