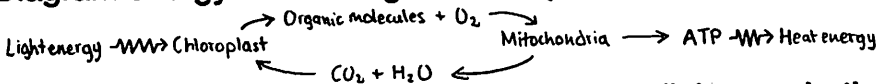
Chapter 9: Cellular Respiration: Harvesting Chemical Energy

1. Diagram energy flow through the biosphere.



2. Describe the overall summary equation for cellular respiration.

Organic compounds + Oxygen → Carbon dioxide + Water + Energy

3. What is oxidative phosphorylation.

The mode of ATP synthesis that is powered by the redox reactions that transfer electrons from food to oxygen.

4. Define oxidation and reduction.

Oxidation is the loss of electrons from one substance. By contrast, reduction is the addition of electrons to another substance.

5. Explain how redox reactions are involved in energy exchanges.

Redox reactions bring electrons closer to oxygen, stripping it away of some of its potential energy. This becomes chemical energy that can be put towards cellular work.

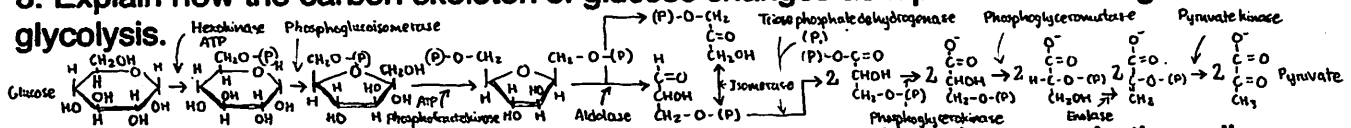
6. Define coenzyme and list those involved in respiration.

Coenzymes are organic molecules that bind to molecules or substrate to help catalytic activity. Coenzymes involved in glycolysis are hexokinase, phosphoglucoisomerase, phosphofructokinase, aldolase, isomerase, triose phosphate dehydrogenase, phosphoglycerokinase, phosphoglyceromutase, enolase, and pyruvate kinase.

7. Explain why ATP is required for the preparatory steps of glycolysis.

Hexokinase phosphorylates glucose using an ATP to make it more chemically reactive. Another ATP molecule is used by phosphofructokinase to further the sugar in glycolysis. This ATP investment allows a net yield of 2 ATP at the end of glycolysis.

8. Explain how the carbon skeleton of glucose changes as it proceeds through glycolysis.



9. Write a summary equation for glycolysis and describe where it occurs in the cell.

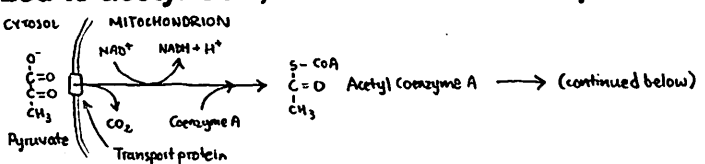
Glucose → 2 Pyruvate + $2H_2O$ Glycolysis occurs in the cytosol.

$2ADP + 2(P) \rightarrow 2ATP$

$2NAD^+ \rightarrow 2NADH + 2H^+$

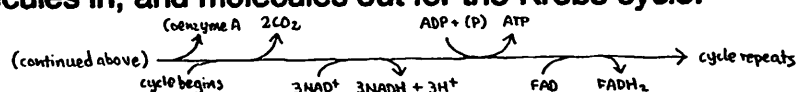
10. Describe where pyruvate is oxidized to acetyl CoA, what molecules are produced and how it links glycolysis to the Krebs cycle.

Pyruvate is oxydized to acetyl CoA in the mitochondrion. The acetyl CoA is the first step in the Krebs cycle.



11. Describe the location, molecules in, and molecules out for the Krebs cycle.

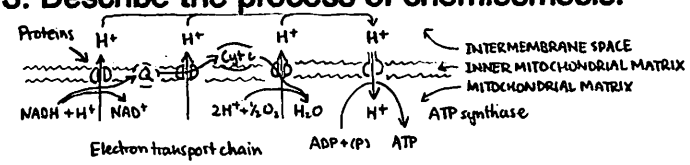
The Krebs cycle happens in the mitochondrial matrix.



12. Describe at what point during cellular respiration glucose is completely oxidized.

Glucose is completely oxidized in the Krebs cycle when NAD^+ and FAD strip electrons to become NADH and $FADH_2$.

13. Describe the process of chemiosmosis.



14. Explain how membrane structure is related to membrane function in chemiosmosis.

15. Describe the fate of pyruvate in the absence of oxygen.

16. Explain why fermentation is necessary.

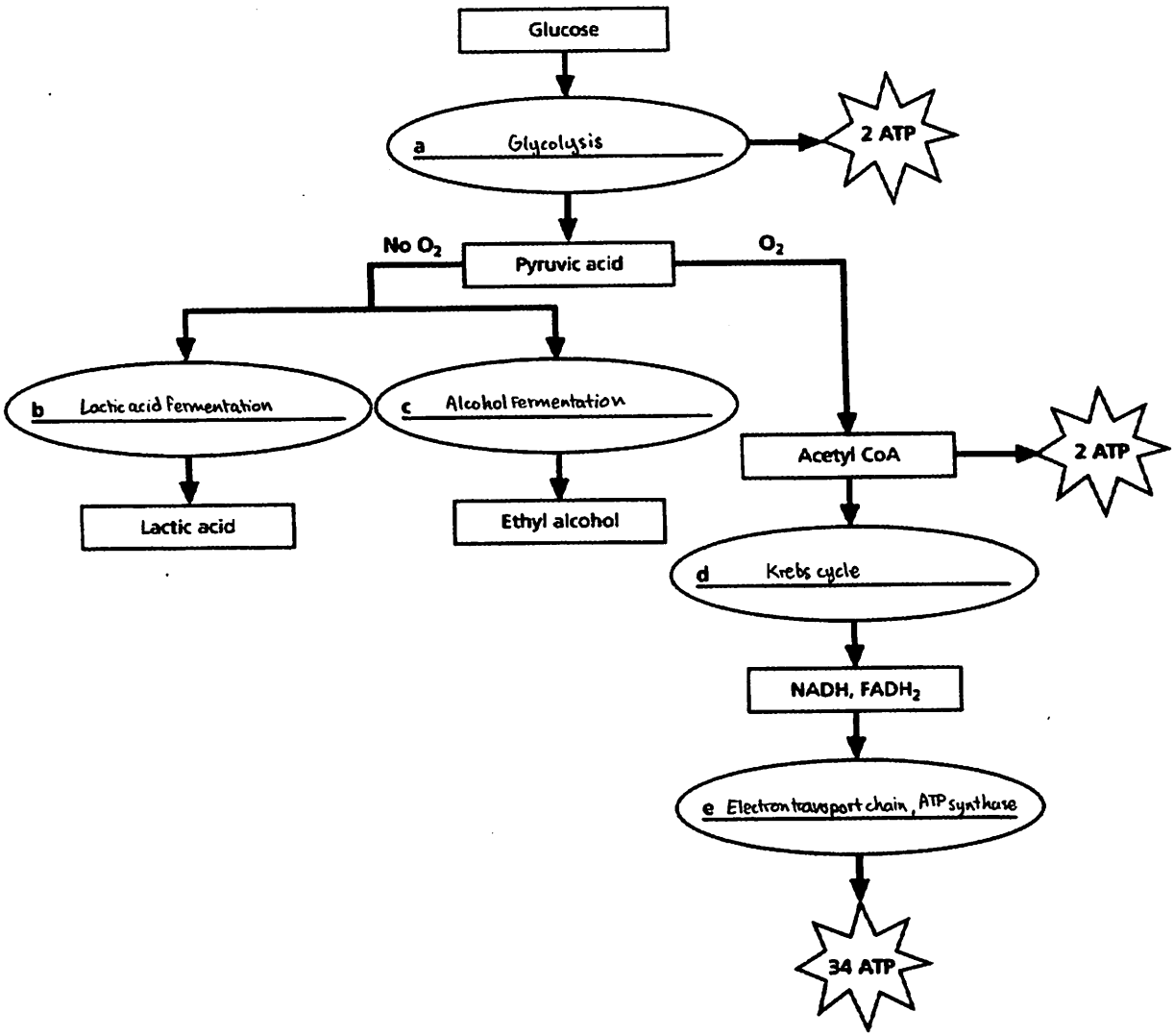
17. Establish between aerobic and anaerobic metabolism.

18. Describe how food molecules other than glucose can be oxidized to make ATP.

19. Explain how ATP production is controlled by the cell and what role the allosteric enzyme, phosphofructokinase, plays in the process.

DRAWING CONCLUSIONS Follow the directions given below.

30. The diagram below depicts the pathways of cellular respiration. Rectangles denote substances involved in cellular respiration and ovals denote processes. Identify the processes by writing the correct term in each blank.



SUMMARY OF THE 1. Krebs CYCLE