

# Lewis Structures – part II

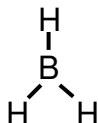
## Chem Worksheet 9-5

Name \_\_\_\_\_

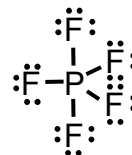
### Molecules that don't follow octet rule

There are some cases in which all of the elements in a Lewis structure will not follow the octet rule. Recall that the **octet rule** states atoms will share valence electrons in a way that gives them a complete set (8). In a few examples the elements have less than octet. Boron trihydride is an example of a compound where an element has less than an octet. Other molecules may contain elements with more than an octet of electrons. In the phosphorus pentafluoride molecule the bonded phosphorus atom has 10 electrons around it. Elements in period 3, 4, 5, and 6 can take extra electrons because they have an empty *d* orbital available.

Boron trihydride ( $\text{BH}_3$ ) – The boron has **less than an octet** of electrons in this molecule.

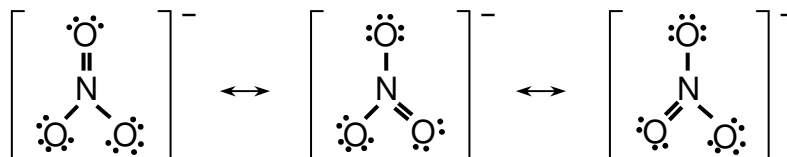


Phosphorus pentafluoride ( $\text{PF}_5$ ) – The phosphorus atom has **more than an octet** of electrons in this molecule.



### Resonance

**Resonance** occurs when more than one valid Lewis structure can be written for a compound. The nitrate ion,  $\text{NO}_3^-$  has a double bond between nitrogen and one of the oxygen atoms. The double bond could form with any of the three oxygen atoms to give a working model of the molecule. Experimentation shows that there are not three distinct models for this ion. Instead there is one structure that is a hybrid of all three – a sort of average. Resonance structures only differ by the placement of their electrons. These Lewis structures are drawn by creating models for each and putting double-headed arrows between each structure.



**Draw Lewis structures for the following. State which element does not have an octet.**

- |                     |                        |
|---------------------|------------------------|
| 1. $\text{BF}_3$    | 6. $\text{ICl}_4^-$    |
| 2. $\text{AsF}_6^-$ | 7. $\text{BeH}_2$      |
| 3. $\text{ClF}_3$   | 8. $\text{TeF}_4$      |
| 4. $\text{SF}_6$    | 9. $\text{SnCl}_3^-$   |
| 5. $\text{RnCl}_2$  | 10. $\text{PO}_4^{3-}$ |

**Draw Lewis structures for these compounds. Show all resonance structures.**

- |   |                        |
|---|------------------------|
| 11. $\text{SO}_3$                               | 14. $\text{SO}_2$      |
| 12. $\text{NO}_2^-$                             | 15. $\text{CO}_3^{2-}$ |
| 13. $\text{SCN}^-$ (carbon is the central atom) | 16. $\text{XeO}_3$     |