Exam 2

# Part 1: Multiple Choice (2 points each)

## Directions: Please circle the *best* answer for each of the following questions.

1. Identify the generic outer electron configuration for the alkaline earth metals.
	1. ns2np6
	2. ns2np3
	3. ns1
	4. ns2np1
	5. ns2
2. Made up of two unshared electrons and shown as two dots in a Lewis structure.
	1. Single bond
	2. Double bond
	3. Triple bond
	4. Lone pair
	5. all of the above
3. Which atom is most likely to violate the octet/duet rule?
	1. B
	2. C
	3. N
	4. O
	5. F
4. What is the most likely empirical formula for glucose, C6H12O6?
	1. CHO
	2. C6H12O6
	3. CH2O
	4. C6H6O6
	5. C12H24O12
5. Which compound has one mole of sulfur?
	1. Hydrogen sulfide, H2S
	2. Sulfuric acid, H2SO4
	3. Sulfur hexafluoride, SF6
	4. Sodium sulfite, Na2SO3
	5. all of the above
6. If a nonmetal has seven valence electrons it is most likely to form \_\_\_\_\_\_\_ bonds and have \_\_\_\_\_\_\_ lone pairs.
	1. 3, 3
	2. 3, 2
	3. 3, 1
	4. 1, 3
	5. 2, 3
7. Rank the following elements according to first ionization energy.
	1. Be > Mg > Ca > Sr
	2. Sr > Be > Ca > Mg
	3. Mg > Sr > Ca > Be
	4. Ca > Be > Sr > Mg
	5. Sr > Mg > Ca > Be
8. Avogadro’s number is 6.022 x 1023 \_\_\_\_\_ is equal to one \_\_\_\_\_\_\_.
	1. mol S, g S
	2. ions Na+, mol Na+
	3. molecules CH4, mol CH4
	4. atoms O, mol O
	5. b, c, and d

Use the graph below to answer questions 9 and 10.

1. What is the actual quantity plotted on the y-axis?
	1. Density, D
	2. Dependent variable
	3. Abscissa
	4. Mercury
	5. all of the above
2. If the slope $-0.0025\frac{g}{mL K}$ and the y-intercept is $14.28\frac{g}{mL}$, what is the equation of the line?
	1. y = -0.0025 x + 14.28
	2. D = -0.0025 x + 14.28
	3. $D=\left(-0.0025\frac{g}{mL K}\right)T+14.28\frac{g}{mL}$
	4. $y=\left(-0.0025\frac{g}{mL K}\right)x+14.28\frac{g}{mL}$
	5. not enough information

# Part 2: Short Answer

## Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work.

1. Classify these atomic orbitals as s, p, or d according to their shape (3 points).



d orbital s orbital p orbital

1. What is the complete and condensed ground state electron configuration for the following atoms (8 points):

|  |  |  |
| --- | --- | --- |
|  | Complete e- configuration | Condensed e- configuration |
| * 1. Nitrogen
 | 1s2 2s2 2p3 | [He] 2s2 2p3 |
| * 1. Titanium
 | 1s2 2s2 2p6 3s2 3p6 4s2 3d2 | [Ar] 4s2 3d2 |
| * 1. Oxide
 | 1s2 2s22p6 | [He] 2s2 2p6 or [Ne]  |

1. Complete the following table (20 points)

|  |  |
| --- | --- |
| Name | Formula  |
| Iron(II) perchlorate hexahydrate | Fe(ClO4)2 ∙ 6 H2O |
| Oxygen difluoride | OF2 |
| Cesium hypoiodite | CsOI |
| Ammonium chromate | (NH4)2CrO4 |
| Tetraphosphorus decoxide | P4O10 |
| Water | H2O |
| Strontium cyanide | Sr(CN)2 |
| Lithium acetate | LiC2H3O2 |
| Hydrofluoric acid | HF (aq) |
| Oxalic acid | H2C2O4 (aq) |

1. For each compound below, draw a dipole moment to show the direction of the bond polarity (3 points).

Br-Br H-Cl F-CH3

1. Draw the Lewis structure for sodium oxide (2 points):



1. Chloral hydrate, a sedative and hypnotic, was the first drug used to treat insomnia. Chloral hydrate has a melting point of 57 °C (9 points).
	1. What is the melting point of chloral hydrate in Kelvin?

K = °C + 273.15 = 57 +273.15 = 330.15 K ≈ 330. K

* 1. Complete the Lewis dot structure for chloral hydrate: 



* 1. Is chloral hydrate a polar or nonpolar molecule? \_\_\_\_polar molecule\_\_\_\_\_\_\_
	2. What is the electron pair geometry around the oxygen atoms?\_\_\_\_tetrahedral\_\_\_\_\_
	3. What is the molecular geometry around the oxygen atoms? \_\_\_bent\_\_\_\_\_\_\_\_\_\_\_\_\_
	4. What is the approximate Cl-C-Cl bond angle? \_\_\_\_109.5°\_\_\_\_\_\_\_\_\_
1. Nitryl chloride, ClNO2, is a powerful oxidizer that is poisonous by inhalation (8 points).
	1. Draw the Lewis structure. 
	2. Identify the electron pair geometry. \_\_\_\_trigonal planar
	3. Identify the molecular geometry. \_\_\_\_trigonal planar
	4. Give the approximate Cl-N-O bond angle. \_\_\_\_\_120°
	5. Identify the molecule as polar or nonpolar. \_\_\_\_polar\_\_\_\_\_\_\_\_
2. Cu3(PO4)2 is a blue salt that is insoluble in water (15 points).
	1. What is the name for Cu3(PO4)2? \_\_\_copper(II) phosphate\_\_\_\_
	2. What is the name for Cu3(PO4)2 using the Latin system? \_\_\_cupric phosphate\_\_\_\_\_\_\_
	3. How many atoms of phosphorus are in 6.40 mol of Cu3(PO4)2?

$$6.40 mol Cu\_{3}(PO\_{4})\_{2}×\frac{2 mol P}{1 mol Cu\_{3}(PO\_{4})\_{2} }×\frac{6.022×10^{23} atoms P}{1 mol P}=7.71×10^{24} atoms P$$

* 1. What is the formula mass (i.e. molar mass) of Cu3(PO4)2?

Cu: 3(63.546 g/mol) = 190.638 g/mol

P: 2(30.974 g/mol) = 61.948 g/mol

O: 2\*4(15.999 g/mol) = + 127.992 g/mol

 380.578 g/mol ≈ 380.58 g/mol

1. What is the %Cu in Cu3(PO4)2?

$$\%Cu=\frac{3(63.546\frac{g}{mol})}{380.58\frac{g}{mol}}×100=50.092\% Cu$$

1. How many moles of Cu3(PO4)2 are in 234 g of Cu3(PO4)2?

$$234 g Cu\_{3}(PO\_{4})\_{2}×\frac{1 mol Cu\_{3}(PO\_{4})\_{2}}{380.58 g Cu\_{3}(PO\_{4})\_{2}}=0.615 mol Cu\_{3}(PO\_{4})\_{2}$$

1. Ascorbic acid (vitamin C) cures scurvy and may help prevent the common cold. A sample of vitamin C has 40.92% carbon, 4.58% hydrogen, and 54.50% oxygen (12 points).
	1. What is the empirical formula?

$$40.92 g C×\frac{1 mol C}{12.011 g C}=3.406877029 mol C$$

$$4.58 g H×\frac{1 mol H}{1.008 g H}=4.543650794 mol H$$

$$54.50 g O×\frac{1 mol O}{15.999 g O}=3.406462904 mol O$$

$$C\_{\frac{3.406877029 mol}{3.406462904 mol}}H\_{\frac{4.543650794 mol}{3.406462904 mol}}O\_{\frac{3.406462904 mol}{3.406462904 mol}}$$

$$\left(C\_{1.00012157}H\_{1.33384572}O\_{1}\right)\_{3}=C\_{3.00036471}H\_{4.001537159}O\_{3}=C\_{3}H\_{4}O\_{3}$$

* 1. The molar mass of vitamin C is about 176 g/mol. What is the molecular formula of vitamin C?

The empirical mass is 88.062 g/mol. Therefore, the molecular formula of vitamin C is the same as the empirical formula of C6H8O6.