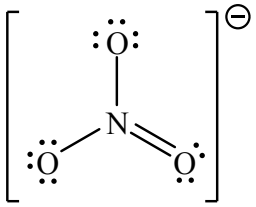
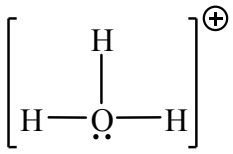
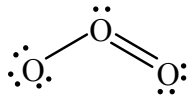
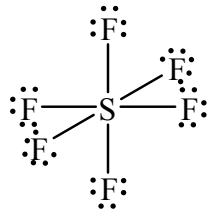
CHEM1101 Answers to Problem Sheet 6

1. **VSEPR can be used to predict shapes of molecules using:**
   - **bonding groups – number of bonds around central atom in Lewis structure**
   - **lone pairs – number of lone pairs around central atom in Lewis structure**
   - **arrangement of pairs – VSEPR arrangement of bonding groups and lone pairs**
   - **geometry / shape – observed shape of the molecule or ion (lone pairs not seen)**

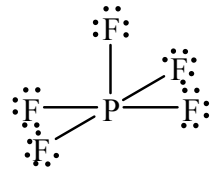
	bonding groups	lone pairs	total number of pairs and arrangement	shape / geometry
(a) NO_3^- 	**3**	**0**	**3 trigonal planar**	**trigonal planar**
(b) H_3O^+ 	**3**	**1**	**4 tetrahedral**	**trigonal pyramidal**
(c) O_3 	**2**	**1**	**3 trigonal planar**	**bent**

(d) SF_6



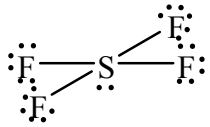
6	**0**	**6 octahedral**	**octahedral**

(e) PF_5



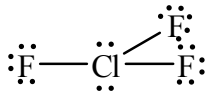
5	**0**	**5 trigonal bipyramid**	**trigonal bipyramid**

(f) SF_4



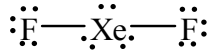
4	**1**	**5 trigonal bipyramid**	**see-saw**

(g) ClF_3



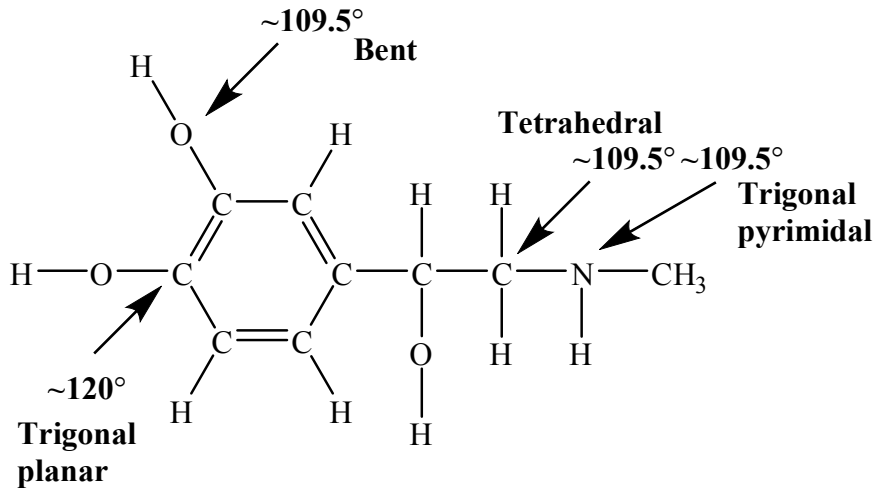
3	**2**	**5 trigonal bipyramid**	**T-shaped**

(h) XeF_2

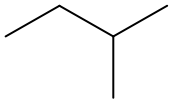
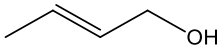
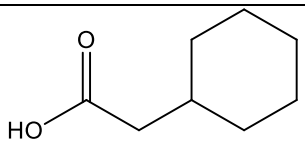
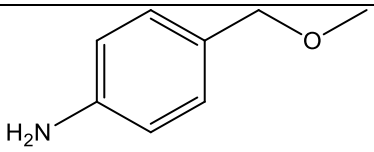


2	**3**	**5 trigonal bipyramid**	**linear**

2.



3.

Stick notation	Number of C atoms	Number of H atoms
	5	12
	4	8
	8	14
	8	11

4. (a) **Dipole-dipole and dispersion forces are acting between the molecules in these compounds.**

(b) **The electronegativity of the halogens decreases in the order F > Cl > Br so the polarity of the bonds decreases in the order C-F > C-Cl > C-Br, as shown by the dipole moments. The dipole-dipole interactions are therefore largest in CH_2F_2. However, dispersion forces increase with the size of the electron cloud and, hence, with the atomic number. These are therefore largest in CH_2Br_2. The dispersion forces must be more important than the dipole-dipole interactions in these compounds so the boiling points increase in the order $CH_2F_2 < CH_2Cl_2 < CH_2Br_2$.**

5. **A and C** **presence of OH groups will lead to H-bonding interactions.**
B **delocalized π electron density will lead to dispersion interactions.**
D **charged group with N-H bonds will lead to interaction with ions and polar groups.**