

CHEMISTRY

FALL SEMESTER FINAL EXAM REVIEW/STUDY GUIDE

Directions: Complete **ALL** questions below. Turn this in on **the day of your final.**

- **Read BELOW!!!!**
 - All answers must be ...
 - a. **hand written,**
 - b. **numbered,**
 - c. on a **separate sheet** of paper,
 - i. 4) **labeled by Unit** and
 - d. you **MUST show ALL work.** !!!!!
 - You can earn 10 bonus points on your final. **(All or None)**
 - You must correctly answer **every** questions in order to receive the bonus points

What day is my FINAL EXAM?

7th – Tuesday, 12/18

1st and 2nd – Wednesday, 12/19

3rd and 4th – Thursday, 12/20

5th and 6th – Friday, 12/21

GRADING POLICY:

Category	Percent of total possible
Summative Assessments: Tests and Projects	45%
Performance Assessments: Labs	25%
Formative Assessments: Classwork / Homework / Quiz	15%
Cumulative Final Exam	15%
Total	100%

TOPIC ANALYSIS:

Topics
Introduction, Lab Safety & Equip, Sci Method, Measures, & Calculations
Matter & Energy
Modern Atomic Theory & Atomic Structure
Periodic Table & Trends
Ions, Naming, Bonding
Chemical Reactions
Acids and Bases

UNIT 1: Math in Chemistry, Lab Equipment & Lab Safety (Ch. 1 and 2)

1. Study the lab safety rules. – Write 3 rules.

2. Know the following glassware and its use. Complete the chart below:

Name of Glassware	Use/Definition	Draw a Picture
beaker		
graduated cylinder		
watch plate		
evaporating dish		
Erlenmeyer flask		

3. Describe the proper way to smell an unknown chemical in lab.

4. What is chemistry?

5. What is qualitative data?

6. What is quantitative data?

7. What are the SI base units for mass, length, and volume?

8. How does one determine the number of significant digits in a number?

9. How many sig figs are in each of the following?

a) 0.000343

b) 34030000

c) 3200

d) 3200.0

e) 32.002

f) 0.000030340

10. What is precision?

11. What is accuracy?

12. Convert the following using dimensional analysis: (SHOW WORK!)

a) 5000cm → km

b) 32304 mL → DL

c) 8324 cg → g

d) 325.6 dm → Dm

13. Convert the following using dimensional analysis: (SHOW WORK!)

a) 19.0 ft into miles

b) 37 hours into days

c) 4.23 cm into inches

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Name: _____

Give the number of significant figures:

14. 420.0 _____

15. 7589 _____

16. 432506.43 _____

17. 0.0000476 _____

18. 0.03 _____

19. 35.17 _____

20. 0.00004 _____

21. 8671.5 _____

Express your answer to the following with the appropriate number of significant figures:22. 2.21×0.3 23. $789.234 \div 47.36$ 24. $2.90 \times 0.01733 \times 920$ 25. 2.02×4.113 26. $\frac{(72)(4.022)}{9.03}$

9.03

Convert the following:

27. 34 m = _____ cm

28. 0.15 mg = _____ g

29. 32.98 L = _____ mL

30. 1286 m = _____ km

31. 72 cm = _____ m

32. 948 mm = _____ cm

33. 32 Dm = _____ m

34. 87 km = _____ Hm

Place the following in scientific notation:

35. 0.000 000 110

36. 0.000 027

37. 6 220 000 000

38. 77 000 000 000

39. 410 000

40. 0.000 000 011

Place the following in standard form:41. 4.3×10^8 42. 2.5×10^{-10} 43. 1.2×10^{-4} 44. 6.2×10^{11} 45. 4.4×10^{-6} 46. 1.3×10^5 **Perform the following calculations:**47. 1.10×10^3) (3.922×10^6)48. (2.377×10^6) (1.81×10^9)49. $(6.30 \times 10^8) \div (2.50 \times 10^3)$ 50. $(7.64 \times 10^6) \div (1.343 \times 10^8)$ **UNIT 2: Matter and Phase Change (Ch 3)**

51. What is a physical property?

52. Give 4 examples of physical properties.

53. What is a chemical property?

54. Give 3 examples of chemical properties.

55. What is a physical change?

56. How do you know if a physical change has occurred?

57. What is a chemical change?

58. How do you know if a chemical change has occurred?

59. Label the following as chemical or physical change.

a) Silver tarnishing

b) Ice melting

c) Evaporating water from a salt
water solution

d) Burning

e) Rusting

f) Cutting

60. What are the six phase changes of matter?

61. Define each phase change of matter.

62. Draw a phase diagram and label each state of matter (3) and phase change. (6)

63. What is the difference between triple point and critical point? (label on your diagram in phase diagram above)

64. Define temperature.

65. Define element.

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66. Define compound.
67. Define mixture.
68. Label each of the following as element, compound, or mixture:
 - a) Water
 - b) salad dressing
 - c) Liquid bromine
 - d) carbon dioxide
 - e) Carbon
 - f) Kool-Aid
 - g) Salt water
 - h) Gatorade
69. What is the difference between a compound and a mixture?

Density: $D=m/V$

70. What is the formula for density?
71. What are the units of density?
72. Given that the density of iron is 11.35 g/cm^3 , what would be the volume of a 5.7 gram piece of iron?
73. What is the density of 37.72 g of water whose volume is 6.80 cm^3 ?
74. The density of Aluminum is 2.70 g/cm^3 . The volume of a solid piece of Al is 1.50 cm^3 . What is the mass of this piece?

UNIT 2 and 4a: From the Atom to the Periodic Table (Ch 4 – 6)**Atomic Theory/Isotope Notation (Ch. 4)**

75. What are all the parts Dalton's atomic theory?
76. What did Aristotle contribute to the atomic theory?
77. What did Chadwick discover?
78. What did Bohr discover?
79. What did Democritus do?
80. What did Rutherford discover?
81. How did Rutherford make his discovery? (Describe experiment)
82. What did Thomson discover?
83. How did Thomson make his discovery? (Describe experiment)
84. What is the law of definite proportions?
85. What is an isotope?
86. What do isotopes have in common?
87. How do isotopes of the same element differ?
88. How do you find the mass number?
89. How do you find the number of neutrons?
90. How do you determine the number of protons?
91. How do you determine the number of electrons?
92. What determines an element's identity?
93. What determines an element's behavior?
94. What have more in common: elements in the same period or elements in the same family?
95. What are the sub atomic particles of an atom?
96. What is the charge on each sub atomic particle in an atom?
97. Where is each sub atomic particle in the atom?
98. How many protons, neutrons, and electrons are in C^{-4} ?

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99. How many protons are present in a titanium atom with a mass of 48 g/mol?
100. Where are the metals, non-metals and metalloids on the periodic table?
101. What are valence electrons?
102. How many valence electrons does each family on the periodic table contain?
103. What is a nuclear symbol? a. C-14 d. $\frac{18}{8}\text{O}^{2-}$
104. How many protons, neutrons, and electrons are in the following? b. $\frac{42}{20}\text{Ca}$ e. $\frac{25}{12}\text{Mg}^{2+}$
- c. S-32 d. $\frac{36}{17}\text{Cl}^{-1}$

Fill in the chart:

	Nuclear Symbol	Mass Number	Atomic Number	# Protons	# Neutrons	# Electrons
105.	$\begin{matrix} 59 \\ 28 \end{matrix} \text{Ni}^{+1}$					
106.		35	17			17
107.	$\begin{matrix} 1 \\ 1 \end{matrix} \text{H}^{+1}$					
108.		32	16			18

The Periodic Table/Periodic Trends

109. Draw or print a periodic table and LABEL the following:
- a) Families/groups, periods, alkali metals, alkaline earth metals, transition metals, halogens, noble gases, lanthanides, actinides, inner transition metals, metals, non-metals, metalloids, charges of families, valence electrons of families, elements that are liquid at room temperature, elements that are gases at room temperature
110. What is group 1? What are some characteristics of group 1?
111. What is the possible charge of group 1?
112. What is group 2? What are some characteristics of group 2?
113. What is the charge on group 2?
114. What are groups 3-12 called? And what are some characteristics of these groups?
115. What is group 17 group 7A? What are some characteristics of group 7A?
116. What is the charge on group 17?
117. What is group 18/group 8A? What are some characteristics of group 8A?
118. What are the two sections at the bottom of the periodic table called?
119. Where are the radioactive elements located on the periodic table?
120. What is a cation?
121. What is an anion?
122. What is atomic radius?
123. What are the group and periodic trends of atomic radius?

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124. What is ionization energy?
125. What are the group and periodic trends of ionization energy?
126. What is electronegativity?
127. What are the group and periodic trends of electronegativity?
128. What element has the highest electronegativity?
129. What are metalloids?
130. What is the law of conservation of mass?

Trends: Circle the element described

- | | | | | |
|------|----|----|----|----------------------------|
| 131. | N | P | As | smallest ionization energy |
| 132. | O | C | N | highest ionization energy |
| 133. | Al | Si | P | most electronegative |
| 134. | Cl | Br | I | least electronegative |
| 135. | Na | K | Li | largest atomic radius |
| 136. | Na | Mg | Al | smallest atomic radius |

UNIT 4b: Electron Configuration

137. Write the long hand electron configuration, short hand electron configuration, and the orbital diagram for the following:
 - a. Magnesium
 - b. Phosphorous
 - c. Selenium
 - d. Xenon
 - e. Calcium
 - f. Oxygen
138. List the 7 diatomic molecules.
139. What element ends in $3p^3$?
140. What element ends in $6s^1$?
141. How many valence electrons are in the p orbital of Kr?
142. How many valence electrons are in the s orbital of Rb?
143. List the electron configuration/noble gas configuration/orbital notation for the following elements:
 - b) Mg
 - c) Ca
 - d) F
 - e) Se
 - f) Si
 - g) P
 - h) S
 - i) As

UNIT 5-7: Bonding and Nomenclature (Ch. 7 Ionic and Metals; Ch. 8 Covalent; Ch 18.1 Acids and Bases)

144. What are ionic compounds composed of?
145. What are covalent molecules composed of?
146. What are acids composed of?
147. How are ionic bonds formed?
148. How are covalent bonds formed?

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149. What are properties of ionic compounds?
150. What are properties of covalent compounds?
151. How do you name ionic compounds?
152. When do you use roman numerals and what do the roman numerals represent?
153. How do you name covalent compounds?
154. What are the 8 prefixes?
155. What do the prefixes in the name represent?
156. What is a Lewis structure?
157. How do you draw a Lewis structure?
158. What is a single bond?
159. What is a double bond?
160. What is a triple bond?
161. Be able to draw Lewis structures.
162. What is a binary acid?
163. What is a ternary acid?
164. What is the difference among a nonpolar and polar bond?
165. How many oxygen atoms are in aluminum hydroxide?
166. How many iron atoms are in Iron (II) sulfate?
167. What is the formula for hydrofluoric acid?
168. What is the formula for chloric acid?
169. What is the formula for perchloric acid?
170. How many lead atoms are in Lead (IV) Sulfate?
171. How many lone pairs on the central atom of Carbon tetrahydride.
172. Draw the Lewis structure of nitrogen trifluoride?
173. Draw the Lewis structure of water.
174. **Write the chemical formula and compound name for the following:**

a. Ca and NO ₃	b. V ³⁺ and CrO ₄	c. Al and OH	d. Pb ²⁺ and C ₂ H ₃ O ₂
e. Ca and PO ₄	f. K and ClO ₃	g. Fe ²⁺ and ClO ₃	h. NH ₄ and C ₂ O ₄
i. K and SO ₄	j. Sn ⁴⁺ and OH	k. Cu ⁺ and SO ₄	l. Na and PO ₄
m. Ba and NO ₃	n. Mg and NO ₃	o. K and MnO ₄	p. Cr ³⁺ and NO ₃
q. Al and SO ₄	r. NH ₄ and SO ₄	s. Sn ²⁺ and PO ₄	t. Pb ⁴⁺ and SO ₄

Molar Mass and the MOLE (Ch. 10.1)

175. What is the mole? (Definition and Number)
176. Be able to calculate molar mass.
177. What are the units of molar mass?

Write the formula for the following compounds:

- | | |
|-------------------------------|-----------------------------|
| 178. carbon tetrabromide | 182. sulfur trioxide |
| 179. silicon dioxide | 183. diphosphorus pentoxide |
| 180. tetraphosphorus decoxide | 184. dinitrogen trioxide |
| 181. diarsenic trisulfide | |

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Determine what type of bond will exist between the following pairs of atoms (Ionic, Covalent, Acid):

- | | | | | | |
|------|-----------|------|----------|------|-----------|
| 185. | H and I | 188. | S and O | 191. | K and Br |
| 186. | Se and Cl | 189. | C and H | 192. | Ca and Cl |
| 187. | Li and F | 190. | Cu and S | 193. | I and Br |

Draw the Lewis structure and predict the polarity for the following molecules:

- | | | | |
|------|------------------|------|-------------------|
| 194. | Cl ₄ | 196. | Cl ₂ O |
| 195. | BCl ₃ | 197. | PI ₃ |

Write the formula for the following acids:

- | | | | |
|------|------------------|------|-------------------|
| 198. | Carbonic acid | 202. | Arsenic acid |
| 199. | Chlorous acid | 203. | Hydrofluoric acid |
| 200. | Iodic acid | 204. | Sulfurous acid |
| 201. | Hydrobromic acid | 205. | Hypochlorous acid |

Write the correct name for the following acids:

- | | | | |
|------|--------------------------------|------|--------------------------------|
| 206. | HBr | 210. | H ₂ CO ₃ |
| 207. | H ₂ SO ₄ | 211. | HCl |
| 208. | HClO ₂ | 212. | H ₂ SO ₃ |
| 209. | H ₂ S | | |

Name the following compounds AND circle the ones that are soluble in water

- | | | | |
|------|------------------------------------|------|---|
| 213. | AgCl | 217. | Sr ₃ (PO ₄) ₂ |
| 214. | Na ₂ SO ₄ | 218. | K ₂ SO ₄ |
| 215. | NH ₄ NO ₃ | 219. | FeBr ₃ |
| 216. | Al(ClO ₄) ₃ | 220. | NaCl |

Identify the type, name AND molar mass of the compound:

	<u>Type</u> Ionic – I Covalent – C Acid – A	<u>Name</u>	<u>Molar Mass</u> (Include Unit)
221. CO ₂			
222. CCl ₄			
223. PCl ₅			
224. SeF ₆			
225. As ₂ O ₅			
226. SO ₃			
227. ICl ₃			
228. PBr ₅			

UNIT 8: Chemical Reactions (Ch. 9)

229. What is a reactant?
230. What is a product?

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- 231. What is the law of conservation of mass/matter?
- 232. Why do we balance equations?
- 233. What are Ms. Day's Helpful Balancing Hints?
- 234. What are indicators of a chemical change?
- 235. What are the 5 reaction types and describe each and provide the general equation?
- 236. What are the requirements for each type? (How do you recognize each reaction type?)
- 237. What type can be predicted using the activity series?
- 238. How is solubility determined? What are you given to help determine this?
- 239. What does soluble mean? Symbol?
- 240. What does insoluble mean? Symbol?
- 241. What is aqueous? Symbol?
- 242. What is a precipitate? Symbol?

Using the activity series, determine if the following reactions will occur. If they do, you must balance.

- 243. $\underline{\hspace{1cm}} \text{Na} + \underline{\hspace{1cm}} \text{AlBr}_3 \rightarrow \underline{\hspace{1cm}} \text{NaBr} + \underline{\hspace{1cm}} \text{Al}$ _____
- 244. $\underline{\hspace{1cm}} \text{Li} + \underline{\hspace{1cm}} \text{CuSO}_4 \rightarrow \underline{\hspace{1cm}} \text{Li}_2\text{SO}_4 + \underline{\hspace{1cm}} \text{Cu}$ _____
- 245. $\underline{\hspace{1cm}} \text{Al} + \underline{\hspace{1cm}} \text{CuSO}_4 \rightarrow \underline{\hspace{1cm}} \text{Al}_2(\text{SO}_4)_3 + \underline{\hspace{1cm}} \text{Cu}$ _____
- 246. $\underline{\hspace{1cm}} \text{Mg} + \underline{\hspace{1cm}} \text{LiNO}_3 \rightarrow \underline{\hspace{1cm}} \text{Mg}(\text{NO}_3)_2 + \underline{\hspace{1cm}} \text{Li}$ _____

Balance AND identify the following reactions:

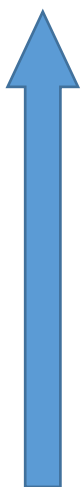

- 247. $\underline{\hspace{1cm}} \text{Mg} + \underline{\hspace{1cm}} \text{Zn}(\text{NO}_3)_2 \rightarrow \underline{\hspace{1cm}} \text{Zn} + \underline{\hspace{1cm}} \text{Mg}(\text{NO}_3)_2$ _____
- 248. $\underline{\hspace{1cm}} \text{Mg} + \underline{\hspace{1cm}} \text{AgNO}_3 \rightarrow \underline{\hspace{1cm}} \text{Ag} + \underline{\hspace{1cm}} \text{Mg}(\text{NO}_3)_2$ _____
- 249. $\underline{\hspace{1cm}} \text{NH}_3 \rightarrow \underline{\hspace{1cm}} \text{N}_2 + \underline{\hspace{1cm}} \text{H}_2$ _____
- 250. $\underline{\hspace{1cm}} \text{MgO} \rightarrow \underline{\hspace{1cm}} \text{Mg} + \underline{\hspace{1cm}} \text{O}_2$ _____
- 251. $\underline{\hspace{1cm}} \text{K} + \underline{\hspace{1cm}} \text{Cl}_2 \rightarrow \underline{\hspace{1cm}} \text{KCl}$ _____
- 252. $\underline{\hspace{1cm}} \text{Al} + \underline{\hspace{1cm}} \text{O}_2 \rightarrow \underline{\hspace{1cm}} \text{Al}_2\text{O}_3$ _____
- 253. $\underline{\hspace{1cm}} \text{HI} \rightarrow \underline{\hspace{1cm}} \text{H}_2 + \underline{\hspace{1cm}} \text{I}_2$ _____
- 254. $\underline{\hspace{1cm}} \text{C}_2\text{H}_6 + \underline{\hspace{1cm}} \text{O}_2 \rightarrow \underline{\hspace{1cm}} \text{CO}_2 + \underline{\hspace{1cm}} \text{H}_2\text{O}$ _____
- 255. $\underline{\hspace{1cm}} \text{Li}_2\text{S} + \underline{\hspace{1cm}} \text{AlP} \rightarrow \underline{\hspace{1cm}} \text{Al}_2\text{S}_3 + \underline{\hspace{1cm}} \text{Li}_3\text{P}$ _____
- 256. $\underline{\hspace{1cm}} \text{K}_2\text{S} + \underline{\hspace{1cm}} \text{PbO}_2 \rightarrow \underline{\hspace{1cm}} \text{K}_2\text{O} + \underline{\hspace{1cm}} \text{PbS}_2$ _____
- 257. $\underline{\hspace{1cm}} \text{Al} + \underline{\hspace{1cm}} \text{CuSO}_4 \rightarrow \underline{\hspace{1cm}} \text{Al}_2(\text{SO}_4)_3 + \underline{\hspace{1cm}} \text{Cu}$ _____
- 258. $\underline{\hspace{1cm}} \text{Pb}(\text{NO}_3)_2 + \underline{\hspace{1cm}} \text{NaI} \rightarrow \underline{\hspace{1cm}} \text{PbI}_2 + \underline{\hspace{1cm}} \text{NaNO}_3$ _____

TABLE 4.4

Names of Common Polyatomic Ions

Ion	Name	Ion	Name
NH_4^+	ammonium	CO_3^{2-}	carbonate
NO_2^-	nitrite	HCO_3^-	hydrogen carbonate (bicarbonate is a widely used common name)
NO_3^-	nitrate		
SO_3^{2-}	sulfite	ClO^-	hypochlorite
SO_4^{2-}	sulfate	ClO_2^-	chlorite
HSO_4^-	hydrogen sulfate (bisulfate is a widely used common name)	ClO_3^-	chlorate
		ClO_4^-	perchlorate
OH^-	hydroxide	$\text{C}_2\text{H}_3\text{O}_2^-$	acetate
CN^-	cyanide	MnO_4^-	permanganate
PO_4^{3-}	phosphate	$\text{Cr}_2\text{O}_7^{2-}$	dichromate
HPO_4^{2-}	hydrogen phosphate	CrO_4^{2-}	chromate
H_2PO_4^-	dihydrogen phosphate	O_2^{2-}	peroxide
PO_3^{3-}	Phosphite		

Activity Series

Halogens Activity Series			Metal Activity Series		
F	Fluorine		Li	Lithium	
Cl	Chlorine		K	Potassium	
Br	Bromine		Na	Sodium	
I	Iodine		Ca	Calcium	
		Mg	Magnesium		
		Al	Aluminum		
		C	Carbon		
		Zn	Zinc		
		Fe	Iron		
		Sn	Tin		
		Pb	Lead		
		H	Hydrogen		
		Cu	Copper		
		Ag	Silver		
		Au	Gold		
		Pt	Platinum		

Solubility Rules

All compounds of the group I metals are soluble and NH_4^+ are soluble.

All NO_3^- , ClO_4^- , ClO_3^- , $\text{C}_2\text{H}_3\text{O}_2^-$ salts are soluble.

All chlorides, bromides, and iodides are soluble **except** those with Ag^+ , Pb^{+2} , Cu^{2+} , Hg^+ , and Hg_2^{+2} .

All sulfates are soluble **except** those with Pb^{+2} , Ca^{+2} , Sr^{+2} , Hg_2^{+2} , and Ba^{+2} and Ag^+ .

All hydroxides and all metal oxides are insoluble **except** those combined with Group I and Ca^{+2} , Sr^{+2} and Ba^{+2} .

All PO_4^{3-} , CO_3^{2-} , SO_3^{2-} , S^{2-} , CrO_4^{2-} and SCN^- are insoluble **except** those with group I and NH_4^+ .

, and NH_4^+

