

Dot Structures Extra Exercises

What keeps atoms together in compounds? Very often, second period covalent compounds follow the *octet rule*; that is each atom, through sharing of electrons, gets “claim” to 8 electrons. Hydrogen, of course, only wants 2 electrons. To show how such atoms bond, we keep track of electrons through *Lewis dot structures*.

Three Basic Rules for Lewis Dot Structures:

1. Each *valence* electron is represented by 1 dot.
2. For hydrogen, halogens and second period non-metals, the number of electrons needed to complete a shell is the number of electrons that the atom will have to share when forming a covalent bond. ***You share what you need!***
3. Each atom in the stable compound must be satisfied. Otherwise you'll have an unstable radical.

Element	Shell Diagram	Valence Electrons (number of dots)	Missing Electrons (number of electrons to be shared)
H	1)	1	2 - 1 = 1
C	2)4	4	8 - 4 = 4
N	2)5	5	8 - 5 = 3
O	2)6	6	8 - 6 = 2
Cl	2)8)7	7	8 - 7 = 1

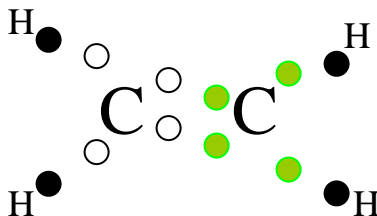
Example 1:



Solution:

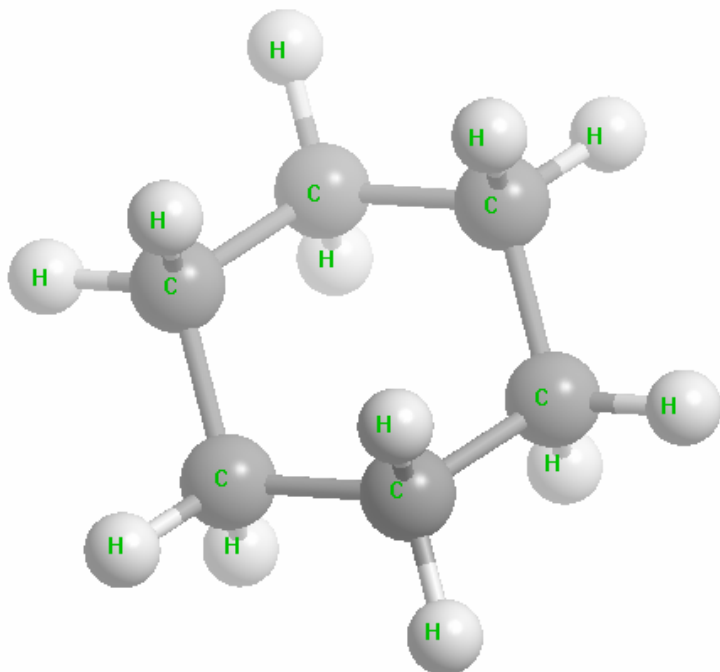
From the table we see that carbon starts with 4, needs 4 more electrons and so must share 4. Each hydrogen starts with 1, needs 1 more, so must share 1.

If one carbon attached itself to four hydrogens, it would make a different compound, CH_4 . So each could only attach itself to two hydrogens and each carbon gets the other two electrons from the other carbon like this:

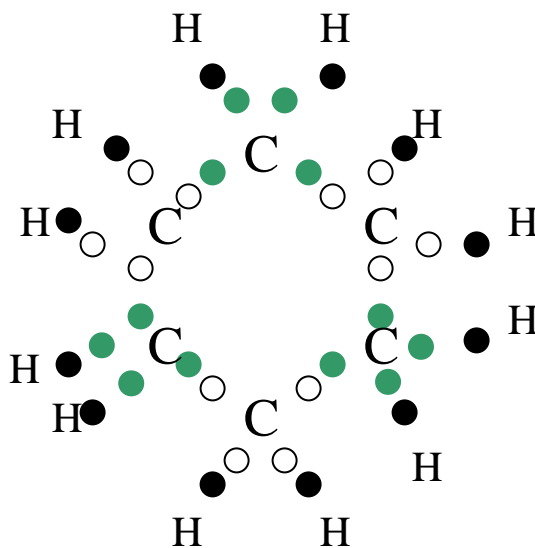


The pair of electrons between each C and H make up a single bond. The two pairs between the two carbons make up a double bond.

Example 2: Cyclic or closed structures are very common in both nature's and man's laboratories. For example one possible version of C_6H_{12} is the solvent cyclohexane.

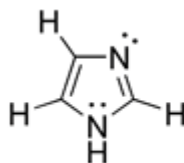


We have shown each bond as a stick. The dot structure would look like the following:



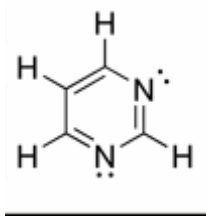
Exercises

1. **Pyrimidine**, $C_4H_4N_2$, is a **six-membered ring** with a carbon in-between the two nitrogen atoms. The DNA bases uracil, thymine and cytosine are all similar in structure to pyrimidine. Draw its dot structure.
2. **Pyrrole** is a **five-membered ring** with the formula C_4H_5N . On its own it is carcinogenic (causes cancer), but as part of larger molecules it makes up vital compounds such as vitamin B-12 and chlorophyll. Draw pyrrole's dot structure.
3. **Pyridine**, a clear liquid with an odor that is sour, putrid, and fish-like, is used in making a wide variety of dyes, pharmaceuticals and pesticides. It is a **six-membered ring** with a formula of C_5H_5N . Draw its dot structure.
4. **Purine**, $C_5H_4N_4$ is related to adenine and guanine, two DNA bases. The former compound is also related in structure to a wide variety of other biological molecules such as RNA, ATP and two of life's vital oxidizing agents: NAD^+ and FAD . The structure of purine is basically a *imidazole ring* (shown below) fused with pyrimidine (from #1).

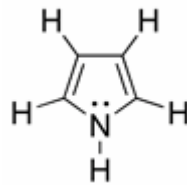


Answers on the next page.

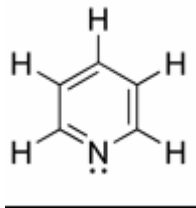
1. Pyrimidine



2. Pyrrole



3. Pyridine



4. Purine

