Final Exam Review

Chapters 13-15

Honors chemistry

1. State the basic principles of the kinetic theory of gases
   - large amount of space between particles
   - molecules have no intermolecular forces
   - molecules move randomly and quickly
   - energy directly prop. to temperature
2. Convert 340kPa to mmHg. $\frac{340\ kPa}{101.3\ kPa} \left| \frac{760\ mm\ Hg}{} \right. = 2550 \approx 2600\ mm\ Hg$
3. When a gas increases in volume, what happens to the temperature if the pressure is held constant?

   increases
4. What happens to the pressure in a balloon if the balloon is squeezed and the volume decreases?

   increases
5. What conditions of pressure and temperature cause more gases to remain dissolved in a liquid?

   high pressure / low temperature
6. What is the pressure in a bottle if it was initially at 2.51atm and 5.4L and the volume decreases to 1.2L?

   $P_1V_1 = P_2V_2$ $(2.51)(5.4) = P_2(1.2)$

   $P_2 = 11\ atm$
7. If a container has 137kPa of pressure and air is removed until the pressure is 87.3kPa, what is the new temperature if it was initially at 45.0°C?

   $\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$ $\frac{137}{317} = \frac{87.3}{T_2}$

   $T_2 = 202\ K$ or $-71^\circ C$
8. What mass of NO_2 is in a container with a ~~pressure of 135kPa~~ at 60.7°C and a volume of 2.00L?

   $PV = nRT$ $\frac{135\ kPa}{101.3\ kPa} \left| \frac{1\ atm}{} \right.$

   $(1.33)(2.00) = n(.08206)(333.7)$

   $n = .0973\ mol \left| \frac{NO_2}{1\ mol} \right| \frac{46.01\ g}{} = 4.47\ g\ NO_2$
9. In the reaction $Mg + 2HCl \rightarrow MgCl_2 + H_2$
   a. How many liters of hydrogen gas will be formed from 1.45moles of HCl at STP?

      $1.45\ mol\ HCl \left| \frac{1\ mol\ H_2}{2\ mol\ HCl} \right| \frac{22.4\ L}{1\ mol\ H_2}$
   b. How many grams of Magnesium are required at 23.5°C and 1.35atm of pressure to produce 34.5L of H_2?

      $(1.35)(34.5) = n(.08206)(296.5)$

      $n = 1.91\ mol$

      $1.91\ mol\ H_2 \left| \frac{1\ mol\ Mg}{1\ mol\ H_2} \right| \frac{24.305\ g\ Mg}{1\ mol\ Mg} = 46.5\ g\ Mg$

10. When 13.5L of a gas at STP is put under a pressure of 685.4torr and 65.9°C, what will the new volume be? $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\frac{(760\ torr)(13.5)}{273} = \frac{(685.4)(V_2)}{(338.9)}$ $V_2 = 19.6\ L$
11. What state has a constant shape and volume?

solid

12. What state will expand to fit its container?

gas

13. What state has no intermolecular forces between the particles?

gas

14. What state exhibits surface tension?

liquid

15. What is the name of the force which exists between two different substances?

adhesion

16. What state change occurs when a dry ice becomes a gas?

sublimation

17. What state change occurs when steam comes from boiling water?

vaporization

18. What is the strongest intermolecular force in covalent compounds?

hydrogen bonds

19. What intermolecular forces are found in HF?

hydrogen bonds
dipole-dipole
dispersion

20. What intermolecular forces are found in CH_4?

dispersion

21. How did God design water to not kill fish?

water expands when it freezes because H-bonds line up to create space between the molecules. As a result ice is less dense so lakes freeze at the top first creating an insulating layer so the whole lake does not freeze

22. Why are pressure cookers useful?

by increasing atmospheric pressure the vapor pressure must get higher so liquids boil at a higher temperature therefore cooking food faster

23. How are intermolecular forces and surface tension related?

stronger intermolecular forces = stronger surface tension

24. Describe metallic bonds and explain how this makes metals good conductors of electricity.

Cations line up in rows and electrons become delocalized and move freely around them. These loosely held electrons can then move to carry an electric current

50. For the following question use these constants:

Specific Heat of Ice=2.108J/g°C

Specific Heat of Water=4.184J/g°C

Specific Heat of Steam=1.996J/g°C

Heat of fusion of water=6.02kJ/mol

Heat of vaporization of water=40.6kJ/mol

What is the energy absorbed when 5.39g of ice at -32.5°C is changed to steam at 154.6°C?

$q = smoT$
$= (2.108)(5.39)(32.5)$
$= 369\,J$ or $.369\,kJ$

$q = n\,H_f$
$= (.299)(6.02)$
$= 1.80\,kJ$

$q = smoT$
$= (4.184)(5.39)(100.)$
$= 2260\,J$ or $2.26\,kJ$

$q = n\,H_v$
$(.299)(40.6)$
$= 12.1\,kJ$

$q = smoT$
$= (1.996)(5.39)(54.6)$
$= 587\,J$ or $.587\,kJ$

17.1 kJ

51. Define a solvent and a solute.

solvent = majority component
solute = minority component

52. How is vapor pressure a colligative property?

vapor pressure decreases with more particles

53. Are solutions heterogeneous or homogeneous? Explain.

homogeneous - they are evenly mixed and the components cannot be distinguished

54. What are 3 ways to speed up the rate of dissolving?

stir
heat it up
smaller grains

55. What type of substance will not dissolve in water?

non polar

56. What are two conditions at which more gases can dissolve in a liquid?

high pressure / low temp.

57. What is the molarity of 1.34g of NaCl in 556mL of solution?

$\frac{1.34}{58.44} = \frac{.0229 mol}{.556 L} = .0412 M$

58. 54.6g of $NaNO_3$ must be added to what mass of water to make a 1.34m solution?

$\frac{54.6}{84.99} = \frac{.642 mol}{x} = 1.34 m$ $.479 kg$

59. What is the percent by mass of 1.45kg of solution which contains 5.43g of sugar?

$\frac{5.43 g}{1450 g} \times 100 = .374\%$

60. If 12.5g of $CaCl_2$ are dissolved in 125.3 g of acetic acid, what will the new freezing point be? New boiling point?

$\frac{12.5 g}{110.98 g} = \frac{.113 mol}{.1253} = .899 m$

$FP = \Delta T = k m p$

$(3.90)(.899)(3)$

$\Delta T = 10.5°C$

$16.6 - 10.5$

$6.1°C$

$BP = \Delta T = K_b m p$

$\Delta T = (2.93)(.899)(3)$

$\Delta T = 7.90°C$

$+ 118.5°C$

$125.5°C$