Formal Charges

# Definitions

|  |  |
| --- | --- |
| Oxidation Numbers | Assigned by assuming in a bond spend all of their time around the most Electronegative element |
| Formal Charges | Assume are shared equally  Determined by equation:  **Best Structure**   * Best structure contains the lowest sum of Formal Charges * Most E.N. element with the lowest F.C. (usually negative) |

## Example 1

### Find total valence

|  |  |  |  |
| --- | --- | --- | --- |
| Element | Charge on element | Valence | Total |
| Nitrogen (N) |  |  |  |
| Carbon (C) |  |  |
| Oxygen (O) |  |  |
|  |  |  |

### Draw preliminary diagrams

|  |  |
| --- | --- |
| **Step** | **Total remaining** |
| **To draw the preliminary diagram, start with only single bonds (only 1 line)** |  |
| **Ex** 🡪 | |
| **Upon that, add the remaining pairs of electrons surrounding the outer elements**  In this case, surround both Nitrogen and Oxygen with 3 lines, each representing 2, for a total of 8 |  |
| **Ex** 🡪 | |
| **The number of on the central atom must add up to 8.**  In this case, Carbon only has 4, meaning that it still needs 4. The only way you can add to a central atom is to increase the number of bonds surrounding it. | |
| **Ex** 🡪 | |
| **There are usually many ways to draw the diagram. Draw all possibilities (or however many are necessary)**  Here’s where this gets interesting (or confusing). There is more than one way to balance the electrons in this example. For example, you can have a triple bond between the Nitrogen and the Carbon with a single bond between the Carbon and Oxygen. Or you can have a triple bond between the Oxygen and the Carbon with a single bond between the Carbon and the Nitrogen. | |
| **Ex 🡪** | |

### Determine Formal Charges

In this step, you must find the Formal Charges for all elements for all diagrams (yes, it’s tedious. Suck it up.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Diagram 1 | Element |  |  | F.C. |
|  | Nitrogen |  |  |  |
| Oxygen |  |  |  |
| Carbon |  |  |  |
| Final Charge | | | |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Diagram 2 | Element |  |  | F.C. |
|  | Nitrogen |  |  |  |
| Oxygen |  |  |  |
| Carbon |  |  |  |
| Final Charge | | | |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Diagram 3 | Element |  |  | F.C. |
|  | Nitrogen |  |  |  |
| Oxygen |  |  |  |
| Carbon |  |  |  |
| Final Charge | | | |  |

Since the final charge on each of the diagrams is the same (), therefore, find the lowest charge on the most E.N element. In this case, the most E.N. element is Oxygen.

|  |  |
| --- | --- |
| Final Charge on Oxygen | |
| Diagram | Formal Charge |
| 1 |  |
| 2 |  |
| 3 |  |



**Best Structure** 🡪