

Spring Semester Final Review 2006

CH 6 bonding

- chemical bonds (ionic, covalent—polar, nonpolar, metallic) & properties (mp, bp, vaporization ease, conductivity, brittle, malleable, lustrous)
- classify bond type by electronegativity difference (EN C=2.5, O = 3.5, K =0.8, F = 4.0, H = 2.1) CO KF CH₄
- vocabulary: crystalline, amorphous, electron sea, lustrous, malleable, ductile
- octet rule
- For the following Nitrate ion nitrogen triiodide C₂H₂ C₂H₄
Identify the electron dot structures, resonance
Identify the VSEPR molecular & electronic geometry
(linear, bent, trigonal planar, pyramidal, tetrahedral, bipyramidal, octahedral)
draw the dipole direction and molecular polarity →
- Hybridization geometry -- draw & label orbitals & bonds for: carbon monoxide nitrogen nitrous acid C₂H₄

CH 10 Physical properties of gases

- kinetic molecular theory (5 parts)
temperature is a measure of _____
- ideal & real gas
T & P conditions for a real gas to behave like ideal gas _____
- characteristic properties of gases
- pressure
units 1 atm = 101.3kPa = 760 mm Hg vocab: barometer/manometer
- temperature Kelvin temperature units K = °C + 273 use Kelvin in all gas calculations
STP
- combined gas law, Boyle's Law, Charles' Law, Gay-Lussac Law
A gas occupies 2.20 L at 1.5 atm and 47°C. Calculate the volume at 107°C and 740 mm Hg.
- Dalton's Law of Partial Pressure
 - Total pressure of N₂ + O₂ = 742 mm Hg. If pressure of N₂ = 542 mm, calculate the partial pressure of oxygen.
 - 5.08 mL of gas is collected over water at 25°C and 727 mm of Hg. What volume will the dry gas have at 84°C and 882 mm Hg?
- Graham's Law of Effusion or Diffusion
Calculate the molar mass of an unknown gas if hydrogen gas effuses 1.32 times faster than the unknown.

CH 11 Ideal gas law & stoichiometry

- Avogadro's Principle Know: standard molar volume of gas 1 mole of ANY GAS = 22.4 L at STP (0°C, 1 atm)
Calculate the volume of oxygen needed to react with 2.5 L H₂ at the same temperature & pressure for H₂ + O₂ → H₂O
- ideal gas law know: PV = nRT or M = dRT/P R = 0.0821Latm/molK
 - Calculate density of nitrogen(g) at -18°C and 1650 mmHg
 - Calculate mass of 3.81 L oxygen gas at 57°C and 675 mmHg
- Stoichiometry involving gases
 - Calculate the mass of oxygen needed to combust 29.0 L methane at 90.0 kPa and 20°C
 - If 8.00 L of ammonia is burned in 8.00 L of oxygen. How many grams of steam are formed?
Ammonia(g) + oxygen(g) → nitrogen monoxide(g) + water(g)

CH 12 Liquids & Solids (Phase changes)

- kinetic molecular theory
- crystalline and amorphous solids, properties & examples
- boiling, evaporation, vaporization, condensation, freezing, melting, sublimation, deposition
- volatile liquids
- Interpret phase diagrams: triple point, critical point, normal freezing point, normal boiling points, equilibrium lines
- know physical properties of water:
density of liquid water = 1.0 g/mL temperature of maximum density = 4°C
molar heat of fusion H_f = -6.009 kJ/mol molar heat of vaporization H_v = 40.79 kJ/mol
normal freezing point = 0°C normal boiling point = 100°C
specific heat capacity of liquid water C = 4.184 J/g°C
specific heat capacity & calculations q = mCΔT heat lost + heat gained = 0

24. A student poured 150.0 g of heated iron into a styrofoam cup that contained 200. g of water at 25°C. The final temperature is 28°C. What was the initial temperature of the metal?
25. calculate the energy needed for combined phase changes
- $$q = \text{heat solid} + \text{melt} + \text{heat liquid} + \text{vaporize} + \text{heat gas} = mC_s\Delta T_s + nH_f + mC_l\Delta T_l + nH_v + mC_g\Delta T_g$$
- How much heat is required to convert 50 g water at 70°C to steam at 120°C?

CH 13 & 14 Solutions

26. homogenous & heterogeneous mixtures, solvent, solute, solutions, suspensions, colloids
27. 5 factors that influence the rate of solution
28. saturated, unsaturated, and supersaturated, miscible, immiscible, concentrated, dilute
29. "like dissolves like" in terms of polar and nonpolar substances.
30. effects of temperature & pressure on solubility of solids and of gases in liquids
31. effects of pressure on solubility of gases in liquids (Henry's law)
32. The solubility of a substance per 100. g water is 18.0 g at 60.0°C and 12.0 g at 20.0°C. How many grams of will crystallize from a 200 mL saturated solution at 60.0 °C if it cools to 20.0 °C?
33. Predict the formation of a precipitate know solubility rules
34. identify strong and weak electrolytes BaSO₄ NH₄NO₃ NaCl AgBr
35. Write total, overall, and net ionic equations. Identify spectator ions KCl(aq) + AgNO₃(aq) →
36. dissociation: write the dissociation equation for sodium nitrate $\Delta H = +20.50$ kJ/mol
write the dissociation equation for lithium perchlorate if the heat of solution = -25 kJ/mol.
37. Choose the ion in each pair that should be more strongly hydrated in aqueous solution Na⁺ or Rb⁺
38. Concentration Calculations Calculate the molarity of 170. g sodium nitrate dissolved in 3.0 L water.
Calculate the molality of a solution made from 50.0 g ethyl alcohol mixed with 100.00 mL water.
39. Dilutions What volume of 0.0800 M solution of sodium borate would be needed to make 100.0 mL of 0.0200 M solution?
40. Solution Stoichiometry
Calculate the volume of a 0.750 M solution of nitric acid required to react completely with 2.80 g calcium carbonate.
Calculate the mass of precipitate formed if 20.0 mL of 0.150 M AgNO₃(aq) are added to 30.0 mL of 0.200 M NaCl(aq).
41. Colligative Properties $fp_{\text{solution}} = fp_{\text{pure}} + iK_m$ $bp_{\text{solution}} = bp_{\text{pure}} + iK_m$
- list the 4 colligative properties
 - electrolytes and nonelectrolytes determine i calcium nitrate, sodium phosphate, ethyl alcohol, glucose C₆H₁₂O₆,
 - Know for water: freezing point constant ($K_f = -1.86$ °C/m) boiling point constant ($K_b = 0.51$ °C/m).
 - calculate the molality of an aqueous calcium chlorate solution if the fp of the solution = -8.4°C
 - Calculate the number of grams of a molecular solute (molar mass = 68.00 g/mole) that must be added to 600. g of aniline to produce a solution that has a boiling point of 192.4°C. $bp = 184.4$ °C. $K_b = 3.52$ °C/m

CH 15 & 16 Acids & Bases

42. review acid names & formulas
43. Memorize the 6 strong acids (H₂SO₄, HNO₃, HClO₄, HCl, HBr, HI) and weak acids HC₂H₃O₂, HF, H₂CO₃, H₃PO₄
44. Memorize the strong bases (group I & II hydroxides, except Mg(OH)₂(aq) and weak bases (Mg(OH)₂(aq) & NH₃)
45. monoprotic, diprotic, and triprotic acid
46. List 5 general properties of aqueous acids phenolphthalein: colorless litmus : red
47. 5 general properties of bases phenolphthalein: magenta litmus : blue
48. hydronium ion, ionization, write the equation of ionization of HCl in water
acetic acid + water →
NH₃ + H₂O ⇌ NH₄⁺ + OH⁻
49. Identify Brønsted acids & bases
50. conjugate acids & bases & relative strength HC₂H₃O₂ + H₂O ⇌ C₂H₃O₂⁻ + H₃O⁺
51. Write net ionic equations for acids
52. Write balanced neutralization reactions HCl + Ca(OH)₂ →
53. titration, end point, equivalence points, standard solution
Calculate volume of 0.50 M KOH to neutralize 20 mL of 0.75 M H₂SO₄
54. pH scale, pOH $pH = -\log[H_3O^+]$ $pH + pOH = 14$ $K_w = [H_3O^+][OH^-]$
Calculate pH given concentration $[H_3O^+] = 5.9 \times 10^{-5}$ $pH = \underline{\hspace{2cm}}$
Calculate $[H_3O^+]$ or $[OH^-]$ given pH $pH = 10.6$ $[H_3O^+] = \underline{\hspace{2cm}}$ $[OH^-] = \underline{\hspace{2cm}}$ acid or base?

CH 17 thermochemistry

55. What is the value of ΔH for this reaction? $3\text{H}_2 + \text{O}_3 \rightarrow 3\text{H}_2\text{O}$ $\Delta H = \underline{\hspace{2cm}}$



56. Which of the following processes are accompanied by an increase in entropy of the system? What are the driving forces?

a. Silver sulfate precipitates from a solution containing silver ions and sulfate ions.

b. Water freezes

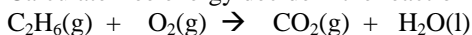
57. Free Energy, & Spontaneity

$$\Delta G = \Delta H - T\Delta S$$

$$-\Delta G = \text{spontaneous}$$

	ΔH kJ mole	S J K mole
$\text{C}_2\text{H}_6(\text{g})$	-84.86	229.5
$\text{O}_2(\text{g})$	0	205.0
$\text{CO}_2(\text{g})$	-393.5	213.6
$\text{H}_2\text{O}(\text{l})$	-285.8	69.9

Calculate free energy decide if the reaction is spontaneous $T = 27^\circ\text{C}$. What are the driving forces?



58. collision theory, activation energy, activated complex, energy diagrams, catalyst and explain its effect on reaction rates,.

Draw the energy diagram for a reaction that has an $E_a = 40 \text{ kJ}$ and $\Delta E_{\text{forward}} = -100 \text{ kJ}$. Determine E_a' and ΔE_r .

59. reaction mechanism and intermediates

60. five factors that influence reaction rates

61. Determine the rate law, the rate constant k , and rate in trial 4 from the data.

	initial [A]	initial [B]	rate of formation of [C]
1	0.100 M	0.100 M	0.0060 M/min
2	0.200 M	0.100 M	0.0480 M/min
3	0.100 M	0.200 M	0.0120 M/min
4	0.300 M	0.200 M	

CH 18 Equilibrium

62. The following system is at equilibrium $\text{C}(\text{s}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + \text{H}_2(\text{g})$ $\Delta H = 131 \text{ kJ/mol}$

Predict how each of the following stresses will affect the direction of the equilibrium shift and the concentration of $\text{H}_2\text{O}(\text{g})$.

a. add more C(s)

d. add a catalyst

g. increase the pressure by

b. add more CO

e. lower the temperature

adding neon, same volume

c. remove some $\text{H}_2\text{O}(\text{g})$

f. decrease the volume

63. Determine K for the equilibrium mixture at 700°C , in a 30. L flask that 28.0 g nitrogen, 30.0 g oxygen, 40.0 g dinitrogen monoxide.
 $\text{nitrogen}(\text{g}) + \text{oxygen}(\text{g}) \rightleftharpoons \text{nitrogen dioxide}(\text{g})$

64. Calculate the solubility product for magnesium fluoride if the solubility is 0.0130 g/ 100g H_2O .

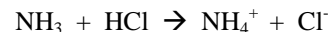
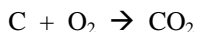
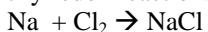
65. Calculate the ion product, Q , to determine if a precipitate forms when 150 mL of 0.0050 M zinc nitrate and 350 mL of 0.0150 M sodium cyanide are mixed at 25°C (K_{sp} for precipitate = 8.0×10^{-12})

66. A 0.2000 M solution of hypochlorous acid has a pH of 4.50. What is the K_a ?

CH 19 Oxidation & Reduction, Electrochemistry

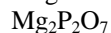
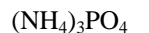
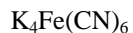
67. oxidation and reduction OIL RIG

68. Identify redox reactions

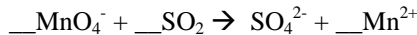
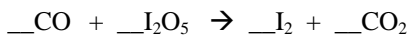


69. Identify oxidizing agents & reducing agents

70. Determine oxidation numbers of each element in the following



71. Balance redox reactions in acidic and basic (honors) solutions



72. Electrochemistry, anode, cathode an ox, red cat

73. voltaic cells, electrolytic cells, electrolysis, electroplating.

74. calculations involving standard electrode potentials & spontaneity + E = spontaneous

What is the E° value of the cell reaction described by the equation $\text{Al} + 3\text{Ag}^+ \rightarrow \text{Al}^{3+} + 3\text{Ag}$?