

(Formula Sheet) –given to you on the semester test

<u>Common Polyatomic Ions</u>			
Ion	Name	Ion	Name
NH_4^+	ammonium	IO_3^-	iodate
NO_2^-	nitrite	$C_2H_3O_2^-$	acetate
NO_3^-	nitrate	$H_2PO_4^-$	dihydrogen phosphate
HSO_4^-	hydrogen sulfate	CO_3^{2-}	carbonate
OH^-	hydroxide	SO_3^{2-}	sulfite
CN^-	cyanide	SO_4^{2-}	sulfate
MnO_4^-	permanganate	$S_2O_3^{2-}$	thiosulfate
HCO_3^-	hydrogen carbonate	O_2^{2-}	peroxide
ClO^-	hypochlorite	CrO_4^{2-}	chromate
ClO_2^-	chlorite	$Cr_2O_7^{2-}$	dichromate
ClO_3^-	chlorate	HPO_4^{2-}	hydrogen phosphate
ClO_4^-	perchlorate	PO_4^{3-}	phosphate
BrO_3^-	bromate	AsO_4^{3-}	arsenate
IO_3^-	iodate		

Electronegativity Difference	Bond Type
0 – .4	Non-polar
.41 – 1.7	Polar Covalent
>1.7	Ionic

Most active

↓

Least active

METALS

Lithium
Rubidium
Potassium
Calcium
Sodium
Magnesium
Aluminum
Manganese
Zinc
Iron
Nickel
Tin
Lead
Copper
Silver
Platinum
Gold

Most active

↓

Least active

HALOGENS

Fluorine
Chlorine
Bromine
Iodine

Semester Test Breakdown

Standards	Number of test questions
HS-PS1-1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	MC: 17 PT: 1
HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties	MC: 12 PT: 1
HS-PS1-3 Plan and carry out an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles	MC: 15
HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction	MC: 12 PT: 1
HS-PS1-8 Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay	MC: 6 PT: 1
HS-ESS1-1 Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.	MC: 1
HS-ESS1-3 Communicate scientific ideas about the way stars, over their life cycle, produce elements	MC: 3
HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.	MC: 4

Total Questions: 70 points Performance Task: 27 points Overall: 97 points

A. Unit 1: Atomic Structure and Nuclear Chemistry

1. You should be familiar with the following vocabulary. Circle any words that are unfamiliar & define them on a separate sheet of paper.

<i>alpha decay</i>	<i>beta decay</i>	<i>group</i>	<i>metalloid</i>	<i>nucleus</i>
<i>atom</i>	<i>electron</i>	<i>isotope</i>	<i>neutron</i>	<i>period</i>
<i>atomic mass</i>	<i>fission</i>	<i>mass number</i>	<i>noble gas</i>	<i>proton</i>
<i>atomic number</i>	<i>fusion</i>	<i>metal</i>	<i>nonmetal</i>	

2. What is the difference between fusion and fission?

fusion - nuclei combining fission - nuclei splitting

3. What elements are most abundant in the universe?

lighter mass elements (H & He)

4. Describe how elements are formed in stars.

through the fusion of light elements

5. What is an alpha particle?

${}^4_2\text{He}$ → Helium nuclei

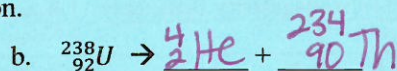
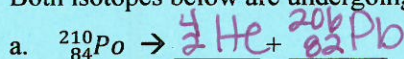
6. What is a beta particle?

${}^0_{-1}\beta$ → an electron

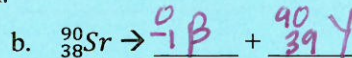
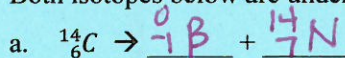
7. What type of radiation is the most penetrating: alpha, beta or gamma?

gamma (most penetrating) — alpha (least penetrating)

8. Both isotopes below are undergoing alpha decay. Complete the reaction.



9. Both isotopes below are undergoing beta decay. Complete the reaction.



10. Circle "p" proton, "n" neutron, and/or "e" electron. There may be more than one answer.

p n e 1+ charge

p n **e** located in "empty space" around nucleus

p n **e** 1- charge

p n **e** must be the same in an element and its ion

p n **e** changes to gain stability (form an ion)

p n **e** no charge

p **n** **e** contributes to most of an element's mass

p **n** **e** relatively "big" particle(s) (~1 amu)

p n e determines element's identity

p n **e** same in different isotopes of the same element

p n **e** determines element's reactivity

p n **e** varies in different isotopes of an element

p **n** **e** located in nucleus

p n **e** very small particle(s) (1/1840 amu)

11. Complete the following table.

Isotope Name	Isotope Symbol	Protons	Electrons	Neutrons	Mass Number
Carbon-12	${}^{12}_6\text{C}$	6	6	6	12
Nitrogen-15	${}^{15}_7\text{N}$	7	7	8	15
Chlorine-35	${}^{35}_{17}\text{Cl}$	17	17	18	35
Uranium-235	${}^{235}_{92}\text{U}$	92	92	143	235

12. There are 2 isotopes of Boron: Boron-10 and Boron-11. Which isotope is more abundant and why?

Boron-11; the atomic mass is closest to mass #11

Atomic mass is the average of all naturally occurring isotopes

B. Unit 2: Periodic Table

1. You should be familiar with the following vocabulary. Circle any words that are unfamiliar & define them on a separate sheet of paper.

actinides	cation	f block	noble gases	s block
alkali metals	core electrons	ground state	orbital	shielding effect
alkaline earth metals	d block	halogens	p block	sublevel
anion	electronegativity	Hund's rule	Pauli Exclusion Principle	transition elements
atomic radius	energy level	ion	representative/main block elements	valence electrons
Aufbau principle	excited state	lanthanides		

2. Know the shape of each set of electron clouds, the number of orbitals & the maximum number of electrons in each sublevel.

Sublevel	Shape of electron clouds	Number of orbitals	Maximum number of electrons
s	sphere	1	2
p	dumbbell	3	6
d		5	10
f		7	14

3. Know which sublevels and orbitals are in each energy level.

Energy Level	Sublevels (s, p, d, or f)	Number of orbitals
1	s	1
2	s, p	4
3	s, p, d	9
4	s, p, d, f	16

4. Be able to write ground state electron configurations for elements from the periodic table. Ex. F = $1s^2 2s^2 2p^5$ Write ground electron configurations for the following:

- a. Mg $1s^2 2s^2 2p^6 3s^2$
- b. Zn $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$
- c. Nitrogen $1s^2 2s^2 2p^3$
- d. Lead $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^{10} 6p^2$

5. Be able to draw orbital diagrams for elements from the periodic table. Remember that only 2 electrons (drawn as arrows) can fill any orbital (box) and that they need to have opposite spins (one arrow up and one arrow down). Draw orbital diagrams for the following:

- a. Mg
- b. O
- c. Si
- d. Ar

6. Be able to write electron configurations using noble gas notation/configuration. Ex. Na = [Ne] $3s^1$ Write the noble gas notation/configuration for the following:

- a. Br [Ar] $4s^2 3d^{10} 4p^5$
- b. Si [Ne] $3s^2 3p^2$
- c. Sr [Kr] $5s^2$
- d. K [Ar] $4s^1$

7. What is the octet rule?

8. Be able to use the periodic table to determine the group & period for an element. Complete the following table:

Element	Group Number	Period Number
Na	1	1
O	16	2
Cl	17	3
P	15	3

9. Be able to describe the properties of the major groups on the periodic table.

Group Number	Group Name	Properties
1	Alkali	- most reactive metals - 1 valence electron - (+) charge ion
2	Alkaline Earth	- very reactive (less than alkali metals) - 2 valence electrons - (2+) charged ions
17	Halogens	- most reactive non-metals - 7 valence electrons - (-) charged ions
18	Noble Gas	- non reactive - 8 valence electrons
	Lanthanides/actinides	- below periodic table - RADIOACTIVE

10. Be able to describe the properties of metals, metalloids, & nonmetals. Circle "m" metal, "md" metalloid, or "nm" nonmetal.

- a. m md **nm** usually brittle solids & gases
- b. m md **nm** forms negative ions
- c. **m** md nm form positive ions
- d. **m** md nm good conductors
- e. m **md** nm like metals and nonmetals
- f. **m** md nm malleable and ductile
- g. m md **nm** poor conductors
- h. m **md** nm semiconductors
- i. **m** md nm shiny, hard, dense

11. Identify what type of element is present: circle Metal (m), Metalloid (md), or Nonmetal (nm).

- a. Fe **m** md nm
- b. Si m **md** nm
- c. Na **m** md nm
- d. He m md **nm**
- e. H m md **nm**
- f. U **m** md nm
- g. Mg **m** md nm
- h. Cl m md **nm**

12. Identify and use the trends on the periodic table including electronegativity, ionization energy, atomic radius, shielding effect and nuclear radius. List the trend down a group and across a period for each.

	Definition	Trend Across a Period	Trend Down a Group	Choose which element has the larger value
Electronegativity	ability of an element to attract an electron	↑	↓	a. Al or B b. Fe or Cu c. Br or Cl
Atomic Radius	size of an element's atom	↓	↑	d. N or O e. Rb or Fr f. P or Mg

representative elements: groups 1, 2, 13-18

13. How can we use the periodic table to predict the charge of an ion formed by a representative element?
 - determine valence electrons from the group #
 - gain/lose to form an octet
14. Complete the following sentences about the formation of ions. If given a choice of words to complete the sentence, circle the correct word.

a. Metals always (gain, lose) electrons to form (anions, cations) while nonmetals always (gain, lose) electrons to form (anions, cations).

b. Answer the following questions about sulfur:

- i. Write the ground state electron configuration for sulfur: $1s^2 2s^2 2p^6 3s^2 3p^4$
 ii. Will sulfur gain or lose electrons to form an ion? gain How many? 2 electrons
 iii. When the sulfur ion is formed, it has the electron configuration of which noble gas? Argon
 iv. Is the sulfur ion a cation or an anion? anion How do you know? negative charge (gain e⁻)
 v. What is the name of the sulfur ion? sulfide

c. Answer the following questions about calcium:

- i. Write the ground state electron configuration for calcium: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
 ii. Will calcium gain or lose electrons to form an ion? lose How many? 2 electrons
 iii. When the calcium ion is formed, it has the electron configuration of which noble gas? Argon
 iv. Is the calcium ion a cation or an anion? cation How do you know? positive charge (lose e⁻)
 v. What is the name of the calcium ion? calcium

C. Unit 3: Bonding

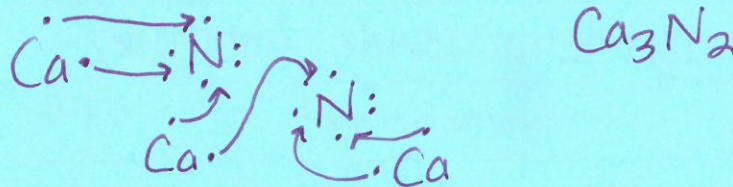
1. You should be familiar with the following vocabulary. Circle any words that are unfamiliar & define them on a separate sheet of paper.

Binary ionic compound	Lewis structure	Polyatomic ion	Unshared/lone pair
Crystal lattice	Molecular compound	Single bond	Valence electrons
Double bond	Molecular formula	Structural formula	
Electrolyte	Nonpolar covalent bond	Multivalent/variable state metal	
Ionic bond	Polar covalent bond	Triple bond	

2. Know which elements are transition metals. Circle the transition metals in the following list.

<u>Fe</u>	Na	Br	Mg	Co	Cl	H	P
<u>Cu</u>	K	O	Pb	<u>Zn</u>	N	<u>Cr</u>	<u>Mn</u>

3. Be able to tell and show how atoms gain and lose electrons to become stable. What does nitrogen do and what does calcium do to become stable? Use electron dot structures to show how nitrogen and calcium form a compound. Include the name and formula of the compound that is formed.



4. Determine if the property describes Ionic and Covalent Bonding

- | | |
|---|--|
| a. <u>I</u> C Created through the transfer of electrons | h. <u>I</u> C All states of matter at room temperature |
| b. <u>I</u> C Created through the sharing of electrons | i. <u>I</u> C Attraction of + and - ions |
| c. <u>I</u> C Hard yet brittle solids | j. <u>I</u> C Conducts electricity when dissolved in water |
| d. <u>I</u> C High melting and boiling points | k. <u>I</u> C Individual molecules |
| e. <u>I</u> C Low melting and boiling points | l. <u>I</u> C Combination of a metal and a nonmetal |
| f. <u>I</u> C Poor conductor of heat | m. <u>I</u> C Never conducts electricity |
| g. <u>I</u> C Always solids at room temperature | |

5. What is the basic structure of all ionic compounds? crystal lattice. (See the picture for a hint.)

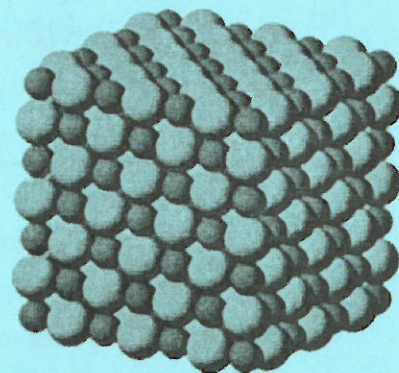
6. Describe this basic structure of ionic compounds.

positive & negative ions attract



7. How do you know if a bond is ionic or covalent using your periodic table?

ionic compounds have metals in them



Be able to write names and formulas of ionic and covalent compounds.

Type of Compound (ionic or covalent)	Name	Formula
8. covalent	dinitrogen pentoxide	9. N_2O_5
10. covalent	trisulfur heptoxide	11. S_3O_7
12. ionic	13. ammonium chloride	NH_4Cl
14. covalent	15. tetraphosphorus decoxide	P_4O_{10}
16. ionic	17. potassium phosphate	K_3PO_4
18. ionic	Zinc hydroxide	19. $Zn(OH)_2$
20. ionic	iron (II) chloride	21. $FeCl_2$
22. ionic	23. manganese (II) sulfite	$MnSO_3$
24. ionic	25. tin (IV)	$Sn(HCO_3)_4$
26. ionic	Silver nitrite	27. $AgNO_2$
28. ionic	Nickel (III) sulfite	29. $Ni_2(SO_3)_3$
30. covalent	31. carbon tetrahydride (methane)	CH_4
32. ionic	Aluminum carbonate	33. $Al_2(CO_3)_3$

Be able to draw Lewis structures.

Compound	Lewis Structure (Structural Formula)	Compound	Lewis Structure (Structural Formula)
34. CCl_4	$\begin{array}{c} :Cl: \\ \\ :Cl - C - Cl: \\ \\ :Cl: \end{array}$	35. H_2S	$\begin{array}{c} :S: \\ / \quad \backslash \\ H \quad \quad H \end{array}$

Compound	Lewis Structure (Structural Formula)	Compound	Lewis Structure (Structural Formula)
36. CS ₂		37. C ₂ H ₄	
38. NH ₃		39. CH ₂ O	

40. Use the electronegativity table to determine polar covalent and nonpolar covalent bonds.
- A difference in electronegativities from **0-0.4** is nonpolar covalent and electrons are shared equally.
 - A difference of **0.4-1.7** is a(n) polar covalent covalent bond and electrons are shared unequally.
 - A difference of greater than **1.7** is a(n) ionic bond. Electrons are transferred rather than shared.
41. Determine the electronegativity difference and classify the bonds as polar covalent, nonpolar covalent, or ionic. Then, if the bond is *polar covalent*, label the atoms as slightly (partial) positive and slightly (partial) negative (see examples on page 267).

Bond	Electronegativity Difference (Show work - pg. 266 in your book!)	Polar, Nonpolar or Ionic? Why?
Cl—Cl	0	nonpolar, <0.4
C—S		
N—H		
H—S		
H—O		
Se—Br		
Na—Cl		

D. Unit 4: Chemical Reactions

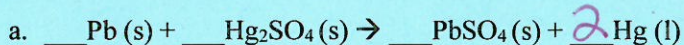
1. You should be familiar with the following vocabulary. Circle any words that are unfamiliar & define them on a separate sheet of paper.

Activity series	Decomposition reaction	Law of Conservation of	Single replacement	Synthesis reaction
Balanced equation	Diatomic molecules	Mass	reaction	Word equation
Coefficient	Double replacement	Products	Skeleton equation	
Combustion reaction	reaction	reactants	Subscript	

2. State the Law of Conservation of Mass. How does it apply to chemical reactions?

Mass cannot be created or destroyed in a chemical process. → Chem. reactions must be balanced

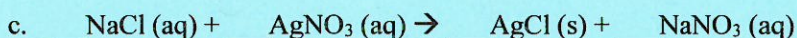
3. Balance and name the types of reactions for the following equations:



single replacement



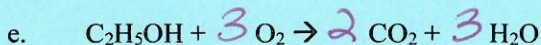
decomposition



double replacement

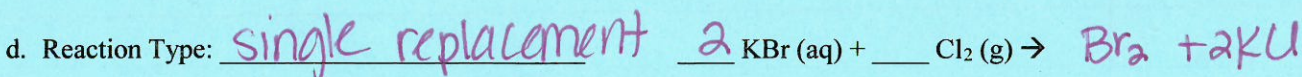
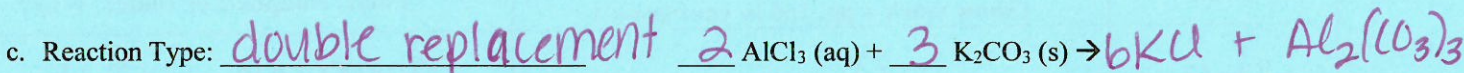
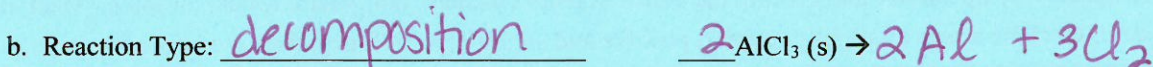
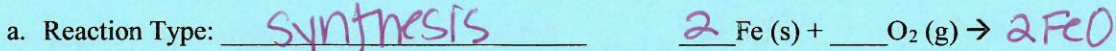


synthesis



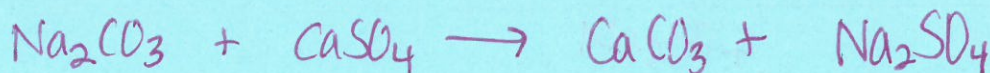
combustion

4. Identify the reaction type(s), then complete and balance the following reactions. If the reaction is a single replacement reaction, first determine if the reaction will happen using your activity series. If the reaction does not occur, explain why not.



5. Write and balance chemical equations for the following. Include states of matter if given.

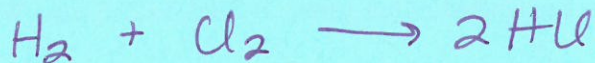
a. Solid calcium carbonate and aqueous sodium sulfate can be produced by mixing aqueous solutions of sodium carbonate and calcium sulfate.



b. Will aluminum metal react with copper (II) nitrate, Cu(NO₃)₂, to form aluminum nitrate, Al(NO₃)₃ and solid copper? If so, write the balanced chemical equation. If not, explain why not. Yes, Al is higher on the activity series



c. Hydrogen and chlorine yields hydrochloric acid, HCl.

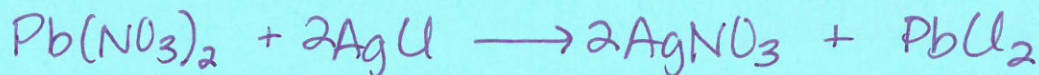


6. Write balanced chemical equations for the following reactions. You may need to predict the products if they are not given. Include the states of matter if given.

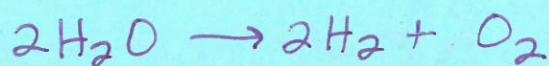
a. Water and lithium yields lithium hydroxide and hydrogen gas.



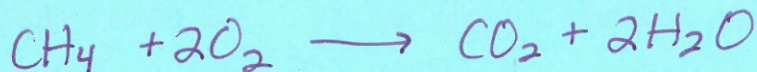
b. Solutions of lead (II) nitrate and silver chloride are mixed.



c. Water is decomposed into its elements.



d. Methane, CH₄, burns in air.



E. Unit 5 Review: Answer the following questions. Show all of your work for any calculations.

1. You should be familiar with the following vocabulary. Circle any words that are unfamiliar & define them on a separate sheet of paper.

Actual yield	Derived unit	Graphing	Mole ratio	Scientific notation
Avogadro's Number	Dimensional analysis	Limiting reactant	Molecular Formula	Significant figures
Base unit	Empirical Formula	Molar Mass	Percent Composition	Stoichiometry
Conversion Factor	Excess reactant	Mole	Percent yield	Theoretical yield

2. Answer the following questions about significant figures:

a. Why do we use significant figures?

b. What are the rules for determining significant figures when multiplying or dividing?

c. What are the rules for determining significant figures when adding or subtracting?

3. How many significant figures are in each of the following?

a. 309.56 _____ c. 1007.50 _____ e. 582.78 _____

b. 0.00675 _____ d. 3500 _____ f. 0.040 _____

4. Complete the following problems. Give the answers with the correct number of significant figures and units:

a. 523.34 mL + 66.6 mL = _____ c. 534 cm x 670.4 cm x 200 cm = _____

b. 670.5 cm - 57.223 cm = _____ d. 56.77 g / 65.0 mL = _____

5. What is the density of a substance and how is it calculated?

6. Complete the following problems. Show your work! Give the answers with the correct number of sig figs & units

a. An object with a mass of 5.5 g raises the water level in a graduated cylinder from 20.2 mL to 25.5 mL. What is the density of the object?

a. The density of aluminum is 2.7 g/mL. What is the volume of 15.0 g?

7. What is a base unit? List the 5 base units and what quantity each represents.

a. meter (length)

b. grams (mass)

c. liters (volume)

d. seconds (time)

e. Kelvin (temp.)

8. What is a derived unit? Give 2 examples of derived units and the quantity each represents.

~~SKIP~~

9. What is dimensional analysis and how do we use it in chemistry?

converting from one unit to another, use it for stoich

10. Convert the following measurements from one metric unit to another using dimensional analysis. Show your work!

a. 345.67 m = 0.34567 km

b. 0.056 mg = 56 g

c. 10.05 L = 10,050 mL

11. Be able to determine the appropriate SI units to use in measurements. What would be the correct SI units to determine:

a. The distance to New York City? km

c. The mass of a bowl of cereal? g

b. How fast you travel in your car? km/hr

d. How much you weigh? kg

12. What is scientific notation and why do we use it in chemistry?

writing large/small numbers in a simpler form

13. Convert the following to scientific notation:

a. 500000 cm = 5×10^5

b. 678000000 = 6.78×10^8

c. 0.000000000056 L = 5.6×10^{-11}

14. What is a mole?

• 1 mole = 6.02×10^{23} atoms Fe

• 1 mole = 6.02×10^{23} formula units of NaCl

• 1 mole = 6.02×10^{23} molecules of H₂O

• 1 mole = 56 g Fe

15. Calculate the number of moles of a gold sample containing 3.33×10^{24} atoms.

$$3.33 \times 10^{24} \text{ atom Au} \times \frac{1 \text{ mol Au}}{6.02 \times 10^{23} \text{ atoms Au}} = 5.48 \text{ mol Au}$$

16. Calculate the grams of 1.25 moles of magnesium chloride.

$$1.25 \text{ mol MgCl}_2 \times \frac{94 \text{ g MgCl}_2}{1 \text{ mol MgCl}_2} =$$

17. Calculate the grams of 1.34×10^{25} molecules of propane, C₃H₈.

18. What is the molar mass of ammonium dichromate, (NH₄)₂Cr₂O₇? _____

19. Compare an empirical formula to a molecular formula.

the molecular formula is a multiple of the empirical formula

20. If the molecular compound of ascorbic acid is $C_6H_8O_6$, what is the empirical formula? $C_3H_4O_3$

21. Calculate the percent composition of Lead (II) chloride.

$$PbCl_2 \quad Pb = 1 \times 207 = 207 \quad Cl = 2 \times 35 = 70 \quad \left. \begin{array}{l} 207 \\ 70 \\ \hline 277 \end{array} \right) \frac{277g}{mol}$$

$$Pb = \frac{207}{277} \times 100 = 75\% Pb$$

$$Cl = \frac{70}{277} \times 100 = 25\% Cl$$

22. How many moles of ammonium sulfate can be produced if 30.0 mol of NH_3 are reacted with excess H_2SO_4 according to the equation $2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4 + H_2$?

$$30.0 \text{ mol } NH_3 \times \frac{1 \text{ mol } (NH_4)_2SO_4}{2 \text{ mol } NH_3} = 15.0 \text{ mol } (NH_4)_2SO_4$$

23. If 20.5 moles of Zn react with excess H_2SO_4 how many grams of $ZnSO_4$ will be produced? $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

$$20.5 \text{ mol } Zn \times \frac{1 \text{ mol } ZnSO_4}{1 \text{ mol } Zn} \times \frac{161g}{1 \text{ mol } ZnSO_4} = 3300.5g$$

$Zn = 1 \times 65 = 65$
 $S = 1 \times 32 = 32$
 $O = 4 \times 16 = 64$
161g/mol

24. For the reaction: $2KClO_3 \rightarrow 2KCl + 3O_2$ How many grams of $KClO_3$ must be decomposed to yield 30.0 grams of oxygen.

$$30.0g O_2 \times \frac{1 \text{ mol } O_2}{32g O_2} \times \frac{2 \text{ mol } KClO_3}{3 \text{ mol } O_2} \times \frac{122.5g KClO_3}{1 \text{ mol } KClO_3} = 74.3g KClO_3$$

$K = 1 \times 39 = 39$
 $Cl = 1 \times 35 = 35$
 $O = 3 \times 16 = 48$
122.5g/mol

25. The reactant that limits the amount of product formed is called the limiting reactant.

26. In the reaction, $2K + Cl_2 \rightarrow 2KCl$ if you have 4 moles of potassium and 3 moles of chlorine, which is the limiting reagent?

$$4 \text{ mol } K \rightarrow 4 \text{ mol } KCl$$

$$3 \text{ mol } Cl_2 \rightarrow 6 \text{ mol } KCl$$

Potassium is LR

27. How many grams of hydrogen gas are formed if 4.21 moles of zinc react with 2.75 moles hydrochloric acid, HCl , according to the following equation: $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ (Hint: If given amounts of both reactants - find limiting reactant first!)

~~SKIP~~

28. When you determine actual yield you do a(n) Experiment / Calculation? When you determine theoretical yield you do a(n) Experiment / Calculation?

29. Which is generally greater, the actual yield or the theoretical yield? theoretical yield

30. The amount of CaO produced in a reaction is 13.1 g. If the predicted yield was 13.9g,

- a. What is the actual yield? 13.1g
- b. What is the theoretical yield? 13.9g
- c. What is the percent yield? $\frac{13.1}{13.9} \times 100 = 94.2\%$

31. In the production of lead (II) chloride 24.6 grams were produced according to the following reaction: $Pb(s) + Cl_2(g) \rightarrow PbCl_2$ (s) m. If the reaction used 21.5 g of lead and excess chlorine, calculate the theoretical yield and the percent yield.

$$21.5g Pb \times \frac{1 \text{ mol } Pb}{207g Pb} \times \frac{1 \text{ mol } PbCl_2}{1 \text{ mol } Pb} \times \frac{277g PbCl_2}{1 \text{ mol } PbCl_2} = 28.8g PbCl_2$$

$Pb = 1 \times 207 = 207$
 $Cl = 2 \times 35 = 70$
277g/mol

↑
theoretical yield

$$\frac{24.6g}{28.8g} \times 100 = 85\%$$

F. Unit 1-5 Multiple Choice: Practice Questions for the Semester Test

- The correct formula of Iron (III) bromide is ____.
a. FeBr₂
b. FeBr₃
c. FeBr
d. Fe₃Br
- The formula for ammonium carbonate is ____.
a. (NH₄)₂CO₃
b. NH₄CO₂
c. (NH₃)₄CO₄
d. (NH₃)₂CO₃
- Chromium and chlorine form an ionic compound whose formula is CrCl₃. The name of this compound is ____.
b. chromium (III) chloride
a. chromium chlorine
c. monochromium trichloride
d. chromium (III) trichloride
- The formula for aluminum hydroxide is ____.
a. AlOH
b. Al₃OH
d. Al(OH)₃
c. Al₂(OH)₃
- The name of the ionic compound (NH₄)₃PO₄ is ____.
a. ammonium phosphate
b. nitrogen hydrogen phosphate
c. tetrammonium phosphate
d. ammonium phosphide
- Which formula/name pair is *incorrect*?
a. Mn(NO₂)₂ - manganese (II) nitrite
b. Mg(NO₃)₂ - magnesium nitrate
d. Mg₃N₂ - magnesium nitrite → should be nitride
c. Mn(NO₃)₂ - manganese (II) nitrate
- Which formula/name pair is *incorrect*?
a. FeSO₄ - iron (II) sulfate
b. Fe₂(SO₃)₃ - iron (III) sulfite
d. Fe₂(SO₄)₃ - iron (III) sulfide → should be sulfate
c. FeS - Iron (II) sulfide
- The suffix -ide is used ____
a. for monoatomic anion names
b. for polyatomic cation names
c. for the name of the first element in a molecular compound
d. for monoatomic cations
- The formula for the compound formed between aluminum ions and phosphate ions is ____.
b. AlPO₄
a. Al₃(PO₄)₃
c. Al(PO₄)₃
d. AlP
- Which metal doesn't require having its charge specified in the name of an ionic compound it forms?
a. Mn
b. Fe
d. Ca
c. Cu
- The nucleus of an atom contains ____.
a. electrons
b. protons, electrons, neutrons
c. protons and neutrons
d. protons and electrons
- The element ____ is the most similar to strontium in chemical and physical properties.
a. Li
b. Rb
c. Ba
d. Cs
- Horizontal rows of the periodic table are known as ____.
a. periods
b. groups
c. metalloids
d. families
- Vertical columns of the periodic table are known as ____.
a. metals
b. periods
c. groups
d. octaves
- Elements in group 1 are known as ____.
b. alkali metals
a. chalcogens
c. alkaline earth metals
d. halogens
- Potassium is a ____ and chlorine is a ____.
a. metal, nonmetal
b. metal, metalloid
c. nonmetal, metal
d. nonmetal, metalloid
- ____ are found uncombined, as monatomic species in nature.
a. noble gases
b. alkali metals
c. halogens
d. transition metals

18. When a metal and a nonmetal react, the ___ tends to lose electrons to form a(n) ____.
- a. metal, cation
b. nonmetal, cation
c. metal, anion
d. nonmetal, anion
19. When a metal and a nonmetal react, the ___ tends to gain electrons to form a(n) ____.
- a. metal, cation
b. nonmetal, cation
c. metal, anion
d. nonmetal, anion
20. The empirical formula of a compound with molecules containing 14 carbon atoms, 16 hydrogen atoms & 8 oxygen atoms is ____.
- a. $C_{14}H_{16}O_8$
b. $C_7H_8O_4$
c. CHO
d. $C_{3.5}H_4O_2$
21. What is the formula of the compound formed between strontium ions and nitrogen ions?
- a. SrN
b. Sr_3N_2
c. Sr_3N_4
d. SrN_2
22. The formula of a salt is XCl_2 . The X-ion in this salt has 28 electrons. The metal X is ____.
- a. Ni
b. Fe
c. Zn
d. Pd
23. The charge on the manganese in the salt MnF_3 is ____.
- a. +1
b. -2
c. -1
d. +3
24. Aluminum reacts with a certain nonmetallic element to form a compound with the general form AlX . Element X is a natural diatomic gas at room temperature. Element X must be ____.
- a. oxygen
b. fluorine
c. sulfur
d. nitrogen
25. All atoms of a given element have the same ____.
- a. mass
b. number of protons
c. number of neutrons
d. number of electrons and neutrons
26. An unknown element is found to have three naturally occurring isotopes with atomic masses of 35.9675 (0.337%), 37.9627 (0.063%) and 39.9624 (99.600%). Which of the following is the known element?
- a. Ar
b. Cl
c. K
d. Ca
27. Of the following, only ___ is not a metalloid.
- a. B
b. Si
c. Al
d. Ge
28. Of the choices below, which one is not an ionic compound?
- a. PCl_5
b. RbCl
c. $MoCl_6$
d. $PbCl_2$
29. Compared to the charge and mass of a proton, an electron has
- a. the same charge and a smaller mass
b. the same charge and the same mass
c. an opposite charge and a smaller mass
d. an opposite charge and the same mass
30. When alpha particles are used to bombard gold foil, most of the alpha particles pass through undeflected. This result indicates that most of the volume of a gold atom consists of
- a. deuterons
b. neutrons
c. protons
d. unoccupied space
31. Which symbols represent atoms that are isotopes?
- a. C-14 and N-14
b. O-16 and O-18
c. I-131 and I-131
d. Rn-222 and Ra-222
32. Atoms of elements in a group on the Periodic Table have similar chemical properties. This similarity is mostly due to the atoms'
- a. number of principal energy levels
b. number of valence electrons
c. atomic numbers
d. atomic masses
33. What is the molar mass of K_2CO_3 ?
- a. 138 g/mol
b. 106 g/mol
c. 99 g/mol
d. 67 g/mol

$$\begin{aligned}
 K &= 2 \times 39 = 78 \\
 C &= 1 \times 12 = 12 \\
 O &= 3 \times 16 = 48 \\
 \hline
 &138 \frac{g}{mol}
 \end{aligned}$$

34. What is the total number of atoms contained in 2.00 moles of nickel?

- a. 58.9
b. 118

35. What is the percent by mass of oxygen in magnesium oxide, MgO?

- a. 20%
b. 40%

36. What is the mass in grams of 3.0×10^{23} molecules of CO_2 ?

- a. 22 g
b. 44 g

37. The mass number of an atom is equal to:

- a. protons + electrons
b. electrons + neutrons

38. Which pair of atoms constitutes a pair of isotopes for the same element?

- a. ${}^{14}_6\text{X}$ ${}^{14}_7\text{X}$
b. ${}^{17}_9\text{X}$ ${}^{17}_8\text{X}$

39. What is the atomic number of Phosphorus?

- a. 15
b. 30

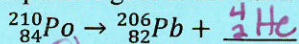
40. What term is used to describe the spitting of two nuclei?

- a. fusion
b. fission

41. Which of the following puts elements in the correct order of increasing atomic radius?

- a. Cl, Bi, P
b. Sr, Mg, Al

42. What particle goes in the blank below?

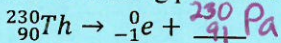


- a. alpha particle
b. beta particle

43. This type of radiation is released when Rn - 224 to Po - 220.

- a. alpha particle
b. beta particle

44. What is the missing product of the following?



- a. ${}^{230}_{91}\text{Th}$
b. ${}^{230}_{89}\text{Ac}$

45. Which of the following is the most penetrating?

- a. alpha particle
b. beta particle

$$2.00 \text{ mol Ni} \times \frac{6.02 \times 10^{23} \text{ atoms Ni}}{1 \text{ mol Ni}}$$

- c. 6.02×10^{23}
d. 1.2×10^{24}

- c. 50%
d. 60%

$$\begin{aligned} \text{Mg} &= 1 \times 24 = 24 \\ \text{O} &= 1 \times 16 = 16 \\ &= \frac{16}{40} \times 100 = 40\% \end{aligned}$$

- c. 66 g
d. 88 g

$$3.0 \times 10^{23} \text{ molec. CO}_2 \times \frac{1 \text{ mol CO}_2}{6.02 \times 10^{23}} \times \frac{44 \text{ g CO}_2}{1 \text{ mol CO}_2}$$

- c. protons + neutrons
d. protons + neutrons + electron

- c. ${}^{20}_{10}\text{X}$ ${}^{21}_{11}\text{X}$
d. ${}^{14}_6\text{X}$ ${}^{12}_6\text{X}$

- c. 30.97376
d. 31

- c. ionization
d. deionization

- c. Si, F, Cl
d. B, Li, K

- c. gamma ray
d. beta emission

- c. gamma ray
d. beta emission

- c. ${}^{231}_{89}\text{Ac}$
d. ${}^{230}_{91}\text{Pa}$

- c. gamma ray
d. all are essentially equal

G. Other Information & Tips

- You will have 50 minutes for the performance task and 90 minutes for the multiple choice test.
- Bring two #2 lead pencils and a good eraser.
- Bring something to study or read after you finish the test
- Try to get a good night's sleep.

- Eat a good breakfast. This will help put you in a good mood and help your brain function.
- Drink water (H_2O) & avoid caffeine ($\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$) & sugar ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$)