Physics: Modeling Nature

Errata

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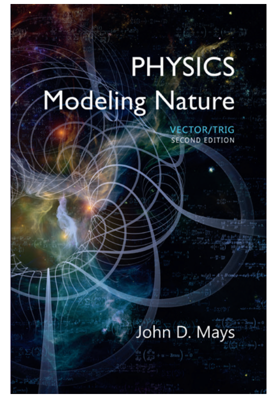


Physics: Modeling Nature 2e (2021)

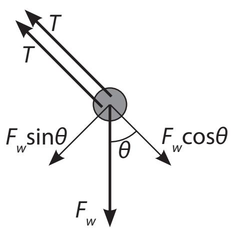
Chapter 1

p. 24: In Fig 1.17, the magnitude of the 3rd red vector at the lower right should be 5.5 cm.

Chapter 3 Answers

27.b. The calculation of acceleration is fine as is. The corrected calculation of the tensions is as follows:

Finally, we draw the free-body diagram and solve for the tension.



$$2T - F_w \cos\theta = ma$$
$$2T - mg\cos\theta = ma$$
$$T = \frac{m(a + g\cos\theta)}{2} = \frac{100\text{ kg}\cdot\left(54.2\ \frac{\text{m}}{\text{s}^2} + 9.80\ \frac{\text{m}}{\text{s}^2}\cdot\cos 45°\right)}{2} = 3056\text{ N}$$
$$\boxed{T = 3100\text{ N}}$$

(Note that the perpendicular weight component is not cancelled out by anything in the FBD. If the machine pulled only at 45° during the acceleration, there would have to be a normal force from the throwing mechanism cancelling this out, such as a track or chute for the stone to slide in while it is being accelerated. But there is no motion in the perpendicular direction and no mention of friction either, so the other force is not drawn. The motion in an actual trebuchet is more complex, but the problem does not supply the information for a more sophisticated solution.)

Chapter 8 Answers

28. $m_1/m_2 = (5 + 2\sqrt{10})/3$

The corrected version of the last part of the solution follows:

$\frac{1}{2}m_2v_2^2 = 2m_2gr + \frac{1}{2}m_2v_3^2$

$v_2^2 = 4gr + gr = 5gr$

$v_2^2 = 5gr$

$\left(\frac{2m_1m_2\sqrt{2gr}}{m_2^2 + m_1m_2}\right)^2 = 5gr$

$8m_1^2m_2^2gr = 5gr\left(m_2^2 + m_1m_2\right)^2$

$8m_1^2m_2^2 = 5\left(m_2^4 + 2m_1m_2^3 + m_1^2m_2^2\right) = 5m_2^4 + 10m_1m_2^3 + 5m_1^2m_2^2$

$3m_1^2m_2^2 = 5m_2^4 + 10m_1m_2^3$

$3m_1^2 = 5m_2^2 + 10m_1m_2$

$3m_1^2 - 10m_1m_2 - 5m_2^2 = 0$

Divide by m_2^2 to make this a quadratic in m_1/m_2:

$3\left(\frac{m_1}{m_2}\right)^2 - 10\frac{m_1}{m_2} - 5 = 0$

$\frac{m_1}{m_2} = \frac{10 \pm \sqrt{100+60}}{6} = \frac{10 \pm \sqrt{160}}{6} = \frac{5 \pm 2\sqrt{10}}{3}$

Since $m_1 > m_2$,

$\frac{m_1}{m_2} = \frac{5 + 2\sqrt{10}}{3}$

Physics: Modeling Nature (2015)

Chapter 1 Text

26 Example 1.2. The result of the R_y calculation should be 1.69 units, and the angle for the resultant should be 7.0°.

Chapter 1 Answers

19. magnitude = 278 km/hr

22f. $\theta = -131°$

25. $\theta = 35.1°$

27. $\theta_R = 140°$

Chapter 2 Problem correction

p. 73, #39. The time given should be 1.00 s, not 2.6 s.

Chapter 2 Answers

10. $v = 0.625$ m/s (0.63 m/s with 2 sig digs)

11b. 15 m/s

12. $v_f = 4.1$ m/s

14. $d = 4.000$ cm

25. $t = 0.474$ s (In the solutions manual, the second equation at the top of page 20 is incorrect,

and should read $d_F = d_K$.)

36. $d_h = 23.4$ m

45. $\theta_p = 41.2°$

Chapter 3 Problem corrections

p. 111, #46. $m_2 = 300.0$ g not kg.

p. 111, #48. The wind should be blowing from due southeast, not southwest.

Chapter 3 Answers

17. $a = -1.34$ m/s2, $F = -9100$ N

24c. $F_N = 41$ N

30c. The answer given is correct, but in the solutions manual the normal force used in the solution should be $F_N = 41$ N.

34. $d = 1.2$ m, $T = 8.21$ N

35. $d = 46$ m

37a. $a = 1.7 \text{m/s}^2$

37b. $v_f = 1.4$ m/s

37c. $d = 0.39$ m

39. $a = 5.3 \text{ m/s}^2$, $T_B = 26$ N

40. $a = 1.2 \text{ m/s}^2$

44b. $T_1 = 8.29$ N

44c. $T_1 = 5.48$ N

46. $m_{max} = 220$ g

48. 2.0×10^2, 102°. The diagram in the Solutions manual shows the wind coming from due SE, but the problem statement says the wind is coming from due SW. Correcting the wind, the result is as shown above.

Chapter 4 Answers

7d. $|\mathbf{p} \times \mathbf{E}| = 1.20 \times 10^3$ m·N

9. $\theta_3 = 139°$ (2 sig digs)

11. $\theta = 63°$

17. F_4: 11 m·N; F_5: 3.5 m·N

18. For the 0.1450 N force on the left, torque = 0.3537 m·N; for the 0.1450 N force on the right, torque = 0.1282 m·N

28. $\theta = +1.4°$ (In the solutions manual, the numerator in the equation 4 lines from the end should have (–) not (+).)

Chapter 5 Answers

18. $F = 3.81 \times 10^{-13}$ N

22. $F = 21.0$ N (3 sig digs)

27. a. and b., $W = 9600$ J

33. $W = 3400$ J

36. The height should use the sine of the angle, giving $v_f = 5.3$ m/s

53. $E = 4.03329$ MeV

56. 239.9°, 42.9 min. The 157° angle shown should be 113.0°. Calculating missing angles gives results precise to tenths, giving a heading precise to tenths (4 sig digs).

57. 1.8 m/s^2. In the final line of the solution, the μg term is precise to tenths. Addition rule then requires result to be precise to tenths.

Chapter 6 Answers

1b. 4.0×10^5 kg·m/s

1c. 9.97×10^{-20} kg·m/s

17. $\frac{\sqrt{5+2\sqrt{2}}}{4} v_0$, –59.6°

Chapter 7 Problem Correction

4. The question in the text should ask about the minute hand, not the hour hand.

Chapter 7 Answers

8. 2.07 rad/s

14. $\alpha = 3.10$ rad/s^2, $s = 218$ m

15. $\theta = 25$ rev. Corrected angle is already shown. Add to it omega = 160 rad/s.

21. $t = 0.107$ s

22. Typo in the units. Should be kg·m/s^2

25. $v = 18.1$ m/s

27. $F_c = 9.60 \times 10^{-5}$ N

Chapter 8 Answers

7. $\tau = -0.000362$ m · N

10. $\alpha = 8.542$ rad/s, $\omega_f = 11.0$ rad/s, $U_K = 70.1$ J

11. $t = 8.84$ s, $\omega_f = 21.6$ rpm

15. $h = 0.0547$ m

32. In line 5 of the solution, the $-2R$ term should be $+ 2R$. This gives $r = 3.83 \times 10^7$ m and $R - r = 3.46 \times 10^8$ m. This means r is 90% of the distance from earth to the moon, and $(R - r)/r = 9.03$.

    In the second part, $F_{GS} / F_{GE} = 1.77$.

Chapter 9 Answers

45. $v_0 = 509$ m/s

46. $v_c = 21$ cm/s

47. $P_{in} = 0.40$ hp

Chapter 10 Answers

1. 159.692 g/mol

2. 108 g

5. The correct atomic mass for iodine is 126.9045 g/mol, giving 2.107298×10^{-22} g/particle.

15. $V_2 = 355\ \text{cm}^3$

19. $F_w = 0.0276$ N

22. $T = 295.2$ K. This gives for oxygen $v_{rms} = 4.80 \times 10^2$ m/s and for nitrogen $v_{rms} = 513$ m/s.

36. $m_w = 10.4$ g, or with 2 sig figs, 1.0×10^1 g.

40. Equilibrium temperature should be 38.5° C.

44. $P_{duct} = 100{,}200$ Pa

Chapter 11 Answers

9. Corrected solution:

$$P = 155\ \text{kPa} = 155{,}000\ \text{Pa}$$
$$V_0 = 5.00\ \text{L} = 0.00500\ \text{m}^3$$
$$V_f = 3.00\ \text{L}$$
$$PV = nRT = const = P \cdot V_0 = 155{,}000\ \text{Pa} \cdot 0.00500\ \text{m}^3 = 775\ \text{Pa} \cdot \text{m}^3 = 775\ \text{J}$$
$$W = nRT \ln\frac{V_f}{V_0} = PV \ln\frac{V_f}{V_0} = 775\ \text{J} \cdot \ln\frac{3}{5} = -396\ \text{J}$$
$$\Delta U = 0$$
$$Q = W = -396\ \text{J}$$

11. The problem statement should read: Determine the amount of work done by a system during a gas expansion from $V_0 = 250$ L to $V_f = 350$ L at constant temperature if 525 J of heat are added to the system during the process.

25. Since heat is being removed, Q is negative and $\Delta S = -1.23$ kJ/K.

33. $W = 1.20 \times 10^2$ hp

Chapter 12 Answers

11. 75 J (2 sig digs)

12. 8.31 cycles

13. 2.0 Hz

18. 2.83×10^7 MHz

25. 1.57×10^8 m/s

34b. 0.353 J

Chapter 13 Answers

8. $a = 52{,}900$ m/s^2

11. In the solution and the diagram, replace θ everywhere with $\theta/2$.

17. $E = 2.9 \times 10^9$ N/C, $\theta = -11°$

26. W = 1.8×10^{-14} J

34. $E = 60{,}200$ N/C

57. 97%

Chapter 14 Answers

9a. $B = 0.0204$ T (0.020 T with 2 sig digs)

9b. $\Phi_B = 9.0$ mWb

10. The last line should read $\Phi_B = B \cdot A \cos\theta$, giving $\Phi_B = 0.83$ μWb

15. Units for q/m are C/kg.

18. $\tau = 0.013$ m · N

20. The question should read: "Explain the concept of a magnetic moment."

25. $B = 2.6 \times 10^{-5}$ T

36. $v(t) = (\sqrt{2} \cdot 240 \text{ V})\sin 100\pi t$

37. $i(t) = (\sqrt{2} \cdot 1.3 \times 10^{-5} \text{ V})\cos 2400\pi t$

51. The graph in part A should be inverted, and thus is the same as the graphs in parts b and c.

53. This represents a 75% reduction.