ENERGY FLOW

1. Sun – origin of energy for living organisms on the earth.

2. Photosynthesis – process by which the autotroph (the producers – plants with chlorophyll) are able to capture some of the energy of the sun and convert it into chemical energy (food-sugar).

$$6\ CO_2 + 6\ H_2O \xrightarrow[\text{chlorophyll}]{\text{sunlight}} C_6H_{12}O_6 + 6\ O_2$$

(Six molecules of carbon dioxide gas are chemically combined with six molecules of water using chlorophyll and the energy from sunlight and one molecule of glucose is produced which is rich in energy. In addition, six molecules of oxygen gas are given off as a waste of this process. This is called an endothermic – or endergonic – reaction and is stored in the sugar.)

3. Respiration – the process by which living organisms (both autotrophs and heterotrophs) take in oxygen and oxidize (burn) the sugar to release the energy stored in it so that this energy can be used for the organism's life activities. This reaction is called exothermic – or exergonic – since energy is released from the reaction. It should be remembered that this energy came from the sun initially. This reaction is aerobic since oxygen is used.

$$C_6H_{12}O_6 + 6\ O_2 \longrightarrow 6\ CO_2 + 6\ H_2O \text{ (plus energy)}$$

4. Fermentation – the process by which some organisms break down sugar without using any oxygen (anaerobic) to release a little of the energy. An example of this is yeast using sugar in grape juice to obtain a little energy for living and releasing carbon dioxide bubbles and alcohol as a waste. This is also an exothermic – or exergonic – reaction since energy is released.

$$C_6H_{12}O_6 \longrightarrow 2\ CO_2 + 2\ C_2H_5OH \text{ (plus a little energy)}$$

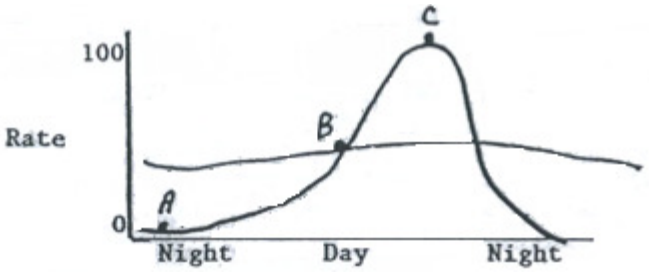
5. Adenosine Triphosphate (ATP) – molecules found in all forms of life which serve for storing energy (like little storage batteries). Each ATP molecule has 3 phosphates in it, the last two attached by high energy bonds. When one is broken away, ATP becomes ADP (di-phosphate) with less energy. When another is broken away, ADP becomes AMP (mono-phosphate) with only one phosphate left. This molecule can then be charged up by burning sugar and using the energy released to reattach the phosphates which were broken away earlier.

$$\text{ATP} \longleftrightarrow \text{ADP} \longleftrightarrow \text{AMP}$$

6. P/R ration – the ratio of photosynthesis to respiration in autotrophs. Respiration continues day and night in green plants while photosynthesis can only operate during the daytime and stops at night. The point where both reactions are equal is known as the <u>compensation point</u> and the P/R value is 1.

BSC 1050 ENERGY FLOW REVIEW SHEET

1. What is the equation for photosynthesis?
2. What is the equation for aerobic respiration?
3. Which equation is exothermic? endothermic?
4. What is the waste gas from the photosynthetic process? the respiration process?
5. Which of these processes is carried on by the heterotroph? the autotroph?
6. Which reaction requires light and chlorophyll?
7. In the graph below, label the P curve and the R curve.



8. What point in the graph about indicates the greatest overall production of food and oxygen?
9. Where is the compensation point(s)?
10. What is the value of the P/R at the compensation point?
11. At noon, is the P/R ratio equal to one, less than one, or more than one?
12. At night, is the P/R ratio equal to one, less than one, or more than one?
13. Which place on the graph makes you, the heterotroph, feel more secure? Why?
14. What is the equation for anaerobic fermentation?
15. Is fermentation an aerobic or anaerobic reaction? Why?
16. What is the waste liquid and gas called from the fermentation process?
17. How does the energy produced from fermentation compare to the energy produced from respiration?
18. What is ATP? ADP? AMP?
19. Which of the above has more stored energy? Least?
20. What is the importance of the ATP molecule to all living organisms?