

# *CH 221 Fall 2021:*

# **Problem Set #3**

## *Instructions*

*Step One (all sections):*

**Learn the material** for Problem Set #3 by **reading Chapter 2 and Chapter 3 (3.1 - 3.3 especially)** of the textbook and/or by watching the videos found on our website (<https://mhchem.org/221>)

**Try the problems** for Problem Set #3 found on the next pages on your own first. Use separate paper and write out your answers, showing all of your work. If you write the answers on the problem set itself, you will receive fewer points. Include your name on your problem set!

*Step Two:*

Section 01 and H1: We will go over Problem Set #3 during recitation. ***Self correct all problems*** of your problem set before turning it in at the end of the class on October 13.

Section W1: **Watch the recitation video** for Problem Set #3:

**<http://mhchem.org/w/r.htm>**

**Self correct all of the problems** while viewing the video. Mark correct problems with a star (or other similar mark), and correct all incorrect problems (show the correct answer and the steps required to achieve it.)

**Submit Problem Set #3 via email ([mike.russell@mhcc.edu](mailto:mike.russell@mhcc.edu)) as a single PDF file** (use CamScanner (<https://camscanner.com>), CombinePDF (<https://combinepdf.com>), etc.) **by 11:59 PM Wednesday, October 13.**

*If you have any questions regarding this assignment, please email ([mike.russell@mhcc.edu](mailto:mike.russell@mhcc.edu)) the instructor! Good luck on this assignment!*

## CH 221 Problem Set #3

\* Complete problem set on separate pieces of paper showing all work, circling final answers, etc.

\* Self correct your work before turning it in to the instructor.

Covering: Chapter Two, Chapter 3.1-3.2 and Chapter Guide Three

Important Tables and/or Constants: 1 mol =  $6.022 \times 10^{23}$ , "Have No Fear Of Ice Clear Brew" (7 Diatomics)

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1. What charges are most commonly observed for monatomic ions of the following elements: **selenium, potassium, and iron**. What are the seven diatomics?
2. Give the symbol, including the correct charge, for each of the following ions:
  - a. permanganate ion
  - b. nitrite ion
  - c. phosphate ion
  - d. dihydrogen phosphate ion
  - e. ammonium ion
  - f. sulfite ion
3. For each of the following compounds, give the formula, charge and the number of each ion that makes up the compound:
  - a.  $\text{Mg}(\text{CH}_3\text{CO}_2)_2$
  - b.  $\text{Al}(\text{OH})_3$
  - c.  $\text{CuCO}_3$
  - d.  $\text{Ti}(\text{SO}_4)_2$
  - e.  $\text{KH}_2\text{PO}_4$
4. Platinum is a transition element and forms  $\text{Pt}^{2+}$  and  $\text{Pt}^{4+}$  ions. Write the formulas for the compounds of each of these ions with a) chloride ions and b) sulfide ions.
5. Which of the following are correct formulas for ionic compounds? For those that are not, give the correct formula.
  - a.  $\text{Ca}_2\text{O}$
  - b.  $\text{SrBr}_2$
  - c.  $\text{Li}_2\text{O}$
  - d.  $\text{Fe}_2\text{O}_5$
6. Name each of the following ionic compounds:
  - a.  $\text{Ca}(\text{CH}_3\text{CO}_2)_2$
  - b.  $\text{Al}(\text{OH})_3$
  - c.  $\text{KH}_2\text{PO}_4$
  - d.  $\text{Ni}_3(\text{PO}_4)_2$
7. Give the formula for each of the following ionic compounds:
  - a. calcium hydrogen carbonate
  - b. potassium permanganate
  - c. magnesium perchlorate
  - d. potassium hydrogen phosphate
  - e. sodium sulfite
8. Consider the two ionic compounds  $\text{NaCl}$  and  $\text{CaO}$ . In which compound are the cation-anion attractive forces stronger? Explain your answer.

*Problem Set #3 continues on next page*

*Problem Set #3, Continued from previous page*

9. Name each of the following binary nonionic compounds containing nitrogen and oxygen:
  - a.  $\text{N}_2\text{O}_5$
  - b.  $\text{NO}_2$
  - c.  $\text{N}_2\text{O}_4$
  - d.  $\text{N}_2\text{O}$
10. Give the formula for each of the following compounds:
  - a. bromine trifluoride
  - b. xenon difluoride
  - c. diphosphorus tetrafluoride
  - d. ammonia
  - e. hydrazine
11. Calculate the molar mass to 0.01 g/mol for each of the following compounds:
  - a.  $\text{Fe}(\text{C}_6\text{H}_{11}\text{O}_7)_2$ , iron(II) gluconate, a dietary supplement
  - b.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{SH}$ , butanethiol, has a skunk-like odor
  - c.  $\text{C}_{20}\text{H}_{24}\text{N}_2\text{O}_2$ , quinine, used as an antimalarial drug
12. Assume you have 0.123 mol of each of the following compounds.
  - a. What mass in grams would you have if the compound is  $\text{C}_{14}\text{H}_{10}\text{O}_4$ , benzoyl peroxide, which is used in acne medications?
  - b. How many molecules of  $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$  (cisplatin, a cancer chemotherapy drug) would you have?
13. Calculate the weight percent of iron in  $\text{Fe}_2\text{O}_3$ , iron(III) oxide. What mass of iron (in grams) is present in 25.0 g of  $\text{Fe}_2\text{O}_3$ ?
14. Nitrogen and oxygen form a series of oxides with the general formula  $\text{N}_x\text{O}_y$ . One of them, a blue solid, contains 36.84% N. What is the empirical formula of this oxide?
15. An organic compound has the empirical formula  $\text{C}_2\text{H}_4\text{NO}$ . If its molar mass is 116.1 g/mol, what is the molecular formula of the compound?
16. You combine 1.25 g of germanium with excess chlorine ( $\text{Cl}_2$ ). The mass of product,  $\text{Ge}_x\text{Cl}_y$ , is 3.69 g. What is the empirical formula of the product?
17. If Epsom salt,  $\text{MgSO}_4 \cdot x \text{H}_2\text{O}$ , is heated to 250 °C, all the water of hydration is lost. On heating a 1.687 g sample of the hydrate, 0.824 g of  $\text{MgSO}_4$  remains. How many molecules of water occur per formula unit of  $\text{MgSO}_4$ ? Name the hydrated compound.
18. Fluorocarbonyl hypofluorite is composed of 14.6% C, 39.0% O and 46.3% F. If the molar mass of the compound is 82 g/mol, determine the empirical and molecular formulas for the compound.