CELLULAR RESPIRATION WORKSHEET

1. Phosphofructokinase is considered to be the enzyme responsible for controlling the rate-limiting step of the glycolytic pathway. Why would this step be considered rate-limiting step? Explain with reference to the feedback mechanisms that are occurring in cell respiration.

   PFK helps to phosphorylate fructose so that the molecule can split somewhat evenly. When ATP levels are too high, ATP itself will inhibit PFK, which halts glycolysis. This feedback inhibition slows down all of cellular respiration until citrate levels get so low that it signals ATP to stop inhibiting PFK.

2. a) Some cells that use the Kreb's cycle and the respiratory chain can also thrive using fermentation under anaerobic conditions. Explain how these cells are still able to function under these conditions.

   Lactic acid fermentation

   Glycolysis: Glucose → Pyruvate (2 ATP and 2 NADH produced) → Lactic Acid (2 NAD^+ regenerated)

   This process recycles NAD^+ so that 2 ATP can be made. This process won't last forever as only 2 ATP are made at a time.

   b) With some strains of yeast, fermentation stops before sugar is exhausted, usually at an alcohol concentration in excess of 12%. What is a plausible explanation? Explain.

   Beyond 12% alcohol begins to kill the yeast cell.

   c) Draw a diagram that illustrates the process of respiration taking place in yeast cells. Why is the yeast necessary for the bread to rise?

   Alcohol Fermentation

   Glycolysis: Glucose → Pyruvate (2 ATP and 2 NADH produced) → Acetylaldehyde (2 CO_2 produced) → ethanol (2 NAD^+ regenerated)

   Yeast is necessary for bread to rise because of the CO_2 that is released.

   d) Following anaerobic activity it is often stated that one goes into oxygen debt. Discuss what this terminology means, and elaborate on how the body compensates in order to return oxygen levels to normal. In addition, discuss how the body rids itself of lactic acid produced from anaerobic respiration.

Oxygen debt refers to the extra oxygen that is needed to catabolize lactic acid to CO_2 and H_2O in the liver. The excess CO_2 that is made is exhaled from the lungs. Panting (breathing faster) helps to get rid of excess CO_2 and also helps to gain more O_2.