

# FIORD errata list

(Typographical and other errors in **Fundamentals of Ionizing Radiation Dosimetry**, Wiley 2017)

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November 9, 2020

## PAGE

- xxiii** - In the list of symbols for ‘**A, a**’ the first entry for  $A$  should be replaced by **atomic mass number or nucleon number (dimensionless)**. When an expression includes  $N_A/A$ ,  $A$  is in  $\text{g mol}^{-1}$ , i.e., it corresponds to the molar mass  $M$ .
- xxviii** - In the list of symbols for ‘**M, m**’ the entry for  $M$  (3rd item) should be replaced by **molar mass,  $M=A \text{ g mol}^{-1}$** .
- xxxv** - In the list of symbols for ‘**Lambda ( $\Lambda, \lambda$ )**’ a second definition for  $\lambda$  should be added, so that:  
 $\lambda$  decay constant of a radionuclide  
**photon wavelength**
- 9** - End the top sentence with **multiplied by the molar mass constant  $M_u (= 1 \text{ g mol}^{-1})$ , i.e., the molar mass**.  
 In the last sentence, the word ‘non-relativistic’ should be inserted so that it reads “...yield the following **non-relativistic** expressions for the particle kinetic...”
- 18** - In caption to Figure 1.5, the 2nd line, should read “(a) and (b) show the probabilities of a given emission...”.
- 20** - In Table 1.3 the  $c_0$  and  $c_1$  fitting coefficients for the L-shell fluorescence yield in the  $Z$  range 26-51 should be

Fluorescence yield	Range of $Z$	Fitting coefficient				
		$c_0$	$c_1$	$c_2$	$c_3$	$c_4$
$\omega_L$	26-51	$-9.2521 \times 10^{-2}$	$8.7531 \times 10^{-3}$	$-2.8087 \times 10^{-4}$	$3.4823 \times 10^{-6}$	-

- 21** - The legend of Figure 1.6(b) should read “Mean fluorescence x-ray energies,  $\bar{k}_i$  (**dashed** lines), in the K, L1 and M1 shells; for comparison, the binding energies,  $U_B(i)$  are also shown (**solid** lines)”.
- 28** - The solutions to exercise #3 are correct but the non-relativistic expression given in the *Solutions to Exercises* book (page 2) does not yield the solutions provided. The student can derive  $E$  from Eq. (1.27), to arrive at

$$E = m_0 c^2 \left( \frac{1}{\sqrt{1 - \beta^2}} - 1 \right) = m_0 c^2 \tau$$

which is also given as Eq. (2.95) in page 82.

## 28 - [NEW]

The solutions to exercise #5 are correct but the expression for the Birge ratio given in the *Solutions to Exercises* book (page 3) should be

$$R_{\text{Birge}} = \frac{s(\bar{x}_w)_{\text{ext}}}{s(\bar{x}_w)_{\text{int}}} = 2.2$$

- 47 - First line below Eq. (2.37), “atomic mass  $A$ ” should be replaced by “**atomic mass number  $A$** ”.
- 64 - Three lines below Eq. (2.75), “ $\text{cm}^2 \text{g}^{-1}$ ” should be replaced by “ **$\text{cm}^2 \text{mol}^{-1}$** ”.
- 79 - Figure 2.22 and its legend should be replaced by

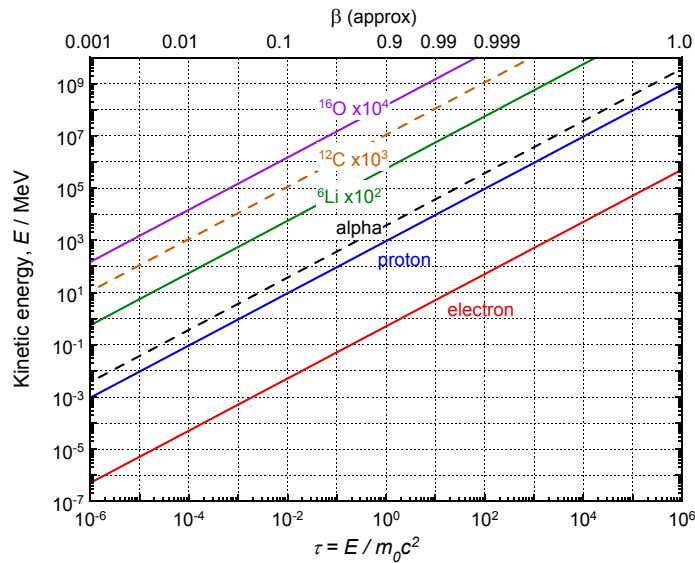


Figure 2.22. Graphical representation of the relation between a particle kinetic energy  $E$  (MeV) and its equivalent in terms of the particle rest energy,  $\tau = E/m_0c^2$ , for electrons and some heavy charged particles and ions. The upper abscissa provides the relation with the relativistic velocity,  $\beta = v/c$ . **For better visualization, the rest masses of  ${}^6\text{Li}$ ,  ${}^{12}\text{C}$  and  ${}^{16}\text{O}$  have been multiplied by  $10^2$ ,  $10^3$  and  $10^4$ , respectively.**

- 83 - Second paragraph, second line, “scaled by the atomic mass” should be replaced by “**scaled by the atomic mass number**”.
- 91 - In Section 2.4.12, line 7, “trasversed” should be replaced by “**traversed**”.
- 99 - In Figure 2.34, the labeling of the electronic stopping power curves ( $S_{\text{el}}/\rho$ ) is incorrect: C should be the top curve and U the bottom curve, i.e.,

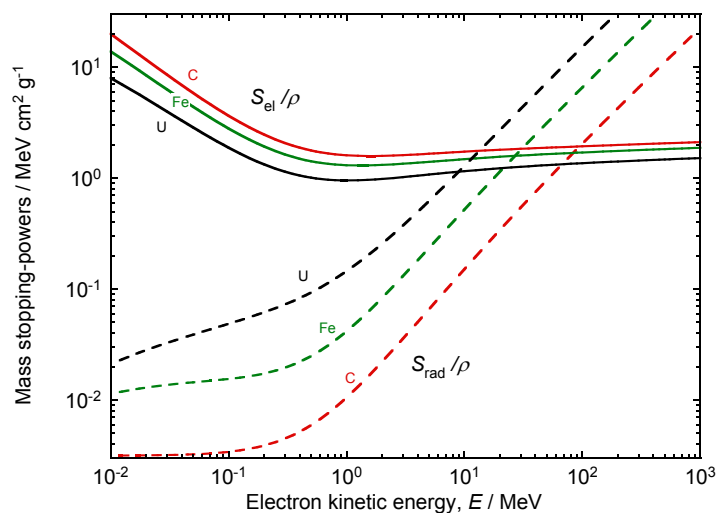


Figure 2.34. Mass radiative (dashed lines) and electronic (solid lines) stopping powers as a function of the kinetic energy of electrons in carbon ( $Z = 6$ ), iron ( $Z = 26$ ), and uranium ( $Z = 92$ ). (Data from ICRU, 1984b).

- 104 - First sentence, “atomic weight” should be replaced by “**atomic mass number**”.

105 - In Figure 2.38, the label of the horizontal axis should just be “Kinetic energy”, as proton data are also included in the plot.

114 - Four lines after Eq. (2.157), “absorber atomic mass” should be replaced by “absorber atomic mass number”.

122 - At the bottom of the page, in the last step of Eq. (2.180), the Thomas-Fermi radius should be squared, i.e.,

$$\frac{4\pi}{q^2 + (1/R_{\text{TF}})^2}$$

136 - The left hand side of Eq. (2.247), should not have  $d\mathcal{W}$ , i.e., the equation should be  $d\sigma = 2\pi b db$ .

136 - Two and three lines above Section 2.11.3.3, item (iv) should read “is proportional to  $\mathcal{W}^{-2}$  (instead of  $\mathcal{W}^2$ )”.

156 - In Eqs. (3.31) – (3.34), the polarization angle  $\phi$  should be replaced by  $\varphi$ , and the last term of Eq. (3.33) should have  $E_0^2$  instead of  $E_0$ , i.e.,

$$B_{\text{out}} = \frac{e}{4\pi\epsilon_0} \frac{\dot{v} \sin \varphi}{c^3 r} = \frac{E_{\text{out}}}{c} \quad (3.31)$$

$$S_{\text{out}} = \frac{E_{\text{out}} B_{\text{out}}}{\mu_0} = \frac{E_{\text{out}}^2}{c \mu_0} = \epsilon_0 c E_{\text{out}}^2 = \epsilon_0 c \left( \frac{e}{4\pi\epsilon_0 c^2} \frac{\dot{v} \sin \varphi}{r} \right)^2 \quad (3.32)$$

$$S_{\text{out}} = \epsilon_0 c \left( \frac{e}{4\pi\epsilon_0 c^2} \frac{\sin \varphi}{r} \right)^2 \left( \frac{e}{m_e} E_0 \sin \omega t \right)^2 = \epsilon_0 c \frac{r_e^2 E_0^2 \sin^2 \omega t \sin^2 \varphi}{r^2} \quad (3.33)$$

$$\bar{S}_{\text{out}} = \epsilon_0 c \overline{E_{\text{out}}^2} = \epsilon_0 c \frac{r_e^2 E_0^2 \overline{\sin^2 \omega t} \overline{\sin^2 \varphi}}{r^2} = \frac{1}{2} \epsilon_0 c r_e^2 E_0^2 \frac{\overline{\sin^2 \varphi}}{r^2} \quad (3.34)$$

160 - In Figure 3.9, the label of the y-axis should have a capital X, i.e., “Atomic form factor,  $F(X, Z)$ ”.

167 - In line below Eq. (3.77), the reference should be to figure 3.16a instead of 3.15a, i.e., “and is shown in Figure 3.16a. The cross section...”.

169 - In Figure 3.16(b), the label of the y-axis should be “ $d\sigma_{\text{c,KN}}/d\phi$  / (mb electron<sup>-1</sup> rad<sup>-1</sup>)”.

173 - In Eq. (3.95),  $m_e c^2$  on both sides of the equation should be squared, i.e.,

$$E_{\text{tot}}'^2 - (m_e c^2)^2 = c^2 (q^2 + 2 \mathbf{q} \cdot \mathbf{p}_e) + E_{\text{tot}}^2 - (m_e c^2)^2 \quad (3.95)$$

180 - In Figure 3.25, the symbols  $E_+$  and  $E_-$  should, for consistency with the text, be replaced by  $E^+$  and  $E^-$ .

191 - In first line below the section header **3.8.2 Cross Section**, a space is missing between “Using” and “ $\epsilon = k/m_e c^2 \dots$ ”

195 - In first line after Eq. (3.156), “A is the atomic mass” should be replaced by “A is the atomic mass number multiplied by the molar mass constant  $M_u$  (1 g mol<sup>-1</sup>)”.

196 - In Figure 3.33 lower panel (b), the horizontal axis number labels don’t match up with the grid, see upper panel (a).

197 - In Figure 3.34, the vertical axis label should be  $\bar{f}_{\text{ph}}$ , to be consistent with Eq. (3.161), instead of  $f_{\text{p}}$ .

213 - The second answer to exercise #15 should be corrected as:

$$\text{Answer: } n_{\text{av}} = \frac{\ln \frac{E_{\text{fin}}}{E_{\text{in}}}}{\ln \left[ \frac{M^2 + m_n^2}{(M + m_n)^2} \right]}; n_{\text{min}} = \frac{\ln \frac{E_{\text{min,fin}}}{E_{\text{in}}}}{\ln \left[ \frac{(M - m_n)^2}{(M + m_n)^2} \right]}$$

as there was an error in the expression for the minimum neutron kinetic energy. The solution (for the Exercises book) then becomes

$$E_{\text{min},f} = E_i - Q_{\text{max}} = E_i \left[ \frac{(M - m_n)^2}{(M + m_n)^2} \right] \sim E_i [\text{m'-ratio}]$$

and for  $n_{\text{min}}$  interactions

$$E_{\text{min,fin}} = E_{\text{in}} \left[ \frac{(M - m_n)^2}{(M + m_n)^2} \right]^{n_{\text{min}}}$$

from where the corrected expression for  $n_{\text{min}}$  is obtained.

249 - In Table 4.2 the photon attenuation values should be

Primary radiation energy (MeV)	Photon attenuation (%) over maximum secondary electron range	Neutron attenuation (%) over maximum secondary proton range
0.1	0.25	0.05
1.0	2.31	0.04
10	10.2	0.5
30	20.0	1.5

250 - In Figure 4.15, the scale of the vertical axis ( $4.0 \times 10^{-14}$  to  $1.0 \times 10^{-13}$ ) should be replaced by  $4.0 \times 10^{-12}$  to  $1.0 \times 10^{-11}$ .

258 - The answer to exercise #13 should be:

$$\text{Answer: } K = 7.65 \times 10^5 \text{ erg g}^{-1} = 76.5 \text{ Gy}; K_{\text{el}} = 5.58 \times 10^5 \text{ erg g}^{-1} = 55.8 \text{ Gy.}$$

as there was a typo in the erg-to-MeV conversion. The full solution (for the Exercises book) then becomes

(a) For kerma,  $K = \Psi (\mu_{\text{tr}}/\rho)_{\text{Pb}}$ , where

$$\Psi = 3.5 \times 10^6 \frac{\text{phot}}{\text{cm}^2 \text{ s}} \times 6.048 \times 10^5 \text{ s} \times \frac{6 \text{ MeV}}{\text{phot}} \times \frac{1.6022 \times 10^{-6} \text{ erg}}{\text{MeV}} = 2.0349 \times 10^7 \frac{\text{erg}}{\text{cm}^2}$$

and from the Data Tables

$$(\mu_{\text{tr}}/\rho)_{\text{Pb},6\text{MeV}} = 0.0376 \text{ cm}^2/\text{g}$$

therefore

$$K = 2.0349 \times 10^7 \frac{\text{erg}}{\text{cm}^2} \times 0.0376 \frac{\text{cm}^2}{\text{g}} = 7.6513 \times 10^5 \frac{\text{erg}}{\text{g}} = 76.51 \text{ Gy}$$

(b) For the electronic kerma,  $K_{\text{el}} = \Psi (\mu_{\text{en}}/\rho)_{\text{Pb}}$

$$(\mu_{\text{en}}/\rho)_{\text{Pb},6\text{MeV}} = 0.0274 \text{ cm}^2/\text{g}$$

therefore

$$K_{\text{el}} = 2.0349 \times 10^7 \frac{\text{erg}}{\text{cm}^2} \times 0.0274 \frac{\text{cm}^2}{\text{g}} = 5.5757 \times 10^5 \frac{\text{erg}}{\text{g}} = 55.76 \text{ Gy}$$

- 263 - In line -7 from bottom, “*A* is the atomic weight” should be replaced by “*A* is the atomic mass number multiplied by the molar mass constant  $M_u$  ( $1 \text{ g mol}^{-1}$ )”.
- 340 - In line above Eq. (7.23), “atomic mass *A*” should be replaced by “atomic mass number *A*”.
- 358 - [NEW]  
Citation “Andreo, 1991;” above eq. (8.35) should be “Andreo, 1991a;”.
- 368 - [NEW]  
In Figure 8.7 the caption cites Andreo (1981) but it should be “Andreo (1991a)”.
- 372 - [NEW]  
At the end of the fourth paragraph the reference should be “Andreo (1988a)”.
- 417 - In Figure 9.11, the label of the x-axis should be “*y* / MV”.
- 524 - Six lines after eq. (12.35), the Boag *et al.* reference should be 1996, instead of 1966.
- 616 - In Figure 14.20, the right-y axis label should be “ $[S_{\text{el}}(E)/\rho]_{\text{med,w}}$ ”.
- 754 - Second paragraph, in 3rd line “atomic mass (g)” should be replaced by “atomic mass number”; in 7th line delete “mass number or”. In the last sentence of footnote no. 4, “atomic mass *A*” should be replaced by “atomic mass  $m_a$ ”.
- 774 - In second line “(amu)” should be replaced by “(u)”. Replace “1/12 of” by “1/12 of” (i.e., “of” in roman font, not in italics).
- 842 - In Table A.1, under “Atomic mass constant”, delete the factor  $\times 10^8$  for the unit of  $m_u$  in MeV, i.e.,  $m_u = 931.494\ 061(21) \text{ MeV}$ .
- 883 - [NEW]  
Reference Andreo (1981) should be changed to “Andreo (1991a)”.