

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:

$$7 \text{ C} = 7 \times 12.0 = 84.0 \text{ amu}$$

$$5 \text{ H} = 5 \times 1.0 = 5.0 \text{ amu}$$

$$3 \text{ N} = 3 \times 14.0 = 42.0 \text{ amu}$$

$$6 \text{ O} = 6 \times 16.0 = 96.0 \text{ amu} = \mathbf{227.0 \text{ amu.}}$$

15. Follow a similar procedure for cholesterol:

$$22 \text{ C} = 22 \times 12.0 = 264 \text{ amu}$$

$$46 \text{ H} = 46 \times 1.0 = 46 \text{ amu}$$

$$1 \text{ O} = 1 \times 16.0 = 16 \text{ amu} = \mathbf{326 \text{ amu.}}$$

and then find the %'s:

$$\text{C \%} = 100\% \times (264/326) = \mathbf{81.0 \%}$$

$$\text{H \%} = 100\% \times (46/326) = \mathbf{14.1 \%}$$

$$\text{O \%} = 100\% \times (16/326) = \mathbf{4.9 \%}$$

19. Find the % of N in each:

$$(a) \text{ KNO}_3 \quad \text{N \%} = 100\% \times 14.0 / (39.1 + 14.0 + 3 \times 16.0) = 13.8 \%$$

$$(b) \text{ NCl}_3 \quad \text{N \%} = 100\% \times 14.0 / (14.0 + 3 \times 35.45) = 11.6 \%$$

$$(c) \text{ CO(NH}_2)_2 \quad \text{N \%} = 100\% \times (2 \times 14.0) / (12.0 + 16.0 + 2 \times 14.0 + 4 \times 1.0) = 46.7 \%$$

$$(d) \text{ Fe(CN)}_2 \quad \text{N \%} = 100\% \times (2 \times 14.0) / (55.85 + 2 \times 12.0 + 2 \times 14.0) = 26.0 \%$$

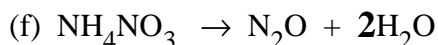
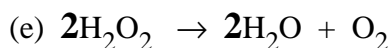
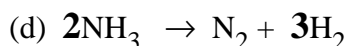
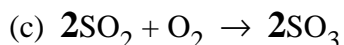
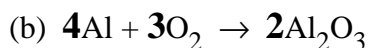
So (c) **CO(NH₂)₂** has the highest % of N.

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.

$$1 \text{ kg} = 1000 \text{ gm} \quad (1 \text{ mole}/107.87 \text{ gm})$$

$$= 9.27 \text{ mole} \times (6.02 \times 10^{23} \text{ atoms/mole}) = \mathbf{5.58 \times 10^{24} \text{ atoms}}$$



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 O₂ 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 converted back to reactants) or an incorrect mixture (insufficient amount of some reactant) will cause some reactants not to be converted to products.
22. (a) $K = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]}$ (b) $K = \frac{[\text{CO}][\text{H}_2\text{O}]}{[\text{CO}_2][\text{H}_2]}$
 (c) $K = \frac{[\text{NO}]^4[\text{H}_2\text{O}]^6}{[\text{NH}_3]^4[\text{O}_2]^5}$
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 $[\text{H}^+]$ in water while a base increases the hydroxide ion concentration $[\text{OH}^-]$.
34. The pH scale is a negative logarithmic measure of the hydrogen ion concentration $[\text{H}^+]$ in mole/liter:

$$\text{pH} = -\log_{10} [\text{H}^+]$$
 Neutral water has $[\text{H}^+] = [\text{OH}^-] = 10^{-7}$ mole/liter = 10^{-7} M and $\text{pH} = 7$.
 Acids, with $[\text{H}^+] > 10^{-7}$ M have $\text{pH} < 7$.
 Bases with $[\text{OH}^-] > 10^{-7}$ M have $[\text{H}^+] < 10^{-7}$ M and $\text{pH} > 7$.
35. Since vinegar (acetic acid) is acidic its pH is **< 7** (see Figure 17-19).
36. (a) $[\text{H}^+] = 10^{-4}$, $M > 10^{-7}$ M so the solution is **acidic**.
 (b) $[\text{H}^+] = 10^{-11}$, $M < 10^{-7}$ M so the solution is **basic**.
 (c) $[\text{H}^+] = 3.5 \times 10^{-13}$, $M < 10^{-7}$ M so the solution is **basic**.
 (d) $[\text{H}^+] = 0.0001 \text{ M} = 10^{-4}$, $M < 10^{-7}$ M so the solution is **acidic**.
37. (a) $\text{pH} = 11$ is **basic**. (b) $\text{pH} = 2$ is **acidic**. (c) $\text{pH} = 7$ is **neutral**.
 (d) $\text{pH} = 8.24$ is **basic**. (e) $\text{pH} = 3.48$ is **acidic**.
46. A. (b) B. (a) D. (c) F. (b)