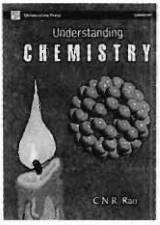
Understanding Chemistry

Animesh Chakravorty



Understanding Chemistry
C N R Rao
Universities Press, 1999
pp.298.

Chemistry is one of the oldest and most faithful friends of man, one that has worked perpetually for man's progress. Making fire, using fuel, extracting metal, making glass and pottery are but milestones of ancient human civilization marching on the broad shoulders of chemistry. And the march continues unabated. Fertilizers, medicines, fibres, plastics, chips – the list is endless. Above all life itself is a concert of chemistry. Only the notation is complex and its deciphering is taking a while.

The story of pollution and toxic chemicals is also the story of overuse or misuse often unknowingly, sometimes knowingly. But then one just goes back to chemistry and it will, without fail, pull out grand solutions from its virtually endless repository. Has not DDT been replaced? Is not freon being replaced? Is not the catalyst box decimating pollution? Chemistry has been, is and will remain a trusted friend of man. It is necessary to repeat this as often and as effectively as possible. Chemistry is too often misunderstand as a kind of high-risk service science in disregard to its infinite benefits and its great creative beauty.

I am therefore delighted to read this monograph by C N R Rao depicting the nature and spirit of chemistry in a simple and candid form. The book is prefaced as 'an elementary introduction intended for high school students and others interested in appreciation of chemistry.' The author believes 'that the book provides a flavour of the subject and how it works.' Indeed it does. And it all begins from the front cover itself which is symbolic of what awaits inside, 'the synthesis of what is old and new in chemistry.' The ancient candle burns on the left side of the cover with an amber flame more or less in its true size. Magnified hundred million times, the red bucky ball, not yet fifteen but Nobel recognised, stares from the right.

The three hundred pages of the book are arranged into seven sections followed by two pages of 'Chemical Records' (like: highest oxidation state, +8; most used drug, aspirin) and a very useful six-page Index. Each section begins with a brief statement of objectives and ends with a few conclusions. Every section is enlivened by numerous colour illustrations as well as by brief life sketches of scientists. 'Besides presenting simple facts and concepts, the book examines aspects of human interest such as the atmosphere, energy, environment, food, water and materials' as well as 'popular subjects such as tea, soap, firecrackers and rockets'. It is a joy to read this book.

The seven sections of the volume are 1. Chemistry in a Capsule, 2. Elements and the Periodic Table, 3. The Chemical Bond, 4. Structure and Shapes of Molecules, 5. Chemical Energy, 6. Chemical Reactions and 7. Two Chemists. Each section is divided into a number of subsections. Section 1 is understandably the longest, about ninety pages. It systematically develops the theme that 'Chemistry pervades the world around us. Chemistry helps us to understand Nature and life processes. It is through chemistry that we can make a variety of materials with novel properties.' Section 7 is specially devoted to the biographies of two immortal chemists. 'It is instructive and inspiring to go through... the scientific biographies of two of the greatest chemists...one from the 19th century and another, from the 20th century.' Michael Faraday and Linus Pauling.

It is the integral style that makes this book specially interesting and useful. Thus Dalton's ideas on atoms are immediately followed by an STM picture of silicon, leaving no doubt in the reader's mind that atoms are real entities. The IUPAC periodic table, artificial elements, supramolecules, modern catalysts, superconductors, nanoparticles, shapes of proteins and nucleic acids, photosynthesis, greenhouse effect, ozone layer, acid rain, smog, batteries, coal, biogas plants, photovoltaic cells, gas hydrates on ocean floor – items like these and many more find entries side by side with principles and facts. This book is a fascinating kaleidoscope of chemistry.

The book is neatly produced with an easy-to-read setting and the price at approximately fifty three paise per page is very affordable. Misprints such as 'Two chemists' on p.291 are rare. Chemistry students, teachers, admirers and critics alike will find this monograph most enjoyable.

Animesh Chakravorty, Indian Association for the Cultivation of Science, Calcutta 700 032, India.

A Mathematician by Rotation ? Lord Kelvin is said to have remarked that a mathematician is one to whom it is obvious that $\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$. One proof – probably the one with which in mind he made the remark – is gotten by squaring this as $\int_{-\infty}^{\infty} e^{-x^2} dx \int_{-\infty}^{\infty} e^{-y^2} dy = \int\int e^{-r^2} r dr d\theta = \pi$. Here is another proof: Consider the region A given in the (x, y)-plane by $0 \leq y \leq e^{-x^2}, x \geq 0$ and the 3-dimensional region obtained by rotating A about the y-axis. This is evidently $0 \leq y \leq e^{-x^2-z^2}$. Its volume is $\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} e^{-x^2-z^2} dx dz = I^2$ where $I = \int_{-\infty}^{\infty} e^{-x^2} dx$. Obviously, the same volume occurs when the curve $x^2 = -\log y, 0 \leq y \leq 1$ is rotated about the y-axis. This is $\int_0^1 \pi x^2 dy = -\pi \int_0^1 \log y dy = \pi$.

Kanakku Puly