Fall 2001: PSC2121 Homework Assignments
Solutions due Nov 20, Ch. 15, 16, and 17

Ch. 15:

14. To determine the molecular mass of TNT add the masses of the individual elements:

7 C = 7 × 12.0 = 84.0 amu
5 H = 5 × 1.0 = 5.0 amu
3 N = 3 × 14.0 = 42.0 amu
6 O = 6 × 16.0 = 96.0 amu = **227.0 amu.**

15. Follow a similar procedure for cholesterol:

22 C = 22 × 12.0 = 264 amu
46 H = 46 × 1.0 = 46 amu
1 O = 1 × 16.0 = 16 amu = **326 amu.**

and then find the %'s:

C % = 100% × (264/326) = **81.0 %**
H % = 100% × (46/326) = **14.1 %**
O % = 100% × (16/326) = **4.9 %**

19. Find the % of N in each:

(a) KNO_3 N % = 100% × 14.0 / (39.1 + 14.0 + 3 × 16.0) = 13.8 %
(b) NCl_3 N % = 100% × 14.0 / (14.0 + 3 × 35.45) = 11.6 %
(c) $CO(NH_2)_2$ N % = 100% × (2 × 14.0) / (12.0 + 16.0 + 2 × 14.0 + 4 × 1.0) = 46.7 %
(d) $Fe(CN)_2$ N % = 100% × (2 × 14.0) / (55.85 + 2 × 12.0 + 2 × 14.0) = 26.0 %

So **(c) $CO(NH_2)_2$ has the highest % of N.**

23. Silver Ag has an atomic mass of 107.87 amu.

This means that 1 mole of Ag has a mass of 107.87 gm.
1 kg = 1000 gm (1 mole/107.87 gm)
= 9.27 mole × (6.02×10^{23} atoms/mole) = **5.58×10^{24} atoms**

42 (a) $\mathbf{4}P + \mathbf{5}O_2 \rightarrow P_4O_{10}$
(b) $\mathbf{4}Al + \mathbf{3}O_2 \rightarrow \mathbf{2}Al_2O_3$
(c) $\mathbf{2}SO_2 + O_2 \rightarrow \mathbf{2}SO_3$
(d) $\mathbf{2}NH_3 \rightarrow N_2 + \mathbf{3}H_2$
(e) $\mathbf{2}H_2O_2 \rightarrow \mathbf{2}H_2O + O_2$
(f) $NH_4NO_3 \rightarrow N_2O + \mathbf{2}H_2O$

43. D. (c) F. (b) G. (d) I. (b)

Ch. 16:

2. When a lump of coal is powdered into dust the surface area increases drastically allowing more coal to come in contact with oxygen in the air.

3. In pure O_2 the concentration of oxygen is greater than in air allowing for a more rapid burn.

5. Placing milk in a refrigerator lowers the temperature (assuming the refrigerator is operating correctly) and thus lowers the rate of the chemical reaction that spoils the milk.

16. Either the presence of a reverse reaction (in which products are converts back to reactants) or an incorrect mixture (insufficient amount of some reactant) will cause some reactants not to be converted to products.

22. (a) K = $\mathbf{[NO]^2 / [N_2][O_2]}$ (b) K = $\mathbf{[CO][H_2O] / [CO_2][H_2]}$
(c) K = $\mathbf{[NO]^4[H_2O]^6 / [NH_3]^4[O_2]^5}$

23. When K is very small the reaction goes least to completion in the forward direction.
Thus, **(a) K = 10^{-10}** goes least to completion.

31. According to Le Chatelier's principle, increasing the temperature adds heat, causes a stress to the left and therefore shifts the equilibrium **to the right.**

34. A. (d) B. (d) D. (c) E. (d) F. (c) H. (d)

Ch. 17:

2. Water. KCl forms an ionic bond and is therefore highly polar and will be more soluble in the polar solvent.

7. Water is the solvent and sugar is the solute.

20. Dissolving salt in water lowers the freezing point so the fresh-water pond will freeze first.

21. Where the salt contacts the ice some of the salt combines with the ice to lower the freezing point melting some of the ice. This salt-slush mixture then comes in contact with more ice and the melting spreads.

29. An acid increases the hydrogen ion concentration $[H^+]$ in water while a base increases the hydroxide ion concentration $[OH^-]$.

34. The pH scale is a negative logarithmic measure of the hydrogen ion concentration $[H^+]$ in mole/liter:

$$\mathbf{pH = -\log_{10} [H^+]}$$

Neutral water has $[H^+] = [OH^-] = 10^{-7}$ mole/liter = 10^{-7} M and pH = 7.
Acids, with $[H^+] > 10^{-7}$ M have pH < 7.
Bases with $[OH^-] > 10^{-7}$ M have $[H^+] < 10^{-7}$ M and pH > 7.

35. Since vinegar (acetic acid) is acidic its pH is **< 7** (see Figure 17-19).

36. (a) $[H^+] = 10^{-4}$, M > 10^{-7} M so the solution is **acidic**.
(b) $[H^+] = 10^{-11}$, M < 10^{-7} M so the solution is **basic**.
(c) $[H^+] = 3.5\times10^{-13}$, M < 10^{-7} M so the solution is **basic**.
(b) $[H^+]$ = 0.0001 M= 10^{-4}, M < 10^{-7} M so the solution is **acidic**.

37. (a) pH = 11 is **basic**. (b) pH = 2 is **acidic**. (c) pH = 7 is **neutral**.
(d) pH = 8.24 is **basic**. (e) pH = 3.48 is **acidic**.

46. A. (b) B. (a) D. (c) F. (b)