Erwin AP CHEMISTRY Summer Review Name: _____

_____ period

Physical vs. Chemical Properties/Changes

1. Classify each of the following conditions as a Physical property (P) or a Chemical property (C).

_____ silver conducts an electric current

_____ when Al is added to HCl, a gas is given off and Al disappears

_____ sugar cubes disappear when added to warm water

_____ mercury's density is 13.6 g/mL

_____ gasoline burns in an automobile engine

_____ water freezes at 0°C

2. Classify each of the following conditions as a Physical change (P) or a Chemical change (C).

_____ ice melting

_____ milk sours

_____ a tire is inflated with air

_____ sugar dissolves in water

_____ food is digested in the stomach

_____ water is absorbed by a paper towel

3. List the clues/evidence that a chemical reaction has occurred.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

4. When combustion occurs, CO_2 and _____ are produced. Which product is an indication that a

_____ reaction has occurred? _____

5. When two clear aqueous solutions react and a solid is produced, this solid is called a _____.

6. By looking at a balanced chemical reaction, how can we tell a reaction took place?

_____

Identify the states of matter: (s) = (l) = (g) = (aq) =

Complete the table below using this equation: $Pb(NO_3)_2$ (aq) + 2 NaI (aq) □ PbI_2 (s) + 2 $NaNO_3$ (aq)

List Reactants	State of Matter
a)	b)
c)	d)
List Products	State of Matter
e)	f)
g)	h)
So the precipitate in the equation is	i)

7. Given the reaction: $Zn + 2\,HCl \rightarrow ZnCl_2 + H_2$ What is the indicator of a chemical change?

_____

8. Given the reaction: $2\,C_2H_6 + 7\,O_2 \rightarrow 4\,CO_2 + 6\,H_2O$ What is the indicator of a chemical change?

_____

9. You are given the following information about a sample:

Length: 3.2 cm	Mass: 5.78 g	Density: 0.87 g/mL
State of matter: solid	Color: Silver	Volume: 6.64 mL

Which piece of data can you use to identify the unknown substance? _____

10. A sample is a temperature of 50°C, has a mass of 5 g, density of 2.1 g/mL, silver in color, and a volume of 2.38 mL. Which piece of data can be used to identify the sample? _____

Density

11. What is the density of water? _____

12. Will a substance with a density of 0.5 g/mL sink or float? _____

13. Determine which of the following will float in water:

a. An object with a volume of 35 mL and a density of 1.6 g/mL.

b. An object with a mass of 4 g and density of 0.97 g/mL.

c. An object with a volume of 2 mL and density of 3.5 g/mL.

d. An object with a mass of 0.88 g and density of 1.1 g/mL.

14. A student was given an irregular object with a mass of 42.3 g. A graduated cylinder had an initial volume of 25.4 mL. After placing the object in the cylinder, the volume rose to 65.4 mL. Calculate the density and determine if the object will sink or float in water.

Sinks OR Floats

15. A density column is a container that has different samples of liquids. The liquids do not mix together. List the substances below in the order in which they would appear in a density column. Finally use the answer from question 14 and determine which layer the object would rest in if it was placed in the density column below.

Substance	**Density**
dichlorobenzene	1.30 g/mL
gasoline	0.70 g/mL
water	1.00 g/mL

Top	
Bottom	

Which layer does the object rest in? _____

Average Atomic Mass

16. Lithium has two isotopes: Li-6 is 7.5% and Li-7 is 92.5%. Which isotope has the greatest effect on its average atomic mass? _____

Periodic Table

17. A group/family is illustrated on the periodic table as a: vertical column OR horizontal row

18. A period/energy level on the periodic table is a: vertical column OR horizontal row

19. Given the information in the table, identify the family to which of the following elements belongs:

	Noble Gas Configuration	Family Name
a)	[Ar] $4s^2$	
b)	[He] $2s^2$ $2p^5$	
c)	[Ne] $3s^1$	
d)	Sodium	
e)	Magnesium	

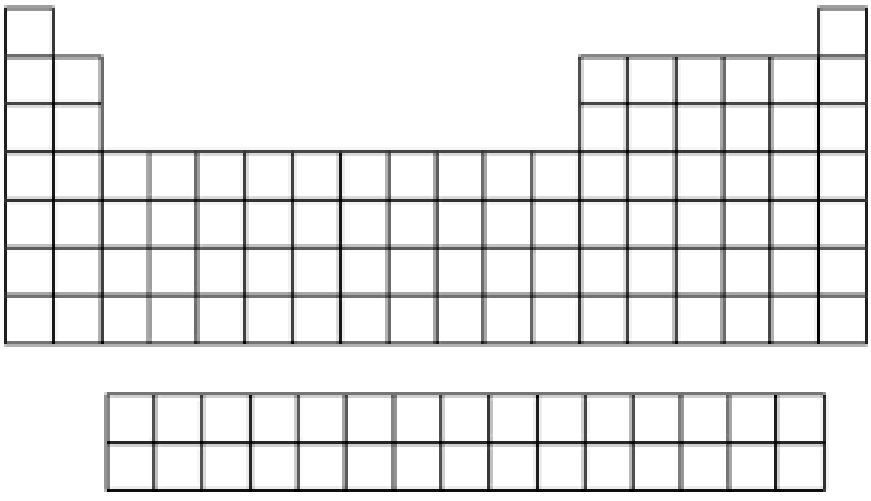
20. Name an element that would have similar properties as calcium: _____

Why does it have similar properties? _____

21. Label the following on the periodic table below: Label the groups, place a line to separate metals/non-metals (label metals area and nonmetals area) and finally, place an X on the gases at room temperature and circle the liquids at room temperature.

Label:

Alkali Metals	S-block
Alkaline Earth Metals	P-block
Transitional Metals	D-block
Halogens	F-block
Noble Gases	



Periodic Trends

22. What is a periodic trend? _____

23. Define electronegativity. _____

24. Which element is the most electronegative? _____

25. As you go across periods (left to right), electronegativity _____, and as you go down families (top to bottom), electronegativity _____.

26. The electronegativity values of the noble gases are _____.

    Why? _____

27. What does atomic radius measure? _____

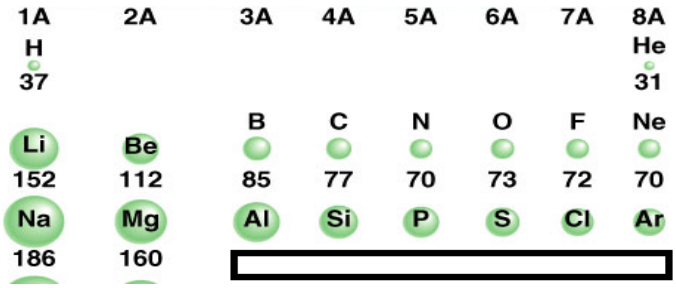
28. As you move across a period (left to right), atomic radius values _____. As you go down a family (top to bottom), atomic radius _____.

29. Circle one element for each row. Which element in the group below has the:

a. highest first ionization energy	O	S	Te			
b. largest radius	O	S	Te			
c. lowest electronegativity	O	S	Te			
d. highest electronegativity	Na	Rb	Cu	N	F	He
e. highest first ionization energy	Na	Rb	Cu	N	F	He
f. largest atomic radius	Na	Rb	Cu	N	F	He

30. Based on the picture, which set of numbers would make the most sense for the atomic radii in the missing box?

a. 98, 99, 103, 110, 118, 143
b. 143, 118, 110, 103, 99, 98
c. 72, 65, 62, 59, 50, 44
d. 44, 50 , 59 62, 65, 72



31. Which subatomic particle identifies the atom? _____

32. Fill in the following table.

Element	Mass Number	Atomic Number	#Protons	#Neutrons	#Electrons	Ion?
Calcium-42						
Aluminum					10	
Iodine						
		17				
			29	37		

Metals, Nonmetals, Metalloids

33. An element that cannot conduct electricity, is dull, and is found on the right side of the periodic table would be classified as a _____.

34. List the properties and locations of metals, nonmetals, and metalloids.

	Metals	**Nonmetals**	**Metalloids**
Appearance			
State of Matter			
Conductive?			
Does it react with acid?			
Location in relation to stair step			
What type of ions do they typically form? (cation OR anion)			

35. Which of the following contains a metal, nonmetal, and a metalloid?
a. Al, C, Si b. Li, Si, Ca c. Cu, Na, Cl d. Ar, P, Si

Electrons

36. During the flame test, as the solution is heated, electrons move from the _____ state to the _____ state. As the electrons fall back _____ they release energy in the form of _____.

37. Identify the elements with the following noble gas configurations:

a. [Ar] $4s^2$ $3d^{10}$ $4p^2$ _____ b. [He] $2s^2$ $2p^4$ _____

38. What is the correct configuration for

a. Bromine _____

b. Manganese _____

39. What is the correct noble gas configuration for

a. Calcium _____

b. Fluorine _____

40. Given the following electron configuration, identify the element and determine what this element wants to do to become a stable ion. $1s^2$ $2s^2$ $2p^6$ $3s^2$

a. Identify the element: _____

b. What does it want to do to become a stable ion? (gain/lose how many electrons) _____

41. Given the electron configurations, put a square around the electron configuration that is most stable. Circle the configuration of the most active metal.

a. $1s^2$ $2s^2$ $2p^3$ b. $1s^2$ $2s^2$ $2p^4$ c. $1s^2$ $2s^2$ $2p^6$ $3s^1$ d. $1s^2$ $2s^2$ $2p^6$

Ionic Bonds

42. What is the oxidation number on

a. aluminum ion: _____ b. chlorine ion: _____ c. magnesium ion: _____

43. When chlorine forms an ionic bond, it would want _____ electrons to become a stable ion.

44. Does oxygen need to gain or lose electrons to become a stable ion? _____ How many? _____

45. Does Mg need to gain or lose electrons to become a stable ion? _____ How many? _____

46. When Fe^{+3} and O^{-2} form a compound it is called: _____

47. What is the correct formula for Copper(I) chloride? _____

48. What is the formula when aluminum and oxygen combine? _____

49. Name LiCl: _____

50. What is the formula for magnesium and the polyatomic ion phosphate? _____

51. What is the formula for the compound formed with magnesium and chlorite ions? _____

52. What is the formula for silver (+1) and the polyatomic ion nitrate? _____

53. What is the formula when zinc (+2) and oxygen combine? _____

54. Use the information in the data table to create the formula and name the following compounds:

Ammonium	NH_4^{+1}	Nitrate	NO_3^{-1}
Iron (II)	Fe^{+2}	Nitrite	NO_2^{-1}
Aluminum	Al^{+3}	sulfate	SO_4^{-2}
Magnesium	Mg^{+2}	sulfite	SO_3^{-2}
Copper (I)	Cu^{+1}	carbonate	CO_3^{-2}

	Formula	Name
a. Copper(I) and carbonate		
b. Aluminum and nitrate		
c. Ammonium and sulfate		
d. Magnesium and sulfite		

Covalent Bonds

55. Covalent bonds _____ electrons to achieve an octet of electrons.

56. Ionic bonds _____ electrons to achieve an octet of electrons.

57. How do you get an octet of electrons for the atoms below?

Atom	Will it lose or gain electrons?	How many electrons lost/gained?	Cation or Anion
S			
N			
Ca			
Mg			
Al			

58. Name the following and show the sharing of electrons to achieve an octet of electrons:

a. CCl_4 _____

b. CO_2 _____

c. CF_6 _____

d. H_2O _____

59. What is the formula for pentanitrogen heptahydride? _____

60. Please match the following. Some answers will be left over.

a. C_2O_2_____

b. CO_2 _____

c. C_2O _____

d. CH_4 _____

i. Carbon tetrahydride

ii. Carbon dioxide

iii. Dicarbon dioxide

iv. Dicarbon monoxide

v. Monocarbon dioxide

vi. Carbon pentachloride

vii. Carbon hydride

Equations

61. Predict the products and balance the following equations. Identify the type of reaction.

a. ___ Na + ___ Li_2SO_4 □ ___ _____ + ___ _____ type: _____

b. ___ $Ca(OH)_2$ + ___ HCl □ ___ _____ + ___ _____ type: _____

c. ___C_2H_6 + ___O_2 □ ___ CO_2 + ___ H_2O type: _____

d. ___Ca + ___H_2SO_4 □ ___ _____ + ___ _____ type: _____

e. ___K_2CO_3 + ___$Sr(ClO_3)_2$ □ ___ _____ + __ _____ type: _____

f. ___H_2O_2 □ ___H_2O + ___O_2 type: _____

62. Predict the products, balance, and classify each of the following equations:

a. Aluminum phosphide + Lithium chloride □ type: _____

b. Iron(III) + Sodium nitrate □ type: _____

c. Aluminum chloride + Fluorine □ type: _____

d. Ammonium carbonate + Lithium sulfide □ type: _____

e. Chromium(III) nitrate + Potassium □ type: _____

Bonding (Intramolecular Forces) and Intermolecular Forces

63. When Magnesium reacts with Oxygen gas what is produced? Show what happens to each atom's electrons and determine the type of bond formed.

64. In #63, if 25 g of Magnesium reacted with 30 g of Oxygen, how many grams of product are produced?

65. Draw diagrams of polar and nonpolar covalent molecules (show using circles). Give an example of each and include their definitions.

a. Polar Covalent

b. Nonpolar Covalent

66. Intermolecular forces

a. (increase/decrease) as viscosity increases.

b. (increase/decrease) as melting point increases.

67. Which has the strongest forces: solids, liquids, or gases?

68. Rank the following molecules from strongest to weakest:

a. _____ water

b. _____ sodium fluoride

c. _____ carbon dioxide

Moles

1. What is a mole? How is Avogadro's number related to it?

2. Determine the molar masses for the following:
   a. $FeCO_3$ b. $Al_2(CrO_4)_3$

3. Convert 5.68 moles of phosphorus, P, to atoms.

4. Convert 6.2 moles of carbon dioxide, CO_2, to mass in grams.

5. Convert 36 grams of nitric acid, HNO_3, to molecules.

6. Find the percent of chlorine in iron(III) chloride, $FeCl_3$.

7. Give the empirical formulas for the following compounds:
   a. C_8H_{18} b. $C_2H_6O_2$ c. N_2O_4

8. The composition of acetic acid is 40.00% carbon, 6.71% hydrogen, and 53.29% oxygen. Calculate the empirical formula for acetic acid.

9. An unknown compound was found to have a molar mass of 92.09 g/mol and an empirical formula of CH_2O.d What is its molecular formula?

Stoichiometry

1. Give the mole ratios below for the following reaction: $2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$

a. $KClO_3$:O_2 _____ b. O_2:KCl _____

Use the following equation to answer the following questions: $3\ Li + AuCl_3 \rightarrow 3\ LiCl + Au$

2. How many moles of lithium chloride, LiCl, can be produced from 4.5 moles of $AuCl_3$?

3. How many grams of gold, Au, can be produced from 2.75 moles of lithium, Li?

4. How many grams of gold chloride, $AuCl_3$, are needed to produce 143 g of lithium chloride, LiCl?

Solutions

1. What is the difference between dissociation and solvation? Describe what happens during both processes and what type of compounds use them.

2. What three factors affect the rate of solvation of a solid in a liquid?

3. Identify all the ways to increase the rate of solvation for a solid in a liquid.

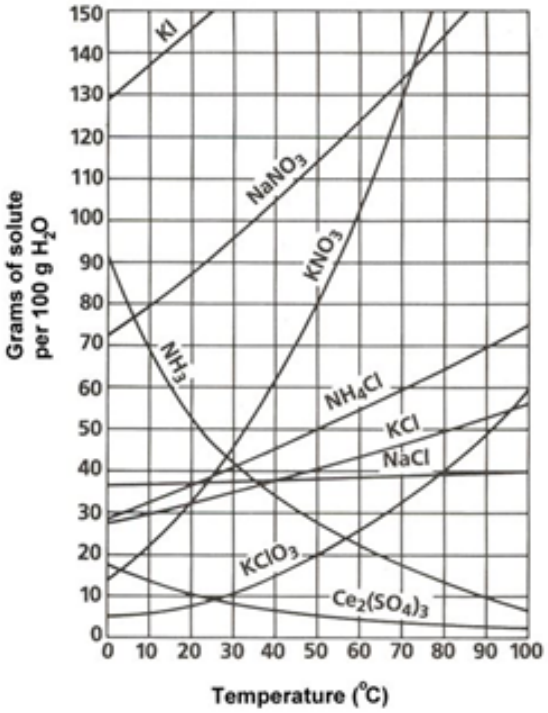
4. What factors affect the rate of solvation of a gas in a liquid?

5. How many liters of a 1.25 M HCl solution would you make if you used 85 grams of HCl?

6. What is the molarity of 0.75 L of KNO_3 solution made with 210 g of KNO_3?

7. What is the percent by mass of a potassium chloride solution containing 65 g of KCl in 285 g of water?

Use the solubility curve graph below to answer the following questions:



8. How many grams of potassium nitrate, KNO_3, can be dissolved in 100g of water at 70°C?

9. Will ammonium chloride, NH_4Cl, be saturated or unsaturated if 60 grams are placed in 100g of water at 70°C?

10. How many grams of KNO_3 does it take to make a saturated solution at 50°C?

11. Explain how you would prepare a 1.0 L solution of 2.5 M KNO_3.
    a. How many grams of KNO_3 would you need to dissolve into the solution?

    b. How much water will you add?

    c. What would be on the correct label for the solution?

Acids & Bases

1. Give 5 characteristics of Acids.

2. Give 5 characteristics of Bases.

3. Identify whether the following substances are acids (A) or bases (B).

a. tastes sour _____
b. changes red litmus to blue _____
c. turns phenolphthalein pink _____
d. changes blue litmus to red _____
e. reacts with metals _____
f. feels slippery _____
g. tastes bitter _____
h. feels like water _____
i. has pH greater than 7 _____
j. feels like water _____

3. Define the following:

a. Arrhenius acid:

b. Arrhenius base:

c. Bronsted-Lowry acid:

d. Bronsted-Lowry base:

4. Identify the following as acid (A), base (B), or neutral (N).

a. vinegar _____
b. alkaline _____
c. lemon juice _____
d. pH 3 _____
e. bleach _____
f. pH 7 _____
g. ammonia _____
h. coffee _____
i. NaOH _____
j. pure water _____

5. How can one determine if an acid or base is strong? Which type of acid/base can conduct electricity - strong or weak? Explain!

6. What is pH? What does it tell about the strength or weakness of an acid?

7. What pH values determine whether a substance is acidic, neutral, or basic?

8. What is neutralization? Give a general equation for neutralization.

9. Name the following:

H_3N _____ _____

HNO_2 _____ _____

HNO_3 _____

HClO _____

$HClO_4$ _____

H_2S _____

Thermochemistry

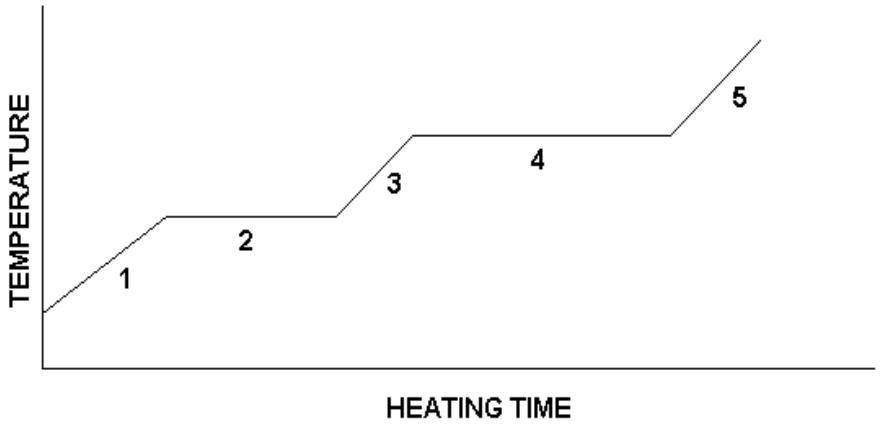
1. How much heat must a 325 g sample of water absorb to raise its temperature from 15°C to 70°C? The specific heat of water is 4.184 J/g°C.

2. What is the specific heat of a 275 g sample of nickel if it absorbs 6,050 J of energy as it is heated from 25°C to 75°C?

3. What is an exothermic reaction? What happens to the system in an exothermic reaction?

4. What is an endothermic reaction? What happens to the system in an endothermic reaction?

5. Label the heating curve below. Include the states of matter and phase changes.



5. Use Hess's law to determine the heat of reaction for the following equation using the information below.

Calculate the enthalpy for this reaction:

$2C(s) + H_2(g) \text{ ---> } C_2H_2(g)$ $\Delta H° = ???$ kJ

Given the following thermochemical equations:

$C_2H_2(g) + {}^5/_2O_2(g) \text{ ---> } 2CO_2(g) + H_2O(\ell)$ $\Delta H° = -1299.5$ kJ

$C(s) + O_2(g) \text{ ---> } CO_2(g)$ $\Delta H° = -393.5$ kJ

$H_2(g) + {}^1/_2O_2(g) \text{ ---> } H_2O(\ell)$ $\Delta H° = -285.8$ kJ

6. Use Hess's law to determine the heat of reaction for the following equation using the information below.

$N_2(g) + 2H_2(g) \rightarrow N_2H_4(l), \ \Delta H = ?$

$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$ $\Delta H = -484$ kJ

$N_2(g) + 2H_2O(g) \rightarrow N_2H_4(l) + O_2(g)$ $\Delta H = +534$ kJ

Kinetics

1. What is collision theory?

2. What are the five factors that can affect the rates of reaction?

3. Explain how the five factors given in #2 can affect the rates of reaction.

4. What is a catalyst? How can it increase the rate of a chemical reaction?

Gas Laws

1. Give the equations for the following gas laws. State whether the law describes a direct or inverse relationship between its variables and what happens if one of the variables is increased.

   a. Boyle's Law: _____ Inverse OR Direct

   b. Charles' Law: _____ Inverse OR Direct

   c. Gay-Lussac's Law: _____ Inverse OR Direct

2. Write the equation for the Ideal Gas Law and explain what each variable represents. Give the units for the variables as well.

3. Define STP.

4. What unit must all temperatures be in when solving gas law problems? What equation do you use to convert temperature scales?

5. Convert the following temperatures:

   a. Convert -25°C to K: _____

   b. Convert 451 K to °C: _____

6. Calculate the final pressure inside a scuba tank after it cools from 1000°C to 25.0°C. The initial pressure in the tank was 130.0 atm.

7. A sample of gas has a volume of 15 L and a pressure of 2.0 atm. If the pressure on the gas increases to 3.5 atm, what will the new volume be for the gas sample?

8. An expandable container contains a gas sample with a volume of 15 mL. The sample's temperature is 20°C. What will the temperature of the sample be, in Celsius, if the volume is decreased to 5 mL.

9. How many moles of a gas would be present in a sample of gas that has a volume of 44 L at STP?

10. What is the volume of 8.0 moles of CO_2 at a temperature of 50°C and a pressure of 4.2 atm?

11. What is the molar volume of any gas at standard temperature and pressure (STP)?

12. Calculate the volume of 2.0 moles of a gas at STP.

13. If a CO_2 gas sample occupies a volume of 50.5 L at STP, how many moles of CO_2 are in the sample?