Lesson plan 10 – Combining power

Subject and Grade Level: Chemistry
Date: 18th May 2018

Competences:
Collaboration - students to work in teams of 2 for the activity
Making – combining power cards
Application – using combining power to predict chemical formulae

Topic: Combining power / valency

Learning Objectives of the Lesson: Students will learn that atoms of different elements form different numbers of bonds

Previous Knowledge of Students: Student should know that atoms of different elements combine to form compounds

Educational Tools, Aids, and Materials: small pieces of card (4 cm x 4 cm) x 26

Flow of the Lesson:
Combining power – limitations of the formation of compounds – activity predicting the formulae of compounds – plenary on forming compounds

Starter

Teaching and learning tasks:
Explain that in order to determine the formula of a binary compound it is necessary to know how many bonds the atoms of one element will form with the atoms of another. This is called the ‘combining power’ of the element. Values for common elements are given in the following table.

<table>
<thead>
<tr>
<th>Combining power</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen (H)</td>
<td></td>
<td>Magnesium (Mg)</td>
<td>Aluminium (Al)</td>
</tr>
<tr>
<td>Lithium (Li)</td>
<td></td>
<td>Calcium (Ca)</td>
<td>Iron (Fe)</td>
</tr>
<tr>
<td>Sodium (Na)</td>
<td></td>
<td>Barium (Ba)</td>
<td>Nitrogen (N)</td>
</tr>
<tr>
<td>Potassium (K)</td>
<td></td>
<td>Copper (Cu)</td>
<td>Phosphorus (P)</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td></td>
<td>Iron (Fe)</td>
<td></td>
</tr>
<tr>
<td>Chlorine (Cl)</td>
<td></td>
<td>Zinc (Zn)</td>
<td></td>
</tr>
<tr>
<td>Bromine (Br)</td>
<td></td>
<td>Oxygen (O)</td>
<td></td>
</tr>
<tr>
<td>Iodine (I)</td>
<td></td>
<td>Sulphur (S)</td>
<td></td>
</tr>
</tbody>
</table>

Main Body

Teaching and learning tasks:
Point out to students that when using the information in Table 2.3.1 you should bear in mind that:
1. It is not possible to combine any two elements to make a compound. In general, compounds are formed between a metal and a non-metal, or two non-metals.
2. Where a compound contains a metal, this symbol is always given first.
3. In compounds of metals and non-metals, the ending of the non-metal changes from ‘ine’ to ‘ide’ e.g. oxide, chloride.
4. Some metals exhibit more than one combining power. To show this we give the combining power as a Roman number after the name of the metal e.g. copper(I) and copper(II), iron(II) and iron(III).
A simple way to find the chemical formula of a binary compound is to write the combining power beneath each element and draw an appropriate number of arrows from one element to the other element.

![Diagram showing potassium and chlorine forming potassium chloride.](image)
The combining power of both potassium and chlorine is 1. One potassium atom bonds with one chlorine atom to form potassium chloride.

![Diagram showing magnesium and bromine forming magnesium bromide.](image)
The combining power of magnesium is 2 and of bromine is 1. One magnesium atom bonds with two bromine atoms to form magnesium bromide.

Explain to students that once they are familiar with combining powers, they will be able to work out the chemical formulae of binary compounds without needing to draw diagrams.

**Activity 1**

Students should work in teams of 2. Provide each team with small pieces of card (3 cm x 5 cm) x 26.

They should make cards to show the combining power of the elements in Table. Each team will need:

- 1 card for each metal with a combining power of 1
- 3 cards for each non-metal with a combining power of 1
- 1 card for each element with a combining power of 3

![Card diagrams for H, Mg, and Al](image)

Students should use their cards to form as many compounds as they can e.g.
They should **write the formula of each compound they make** e.g. AlCl₃.

<table>
<thead>
<tr>
<th><strong>Plenary</strong></th>
<th>There will be considerable duplication in the compounds suggested by students. Invite one person from each team in turn to give the formula of a compound and write a list on the board. If anyone offers an incorrect formula, write it on the board anyway and see if other students in the class spot that it is not correct.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Notes</strong> <em>(teacher’s self-evaluation of the lesson)</em></td>
<td>What went well and what went badly? Are any changes needed to the lesson before I teach it again?</td>
</tr>
</tbody>
</table>