Exam 2

# Part 1: Multiple Choice (2 points each)

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

1. When graphing which of the following is not important?
	1. circle the data points
	2. include a table of data
	3. the data must make a straight line
	4. the y-axis is the dependent variable
	5. none of the above
2. Which of the following is true?
	1. 1 mol = 1 gram
	2. 2 mol = 6.022 x 1023 atoms
	3. 3.45 atoms Na = 1 mol NaCl
	4. 6.70 g/mol = 1 molecule
	5. none of the above
3. \_\_\_\_\_\_\_ has both ionic and covalent bonding present.
	1. Magnesium nitride, Mg3N2
	2. Sodium sulfate, Na2SO4
	3. Dinitrogen tetrahydride, N2H4
	4. Hydrogen gas, H2
	5. Iron(III) chloride, FeCl3
4. Which element would have a Lewis symbol that contains five dots?
	1. 5B
	2. 7N
	3. 15P
	4. b and c
	5. all of the above
5. The electron sea model explains the behavior of
6. ionic solids.
7. molecular solids.
8. metal solids.
9. most gases.
10. orbitals.
11. Which atom is most likely to violate the octet/duet rule?
	1. F
	2. O
	3. Cl
	4. Be
	5. none of the above
12. A dipole moment is formed by
	1. two positive charges at the same location in space.
	2. two positive charges separated by a distance.
	3. a positive charge and a negative charge separated by a distance.
	4. a positive charge and a negative charge at the same location in space.
	5. none of the above
13. What is a possible molecular formula given an empirical formula of C2H4?
	1. C4H10
	2. C6H12
	3. C2H6
	4. C3H6
	5. C2H4O
14. Without actually drawing them, which of the following species do not have a Lewis structure that satisfies the octet rule?
	1. N2O
	2. NO2
	3. NF3
	4. N2O3
	5. NOCl
15. How many moles of oxygen are in 1.24 moles of phosphorous acid, H3PO3 (aq)?
	1. 0.413 mol O
	2. 1.24 mol O
	3. 3.72 mol O
	4. 4.96 mol O
	5. none of the above

# 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. Correct the following chemical formulas (4 points).
	1. CACO3 CaCO3
	2. Na2Cl2 NaCl
	3. Hi (aq) HI (aq)
	4. 2HO either H2O2 or H2O
2. Draw the Lewis structure for sodium oxide (2 points):



1. Complete the following table (20 points)

|  |  |
| --- | --- |
| Name | Formula  |
| Disulfur trioxide | S2O3 |
| Ammonium chromate | (NH4)2CrO4 |
| Silver cyanide | AgCN |
| Arsenic acid | H3AsO4 (aq) |
| Magnesium sulfate hexahydrate | MgSO4 ∙ 6 H2O |
| Sodium hypochlorite | NaOCl |
| Tetraphosphorus decoxide | P4O10 |
| Sulfur hexafluoride | SF6 |
| Mercury(II) phosphate | Hg3(PO4)2 |
| Hydroiodic acid | HI (aq) |

1. Explain how polar bonds differ from nonpolar bonds. How do you know if a bond is polar? Give an example of a polar and a nonpolar bond (5 points).

Polar bonds have positive and negative ends. Polar bonds have atoms with different electronegativies bonded together. An example of a polar bond is H-F and a nonpolar bond is F-F.

1. Answer the following questions about ethanol, C2H6O, in which O is bonded to two kinds of atoms. Do not consider cyclic (ring) structures (12 points).



* 1. The number of C-H bonds is 5
	2. The number of O-H bonds is 1
	3. The number of C-C single bonds is 1
	4. The number of C-O single bonds is 1
	5. The total number of lone pairs is 2
	6. What is the electron pair geometry around the carbon atom? Tetrahedral
	7. What is the molecular geometry around the carbon atom? Tetrahedral
	8. What is the electron pair geometry around the oxygen atom? Tetrahedral
	9. What is the molecular geometry around the oxygen atom? Bent
	10. What is the H-C-H bond angle? 109.5°
	11. What is the C-O-H bond angle? <109.5° or ~104.5°
	12. What type of organic functional group is represented in part a? alcohol
1. Answer the following questions about ozone, O3 (6 points).
	1. Draw the Lewis structure; be sure to draw any resonance structures if appropriate.



* 1. Electron pair geometry trigonal planar
	2. Molecular shape bent
	3. Bond Angle <120°
1. C2H4F2 has two isomers. What is an isomer? Draw both isomers (4 points).

An isomer is two or more compounds that have the same atoms, but different connectives of those atoms.



1. A 2.45 g sample of strontium completely reacts with oxygen to form 2.89 g of strontium oxide. Use this data to calculate the mass percent composition of strontium in strontium oxide (5 points).

$$\%Sr=\frac{m\_{Sr}}{m\_{SrO}}×100=\frac{2.45 g}{2.89 g}×100=84.77508651\%≈84.8\%$$

1. Iron is found in Earth’s crust as several different iron compounds including hematite, Fe2O3 (10 points).
	1. What is the systematic name? \_\_\_\_iron(III) oxide or ferric oxide\_\_
	2. What is the molar mass?

Fe: (2)(55.845 g/mol) = 111.69 g/mol

O: (3)(15.999 g/mol) = 47.997 g/mol

Fe2O3: 159.687 g/mol ≈ 159.69 g/mol

* 1. Calculate the mass (in kg) of hematite, Fe2O3, which contains 1.0 × 103 kg iron.

$$1.0×10^{3} kg Fe×\frac{1 kmol Fe}{55.845 kg Fe}×\frac{1 kmol Fe\_{2}O\_{3}}{2 kmol Fe}×\frac{159.69 kg Fe\_{2}O\_{3}}{1 kmol Fe\_{2}O\_{3}}=1429.760945 kg Fe\_{2}O\_{3}≈1.4×10^{3} kg Fe\_{2}O\_{3}$$

1. Methyl butyrate is one of the components of apple flavor and scent. It contains 58.80% carbon, 9.87% hydrogen, and 31.33% oxygen by mass (12 points).
	1. What is the empirical formula?

$$58.80 g C×\frac{1 mol C}{12.011 g C}=4.870535343 mol C$$

$$9.87 g H×\frac{1 mol H}{1.008 g H}=9.791666667 mol H$$

$$31.33 g O×\frac{1 mol O}{15.999 g O}=1.95824739 mol O$$

$$C\_{\frac{4.870535343}{1.95824739}}H\_{\frac{9.791666667}{1.95824739}}O\_{\frac{1.95824739}{1.95824739}}$$

$$\left(C\_{2.487191029}H\_{5.000219441}O\_{1}\right)\_{2}=C\_{4.974382058}H\_{10.00043888}O\_{2}=C\_{5}H\_{10}O\_{2}$$

* 1. The molar mass of methyl butyrate is about 102 g/mol. What is the molecular formula of methyl butyrate?

The empirical mass is 102.133 g/mol. Therefore, the molecular formula of methyl butyrate is the same as the empirical formula of C5H10O2.