

Name\_\_\_\_\_

**Chemistry 333**  
**Principles of Biochemistry**  
**Homework #3 (30 points)**  
**Due Monday, November 23, 2009 (No later than 5pm!)**

1. (14 points)
  - A. Your “favorite” TA, enjoys eating foods containing high levels of lactose and he wants to know how much ATP (in moles) is generated from the complete oxidation of one mole of lactose.
    - i. Draw the structure of lactose and name its constituent monosaccharides.
    - ii. What enzyme is responsible for the degradation of lactose into its component parts?
    - iii. As what molecule does each of the sugars enter glycolysis?
    - iv. Show all the work for the ATP calculation.

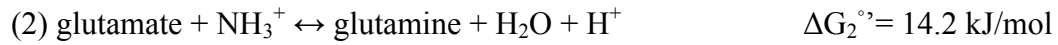
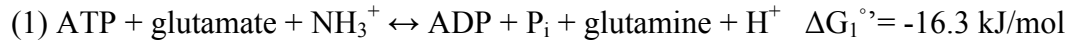
(Hint: Be sure to account for energy used in activating the components of lactose so that they can enter glycolysis)

- B. As a belated Halloween joke, you have decided to give Kevin a batch of cookies containing an inhibitor of some enzyme associated with metabolism. After eating these delectable cookies, Kevin finds that only **34** moles of ATP are being produced per mole of lactose.
    - C. Where does the inhibitor act? Name the enzyme that is inhibited and the pathway with which it is usually associated.

\*Choose from enzymes in glycolysis, pyruvate dehydrogenase complex, and the TCA cycle. Assume electron transport and oxidative phosphorylation pathways are unaffected.

2. (6 points) As a joke, Kalub made Chris a batch of “special” brownies containing an inhibitor of an enzyme associated with metabolism. After eating these delectable brownies, Chris finds that only moles of **48 ATP** are being produced per mole of sucrose. Which enzyme does the inhibitor act upon? Be sure to name the **inhibited enzyme** and the pathway with which it is usually associated.
3. (8 Points) You administer 360.32 grams of oral glucose to a patient. Calculate the amount of **ATP** your patient can generate under **aerobic** and **anaerobic** conditions with this glucose. Remember the different fates of pyruvate!

4. (2 Points) In the hydrolysis of ATP to ADP and  $P_i$ , the equilibrium concentration of ATP is too small to be measured accurately. A better way of determining  $K'_{eq}$ , and hence  $\Delta G'^{\circ}$  of this reaction, is to break it up into two steps whose values of  $\Delta G'^{\circ}$  can be accurately determined. This has been done using the following pair of reactions (the first being catalyzed by glutamine synthetase):



What is the  $\Delta G'^{\circ}$  of ATP hydrolysis according to these data and is the **overall** reaction spontaneous?