

Biology 48 - Human Physiology

Lecture Summary Sheet - Norris

Cell: Cellular Chemistry / Metabolism

I. Definitions

A. Metabolism

II. Laws of Thermodynamics

A. First Law - energy cannot be created or destroyed

B. Second Law - all things tend towards disorder (called entropy)

III. Classes of Chemical Reactions

A. Endergonic

B. Exergonic

C. Activation Energy

IV. Enzymes

A. Mechanism of Action

B. Control

1. Control of Synthesis

2. Control of Enzyme Activity

a. Temperature

b. pH

c. Cofactors & Coenzymes

d. Concentration (reactants or products)

V. Energy Metabolism (Chemistry of Energy Maintenance)

Energy is stored in the chemical bonds of molecules and is released when the bonds are broken; the energy may be released in an uncontrolled reaction (i.e. burning) or its release can be controlled through a series of reactions as occurs in the cell. These controlled exergonic reactions are coupled to endergonic reactions in the cell resulting in the production of adenosine triphosphate (ATP), often described as the energy currency of the cell. The release of ATP energy can be coupled to all energy requiring reactions in the cell. The production of ATP is described here.

A. Glycolysis

1. Lactic Acid Fermentation (Anaerobic Metabolism) and the Cori cycle

B. Tricarboxylic Acid Cycle (TCA, Citric Acid, or Krebs Cycle)

C. Electron Transport System

IV. Additional Key Terms

binder

catalyst

cytochrome

gluconeogenesis

glycogenesis

glycogenolysis

isoenzyme

keto acid

ketone body

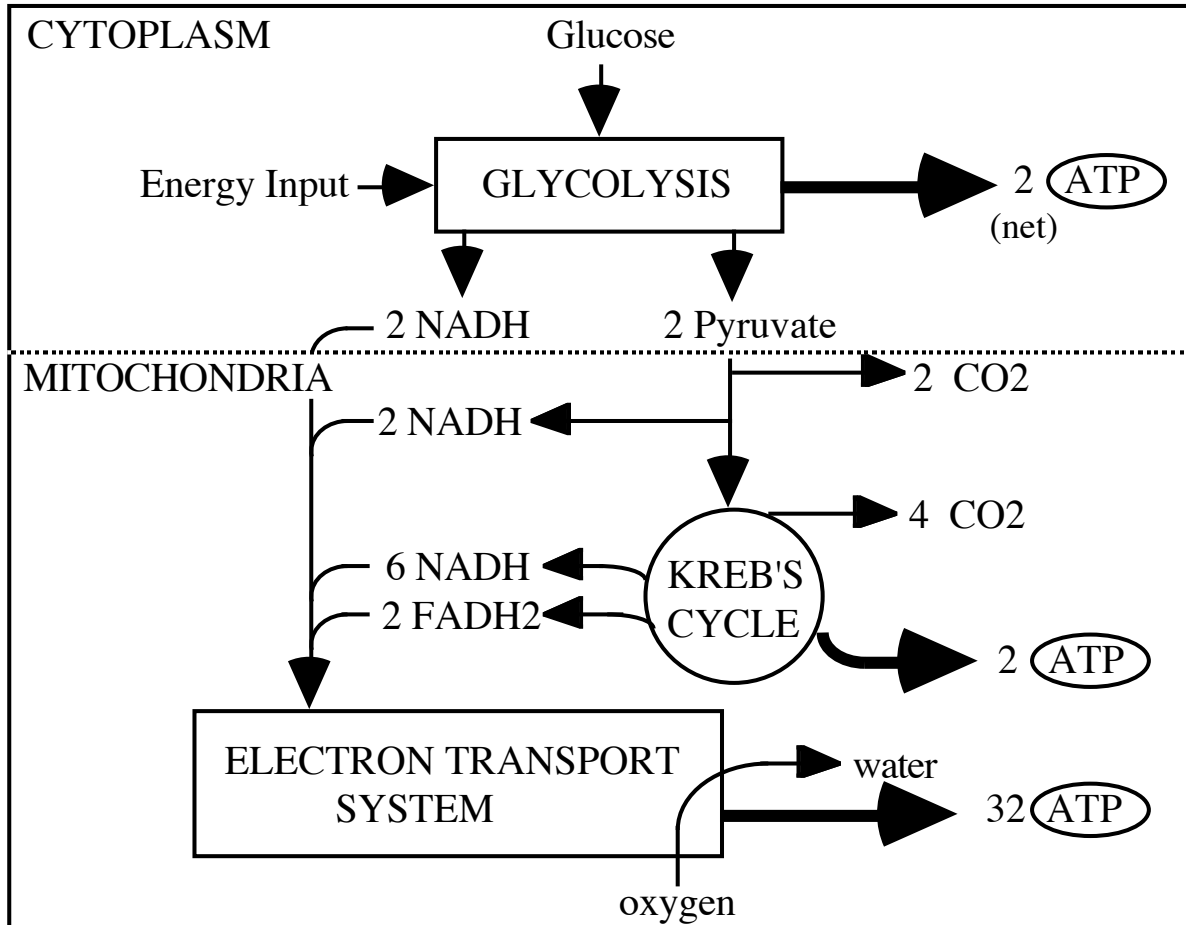
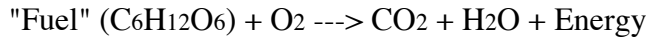
ligand

oxidation

reduction

CELL METABOLISM SUMMARY SHEET

A. Aerobic Energy Releasing Pathways (Aerobic Respiration)



1. Glycolysis

location:

reactants:

products:

2. Krebs' Cycle (aka Citric Acid Cycle, TriCarboxylic Acid cycle (TCA))

location:

reactants:

products:

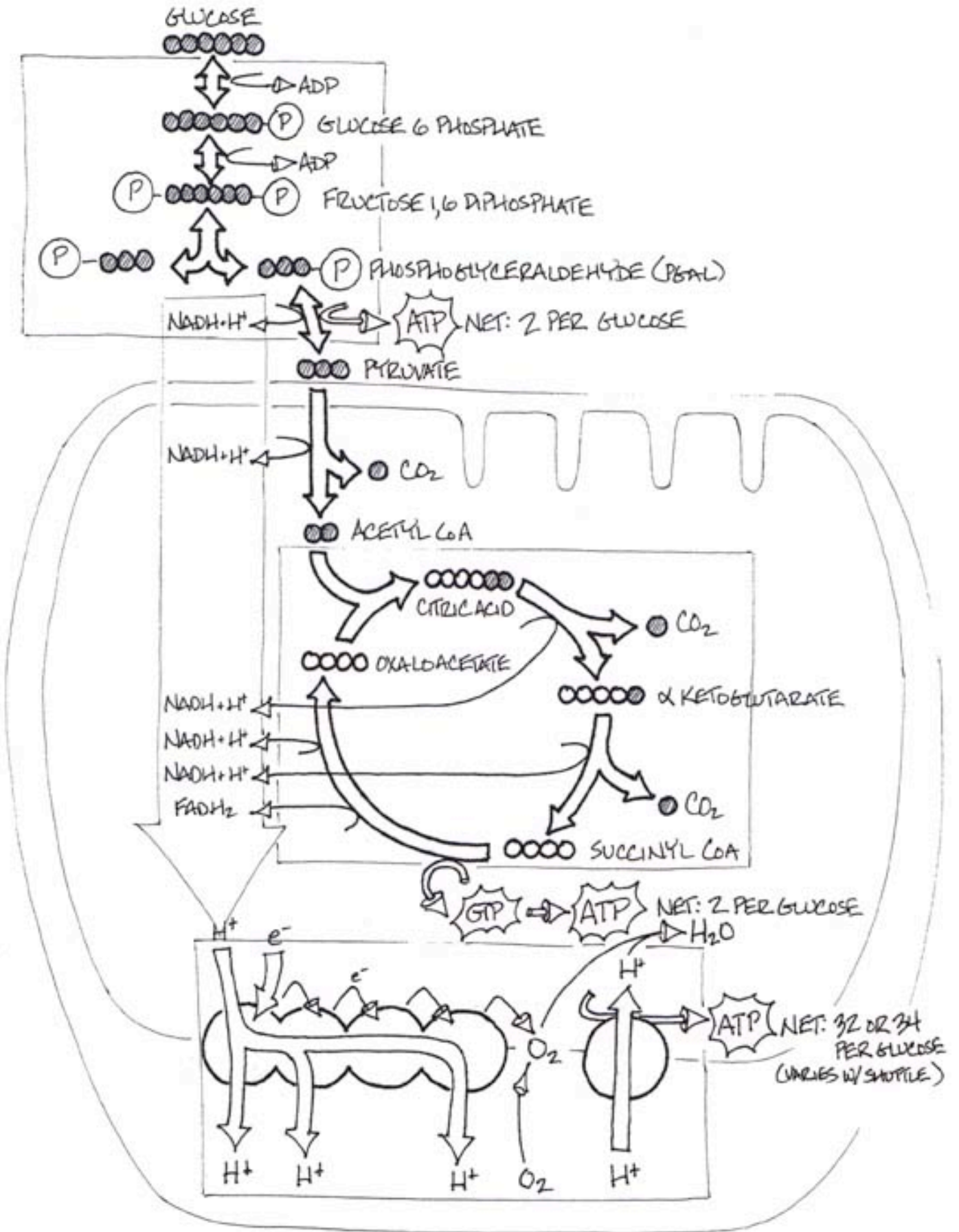
3. Electron Transport System (ETS)

location:

reactants:

products:

DETAILED CELL METABOLISM SUMMARY SHEET



Study Questions – Cell Chemistry:

1. Define “metabolism”.
2. Describe the 1st and 2nd laws of thermodynamics.
3. Group the following terms into 2 related categories: hydrolysis, condensation, synthesis, decomposition, anabolic, endergonic, exergonic, catabolic, exothermic, endothermic. Explain.
4. Define “activation energy”.
5. Describe the characteristics of enzymes.
6. Describe how enzymes effect chemical reactions.
7. Explain the lock and key model of enzyme action.
8. Explain how temperature and pH influence enzyme activity.
9. Explain the roles of cofactors and coenzymes.
10. What does allosteric binding mean?
11. What does competitive binding mean?
12. What are the three major steps in aerobic cellular respiration?
13. Describe “glycolysis”. Where in the cell does this metabolic step occur, what are the reactants needed for it to occur, and what are its products?
14. What are the different names for the “citric acid cycle”?
15. Describe the “citric acid cycle”. Where in the cell does this metabolic step occur, what are the reactants needed for it to occur, and what are its products?
16. Describe the “electron transport system”. Where in the cell does this metabolic step occur, what are the reactants needed for it to occur, and what are its products?
17. Why is “aerobic respiration” given the name “aerobic respiration”?
18. What is the final step in “aerobic respiration”?
19. Are all of the steps of aerobic cellular respiration “one way”? What is the significance of this?
20. What is the function of NAD in “aerobic respiration”?
21. Compare and contrast “aerobic respiration” and “anaerobic respiration”.
22. Describe the two different forms of “anaerobic respiration”. What are the products of each?
23. Do proteins and fats enter the metabolic pathway at the same point as carbohydrates?