Exam 5a
Chem 1121
Summer 2008

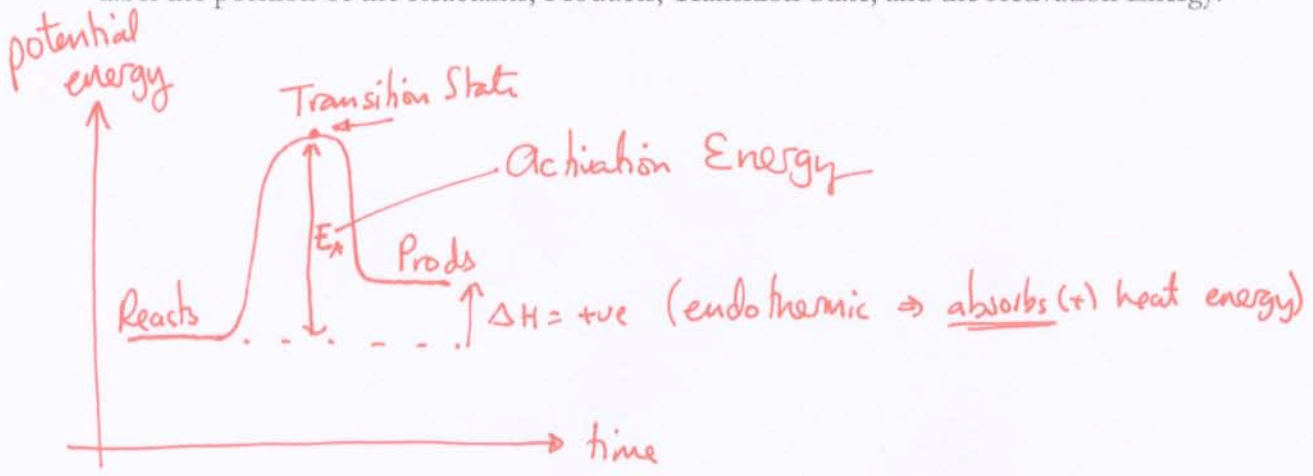
Name: KEY

Take a deep breath, and relax! First, answer the questions you know how to do and then work on the more difficult problems. Don't forget to show all your work, so I can give you as much credit as possible.

Good Luck!

Andy

Q1 [10 pts.] Sketch a diagram of energy vs. time for an ENDOTHERMIC reaction. Be sure to clearly label the position of the Reactants, Products, Transition-State, and the Activation Energy.



Q2 [8 pts.] Consider the equilibrium: $CO_2(g) + H_2O(l) \rightleftharpoons H_2CO_3(aq)$ + heat

Which direction (*left* or *right*) does the equilibrium shift when:

a) The amount of CO_2 is increased. RHS

b) The amount of H_2CO_3 is decreased. RHS

c) The amount of H_2O is increased. RHS

d) Heat is added. LHS

Q3 [6 pts.] What are the three factors that affect the rate of chemical reactions?

i) Temperature

ii) Concentration

iii) Presence of a Catalyst

Q4 [6 pts.] What is the %(w/w) of a solution of 5.40 g of glucose and 45.00 g of water?

$\%(w/w) = \frac{\#g\ solute}{\#g\ solution} \times 100\%$

$\#g\ solute = 5.40g$

$\#g\ solution = 5.40g + 45.00g = 50.40g$

$\Rightarrow \%(w/w) = \frac{5.40g}{50.40g} \times 100\% = 10.7\%(w/w)$

Q5 [6 pts.] How many grams of glucose are there in 125 mL of a 1.50 %(w/v) solution of glucose?

1.50%(w/v) means $\frac{1.50g\ solute}{100mL\ solution}$

$\Rightarrow 125mL\ solution \times \frac{1.50g\ solute}{100mL\ solution} = 1.88g\ solute\ (glucose)$

Q6 [12 pts.] Describe what would happen if a red blood cell (RBC) was placed into:

i) An isotonic solution:

No change in size/shape of RBC

ii) A hypertonic solution:

Water would leave RBC, causing shrinkage (crenation)

iii) A hypotonic solution:

Water would enter RBC, causing expansion, and possible "popping"! (Hem

Q7 [8 pts.] Write down the chemical reaction corresponding to the self-ionization of water. At 25 °C, what are the concentrations of the individual ions?

$2H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + OH^-_{(aq)}$

@ 25°C, and in pure water: $[H_3O^+] = [OH^-] = 1.0 \times 10^{-7}\ M$

Q8 [6 pts.] Explain the difference between a strong acid and a weak acid.

Strong acids undergo ≈100% dissociation in water to form H^+ and conj. base.
Weak acids undergo partial dissociation in water.

ex: HCl (strong): $HCl \longrightarrow H^+ + Cl^-$, $HC_2H_3O_2$ (weak): $HC_2H_3O_2 \rightleftharpoons H^+ + C_2H_3O_2^-$
≈95% ≈5%

Q9 [8 pts.] Sulfuric acid is a diprotic acid.

i) What does diprotic mean?

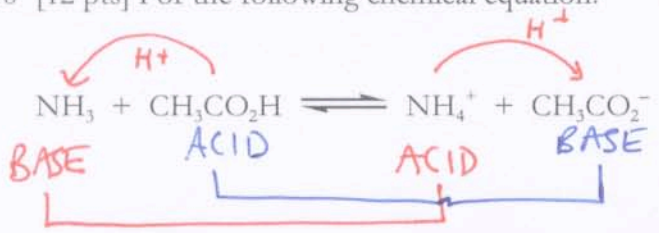
Each molecule has 2 H^+ that it can lose

ii) Write down the dissociation reaction(s) for sulfuric acid in water.

$H_2SO_4 \longrightarrow H^+ + HSO_4^-$

$HSO_4^- \rightleftharpoons H^+ + SO_4^{2-}$

Q10 [12 pts] For the following chemical equation:



Identify each of the four species: NH_3, CH_3CO_2H, NH_4^+, and $CH_3CO_2^-$ as being either an acid or a base according to the Brønsted-Löwry of acids and bases.

Q11 [12 pts.] Give two properties of acids and bases:

ACIDS:

i) Taste Sour

ii) Turns litmus Red

BASES:

i) Taste Bitter

ii) ~~Feel~~ Turns litmus Blue

Q12 [6 pts.] What is a catalyst? How does it work?

A catalyst is a substance that speeds up a chemical rxn, without being consumed in the rxn. It does so by effectively reducing the size of the activation energy.

BONUS QUESTION:

What is an enzyme?

A biological catalyst, normally made from protein.