

Chapter 2

2.1

$$\begin{array}{llllll}
 1. s = vt & 2. v = at & 3. m = \frac{w}{g} & 4. a = \frac{F}{m} & 5. R = \frac{E}{I} & 6. w = \frac{V}{1h} \\
 7. g = \frac{PE}{mh} & 8. h = \frac{PE}{mg} & 9. h = \frac{v^2}{2g} & 10. f = \frac{X_L}{2\pi L} & 11. w = Pt & 12. F = pA \\
 13. t = \frac{W}{P} & 14. A = \frac{F}{P} & 15. m = \frac{2(KE)}{v^2} & 16. v^2 = \frac{2(KE)}{m} & 17. s = \frac{W}{F} & 18. a = \frac{v_f - v_i}{t} \\
 19. I = \frac{V-E}{-r} \text{ or } I = \frac{E-V}{r} & 20. t = \frac{v_2 - v_1}{a} & 21. P = \frac{\pi}{2R} & 22. L = \frac{Rd^2}{k} & & \\
 23. C = \frac{5F-160}{9} \text{ or } C = \frac{5(F-32)}{9} & 24. F = \frac{9}{5}C + 32 & 25. f = \frac{1}{2\pi CX_C} & & & \\
 26. L = \frac{RA}{\rho} & 27. R_3 = R_T - R_1 - R_2 - R_4 & 28. Q_2 = \frac{Q_1 + Q_1P}{P} \text{ or } Q_2 = \frac{Q_1}{P} + Q_1 & & & \\
 29. I_P = \frac{I_s N_s}{N_P} & 30. N_S = \frac{V_s N_P}{V_P} & 31. v_i = 2v_{avg} - v_f & 32. a = \frac{v^2 - v_i^2}{2(s - s_i)} \text{ or } \frac{v^2 - v_i^2}{2s - 2s_i} & & \\
 33. s = \frac{v^2 - v_i^2 + 2as_i}{2a} & 34. V_1 = V_2 - \frac{Ft}{m} \text{ or } V_1 = \frac{mV_2 - Ft}{m} & 35. R = \frac{QJ}{I^2 t} & & & \\
 36. x_i = x - v_i t - \frac{1}{2}at^2 & 37. r = \sqrt{\frac{A}{\pi}} & 38. r = \sqrt{\frac{V}{\pi h}} & 39. d = \sqrt{\frac{kL}{R}} & 40. r = \sqrt{\frac{3V}{\pi h}} & \\
 41. I = \pm \sqrt{\frac{QJ}{Rt}} & 42. I = \pm \sqrt{\frac{Fr}{m}} & & & &
 \end{array}$$

2.2

$$\begin{array}{llllll}
 1. (a) A = bh & (b) 162 \text{ cm}^2 & 2. (a) V = lwh & (b) 4420m^3 & 3. (a) b = \frac{A}{h} & (b) 7.50 \text{ cm} \\
 4. (a) b = \frac{P}{4} & (b) 105 \text{ in.} & 5. (a) c = P - a - b & (b) 6.0 \text{ cm} & 6. (a) d = \frac{C}{\pi} & \\
 (b) 158 \text{ ft} & 7. (a) r = \frac{C}{2\pi} & (b) 10.9 \text{ yd} & 8. (a) h = \frac{2A}{b} & (b) 26.0 \text{ m} & \\
 9. (a) b = \frac{P-2a}{2} & (b) b = \frac{P}{2} - a & (b) 33.2 \text{ km} & 10. (a) V = \pi r^2 h & (b) 1,460,000 m^3 & \\
 11. (a) h = \frac{V}{\pi r^2} & (b) 6.11 \text{ m} & 12. (a) h = \frac{A}{2\pi r} & (b) 5.80 \text{ cm} & 13. (a) B = \frac{V}{h} & (b) 154 m^2 \\
 14. (a) r = \sqrt{\frac{A}{\pi}} & (b) 12.15 \text{ m} & 15. (a) b = \sqrt{A} & (b) 21.6 \text{ in.} & 16. (a) r = \sqrt{\frac{3V}{\pi h}} & (b) 13.2 \text{ m} \\
 17. (a) C = 2\pi r & (b) 121.6 \text{ m} & 18. (a) V = \frac{4}{3}\pi r^3 & (b) 70,690 m^3 & 19. (a) B = \frac{3V}{h} & \\
 (b) 122.4 \text{ ft}^2 & 20. (a) h = \frac{2A}{a+b} & (b) 11.40 \text{ m} & & &
 \end{array}$$

2.3

$$\begin{array}{ll}
 1. V = lwh = (36.0\text{cm})(30.0\text{cm})(24.0\text{cm}) = 25,900\text{cm}^3 & \\
 2. V = \pi r^2 h = \pi(2.10\text{in.})^2(7.50\text{in.}) = 104\text{in}^3 & 3. V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(5.40\text{cm})^2(9.30\text{cm}) = 284\text{cm}^3 \\
 4. V = \pi r^2 h = \pi\left(\frac{11.40\text{cm}}{2}\right)^2(24.00\text{cm}) = 2450\text{cm}^3 & 5. A = \pi r^2 = \pi\left[\frac{11.40\text{cm}}{2}\right]^2 = 102.1\text{cm}^2
 \end{array}$$

$$6. A = \pi dh = \pi(11.40\text{cm})(24.00\text{cm}) = 859.5\text{cm}^2$$

$$7. V = \left(1w + \frac{1}{2}bh\right)h' = \left[(22.0\text{ft})(10.0\text{ft}) + \frac{1}{2}(22.0\text{ft})(4.70\text{ft})\right](37.0\text{ft}) = 10,100\text{ft}^3$$

$$8. A = \left[\frac{a+b}{2}\right]h = \left[\frac{3.70\text{ft} + 6.80\text{ft}}{2}\right](19.3\text{ft}) = 101\text{ft}^2$$

$$9. V = 1wh = (9.00\text{ft})(12.0\text{ft})(8.00\text{ft}) = 864\text{ft}^3 \quad 10. A = \pi r^2 = \pi\left[\frac{3.25\text{cm}}{2}\right]^2 = 8.30\text{cm}^2$$

$$11. A = \frac{1}{2}bh = \frac{1}{2}(4.00\text{cm})(6.00\text{cm}) = 12.0\text{cm}^2$$

$$12. c = \sqrt{a^2 + b^2} = \sqrt{(4.00\text{cm})^2 + (6.00\text{cm})^2} = 7.21\text{cm}$$

$$13. A = \pi(r_1^2 - r_2^2) = \pi\left[\left(\frac{3.50\text{cm}}{2}\right)^2 - \left(\frac{3.20\text{cm}}{2}\right)^2\right] = 1.58\text{cm}^2$$

$$14. V = \frac{4\pi r^3}{3} = \frac{4}{3}\pi(8.00\text{m})^3 = 2140\text{m}^3 \quad 15. w = \frac{A}{1} = \frac{900\text{m}^2}{25.0\text{m}} = 36.0\text{m}$$

$$16. h = \frac{V}{1w} = \frac{192\text{m}}{(8.00\text{m})(4.00\text{m})} = 6.00\text{m} \quad 17. V = \pi r^2 h = \pi(2.00\text{cm})^2(4.20\text{cm}) = 52.8\text{cm}^3$$

$$18. V = \pi r^2 h = \pi(3.90\text{cm})^2(8.00\text{cm}) = 382\text{cm}^3$$

$$19. d = \frac{C}{\pi} = \frac{29.5\text{m}}{\pi} = 9.39\text{m}$$

$$20. h = \frac{V}{\pi r^2} = \frac{1000\text{m}^3}{\pi\left(\frac{9.39\text{m}}{2}\right)^2} = 14.4\text{m}$$

$$21. \text{Distance} = C(\text{no. of rev}) = \pi d(\text{no. of rev}) = \pi(30.0\text{cm})(145) \times \left(\frac{1\text{m}}{100\text{cm}}\right) = 137\text{m}$$

$$22. A = Ch = (29.5\text{m})(14.4\text{m})\left(\frac{1\text{L}}{5.0\text{m}^2}\right) = 85\text{L} \quad 23. h = \frac{V}{\pi r^2} = \frac{500,000\text{gal} \times \frac{1\text{ft}^3}{7.50\text{gal}}}{\pi(18.0\text{ft})^2} = 65.5\text{ft}$$

$$24. r = \sqrt{\frac{V}{\pi h}} = \sqrt{\frac{500,000\text{gal} \times \frac{1\text{ft}^3}{7.50\text{gal}}}{\pi(42.0\text{ft})}} = 22.5\text{ft} \quad 25. \frac{A_1}{A_2} = \frac{(12.0\text{ft})(15.0\text{ft})}{(1.00\text{ft})(3.00\text{ft})} = \frac{180\text{ft}^2}{3.00\text{ft}^2} = 60\text{panels}$$

$$26. A_{\text{total}} = A_{\text{rectangle}} - A_{\text{trapezoid}} \quad A = (3.50\text{cm})(2.00\text{cm}) - \left(\frac{1.90\text{cm} + 2.20\text{cm}}{2}\right)(0.400\text{cm}) = 6.18\text{cm}^2$$

$$27. V = V_{\text{cylinder}} + V_{\text{cone}} \quad V = \pi(1.50\text{m})^2(2.75) + \frac{1}{3}\pi(1.50\text{m})^2(2.00\text{m}) = 24.1\text{m}^3$$

$$28. r = \sqrt{\frac{A}{\pi}} = \sqrt{\frac{3.05\text{m}^2}{\pi}} = 0.985\text{m}; \text{yes} \quad 29. V = 1wh = (12.0\text{ft})(20.0\text{ft})(0.500\text{ft}) \times \frac{1\text{yd}^3}{27\text{ft}^3} = 4.44\text{yd}^3$$

$$30. 1 = \frac{V}{wh} = \frac{2.00 \text{ yd}^3}{(4.00 \text{ ft})(0.333 \text{ ft})} \times \frac{27 \text{ ft}^3}{1 \text{ yd}^3} = 40.5 \text{ ft}$$

$$31. V = 1wh - \pi r^2 h = (8.00 \text{ in.})(8.00 \text{ in.})(6.00 \text{ in.}) - \pi(2.50 \text{ in.})^2(6.00 \text{ in.}) = 266 \text{ in}^3$$

$$32. V = \pi r^2 h - \pi r^2 h = \pi(25.0 \text{ cm})^2(60.0 \text{ cm}) - \pi(10.0 \text{ cm})^2(60.0 \text{ cm}) = 99,000 \text{ cm}^3$$

Chapter 2 Review Questions

1. c 2. b 3. a 4. (1) To find the volume of liquid storage tanks. (2) To determine the amount of concrete needed for a driveway. 5. As a shorthand way to designate different measured quantities of the same type. 6. Most mistakes are made in problem solving by missing needed information or misinterpreting the information given. 7. Making a sketch helps visualize what is happening in the problem. 8. The basic question. 9. The working equation is found by solving the basic equation for the unknown quantity. 10. Carrying the units through a problem shows whether the answer is the kind expected. 11. Making an estimate of the correct answer shows whether the solution is reasonable.

Chapter 2 Review Problems

$$1. (a) m = \frac{F}{a} \quad (b) a = \frac{F}{m} \quad 2. h = \frac{v^2}{2g} \quad 3. v_f = \frac{2s}{t} - v_i \quad 4. v = \sqrt{\frac{2KE}{m}}$$

$$5. b = P - a - c = 36 \text{ ft} - 12 \text{ ft} - 6 \text{ ft} = 18 \text{ ft}$$

$$6. a = 2\left(\frac{A}{h} - \frac{b}{2}\right) = 2\left(\frac{210 \text{ m}^2}{15.0 \text{ m}} - \frac{16.0 \text{ m}}{2}\right) = 12.0 \text{ m} \quad 7. r = \sqrt{\frac{A}{\pi}} = 2.19 \text{ m}$$

$$8. A = \frac{1}{2} b h = \frac{1}{2} (12.2 \text{ cm}) (20.0 \text{ cm}) = 122 \text{ cm}^2 \quad 9. h = \frac{3V}{\pi r^2} = \frac{3(314 \text{ cm}^3)}{\pi(5.00 \text{ cm})^2} = 12.0 \text{ cm}$$

$$10. c = \sqrt{a^2 + b^2} = \sqrt{(41.2 \text{ mm})^2 + (9.80 \text{ mm})^2} = 42.3 \text{ mm}$$

$$11. A = 2\pi r h = 2\pi(7.20 \text{ cm})(13.4 \text{ cm}) = 606 \text{ cm}^2$$

$$12. 40.0 \text{ cm} = 2(14.0 \text{ cm}) + 2\omega \quad \omega = 6.0 \text{ cm} \quad 13. r = \sqrt{\frac{V}{\pi h}} = \sqrt{\frac{2100 \text{ m}^3}{\pi 17.0 \text{ m}}} = 6.27 \text{ m}$$

$$14. h = \frac{2A}{b} = \frac{2(88.6 \text{ m}^2)}{12.3 \text{ m}} = 14.4 \text{ m}$$

$$15. V = V_1 - V_2 = (9.0 \text{ cm} \cdot 6.0 \text{ cm} \cdot 12 \text{ cm}) - (6.0 \text{ cm} \cdot 3.0 \text{ cm} \cdot 12 \text{ cm}) = 430 \text{ cm}^3$$

$$16. A = A_1 - A_2 = (40.0 \text{ cm} \cdot 120 \text{ cm}) - (10.0 \text{ cm} \cdot 12.0 \text{ cm}) = 4680 \text{ cm}^2$$

Chapter 2 Applied Concepts

$$1. A_{\text{property}} - A_{\text{house}} = l_{\text{prop}} w_{\text{prop}} - l_{\text{house}} w_{\text{house}} = (100 \text{ ft})(200 \text{ ft}) - (35.0 \text{ ft})(80.0 \text{ ft}) = 17,200 \text{ ft}^2$$

$$\frac{\$50.00}{17200 \text{ ft}} \left(\frac{9 \text{ ft}^2}{1 \text{ yd}^2} \right) = \$0.026 / \text{yd}^2 = 2.62 \text{ ¢} / \text{yd}^2$$

$$2. V = h \times w \times l = (8.00 \text{ ft})(10.0 \text{ ft})(32.0 \text{ ft}) = 2560 \text{ ft}^3; \quad \frac{2560 \text{ ft}^3}{20.0 \text{ min}} \left(\frac{1 \text{ min}}{60 \text{ sec}} \right) = 2.13 \text{ ft}^3 / \text{s}$$

$$3. V_{\text{SolidBeam}} = lwh = (240 \text{ ft})(8.00 \text{ in.})(8.00 \text{ in.}) = 15400 \text{ in}^3$$

$$V_{\text{IBeam}} = V_{\text{top}} + V_{\text{vertical}} + V_{\text{bottom}} = (1.00 \text{ in.})(8.00 \text{ in.})(240 \text{ in.}) + (6.00 \text{ in.})(1.00 \text{ in.})(240 \text{ in.}) + (1.00 \text{ in.})(8.00 \text{ in.})(240 \text{ in.}) = 5280 \text{ in}^3$$

$$\frac{V_{\text{solid}}}{V_{\text{IBeam}}} = \frac{15400 \text{ in}^3}{5280 \text{ in}^3} = 2.91$$

$$4. \text{ \# of balls wide} = \frac{w}{2r} = \frac{16.8in.}{2 \times 4.00in.} = 2.10balls$$

$$\text{\# of balls high} = \frac{h}{2r} = \frac{16.8in.}{2 \times 4.00in.} = 4.20balls$$

$$2 \text{ balls} \times 2 \text{ balls} \times 4 \text{ balls} = 16 \text{ balls}$$

$$\text{\# of balls long} = \frac{l}{2 \times r} = \frac{33.6in.}{2 \times 4.00in.} = 4.20balls$$

$$5. \text{ (a) } V_{cylinder} = \pi r^2 h = \pi (1.53m)^2 (0.915m) = 6.73m^3$$

$$\text{(b) } m = DV = \left(7750 \frac{kg}{m^3} \right) (6.73m^3) = 522,000kg$$

$$F = m \times g = (522,000kg) \left(9.80 \frac{m}{s^2} \right) = 512,000N$$