

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) 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>)

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, CH₄
2. Nitrogen trichloride, NCl₃
3. Carbon dioxide, CO₂ (*answers on central C*)
4. Acetone, CH₃COCH₃
5. Ammonium ion, NH₄¹⁺

6. For each of the following sets of elements, choose the two that would be expected to have similar chemical properties.
 - a. ¹¹Na, ¹⁴Si, ²³V, ⁵⁵Cs
 - b. ¹³Al, ¹⁹K, ³²Ge, ⁵⁰Sn
 - c. ³⁷Rb, ³⁸Sr, ⁵⁴Xe, ⁵⁶Ba
 - d. ²He, ⁶C, ⁸O, ¹⁰Ne
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. ⁶C
 - b. ¹⁰Ne
 - c. ¹⁵P
 - d. ³⁶Kr
 - e. ³¹Ga
 - f. ⁴⁸Cd

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

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