Chemistry Pretest 3.1 Version 2016

1. a) In photosynthesis, what form of energy causes an electron to pop out of chlorophyll molecules in photosystem I?

   b) What supplies the second photosystem with the electrons that its chlorophylls have lost?

   c) What is the equation of the reaction that shows how water breaks down to oxygen and H^+ ions?

   d) Which if the following products from the light reactions are needed by the chloroplasts to produce glucose?

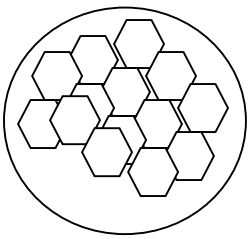
   1. NADPH
   2. ATP
   3. O_2
   4. CO_2

2. a) During what state of inactivity does a chipmunk lowers its heart rate from about 200 to 5 beats per minute?

   b) What overall body rate is lowered during this state of inactivity?

3. a) In refrigeration why is the spoilage of food slowed down?

   b) Draw the cross section of a catalytic converter to reveal how it speeds up the rate of pollution breakdown.

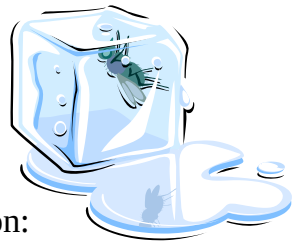


   c) What's the difference between detergent and soap?

4. Water is flowing into a sink at a rate of 0.250 L per minute. It is going down the drain at the same rate, so the amount of water in the sink does not change.

   Irreversible? Steady state ? Or equilibrium? Explain.

5. a) A layer of ice and some water underneath the ice are at equilibrium at 0° C. Can the *temperature change* while the closed system remains at equilibrium?

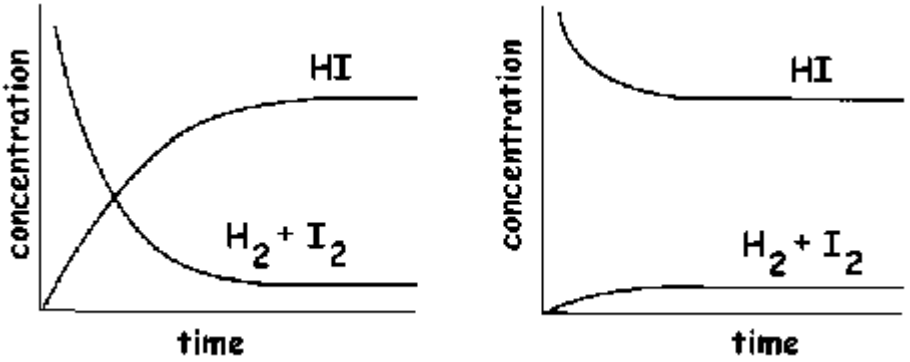


b) Is any freezing occurring? Melting?

6. Explain what is going on at the molecular level in the following reaction:

$$N_2 + 3\ H_2 \rightleftarrows 2\ NH_3$$

7. In each of the following graphical representations of concentration versus time, show where equilibrium first appears.



8. TRUE? Or FALSE?

a) A system at equilibrium is closed.

b) The equilibrium reactants are completely transformed into products.

c) For a system to remain at equilibrium, the temperature must remain constant.

d) Equilibrium reactions are reversible.

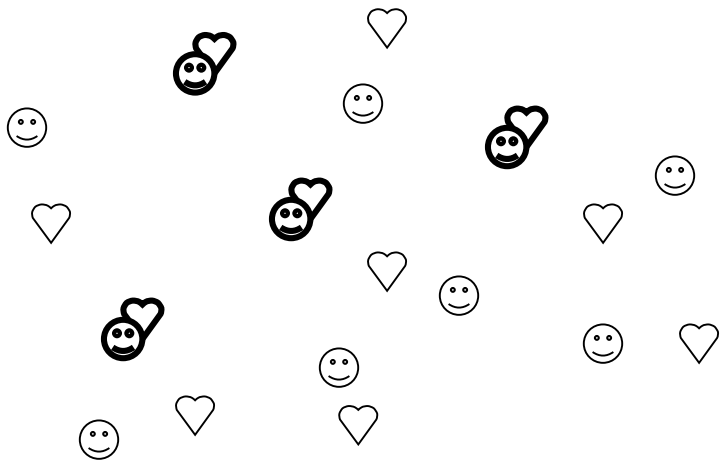
e) The macroscopic properties of an equilibrium system remain constant.

f) In a steady state the input rate equals the output rate.

g) In a reaction at equilibrium the forward rate is greater than the reverse rate.

9. For every cerebral character (happy face) that befriends a romantic (heart), a cerebral-romantic couple (heart stuck to face) breaks up.

This common situation is illustrated below:



a) In two years, how many couples will there be if this system remains at equilibrium? (see diagram)

b) Write an equation to represent the equilibrium. Place the single people on the left hand side of the equation.

c) How would we disturb equilibrium if we introduced stars into the system? Stars are known to steal hearts away from cerebral types.

(By the way, the reason romance exists in life is so that you can better understand equilibrium!)

10. In which of the following reactions would the equilibrium constant, K, increase by lowering the temperature?

a) heat + $H_2CO_{3(aq)}$ $\rightleftharpoons$ $H^+_{(aq)}$ + $HCO_3^-{}_{(aq)}$

b) $H_2O_{(g)}$ $\rightleftharpoons$ $H_2O_{(l)}$

11. a) If we increased the pressure, what would be the effect on K, if any, on the following equilibrium systems?

heat + $H_2CO_{3(aq)}$ $\rightleftharpoons$ $H^+_{(aq)}$ + $HCO_3^-{}_{(aq)}$

b) $H_2O_{(g)}$ $\rightleftharpoons$ $H_2O_{(l)}$

12. Write an equilibrium law expression for the following reaction:

2 $H_2O_{(g)}$ + 2 $S_{(s)}$ $\rightleftharpoons$ 2 $H_2S_{(g)}$ + $O_{2(g)}$

13. What chemical equation is represented by the following expression?

$\frac{[H_2O]^4[CO_2]^3}{[C3H8\,][O_2]^5} = K$ (Good luck trying to form this equilibrium! it's really an irreversible reaction, in reality)

14. At equilibrium [$NO_{2(g)}$] = 3.0 M and [$N_2O_{4(g)}$] = 4.0 M. Calculate the equilibrium constant, K.

2 $NO_{2(g)}$ = $N_2O_{4(g)}$ + energy

15. a) In a 5.0 L flask, 3.0 moles of oxygen are introduced with 8.0 moles of iodine.

At equilibrium we find 1.0 mole of oxygen among the other chemicals. Find K.

$O_{2(g)}$ + 2 $I_{2(g)}$ = 2 $OI_{2(g)}$

b) If temperature is raised and K is found to be a lower value, then is the reaction endothermic?

16. Given: 4 $HCl_{(g)}$ + $O_{2(g)}$ = 2$H_2O_{(g)}$ + 2$Cl_{2(g)}$ + 112kJ

At a certain temperature, the equilibrium constant for the above reaction is 32.

There were no products initially and the following equilibrium concentrations were measured. [HCl] = 2.0 moles/L [O_2] = 2.0 moles/L (By the way 2.0 M means 2.0 moles/L)

What are the equilibrium concentrations of steam and chlorine?

17. Use the K_{sp} for calcium fluoride to calculate its solubility in grams per liter. (CaF_2: $K_{sp} = 4.0 \times 10^{-11}$)

18. a) What is the solubility in moles/L of $AlPO_4$ in 0.050 M Na_3PO_4?
K_{sp} of $AlPO_4$ = **9.84×10^{-21}**

b) If it wasn't for the 0.050M Na_3PO_4, how would the solubility have compared?

FLASHBACKS:

19. Knowing that the rate of a reaction = $k[A]^2[B]$, what must be done to the concentration of solute B, if the rate is to triple by using only 0.6th of the original concentration of A?

20. In organic chemistry, an SN_1 reaction occurs in several steps, of which only one is rate-determining, and the reaction is considered to be *1st order* because the rate depends on just one reactant's concentration.

The overall reaction is:

$(CH_3)_3CCl_{(aq)} + NH_{3(aq)} \rightarrow (CH_3)_3CNH_{2(aq)} + HCl_{(aq)}$

The mechanism of the following:

Step (1) $(CH_3)_3CCl_{(aq)} \rightarrow (CH_3)_3C^+_{(aq)} + Cl^-_{(aq)}$ *slow*

Step (2) $(CH_3)_3C^+_{(aq)} + NH_{3(aq)} \rightarrow (CH_3)_3CNH_3^+_{(aq)}$ *fast*

Step (3) $(CH_3)_3CNH_3^+_{(aq)} + Cl^-_{(aq)} \rightarrow (CH_3)_3CNH_{2(aq)} + HCl_{(aq)}$ *fast*

a) What is the **rate expression** for the formation of $(CH_3)_3CNH_{2(aq)} + HCl_{(aq)}$

b) Why is the reaction labeled *1st order*?