Essentials of Nuclear Chemistry. H. J. Arnikar, Fourth edition. Wiley Eastern Limited, 4835/24, Ansari Road, Daryaganj, New Delhi 110 002. 498 pp. Price: Rs 155.

The book presents a wide spectrum of topics, and some kind of comprehensive coverage on some of these, in the broad areas of nuclear-, radiation-, and radiochemistry. It attempts to reach far beyond the 'essentials' of nuclear chemistry. The text is so much marred with typographical errors, conceptually wrong statements, grammatical errors and mis-information, that a student would be better off if he is not lured into reading this book, attracted by its charming appearance and get-up.

The author very often shows a lack of concern about the reliability and correctness of the data that are drawn from various sources. On page 7 (footnote) the half-life of proton decay is quoted from a 1981 unpublished work. This was OK for the first edition of the book published in 1982. But in 1995 the picture is very different. On page 403 (footnote) the ^{14}C specific activity in modern wood is quoted to be 13.6 dpm/g and to be controversial from a reference that is given in a text book of nuclear physics published in 1979. This issue must have been resolved by now. Taking another example, the oldest terrestrial rocks are stated to be 2.7×10^9y, and the age of the earth is given as $(5.0 \pm 0.50) \times 10^9$y, (p. 407), both values from a 1954 text. Even in 1981, these values had become obsolete. Much progress has been made in this field.

Examples of conceptually erroneous presentations:

(i) Page 4, line 3 from bottom: 'An atomic nucleus, considered without relationship to the outer sphere, is often referred to as a *nuclide*....'

(ii) Page 5, Section 1.3.1 (b) '*Isobars*: These are nuclei of different neighbouring chemical elements having....'

(iii) Page 8, line 11: 'This suggests.... the charge independent nature of the nucleons in respect of stability'.

(iv) Page 23: In Figure 2.1 the ordinate should be ρ/ρ_0. (not ρ, as given) and the number 4.40 should be replaced by 4.4α.

(v) Page 23, Figure 2.2: The ordinate label 'Nucleon Density (Relative)' should be changed to 'Nucleon Density; 10^{44} nucleons/m^3'. The ordinate scale should have values from 0 to 2.00.

(vi) Page 25, eq 2.7b. It is incorrect to say that in this equation a, and b are constants.

(vii) Page 40, Section 2.92: 'If all the energy levels in an assembly of molecules.... were equally populated, no resultant magnetization would occur on the application of an external field.'

(viii) Page 41, line 3: 'In 1.8 g of water the numbers (of molecules) in the lower and higher energy states will be of the orders of 10^{23} and 10^{18} respectively'.

(ix) Page 54, para (b), line 4: 'Generally, a single crystal of sodium nitroprusside.... is adopted as a standard...'.

(x) Page 56, para (c), line 2: 'However, when the environment is asymmetrical a feeble internal electric field operates and this leads to a quadrupole splitting of the line....'

(xi) Page 58, para (g) line 3: '...(The Curie point)... is also the temperature below which the single Mossbauer line *splits into six lines due to a sharp* decrease in the electron density at the nucleus.'

(xii) Page 83, Figure 3.3(b): The meaning and usefulness of $V_c(r)$ as shown in the figure, is not found anywhere in the text.

(xiii) Page 134, last line: An incorrect expression, $e^{\lambda_1 - \lambda_2}$, has been used. The exponent must be dimensionless. This mistake also occurs in the first edition of the same book by the author.

(xiv) Page 243, line 4 from bottom: '... the yield of symmetrical fission... is the lowest...'. This is not so.

(xv) Page 246, para 6.5 line 4: '... *fission fragments.... fly* apart with velocities much in excess of those of their orbital electrons.'

(xvi) Page 294, second sentence: 'Excepting γ which is purely an electromagnetic radiation, and neutrons which are uncharged, all other forms of radioactive samples emit charged particles as $\beta^{\pm}$, p, d, t, α,... whose detection ...'.

(xvii) Page 182, Problem 4.1: '...1 g of ^{226}Ra emits ... atoms of radon ....' Using similar words can we say that '^{14}C decays by emission of nitrogen?'

(xviii) page 364 Section (b): '.... ^{14}C are formed continually in nature by an alternative interaction of fast neutrons of cosmic origin with the atmospheric nitrogen.'

(xix) Page 383, Equation 10.22: Using this equation and the data that are given, b comes out to be 0.88×10^{-16} and not 4.11×10^{-16}.

(xx) Page 430, Equation 11.3: The equation LET $\propto Mz^2/E$ is interpreted by the author as 'The above expression shows that LET increases upto a maximum as v decreases along the path, after which the LET decreases along with v.'

(xxi) pp 405–407, Section (c); Age of Minerals and Rocks: The matter presented in this section is erroneous on almost every point. The relation.

$$M = N_1(e^{\lambda_1 t} - 1) + N_2(e^{\lambda_2 t} - 1)....10.38$$

has been simplified by the author to: $M = (N_1\lambda_1 + N_2\lambda_2)t$, and is used, on pages 406 and 407, to calculate the age of granites and the age of earth's crust using ^{40}K as a chronometer, whose half-life is 1.28 Gy. Since, for the values of ages involved, the exponent in eq. 10.38 is greater than 1, the adopted simplification is invalid. The author fails to note this, and using the invalid but simple expression, calculates the ages of granites, and that of the earth's crust respectively, as 10.1 and 8.6 Gy. He tries to cover the discrepancy by 'suggesting an overestimation of radiogenic calcium content'. He 'explains' the high K–Ar age by stating that 'the bulk of the present day Ar in the atmosphere was released thereto while the surface of the earth was still in the fluid form'. Such a scenario would, however, give a lower radiogenic argon and would go in opposite direction. The author, irrelevently, brings in the name of Professor Urey here – blatant misinformation.

(xxii) Pages 232–236, Section 5.12; The origin and evolution of elements.

This section is entirely incorrect and full of misconception. Ideas that have been found to be untenable are presented as valid explanations, while some of the well-accepted processes are presented with such distortions that they lose their meaning. We know that nucleosynthesis of elements beyond helium is not possible in Big Bang. The suggestion, presented in Section 5.12.3, that the medium weight elements were

formed by fission of heavy elements fails to account for the presence of the p-process nuclides and has never been taken seriously.

Examples of some sentences that suffer from 'language problem':

(i) Page 79, para (f): 'The energy discontinuity is around 2 MeV, i.e. about 25% of mean binding energy in β disintegrations in the neighbourhood of magic numbers.'

(ii) Page 269, second para, last sentence: 'Since then ever so many reactors have been functioning in many countries at very many times higher power levels, extending upto 10^9 W.'

(iii) Page 227, first para, second sentence: 'This is in spite of its advantages in respect of the raw materials needed being very much cheaper and the process involving far less of radiation hazard as none of the by-products is radioactive which is not wholly contained.'

(iv) Page 290, third para: 'Let us note that reactor or no reactor, mankind has been exposed from the beginning of time to nuclear radiations of cosmic and terrestrial origin, besides those due to ^{40}K present in all rocks and the seas and in our very body, besides ^{14}C.'

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Wheat Revolution – A Dialogue. M. S. Swaminathan (ed.). Macmillan India Ltd., P.B. No. 7092, Daryaganj, New Delhi 110 002. 1993. 164 pp. Price: Rs 224.

This book contains the history of growth of wheat production in India, leading the country not only to self-sufficiency but to food security. Revolutions are a radical change in the constitution of a country after revolt, which are often violent, and after a change in government dissipate over time. 'Wheat revolution', however, saved the country from going through a revolution as was predicted by some writers from developed countries. Has the 'Wheat revolution' dissipated as pointed out by Mr. Shivaraman? Therefore, recapitulations of events, in the form of a dialogue by major actors which led to 'Wheat revolution' synonymous with green revolution was an appropriate and laudable effort. M. S. Swaminathan, who organized the dialogue at M. S. Swaminathan Foundation, and had the central role in it, is to be commended for bringing out this book for the benefit of present and future generations.

Several questions have been raised in the recent past about 'Wheat revolution/Green revolution' relating to leadership, scientific basis and policy actions. The book provides answers, to some extent, to these questions through group discussion on (a) Package of technology, including new varieties, agronomic practices and post harvest handling, (b) Package of services, including the timely supply of seeds, fertilizer, water and credit and (c) Package of public policies, assured and remunerative marketing, building of grain reserves, etc.

It is obvious from the discussions that till 1963 there was no technology when the seeds of varieties having Norin dwarf traits in spring wheat background were obtained in sufficient quality from Borlaug to plant experiments at IARI (Indian Agricultural Research Institute, New Delhi). Since this material was found promising at Delhi, Ludhiana and Pantnagar, a decision was taken to put demonstrations in farmers fields, thus bye-passing the usual norms of coordinated trials and extension programmes. This speaks of the confidence of scientists in adopting an alternate strategy. A large amount of credit goes to decision makers, particularly C. Subramaniam who agreed for the import of 18000 tonnes of wheat seed from Mexico of the varieties which were already identified at Delhi, Ludhiana and Pantnagar. This material was planted in Punjab (then Punjab and Haryana) and Western UP where the climate was suitable for wheat production and supported by assured water supply, and enterprising farmers. Within three years production jumped from 12 to 17 million tonnes from 1965 to 1968. There would have not been so much success if the decision to purchase red wheat by government at the same price as desi wheat was not taken because the red grain of new varieties did not fetch good price in open market. Even today the amber varieties derived from Mexican dwarfs such as Kalyansona, HD2329, HD2285 and others fetch less price than desi varieties such as C306, NP824, K68 and others. Thus the purchase price was an important decision for encouraging wheat production. Having got success with production, it was necessary to develop varieties with amber grain colour as against the red colour and chapati quality acceptable to consumer. Interestingly, a population S227 which came from Mexico provided several amber grain selections such as S227, S307, and S308. The selection S227 was named as Kalyansona which had performed very well at Delhi, Ludhiana and Pantnagar. Kalyansona was an acceptable variety for grain colour but still required improvement for chapati quality. Later on several crosses using Indian varieties and new dwarf varieties were made and varieties with better quality were developed. The technology with reference to irrigation and fertilizer application was developed. It so happened that 1964 and 1965 had deficient monsoon rains, and possibly a kharif crop preceded wheat crop, therefore, six irrigations appeared to produce the maximum yield. At that time not much attention was paid to soil-moisture profile and winter rains. However, the recommendation of five to six irrigations was extensively popularized and made sacrosant. This led to over-irrigation and with considerable difficulty, now, the reduced number of irrigations are an acceptable recommendation. It also took time to fix an economic dose of fertilizers which is dependent on location, variety, irrigation, etc. The most fortunate aspect of wheat production in India is that we have no insect pest problem and the Indian scientists from the time of K. C. Mehta and B. P. Pal have been experts in breeding for rust resistance.

The 'package of services' includes the recommended seed for a given location, irrigation, fertilizer availability, and any other input such as machinery or energy which now have become important. In the initial phase 1966 to 1968, the target area was Punjab (Punjab and Haryana) and West UP where most of these services were available. However, there was a coordinated effort among scientists, bureaucrats, politicians and above all