The Physics of Energy: Errata

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These errata refer to Edition 1, printing 1, January 2018.

Material marked in red represents modifications correcting original text.

Thanks to Andrew Turner for assistance in compiling this errata list, and to many others for communicating many of these errors to us.

Please send information on further errata to `jaffe@mit.edu` and `wati@mit.edu`.

Chapter 4

Pg. 60, Example 4.1: Displayed equation should read

$$
\begin{aligned}
c_n &= \sqrt{\frac{2}{L}} \int_0^L dx\, y(x,0) \sin(n\pi x/L) \\
&= a\sqrt{\frac{2}{L}} \left(\int_0^{L/2} dx\, x \sin(n\pi x/L) + \int_{L/2}^{L} dx\, (L - x) \sin(n\pi x/L) \right) \\
&= \frac{(2L)^{3/2} a}{n^2 \pi^2} \sin(n\pi/2)\,.
\end{aligned}
$$

Pg. 61, Eqs. (4.17) and (4.18) should read

$$
\begin{aligned}
E &= \int_{-\infty}^{\infty} dx\, u(x,t) = 4\pi\rho \int_0^{\infty} dk\, (|Y_+(k)|^2 + |Y_-(k)|^2)\omega(k)^2 \\
&\equiv \int_0^{\infty} d\omega \frac{dE}{d\omega}, \text{ with } \frac{dE}{d\omega} = 4\pi\frac{\rho}{v}(|Y_+(\frac{\omega}{v})|^2 + |Y_-(\frac{\omega}{v})|^2)\omega^2\,.
\end{aligned}
$$

Chapter 5

Pg. 79, Example 5.2: text in second line below displayed equation should read
"... until it returns to the initial temperature $T = 0°\mathrm{C}$.
[Thanks to C. Paus]

Chapter 6

Pg. 101, Example 6.2: Calculation in second paragraph should be

$R \approx 2(0.03/0.18) + 0.2(22.7) \approx 4.9 \text{ m}^2\,\text{K/W}.$

Chapter 8

Pg. 140 Replace the third sentence at the top of the second column by "First, we assign the bit 0 to A and 1 to *both* B and C, since ..."

Chapter 9

Pg. 182, Problem 9.20: Human body temperature should be 37°C, not 38°.

Chapter 11

Pg. 215, Figure 11.11 should be

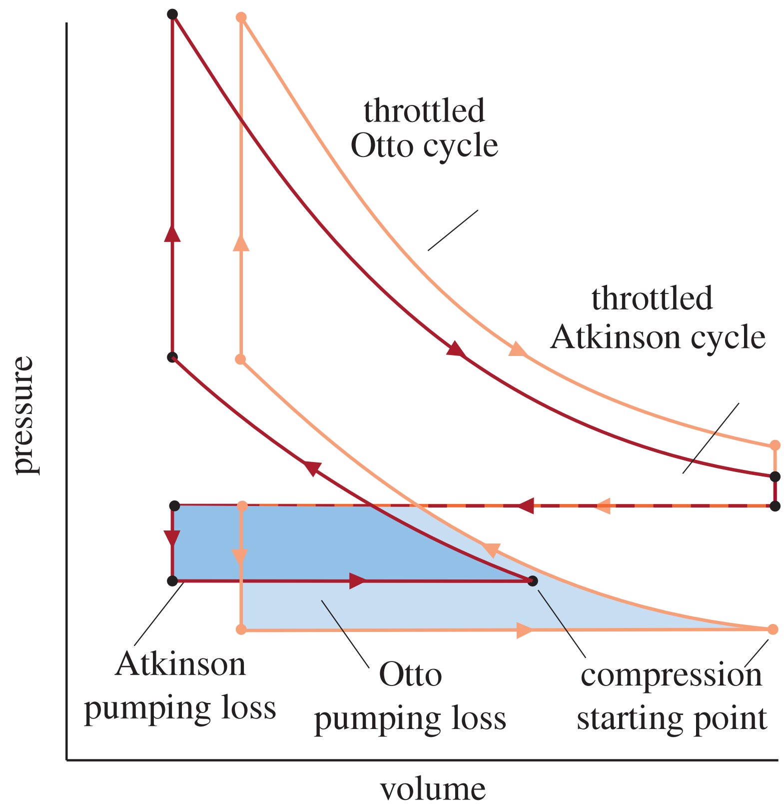

Figure 11.11

Chapter 15

Pg. 288 Title of example box should be Example 15.3.

Pg. 289 Problem 15.6: "Box 15.2" should be "Example 15.2".

Pg. 290 Problem 15.9: "Example 15.2" should be "Example 15.3".

Chapter 18

Pg. 332, Table 18.4, second to last entry: should be ^{147}Pm, not ^{237}Pm.

Chapter 22

Pg. 430, below eq. (22.22): Should read: "$U(\omega)d\omega$ describes the density of energy per unit volume contained. . . "

Chapter 23

Pg. 434, Figure 23.2 should be

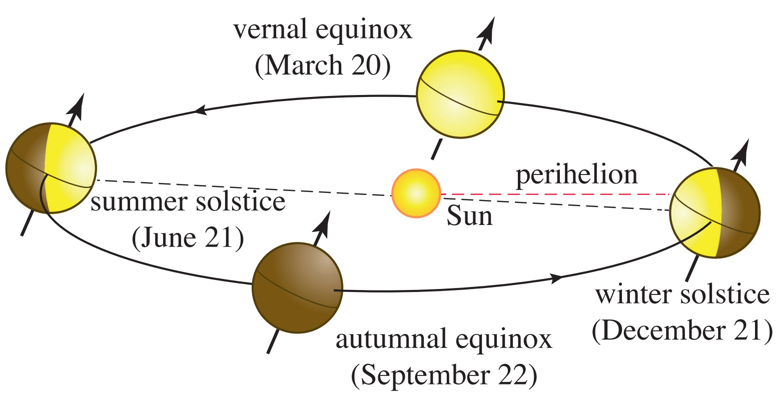

Figure 23.2

[In the corrected figure, at the summer solstice (as at all times), the lit side of the Earth faces the Sun.]

Chapter 25

Pg. 472, In Figure 25.7(b), along the horizontal axis, on the left should read

$$-\frac{\pi\hbar}{\Delta}$$

Pg. 473, The sentence above eq. (25.8) and the equation should read:

"... which gives the (non-normalized) probability of finding an electron in a state of energy E when the system is at temperature T,

$$p(E) \propto \frac{e^{-E/k_\mathrm{B}T}}{e^{-E/k_\mathrm{B}T} + e^{-E_F(T)/k_\mathrm{B}T}} = \frac{1}{1 + e^{(E-E_F(T))/k_\mathrm{B}T}} \, .$$

Pg. 480, 481, Figures 25.17 & 25.18 should be

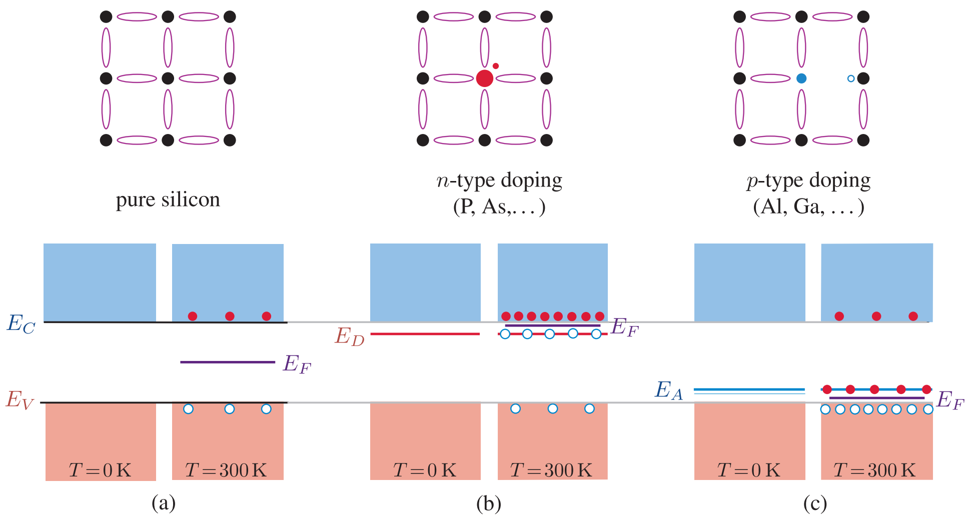

Figure 25.17

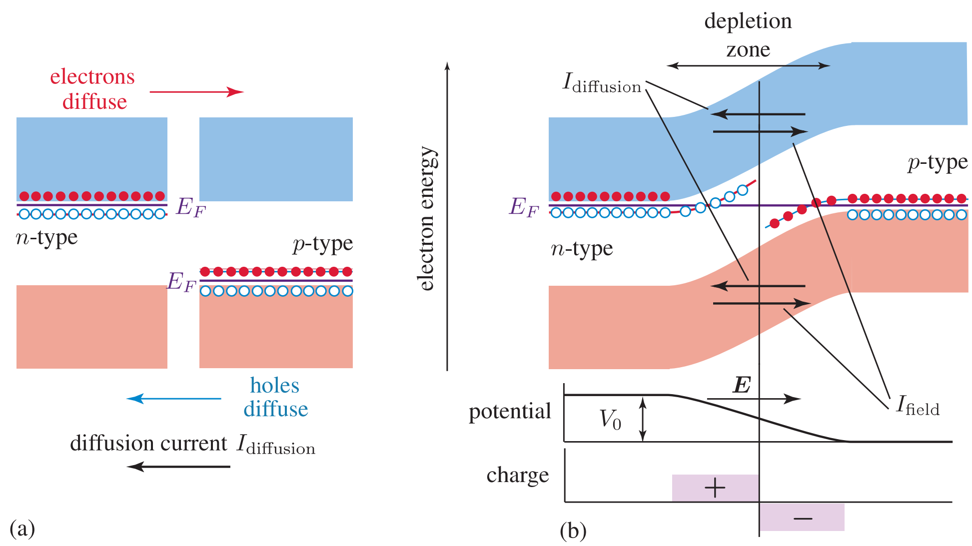

Figure 25.18

(Fermi levels at $T = 300\text{K}$ were incorrect)

Pg. 486, end of concept box: last equation should read $V_{\text{oc}} \cong 0.7\,\text{V}$.

Chapter 27

Pg. 522, Eq. (27.9), should read:

$$\int_0^\infty dz\, e^{-z/z_0} \cos(\pi/4 + z/z_0) = 0\,.$$

Pg. 527, first line of main text in left column: should read "formation of sea ice", not "formation of icebergs".

Chapter 28

Pg. 545, Box 28.3: The second and third displayed equations each have an incorrect extra factor of v, and should read

$$\mathcal{P} = \Phi\, \Delta E_{\text{kin}} = 2(mn)w(v-w)^2 = 2\rho w(v-w)^2,$$

and

$$\frac{d\mathcal{P}}{dw} = 2\rho(v^2 - 4wv + 3w^2) = 2\rho(v-3w)(v-w) = 0.$$

Pg. 548, line before eq. (28.14), should be $\tilde{v}$, not $\bar{v}$.

Figure 28.18 caption: should be $\tilde{v}$, not $\bar{v}$, in two places.

Pg. 549 Example 28.2: Should be $\tilde{v}$, not $\bar{v}$, in two places.

Pg. 555, Problem 28.14: Should be $\tilde{v}$, not $\bar{v}$.

Chapter 29

Pg. 561, Bernoulli's Principle Box: Last displayed equation should read

$$\frac{1}{2}v^2 + \frac{p}{\rho_0} + gz \approx \text{ constant}\,.$$

In last paragraph, should read "ambient pressure p_0".

Pg. 562, Venturi Flow Meter Box: The last displayed equation should read

$$Q = \rho A_1 A_2 \sqrt{\frac{2g(h_1 - h_2)}{A_1^2 - A_2^2}}\,.$$

Pg. 576, Problem 29.12, line 8 should read $\boldsymbol{\nabla} \cdot \boldsymbol{v}_a = 0$

Chapter 30

Pg. 585, The line before eq. (30.12) should read
"...components of $\boldsymbol{f}_l$ defined in eq. (29.32)"

Chapter 31

Pg. 592, Eq. (31.2): Should read

$$P = \epsilon\, dV/dt = \rho g Z \epsilon Q\,.$$

Pg. 599, Eq. (31.17): First line should read

$$\langle \mathcal{E}_{\rm pot} \rangle = \frac{\rho g}{2L} \int_0^L dx |s_z(x,0,t)|^2$$

Pg. 618, Problem 31.9: Text following displayed equation should read:
"... for a surface gravity wave in an ocean ...".
Last sentence should read: "Show that the energy density in this wave is the same as in a deep-water wave, eq. (31.15)".

Chapter 34

Pg. 689, Text on lines 4, 5 of first column should read:
"... which with line broadening (see Box 23.3) produce..."

Pg. 683, Below eq. (34.1): Third sentence following should read:
"The surface contribution to Earth's net albedo is about 0.04 (including effects of atmospheric attenuation), and clouds and aerosols together contribute roughly another 0.2."
Example 34.1: last parts of first two sentences should read:
"... atmosphere contains no clouds." and
"... and that the net albedo is $a = 0.16$.

Pg. 693, Example 34.3: Should read as follows:
Consider a modification of Earth's average surface albedo by 0.01, as might occur for example with substantial ice sheet accumulation. *Estimate the radiative forcing resulting from this albedo change.*
As explained earlier in this chapter, the average insolation at the surface is roughly $250\,\mathrm{W/m^2}$. Increasing surface albedo by 0.01 would thus increase the intensity of reflected radiation at the surface by $\cong 2.5\,\mathrm{W/m^2}$. This radiation would be distributed according to the (ground

level) solar spectrum. This outgoing radiation is reduced by atmospheric absorption and reflection. Assuming that the fraction of this radiation that goes out through the atmosphere is the same ($250/340 \cong 0.73$) as the fraction of ingoing radiation that reaches the surface (and ignoring higher-order effects from multiple reflections), the effect of this change would be seen in a net upward radiative forcing at the tropopause on the order of $0.73 \times 2.5 \cong -1.8\,\mathrm{W/m^2}$, where the negative sign indicates upward radiation flux. Note that if the albedo change were due primarily to an increase in ice sheets near the poles, the net magnitude of radiative forcing would be somewhat smaller due to latitudinal variation in insolation.

Chapter 35

Pg. 738 Example 35.2: The equation should read

$$\Delta E_{\text{separation}}/\ \text{mol(flue gas)} \geq -RT(0.21\ln(0.21) + 0.79\ln(0.79)) = 1.28\,\text{kJ/mol(flue gas)},$$

Chapter 36

Pg. 772 Problem 36.7: The first sentence should read
"Reproduce the results in Box 36.1 using eq. (36.25)..."

Appendix B

Pg. 838, Eq. (B.51): Should read:

$$\langle f, g\rangle = \overline{\langle g, f\rangle} = \int dx\, \bar{f}(x) g(x)\,,$$

Pg. 839, Example B.3: Displayed equation should read

$$F(k) = \frac{1}{2\pi}\int_{-\infty}^{\infty} dx\, \cos(3\pi x)\, e^{-x^2/4}\, e^{ikx}$$
$$= \frac{1}{\pi}\int_{0}^{\infty} dx\, \cos(3\pi x)\, e^{-x^2/4}\cos(kx) = \frac{1}{2\sqrt{\pi}}\left(e^{-(k-3\pi)^2} + e^{-(k+3\pi)^2}\right)\,.$$

Pg. 839, Eq. (B.57): Should read:

$$f(x) = \sum_{n=1}^{\infty} a_n \sqrt{\frac{2}{L}} \sin\left(\frac{2\pi n x}{L}\right)$$
$$+ \frac{b_0}{\sqrt{L}} + \sum_{m=1}^{\infty} b_m \sqrt{\frac{2}{L}} \cos\left(\frac{2\pi m x}{L}\right)\,.$$