**Academic Chemistry Final 2015**

**Study Guide ANSWERS**

**Academic Chemistry Final**:

 36 Multiple Choice Questions

 17 Short Answer/Calculations

**Resources for the final exam**

* You will be given a periodic table/ion chart and a formula sheet of equations.
* You may use a calculator (NO cell phones).

**Formula Sheet:**

**Gas Laws:**

P1V1 = P2V2

 T1 T2

PV = nRT

P = Pressure (atm)

V = Volume (Liters)

n = amount (moles)

R = .0821 L • atm = Universal Gas Constant

  mol • K

T = temperature (Kelvin)

1 L = 1000 mL

1 atm = 760 mmHg

1 atm = 101.3 kPa

STP = 273K and 1 atm

22.4L in 1 mole at STP

**Mixtures:**

Molarity = mol

L

M = Molarity or molar

**Acids and Bases:**

pH = -log [H+]

pH = power of Hydrogen concentration

[H+] = concentration of Hydrogen ions

**Chapter 10: Stoichiometry**

**Vocabulary**

* law of conservation of matter
* molar ratios

**Be able to….**

* Determine molar ratios

**Practice Problems:**

Use the following balanced equation to answer questions using mole ratios:

**2Al2(CO3)3 + 3H2SO4 🡪 2Al2(SO4)3 + 3 H2O + 3CO2**

* 1. 2:3 What is the molar ratio for Al2(CO3)3 and H2O?
	2. 3 mol How many moles of CO2 are produced when 3 moles of H2SO4 react?
	3. .37 g H2O How many grams of H2O are produced when 2.0g of H2SO4  reacts?

**H2B4O7(s) + H2O(l) → 4HBO2(aq) + 11.3 kJ**

* 1. 1:4 What is the ratio of H2B4O7 to HBO2 ?
	2. 2.5 mol How many moles of tetraboric acid (H2B4O7) are needed to make 10 moles of metaboric acid (HBO2)?
	3. 45 g How many grams of HBO2 are produced by 70 g of H2B4O7?

**Chapter 11: Heat & Energy**

**Vocabulary**

* heat
	+ temperature

**Be able to….**

* Identify exothermic vs endothermic reactions.
* Compare sources of energy for transportation, electricity, and heating.

**Practice Problems:**

Label each reaction example as **exothermic** or **endothermic**:

1. 2H2(g) + O2(g) → 2H2O(g) **ΔH°= -243 kJ** exothermic (ΔH is negative)
2. H2B4O7(s) → B2O3(s) + H2O(l) **feels warm** exothermic (exo = warm)
3. H2B4O7(s) + H2O(l) → 4HBO2(aq) + **11.3 kJ** exothermic (energy is a product)

**Sources of energy:**

1. What is the most common source of energy for transportation? gasoline (derived from OIL)

What are three alternatives? diesel, ethanol, biodiesel, fuel cell car, etc.

Which do you think is best? Explain two reasons: opinion question, support with evidence

1. What is the most common source of energy for electricity? coal

What are three alternatives? natural gas, nuclear, hydropower, solar, etc.

Which do you think is best? Explain two reasons: opinion question, support with evidence

1. What is the most common source of energy for home heating? natural gas, oil

What are three alternatives? geothermal, solar, etc.

Which do you think is best? Explain two reasons: opinion question, support with evidence

**Chapter 12: Gases**

**Vocab:**

* Kinetic Molecular Theory
* Atmospheric pressure
* Temperature
* Kinetic Energy
* Pressure
* STP

**Be able to….**

* Compare/ contrast the characteristics of solids/ liquids/ gases
* Describe the Kinetic-Molecular theory and explain how it explains gas behavior.
	+ - Define Temperature in terms of particles:
			* temperature is kinetic energy (motion of particles)
* Explain what gas pressure means and describe how it is measured.
	+ - * Pressure is collisions of the particles/ molecules with the walls of the container (force/area)
			* Measured by a barometer; units = atmospheres, mmHg, kPa, torr
* Solve problems using the gas laws.

**Practice Problems:**

Compare the characteristics of solids/ liquids/ gases:



Solids definite shape, definite volume; particles vibrate in position

Liquids indefinite shape, definite volume

Gases indefinite shape, indefinite volume; particles are far apart (low density, compressible);

particles move in straight lines and collide with walls of the container

1. **91 K** A 3.00 liter (**V1**) sample of neon gas at 0°C (T1 = 273 K) and 1.25 atm (P1) is compressed into a 1.00 liter (V2) container. If the pressure remains constant, what temperature will the container be?

**T2 = P2V2T1 🡪 T2 = V2T1 = 1.00L x 273 K = 91 K**

 **P1V1  V1 3.00L**

1. **96.22atm** What is the pressure (**P = ?**) exerted by 2 moles of oxygen confined to a volume of 500 mL (**V = .500L**) at 20 °C (**T = 293 K**)?

 **P = nRT = 2.0mol x .0821 x 293 K = 96.22atm (this Pressure seems really high?)**

 **V .500L**

1. **1.3 mol** How many moles of gas are in a 52 L (**V**) sample collected at 220 K (**T**) and .444atm?

**n = PV = .444atm x 52L = 1.3 mol**

 **TR 220K x .0821**

1. **4.9 L** Find the new volume (**V2 = ?**) when a 2.1 L (**V1**) sample of a gas collected at 245 Kelvin (**T1**) and 2.1atm (**P1**) is changed to standard conditions (**STP: T2 = 273 K, P2 = 1 atm**).

 **V2 = P1V1T2 = 2.1 atm x 2.1 L x 273 K = 4.9 L**

**T1P2 245 K x 1 atm**

1. **23 mL** Find the new volume (**V2= ?**) of a gas that changes 65 ml (**V1**) at 150 mmHg (**P1**) to 425 mmHg (**P2**).

 **V2 = P1V1T2 = V2 = P1V1 = 150 mmHg x 65 mL = 23 mL**

**T1P2 P2 425 mmHg**

1. Explain the relationship between each of the variables for the following gas laws:

Boyle’s Law:

as P increases, V must increase if T and n are constant

Charles’ Law:

as T increases, P increases (greater T = more movement = more collisions)

Avogadro’s Law:

 as n (moles) increases, V increases (think about blowing up a balloon)

**Chapter 13: Solutions**

**Vocab**

* solute substance that *dissolves (ex iced tea mix)*
* solvent substance that does the *dissolving (ex water)*
* saturated a solution that can hold no more solute
* unsaturated a solution that can hold more solute
* supersaturated a solution that has extra solute than when saturated
* polar/non-polar “like dissolves like” polar dissolves in polar; oil & water
* soluble a solid solute does dissolve in a solvent
* insoluble a solid solute does NOT readily dissolve in a solvent
* solubility curve graph illustrating solubility versus temperature of various solutes in 100g of a solvent
* miscible two liquids dissolve in one another (“like dissolves like”)
* immisicle two liquids do not mix in one another (polar/nonpolar)
* solution a homogenous mixture (kool-aid, salt water)
* colloid particles are dispersed (cloudy milk, mayo)
* suspension particles settle to the bottom (muddy water)
* Molarity a unit of concentration in moles / liter

**Be able to…**

* + Classify mixtures as solutions, colloids, or suspensions
	+ Explain colligative properties and relate to practice applications
		- salting roads, ice cream
		- adding a SOLUTE to a solvent changes the properties of a solvent (ex: lowering freezing point or increasing melting point)
		- only IONIC compounds (compounds that will dissolve in water) will change the properties of water
	+ Interpret a solubility curve
	+ Identify substances as saturated, unsaturated, or supersaturated
	+ Calculate molarity

**Practice Problems:**

Interpret solubility curves:



1. What substance is most soluble at 20oC?

KClO3

1. What substance is least soluble at 90 oC?

Ce2(SO4)3

1. What is the solubility of KNO3 at 50 oC?

80 g

1. How many grams of NaNO3 can dissolve in 100 grams of water at 60° C?

122 - 123 g

1. If 70g of KCl is dissolved at 70 oC, is the solution saturated, unsaturated, or supersatured?

supersaturated

1. **.33M** Calculate the molarity when 2 mol of CuSO4 dissolves in 6L of water.

**2 mol = .33M**

 **6 L**

1. **.80M** Find the molarity when 2.0 mol NaCl is dissolved in 2500mL of water.

 **2.0 = .80M**

 **2.500 L**

1. **.005mol** How many moles of HCl is needed to prepare 1.5 L of a 0.010 M solution.

**1.5L x .010 mol = .005mol**

 **1L**

**Chapter 15: Acids and Bases:**

**Vocabulary**

* Arrhenius Acid
* Arrhenius Base
* dissociation

**Be able to…**

* Identify substances in chemical equations as acids or bases
	+ Example Acid formulas :
	+ Example Base formulas:
* Identify the common physical and chemical properties of acids and bases
* Calculate pH of solutions

**Practice Problems:**

Label the properties of acids and bases:

|  |  |  |
| --- | --- | --- |
|  | **Acids** | **Bases** |
| Dissociates into \_\_\_\_ ions | H+ | OH- |
| pH range? | 0-7 | 7-14 |
| Taste? | Sour | Bitter |
| Feels? |  | Slipper |
| Conducts Electricity? | Yes | Yes |
| Turns litmus paper red/blue | Pink | Blue |
| Turns Phenolphthalein clear/pink | Clear | Pink |

1. 3 Find the pH of a 1.0 x 10-3 M solution of HCl

 pH = -log [1.0 x 10-3] = 3

1. 8 Find the pH of a NaOH solution where H+ = [1.0 x 10-8]

 pH = -log [1.0 x 10-8] = 8

**Chapter 16: Reaction Rates**

**Vocabulary**

* Collision Theory reactions are caused by collisions
* Catalyst increases a reaction by lowering activation energy

**Be able to…**

* Describe the two conditions for a successful chemical reaction
	+ enough energy to overcome the activation energy and correct molecular orientation
* Understand chemical reactions in terms of collision theory
* Be able to list and describe the 5 factors that affect reaction rates

**Practice Problems:**

1. What are the conditions for a chemical reaction to occur?

1) particles need enough energy to overcome the activation energy and

2) correct molecular orientation

1. Explain how the following factors change reaction rates:
* surface area of a solid reactant

increase surface area (powder) because a greater surface area means there are more possible sites for collisions = faster reaction

* concentration of a reactant

increase concentration so that there are more reactant particles which means more collisions = faster reaction

* temperature

increase temperature because temperature is a measure of the average kinetic energy, so particles move faster and collide more often = faster reaction

* nature of the reactants

the reactants must react with one another for a reaction to occur

* presence of a catalyst

catalysts speed up reactions by lowering the activation energy