Solutions Manual
to Accompany
Accelerated Studies in Physics and Chemistry

second edition

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Contents

Chapter 2

Unit Conversions

1.

$$1750\text{ m}\cdot\frac{100\text{ cm}}{1\text{ m}}\cdot\frac{1\text{ in}}{2.54\text{ cm}}\cdot\frac{1\text{ ft}}{12\text{ in}}=5740\text{ ft}$$

2.

$$3.54\text{ g}\cdot\frac{1\text{ kg}}{1000\text{ g}}=0.00354\text{ kg}$$

3.

$$41.11\text{ mL}\cdot\frac{1\text{ L}}{1000\text{ mL}}=0.04111\text{ L}$$

4.

$$7\times10^{8}\text{ m}\cdot\frac{100\text{ cm}}{1\text{ m}}\cdot\frac{1\text{ in}}{2.54\text{ cm}}\cdot\frac{1\text{ ft}}{12\text{ in}}\cdot\frac{1\text{ mi}}{5280\text{ ft}}=4\times10^{5}\text{ mi}$$

5.

$$1.5499\times10^{-12}\text{ mm}\cdot\frac{1\text{ m}}{1000\text{ mm}}=1.5499\times10^{-15}\text{ m}$$

6.

$$750\text{ cm}^3\cdot\frac{1\text{ mL}}{1\text{ cm}^3}\cdot\frac{1\text{ L}}{1000\text{ mL}}\cdot\frac{1\text{ m}^3}{1000\text{ L}}=7.5\times10^{-4}\text{ m}^3$$

7.

$$2.9979\times10^{8}\ \frac{\text{m}}{\text{s}}\cdot\frac{100\text{ cm}}{1\text{ m}}\cdot\frac{1\text{ in}}{2.54\text{ cm}}\cdot\frac{1\text{ ft}}{12\text{ in}}=9.8356\times10^{8}\ \frac{\text{ft}}{\text{s}}$$

8.

$$168\text{ hr}\cdot\frac{60\text{ min}}{1\text{ hr}}\cdot\frac{60\text{ s}}{1\text{ min}}=605{,}000\text{ s}$$

9.

$$5570\ \frac{\text{kg}}{\text{m}^3}\cdot\frac{1000\text{ g}}{1\text{ kg}}\cdot\frac{1\text{ m}^3}{1000\text{ L}}\cdot\frac{1\text{ L}}{1000\text{ mL}}\cdot\frac{1\text{ mL}}{1\text{ cm}^3}=5.57\ \frac{\text{g}}{\text{cm}^3}$$

10.

$$45\ \frac{\text{gal}}{\text{s}}\cdot\frac{3.786\ \text{L}}{1\ \text{gal}}\cdot\frac{1\ \text{m}^3}{1000\ \text{L}}\cdot\frac{60\ \text{s}}{1\ \text{min}}=1.0\times10^{1}\ \frac{\text{m}^3}{\text{min}}$$

11.

$$600{,}000\ \frac{\text{ft}^3}{\text{s}}\cdot\frac{(0.3048\ \text{m})^3}{1\ \text{ft}^3}\cdot\frac{1000\ \text{L}}{1\ \text{m}^3}\cdot\frac{60\ \text{s}}{1\ \text{min}}\cdot\frac{60\ \text{min}}{1\ \text{hr}}=6\times10^{10}\ \frac{\text{L}}{\text{hr}}$$

12.

$$5200\ \text{mL}\cdot\frac{1\ \text{L}}{1000\ \text{mL}}\cdot\frac{1\ \text{m}^3}{1000\ \text{L}}=5.2\times10^{-3}\ \text{m}^3$$

13.

$$5.65\times10^{2}\ \text{mm}^2\cdot\frac{1\ \text{cm}}{10\ \text{mm}}\cdot\frac{1\ \text{cm}}{10\ \text{mm}}\cdot\frac{1\ \text{in}}{2.54\ \text{cm}}\cdot\frac{1\ \text{in}}{2.54\ \text{cm}}=0.876\ \text{in}^2$$

14.

$$32.16\ \frac{\text{ft}}{\text{s}^2}\cdot\frac{12\ \text{in}}{1\ \text{ft}}\cdot\frac{2.54\ \text{cm}}{1\ \text{in}}\cdot\frac{1\ \text{m}}{100\ \text{cm}}=9.802\ \frac{\text{m}}{\text{s}^2}$$

15.

$$5.001\ \frac{\mu\text{g}}{\text{s}}\cdot\frac{1\ \text{g}}{10^6\ \mu\text{g}}\cdot\frac{1\ \text{kg}}{1000\ \text{g}}\cdot\frac{60\ \text{s}}{1\ \text{min}}=3.001\times10^{-4}\ \frac{\text{kg}}{\text{min}}$$

16.

$$4.771\ \frac{\text{g}}{\text{mL}}\cdot\frac{1\ \text{kg}}{1000\ \text{g}}\cdot\frac{1000\ \text{mL}}{1\ \text{L}}\cdot\frac{1000\ \text{L}}{1\ \text{m}^3}=4771\ \frac{\text{kg}}{\text{m}^3}$$

17.

$$13.6\ \frac{\text{g}}{\text{cm}^3}\cdot\frac{1000\ \text{mg}}{1\ \text{g}}\cdot\frac{100\ \text{cm}}{1\ \text{m}}\cdot\frac{100\ \text{cm}}{1\ \text{m}}\cdot\frac{100\ \text{cm}}{1\ \text{m}}=1.36\times10^{10}\ \frac{\text{mg}}{\text{m}^3}$$

18.

$$93{,}000{,}000\ \text{mi}\cdot\frac{5280\ \text{ft}}{1\ \text{mi}}\cdot\frac{0.3048\ \text{m}}{1\ \text{ft}}\cdot\frac{100\ \text{cm}}{1\ \text{m}}=1.5\times10^{13}\ \text{cm}$$

19.

$$65\ \frac{\text{mi}}{\text{hr}}\cdot\frac{5280\ \text{ft}}{1\ \text{mi}}\cdot\frac{0.3048\ \text{m}}{1\ \text{ft}}\cdot\frac{1\ \text{hr}}{60\ \text{min}}\cdot\frac{1\ \text{min}}{60\ \text{s}}=29\ \frac{\text{m}}{\text{s}}$$

20.

$$633 \text{ nm} \cdot \frac{1 \text{ m}}{1\times10^{9} \text{ nm}} \cdot \frac{100 \text{ cm}}{1 \text{ m}} \cdot \frac{1 \text{ in}}{2.54 \text{ cm}} = 2.49\times10^{-5} \text{ in}$$

21.

$$0.05015 \cdot 3.00\times10^{8} \ \frac{\text{m}}{\text{s}} \cdot \frac{60 \text{ s}}{1 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} \cdot \frac{1 \text{ ft}}{0.3048 \text{ m}} \cdot \frac{1 \text{ mi}}{5280 \text{ ft}} = 3.37\times10^{7} \ \frac{\text{mi}}{\text{hr}}$$

22.

$T_F = 98.6°\text{F}$

$T_C = ?$

$$T_C = \frac{5}{9}(T_F - 32) = \frac{5}{9}(98.6°\text{F} - 32) = 37.0°\text{C}$$

23.

$T_C = 50.0°\text{C}$

$T_F = ?$

$$T_C = \frac{5}{9}(T_F - 32)$$

$$T_F = \frac{9}{5}T_C + 32 = \frac{9}{5}(50.0°\text{C}) + 32 = 122°\text{F}$$

24.

$$t = 1 \text{ yr} \cdot \frac{365 \text{ days}}{1 \text{ year}} \cdot \frac{24 \text{ hr}}{1 \text{ day}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} \cdot \frac{60 \text{ s}}{1 \text{ min}} = 31{,}540{,}000 \text{ s}$$

$$v = c = 3.00\times10^{8} \frac{\text{m}}{\text{s}}$$

$d = ?$

$$v = \frac{d}{t}$$

$$d = vt$$

$$d = 3.00\times10^{8} \frac{\text{m}}{\text{s}} \cdot 31{,}540{,}000 \text{ s} = 9.46\times10^{15} \text{ m (this is one lt-yr expressed in m.)}$$

$$4.3 \text{ lt-yr} = 4.3 \cdot 9.46\times10^{15} \text{ m} = 4.07\times10^{16} \text{ m} \cdot \frac{1 \text{ km}}{1000 \text{ m}} = 4.1\times10^{13} \text{ km}$$

Motion Study Questions Set 1

1.

$$d = 25.1 \text{ mi} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} \cdot \frac{0.3048 \text{ m}}{1 \text{ ft}} = 4.04 \times 10^4 \text{ m}$$

$$t = 0.50 \text{ hr} \cdot \frac{60 \text{ min}}{1 \text{ hr}} \cdot \frac{60 \text{ s}}{1 \text{ min}} = 1800 \text{ s}$$

$$v = ?$$

$$v = \frac{d}{t} = \frac{4.04 \times 10^4 \text{ m}}{1800 \text{ s}} = 22 \frac{\text{m}}{\text{s}}$$

2.

$$22 \frac{\text{m}}{\text{s}} \cdot \frac{1 \text{ km}}{1000 \text{ m}} \cdot \frac{60 \text{ s}}{1 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} = 79 \frac{\text{km}}{\text{hr}}$$

3.

$$t = 4.25 \text{ hr} \cdot \frac{3600 \text{ s}}{\text{hr}} = 15{,}300 \text{ s}$$

$$v = 5.0000 \frac{\text{km}}{\text{hr}} \cdot \frac{1000 \text{ m}}{\text{km}} \cdot \frac{1 \text{ hr}}{3600 \text{ s}} = 1.389 \frac{\text{m}}{\text{s}}$$

$$d = ?$$

$$v = \frac{d}{t}$$

$$d = vt$$

$$d = 1.389 \frac{\text{m}}{\text{s}} \cdot 15{,}300 \text{ s} = 21{,}300 \text{ m} \cdot \frac{1 \text{ km}}{1000 \text{ m}} = 21.3 \text{ km}$$

4.

$$21.3 \text{ km} \cdot \frac{1000 \text{ m}}{1 \text{ km}} \cdot \frac{1 \text{ ft}}{0.3048 \text{ m}} \cdot \frac{1 \text{ mi}}{5{,}280 \text{ ft}} = 13.2 \text{ mi}$$

5.

$$150.0 \frac{\text{mi}}{\text{hr}} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} \cdot \frac{0.3048 \text{ m}}{1 \text{ ft}} \cdot \frac{1 \text{ km}}{1000 \text{ m}} = 241.4 \frac{\text{km}}{\text{hr}}$$

6.

$$v = 150.0\ \frac{\text{mi}}{\text{hr}} \cdot \frac{1609\ \text{m}}{\text{mi}} \cdot \frac{1\ \text{hr}}{3600\ \text{s}} = 67.04\ \frac{\text{m}}{\text{s}}$$

$$d = 10.0\ \text{mi} \cdot \frac{1609\ \text{m}}{\text{mi}} = 16{,}090\ \text{m}$$

$$t = ?$$

$$v = \frac{d}{t}$$

$$t = \frac{d}{v} = \frac{16{,}090\ \text{m}}{67.04\ \frac{\text{m}}{\text{s}}} = 240.0\ \text{s} \cdot \frac{1\ \text{min}}{60\ \text{s}} = 4.00\ \text{min}$$

7.

$$d = 3.0\ \text{km} \cdot \frac{1000\ \text{m}}{1\ \text{km}} = 3.0 \times 10^3\ \text{m}$$

$$t = 1\ \text{hr}\ 20.0\ \text{min} = 80.0\ \text{min} \cdot \frac{60\ \text{s}}{1\ \text{min}} = 4.80 \times 10^3\ \text{s}$$

$$v = ?$$

$$v = \frac{d}{t} = \frac{3.0 \times 10^3\ \text{m}}{4.80 \times 10^3\ \text{s}} = 0.63\ \frac{\text{m}}{\text{s}}$$

8.

$$v_i = 0$$

$$v_f = 45\ \frac{\text{mi}}{\text{hr}} \cdot \frac{1\ \text{hr}}{60\ \text{min}} \cdot \frac{1\ \text{min}}{60\ \text{s}} \cdot \frac{5{,}280\ \text{ft}}{1\ \text{mi}} \cdot \frac{0.3048\ \text{m}}{1\ \text{ft}} = 20.1\ \frac{\text{m}}{\text{s}}$$

$$t = 36\ \text{s}$$

$$a = ?$$

$$a = \frac{v_f - v_i}{t} = \frac{20.1\frac{\text{m}}{\text{s}} - 0}{36\ \text{s}} = 0.56\ \frac{\text{m}}{\text{s}^2}$$

9.

$v_i = 31\ \dfrac{\text{m}}{\text{s}}$

$t = 17\ \text{s}$

$v_f = 22\ \dfrac{\text{m}}{\text{s}}$

$a = ?$

$$a = \frac{v_f - v_i}{t} = \frac{22\ \frac{\text{m}}{\text{s}} - 31\ \frac{\text{m}}{\text{s}}}{17\ \text{s}} = -0.53\ \frac{\text{m}}{\text{s}^2}$$

10.

$d = 14.5\ \text{m}$

$v = c = 3.00 \times 10^8\ \dfrac{\text{m}}{\text{s}}$

$t = ?$

$$v = \frac{d}{t}$$

$$t = \frac{d}{v} = \frac{14.5\ \text{m}}{3.00 \times 10^8\ \frac{\text{m}}{\text{s}}} = 4.83 \times 10^{-8}\ \text{s} \cdot \frac{1 \times 10^9\ \text{ns}}{\text{s}} = 48.3\ \text{ns}$$

11.

$v_i = 0$

$v_f = 0.80 \cdot 3.00 \times 10^8\ \dfrac{\text{m}}{\text{s}} = 2.40 \times 10^8\ \dfrac{\text{m}}{\text{s}}$

$t = 18\ \text{hr}\ 6\ \text{min}\ 45\ \text{s} = 64{,}800\ \text{s} + 360\ \text{s} + 45\ \text{s} = 65{,}205\ \text{s}$

$a = ?$

$$a = \frac{v_f - v_i}{t} = \frac{2.40 \times 10^8\ \frac{\text{m}}{\text{s}} - 0}{65{,}205\ \text{s}} = 3680\ \frac{\text{m}}{\text{s}^2}$$

12.

$$d = 8.96\times10^{9}\ \text{km}\cdot\frac{1000\ \text{m}}{1\ \text{km}} = 8.96\times10^{12}\ \text{m}$$

$$v = 3.45\times10^{5}\ \frac{\text{m}}{\text{s}}$$

$$t = ?$$

$$v = \frac{d}{t}$$

$$t = \frac{d}{v} = \frac{8.96\times10^{12}\ \text{m}}{3.45\times10^{5}\ \frac{\text{m}}{\text{s}}} = 2.597\times10^{7}\ \text{s}\cdot\frac{1\ \text{hr}}{3600\ \text{s}}\cdot\frac{1\ \text{day}}{24\ \text{hr}} = 301\ \text{days}$$

13.

$$a = 5.556\times10^{6}\ \frac{\text{cm}}{\text{s}^2}\cdot\frac{1\ \text{m}}{100\ \text{cm}} = 5.556\times10^{4}\ \frac{\text{m}}{\text{s}^2}$$

$$t = 45\ \text{ms}\cdot\frac{1\ \text{s}}{1000\ \text{ms}} = 4.5\times10^{-2}\ \text{s}$$

$$v_i = 0$$

$$v_f = ?$$

$$a = \frac{v_f - v_i}{t}$$

$$v_f = at + v_i = (5.556\times10^{4}\ \frac{\text{m}}{\text{s}^2})(4.5\times10^{-2}\ \text{s}) + (0\ \frac{\text{m}}{\text{s}}) = 2.5\times10^{3}\ \frac{\text{m}}{\text{s}}$$

14.

$$v_i = 4.005\times10^{3}\ \frac{\text{m}}{\text{s}}$$

$$a = 23.1\ \frac{\text{m}}{\text{s}^2}$$

$$t = 13.5\ \text{s}$$

$$v_f = ?$$

$$a = \frac{v_f - v_i}{t}$$

$$v_f = at + v_i = (23.1\ \frac{\text{m}}{\text{s}^2}\cdot13.5\ \text{s}) + 4.005\times10^{3}\ \frac{\text{m}}{\text{s}} = 4.32\times10^{3}\ \frac{\text{m}}{\text{s}}$$

15.

$$v = c = 2.9979 \times 10^{8} \ \frac{\text{m}}{\text{s}}$$

$$d = 1.4965 \times 10^{8} \ \text{km} \cdot \frac{1000 \ \text{m}}{1 \ \text{km}} = 1.4965 \times 10^{11} \ \text{m}$$

$$t = ?$$

$$v = \frac{d}{t}$$

$$t = \frac{d}{v} = \frac{1.4965 \times 10^{11} \ \text{m}}{2.9979 \times 10^{8} \ \frac{\text{m}}{\text{s}}} = 499.18 \ \text{s} \cdot \frac{1 \ \text{min}}{60 \ \text{s}} = 8.3197 \ \text{min}$$

Chapter 3

Newton's Second Law Practice Problems

1.

$m = 1880 \text{ kg}$

$a = 1.50 \ \frac{\text{m}}{\text{s}^2}$

$F = ?$

$a = \frac{F}{m}$

$F = ma = 1880 \text{ kg} \cdot 1.50 \ \frac{\text{m}}{\text{s}^2} = 2820 \text{ N}$

2.

$m = 188.4 \text{ g} \cdot \frac{1 \text{ kg}}{1000 \text{ g}} = 0.1884 \text{ kg}$

$g = 9.80 \ \frac{\text{m}}{\text{s}^2}$

$F_w = ?$

$F_w = 0.1884 \text{ kg} \cdot 9.80 \ \frac{\text{m}}{\text{s}^2} = 1.85 \text{ N}$

3.

$F = 250.0 \text{ N}$

$m = 144{,}000 \text{ mg} \cdot \frac{1 \text{ g}}{1000 \text{ mg}} \cdot \frac{1 \text{ kg}}{1000 \text{ g}} = 0.144 \text{ kg}$

$a = ?$

$a = \frac{F}{m} = \frac{250.0 \text{ N}}{0.144 \text{ kg}} = 1740 \ \frac{\text{m}}{\text{s}^2}$

4.

$$a = 2.3\ \frac{\text{m}}{\text{s}^2}$$

$$F = 230{,}000\ \text{N}$$

$$m = ?$$

$$a = \frac{F}{m}$$

$$m = \frac{F}{a} = \frac{230{,}000\ \text{N}}{2.3\ \frac{\text{m}}{\text{s}^2}} = 1.0 \times 10^5\ \text{kg}$$

5.

$$a = 0.0022\ \frac{\text{mi}}{\text{hr}^2} \cdot \frac{5280\ \text{ft}}{1\ \text{mi}} \cdot \frac{0.3048\ \text{m}}{1\ \text{ft}} \cdot \frac{1\ \text{hr}}{3600\ \text{s}} \cdot \frac{1\ \text{hr}}{3600\ \text{s}} = 2.732 \times 10^{-7}\ \frac{\text{m}}{\text{s}^2}$$

$$m = 2.2\ \text{Mg} \cdot \frac{1 \times 10^6\ \text{g}}{1\ \text{Mg}} \cdot \frac{1\ \text{kg}}{1000\ \text{g}} = 2.2 \times 10^3\ \text{kg}$$

$$F = ?$$

$$a = \frac{F}{m}$$

$$F = ma = 2.2 \times 10^3\ \text{kg} \cdot 2.732 \times 10^{-7}\ \frac{\text{m}}{\text{s}^2} = 6.0 \times 10^{-4}\ \text{N}$$

6.

$$F_w = 125.1\ \text{lb} \cdot \frac{4.45\ \text{N}}{1\ \text{lb}} = 556.7\ \text{N}$$

$$g = 9.80\ \frac{\text{m}}{\text{s}^2}$$

$$m = ?$$

$$F_w = mg$$

$$m = \frac{F_w}{g} = \frac{556.7\ \text{N}}{9.80\ \frac{\text{m}}{\text{s}^2}} = 56.8\ \text{kg}$$
