CHEMISTRY – FINAL 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.

# 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).

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

Write formulas for the compounds in 7-10.

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| --- | --- |
| 1. magnesium fluoride 2. dinitrogen pentoxide | 1. sodium sulfate 2. phosphoric acid |

Name the compounds in 11-14.

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| 1. KNO3 | 1. HBr | 1. SO3 | 1. FeCl3 |

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

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| 1. AsH3 | 1. BF3 |

# The Mole

1. How many magnesium sulfate molecules are in 25.0 g?
2. Find the molarity of a 750 mL solution containing 346 g of potassium nitrate.
3. Calculate the number of grams required to make a 50.0 mL solution of 6.0*M* NaOH.
4. Find the % composition of copper(II) chloride.
5. 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

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

*Ba(ClO3)2(s) BaCl2(s) + 3O2(g)*

1. 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.

1. Cu(s) + MgSO4(aq) →
2. C5H12(l) + O2(g) →
3. NH4Cl(aq) + Pb(NO3)2(aq) →
4. Fe2O3(s) →
5. 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).

1. PE of products is lower than PE of reactants.
2. PE of products is higher than PE of reactants.
3. When substances are mixed, the test tube feels cold.
4. In your car’s engine, fuel is burned to produce energy.
5. List three conditions required for a successful collision according to Kinetic Molecular Theory.
6. Name four ways to increase the rate of a reaction.

**VOCAB**: endothermic

exothermic

catalyst

# Stoichiometry

1. How many grams of copper would be produced from 49.48 g of chromium? Cr + CuSO4 → Cu + Cr2(SO4)3
2. How many grams of chromium are required to react with 125 mL of 0.75*M* CuSO4. (same reaction as #36)
3. How many grams of ZnS are required to react with 12.6 L of oxygen gas at STP? ZnS + O2 → ZnO + SO2
4. 6.45 g of lithium reacts with 9.20 g of oxygen gas to produce lithium oxide. How many grams of Li2O are formed?
5. What are the limiting and excess reactants in #38?
6. 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

# Liquids & Solids

Identify each intermolecular force described in 55-58.

1. Attraction between *any* two polar molecules.
2. Very weak force that increases with molar mass.
3. Attraction between two *momentary* dipoles.
4. Very strong attractive force between molecules with N-H, O-H, or F-H bonds.
5. Identify the type(s) of intermolecular forces present in the following molecules – CH4, SCl2, F2, NH3.
6. Compare and contrast liquids and solids.

Identify each type of solid in 61-65.

1. Every atom is covalently bonded to another atom.
2. Atoms are surrounded by a sea of electrons.
3. Particles are connected only by IMF.
4. There is no geometric pattern in the structure.
5. Charged particles in a geometric pattern.
6. Explain the relationship between strong intermolecular forces and the following properties – volatility, vapor pressure, and boiling point.
7. 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.

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| 1. liquid is boiling 2. solid is warming 3. solid is melting | 1. potential energy is increasing 2. kinetic energy is increasing |

**VOCAB**: surface tension crystalline vs. amorphous

capillary action sublimation

volatility heat capacity

vapor pressure heat of fusion

boiling point heat of vaporization

# Solutions

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

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

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| 1. KCl in water 2. ammonia in oil | 1. wax in C6H6 2. CH4 in water |

1. Read solubility curves (See *Nature of Solutions w/s* and *Solutions Quiz*).
2. How many grams of AlCl3 are required to make a 2.25m solution in 30.0 g of water?
3. What volume of 12*M* HCl is needed to prepare 250 mL of 0.20*M* HCl?
4. Explain the difference in preparing solutions based on molarity versus molality.
5. Which will have the greatest effect on Δtf at the same molality: C12H22O11, MgBr2, AlCl3, or NH4NO3?
6. 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 solubility

dissociation ionization

molality strong/weak/nonelectrolyte

# Acids and Bases

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

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| --- | --- |
| 1. Have a sour taste. 2. React with metals. | 1. Feel slippery 2. Turn blue litmus paper red. |

1. Define acids and bases according to Arrhenius, Brønsted-Lowry, and Lewis.
2. Identify each substance as acid, base, conjugate acid, or conjugate base. H2S + H2O → HS – + H3O+
3. Give the conjugate acids of: NH3 and Br –.
4. Give the conjugate bases of: H3O+ and HSO4–.
5. Find the pH of 0.75*M* HCl.
6. Find the molarity of a KOH solution with a pH of 9.5.
7. Is the solution in #94 acidic or basic?
8. When a neutralization reaction between a strong acid and a weak base reaches the equivalence point, will the solution be acidic, basic, or neutral?
9. 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 neutralization reaction

amphoteric substance titration

strong/weak acid/base equivalence point

# Nuclear Chemistry

Match each description with the appropriate type of radiation – alpha, beta, positron, or gamma

1. A negatively charged electron.
2. Blocked only by several feet of concrete.
3. A positively charged particle stopped by lead.
4. Blocked by paper or clothing.
5. Radiation energy with no electrical charge.

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1. Carbon-14 has a half-life of 5,730 years. If a plant contained 2.0 g of 14C when it died, how much is left after 34,380 years?

**VOCAB**: half-life fission vs. fusion mass defect critical mass

nuclear binding energy chain reaction

CHEMISTRY– FINAL REVIEW –

ANSWER KEY

1. 1s22s22p63s23p64s23d104p3
2. bottom-left
3. chemical
4. chemical
5. physical
6. low PE = high stability

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| --- | --- |
| 1. MgF2 2. N2O5 | 1. Na2SO4 2. H3PO4 |

1. potassium nitrate

H N H

H

1. hydrobromic acid
2. sulfur trioxide
3. iron(III) chloride
4. polar (see diagram)
5. nonpolar (see diagram)

F B F

F

1. 1.25 × 1023 molecules MgSO4
2. 4.6*M* KNO3
3. 12 g NaOH
4. 47.27% Cu, 52.73% Cl
5. empirical formula – CH2O, molecular formula – C6H12O6
6. One unit of solid barium chlorate when heated produces one unit of solid barium chloride and three molecules of oxygen gas.
7. 2NaClO3(s) *2*NaCl(s) + 3O2(g)
8. Cu(s) + MgSO4(aq) → N.R.
9. C5H12(l) + 8O2(g) → 5CO2(g) + 6H2O(g)
10. 2NH4Cl(aq) + Pb(NO3)2(aq) → 2NH4NO3(aq) + PbCl2(s)
11. 2Fe2O3(s) → 4Fe(s) + 3O2(g)
12. single replacement, combustion, double replacement, decomposition

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| --- | --- |
| 1. exothermic 2. endothermic | 1. endothermic 2. exothermic |

1. particles must collide, they must collide at the proper orientation, they must collide with sufficient KE
2. 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
3. 2Cr + 3CuSO4 → 3Cu + Cr2(SO4)3, 90.71 g Cu
4. 3.3 g Cr
5. 2ZnS + 3O2 → 2ZnO + 2SO2, 36.5 g ZnS
6. 4Li + O2 → 2Li2O, 13.9 g Li2O
7. limiting reactant – Li, excess reactant – O2
8. 89.9% yield
9. Boyle’s Law, P&V, inverse
10. Charles’ Law, V&T, direct
11. Gay-Lussac’s Law, P&T, direct
12. Dalton, 75.5 kPa
13. Gay-Lussac, 1180 torr
14. Boyle, 180. kPa
15. Graham, 28.0 g/mol
16. Charles, 490°C
17. Ideal, 80. L
18. Graham, 333 m/s
19. Combined, 440. L
20. 7.95 dm3 SO2 (or 7.93 dm3 SO2)
21. Real gas molecules have a volume and attract each other. They act ideal at high temperatures and low pressures.
22. Greater molar mass = slower rate of diffusion

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| --- | --- |
| 1. dipole-dipole 2. dispersion | 1. dispersion 2. hydrogen bond |

1. CH4 – dispersion

SCl2 – dispersion, dipole-dipole

F2 – dispersion

NH3 – dispersion, dipole-dipole, hydrogen bond

1. Both are incompressible with high density. Liquids are fluids. Solids have stronger IMF and slower diffusion.
2. covalent network crystal
3. metallic crystal
4. covalent molecular crystal
5. amorphous
6. ionic crystal
7. 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.
8. See w/s and quiz.

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| 1. flat 2. rising 3. flat | 1. flat 2. rising |

1. Unsaturated – solute will dissolve. Saturated – solute will not dissolve. Supersaturated – rapid crystallization.
2. Solubility of gases increases with low temps & high pressure. Solubility of solids increases with high temps.

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| 1. soluble (P/P) 2. insoluble (P/NP) | 1. soluble (NP/NP) 2. insoluble (NP/P) |

1. See worksheet and quiz.
2. 9.00 g AlCl3
3. 4.2 mL 12*M* HCl
4. Molarity – measure amount of solute, add enough water to reach the desired volume. Molality – measure amount of solute, measure kg of water, combine.
5. C12H22O11 – 1, MgBr2 – 3, **AlCl3 – 4**, NH4NO3 – 2
6. – 4.8°C

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| --- | --- |
| 1. acid 2. acid | 1. base 2. acid |

1. Arr acid – forms H3O+ 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.
2. A, B, CB, CA
3. NH4+ and HBr
4. H2O and SO42–
5. 0.12
6. 3.2 × 10-5 *M* KOH (pOH = 4.5)
7. basic
8. acidic
9. 0.13*M* Ca(OH)2
10. 0.112353 amu, 1.68 × 10-11 J

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| 1. beta 2. gamma 3. positron | 1. alpha 2. gamma |