Stereochemistry Lab Teacher Notes Chemistry 20

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Partner \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Purpose**: To use the VSEPR theory to predict shapes around central atoms of molecular compounds & polyatomic ions

Don’t be afraid to spend 3 or 4 eighty minute periods on this. Time spent here will pay off later in the course!! And in chemistry 30 when you do the organic section!

**Procedure:**

Use the model kits provided to build 3-D models of the following molecular compounds.

Fill in all the missing areas of the observation table. Your text book may be of help. (See pages 85 🡪 112) – these pages are based on the Nelson book. If you have a different text, then adjust the page numbers

**Observations**: Enlarge this chart and fill in all spaces. (2 marks per line) (1/2 mark will be subtracted for every error per line)

In the stereo chemical formula line:

Remember that – means ‘in the plane’, ---- means ‘up towards you’ , and means ‘down away from you’│

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Empirical formula / Molecular formula | Lewis Diagram  Show valence e- only | Stereo-chemical formula |  | Central Atom(s) – lone pairs | Central Atoms(s) – bonding e- | shape(s) around each central atom | Bond dipoles | Polar or Non-polar |
| 1 | NH3(g) | N has 5 valence e-,  H has 1 valence e- | H -- N – H  │  H  Another stereo diagram would have the left hand H pointing away from you |  | N – one lone pair | N – 3 bonding electrons | Pyramidal | N🡨 🡪H  nitrogen is more electronegative  unbalanced dipole | Polar |
| 2 | C2Cl4(g) | Note the double bond between the two carbons. Carbon acts like it is bonding in three directions instead of four directions | Cl – C = C – Cl    Cl Cl  Bond angles should all be 120o |  | C atoms have  0 – lone pairs | Both C atoms have – 4 bonding electrons – but only 3 directions | Trigonal planar | C🡨 🡪C no dipole  C🡨 🡪 Cl  Chlorine is more electronegative  Dipoles cancel | Non polar |
|  | Empirical formula / Molecular formula | Lewis Diagram  Show valence e- only | Stereo-chemical formula |  | Central Atom(s) – lone pairs | Central Atoms(s) – bonding e- | shape(s) around each central atom | Bond dipoles | Polar or Non-polar |
| 3 | CF4(g) | C has 4 valence electrons  F has 7 valence electrons | F  │  F – C --- F    F |  | Carbon has 0 lone pairs | Carbon has 4 bonding electrons | Tetra hedral | F 🡨 🡪 C  Fluorine is more electronegative  Dipoles cancel | Non polar |
| 4 | OCl2(g) | O has 6 valence e-  Cl has 7 valence e- | Cl – O  │  Cl |  | Oxygen has 2 lone pairs | Oxygen has 2 bonding electrons | Angular, bent, v-shaped | O🡨 🡪 Cl  Oxygen is slightly more electronegative than chlorine  Unbalanced dipole | Polar |
| 5 | C2F2(g) | C has 4 valence e-  F has 7 valence e- | F – C Ξ C – F |  | Carbon has 0 lone pairs | Carbon has 4 bonding e-, but they all go in one direction | Linear | F🡨 🡪 C  Fluorine is more electronegative  Dipoles cancel | Non polar |
| 6 | HOF(l) | H has 1 valence e-  O has 6 valence e­  F has 7 valence e- | H – O  │  F |  | Oxygen has 2 lone pairs | Oxygen has 2 bonding electrons | Angular, Bent, v-shaped | O🡨 🡪 H  Oxygen is more electronegative  O🡨 🡪 F  Fluorine is more electronegative | polar |
| 7 | NHF2(g) | N has 5 valence e‑  H has 1 valence e-  F has 7 valence e- | F – N – H  │  F |  | Nitrogen has one lone pair | Nitrogen has 3 bonding e- | Pyramidal | N🡨 🡪 F  Fluorine is more electronegative  N🡨 🡪 H  Nitrogen is more electronegative | polar |
|  | Empirical formula / Molecular formula | Lewis Diagram  Show valence e- only | Stereo-chemical formula |  | Central Atom(s) – lone pairs | Central Atoms(s) – bonding e- | shape(s) around each central atom | Bond dipoles | Polar or Non-polar |
| 8 | C2IBr(l) | C has 4 valence e‑  I and Br both have 7 valence e‑ | Br – C Ξ C – I |  | Both C atoms have 0 lone pairs | Both C atoms have – 4 bonding electrons – but only 2 directions | Linear | C🡨 🡪 Br  Br is more electronegative  C🡨 🡪 I  I is slightly more electronegative | polar |
| 9 | CHClBr2(l) | C- 4 valence e-  H – 1 valence d‑  Cl and Br – 7 valence e- | Br  │  H – C--- Br    Cl |  | C has 0 lone pairs | C has 4 bonding e- | tetrahedral | C🡨 🡪 Br  Br is more electronegative  C🡨 🡪 Cl  Chlorine is more electronegative  C🡨 🡪 H  C is more electronegative | polar |
| 10 | C2HF3(l) | C – 4 valence e-  H – 1 valence e-  F – 7 valence e- | F – C = C – F  │ │  H F |  | C has 0 lone pairs | C has 4 bonding e-, but 3 directions | Trigonal planar | C🡨 🡪 H  C is more electronegative  C🡨 🡪 F  Fluorine is more electronegative | polar |
| 11 | H2O2(l) | H – 1 valence e-  O – 6 valence e- | H – O  │  O – H  Can also be a ‘boat shape’ |  | O has 2 lone pairs | O has 2 bonding e- | Angular, bent, v-shaped | O🡨 🡪 H  Oxygen is more electronegative | polar |
| 12 | CO2(g) | C – 4 valence e-  O – 6 valence e- | O = C = O |  | C has 0 lone pairs | C has 4 bonding e- | Linear | C🡨 🡪 O  Oxygen is more electronegative  Dipole cancel | Non polar |
|  | Empirical formula / Molecular formula | Lewis Diagram  Show valence e- only | Stereo-chemical formula |  | Central Atom(s) – lone pairs | Central Atoms(s) – bonding e- | shape(s) around each central atom | Bond dipoles | Polar or Non-polar |
| 13 | N2H3F(g) | N – 5 valence e-  H – 1 valence e-  F – 7 valence e- | H –N – N 🡪F  │  H H |  | N has 1 lone pair | N has 3 bonding e- | Pyramidal and pyramidal | N🡨 🡪 H  Nitrogen is more electronegative  N🡨 🡪 N no dipole  N 🡨 🡪 F  Fluorine is more electronegative | polar |
| 14 | C2H5OH(l) | C – 4 valence e-  O – 6 valence e-  H – 1 valence e- | H H  │ │  H -- C – C – O  │  H H H |  | C has 0 lone pairs  O has 2 lone pairs | C – 4 bonding e-  O – 2 bonding e- | Tetrahedral  Tetrahedral  Angular or bent or v-shaped | C🡨 🡪 O  Oxygen is more electronegative  O🡨 🡪 H  Oxygen is more electronegative  H🡨 🡪 C  C is more electronegative | polar |
| 15 | NH4+ (aq) | N – 5 valence e-  H – 1 valence e- | H+  │  H – N--- H    H |  | N has 1 lone pair | N – 3 bonding e‑  One coordinate covalent bond with the H+ | Tetrahedral | N🡨 🡪 H  Nitrogen is more electronegative | So polar that it forms an ion |
| 16 | CO32-(aq) | C has 4 valence e-  O has 6 valence e-  O- has 7 valence e‑ | O- - C = O  │  O- |  | C – 0 lone pairs  O – 2 lone pairs  O-  has 2 lone pairs | C – 4 bonding e-  O – 2 bonding e-  O-  has 1 bonding e- | Trigonal pyramidal | C🡨 🡪 O  O is more electronegative  C🡨 🡪 O-  O-  is more electronegative | So polar that it forms an ion |
|  | Empirical formula / Molecular formula | Lewis Diagram  Show valence e- only | Stereo-chemical formula |  | Central Atom(s) – lone pairs | Central Atoms(s) – bonding e- | shape(s) around each central atom | Bond dipoles | Polar or Non-polar |
| 17 | NO3-(aq) | N – 5 valence e-  O – 6 valence e-  O-  7 valence e- | O- - N – O  │  O |  | N – 1 lone pair  O – 2 lone pairs  O- has 2 lone pairs | N – 3 bonding e-  O – 2 bonding e-  O- has 1 bonding e‑ | Around N – pyramidal  Around O – bent, angular or v-shaped | N🡨 🡪 O  O is more electronegative  N🡨 🡪 O-  O- is more electronegative | So polar that it forms an ion |

1. Identify molecules (compounds or polyatomic ions) with multiple bonds: C2Cl4, C2F2, C2IBr, C2HF3, CO2, CO32-

* Multiple bonds make the reagent less stable
* Multiple bonds bring the atoms closer together

2. Identify the molecule(s) with coordinate covalent bonds. NH4+

3. Based on given states, which molecules have the strongest bonds? All the liquids

4. Based on given states, which molecules have the weakest bonds? All the gases

5. Do questions 9, 10, and 11 from pages 100 🡪 101 of your text. (Attach a piece of paper please)

6. Glucose has MANY isomers. Sketch three different line diagrams for glucose.