Corrections to the 3rd Edition of *Matter & Interactions*

How to tell which printing you have:

Look at the bottom of the copyright page.

If the numbers say 10 9 8 7 6 5 4 3 2 1 it is the first printing.

If the numbers say 10 9 8 7 6 5 4 3 2 it is the second printing.

Significant errors in all printings

p. 12, 1st paragraph: ...the vector as a whole, except that if all the components are zero we say that this is a zero vector.

p. 13, 3rd equation: The $\frac{1}{2}$ should not have brackets.

p. 14, just before Calculating Unit Vectors: are both approximately unit vectors, since the magnitude of each is approximately equal to 1.

p. 14, last equation: The m/s units in the denominator should be outside the square root.

p. 19, last Solution: There is a missing unit "m" in the numerator of the equation for $\hat{r}$.

p. 22, next-to-last paragraph: What was the average speed of the bee, assuming that it flew in a straight line? (The calculation gives the average speed of the bee in this straight-line case.) Similarly, in 1.X.29 and 1.X.30 on p. 23, assume that the motion is nearly in a straight line.

p. 24, 1.X.32: Assume that the velocity is nearly constant for this rather short time.

p. 27, 1.X.36: What is asked for is the *instantaneous* acceleration (two places).

p. 38, 1.X.45 (b): The light is not red.

p. 43, 1.X.83: (a) What is the vector pointing from the star to the planet? (b) What is the vector pointing from the planet to the star?

p. 43, 1.X.84: (a) What is the vector $\vec{r}$ pointing from the star to the planet? (b) What is the magnitude of $\vec{r}$? (c) What is the unit vector $\hat{r}$ (vector with magnitude 1) in the direction of $\vec{r}$?

p. 47, 1.X.31: $\langle 2.1 \times 10^5, 1.4 \times 10^5, -2.8 \times 10^5 \rangle$ m

p. 47, 1.X.36: The acceleration at time t is $\langle 0, 8, -36t \rangle$, and the acceleration at time $t = 0$ is $\langle 0, 8, 0 \rangle$.

p. 47, 1.X.41: $\langle 111.31, 0, 18.46 \rangle$ m

p. 47, 1.X.44: (a) $\langle 0, 0, 2 \rangle$; (b) $\langle 7, 0, 0 \rangle$

p. 53, part (b) at top of page: Delete "(2 seconds)".

p. 60, just before "Solution": "...over this 6-second interval?"

p. 68, third step: $s = -0.0411$ m; $p_{fy} = -0.0118$ kg $\cdot$ m/s; the other values are correct.

p. 75, 2.X.23 (b): The question should ask for speed, not velocity.

p. 79, end of paragraph in Estimating Times: "about one two-hundredths of a second".

p. 81, top left inset: Force has units (kg)(m/s)/s.

p. 84, 3rd equation: $p_x = F_{\text{net},x}t + p_{ix}$

p. 84, 3rd from last equation: Last quantity should be v_{ix}.

p. 94, 2.X.9: The average x-component of velocity is 83.3 km/hr.

p. 94, 2.X.25 (a): Student on the left.

p. 100, end of first "Check" paragraph: $\sqrt{(-0.298)^2 + (-0.745)^2 + (0.596)^2} = 0.9995$

p. 102, middle of page: $\vec{g} = \langle 0, -g, 0 \rangle$.

p. 129: The multiparticle Momentum Principle is $\Delta\vec{p}_{\text{sys}} = \vec{F}_{\text{net,surr}}\Delta t$

p. 132, 3.P.52: Sphere 1 is at location $\langle 0.50, 0.20, 0 \rangle$ m, and sphere 2 is at location $\langle -0.40, 0.40, 0 \rangle$ m.

p. 137, 3.X.19: Units of velocity are m/s.

p. 144, next to last equation: $A = \pi(0.0025 \text{ m})^2 = 1.96 \times 10^{-5} \text{ m}^2$

p. 157, next to next to last equation: $\dfrac{dp_x}{dt} = -k_s x$

p. 159: In parts (c) and (d) of the problem statement, the text should read "...if the initial stretched length of the spring were 35 cm instead of 30 cm?"

p. 172, 4.P.44: There are 6.02×10^{23} atoms in one mole.

p. 173, 4.P.51: The initial length of the wire should be 0.95 m.

p. 193, 5.X.6 (d): Is the rate of change of the magnitude of the comet's momentum positive, negative, or zero?

p. 199, first equation: The distance in the numerator should be 6.4×10^6 m.

p. 206, top line: Delete final ")".

p. 218, 5.X.5: number 3 on the right; toward the center of the kissing circle

p. 243, next to the next to the last equation in the Example: $K_f + (0.1 \text{ kg})(9.8 \text{ N/kg})(-3 \text{ m}) = 0$

p. 264, last sentence of 1st paragraph: Change "momentum" to "velocity" (in two places).

p. 271, first sentence of 3rd paragraph: Interchange $p_{\min}$ and p_1.

p. 278, 6.X.53: In the first sentence, $E = \gamma mc^2$.

p. 304, last line: power $= \dfrac{\vec{F} \bullet d\vec{r}}{dt} = \vec{F} \bullet \dfrac{d\vec{r}}{dt} = \vec{F} \bullet \vec{r}$

p. 317, paragraph preceding equations for A and $\cos\phi$: "...determined by the following expressions, where $\omega_F^2 = k_s/m$:

p. 385, start of last paragraph: $K_1 + K_2$ might change...

p. 423, last section: This should be titled "If the Masses Don't Lie in a Plane Perpendicular to the Axis." In the first sentence, for the first printing delete "the same plane,"; for the second printing, delete "perpendicular to the Axis,".

p. 424: Exercises 11.X.6 and 11.X.7 should be moved to p. 426, just before 11.X.8.

p. 425, Figure 11.24: The vector from A to the center of mass should be labeled $\vec{r}_{CM}$.

p. 440, Figure 11.51: The location A should be at the top of the rod, so that the torque $\vec{\tau}_A = 0$.

p. 454, Figure 11.71: Switch the labels $\vec{L}_{13}$ and $\vec{L}_{24}$.

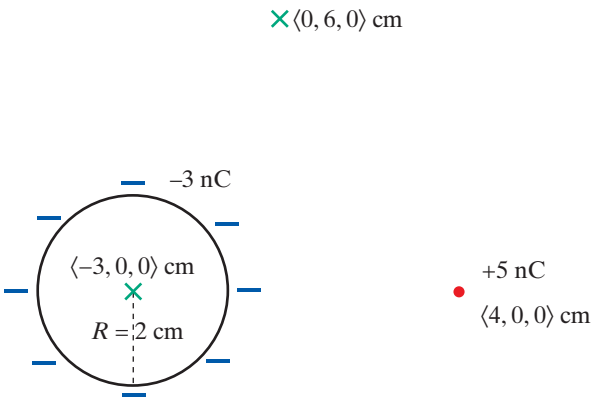
p. 515: In the calculation at the bottom of the page, a factor of $\frac{1}{4}$ is missing in the intermediate calculation; the final result is correct.

p. 555, midpage and Figure 14.2: The number of atoms in a cubic centimeter of solid metal is closer to 1×10^{23} than 1×10^{24}.

p. 577, 14.X.31, 2nd sentence: "What is the magnitude of the electric field due to the electron at a location 1×10^{-10} m away?"

p. 579, 14.P.46, 1st sentence: "The electric field at a location C points west, and the magnitude is 2×10^6 N/C."

p. 580, Figure 14.64 should look like this:



p. 620, 15.X.53: In (A) delete "static". In (D) and (E) replace "at equilibrium" by "in equilibrium".

p. 620, 15.X.54: Delete the 2nd sentence (about static equilibrium). In (A) delete "not" and change "at static equilibrium" to "in equilibrium". In (B) change "aluminum" to "metal". In (C) replace "at static equilibrium" by "in equilibrium". In (E) delete "static" and replace "no" by "a".

p. 632, Figure 16.7: E_y at $y = -0.35$ and $y = -0.45$ should be positive.

p. 653, just before Figure 16.47: $E_{\text{fringe}} \approx \dfrac{Q/A}{2\varepsilon_0}\left(\dfrac{s}{R}\right)$

p. 659, 16.X.54: In the questions following part (H), replace the word "field" with "force" (in three places).

p. 684, Figure 17.33: The top path (A-B-C), is Path 1.

p. 687: In the integrand in the final equation, replace q by Q.

p. 697: In the summary, the field energy density should have the units of J/m^3.

p. 713, equation at top of page: $B_{\text{Earth}} = 2 \times 10^{-5}$ T

p. 714: In the second bullet at the top of the page, and in the last paragraph, replace "angular momentum" with "cross product".

p. 721: There is a missing "I" from the first part of "*Magnetic field due to one piece*". In Step 3, B is the magnitude of the field.

p. 723: Just before "*Origin*: Center of loop", replace "the diagram" with "Figure 18.27".

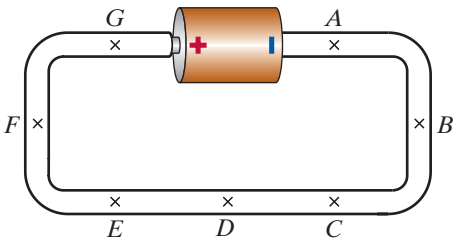
p. 723: Line starting with "$\Delta\vec{l}$:" should say that $\Delta\vec{l} = \langle -R\Delta\theta, 0, 0\rangle$, with no absolute value bars. Also, in the equation for $\Delta\vec{B}$, replace $d\vec{l}$ with $\Delta\vec{l}$.

p. 727, 4th equation: $B_{\text{magnet}} = \dfrac{\mu_0}{4\pi}\dfrac{2\mu}{r^3}$

p. 738, summary for Magnetic field of a loop: $\mu = (\pi R^2)I$

p. 748, 18.P.76: There should be an arrow pointing up on the page to represent North.

p. 785: Figure 19.75 should look like this:



p. 785: Figure 19.76 should be the same as Figure 19.72.

p. 785, 19.X.50: The two sentences in part 7 should be considered two parts, 7 and 8.

p. 791, 19.X.3: 0.011 N/C

p. 807, last equation at bottom of page: $i = \dfrac{I}{|q|}$, not $i = \dfrac{1}{|q|}$.

p. 834, answer to 20.X.19 is missing: -8.0 volts; 3.2 watts; 4.8 watts

p. 854, last line: ...on proton 2 due to proton 1?

p. 876, first set of equations: $E'_y = (E_y - vB_z)/\sqrt{1 - v^2/c^2}$

p. 884: Section 20.2 should be Section 21.2.

p. 892: Section 20.6 should be Section 21.6.

p. 893, 21.X.91: The rails are conducting, not insulating.

p. 893: Sections 20.7-20.8 should be Section 21.7, Section 20.9 should be Section 21.8, Section 20.10 should be Section 21.9, and Section 20.11 should be Section 21.10.

p. 967, 2nd paragraph of Transformers section: "...$N_2 = 20$ times the emf in one turn..."

p. 979, 23.P.27: Figure 23.67 is missing a dot labeled "Q" on the loop, opposite the "P". Also, add "At location Q?" to part (f).

p. 1035, Figure 24.115: There is a missing θ between the $\vec{a}$ vector and the $\vec{r}$ vector.

If you have the hardbound edition with all 25 chapters, be aware that there is a blank page between the inside back cover and a useful list of Greek symbols and other information.

Significant errors in the first printing that have been corrected in the second printing

p. 11, midpage: Should read $\sqrt{(4\text{m})^2 + (3\text{m})^2 + (2\text{m})^2} = \sqrt{29}$ m $= 5.39$ m.

p. 29, Example statement: "a velocity of (2×10^7) m/s" should be "a velocity of $\langle 2 \times 10^7, 1 \times 10^7, -3 \times 10^7 \rangle$ m/s". Also, in the second line of the solution, c in the denominator should be 3×10^8.

p. 31, Example statement: "(ns = nanosecond $= 1 \times 10^{-19}$ s)" should be "(ns = nanosecond $= 1 \times 10^{-9}$ s)"

p. 47, 1.X.14: 18.5 m/s

p. 51, 2.X.3: 3 N instead of 5 N; 1.5 N instead of 2.5 N.

p. 60, 2nd equation in Solution: $\Delta\vec{p}_2 = \langle 0, -0.6, 0 \rangle$ kg $\cdot$ m/s

p. 67, first equation: $\vec{L} = \langle 0, 0.1, 0 \rangle - \langle 0, 0, 0 \rangle = \langle 0, 0.1, 0 \rangle$ m

pp. 78-80: The mass of a hockey puck is 0.16 kg, not 0.04 kg. The mass was omitted in calculating the momentum change, which should be $\vec{p}_f - \vec{p}_i = \langle 0, 0, 5.072 \rangle$ kg $\cdot$ m/s, and $\Delta t = 0.005$ s. In 0.005 s the puck travels 0.1 m in the x direction and 0.08 m in the y direction. At the top of p. 80, if we guess that the puck slid 20 cm, $\Delta t = 0.01$ s, a factor of 2 different from what we find in the full analysis.

p. 99, 4th bullet: Calculate $-\hat{r} = -\vec{r}/|\vec{r}|$ ...

p. 99, last 2 lines: The distance is 3.35×10^{11} m, and the force is 7.15×10^{21} N.

p. 100: $\hat{F}_{\text{on } P \text{ by } S} = \langle -0.298, -0.745, 0.596 \rangle$
$\sqrt{(-0.298)^2 + (-0.745)^2 + (0.596)^2} = 0.9995$
The last line of the example should be this:
$\vec{F}_{\text{on } S \text{ by } P} = \langle 2.13 \times 10^{21}, 5.33 \times 10^{21}, -4.26 \times 10^{21} \rangle$ N

p. 110, paragraph after first question: "Two negatively charged particles such as electrons also REPEL each other..."

p. 132, 3.X.56: Replace "At a certain instant" with "When they are far apart". Change the y component of the later momentum from 1.6×10^{-21} kg $\cdot$ m/s to 1.55×10^{-21} kg $\cdot$ m/s.

p. 134, last sentence of 3.P.70: "...of the meteor, and $\vec{v}$ is the initial velocity of the center of mass of the satellite, in the x direction."

p. 137, 3.X.17 (a) and (b): x component should be -4.

p. 137, 3.X.22: (b) $\langle 0, -7.84, 0\rangle$ N; (c) $\langle 2.2, -1.184, 2.6\rangle$ kg $\cdot$ m/s.

p. 156, 4.X.12: Change the final x component of velocity from 5.02 to 4.98.

p. 176: Section 14.13 should be Section 4.13.

p. 177, 4.X.12: The x components in the three vectors are -2, -0.16, and -0.16.

p. 208, point 2 in left column: "...and drawing the resultant arrow starting at the tip of $\vec{p}_i$..."

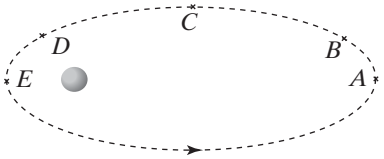
p. 222: For added clarity, in the box labeled "REST ENERGY" the equation should read $E_{\text{rest}} = mc^2$, and in the first sentence after this box $m = E_{\text{rest}}/c^2$.

p. 278, 6.X.53: Add to the first sentence "where $E = \gamma mc^2$". In F and G replace W_{ext} with W_{surr}.

p. 279, 6.P.60: Interchange the words "final" and "initial" between A and B.

p. 279, 6.P.67: In (a) the force is 240 N. In (b) the force is 60 N and the displacement is 3 meters.

p. 280: Figure 6.X.71 should look like this:



p. 281, 6.P.82: The radius of an airless planet is 2000 km (2×10^6 m), and its mass is 1.2×10^{23} kg. An object is launched straight up from the surface. (a) What initial speed is needed so that when the object is far from the planet its final speed is 900 m/s? (b) What initial speed is needed so that when the object is far from the planet its final speed is 0 m/s? (This is called the "escape speed.")

p. 302, Figure 7.29: The green arrow should be labeled $Q < 0$.

p. 319, 7.X.25: The relaxed length is 0.66 meters.

p. 320, 7.P.32: "heavy black horizontal line" should be "blue horizontal line".

p. 320, 7.P.33 (a): Delete "(shown here as an example to get you started)".

p. 321: Heading should be Sections 7.4-7.9.

p. 322: Heading should be Sections 7.10-17.14.

p. 327, last equation: $E_{\text{H},f} + K_{\text{photon}} = E_{\text{H}^*,i}$

p. 337, 8.X.11: "What is the energy of the photon emitted by a..."

p. 348, in last line: $M_1\vec{R}_1 = m_{11}\vec{r}_{11} + m_{12}\vec{r}_{12} + ...$

p. 391, last two equations:

$$0 = p_3 \cos(90^\circ - \theta) + p_4 \cos(90^\circ + \phi)$$

$$\frac{p_1^2}{2m} = \frac{p_3^2}{2m} + \frac{p_4^2}{2M}$$

p. 423, last section: Add to the caption for Figure 11.20, "The two masses at this instant are in the xy plane." (This is implicitly shown by the momenta coming out of the page.) Also, in the last paragraph on p. 423, replace r by r_1 in three places.

p. 433, result at top of page: $\omega = 0.316$ radians/s.

p. 453, Figure 11.68: The Earth's orbit should pass behind the Sun.

p. 465, 11.P.69: The two figures of the diver are reversed. First the diver is tucked, then extended.

p. 471, 11.X.5 and 11.X.7: All of these angular momenta are into the page. Also, the answer to 11.X.5 (c) is $I = 0.072 \text{ kg} \cdot \text{m}^2$.