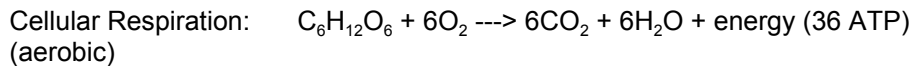
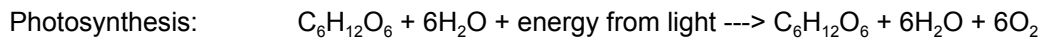


**INTRODUCTION**

Two conditions must be met for life to continue.

- (1) Matter must be constantly recycled (Fig. 2 on pg. 59, Fig. 3 on pg. 60)
- ie. (i) oxygen released by **photosynthesis** is used in **cellular respiration**
  - (ii) carbon dioxide and water released by cellular respiration is used in photosynthesis
  - (iii) atoms and molecules in the bodies of living organisms are released into the environment for re-use by the action of decomposers (bacteria, worms, etc.)



- (2) Energy must be constantly supplied (Fig. 2 on pg. 59, Fig. 3 on pg. 60)
- ie. sunlight provides energy for plants (**autotrophs** = make their own food) which perform photosynthesis and that energy is trapped in carbohydrates by the plants and released when animals (**heterotrophs** = can't make their own food) eat the carbohydrates and perform cellular respiration

**CELLULAR RESPIRATION**

- includes all the chemical reactions that provide energy for life.
- carbohydrates are primary energy source (others used after carbohydrates used up).
- plants and animals perform cellular respiration.

- (1) Production of ATP (Fig. 4 on pg. 63)
- **adenosine triphosphate**: A-P-P-P (A = adenosine, P = phosphate group)
  - as the bonds of glucose are broken, energy is released and stored in ATP
  - ATP acts like a "battery" providing energy for chemical reactions, active transport etc. by donating a phosphate group
  - the addition of a phosphate group to a any molecule is called **phosphorylation**

Draw Fig. 4 on pg. 63:

(2) Processes of Cellular Respiration

- happens inside the cell and is a 3-step process:
  - (i) **Glycolysis**
    - occurs in cytoplasm
    - breaks down glucose and produces **2 ATP**
  - (ii) **Krebs Cycle**
    - occurs in mitochondrion (in matrix)
    - continues breakdown of glucose and produces **2 ATP**
  - (iii) **Electron Transport System** (see Fig. 6b on pg. 63)
    - occurs in mitochondrion (on cristae)
    - finishes breakdown of glucose, grabs electrons and passes them along a chain of molecules (called the electron transport system)
    - as electrons travel, more energy is released and used to make **32 ATP**

(3) Types of Respiration

- if it requires oxygen it is called **Aerobic Respiration**
- if it does NOT require oxygen it is called **Anaerobic Respiration**

**Aerobic Respiration**

- in most plant and animal cells
- occurs by 3-step process (see steps above)
- presence of oxygen allows glucose to be FULLY broken down (oxidized)
- **36 ATP** made
- this is why you must breathe!!!

**Anaerobic Respiration**

- mostly a 1-step process
- glucose is not fully broken down (oxidized) since oxygen is lacking
- two types:

(i) **Lactic Acid Fermentation**

- in cytoplasm of human cells (ie. working muscles) when oxygen is lacking
- glucose partially broken down to lactic acid,  $C_3H_6O_3$
- **only 2 ATP made**
- lactic acid builds up and causes sore muscles

(ii) **Alcoholic Fermentation**

- in cytoplasm of yeast
- glucose partially broken down to alcohol,  $C_2H_5OH$ , and  $CO_2$
- **only 2 ATP made**
- this is how beer, wine, etc. are made

Questions:

1. Draw Fig. 2 on pg. 59 and Fig. 3 on pg. 60.
2. How many ATP are produced by cellular respiration of 3 glucose molecules in the presence of oxygen? In the absence of oxygen?
3. In terms of ATP, why is the mitochondrion called the “powerhouse of the cell”?