

Chemistry 113 – Chemistry and the Environment
Take-Home Quiz 2 (February 8, 2002)
Due at the beginning of class Monday, February 11, 2002

3. (15 pts) Given:

$C_6H_{12}O_6 (s)$	$\Delta H_f^\circ = -1273.02 \text{ kJ/mol}$
$CO_2 (g)$	$\Delta H_f^\circ = -393.5 \text{ kJ/mol}$
$H_2O (g)$	$\Delta H_f^\circ = -241.83 \text{ kJ/mol}$
$H_2O (l)$	$\Delta H_f^\circ = -285.83 \text{ kJ/mol}$
$C_2H_5OH (l)$	$\Delta H_f^\circ = -277.7 \text{ kJ/mol}$

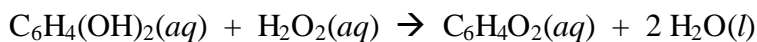
*Constants taken from Brown, LeMay and Bursten (1997). CTCS

Dr. Steve Johnston (Prof of Biology) has boldly claimed that *Saccharomyces cerevisiae* or yeast is the coolest organism. One “cool” thing about yeast is that it can perform either aerobic or anaerobic metabolism. In aerobic metabolism, glucose ($C_6H_{12}O_6$) goes through combustion. However, in anaerobic metabolism, yeast would breakdown glucose WITHOUT using oxygen. The products in anaerobic metabolism are ethanol (C_2H_5OH) and CO_2 .

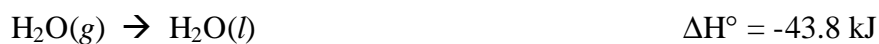
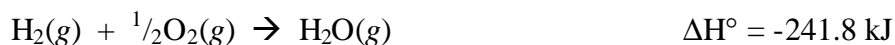
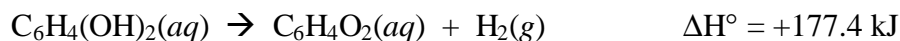
- (a) Write a balanced chemical equation for the anaerobic metabolism of glucose in yeast (3 pts).
- (b) Write a balanced chemical equation for the combustion of glucose (2 pts).
- (c) Calculate the change in enthalpy (ΔH) for the reaction in part b. (5 pts).
- (d) In the presence of a lot of oxygen (assume unlimited amount) and glucose, would yeast most likely perform aerobic or anaerobic metabolism? Explain and support your answer. (3 pts).
- (e) According to previous studies, for every 1 mole of glucose broken down by aerobic metabolism, a yeast cell will store about 1900 kJ for later use. Is this number (1900 kJ/mol) and the enthalpy calculated in part b similar? If yes, why would they be the same? If no, why would they be different? (2 pts).

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4. (10 pts) The bombardier beetle uses an explosive discharge as a defensive measure. The chemical reaction involved is the oxidation of hydroquinone by hydrogen peroxide to produce quinone and water:



Calculate ΔH° for this reaction from the following data:



5. (8 pts) Disodium aurothiomalate ($\text{Na}_2\text{C}_4\text{H}_3\text{O}_4\text{SAu}$) has the trade name Myocrisin and is used in the treatment of rheumatoid arthritis. Patients receive weekly intramuscular injections consisting of 50.0 mg Myocrisin in 0.500 mL of solution. Calculate the concentration of Myocrisin in terms of molarity. During treatment, blood serum levels of gold can reach levels as high as 300.0 μg gold per 100.0 mL serum. Calculate the concentration of gold in the serum in molarity and then determine the molarity of the Myocrisin in the serum.

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6. (8 pts) **Describe** how would you prepare 1.00 L of a 0.50 M solution of H_2SO_4 from concentrated (18 M) sulfuric acid?
7. (12 pts) When nitroglycerin, $\text{NO}_2\text{OCH}(\text{CH}_2\text{ONO}_2)_2$, decomposes a lot of heat is released. Calculate the $\Delta H_{\text{rxn}}/\text{mol}$ nitroglycerin using bond energies. If you need help seeing what this molecule looks like, see me.
8. (9 pts) Predict the empirical formulas of the ionic compounds formed from the following pairs of elements. Name each compound.
- a) Al and Cl
 - b) Ba and S
 - c) Ga and O

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9. (8 pts) Notice the Lattice energy for LiF using Table 8.2. Based on that information, determine a rough estimate for the Lattice energy of MgO using Figure 8.5. (Hint: What is lattice energy based on?)

10. (10 pts) Predict the products and write the balanced molecular equation, complete ionic equation, and the net ionic equation for the following.

