

# *CH 151 Summer 2025:*

# **Problem Set #4**

## *Instructions*

### *Step One:*

- **Learn the material** for Problem Set #4 by **reading Chapter 4 (sections 4.4 - 4.6 only) and Chapter 3 (sections 3.3 - 3.5 only)** of the textbook and/or by watching the videos found on the website (<https://mhchem.org/151>)
- **Try the problems** for Problem Set #4 found on the next pages on your own first. **Write out the answers (and show your work) by hand (on a tablet or paper)**; do not type your answers (and work) to avoid a point penalty. If you write the answers on the problem set itself, you will receive fewer points. Include your name on your problem set!
- If you get stuck on a particular problem, you can watch the recitation video for Problem Set #4, found using this link: **<http://mhchem.org/t/d.htm>**

### *Step Two:*

We will go over Problem Set #4 during recitation. ***Self correct all problems*** of your problem set before turning it in at the end of recitation.

Problem Set #3 will be **due on Tuesday, July 15 at 8 AM**.

*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 151 Problem Set #4 - Chapter 4.4-4.6 and Chapter 3.3-3.5

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

\* Self correct problem set during recitation (**July 15, 8 AM**) before turning in to the instructor

Covering: **Chapter Four (sections 4.4 - 4.6 only) and Chapter 3 (sections 3.3 - 3.5 only)**

Important Tables and/or Constants: periodic table (<http://mhchem.org/pertab>)

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For Problems #1 - #5:

- Calculate the valence electrons in the molecule
- Draw a Lewis structure
- Describe the Electron Pair Geometry and Molecular Geometry for the molecule
- Describe any bond angles in the molecule
- Predict if the molecule is polar or nonpolar

1. Methane,  $\text{CH}_4$
2. Nitrogen trichloride,  $\text{NCl}_3$
3. Carbon dioxide,  $\text{CO}_2$  (*answers on central C*)
4. Acetone,  $\text{CH}_3\text{COCH}_3$
5. Ammonium ion,  $\text{NH}_4^{1+}$
6. For each of the following sets of elements, choose the two that would be expected to have similar chemical properties.
  - a.  $_{11}\text{Na}$ ,  $_{14}\text{Si}$ ,  $_{23}\text{V}$ ,  $_{55}\text{Cs}$
  - b.  $_{13}\text{Al}$ ,  $_{19}\text{K}$ ,  $_{32}\text{Ge}$ ,  $_{50}\text{Sn}$
  - c.  $_{37}\text{Rb}$ ,  $_{38}\text{Sr}$ ,  $_{54}\text{Xe}$ ,  $_{56}\text{Ba}$
  - d.  $_{2}\text{He}$ ,  $_{6}\text{C}$ ,  $_{8}\text{O}$ ,  $_{10}\text{Ne}$
7. Give the maximum number of electrons that can occupy each of the following electron **subshells**.
  - a.  $6p$
  - b.  $1s$
  - c.  $5f$
  - d.  $4d$
8. Give the maximum number of electrons that can occupy each of the following electron **orbitals**.
  - a.  $1s$
  - b.  $3d$
  - c.  $5p$
  - d.  $4d$
9. Which of the following electron subshell and electron orbital designations is not allowed?
  - a.  $2d$  subshell
  - b.  $4s$  orbital
  - c.  $3p$  subshell
  - d.  $2f$  orbital
10. With the help of an Aufbau diagram, write the complete electron configuration for each of the following atoms.
  - a.  $_{6}\text{C}$
  - b.  $_{10}\text{Ne}$
  - c.  $_{15}\text{P}$
  - d.  $_{36}\text{Kr}$
  - e.  $_{31}\text{Ga}$
  - f.  $_{48}\text{Cd}$

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11. Based on total number of electrons present, identify the **neutral element** represented by each of the following electron configurations.
- a.  $1s^2 2s^2 2p^2$
  - b.  $1s^2 2s^2 2p^6 3s^2 3p^3$
  - c.  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
  - d.  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
12. Determine how many unpaired electrons there are in an atom of the following elements. Indicate whether the elements are **paramagnetic** or **diamagnetic**.
- a. lithium
  - b. aluminum
  - c. calcium
  - d. bromine
13. Write the electron configuration for each of the following ions.
- a.  $S^{2-}$
  - b.  $P^{3-}$
  - c.  $Be^{2+}$
  - d.  $Na^{1+}$

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