

Exam 2

MULTIPLE CHOICE (3pts each): Write the ONE letter corresponding to the correct answer on the line next to each question. The LETTER ASSOCIATED WITH THE CORRECT ANSWER MUST BE WRITTEN ON THE LINE NEXT TO THE QUESTION in order to receive full credit.

- What is the most appropriate name for the compound with the formula SnO_2 ? 1.) D
 a.) Tin dioxide b.) Tin (II) oxide c.) Tin (II) dioxide d.) (D) Tin (IV) oxide
- What is the molar mass of lithium oxide? Li_2O 2.) A
 a.) (A) 29.8814 g/mol b.) 38.9398 g/mol c.) 22.9404 g/mol d.) 36.8224 g/mol
 $[6.941 \text{ g/mol} \times 2] + 15.9994 \text{ g/mol}$
- How many bromide ions are present in 0.150 mol of CaBr_2 ? $\leq 2\text{Br}^- \text{ per } \text{Ca}^{2+}$ 3.) B
 a.) 9.03×10^{22} mol b.) (B) 1.81×10^{23} mol c.) 1.81×10^{25} mol d.) 3.61×10^{25} mol
 $0.150(2) = 0.300 \text{ mol Br}^- \times 6.022 \times 10^{23} \text{ ions/mol}$
- Which of the following pairs of atoms would form a nonpolar covalent bond? 4.) C
 a.) Na & Cl 3.0 - 0.9 = 2.1 ionic
 b.) O & C 3.5 - 2.5 = 1.0 polar
 c.) (C) I & Br 2.8 - 2.5 = 0.3 nonpolar
 d.) B & Cl 3.0 - 2.0 = 1.0 polar
- What is the mass percent of oxygen in Ca(OH)_2 ? 5.) A
 a.) (A) 43.2% b.) 40.0% c.) 32.0% d.) 21.6%
 $\text{MM: } 74.09268 \text{ g/mol}$
 $15.9994 \times 2 = 31.9988 \text{ g/mol}$
 $\frac{31.9988}{74.09268} \times 100$
- Which of the following pairs of atoms would form a polar covalent bond? 6.) D
 a.) Br & Cl 3.0 - 2.8 = 0.2 nonpolar
 b.) K & Br 2.8 - 0.8 = 2 ionic
 c.) Cr & Mn n/a metallic
 d.) (D) Ge & Cl 3.0 - 1.8 = 1.2 polar
- What is the formal charge on nitrogen in NO_3^{1-} ? 7.) B
 a.) 0 b.) (B) +1 c.) -1 $\text{:}\ddot{\text{O}}\text{:}-\text{N}^+=\text{O}\text{:}$ d.) +2
 24 val e^-
- What is the strongest type of intermolecular attractive force than a molecule of CF_4 can use to interact with other CF_4 molecules? 8.) C
 a.) hydrogen bonding b.) covalent bonding c.) (C) dispersion forces d.) dipole-dipole
 $\text{dipoles cancel - nonpolar}$
- Which formula represents sulfuric acid? 9.) D
 a.) HNO_3 b.) H_3PO_4 c.) HCl d.) (D) H_2SO_4
- What is the strongest type of intermolecular attractive force than a molecule of CH_3OH can use to interact with other CH_3OH molecules? 10.) A
 a.) (A) hydrogen bonding b.) covalent bonding c.) dispersion forces d.) dipole-dipole

SHORT ANSWER (10 pts each): Completely answer all of the following questions. Read all questions carefully!!! ALL WORK MUST BE SHOWN TO RECEIVE FULL CREDIT. If your work is in a different location, you must make a note of this in the given work area for the problem in order for the work to be considered for partial credit. Make sure to include units and report all mathematical answers to the correct number of significant figures. Write final answers in designated locations when indicated.

1.) a.) What is the molar mass of $\text{Co}(\text{OH})_3$?

Answer: 109.955 g/mol

$$\text{Co}: 58.933 \text{ g/mol} \times 1 = 58.933 \text{ g/mol}$$

$$\text{O}: 15.9994 \text{ g/mol} \times 3 = 47.9982 \text{ g/mol}$$

$$\text{H}: 1.00794 \text{ g/mol} \times 3 = 3.02382 \text{ g/mol}$$

$$\underline{109.95502 \text{ g/mol}}$$

b.) How many moles are present in 75.2g $\text{Co}(\text{OH})_3$?

Answer: 0.684 mol

$$75.2 \text{ g} \left(\frac{1 \text{ mol}}{109.95502 \text{ g}} \right) = 0.683916 \text{ mol}$$

c.) What is the mass of 0.186 mol of $\text{Co}(\text{OH})_3$?

Answer: 20.5 g

$$0.186 \text{ mol} \left(\frac{109.95502 \text{ g}}{\text{mol}} \right) = 20.4516 \text{ g}$$

d.) How many oxygen atoms are present in 56.8g of $\text{Co}(\text{OH})_3$?

Answer: 9.33×10^{23} atoms O

$$56.8 \text{ g} \left(\frac{1 \text{ mol}}{109.95502 \text{ g}} \right)$$

$$= 0.516575 \text{ mol} \left(\frac{6.022 \times 10^{23} \text{ Co}(\text{OH})_3}{\text{mol}} \right) = 3.110814 \times 10^{23} \text{ Co}(\text{OH})_3 \left(\frac{3 \text{ O}}{1 \text{ Co}(\text{OH})_3} \right)$$

$$= 9.33244 \times 10^{23} \text{ atoms O}$$

2.) For the following ionic compounds:

a.) What is the best name for:



Answer: Manganese (IV) bromide



Answer: Barium nitrate

b.) What is the correct formula for:

Potassium sulfate

Answer: K_2SO_4

Iron (III) fluoride

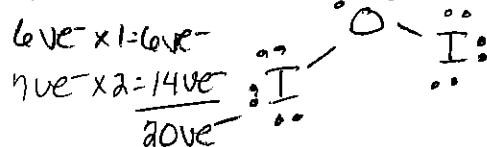
Answer: FeF_3

A compound made with Cr^{3+} & S^{2-}

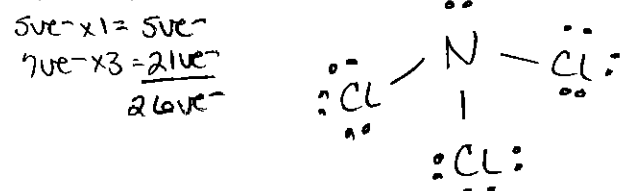
Answer: Cr_2S_3

3.) Draw Lewis Structures for the following molecules. Include all lone pairs. Make sure to minimize formal charges and to show any non-zero formal charges. Only one structure will violate the octet rule.

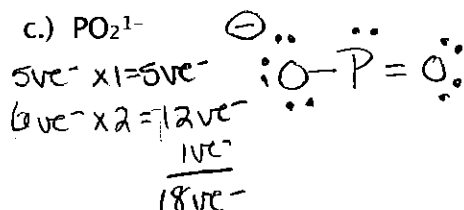
a.) OI_2



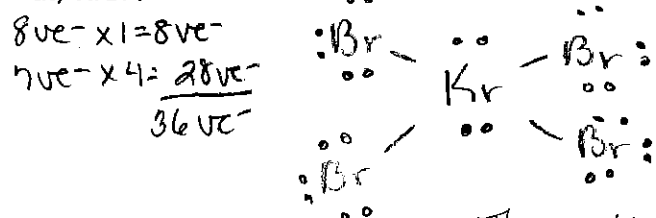
b.) NCl_3 (Cl is chlorine)



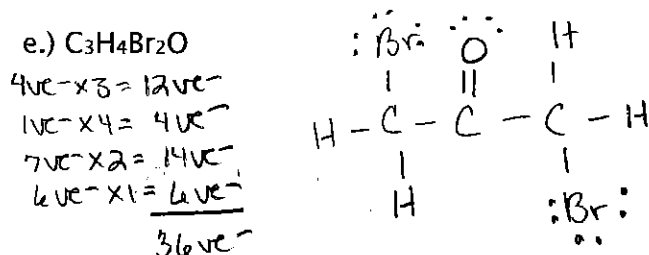
c.) PO_2^{1-}



d.) KrBr_4



e.) $\text{C}_3\text{H}_4\text{Br}_2\text{O}$



This molecule
Violates the
octet rule

4.) For each of the molecules listed, write the electron pair geometry and molecular geometry, and indicate whether the molecule is polar or nonpolar.

Molecule	Electron Pair Geometry	Molecular Geometry	Polarity
OI_2 	tetrahedral	bent	polar
CH_2F_2 	tetrahedral	tetrahedral	polar
KrBr_4 	octahedral	square planar	

(KrBr_4 is non polar
due to dipoles canceling)
CHM101 2023F

5.) For the following covalent compounds:

c.) What is the best name for:



Answer: Carbon tetrabromide



Answer: diphosphorus trioxide



Answer: trinitrogen hexachloride

d.) What is the correct formula for:

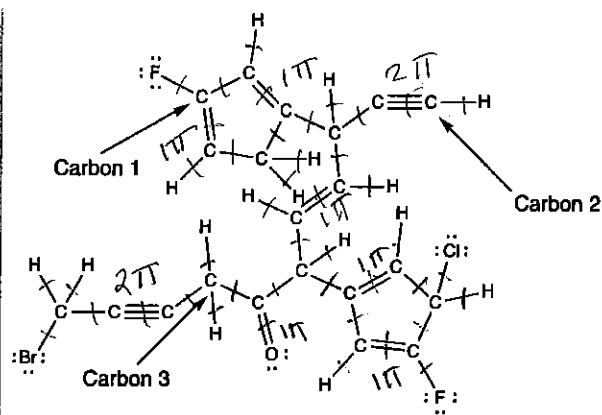
Diarsenic pentachloride

Answer: As_2Cl_5

Selenium trifluoride

Answer: SeF_3

6.) For the following molecule, indicate the hybridization of each atom indicated below.



a.) Carbon 1: sp^2

b.) Carbon 2: sp

c.) Carbon 3: sp^3

d.) How many sigma bonds are present in this molecule? Answer: 43

e.) How many pi bonds are present in this molecule? Answer: 10

7.) a.) What is the empirical formula of a compound with a mass percent composition of 54.5% carbon, 9.15% hydrogen, and 36.4% sulfur?

Assume 100g

Answer: C_4H_8S

$$54.5g C \left(\frac{1 \text{ mol}}{12.011g} \right) = 4.5375 \text{ mol C} / 1.13516 = 3.997 \approx 4$$

$$9.15g H \left(\frac{1 \text{ mol}}{1.00794g} \right) = 9.07792 \text{ mol H} / 1.13516 = 7.997 \approx 8$$

$$36.4g S \left(\frac{1 \text{ mol}}{32.066g} \right) = 1.13516 \text{ mol S} / 1.13516 = 1$$

b.) What is the molecular formula of the compound in part a if the molar mass is 176.347g/mol?

MM C_4H_8S

Answer: $C_8H_{16}S_2$

$$C: 12.011 \text{ g/mol} \times 4 = 48.044 \text{ g/mol}$$

$$H: 1.00794 \text{ g/mol} \times 8 = 8.06352 \text{ g/mol}$$

$$S: 32.066 \text{ g/mol} \times 1 = \underline{32.066 \text{ g/mol}}$$

$$88.17352 \text{ g/mol}$$

$$\frac{176.347 \text{ g/mol}}{88.17352 \text{ g/mol}} = 1.99999995 \approx 2$$

