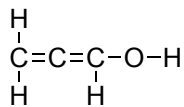
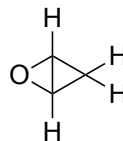
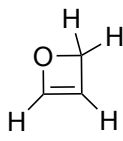
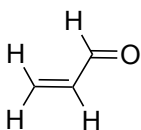
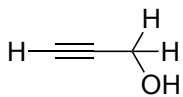
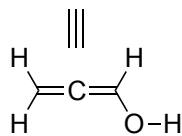


1. (4 points) Draw two valid Lewis structures for C_3H_4O where none of the atoms have a formal charge.

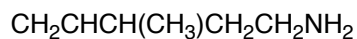


← 2 unsaturations therefore need 2 pi bonds; 2 rings; or a pi bond and a ring

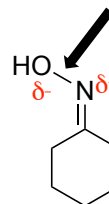
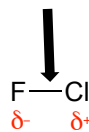
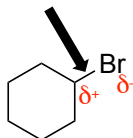
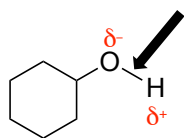


several others

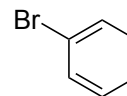
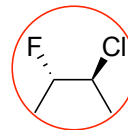
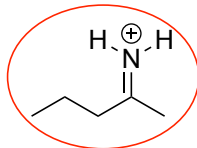
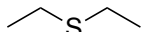
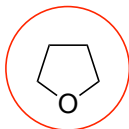
2. (3 points) Convert the following condensed structure into a Lewis structure or bond-line structure.



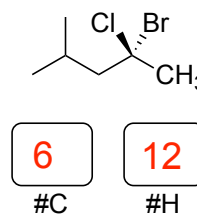
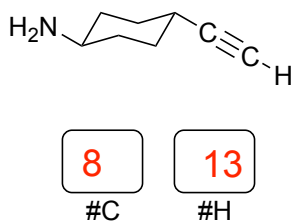
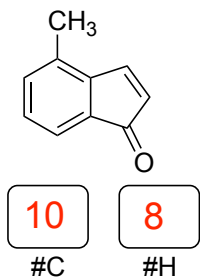
3. (4 points) Indicate the polarity of the indicated bonds using δ^+ and δ^-



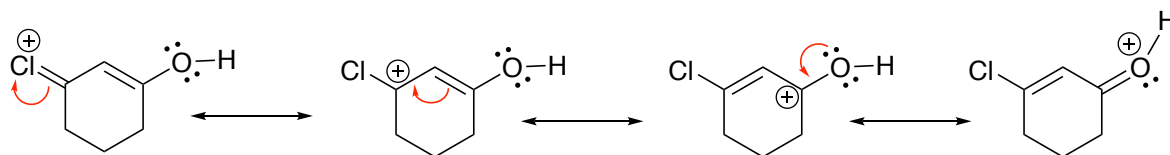
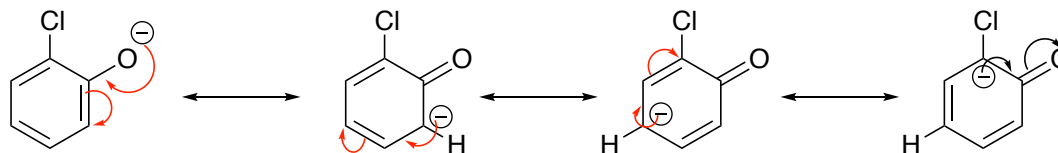
4. (4 points) Circle the compound(s) below that will participate in hydrogen bonding.



5. (6 points) Indicate the number of carbons and hydrogens in each of the structures below.



6. (12 pts) Using curly arrows, draw the resonance structures of the following compounds to show distribution of charge. Note the correct use of curly arrows are required and will constitute a significant number of points.



7. (15 points) Below is the structure of Breo Ellipta, which had \$1.39 billion dollars in sales in 2025 for treatment of pulmonary diseases.

- in the 3 circles labeled “hybrid.”, give the indicated atom's hybridization (i.e. sp^4 , sp^3 , sp^2 , or sp)
- in the 4 triangles labeled “type”, indicate the type of carbon (i.e. 0° , 1° , 2° , 3° , 4° , 5°)
- in the box labeled “orbitals”, indicate the orbitals that makeup the indicated bonds
- on the 4 lines with arrows pointing to the 4 oxygens with boxes () around them, indicate the name of the functional group* that the oxygen is involved in

*note: carbonyl is not an answer here.

