Isotopes

The number of protons in a nucleus determines the identity of the element. For example, any atom having 6 protons will be a "carbon" atom. If we were to add an extra proton to the nucleus, we would have an entirely different element. For example,

$$\text{C (6 protons)} + 1 \text{ proton} \rightarrow \text{N (7 protons)}$$

On the other hand, if we add an extra NEUTRON to a nucleus we simply end up with the same element, just a little heavier, since the charge on the nucleus would be unchanged.

**ISOTOPES of a given element have the same ATOMIC NUMBER but a different ATOMIC MASS.**

In other words, isotopes have the same number of protons but a different number of neutrons.

Since any atom having 9 protons (Z = 9) must be an atom of fluorine, we can omit the Z-value and just use the symbol F for many purposes, i.e., we can write $^{19}\text{F}$ instead of $^{19}_9\text{F}$.

**Example:** Oxygen has 3 naturally occurring isotopes, namely $^{16}\text{O}$, $^{17}\text{O}$ and $^{18}\text{O}$.

Each of these three atoms has 8 protons and 8 electrons. However, the first isotope has ___ neutrons, the second has ___ neutrons and the third has ___.

1. Use the standard notation given to fill in the following table for each of the isotopes listed.

<table>
<thead>
<tr>
<th>Stand. notation</th>
<th>Atomic Mass</th>
<th>Atomic #</th>
<th># Protons</th>
<th># Neutrons</th>
<th># Electrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{23}\text{Na}$</td>
<td></td>
<td>11</td>
<td>11</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>$^{20}\text{Ne}$</td>
<td></td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>$^{201}\text{Hg}$</td>
<td></td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>$^{65}\text{Zn}$</td>
<td></td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>$^{27}\text{Al}$</td>
<td></td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>13</td>
</tr>
</tbody>
</table>

2. Complete the following table (beware of the ion!).

<table>
<thead>
<tr>
<th>Stand. notation</th>
<th>Atomic Mass</th>
<th>Atomic #</th>
<th># Protons</th>
<th># Neutrons</th>
<th># Electrons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>84</td>
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<td>35</td>
<td>45</td>
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</tr>
<tr>
<td></td>
<td>127</td>
<td>53</td>
<td>27</td>
<td>32</td>
<td>27</td>
</tr>
</tbody>
</table>