CHEMISTRY I HONORS – FINAL EXAM REVIEW

STRATEGY: Start by reading through your notes to refresh your memory on these topics. Then, use this review sheet as a starting point to identify the areas on which you need to spend more study time. For those areas, go back to homework assignments, quizzes, and reviews to practice more problems. Keep in mind that these questions are only samples and do not include specific examples of how vocabulary and other conceptual information might appear in a scantron format. Remember you can access notes and reviews under Lecture Notes on the website (www.nisd.net/communicationsarts/pages/chem).

FORMAT:

- Questions will include multiple-choice and matching.
- A formula bank will be provided in addition to any values that you might need (solubility table, pressure conversions, etc.), but you will NOT be given "formulas" for items listed in the VOCAB sections (molarity, % composition, etc).

First Semester Topics

1. Give the longhand electron configuration for arsenic.
2. The largest atoms are in the ___ corner of the table.

Classify the following as chemical or physical changes (3-5).

3. rusting of iron
4. digestion of meat
5. boiling water
6. Describe the relationship between PE and stability.

Write formulas for the compounds in 7-10.

7. magnesium fluoride
8. dinitrogen pentoxide
9. sodium sulfate
10. phosphoric acid

Name the compounds in 11-14.

11. KNO_3 12. HBr 13. SO_3 14. $FeCl_3$

Draw the Lewis diagram & specify the molecular polarity (15-16).

15. AsH_3 16. BF_3

The Mole – Ch. 3 & 7

17. How many magnesium sulfate molecules are in 25.0 g?
18. Find the molarity of a 750 mL solution containing 346 g of potassium nitrate.
19. Calculate the number of grams required to make a 50.0 mL solution of 6.0*M* NaOH.
20. Find the % composition of copper(II) chloride.
21. The percent composition of a compound is 40.0% C, 6.7% H, and 53.7% O. The molecular mass of the compound is 180.0 g/mol. Find its empirical and molecular formulas.

VOCAB: Avogadro's number, empirical formula, percent composition, molecular formula, molarity

Chemical Reactions – Ch. 8

22. Write a word equation for the following reaction (incl. how many? of what? what state?).

$$Ba(ClO_3)_2(s) \xrightarrow{\Delta} BaCl_2(s) + 3O_2(g)$$

23. Rewrite and balance the following word equation using chemical formulas, physical states, and energy. – *When solid sodium chlorate absorbs energy, it produces solid sodium chloride and oxygen gas*.

Predict the products and balance (24-27). Write N.R. if no reaction will occur. Include physical states for extra credit.

24. $Cu(s) + MgSO_4(aq) \rightarrow$
25. $C_5H_{12}(l) + O_2(g) \rightarrow$
26. $NH_4Cl(aq) + Pb(NO_3)_2(aq) \rightarrow$
27. $Fe_2O_3(s) \rightarrow$
28. For each of the reactions in #24-27, specify whether it is *combustion*, *synthesis*, *decomposition*, *single replacement*, or *double replacement*.

Identify as endothermic or exothermic (29-32).

29. PE of products is lower than PE of reactants.
30. PE of products is higher than PE of reactants.
31. When substances are mixed, the test tube feels cold.
32. In your car's engine, fuel is burned to produce energy.
33. List three conditions required for a successful collision according to Kinetic Molecular Theory.
34. Name four ways to increase the rate of a reaction.

VOCAB: endothermic, exothermic, catalyst

Stoichiometry – Ch. 9

35. How many grams of copper would be produced from 49.48 g of chromium? $Cr + CuSO_4 \rightarrow Cu + Cr_2(SO_4)_3$
36. How many grams of chromium are required to react with 125 mL of 0.75*M* $CuSO_4$. (same reaction as #36)
37. How many grams of ZnS are required to react with 12.6 L of oxygen gas at STP? $ZnS + O_2 \rightarrow ZnO + SO_2$
38. 6.45 g of lithium reacts with 9.20 g of oxygen gas to produce lithium oxide. How many grams of Li_2O are formed?
39. What are the limiting and excess reactants in #38?
40. The actual yield of the reaction in #39 is 12.5 g. What is the percent yield of this reaction?

VOCAB: theoretical yield, limiting reactant, percent yield, excess reactant

Gases – Ch. 10 & 11

Identify the gas laws that explain these situations (41-43). Specify the variables involved and direct/inverse relationship.

41. A balloon pops after floating high into the atmosphere.
42. A balloon pops in a hot car on a summer day.
43. Do not store aerosol cans at temperatures above 120°F. Danger of explosion.

Identify the gas law and solve the problem (44-51).

44. Hydrogen gas is collected over water at 35°C to give a total pressure of 0.80 atm. Find the pressure of the dry hydrogen gas in kPa. (see p.899 for necessary data)
45. A jar is tightly sealed at 22°C and 772 torr. What is the pressure inside the jar after it has been heated to 178°C?

Gases – Ch. 10 & 11 (continued)

46. 300.0 mL of gas has a pressure 75.0 kPa. When the volume is decreased to 125.0 mL, what is its pressure?
47. Hydrogen diffuses 3.72 times faster than an unknown gas. Find the molar mass of the unknown gas.
48. 50.0 L of gas has a temperature of 75°C. What is the temp in Celsius when the volume changes to 110 L?
49. What is the volume of a container that holds 48.0 g of helium at a pressure of 4.0 atm and temperature of 52°C?
50. Neon diffuses at a rate of 688 m/s. What is the speed of ammonia (NH_3) at the same temperature and pressure?
51. A gas occupies 325 L at 25°C and 98.0 kPa. What is its volume at 70.0 kPa and 15°C?
52. What volume of SO_2 is produced from 32.5 g of ZnS at 23°C and 103.3 kPa? $ZnS + O_2 \rightarrow ZnO + SO_2$
53. Define real gases. When do they act like ideal gases?
54. Explain Graham's law. How does molar mass affect the rate of diffusion?

VOCAB: Kelvin, STP, diffusion, effusion

Liquids & Solids – Ch. 12

Identify each intermolecular force described in 55-58.

55. Attraction between *any* two polar molecules.
56. Very weak force that increases with molar mass.
57. Attraction between two *momentary* dipoles.
58. Very strong attractive force between molecules with N-H, O-H, or F-H bonds.
59. Identify the type(s) of intermolecular forces present in the following molecules – CH_4, SCl_2, F_2, NH_3.
60. Compare and contrast liquids and solids.

Identify each type of solid in 61-65.

61. Every atom is covalently bonded to another atom.
62. Atoms are surrounded by a sea of electrons.
63. Particles are connected only by IMF.
64. There is no geometric pattern in the structure.
65. Charged particles in a geometric pattern.
66. Explain the relationship between strong intermolecular forces and the following properties – volatility, vapor pressure, and boiling point.
67. Read vapor pressure graphs (See *Changes of State w/s* or *Liquids & Solids Quiz*.)

Indicate whether a heating curve would be *flat* or *rising* in 68-72.

68. liquid is boiling
69. solid is warming
70. solid is melting
71. potential energy is increasing
72. kinetic energy is increasing

VOCAB: surface tension, capillary action, volatility, vapor pressure, boiling point, crystalline vs. amorphous, sublimation, heat capacity, heat of fusion, heat of vaporization

Solutions – Ch. 13 & 14

73. Explain the effect of adding more solute to unsaturated, saturated, and supersaturated solutions.
74. Explain how temperature and pressure affect solubility.

State whether each pair is soluble or insoluble (75-78).

75. KCl in water
76. ammonia in oil
77. wax in C_6H_6
78. CH_4 in water
79. Read solubility curves (See *Nature of Solutions w/s* and *Solutions Quiz*).
80. How many grams of $AlCl_3$ are required to make a 2.25m solution in 30.0 g of water?
81. What volume of 12*M* HCl is needed to prepare 250 mL of 0.20*M* HCl?
82. Explain the difference in preparing solutions based on molarity versus molality.
83. Which will have the greatest effect on Δt_f at the same molality: $C_{12}H_{22}O_{11}$, $MgBr_2$, $AlCl_3$, or NH_4NO_3?
84. When 26.4 g of NaBr dissolves in 0.20 kg of water, what is the freezing point of the solution? (see p.438)

VOCAB: solvation, dissociation, molality, solubility, ionization, strong/weak/nonelectrolyte

Acids and Bases – Ch. 15 & 16

State whether the following are acids or bases (85-88).

85. Have a sour taste.
86. React with metals.
87. Feel slippery
88. Turn blue litmus paper red.
89. Define acids and bases according to Arrhenius, Brønsted-Lowry, and Lewis.
90. Identify each substance as acid, base, conjugate acid, or conjugate base. $H_2S + H_2O \rightarrow HS^- + H_3O^+$
91. Give the conjugate acids of: NH_3 and Br^-.
92. Give the conjugate bases of: H_3O^+ and HSO_4^-.
93. Find the pH of 0.75*M* HCl.
94. Find the molarity of a KOH solution with a pH of 9.5.
95. Is the solution in #94 acidic or basic?
96. When a neutralization reaction between a strong acid and a weak base reaches the equivalence point, will the solution be acidic, basic, or neutral?
97. If 43.5 mL of 0.15 M HBr is required to neutralize 25.0 mL of $Ca(OH)_2$, what is the molarity of $Ca(OH)_2$?

VOCAB: hydronium ion, amphoteric substance, strong/weak acid/base, neutralization reaction, titration, equivalence point

Nuclear Chemistry – Ch. 22

98. Find the mass defect and nuclear binding energy of nitrogen-14 if its actual mass is 14.003074 amu. 1 proton = 1.007276 amu, 1 neutron = 1.008665 amu, 1 electron = 0.0005486 amu, and 1 amu = 1.6605×10^{-27} kg.

Match each description with the appropriate type of radiation – alpha, beta, positron, or gamma (99-103).

99. A negatively charged electron.
100. Blocked only by several feet of concrete.
101. A positively charged particle stopped by lead.
102. Blocked by paper or clothing.
103. Radiation energy with no electrical charge.

Write equations for the nuclear decay reactions in 104-108.

104. Decay of polonium-218 by alpha (α) emission.
105. Decay of sodium-22 by electron capture.
106. Decay of carbon-14 by beta (β-) emission.
107. Decay of chlorine-32 by positron (β+) emission.
108. Carbon-14 has a half-life of 5,730 years. If a plant contained 2.0 g of ^{14}C when it died, how much is left after 34,380 years?

VOCAB: half-life, mass defect, nuclear binding energy, fission vs. fusion, critical mass, chain reaction

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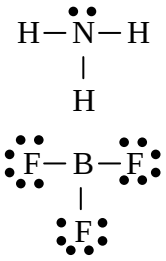
ANSWER KEY

1. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$
2. bottom-left
3. chemical
4. chemical
5. physical
6. low PE = high stability
7. MgF_2
8. N_2O_5
9. Na_2SO_4
10. H_3PO_4
11. potassium nitrate
12. hydrobromic acid
13. sulfur trioxide
14. iron(III) chloride
15. polar (see diagram)
16. nonpolar (see diagram)
17. 1.25×10^{23} molecules $MgSO_4$
18. 4.6*M* KNO_3
19. 12 g NaOH
20. 47.27% Cu, 52.73% Cl



21. empirical formula – CH_2O, molecular formula – $C_6H_{12}O_6$
22. One unit of solid barium chlorate when heated produces one unit of solid barium chloride and three molecules of oxygen gas.
23. $2NaClO_3(s) \xrightarrow{\Delta} 2NaCl(s) + 3O_2(g)$
24. $Cu(s) + MgSO_4(aq) \rightarrow$ N.R.
25. $C_5H_{12}(l) + 8O_2(g) \rightarrow 5CO_2(g) + 6H_2O(g)$
26. $2NH_4Cl(aq) + Pb(NO_3)_2(aq) \rightarrow 2NH_4NO_3(aq) + PbCl_2(s)$
27. $2Fe_2O_3(s) \rightarrow 4Fe(s) + 3O_2(g)$
28. single replacement, combustion, double replacement, decomposition
29. exothermic
30. endothermic
31. endothermic
32. exothermic
33. particles must collide, they must collide at the proper orientation, they must collide with sufficient KE
34. increase the surface area by grinding or dissolving the solid in water, increase the concentration of the reactants, increase the temperature of the reactants, use a catalyst
35. $2Cr + 3CuSO_4 \rightarrow 3Cu + Cr_2(SO_4)_3$, 90.71 g Cu
36. 3.3 g Cr
37. $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$, 36.5 g ZnS
38. $4Li + O_2 \rightarrow 2Li_2O$, 13.9 g Li_2O
39. limiting reactant – Li, excess reactant – O_2
40. 89.9% yield
41. Boyle's Law, P&V, inverse
42. Charles' Law, V&T, direct
43. Gay-Lussac's Law, P&T, direct
44. Dalton, 75.5 kPa
45. Gay-Lussac, 1180 torr
46. Boyle, 180. kPa
47. Graham, 28.0 g/mol
48. Charles, 490°C
49. Ideal, 80. L
50. Graham, 333 m/s
51. Combined, 440. L
52. 7.95 dm^3 SO_2 (or 7.93 dm^3 SO_2)
53. Real gas molecules have a volume and attract each other. They act ideal at high temperatures and low pressures.
54. Greater molar mass = slower rate of diffusion
55. dipole-dipole
56. dispersion
57. dispersion
58. hydrogen bond
59. CH_4 – dispersion
    SCl_2 – dispersion, dipole-dipole
    F_2 – dispersion
    NH_3 – dispersion, dipole-dipole, hydrogen bond
60. Both are incompressible with high density. Liquids are fluids. Solids have stronger IMF and slower diffusion.
61. covalent network crystal
62. metallic crystal
63. covalent molecular crystal
64. amorphous
65. ionic crystal
66. Strong IMF means molecules want to stay in the liquid state so volatility is low. Since there are fewer vapor molecules, v.p. is low. The b.p. is high because higher temps are needed to overcome the strong forces.
67. See w/s and quiz.
68. flat
69. rising
70. flat
71. flat
72. rising
73. Unsaturated – solute will dissolve. Saturated – solute will not dissolve. Supersaturated – rapid crystallization.
74. Solubility of gases increases with low temps & high pressure. Solubility of solids increases with high temps.
75. soluble (P/P)
76. insoluble (P/NP)
77. soluble (NP/NP)
78. insoluble (NP/P)
79. See worksheet and quiz.
80. 9.00 g $AlCl_3$
81. 4.2 mL 12*M* HCl
82. Molarity – measure amount of solute, add enough water to reach the desired volume. Molality – measure amount of solute, measure kg of water, combine.
83. $C_{12}H_{22}O_{11}$ – 1, $MgBr_2$ – 3, **$AlCl_3$ – 4**, NH_4NO_3 – 2
84. – 4.8°C
85. acid
86. acid
87. base
88. acid
89. Arr acid – forms H_3O^+ in water. Arr base – forms OH^- in water. B-L acid – proton donor, B-L base – proton acceptor. Lewis acid – e^- pair acceptor, Lewis base – e^- pair donor.
90. A, B, CB, CA
91. NH_4^+ and HBr
92. H_2O and SO_4^{2-}
93. 0.12
94. 3.2×10^{-5} *M* KOH (pOH = 4.5)
95. basic
96. acidic
97. 0.13*M* $Ca(OH)_2$
98. 0.112353 amu, 1.68×10^{-11} J
99. beta
100. gamma
101. positron
102. alpha
103. gamma
104. $^{218}_{84}Po \rightarrow {}^{4}_{2}He + {}^{214}_{82}Pb$
105. $^{22}_{11}Na + {}^{0}_{-1}e \rightarrow {}^{22}_{10}Ne$
106. $^{14}_{6}C \rightarrow {}^{0}_{-1}e + {}^{14}_{7}N$
107. $^{32}_{17}Cl \rightarrow {}^{0}_{+1}e + {}^{32}_{16}S$
108. 0.63 g