

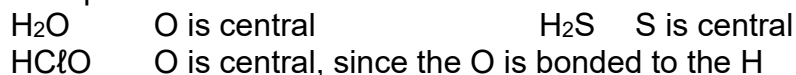


Lewis Dot Diagrams 1

GUIDELINES TO CONSTRUCTING LEWIS DOT DIAGRAMS

- [1] Determine which atoms are attached to each other.
 - [a] The central atom of a molecule is *often* written first in the formula, followed by the atoms that surround it (e.g., CO_2 , NH_3 , NO_2 , NO_3^- , SO_3 , CO_3^{2-} , SO_4^{2-} , . . .)
 - [b] H is never the central atom.
 - [c] For molecules containing C, C is the central atom.
 - [d] For other molecules of the form H_mXO_n (oxyacids), the hydrogen atoms are bonded to oxygen atoms. The remaining element, X, is usually the central atom.
 - [e] For binary compounds, the atom that occurs once is the central atom (e.g., in SCl_4 , S is the central atom)

Some examples are:



- [2] Count up all the valence electrons in the atoms. For ions, add an electron for each negative charge, and remove an electron for each positive charge.
- [3] Place one pair of electrons in each bond.
- [4] Complete the octets of the atoms bonded to the central atom, remembering that the valence shell for hydrogen is complete with only two electrons, and remembering that there are exceptions to the octet rule (see below).
- [5] Place additional electrons on the central atom, in pairs.
- [6] If the central atom still does not have an octet, form multiple bonds so that each atom has an octet.

DRAWING THE DIAGRAM

- [1] Dashes can represent electron pairs between atoms.
- [2] Lewis structures of ions are written in brackets, with the charge written as a superscript (exponent).

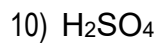
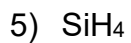
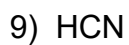
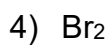
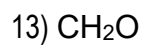
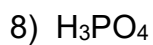
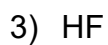
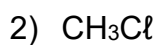
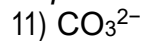
EXCEPTIONS TO THE OCTET RULE

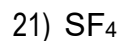
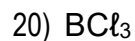
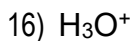
- [1] The central atom can have less than an octet of electrons around it: in BeCl_2 the beryllium atom has only four valence electrons. Boron can have just six.
- [2] Atoms in the third period onwards (sodium and higher) can have more than an octet of electrons around them: In PCl_5 , phosphorus has 10 electrons.
- [3] Because there are exceptions to the rule, the octet rule should not be used as the main method for deciding on the configuration of electrons in a molecule. It is more useful to apply the rules for common elements that don't vary much.
 - [a] Hydrogen and the group 1 elements always bond once.
 - [b] Carbon *almost* always bonds four times.
 - [c] The halogens *almost* always bond once (oxyanions are often an exception).
 - [d] Oxygen usually bonds twice.
 - [e] Nitrogen often bonds three times, but is unpredictable.



EXERCISES

A. For each other following, determine the number of valence electrons, and draw the Lewis dot diagram. [*Hint: Boron and beryllium can have exceptions.*]



**SOLUTIONS**