Website: contoureducation.com.au | **Phone:** 1800 888 300
Email: hello@contoureducation.com.au

VCE Biology ¾
AOS 2 Revision [2.0]
Contour Check

Contour Checklist

[2.1] - Photosynthesis & Biochemical Pathways (Checkpoints)

- [ ] **[2.1.1] –** Recall the Inputs, Outputs & Locations & the Relationship between Both Stages of Photosynthesis Pg 3-8
- [ ] **[2.1.2] –** Explain the Role of Enzymes & Coenzymes on the Process of Photosynthesis Pg 9-12
- [ ] **[2.1.3] –** Explain the Function of Rubisco in Photosynthesis & Describe the Factors that Increase its Affinity for O_2 Pg 13-16
- [ ] **[2.1.4] –** Describe the Adaptations of C_4 & CAM Plants for Reducing Photorespiration, as Compared to C_3 Plants, Including Structural & Physiological Differences Pg 17-20
- [ ] **[2.1.5] –** Use Data to Identify an Unknown Plant as C_3, C_4 or CAM with Reference to Conditions Where they Perform Photosynthesis Best Pg 21-23
- [ ] **[2.1.6] –** Identify & Explain the Factors - Light Colour, Intensity, CO_2 Concentration, Temperature, Water Availability - that Affect the Efficiency of Photosynthesis Pg 24-29
- [ ] **[2.1.7] –** Apply Experimental Principles to Investigate Factors Affecting the Rate of Photosynthesis Pg 30-33
- [ ] **[2.1.8] –** Explain How CRISPR-Cas9 Can Be Used to Increase Photosynthetic Efficiency Pg 34-37

[2.2] - Cellular Respiration & Anaerobic Fermentation (Checkpoints)

- [ ] **[2.2.1] –** Recall the Inputs, Outputs & Locations of All Stages of Aerobic Cellular Respiration Pg 38-40
- [ ] **[2.2.2] –** Recall the Inputs, Outputs & Locations of All Stages of Anaerobic Cellular Respiration Pg 41-43
- [ ] **[2.2.3] –** Describe the Significance of the Mitochondria as the Necessary Location for Aerobic Respiration Pg 44-47
- [ ] **[2.2.4] –** Identify & Describe Factors - Such As Temperature, Glucose Availability, & Oxygen Concentration - On the Rate of Cellular Respiration Pg 48-54
- [ ] **[2.2.5] –** Identify & Explain the Role of Enzymes & Coenzymes in Cellular Respiration Pg 55-58
- [ ] **[2.2.6] –** Apply Experimental Design Principles to Create Methodologies to Test Factors That Affect Cellular Respiration Pg 59-62
- [ ] **[2.2.7] & [2.2.8] –** Describe the Importance of Breaking Down Biomass Into Simple Sugars for Biofuel Production; Explain How Yeast Can be Used to Produce Bioethanol From Biomass Pg 63-64

[2.1 – 2.2] - Overall (VCAA Qs) Pg 65-74

Section A: [2.1] - Photosynthesis & Biochemical Pathways (Checkpoints) (73 Marks)

Sub-Section [2.1.1]: Recall the Inputs, Outputs & Locations & the Relationship between Both Stages of Photosynthesis

Question 1

Definitions:

a. Photosynthesis:

_____

_____

b. Light-dependent stage:

_____

_____

c. Light-independent stage (Calvin Cycle):

_____

_____

d. Thylakoid membrane:

_____

_____

e. Stroma:

_____

_____

f. ATP (Adenosine triphosphate):

_____

_____

g. NADPH:

_____

_____

h. Photolysis:

_____

_____

i. Glucose:

_____

_____

Question 2 (1 mark)

Which of the following best describes the role of the thylakoid membrane in photosynthesis?

A. A site where glucose is synthesised.

B. The location where CO_2 is reduced into organic compounds.

C. A structure that facilitates ATP and NADPH production during the light-dependent stage.

D. A storage site for water used in photolysis.

Space for Personal Notes

Question 3 (1 mark)

During the light-independent stage, why is ATP critical for glucose synthesis?

A. It directly combines with RuBP to produce glucose.

B. It provides the energy required for the reduction of 3-PGA to G3P.

C. It acts as an electron carrier for CO_2 reduction.

D. It oxidises NADPH to facilitate carbon fixation.

Question 4 (1 mark)

If the stroma of a chloroplast becomes more acidic, what is the most likely impact on photosynthesis?

A. ATP production in the light-dependent stage would increase.

B. Carbon fixation in the Calvin Cycle would slow down.

C. NADPH would accumulate in the thylakoid membrane.

D. Glucose synthesis would occur at a higher rate.

Question 5 (1 mark)

Why is it crucial for the products of the light-dependent stage to immediately feed into the Calvin Cycle?

A. To ensure that photolysis continues uninterrupted.

B. To regenerate RuBP for ongoing carbon fixation.

C. To maintain a high concentration of oxygen in the stroma.

D. To allow the thylakoid membranes to absorb more CO_2.

Space for Personal Notes

Question 6 (1 mark)

A scientist introduces a mutation that prevents water from splitting during the light-dependent stage. What is the most immediate effect?

A. ATP synthesis would increase.

B. Oxygen production would cease.

C. $NADP^+$ reduction to NADPH would accelerate.

D. The Calvin Cycle would proceed without interruption.

Question 7 (3 marks)

a. Light-Dependent Stage:

Inputs	Outputs	Location

b. Light-Independent Stage:

Inputs	Outputs	Location

c. Describe the relationship between the light-dependent and independent stages of photosynthesis. (3 marks)

_____

_____

_____

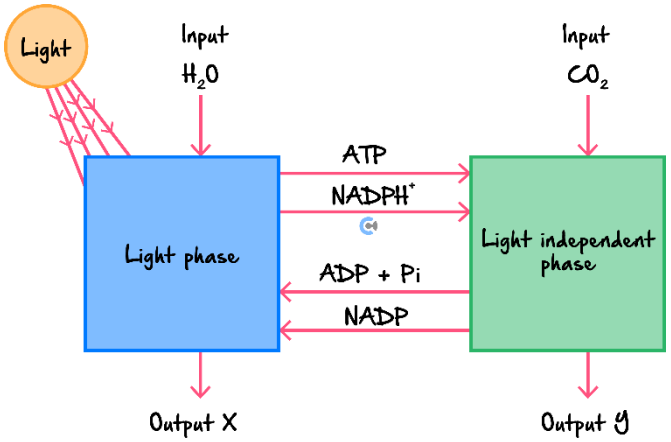
_____

_____

_____

Question 8 (5 marks)

a. Although photosynthesis is often summarised by a single equation, in fact, the process occurs in two distinct phases; the light phase and another phase called the carbon fixation phase or the light-independent phase. These two phases can be summarised in diagrammatic form as follows.



The diagram shows outputs *X* and *Y*.

i. What is output *X*? (1 mark)

_____

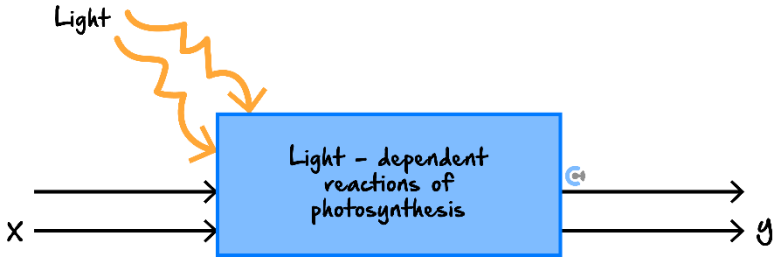
ii. How is output *X* produced? (1 mark)

_____

iii. What is output *Y*? (1 mark)

_____

b. The following diagram shows a simplified representation of the first stage of photosynthesis.



i. Name one input item that ***X*** could represent. (1 mark)

_____

ii. Name one input item that ***Y*** could represent. (1 mark)

_____

Space for Personal Notes

Sub-Section [2.1.2]: Explain the Role of Enzymes & Coenzymes on t Process of Photosynthesis

Question 9

Definitions:

a. Enzyme:

_____

_____

b. Rubisco (Ribulose-1, 5-bisphosphate carboxylase/oxygenase):

_____

_____

c. PEP carboxylase:

_____

_____

d. Coenzyme:

_____

_____

e. $NADP^+$ (Nicotinamide adenine dinucleotide phosphate):

_____

_____

f. Active site:

_____

_____

g. Substrate:

_____

_____

Question 10 (1 mark)

Why is RuBisCo considered both essential and inefficient for photosynthesis?

A. It facilitates CO_2 fixation but is easily denatured by light.

B. It fixes CO_2 into RuBP but competes with O_2 due to oxygenase activity.

C. It catalyses ATP production but is prone to breaking down in high temperatures.

D. It absorbs light energy but requires high concentrations of CO_2 to function.

Question 11 (1 mark)

A researcher genetically modifies a plant to produce a coenzyme that can store twice as many electrons as NADPH. What is the most likely consequence of photosynthesis?

A. Photolysis would proceed at a faster rate.

B. The Calvin Cycle would slow down due to $NADP^+$ accumulation.

C. Glucose synthesis would be more efficient, especially under low light.

D. ATP production would stop as electrons bypass the ETC.

Space for Personal Notes

Question 12 (1 mark)

If PEP carboxylase were absent in C_4 plants, which step in their photosynthetic pathway would be most affected?

A. Regeneration of RuBP.

B. CO_2 fixation into a 4-carbon compound.

C. Transfer of electrons from NADPH to CO_2.

D. Reduction of 3-PGA to G3P.

Question 13 (1 mark)

What role does the active site of RuBisCo play in photorespiration?

A. It reduces RuBP into 3-PGA when O_2 is available.

B. It binds O_2 instead of CO_2 under high-temperature conditions.

C. It generates ATP by facilitating proton movement.

D. It allows NADPH to deliver electrons to CO_2.

Question 14 (1 mark)

In an experiment, RuBisCo activity is measured at high temperatures. Which result would support the hypothesis that photorespiration is occurring?

A. A decrease in G3P production.

B. An increase in NADPH concentration in the stroma.

C. Enhanced ATP production in the thylakoid membrane.

D. Accumulation of 4-carbon intermediates in bundle sheath cells.

Space for Personal Notes

Question 15

A researcher observes that a plant's Calvin Cycle is unable to proceed efficiently due to a lack of energy and reducing power. Upon further investigation, it is found that the light-dependent stage is functioning but ATP and NADPH are not being transported to the stroma.

Explain the role of coenzymes in the process of photosynthesis and why their absence affects the Calvin Cycle in this scenario.

_____

_____

_____

_____

_____

_____

Space for Personal Notes

Sub-Section [2.1.3]: Explain the Function of RuBisCo in Photosynthesis & Describe the Factors that Increase its Affinity for O_2

Question 16

Definitions:

a. RuBisCo:

_____

_____

b. Photorespiration:

_____

_____

c. Affinity:

_____

_____

d. RuBP (Ribulose-1,5-bisphosphate):

_____

_____

e. Carboxylase:

_____

_____

f. Oxygenase:

_____

_____

g. Stomata:

_____

_____

Question 17 (1 mark)

Under which conditions is RuBisCo most likely to bind O_2 instead of CO_2?

A. Low light intensity and high humidity.

B. High temperature and low CO_2 concentration.

C. Low temperature and low O_2 concentration.

D. High light intensity and high CO_2 concentration.

Question 18 (1 mark)

How does the activity of RuBisCo affect overall plant productivity in C_3 plants?

A. It increases photosynthetic rates at high oxygen levels.

B. It decreases photosynthetic efficiency when O_2 is present.

C. It ensures consistent glucose production regardless of environmental conditions.

D. It accelerates ATP synthesis during photorespiration.

Space for Personal Notes

Question 19 (1 mark)

A mutation enhances RuBisCo′s carboxylase activity but reduces its oxygenase activity. How would this affect photosynthesis in a C_3 plant?

A. Photorespiration would increase.

B. CO_2 fixation would become more efficient.

C. Glucose synthesis would decrease at low temperatures.

D. The Calvin Cycle would become unnecessary.

Question 20 (1 mark)

Why do stomata remain closed during hot, dry conditions, and how does this affect RuBisCo's function?

A. To prevent CO_2 loss, causing RuBisCo to bind O_2 instead of CO_2.

B. To conserve oxygen, enhancing RuBisCo's carboxylase activity.

C. To prevent water loss, ensuring RuBP is regenerated.

D. To limit glucose production, reducing ATP usage.

Question 21 (1 mark)

A scientist measures the CO_2 affinity of RuBisCo in a plant grown at 10°C versus one grown at 35°C. What difference would they likely observe?

A. Higher CO_2 affinity at 10°C due to reduced photorespiration.

B. Lower CO_2 affinity at 10°C because RuBisCo denatures.

C. Higher CO_2 affinity at 35°C due to increased enzymatic activity.

D. No difference, as RuBisCo activity is independent of temperature.

Space for Personal Notes

Question 22 (3 marks)

a. What is the function of RuBisCo? (1 mark)

_____

_____

b. RuBisCo can undergo another process called photorespiration. When is photorespiration most likely to occur? (2 marks)

_____

_____

_____

_____

Space for Personal Notes

Sub-Section [2.1.4]: Describe the Adaptations of C_4 & CAM Plants for Reducing Photorespiration, as Compared to C_3 Plants, Including Structural & Physiological Differences

Question 23

Definitions:

a. C_3 plants:

_____

_____

b. C_4 plants:

_____

_____

c. CAM plants:

_____

_____

d. PEP carboxylase:

_____

_____

e. Spatial separation:

_____

_____

f. Temporal separation:

_____

_____

g. Photorespiration:

_____

_____

Question 24 (1 mark)

What adaptation allows CAM plants to conserve water in arid environments?

A. Storing CO_2 as a 4-carbon compound during the day.

B. Conducting the Calvin Cycle only at night.

C. Temporally separating CO_2 fixation and the Calvin Cycle.

D. Using PEP carboxylase in mesophyll cells.

Question 25 (1 mark)

Which feature of C_4 plants helps reduce photorespiration?

A. High chlorophyll concentration in mesophyll cells.

B. Spatial separation of CO_2 fixation and the Calvin Cycle.

C. Exclusive reliance on RuBisCo for CO_2 fixation.

D. Ability to fix CO_2 directly into glucose.

Space for Personal Notes

Question 26 (1 mark)

In an experiment comparing photosynthesis in C_3, C_4, and CAM plants, which condition would favour CAM plants?

A. Cool temperatures with high humidity.

B. Intense sunlight with limited water availability.

C. High CO_2 concentration and moderate light intensity.

D. Continuous light exposure with abundant water.

Question 27 (1 mark)

Why are C_3 plants less efficient than C_4 plants in hot, dry environments?

A. C_3 plants rely solely on ATP from the light-dependent stage.

B. C_3 plants cannot prevent O_2 from binding to RuBisCo.

C. C_3 plants use PEP carboxylase for CO_2 fixation.

D. C_3 plants do not require stomata for gas exchange.

Question 28 (1 mark)

How would increasing CO_2 concentration in the atmosphere affect the relative efficiency of C_3 and C_4 plants?

A. C_3 plants would become more efficient than C_4 plants.

B. C_4 plants would be unaffected due to spatial CO_2 fixation.

C. Both plant types would exhibit reduced photorespiration.

D. C_4 plants would increase oxygenase activity in RuBisCo.

Space for Personal Notes

Question 29 (5 marks)

A researcher is studying three different plant species (Plant *A*, Plant *B*, and Plant *C*) under various environmental conditions. The plants are observed for their photosynthetic pathways:

- **Plant *A*** performs best at 25°C and 80% humidity but struggles at 40°C and low humidity.
- **Plant *B*** maintains photosynthetic efficiency at 40°C and low humidity but shows poor growth in low light conditions.
- **Plant *C*** performs photosynthesis primarily at night in arid conditions.

a. Which photosynthetic pathway is most likely utilised by each plant? Explain the reasoning for your answer. (2 marks)

_____

_____

_____

_____

b. Why does Plant *A* exhibit reduced efficiency under hot and dry conditions compared to Plant *B*? (1 mark)

_____

_____

c. Under which conditions would Plant *C* have an advantage over Plant *B*, and why?

_____

_____

_____

_____

Space for Personal Notes

Sub-Section [2.1.5]: Use Data to Identify an Unknown Plant as C_3, C_4 or CAM with Reference to Conditions Where they Perform Photosynthesis Best

Question 30 (1 mark)

A plant demonstrates high glucose production at 25°C and 80% humidity but shows a sharp decline at 40°C and 30% humidity. Which photosynthetic pathway is this plant most likely to use?

A. C_3 photosynthesis.

B. C_4 photosynthesis.

C. CAM photosynthesis.

D. Photorespiration.

Question 31 (1 mark)

Which of the following is a key characteristic of C_4 plants that allows them to perform photosynthesis efficiently under hot and dry conditions?

A. Stomata remain open during the night to conserve water.

B. CO_2 fixation occurs in the mesophyll cells and the Calvin Cycle in the bundle sheath cells.

C. RuBisCohas a higher affinity for oxygen than CO_2.

D. Photosynthesis is limited to low-light conditions.

Question 32 (1 mark)

A plant produces glucose efficiently at 40°C but only under low humidity. At moderate temperatures, it performs poorly compared to other species. Which type of photosynthetic pathway does this plant most likely use?

A. C_3 photosynthesis.

B. C_4 photosynthesis.

C. CAM photosynthesis.

D. None of the above.

Question 33 (1 mark)

Which observation would most strongly suggest that a plant utilises CAM photosynthesis?

A. High photosynthetic rate at 25°C and 90% humidity.

B. Glucose production is highest when CO_2 is supplied during the night.

C. Photosynthesis is equally efficient under both day and night conditions.

D. Photosynthesis ceases completely when exposed to high temperatures.

Question 34 (1 mark)

If a plant relies on RuBisCofor direct CO_2 fixation and shows reduced glucose production when the oxygen concentration is increased, which photosynthetic pathway does it most likely use?

A. C_3 photosynthesis.

B. C_4 photosynthesis.

C. CAM photosynthesis.

D. Both C_4 and CAM.

Space for Personal Notes

Question 35

A group of scientists conducted experiments investigating the photosynthetic output of a newly discovered plant species. The plants were exposed to differing environmental conditions in an enclosed greenhouse. Light and water availability were kept the same. The amount of glucose produced was measured and recorded in the table below. Plants of the same size were used in each of these experiments.

Air temperature (°C)	**Carbon dioxide in surrounding air** (%)	**Relative humidity of surrounding air** (%)	**Quantity of glucose produced** (mg/day)
15	5	90	90
15	2	90	55
25	5	70	75
25	2	50	40
35	5	30	30
35	2	30	15

Plants can be placed into three main groups, **C_3, C_4** or **CAM** plants, based on their photosynthetic adaptations.

To which of these groups would this newly discovered plant species most likely belong? Justify your answer.

_____

_____

_____

_____

_____

_____

Space for Personal Notes

Sub-Section [2.1.6]: Identify & Explain the Factors - Light Colour, Intensity, CO_2 Concentration, Temperature, Water Availability - that Affect the Efficiency of Photosynthesis

Question 36

Definitions:

a. Light intensity:

_____

_____

b. Light wavelength:

_____

_____

c. CO_2 concentration:

_____

_____

d. Temperature:

_____

_____

e. Water availability:

_____

_____

Question 37 (1 mark)

Why does high temperature reduce photosynthesis efficiency in C_3 plants?

A. It denatures chlorophyll pigments, reducing light absorption.

B. It increases photorespiration due to the higher oxygenase activity of Rubisco.

C. It reduces ATP production in the light-dependent stage.

D. It causes stomata to remain open, losing CO_2.

Question 38 (1 mark)

How does light wavelength influence the efficiency of photosynthesis?

A. Green light is absorbed most efficiently, boosting glucose production.

B. Red and blue light maximise chlorophyll absorption, enhancing photosynthesis.

C. Infrared light increases the rate of ATP production.

D. Yellow light is required for photolysis.

Question 39 (1 mark)

In an experiment, plants are exposed to varying CO_2 concentrations. Which observation would indicate a saturation point has been reached?

A. Increased ATP production with increasing CO_2 levels.

B. Glucose production remains constant despite rising CO_2.

C. Photorespiration increases with higher CO_2 levels.

D. NADPH synthesis decreases as CO_2 rises.

Space for Personal Notes

Question 40 (1 mark)

Why might water availability indirectly limit photosynthesis?

A. It inhibits ATP production in the light-dependent stage.

B. It prevents $NADP^+$ reduction in the Calvin Cycle.

C. It forces stomata closure, reducing CO_2 uptake.

D. It increases photorespiration by raising O_2 levels in the stroma.

Question 41 (1 mark)

Which combination of conditions would maximise photosynthesis efficiency in a typical C_3 plant?

A. High temperature, low humidity, low light intensity.

B. Moderate temperature, high CO_2 concentration, ample water.

C. High CO_2, high temperature, and intense light.

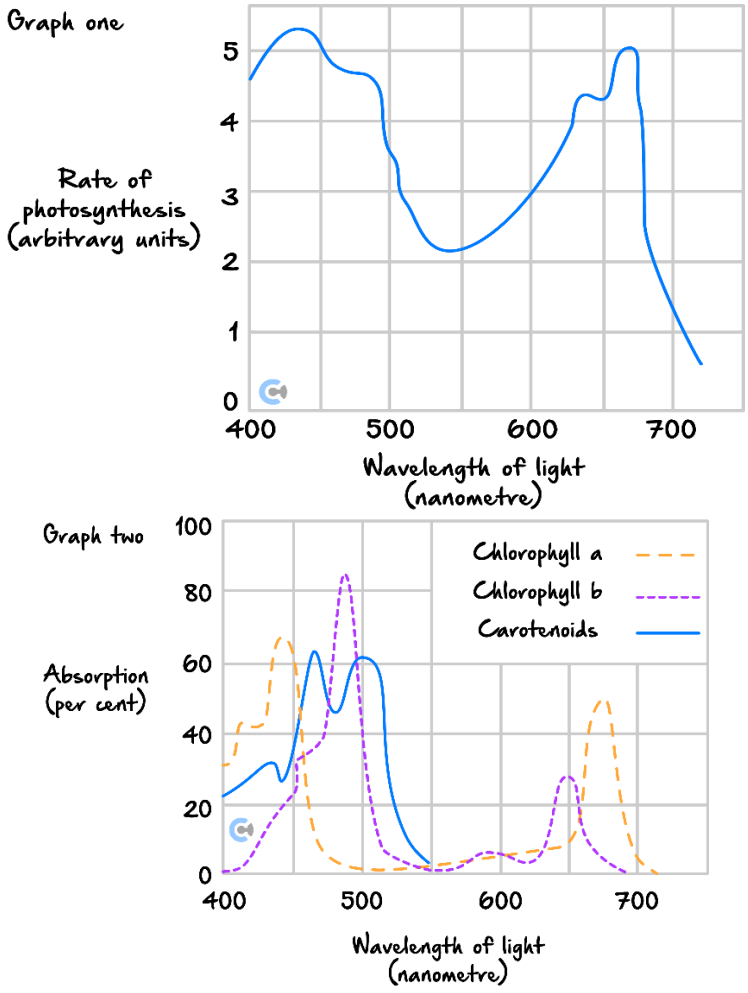
D. Low CO_2, high humidity, and low light.

Space for Personal Notes

Question 42 (5 marks)

a. The following diagrams show:

- **Graph one:** The rate of photosynthesis in a green plant at different wavelengths of light.
- **Graph two:** The estimated absorption of the different wavelengths of light by the different plant pigments.



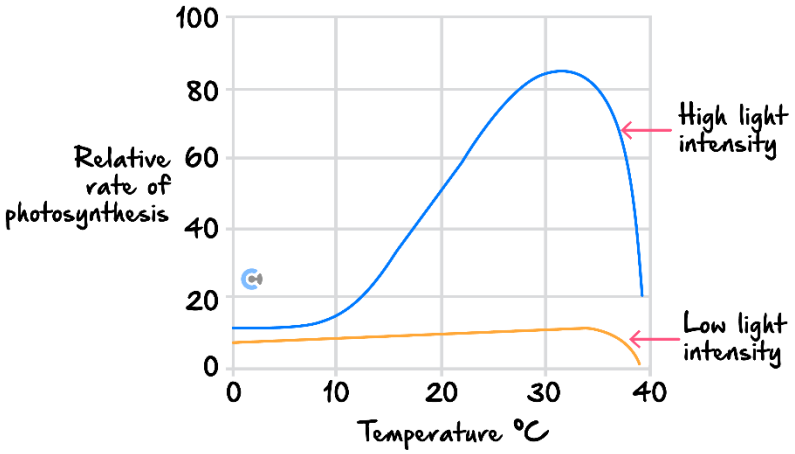
Explain why the graph showing the rate of photosynthesis has approximately the same shape as the absorption graphs of the plant pigments. (1 mark)

_____

_____

_____

b. Scientists exposed two groups of identical plants to a range of temperatures. One group was kept in a low-light intensity and the other in a high-light intensity environment. The following graph summarises the results obtained by the scientists.



Account for the difference in the rate of photosynthesis for the two groups of plants over the range of temperatures shown. (2 marks)

_____

_____

_____

_____

c. A light is placed near a plant and the rate of photosynthesis is measured. The intensity of the light is increased over time as shown in the figure below.

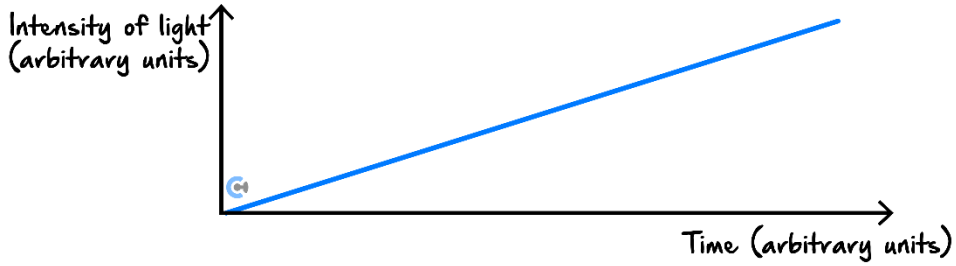


Figure 9

List the three possible limiting factors that may stop the rate of photosynthesis from increasing, even though the light intensity continues to increase. (2 marks)

_____

_____

_____

_____

Space for Personal Notes

Sub-Section [2.1.7]: Apply Experimental Principles to Investigate Factors Affecting the Rate of Photosynthesis

Question 43 (1 mark)

A student investigates the effect of light intensity on photosynthesis using pondweed. If the number of oxygen bubbles released begins to plateau despite increasing light intensity, what is the most likely limiting factor?

A. Water availability.

B. CO_2 concentration.

C. Temperature.

D. ATP availability.

Question 44 (1 mark)

A researcher designs an experiment to measure the effect of temperature on photosynthesis. What control variable is critical for ensuring reliable results?

A. The amount of light provided to the plants.

B. The concentration of oxygen in the environment.

C. The type of plant species used in the study.

D. Both A and C.

Question 45 (1 mark)

In an experiment, plants are exposed to different wavelengths of light. Which dependent variable would provide the best indicator of photosynthetic activity?

A. The chlorophyll content in the leaves.

B. The rate of oxygen production in the plants.

C. The concentration of NADPH in the chloroplasts.

D. The amount of CO_2 absorbed by the plants.

Question 46 (1 mark)

During an experiment, a student increases the CO_2 concentration around a plant and observes a temporary increase in photosynthetic rate before it plateaus. What most likely caused this plateau?

A. Insufficient ATP and NADPH production.

B. Limited availability of water for photolysis.

C. Decreased activity of chlorophyll pigments.

D. The saturation of enzymes in the Calvin Cycle.

Question 47 (1 mark)

A scientist is testing the effect of light wavelength on photosynthesis using spinach leaf discs. Which setup would serve as the most appropriate control for the experiment?

A. Exposing the leaf discs to white light.

B. Keeping the leaf discs in complete darkness.

C. Exposing the leaf discs to red light only.

D. Using a leaf disc from a non-photosynthetic plant.

Space for Personal Notes

Question 48 (9 marks)

A scientist conducts an experiment to investigate how different concentrations of carbon dioxide affect the rate of photosynthesis. She uses small discs of spinach leaves and removes the air from them using a syringe. These discs are then placed in beakers with bicarbonate solutions of varying CO_2 concentrations (0.2%, 0.5%, and 1.0%) and exposed to bright white light for 10 minutes. She counts the number of leaf discs that rise every minute as an indicator of photosynthetic activity.

a. Why does the rate of rising of the leaf discs allow the scientist to determine the extent of photosynthesis? (2 marks)

_____

_____

_____

_____

b. Write a suitable hypothesis for this experiment. Explain your hypothesis. (2 marks)

_____

_____

_____

_____

c. What would be the suitable control for this experiment? (1 mark)

_____

_____

d. Identify the stage of photosynthesis being tested in this experiment. State what is produced as a result of this stage. (2 marks)

_____

_____

_____

_____

e. The scientist predicted that the rate of photosynthesis would plateau at a certain CO_2 concentration. Is she correct? Explain your reasoning. (2 marks)

_____

_____

_____

_____

Space for Personal Notes

Sub-Section [2.1.8]: Explain How CRISPR-Cas9 Can Be Used to Increase Photosynthetic Efficiency

Question 49

Definitions:

a. CRISPR-Cas9:

_____

_____

b. Genome editing:

_____

_____

c. RuBisCoefficiency:

_____

_____

d. Drought tolerance :

_____

_____

e. Crop yield:

_____

_____

f. Photorespiration reduction:

_____

_____

Question 50 (1 mark)

How can CRISPR-Cas9 be used to reduce photorespiration in plants?

A. By increasing the expression of RuBisCo.

B. By editing RuBisCogenes to improve CO_2 specificity and reduce O_2 binding.

C. By modifying chlorophyll molecules to absorb more light.

D. By introducing genes for PEP carboxylase into C_3 plants.

Question 51 (1 mark)

Which of the following is a key advantage of using CRISPR-Cas9 in improving photosynthesis?

A. It can directly increase glucose production in all plants.

B. It allows for precise editing of genes involved in photosynthetic pathways.

C. It enables plants to perform photosynthesis without sunlight.

D. It eliminates the need for the Calvin Cycle.

Space for Personal Notes

Question 52 (1 mark)

A researcher uses CRISPR-Cas9 to introduce genes for C_4 photosynthesis into a C_3 plant. What is the expected outcome?

A. The C_3 plant will increase photorespiration.

B. The C_3 plant will perform photosynthesis more efficiently at high temperatures.

C. The C_3 plant will only perform photosynthesis at night.

D. The C_3 plant will switch to CAM photosynthesis.

Question 53 (1 mark)

Which of the following traits can be targeted using CRISPR-Cas9 to improve photosynthesis in crops?

A. Increasing RuBisCo's affinity for O_2.

B. Enhancing the water-use efficiency of plants.

C. Eliminating the need for light in photosynthesis.

D. Shortening the Calvin Cycle to produce glucose faster.

Space for Personal Notes

Question 54 (4 marks)

Describe the steps used in using CRISPR to edit plants.

_____

_____

_____

_____

_____

_____

_____

_____

Space for Personal Notes

Section B: [2.2] - Cellular Respiration & Anaerobic Fermentation (Checkpoints) (66 Marks)

Sub-Section [2.2.1]: Recall the Inputs, Outputs & Locations of All Stages of Aerobic Cellular Respiration

Question 55

Definitions:

a. Glycolysis.

_____

_____

b. Link Reaction.

_____

_____

c. Krebs Cycle (Citric Acid Cycle).

_____

_____

d. Electron Transport Chain (ETC).

_____

_____

Space for Personal Notes

Question 56 (1 mark)

Which of the following best explains the importance of the Link Reaction in aerobic respiration?

A. It produces pyruvate for glycolysis.

B. It connects glycolysis to the Krebs Cycle by producing acetyl-CoA and NADH.

C. It generates ATP directly via substrate-level phosphorylation.

D. It allows electrons to flow through the Electron Transport Chain.

Question 57 (1 mark)

During the Electron Transport Chain, what creates the proton gradient necessary for ATP synthesis?

A. The reduction of oxygen in the water.

B. The release of CO_2 from the Krebs Cycle.

C. The transfer of electrons between protein complexes.

D. The movement of pyruvate into the mitochondria.

Question 58 (1 mark)

Where in the cell does glycolysis occur, and why is this location significant?

A. Mitochondrial matrix; it contains the enzymes for glycolysis.

B. Cristae; it provides the surface area needed for glycolysis.

C. Cytoplasm; it allows glycolysis to proceed without oxygen.

D. Cytoplasm; it maximises ATP production under aerobic conditions.

Space for Personal Notes

Question 59 (1 mark)

What would most likely occur if oxygen is unavailable during aerobic respiration?

A. The Krebs Cycle would continue, but the Electron Transport Chain would stop.

B. The Link Reaction would cease due to a lack of pyruvate.

C. Glycolysis would proceed anaerobically, leading to lactic acid or ethanol production.

D. Oxidative phosphorylation would continue at a slower rate.

Question 60 (1 mark)

How is ATP synthesis in glycolysis different from ATP synthesis in the Electron Transport Chain?

A. ATP in glycolysis is produced by substrate-level phosphorylation, while ATP in the ETC is generated by oxidative phosphorylation.

B. ATP in glycolysis requires oxygen, whereas ATP in the ETC does not.

C. Glycolysis generates ATP using NADH, while the ETC does not.

D. ATP in glycolysis is produced in the mitochondria, whereas ATP in the ETC is produced in the cytoplasm.

Question 61

Stage	Inputs	Outputs	Location
Glycolysis			
Link Reaction			
Krebs Cycle			
Electron Transport Chain			

Sub-Section [2.2.2]: Recall the Inputs, Outputs & Locations of All Stages of Anaerobic Cellular Respiration

Question 62

Definitions:

a. Lactic Acid Fermentation.

_____

_____

b. Alcoholic Fermentation.

_____

_____

c. Anaerobic Respiration Location.

_____

_____

Question 63 (1 mark)

Why is NAD^+ regeneration critical during anaerobic respiration?

A. It ensures the complete breakdown of glucose in glycolysis.

B. It provides energy directly for ATP production.

C. It allows glycolysis to continue producing ATP in the absence of oxygen.

D. It prevents the buildup of CO_2 in the cytoplasm.

Question 64 (1 mark)

What is the key difference between lactic acid fermentation and alcoholic fermentation?

A. Lactic acid fermentation produces CO_2, while alcoholic fermentation does not.

B. Lactic acid fermentation occurs in yeast, while alcoholic fermentation occurs in humans.

C. Lactic acid fermentation produces lactic acid, while alcoholic fermentation produces ethanol and CO_2.

D. Lactic acid fermentation generates more ATP than alcoholic fermentation.

Question 65 (1 mark)

Why does glycolysis occur in both aerobic and anaerobic respiration?

A. It directly provides ATP for all cells regardless of oxygen availability.

B. It supplies pyruvate for fermentation or further aerobic processing.

C. It occurs in the mitochondria, allowing for oxygen-independent respiration.

D. It is the only stage of respiration that generates water.

Question 66 (1 mark)

During alcoholic fermentation in yeast, why is CO_2 released?

A. It results from the breakdown of glucose during glycolysis.

B. It is a byproduct of pyruvate decarboxylation.

C. It is produced when ethanol is oxidised.

D. It is generated by the regeneration of NAD^+.

Space for Personal Notes

Question 67 (1 mark)

Which of the following best explains why anaerobic respiration produces less ATP than aerobic respiration?

A. It occurs in the cytoplasm rather than the mitochondria.

B. It relies solely on glycolysis, which produces a small amount of ATP.

C. It uses NADH to regenerate pyruvate instead of sending it to the ETC.

D. It does not utilise oxygen to complete the Electron Transport Chain.

Question 68

Stage	Inputs	Outputs	Location
Glycolysis			
Lactic Acid Fermentation			

Stage	Inputs	Outputs	Location
Glycolysis			
Alcoholic Fermentation			

Space for Personal Notes

Sub-Section [2.2.3]: Describe the Significance of the Mitochondria as the Necessary Location for Aerobic Respiration

Question 69

Definitions:

a. Cristae.

_____

_____

b. Matrix.

_____

_____

c. Endosymbiotic Theory.

_____

_____

Question 70 (1 mark)

Which feature of the cristae directly supports efficient ATP production?

A. Its ability to trap oxygen for the Krebs Cycle.

B. Its increased surface area for Electron Transport Chain reactions.

C. Its capacity to store ATP until it is needed.

D. Its location next to the mitochondrial matrix.

Space for Personal Notes

Question 71 (1 mark)

If the mitochondrial matrix was depleted of enzymes, which stage of aerobic respiration would fail?

A. Glycolysis

B. Krebs Cycle

C. Electron Transport Chain

D. Pyruvate Oxidation

Question 72 (1 mark)

What evidence supports the Endosymbiotic Theory regarding the mitochondria's origin?

A. Mitochondria have a single membrane similar to bacterial cell walls.

B. Mitochondria replicate independently and contain their own DNA.

C. Mitochondria are capable of glycolysis, an ancestral metabolic pathway.

D. Mitochondria produce their own glucose for energy.

Question 73 (1 mark)

If protons leaked through the inner mitochondrial membrane, how would this affect aerobic respiration?

A. ATP production would decrease as the proton gradient dissipates.

B. Glycolysis would halt because of reduced oxygen availability.

C. The Krebs Cycle would produce more NADH to compensate.

D. Oxidative phosphorylation would speed up to restore equilibrium.

Space for Personal Notes

Question 74 (1 mark)

Why is the mitochondrial matrix essential for aerobic respiration?

A. It provides the environment for oxidative phosphorylation.

B. It contains the enzymes required for the Krebs Cycle and pyruvate oxidation.

C. It stores glucose for glycolysis.

D. It allows oxygen to diffuse directly into the Electron Transport Chain.

Question 75 (1 mark)

A scientist designs an experiment to test the effect of temperature on cellular respiration using yeast cells. Which factor should be the dependent variable?

A. The concentration of glucose in the medium.

B. The temperature of the environment.

C. The rate of carbon dioxide production by yeast.

D. The type of respiration (aerobic or anaerobic).

Question 76 (1 mark)

In an experiment testing how glucose concentration affects the rate of cellular respiration in mitochondria, what would serve as a suitable control?

A. Using a non-respiring substance instead of glucose.

B. Measuring oxygen levels at varying light intensities.

C. Maintaining the same glucose concentration for all groups.

D. Testing mitochondrial respiration in the absence of glucose.

Space for Personal Notes

Question 77 (1 mark)

A student investigates the effect of oxygen concentration on the rate of ATP production in cells. Which of the following would best measure the dependent variable?

A. The amount of glucose consumed.

B. The amount of CO_2 produced per unit time.

C. The pH of the solution.

D. The temperature of the cellular environment.

Question 78 (1 mark)

In an experiment measuring the effect of pH on cellular respiration, which setup would serve as the independent variable?

A. Varying the pH levels of the environment.

B. Measuring the amount of ATP produced.

C. Keeping the oxygen concentration constant.

D. Using a control without any cellular respiration occurring.

Question 79 (1 mark)

Why is it important to control other factors, such as temperature and oxygen levels, when testing the effect of glucose availability on cellular respiration?

A. To ensure oxygen is the primary limiting factor.

B. To isolate the effect of glucose concentration as the independent variable.

C. To maximise ATP production in the mitochondria.

D. To ensure glycolysis continues uninterrupted.

Space for Personal Notes

Sub-Section [2.2.4]: Identify & Describe Factors - Such As Temperature, Glucose Availability, & Oxygen Concentration - On the Rate of Cellular Respiration

Question 80

Definitions:

a. Temperature.

_____

_____

b. Glucose Availability.

_____

_____

c. Oxygen Concentration.

_____

_____

d. pH.

_____

_____

Space for Personal Notes

Question 81 (1 mark)

Why does a decrease in oxygen concentration slow cellular respiration?

A. Oxygen is needed for glycolysis to proceed.

B. It prevents the regeneration of NAD^+ in the Electron Transport Chain.

C. It denatures enzymes in the Krebs Cycle.

D. It inhibits glucose transport into the cell.

Question 82 (1 mark)

A student measures the rate of respiration at 20°C, 30°C, and 60°C. At 60°C the rate drops dramatically. What is the most likely explanation?

A. The Krebs Cycle produces less ATP at high temperatures.

B. Enzymes involved in respiration are denatured at 60°C.

C. Glycolysis cannot occur at high temperatures.

D. Oxygen concentration decreases as temperature increases.

Question 83 (1 mark)

Why does the availability of glucose not always increase the rate of respiration?

A. . Excess glucose inhibits the Krebs Cycle.

B. Glycolysis has a maximum rate due to enzyme saturation.

C. Oxygen becomes the primary limiting factor when glucose is abundant.

D. Glucose availability only affects anaerobic respiration.

Space for Personal Notes

Question 84 (1 mark)

What happens if pH deviates significantly from the optimal range during cellular respiration?

A. Glucose cannot be transported into the cell.

B. Enzymes involved in glycolysis and the Krebs Cycle become less effective.

C. The ETC speeds up to compensate.

D. Pyruvate is no longer converted to acetyl-CoA.

Question 85 (1 mark)

How does a drop in temperature below optimal levels affect cellular respiration?

A. ATP production increases due to enhanced enzyme activity.

B. Enzyme activity slows, reducing the rate of respiration.

C. Glycolysis stops entirely, halting glucose breakdown.

D. Oxygen availability decreases, leading to anaerobic respiration.

Space for Personal Notes

Question 86 (2 marks)

A student investigated the rate of carbon dioxide production by yeast undergoing fermentation at different temperatures. The following results were obtained:

Temperature (℃)	**Mean Rate of CO_2 Production (cm^3/min)**
0	0.001
10	0.045
20	0.110
30	0.210
40	0.225
50	0.180

Explain the results observed.

_____

_____

_____

_____

Space for Personal Notes

Question 87 (2 marks)

A student investigated the effect of pH on the rate of carbon dioxide production by yeast undergoing fermentation. The following results were recorded:

pH Level	Mean Rate of CO_2 Production (cm^3/min)
4	0.030
5	0.095
6	0.200
7	0.220
8	0.190
9	0.100

Explain the results observed.

_____

_____

_____

_____

Space for Personal Notes

Question 88 (2 marks)

A student measured the effect of oxygen concentration on the rate of carbon dioxide production during aerobic respiration in yeast. The results are as follows:

Oxygen Concentration (%)	**Mean Rate of CO_2 Production (cm^3/min)**
0	0.050
10	0.150
20	0.275
30	0.280
40	0.270

Explain the results observed.

_____

_____

_____

_____

Space for Personal Notes

Question 89 (2 marks)

A student investigated the effect of glucose concentration on the rate of carbon dioxide production by yeast undergoing fermentation. The following results were obtained:

Glucose Concentration (%)	**Mean Rate of CO_2 Production (cm^3/min)**
1	0.050
2	0.120
4	0.250
6	0.260
8	0.260

Explain the results observed.

_____

_____

_____

_____

Space for Personal Notes

Sub-Section [2.2.5]: Identify & Explain the Role of Enzymes & Coenzymes in Cellular Respiration

Question 90

Definitions:

a. Enzymes.

_____

_____

b. Co-enzymes.

_____

_____

Question 91 (1 mark)

What role do coenzymes such as NAD^+ play in cellular respiration?

A. They directly phosphorylate ADP to form ATP.

B. They act as carriers for electrons and protons to the ETC.

C. They break down glucose into pyruvate during glycolysis.

D. They denature enzymes in the Krebs Cycle.

Space for Personal Notes

Question 92 (1 mark)

What would happen if NADH could not be oxidised during the ETC?

A. ATP production via oxidative phosphorylation would decrease.

B. Glycolysis would continue without interruption.

C. The Krebs Cycle would produce more NADH to compensate.

D. Cellular respiration would switch entirely to anaerobic pathways.

Question 93 (1 mark)

How does ATP synthase produce ATP in the Electron Transport Chain?

A. It transfers electrons to oxygen, forming ATP as a byproduct.

B. It uses the proton gradient across the inner mitochondrial membrane to drive ATP synthesis.

C. It catalyses the breakdown of NADH into ATP.

D. It directly absorbs energy from glucose breakdown.

Question 94 (1 mark)

What distinguishes enzymes from coenzymes in cellular respiration?

A. Enzymes are catalysts, while coenzymes transport molecules like electrons or protons.

B. Coenzymes catalyse reactions, while enzymes are passive carriers.

C. Both enzymes and coenzymes are regenerated during cellular respiration.

D. Coenzymes are used only in glycolysis, while enzymes are used in the Krebs Cycle.

Space for Personal Notes

Question 95 (1 mark)

What would happen if $FADH_2$ levels were significantly reduced?

A. ATP production in the ETC would decrease.

B. Glycolysis would stop due to a lack of substrate.

C. Oxygen consumption in the ETC would increase.

D. The Krebs Cycle would continue unaffected.

Question 96 (5 marks)

In mammalian cells, the breakdown of glucose involves a series of metabolic pathways facilitated by enzymes and coenzymes. Coenzymes play a crucial role in transferring energy during cellular respiration.

a. Describe the roles of coenzymes in glycolysis and the Electron Transport Chain (ETC). (3 marks)

_____

_____

_____

_____

_____

_____

When glucose enters a cell, it is converted into glucose-6-phosphate by hexokinase. This intermediate can be further processed through glycolysis, or diverted to other pathways. Enzymes with specific active sites ensure efficient processing of these intermediates.

b. Identify one structural feature of enzymes mentioned in the information above and explain how this structural feature affects their specificity. (2 marks)

_____

_____

_____

_____

Space for Personal Notes

Sub-Section [2.2.6]: Apply Experimental Design Principles to Create Methodologies to Test Factors That Affect Cellular Respiration

Question 97 (1 mark)

In an experiment testing the effect of temperature on respiration, which variable is independent?

A. Rate of CO_2 production.

B. Amount of glucose used.

C. The temperature at which the experiment is conducted.

D. The concentration of oxygen in the environment.

Question 98 (1 mark)

Why is it important to use a control group when testing the effect of glucose concentration on cellular respiration?

A. To ensure that glycolysis occurs properly.

B. To compare the effect of glucose against a baseline where no glucose is present.

C. To isolate the role of oxygen in the experiment.

D. To measure the rate of fermentation instead of respiration.

Question 99 (1 mark)

What would be a valid dependent variable for an experiment testing the effect of oxygen availability on respiration?

A. The concentration of glucose in the medium.

B. The rate of CO_2 production.

C. The temperature of the environment.

D. The pH of the solution.

Question 100 (1 mark)

A student investigates the effect of pH on the Krebs Cycle. Which step would best serve as the independent variable?

A. Adjusting the pH of the mitochondrial solution.

B. Measuring the amount of ATP produced.

C. Keeping the oxygen concentration constant.

D. Measuring the amount of CO_2 produced.

Question 101 (1 mark)

Why does controlling temperature matter when designing an experiment to test respiration?

A. Temperature variations can denature enzymes, affecting the results.

B. Low temperatures increase ATP production artificially.

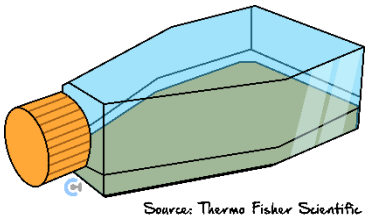
C. High temperatures prevent glucose from entering the Krebs Cycle.

D. Temperature changes directly affect oxygen concentration.

Space for Personal Notes

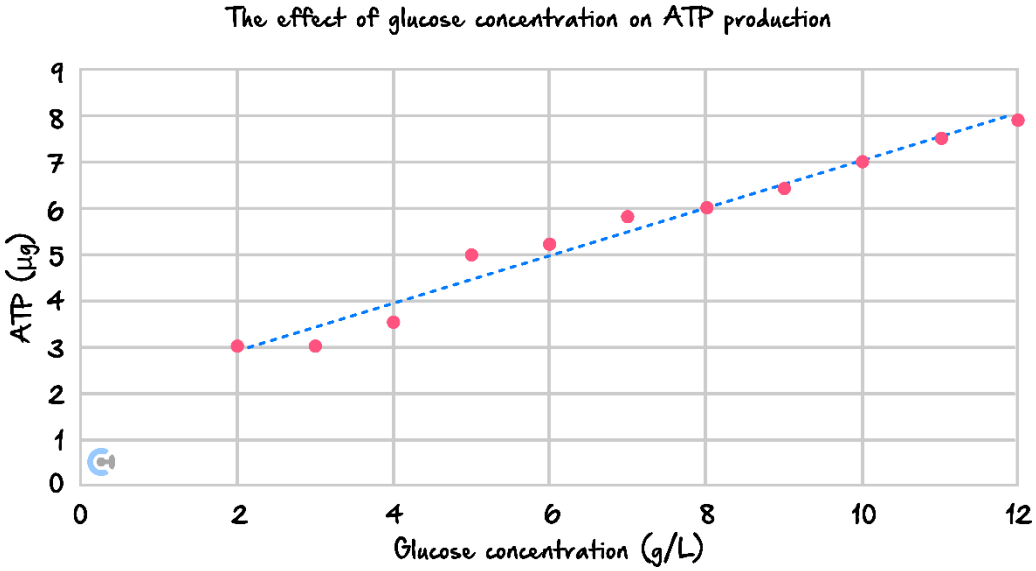
Question 102 (9 marks)

A researcher carries out an experiment to test the effect that altering glucose concentration has on ATP production in muscle cells. This was accomplished by placing samples of muscle cells into sealed tissue culture flasks (as shown in the image below). Each sample of muscle cells was provided with a nutrient solution that contained a different concentration of glucose.



Source: Thermo Fisher Scientific

The amount of ATP produced in each condition was recorded and used to construct the graph shown below.



a. Explain why the experimenter chose to use muscle cells in this experiment. (1 mark)

_____

_____

b. Name the independent variable in this experiment. (1 mark)

_____

_____

c. Name the dependent variable in this experiment. (1 mark)

_____

_____

d. Name a specific variable that would need to be controlled in this experiment. Explain why this variable would need to be controlled. (2 marks)

_____

_____

_____

_____

e. Describe the trend that is shown in the graph. Explain why this trend occurs. (2 marks)

_____

_____

_____

_____

f. The researcher found that when the glucose concentration was $0\ g/L$, ATP production was $1.5\ \mu g$. The researcher did not include this data on their graph because they believed it was an error.

Instead of leaving the information off the graph, what should the researcher have done to increase the validity of their results? Explain why this action should have been taken. (2 marks)

_____

_____

_____

_____

Space for Personal Notes

Sub-Section [2.2.7] & [2.2.8]: Describe the Importance of Breaking Do Biomass Into Simple Sugars for Biofuel Production; Explain How Yeast Can be Used to Produce Bioethanol From Biomass

Question 103 (1 mark)

Biofuels are an alternative to traditional energy sources that are finite, such as fossil fuels. Which of the following is an implication that should be considered with the use of biofuels?

A. Excess carbon dioxide will be produced through the fermentation pathway.

B. Not everyone will have access to biofuels.

C. Contamination from other products mixed with the initial fuel source.

D. All the above.

Question 104 (1 mark)

What would happen if oxygen were present during bioethanol production?

A. Yeast would switch to aerobic respiration, reducing ethanol production.

B. Ethanol production would increase due to faster fermentation.

C. The enzymatic hydrolysis process would stop.

D. The biomass would not break down into simple sugars.

Question 105 (1 mark)

Why are simple sugars essential for yeast fermentation?

A. They provide the enzymes required for ethanol production.

B. They serve as the primary substrate for glycolysis and fermentation.

C. They prevent oxygen from interfering with fermentation.

D. They act as a solvent for ethanol production.

Question 106 (6 marks)

a. Bioethanol and biodiesel are 2 biofuels produced from biomass. For biomass to be converted into a usable energy source for commercial use a series of steps must occur.

Complete the following table outlining what occurs at each step of the bioethanol production. (4 marks)

Steps	Key Events
Pre-treatment	
Enzymatic Hydrolysis	
Fermentation	
Distillation and Purification	

b. Is bioethanol renewable? Explain with reference to its definition. (2 marks)

_____

_____

_____

_____

Space for Personal Notes

Section C: [2.1 – 2.2] – Overall (VCAA Qs) (53 Marks)

Question 107 (11 marks)

Elsa read that blue algae survive better under low light intensity than green algae because blue algae possess specialised pigments that absorb a wider range of light wavelengths. Elsa decided to investigate this by carrying out an experiment.

Using a standard technique, single-celled algae were trapped in jelly balls. One set of balls contained green algae, and another set contained blue algae.

To measure the rate of photosynthesis, Elsa used a stopwatch and an oxygen sensor to detect the concentration of oxygen dissolved in the solution. Oxygen production is an indicator of photosynthetic activity. Elsa placed the jelly balls into test tubes and illuminated them using a lamp with blue light filters. She then measured the change in dissolved oxygen concentration over time.

a. State the hypothesis that Elsa was testing. (1 mark)

_____

_____

b. List three variables that would need to be controlled to ensure the experiment produced valid results. (3 marks)

_____

_____

_____

_____

_____

_____

c. State the independent variable and the dependent variable in this experiment. (2 marks)

_____

_____

_____

_____

d. Explain how Elsa could confirm that the oxygen concentration is a reliable indicator of photosynthetic activity. (2 marks)

_____

_____

_____

_____

e. Predict what Elsa might observe if her hypothesis is correct. (3 marks)

_____

_____

_____

_____

_____

_____

Question 108 (6 marks)

Scientists measured the metabolic activity of mammalian cells by measuring the uptake of glucose into the cells. The cells were maintained at 37°C with a pH of 7.4 and suspended in a nutrient solution containing glucose. The uptake of glucose into the cells was recorded for the next 30 minutes.

a. Explain why the uptake of glucose into the cells could be used to measure the metabolic activity of the cells. (2 marks)

_____

_____

_____

_____

b. The scientists repeated the experiment. They kept all conditions the same as for the first experiment, except that the cells were kept in low-oxygen conditions.

Would the uptake of glucose into the cells be expected to be higher, lower, or the same as for the first experiment? Justify your response. (4 marks)

_____

_____

_____

_____

_____

_____

_____

_____

Question 109 (6 marks)

In most mammalian cells, ATP is produced from the complete breakdown of glucose through various chemical reactions. Coenzymes play an essential role in facilitating these reactions, particularly in energy transfer.

a. Describe the roles of coenzymes in cellular respiration. (3 marks)

_____

_____

_____

_____

_____

_____

A researcher measured the effect of oxygen availability on the metabolism of glucose in skeletal muscle cells at 37°C. The results are shown in the table below:

Oxygen Availability	**Glucose Consumed (*n* moles/ 10^7 cells/hour)**	**Lactate Produced (*n* moles/ 10^7 cells/hour)**
Absent	2.0	4.0
Present	1.2	0.5

b. Why do the results differ in the presence and absence of oxygen? Explain your answer. (3 marks)

_____

_____

_____

_____

_____

_____

_____

_____

Space for Personal Notes

Question 110 (12 marks)

a. Metabolic pathways possess a number of key regulatory enzymes. If one of these enzymes were inhibited using a non-competitive inhibitor, explain how this inhibitor would affect the activity of this enzyme. (2 marks)

_____

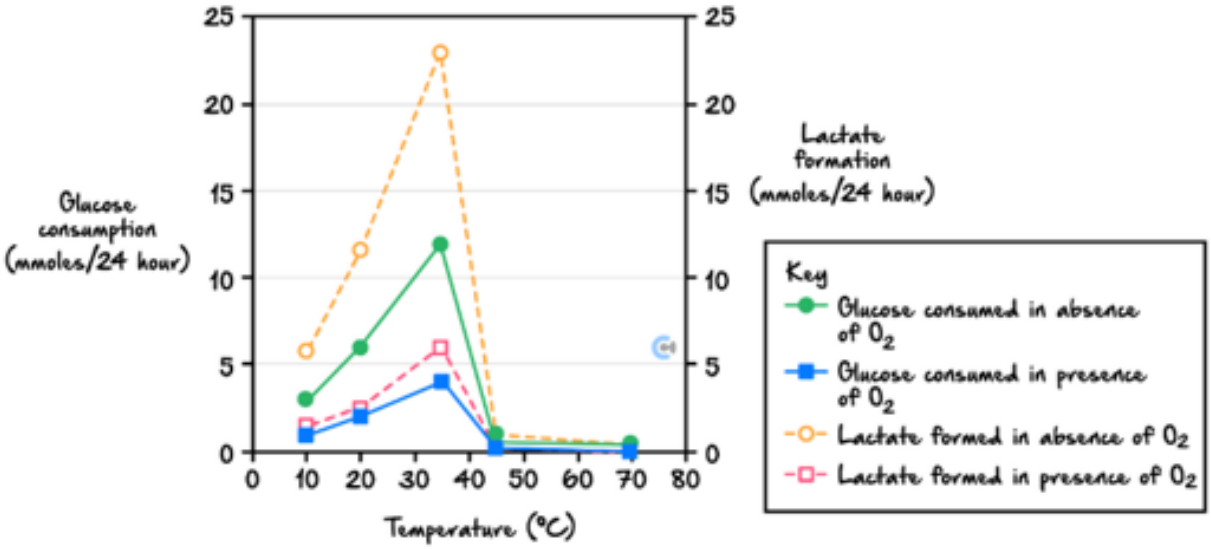
_____

_____

_____

A student was conducting an experiment using cultured human kidney cells. The student added the same number of cells suspended in the same volume of nutrient solution to 10 identical containers. Each container was then placed into its own incubator.

Ten incubators were set at one of five temperatures, 10°C, 20°C, 35°C, 45°C, or 70°C. At each temperature setting there were two incubators. One incubator at each temperature, setting was supplied with oxygen while the other was not. After 24 hours, the student measured the amount of glucose consumed and the amount of lactate produced in each cell population. The results they obtained were plotted below.



b.

i. What were the values for glucose consumption and lactate production at 35°C for the cells grown in the presence of oxygen? (2 marks)

Glucose consumption: _____

Lactate production: _____

ii. Explain why the consumption of glucose and the production of lactate by these cells at 35°C was different if they were grown in the presence or absence of oxygen. (5 marks)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

c. Explain why both glucose consumption and lactate production in the cells grown at 45°C were lower than those grown at 35°C. (3 marks)

_____

_____

_____

_____

_____

_____

Space for Personal Notes

Question 111 (11 marks)

A study investigated the effect of a drug called Pyruvablock, which inhibits the enzyme pyruvate dehydrogenase, a key enzyme required to convert pyruvate into acetyl-CoA. Researchers analysed glucose metabolism in actively growing muscle cells in two groups: one treated with 5 micromoles of Pyruvablock and the other untreated. The results are shown below:

Pyruvablock (micromoles)	**Glucose Consumed (micromoles/10^6 cells)**	**Lactate Produced (micromoles/10^6 cells)**
0	12.10	4.50
5	24.25	48.60

a. Explain why both glucose consumption and lactate production change when cells are treated with 5 micromoles of Pyruvablock. (2 marks)

_____

_____

_____

_____

b. For cells not treated with Pyruvablock, from which metabolic pathways would they be obtaining most of their energy, and where do these pathways occur in the cell? (2 marks)

_____

_____

_____

_____

c. Predict what would happen to ATP production if the concentration of Pyruvablock were increased to 10 micromoles. Explain your reasoning. (3 marks)

_____

_____

_____

_____

_____

_____

d. **2-Deoxy-ATP** (**2-DATP**) inhibits the activity of the enzyme phosphofructokinase (PFK), a key enzyme in glycolysis that converts fructose-6-phosphate to fructose-1,6-bisphosphate. You can measure the formation of fructose-1,6-bisphosphate in muscle cells.

Design a controlled experiment to determine whether **2-DATP** is a competitive or non-competitive inhibitor. In your response, include the setup, controls, and expected results for each type of inhibitor. (5 marks)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Space for Personal Notes

Question 112 (7 marks)

Yeast is a single-celled, microscopic fungus that uses sucrose as a food source. An experiment was carried out to investigate cellular respiration by a particular species of yeast.

Yeast cells were placed in a container and a sucrose solution was added. An airtight lid was placed on the container. The percentages of oxygen and ethanol in the container were recorded over a one-hour period. The experiment was carried out at room temperature. The results are shown in the following table.

	Percentage of oxygen	**Percentage of ethanol**
At the start of the experiment	21	0
At the end of the experiment	18	4

a. Explain any changes that have been observed in oxygen and ethanol levels within the airtight container. (2 marks)

_____

_____

_____

_____

Levels of carbon dioxide were also monitored during the experiment.

b. Predict whether the carbon dioxide concentration inside the airtight container would increase, stay the same or decrease within the time the experiment was carried out. Explain the reasoning behind your prediction. (2 marks)

Prediction: _____

Explanation: _____

Scientists are looking at ways to increase the efficiency of photosynthesis in plants, including the way in which carbon dioxide is captured.

c.

i. Name the stage of photosynthesis in which carbon dioxide is captured. (1 mark)

_____

_____

ii. The stage of photosynthesis in which carbon dioxide is captured requires other inputs. Name two other inputs and describe the role played by each in this stage of photosynthesis. (2 marks)

Name of the input	Role

Space for Personal Notes

CONTOUREDUCATION

Website: contoureducation.com.au | **Phone:** 1800 888 300 | **Email:** hello@contoureducation.com.au

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