Accompanying Questions
Topic 04: Molecular Structure and Polarity

Objective:

This is to provide guiding questions to help you comprehend the material we have covered in this section of the class. These questions have been answered within the video lecture and/or live class.

Instructions and Notes:

- Most of these questions/concepts are taken or derived from the chapters in the Chemistry: Atoms First 2e Online Textbook (OpenStax)
- Book sections covered: 4.6, 4.2

Submission:

Students do not submit this and it is not graded.

Helpful Tips:

- These questions or very similar questions may appear on the exams so I strongly recommend that you complete them.
- Download the lectures and rewatch the lectures.
- Pause the lectures and rewind them through concepts you don't fully understand.
- Go to tutoring in the ASTC or MESA, ask your classmates in our Discord room, watch YouTube Videos, come to office hours, etc.

In-Lecture Questions

1. What charge are electrons? Do exterior unbonded electrons repel or attract each other?
2. What is electron geometry? And which atom does it take place around?
3. What are the three (3) electron geometries?
4. List the two (2) types of regions of high electron density (connections.
5. Draw the 2D structure of CO and answer the following questions: how many connections for C, what is the electron geometry?
6. Draw the 2D structure of CO_2 and answer the following questions: how may connections for the center atom, and what is the electron geometry?
7. Draw the 2D structure of CH_2O and answer the following questions: how may connections to the center atom, and what is the electron geometry?
8. For drawing 3D structures, what do these mean? A straight line, a solid wedge, a dashed wedge.
9. Draw the 3D structure of CCl_4 and answer the following questions: how may connections to the center atom, and what is the electron geometry?
10. Draw the 3D structure of H_2O and answer the following questions: how may lone pairs are connected to the center atom, how many atoms are connected to the center atom, what is the electron geometry, and what is the molecular structure?

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11. Draw the 3D structure of NH_3 and answer the following questions: how may lone pairs are connected to the center atom, how many atoms are connected to the center atom, what is the electron geometry, and what is the molecular structure?
12. What is the electron geometry and molecular structure of carbonate, CO_3^{2-}
13. What is the electron geometry and molecular structure of hydronium, H_3O^{1+}

14. What is electronegativity?
15. Where is the most electronegative side of the periodic table? The least electronegative?
16. What are the numerical ranges of these bonds? Pure covalent, polar covalent, and ionic
17. Is H_2 polar? If so, draw the delta symbols and polarity vector.
18. Is Cl_2 polar? If so, draw the delta symbols and polarity vector.
19. Is HCl polar? If so, draw the delta symbols and polarity vector.
20. Using the electronegativity values in Figure 4.6, arrange the bonds (Si–O, Si–C, C–H, and C–C) in order of increasing polarity and designate the positive and negative atoms using the symbols δ+ and δ– as well as draw the polarity vectors.
21. Describe a way to figure out if a molecule is polar or not.

Draw the 3D structures for the following molecules (include lone pairs if any), label each exterior atom with their partial charges (δ- and δ +). Draw the polarity vector if the molecule is polar. If they aren't polar, label them "nonpolar". Do not use the periodic table for electronegativity values, just use the trend of atoms higher and to the right on the periodic table are more electronegative.

22. H_2
23. Cl_2
24. HCl
25. CO
26. CO_2
27. CH_2O
28. CCl_4
29. CH_4
30. CH_3F
31. H_2O
32. NH_3
33. OCS