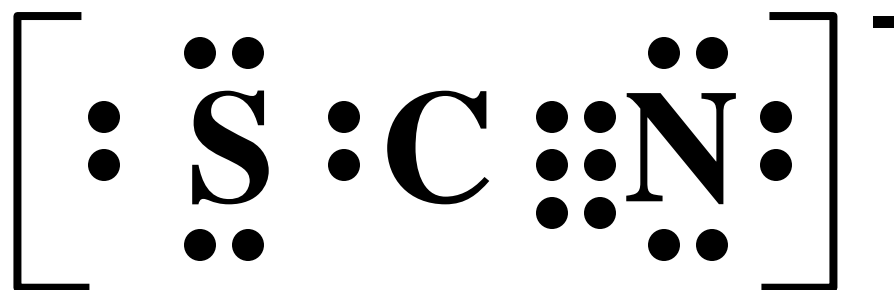


FORMAL CHARGE AND LEWIS DOT DIAGRAMS

FORMAL CHARGE AND LEWIS DOT DIAGRAMS

Draw the Lewis Dot Diagram for **SCN⁻**

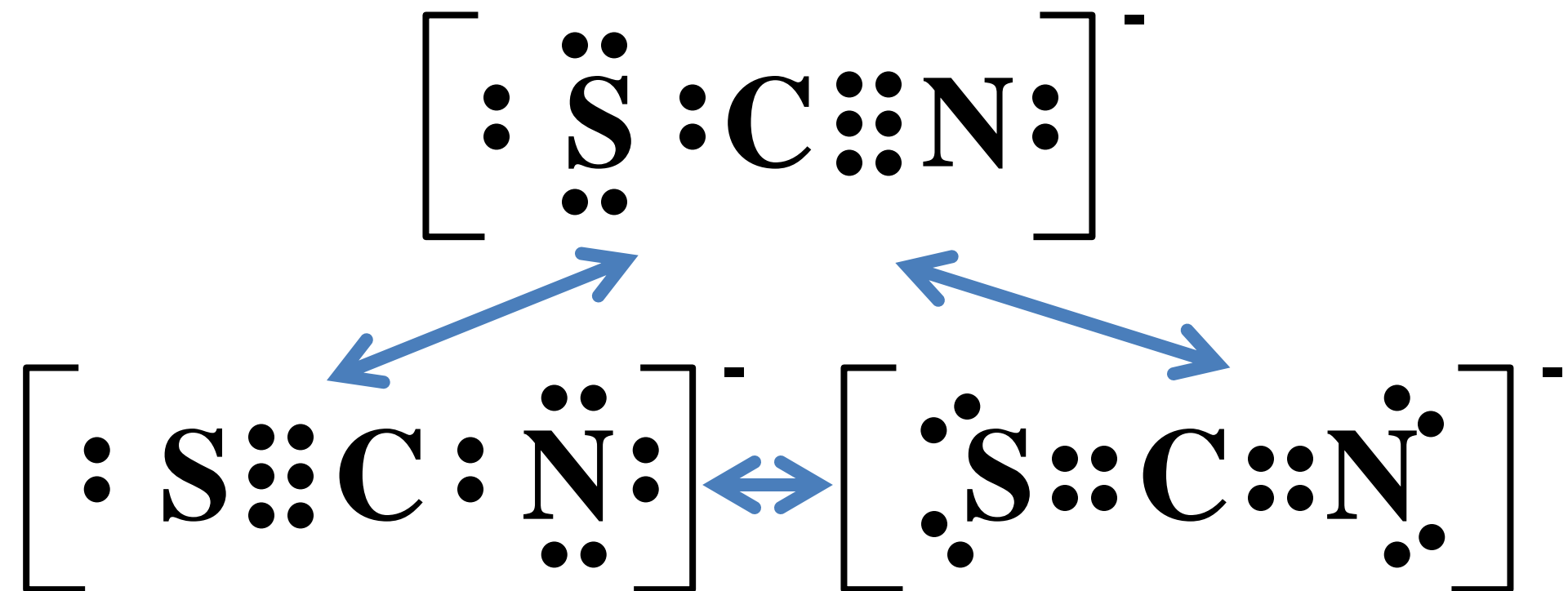


$$6 + 4 + 5 + 1 = 16 \text{ electrons}$$

But this **isn't** the only possible way to draw the structure

FORMAL CHARGE AND LEWIS DOT DIAGRAMS

Draw the 3 possible Lewis Dot Diagrams for **SCN⁻**



Which of these is the most likely resonance structure?

FORMAL CHARGE AND LEWIS DOT DIAGRAMS

Formal charges can be used to determine

- 1) which resonance structure is preferred over the others when several resonance structures exist;
- 2) whether a particular structure is reasonable;
- 3) which part of a molecule is charged.

Formal Charge = Valence Electrons – (number of nonbonding electrons + number of bonds)

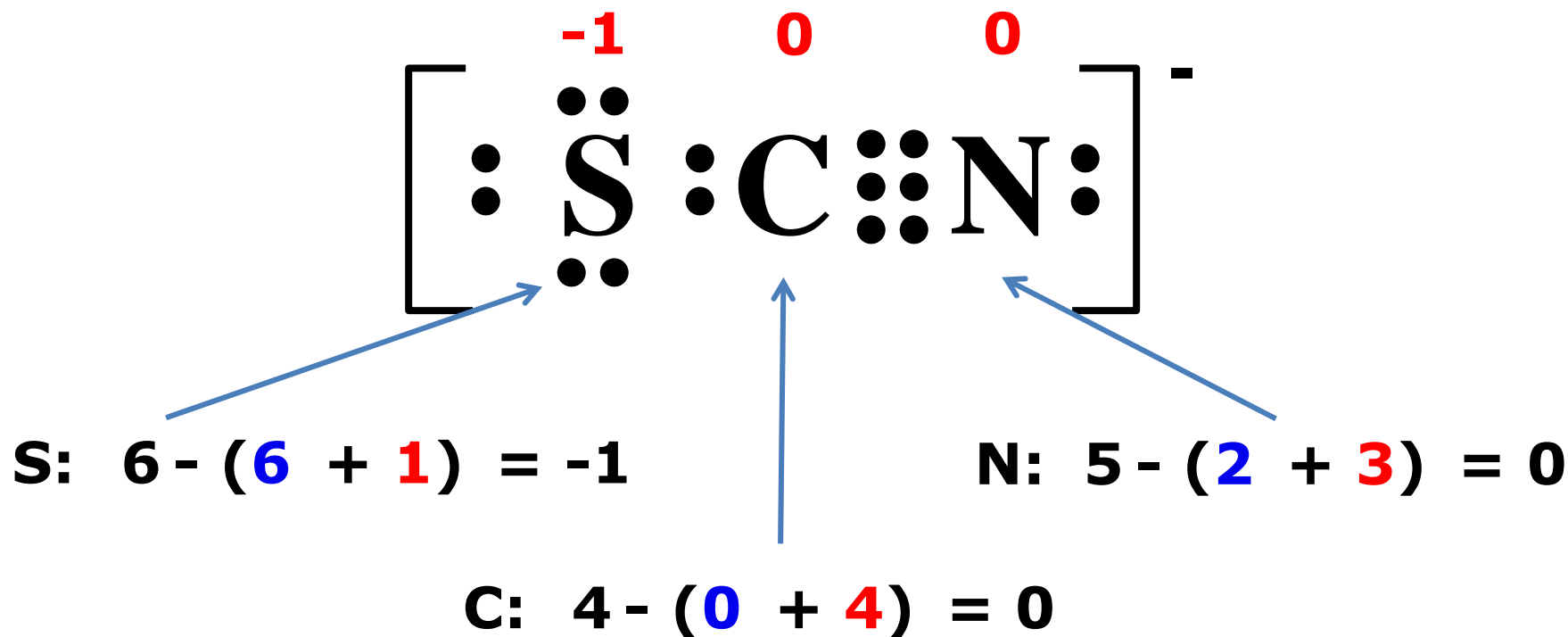
NOTE:

Formal charge is **NOT** the overall charge of a molecule. Instead, they *add up* to the charge of a molecule.

FORMAL CHARGE AND LEWIS DOT DIAGRAMS

Assigning formal charges:

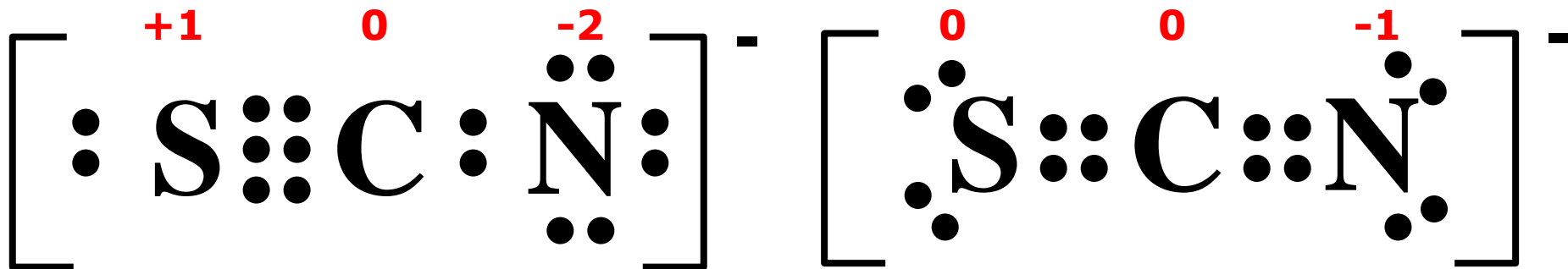
Formal Charge = Valence Electrons – (number of nonbonding electrons + number of bonds)



FORMAL CHARGE AND LEWIS DOT DIAGRAMS

Assign formal charges to the other structures for **SCN⁻**

Formal Charge = Valence Electrons – (number of nonbonding electrons + number of bonds)



$$\text{S: } 6 - (2 + 3) = +1$$

$$\text{C: } 4 - (0 + 4) = 0$$

$$\text{N: } 5 - (6 + 1) = -2$$

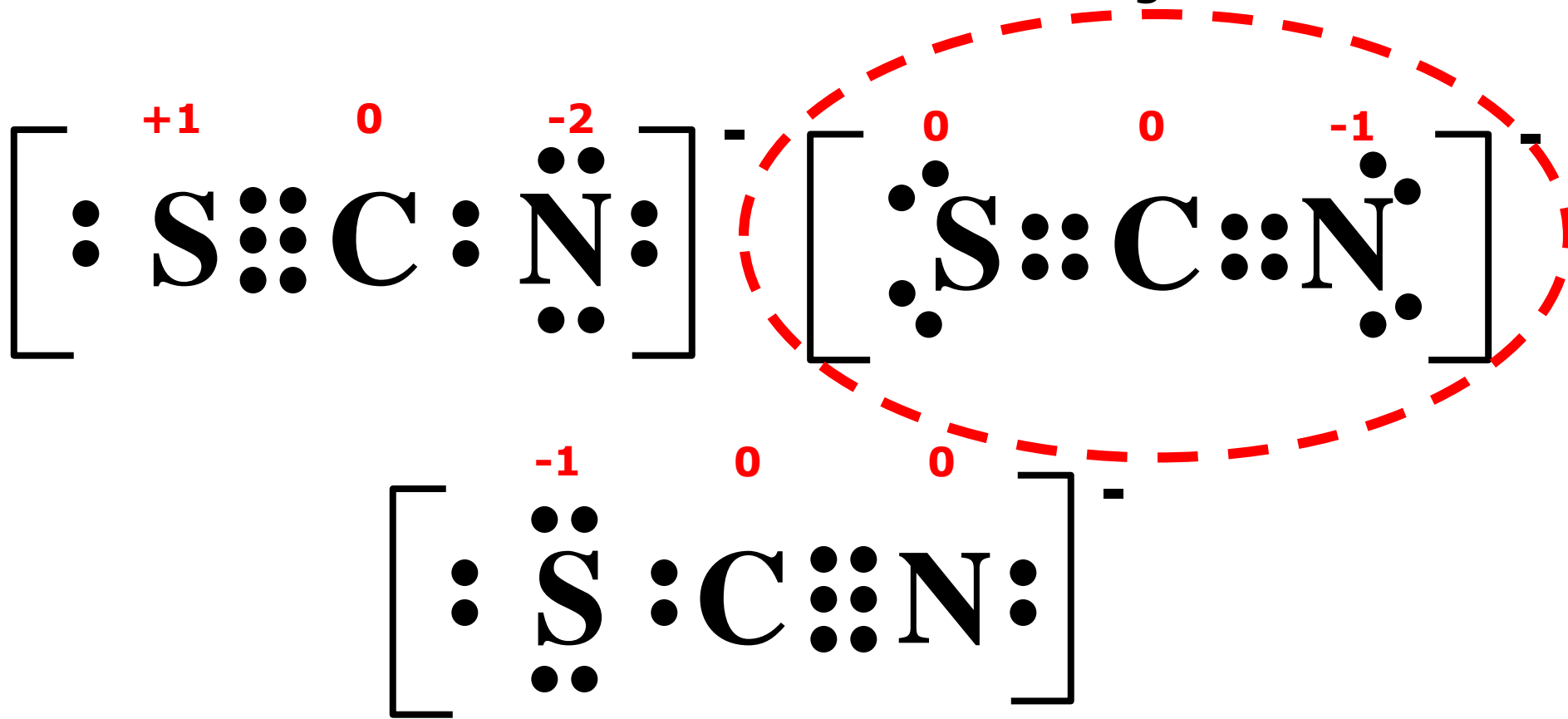
$$\text{S: } 6 - (4 + 2) = 0$$

$$\text{C: } 4 - (0 + 4) = 0$$

$$\text{N: } 5 - (4 + 2) = -1$$

FORMAL CHARGE AND LEWIS DOT DIAGRAMS

Example #1: Compare the SCN⁻ structures. Which one has the most neutral formal charges?

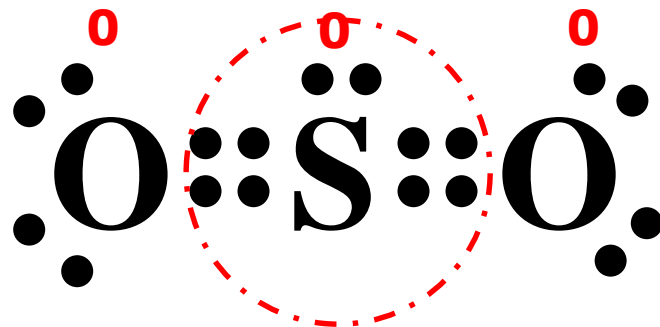


This is the **most preferred** structure. There are the most 0 formal charges and the most electronegative atom has the negative charge.

FORMAL CHARGE AND LEWIS DOT DIAGRAMS

Formal charges can also be used to determine if a structure is reasonable.

Example #2: Can **SO₂** have this Lewis structure?



Sulfur exceeds the octet

$$\text{O: } 6 - (4 + 2) = 0$$

$$\text{S: } 6 - (2 + 4) = 0$$

ALL formal charges are zero. Thus this structure is reasonable.

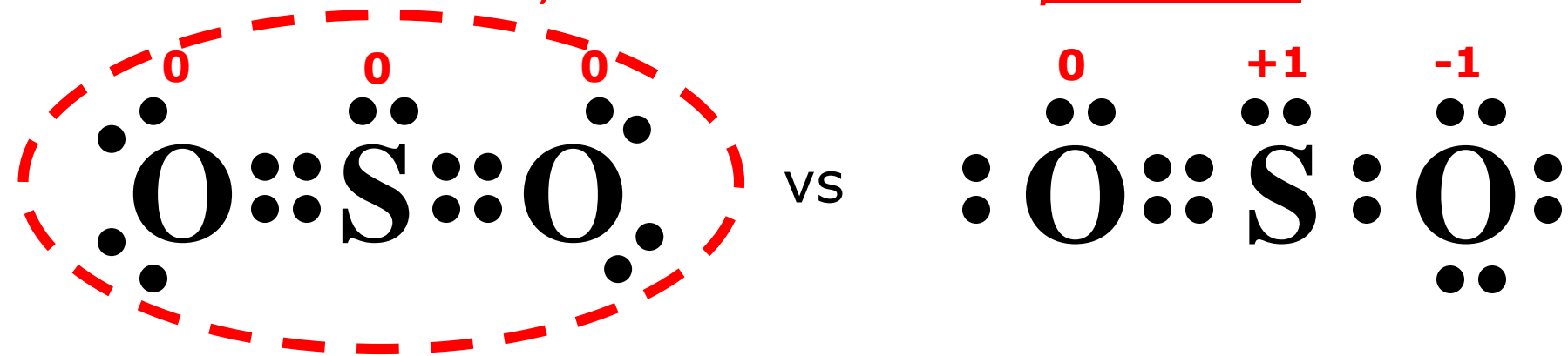
Formal Charge = Valence Electrons – (number of nonbonding electrons + number of bonds)

FORMAL CHARGE AND LEWIS DOT DIAGRAMS

Formal charges can also be used to determine if a structure is reasonable.

Example #2: Can SO_2 have this Lewis structure?

In fact, this structure is preferred

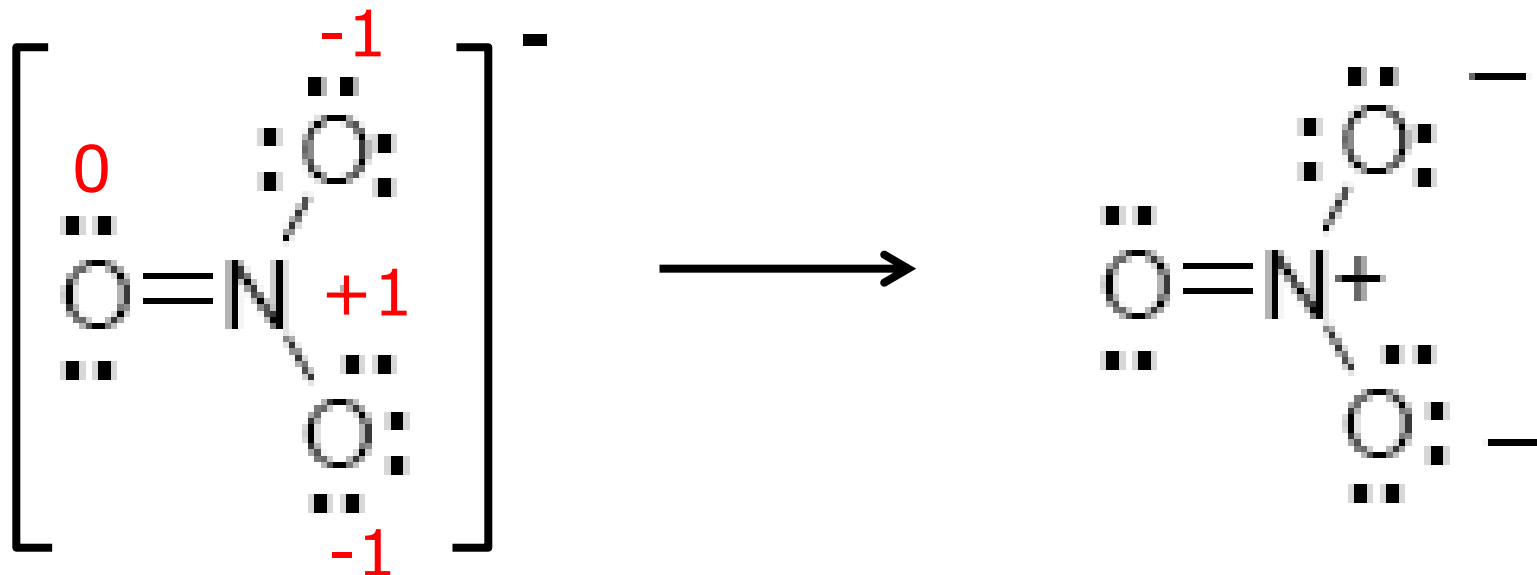


Often it is preferred to **violate the Octet Rule** in order to achieve a zero formal charge on an atom.

FORMAL CHARGE AND LEWIS DOT DIAGRAMS

Furthermore, formal charges can be used to identify which part of a molecule is charged

Example #3: Which part of NO_3^- is charged?



$$\text{O: } 6 - (6 + 1) = -1$$

$$\text{O': } 6 - (4 + 2) = 0$$

$$\text{N: } 5 - (0 + 4) = +1$$

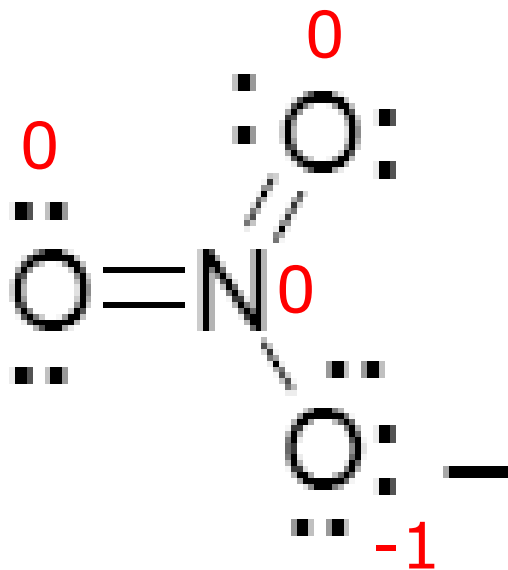
The 2 single-bonded oxygen atoms have a negative charge, and nitrogen has a positive charge.

FORMAL CHARGE AND LEWIS DOT DIAGRAMS

Furthermore, formal charges can be used to identify which part of a molecule is charged

Example #3: Which part of NO_3^- is charged?

Why can't NO_3^- be drawn this way so that the central atom does not have a positive charge?



Nitrogen **cannot** exceed the octet. Only elements beyond atomic number 10 (Neon) can exceed the Octet Rule.

FORMAL CHARGE AND LEWIS DOT DIAGRAMS

Showing how formal charges can *replace* square brackets in Lewis diagrams of ions

