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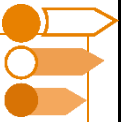
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VCE Biology $\frac{3}{4}$
Cellular Respiration and Anaerobic Fermentation [2.2]
Homework

Homework Outline:

Homework Questions	Pg 02 – Pg 21
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Section A: Homework Questions (42 Marks)**Sub-Section [2.2.1]: Recall the Inputs, Outputs & Locations of All Stages of Aerobic Cellular Respiration****Question 1**

Definitions:

a. Glycolysis

b. Link Reaction

c. Krebs Cycle (Citric Acid Cycle)

d. Electron Transport Chain (ETC)

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Question 2 (1 mark)


Which of the following correctly describes the role of oxygen in aerobic respiration?

- A. It is a substrate in glycolysis.
- B. It acts as the final electron acceptor in the Electron Transport Chain.
- C. It is converted into CO_2 in the Krebs cycle.
- D. It generates NADH in the link reaction.

Question 3 (1 mark)


In the Electron Transport Chain, what drives the production of ATP by ATP synthase?

- A. The breakdown of glucose.
- B. The flow of electrons through protein complexes.
- C. The movement of protons down their concentration gradient.
- D. The release of CO_2 from the Krebs cycle.

Question 4 (1 mark)


Which of the following best describes the role of the link reaction in cellular respiration?

- A. It produces ATP by oxidising acetyl-CoA.
- B. It transfers electrons to the ETC.
- C. It connects glycolysis to the Krebs cycle by producing acetyl-CoA and NADH.
- D. It regenerates NAD^+ for glycolysis in the absence of oxygen.

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Question 5 (1 mark)

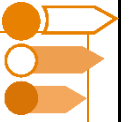

Which stage of aerobic respiration produces the most NADH?

- A. Glycolysis
- B. Link Reaction
- C. Krebs Cycle
- D. Electron Transport Chain

Question 6


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

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**Sub-Section [2.2.2]: Recall the Inputs, Outputs & Locations
of All Stages of Anaerobic Cellular Respiration,
Including Lactic Acid & Alcoholic Fermentation**

Question 7


Definitions:

a. Lactic Acid Fermentation

b. Alcoholic Fermentation

c. Anaerobic Respiration Location

Question 8 (1 mark)


Why does glycolysis occur in both aerobic and anaerobic conditions?

- A.** It requires oxygen as an input.
- B.** It occurs in the mitochondria, independent of oxygen.
- C.** It is the only stage of respiration that does not require oxygen.
- D.** It produces water as a byproduct.

Question 9 (1 mark)

In yeast fermentation, why is CO_2 released?

- A. It is a waste product of glycolysis.
- B. It results from the breakdown of ethanol.
- C. It is produced when pyruvate is decarboxylated.
- D. It forms when NADH is oxidised.

Question 10 (1 mark)

During which process would the production of lactic acid be observed?

- A. Aerobic Cellular Respiration
- B. Fermentation in Animals
- C. Fermentation in Yeasts
- D. Photosynthesis

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Question 11


Stage	Inputs	Outputs	Location
Glycolysis			
Lactic Acid Fermentation			

Stage	Inputs	Outputs	Location
Glycolysis			
Alcoholic Fermentation			

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

Question 12



Definitions:

a. Cristae

b. Matrix

c. Endosymbiotic Theory

Question 13 (1 mark)



What feature of the mitochondria is directly related to its efficiency in ATP production?

- A. Its ability to synthesise glucose.
- B. Its highly folded cristae that increase surface area.
- C. Its single membrane that enhances permeability.
- D. Its location in the cytoplasm.

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Question 14 (1 mark)



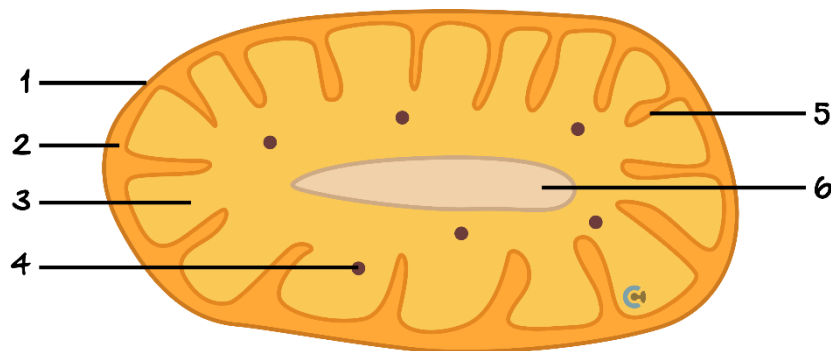
Which statement best explains why the Krebs cycle occurs in the mitochondrial matrix?

- A. The matrix is where glucose is stored.
- B. The enzymes needed for the Krebs cycle are located there.
- C. The matrix contains the DNA required for the Krebs cycle.
- D. The matrix traps CO₂ released during the cycle.

The following information applies to the two questions that follow.



The diagram below shows a mitochondrion with labels 1-6 representing locations or structures within the organelle.



Question 15 (1 mark)

Which one of the following processes occurs at structure 5?

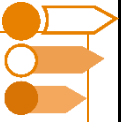
- A. Glycolysis
- B. Krebs Cycle
- C. Electron Transport Chain
- D. ATP Phosphorylation

Question 16 (1 mark)

The purpose of location 2 is to:

- A.** Remove hydrogen from NADH.
- B.** Provide a difference in hydrogen concentration compared to location 3.
- C.** Store enzymes produced by structure 4.
- D.** Separate structure 1 from structure 6.

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

Question 17


Definitions:

a. Temperature

b. Glucose Availability

c. Oxygen Concentration

d. pH

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Question 18 (1 mark)


ATP synthase is a key enzyme in the electron transport chain. A molecule bound to ATP synthase, altering the shape of the active site so that the substrate could no longer bind is an example of:

- A. Competitive Inhibition
- B. Non-competitive Inhibition
- C. Saturation
- D. Limiting Factor

Question 19 (1 mark)


An experiment was conducted to determine the effect of heat on aerobic cellular respiration. Five sets of mitochondria suspended in the cytosol were exposed to temperatures of 0°C, 20°C, 40°C, 60°C and 80°C. All other variables remained the same.

One way that the rate of aerobic respiration could be measured is to:

- A. Measure the decrease in carbon dioxide.
- B. Measure the decrease in oxygen.
- C. Measure the decrease in water level.
- D. Measure the increase in glucose concentration.

Question 20 (1 mark)


The rate of aerobic cellular respiration in a human cell may increase if the:

- A. Temperature of the cell is lowered from 37°C to 35°C.
- B. Oxygen concentration available to the mitochondria increases.
- C. Carbon dioxide concentration in the cytosol of the cell increases.
- D. Rate of facilitated diffusion of glucose into the cytosol of the cell decreases.

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Question 21 (1 mark)


At high glucose concentrations, why does ATP production plateau?

- A. Enzymes involved in glycolysis and the Krebs cycle are saturated.
- B. Excess glucose is converted into lactic acid.
- C. Oxygen is no longer needed to sustain respiration.
- D. Mitochondria lack the capacity to oxidise pyruvate.

Question 22 (2 marks)


If oxygen is not present in sufficient amounts, cells undergo anaerobic respiration. A student investigated the rate of carbon dioxide production by yeast undergoing fermentation at different temperatures and obtained the following results.

Temperature (°C)	Mean Rate of CO ₂ Production (cm ³ /min)
0	0.002
10	0.062
20	0.120
30	0.235
40	0.237
50	0.202

Explain the results observed.



Sub-Section [2.2.5]: Identify & Explain the Role of Enzymes & Coenzymes in Cellular Respiration, Including Both Aerobic & Anaerobic

Question 23



Definitions:

a. Enzymes

b. Co-enzymes

Question 24 (1 mark)



The loaded co-enzymes in cellular respiration include:

- A. NADPH, ATP and FADH_2
- B. NADH, ATP + Pi and H_2O
- C. NADH, ATP and FADH_2
- D. NADPH, ATP and Pi

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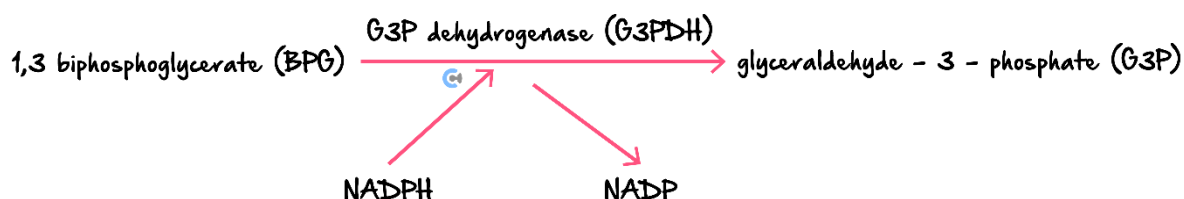
Question 25 (1 mark)


Which one of the following statements about enzyme structure and function during cellular respiration is correct?

- A. Any of the substrates would have a complementary shape to all enzymes involved in the process.
- B. Once a reaction is complete, the enzyme needs to be replaced to maintain a constant concentration of the enzyme.
- C. A greater number of collisions between an enzyme and a substrate will occur as the temperature increases indefinitely.
- D. Each enzyme could function at a tertiary or quaternary level of arrangement.

Question 26 (1 mark)


The biochemical reaction shown below occurs within the cytosol of an autotrophic cell.



Which row of the table correctly identifies each part of the reaction?

	Substrate	Product	Catalyst	Co-enzyme
A.	BPG	G3P	G3PDH	NADPH
B.	NADPH	G3P	NADP	G3PDH
C.	G3P	G3PDH	NADPH	BPG
D.	BPG	NADP	G3PDH	G3P

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Question 27 (5 marks)

In most mammalian cells the ATP produced from the complete breakdown of glucose occurs by a series of chemical reactions. Coenzymes also play an important role in glucose metabolism.

- a. Describe the roles of coenzymes in the formation of ATP. (3 marks)

When glucose enters a cell, it is converted into glucose 6-phosphate by hexokinase. Glucose 6-phosphate is a key metabolic substrate because it lies at the intersection of several major metabolic pathways. It can enter glycolysis via phosphoglucose isomerase to provide cellular energy. Glucose 6-phosphate may also be metabolised by glucose 6-phosphate dehydrogenase (G6PD); it will then enter the pentose phosphate pathway (PPP) to increase the oxygen absorption of cells such as red blood cells. Finally, glucose 6-phosphate can be converted into glucose 1-phosphate by phosphoglucomutase, the first step in glycogen synthesis.

- b. Identify **one** structural difference between the four enzymes mentioned in the information above and explain the importance of the structural difference. (2 marks)

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

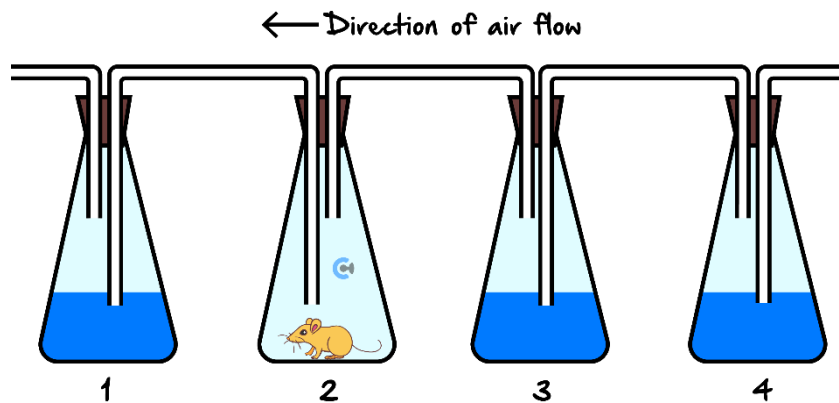
Question 28 (7 marks)



A group of scientists set up an experiment to test the rate of aerobic cellular respiration.

This experiment involved the use of four sealed conical flasks. Distilled water, two drops of ammonia and phenol red indicator were placed into flasks 1, 3, and 4. A mouse was placed into flask 2. If carbon dioxide is produced during the course of the experiment it will dissolve in the water producing carbonic acid.

Phenol red is an indicator that is yellow under acidic conditions and pink under basic conditions. The fluid in the three flasks containing water is initially pink.



- a. After 24 hours the solution in flasks 3 and 4 remained pink while the solution in flask 1 had turned yellow. Explain why the colour change occurred in flask 1. (2 marks)

- b.** Explain why the extent of colour change in flask 1 can be used to estimate the rate of aerobic respiration. (2 marks)

- c.** The process of aerobic respiration is a metabolic pathway that includes several stages, each of which consists of a variety of reactions. Which stage is responsible for producing the greatest amount of ATP? Explain. (2 marks)

- d.** Aerobic respiration is enzyme catalysed. The enzymes that catalyse this reaction are highly specific. Explain the advantage of specificity. (1 mark)

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Sub-Section [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

Question 29 (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 30 (1 mark)



Some species of bacteria can be added to biomass to produce bioethanol, a renewable energy source. The production of bioethanol involves the breakdown of starch:

- A. By glycolysis followed by alcoholic fermentation.
- B. Via aerobic respiration followed by carbon dioxide production.
- C. Through the Krebs cycle followed by lactic acid fermentation.
- D. In the presence of oxygen followed by fermentation.

Question 31 (1 mark)



Why does yeast perform fermentation during bioethanol production?

- A. To oxidise glucose into carbon dioxide and ethanol.
- B. To regenerate NAD^+ for glycolysis in the absence of oxygen.
- C. To produce ATP through the Electron Transport Chain.
- D. To directly convert ethanol into ATP.

Question 32 (1 mark)


Why must biomass be broken down into simple sugars for bioethanol production?

- A. Simple sugars are the only substrates yeast can ferment into ethanol.
- B. Simple sugars release more oxygen during combustion.
- C. Complex carbohydrates inhibit fermentation enzymes.
- D. Biomass cannot store energy unless converted to glucose.

Question 33 (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)



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