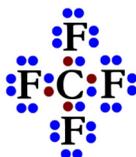


Solutions to the Extra Problems for Chapter 5

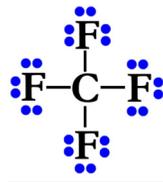
1. a. We have one carbon atom, which is in group 4A and therefore has four valence electrons. We also have four fluorine atoms. Since fluorine is in Group 7A, they each have seven dots around them:



We put the carbon in the center, since it has the most unpaired electrons, and when we have the fluorines each share one of those electrons, every atom gets eight:



Replacing the shared electron pair with a line gives us:



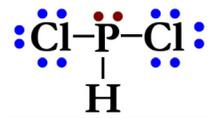
b. We have one phosphorus, which is in Group 5A and thus has five dots around it. We also have two chlorines, which are in Group 7A and thus have seven dots around them. Finally, there is one hydrogen, which has one dot:



The phosphorus goes in the middle, since it has the most unpaired electrons. When we attach the chlorines and hydrogen to it, every atom has what it needs:



Replacing each shared electron pair with a line gives us:

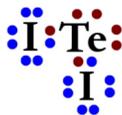


Remember, it doesn't matter where your Cl's and H are, as long as the P is in the middle, and you have each Cl single-bonded to it and the H single-bonded to it.

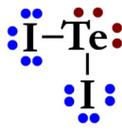
c. We have one Te, which is in Group 6A and therefore has six dots and two iodines, which are in Group 7A and therefore have seven dots:



Te goes in the middle, because it has the most unpaired electrons. When we attach the others to it, all atoms have what they need:



Replacing each shared electron pair with a line gives us:



d. We have two selenium atoms, each of which has six dots, because selenium is in Group 6A:



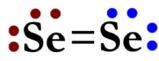
We have to put them together to see what we can do next:



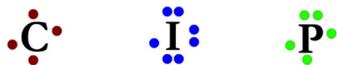
Both atoms have only seven dots around them, but if they each share their one unpaired electron, that will give them each eight:



Replacing each shared electron pair with a line gives us:



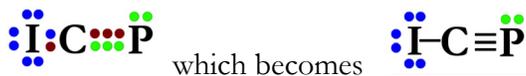
e. We have one carbon (with four dots), one iodine (with seven dots), and one phosphorus (with five dots):



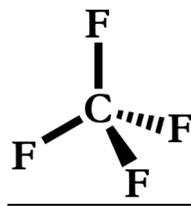
The carbon goes in the middle, since it has the most unpaired electrons. Hanging the others on it gives us:



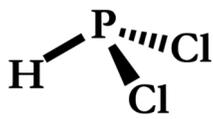
The iodine has eight dots, but the carbon and phosphorus have only six. However, if they each share their unpaired electrons, we get:



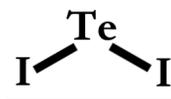
2. a. The Lewis structure shows four bonds around the carbon atom. That makes the shape tetrahedral.



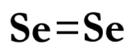
b. The Lewis structure shows four moveable groups of electrons around the phosphorus atom, so the base geometry is tetrahedral. However, one of those groups is not a bond, so there are only three legs on the tetrahedron. That makes it pyramidal.



c. There are four moveable groups of electrons around the Te atom, so the base geometry is tetrahedral. However, two of those groups are not bonds, so there are only two legs on the tetrahedron. That makes it bent.



d. There are only two elements in the molecule, so this is linear:



e. There are only two moveable groups around the carbon atom (one single bond and one triple bond), so this is also linear:



3. a. Fluorine is more electronegative than carbon (farther to the right on the Periodic Table), but if you look at the stick figure, the electrons are being pulled in all directions. Thus, the electron pulls cancel one another out, and this molecule is purely covalent.

b. Chlorine is more electronegative than phosphorus (farther to the right on the Periodic Table). It turns out that hydrogen and phosphorus have the same electronegativity, but that doesn't matter. Since the P-Cl bonds are polar and they don't cancel one another out (they both pull down and to the right in the stick figure), then this molecule is polar covalent.

c. Iodine is more electronegative than Te (farther to the right on the Periodic Table). Since the bonds are polar and they don't cancel one another out (they both pull down), then this molecule is polar covalent.

d. This molecule has two of the same atom, so the bond is not polar. Thus, this is purely covalent.

e. Carbon and iodine have the same electronegativity so that bond is not polar (see the electronegativity table). Phosphorus is less electronegative than carbon (see the electronegativity table), so that bond is polar. Since there is no bond that can cancel that polar bond out, this molecule is polar covalent.

4. Water tends to dissolve polar covalent and ionic molecules. Thus, while (b), (c), and (e) are likely to dissolve in water, (a) and (d) are not.

5. a. This one is there to keep you on your toes. You don't use prefixes, because this molecule has a metal and nonmetal and is therefore ionic. Thus, it is calcium chloride.

b. There are two nitrogens and one oxygen, so it is dinitrogen monoxide. You can also say dinitrogen monoxide.

c. There is one sulfur and three oxygens. We drop the "mono" prefix for the first element, so it is sulfur trioxide.

d. There are two nitrogens and four oxygens, so this is dinitrogen tetroxide. You can also say dinitrogen tetraoxide.

e. There are two carbons and two chlorines, so this is dicarbon dichloride.

6. Size decreases as you go up and to the right on the Table, so the element highest and farthest to the right is the smallest, and those that appear farther down and to the left are larger: O, Al, Ca, Cs.

7. Electronegativity increases as you go to the right and up, so the one farthest down and to the left is the least electronegative, and those farther up and to the right are more electronegative: Rb, Ca, Ga, P, O.

8. Purely covalent bonds occur when the bonded atoms have the same electronegativity. Since O₂ has two of the same element bonded together, it will have a purely covalent bond.