HAVE FUN WHILE CELEBRATING IYC–2011

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The United Nations has designated the year 2011 as the International Year of Chemistry —2011. The focal theme of the IYC—2011 is 'Chemistry—Our Life, Our Future.' The United Nations has also decided to celebrate the year 2011 as the International Year of Chemistry, primarily due to two reasons. First, the year 2011 marks the one hundredth anniversary of the Nobel Prize in Chemistry awarded to Marie Curie in 1911.This was Marie Curie's second Nobel Prize. The first Nobel Prize was received by her in Physics in 1903 along with her husband Pierre Curie and Henry Bequerel.

The International Union for Pure and Applied Chemistry (IUPAC) plays a very important role in the field of Chemistry. Formerly, it was known as the International Association of Chemical Societies. First established in 1911 in Paris, the year 2011 also happens to be its one hundredth anniversary.

In the Indian context, the IYC—2011 has significance too. The year 2011 is 150th birth anniversary of Acharya Prafulla Chandra Roy who started the tradition of research in modern chemistry in India and was also instrumental in laying the foundation of chemical industry.

What is Chemistry?

Chemistry is considered to be a very important branch of science. In brief, we can say that it is the scientific study of composition and properties of matter. It deals with the behaviour of matter and how different kinds of matter react to change from one form to another. Chemistry governs our understanding of the material nature of the world. In fact, all living processes are controlled by chemical reactions.

Chemistry is connected with every aspect of our life. In daily life also it plays an important role. Right from the moment we get up in the morning till we go to bed we encounter various chemicals and other things that are intimately connected to chemistry. From foodstuff, a dress, building material, fuels, drugs, fertilizers to a host of other items, chemistry has a key role in almost everything. Its all-encompassing role even extends

to such diverse areas of human endeavour as art and culture where paints, colours, fabrics, etc., which are all products of chemistry, are extensively used. No wonder then the chemistry is often called the 'central science'.

It may be mentioned that in popularising chemistry as central science, the book titled *'Chemistry: the central science'* played a very important role. Written by Theodore L. Brown and H. Eugene LeMay in 1977 the twelfth edition of this book has come out in the year 2011.

The Elements

Chemistry is primarily concerned with chemical elements and how they react with each other. What, after all is an element? The Greeks regarded earth, fire, air and water as elements. However, as early as 1660, the Irish born chemist Robert Boyle recognised that the Greek notion of elements was not correct. He, therefore, provided a new definition of element. We now define element as a fundamental substance which cannot be broken down further by chemical means. An element has only one kind of atoms. It was the English physicist, meteorologist and chemist John Dalton who in 1803 first propounded his atomic theory. In his theory, Dalton said that elements consisted of tiny, indivisible particles are called atoms. He also said that although all atoms of an element were identical, the atoms of different elements were different from one another.

So far 118 elements are known to us. Of these 92, starting from hydrogen (atomic number 1) to uranium (atomic number 92), occur in Nature. One must note that the atomic number of an element is the number of protons in the nucleus or the number of electrons in the extranuclear orbits of the atom of the element. The elements with atomic numbers greater than 92 are known as transuranic (the term transuranic means beyond uranium) elements. They have been produced artificially in the laboratory, their total number till date being 26.

The Vacant Places in the Periodic Table

Although now we know about 118 elements. In the 18th century at the time of Lavoisier, who discovered oxygen, only 23 elements were known. Slowly, more elements were discovered. By 1825 about 52 elements were known. Understanding and remembering the properties of all these elements proved to be a stupendous task indeed. However, in 1869 the Russian scientist Dmitri Mendeleev made the job easier by preparing a system of classifying the elements. He arranged 63 elements known till then in the periodic table designed by him in increasing order of their atomic masses. He arranged the elements with similar properties into nine vertical columns which he named as groups. The elements, when arranged in such a manner, also formed seven horizontal rows called periods. In a period, the elements exhibited gradual, periodic variation in their properties. Therefore, Mendeleev had to leave certain places in the periodic table vacant. He left four such vacant places and predicted that they would be filled by the new elements to be discovered subsequently.

The first of such elements predicted by Mendeleev, called *eka-aluminium* by him, was indeed discovered in 1875 by P.E.Lecoq

Boisbandran. It was named gallium. Subsequently, three other elements predicted by Mendeleev were also discovered. The element, called *eka-boron*, was discovered in 1879 by L. Nilson. It was named scandium. The element, called *eka-silicon*, was discovered in 1885 by Winkler and was named germanium.

After discovery of the three missing elements predicted by Mendeleev search for the fourth missing element, named *eka-manganese*, intensified. There were unconfirmed reports of its discovery from Russia and Japan. Even an apparently convincing report of its discovery came from Germany. However, the missing element could finally be discovered in 1937 by a group of Italian scientists working under the leadership of Carlo Perrier and Emilio Segre at the University of Pelermo in Sicily. Of the duo who led the research, Carlo incidentally was a mineralogist while Segre was a particle physicist who later shared the Nobel Prize in Physics in 1959 with Owen Chamberlain for the discovery of antiproton. The missing element discovered by Carlo and Segre was named technetium.

In 1913, the English physicist Henry Moseley suggested that the elements should be arranged in the periodic table in the increasing order of their atomic numbers and not their atomic masses. To Moseley, the atomic number of an element and not its atomic mass was more fundamental to its chemical properties. In this way, the new or modern periodic table came into being. It may be noted that the Moseley's classification of elements on the basis of their atomic numbers helped the chemists to remove most of the discrepancies of the Mendeleev's periodic table. However, as far as Moseley's personal life goes, he was killed in the First World War at a very young age of 27.

Symbols of Elements

Getting familiar with the chemical symbols of elements can be of great help in understanding chemistry. We, therefore, discuss some notable facts about the chemical symbols of elements.

Generally, the first or capital letter from the common English names of elements is used to write the symbols of elements. For instance, the element hydrogen has the symbol H; carbon has the symbol C while nitrogen has the symbol N. It may be noted that except J and Q there exist elements starting with all the capital letters from A-Z. As an interesting exercise you may ask your friends to find out how many elements are there starting with the first letter of their names.

Sometimes, the first two letters from the common English names of elements are used to write their symbols where the first letter is capital and the second is in lower case. For example, the symbol of the element lithium is Li, symbol of helium is He, the symbol of calcium is Ca and the symbol of silicon is Si. However, in some cases, although the first letter in the symbol is capital, the second letter (in lower case) need not be the second letter in the English names of the elements. For instance, the symbol of magnesium is Mg, the symbol of chlorine is Cl, the symbol of zinc is Zn and the symbol of zirconium is Zr. In all these cases, the second letter does not correspond to the second letter in the English names of these elements.

However, the above scheme of things is no longer applicable to a few elements like sodium,

copper, iron, silver, gold, etc. In such cases, the names are derived from the Latin words. For example, the element sodium derives its symbol from the Latin word Natrium (Na).Similarly, the symbols of copper, iron, silver and gold are, respectively, derived from the Latin words Cuprum (Cu), Ferrum (Fe), Argentum (Ag) and Aurum (Au).The symbols of elements tin, mercury and lead are also derived from the Latin words Stannum (Sn), Hydrargyram (Hg) and Plumbum (Pb), respectively. The element tungsten, however, derives its symbol from the German word Wolfram (W).

Nomenclature of Elements: Interesting Facts

There are some very interesting facts about the nomenclature of elements which we would like to share with the readers.

Some elements have been named after planets, the Sun, the Moon and even asteroids. The element uranium was named after the planet Uranus while the element selenium was named after Moon (which in Greek is Selene).The element palladium was named after the asteroid Pallas. You can find out some other elements named after planets, the Sun and asteroids.

Some elements have also been named after names of countries, cities, continents and villages. For example, the element germanium has been named after Germany; the element europium has been named after the continent of Europe while the element berkelium has been named after Berkeley, a city of California. As an interesting exercise, you may find out some other elements named after the names of countries, cities, continents and villages.

Some elements have also been named after the characters of Greek mythology. For example, the element titanium has been named after titans, the Gods of the Greek mythology. Some elements have even been named after colours. For instance, the element indium has been named after the Latin Indicum meaning indigo.

Some elements have also been named after the names of scientists, e.g. fermium has been named after Enrico Fermi, einsteinium has been named after Albert Einstein, etc. From the periodic table you may find many more elements whose names have been derived after the characters of Greek mythology, after the names of colours and after the names of scientists.

The International Year of Chemistry—2011 provides you an opportunity to collect more and more information about the chemical elements by connecting yourself intimately with them and share the information so collected with your friends. On this occasion, you may also make informative projects, models and charts on chemistry. At the same time, you may entertain yourself and your friends by making interesting quizzes on chemistry. In this way, you can have plenty of fun while celebrating chemistry during the IYC—2011.