1.2 SI Units of Length, Mass, and Time

1. (c).

2. (b).

3. (b).

1.3 More about the Metric System

9. (b).

10. (b).

11. (a).

$\boxed{18}$. That is because $\boxed{\text{1 nautical mile = 6076 ft}}$ = 1.15 mi. A nautical mile is larger than a (statute) mile.

1.4 Unit Analysis

$\boxed{22}$. $\boxed{\text{No}}$, it only tells if the equation is dimensionally correct.

25. $(\text{Length}) = (\text{Length}) + \dfrac{(\text{Length})}{(\text{Time})} \times (\text{Time}) = (\text{Length}) + (\text{Length})$.

$\boxed{28}$. $\boxed{\text{Yes}}$, since $[\text{m}^3] = [\text{m}]^3 = [\text{m}^3]$.

29. $\boxed{\text{No}}$. $V = 4\pi r^3/3 = 4\pi(8r^3)/24 = 4\pi(2r)^3/24 = \pi d^3/6$. So it should be $\boxed{V = \pi d^3/6}$.

38. (a) Since $E = mc^2$, the units of energy = $(\text{kg})(\text{m/s})^2 = \boxed{\text{kg}\cdot\text{m}^2/\text{s}^2}$.

(b) $\boxed{\text{Yes}}$, because $(\text{kg})(\text{m/s}^2)(\text{m}) = \text{kg}\cdot\text{m}^2/\text{s}^2$ ($E = mgh$).

1.5 Unit Conversions

$\boxed{46}$. (a) The answer is $\boxed{\text{(4) centimeter}}$, as it is the smallest unit among those listed.

(b) Since 1 ft = 30.5 cm, $6.00\text{ ft} = (6.00\text{ ft}) \times \dfrac{30.5\text{ cm}}{1\text{ ft}} = \boxed{183\text{ cm}}$.

47. $40\,000\text{ mi} = (40\,000\text{ mi}) \times \dfrac{1609\text{ m}}{1\text{ mi}} = 64\,400\,000\text{ m}$.

So $\dfrac{64\,400\,000\text{ m}}{1.75\text{ m}} = \boxed{37\,000\,000\text{ times}}$.

51. $0.35\text{ m/s} = (0.35\text{ m/s}) \times \dfrac{1\text{ mi}}{1609\text{ m}} \times \dfrac{3600\text{ s}}{1\text{ h}} = 0.78\text{ mi/h}$. So in 1.0 h, it travels $\boxed{0.78\text{ mi}}$.

$\boxed{53}$. (a) $1\text{ km/h} = (1\text{ km/h}) \times \dfrac{1000\text{ m}}{1\text{ km}} \times \dfrac{1\text{ h}}{3600\text{ s}} = 0.8\text{ m/s} < 1\text{ m/s}$.

$1\text{ ft/s} = (1\text{ ft/s}) \times \dfrac{1\text{ m}}{3.28\text{ ft}} = 0.30\text{ m/s} < 1\text{ m/s}$.

$$1\text{ mi/h} = (1\text{ mi/h}) \times \frac{1609\text{ m}}{1\text{ mi}} \times \frac{1\text{ h}}{3600\text{ s}} = 0.45\text{ m/s} < 1\text{ m/s}.$$

So $\boxed{(1)\ 1\text{ m/s}}$ represents the greatest speed.

(b) $15.0\text{ m/s} = (15.0\text{ m/s}) \times \dfrac{1\text{ mi}}{1609\text{ m}} \times \dfrac{3600\text{ s}}{1\text{ h}} = \boxed{33.6\text{ mi/h}}$.

63. (a) The volume is equal to $V = Ah = \pi r^2 h = \pi(125\text{ m})^2(10\text{ ft})(0.305\text{ m/ft}) = \boxed{1.5 \times 10^5\text{ m}^3}$.

(b) The water density of is 1000 kg/m^3.

$$\rho = \frac{m}{V}, \quad ☞ \quad m = \rho V = (1000\text{ kg/m}^3)(1.5 \times 10^5\text{ m}^3) = \boxed{1.5 \times 10^8\text{ kg}}.$$

(c) One kg is equivalent to 2.2 lb. $1.5 \times 10^8\text{ kg} = (1.5 \times 10^8\text{ kg}) \times \dfrac{2.2\text{ lb}}{1\text{ kg}} = \boxed{3.3 \times 10^8\text{ lb}}$.

1.6 Significant Figures

69. $\boxed{\text{No}}$, there is always one doubtful digit, the last digit.

72. $\boxed{0.001\text{ m or }1\text{ mm}}$.

80. (a) $12.634 + 2.1 = \boxed{14.7}$. (b) $13.5 - 2.134 = \boxed{11.4}$.

(c) $\pi(0.25\text{ m})^2 = \boxed{0.20\text{ m}^2}$. (d) $\sqrt{2.37/3.5} = \boxed{0.82}$.

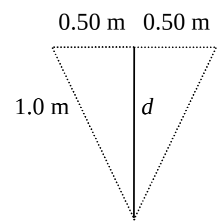
81. (a) The answer is $\boxed{(1)\text{ zero}}$, since 38 m has zero decimal places.

(b) $46.9\text{ m} + 5.72\text{ m} - 38\text{ m} = \boxed{15\text{ m}}$.

1.7 Problem Solving

83. (a).

84. (c).



95. According to Pythagorean theorem, $(1.0\text{ m})^2 = (0.50\text{ m})^2 + d^2$.

So $d = \sqrt{(1.0\text{ m})^2 - (0.50\text{ m})^2} = \boxed{0.87\text{ m}}$.

$\boxed{96}$. The $\boxed{12\text{-in.}}$ pizza is a better buy. A better buy gives you more *area* (more pepperoni) per dollar, and the area of a pizza depends on the square of the diameter.

For the 9.0 in.: $\dfrac{\pi(4.5\text{ in.})^2}{\$7.95} = \boxed{8.0\text{ in.}^2\text{/dollar}}$. For the 12 in.: $\dfrac{\pi(6.0\text{ in.})^2}{\$13.50} = \boxed{8.4\text{ in.}^2\text{/dollar}}$.

102. (a) The number of hairs lost in a month is $(65\text{ hairs/day})(30\text{ days}) = \boxed{1950\text{ hairs}}$.

(b) 15% bald means 85% with hair. So in one day, the “bald is beautiful” person loses

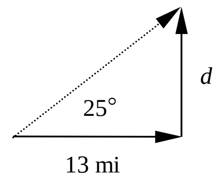
(0.85)(65 hairs) = 55 hairs.

In one year, the total is (365)(55 hairs) = $\boxed{2.0 \times 10^4 \text{ hairs}}$.

Comprehensive Exercises

$\boxed{106}$. (a) Since d = (13 mi) tan 25° and tan 25° < 1 (tan 45° = 1),

d is $\boxed{\text{(1) less than}}$ 13 mi.



(b) d = (13 mi) tan 25° = $\boxed{6.1 \text{ mi}}$.

109. $r_E = 1.5 \times 10^8$ km and $r_M = 2.3 \times 10^8$ km.

From the law of cosine, $r_M^2 = r_E^2 + r^2 - 2rr_E \cos 50°$

or $(2.3 \times 10^8 \text{ km})^2 = (1.5 \times 10^8 \text{ km})^2 + r^2 - 2r(1.5 \times 10^8 \text{ km}) \cos 50°$.

Reducing to quadratic equation $r^2 - (1.93 \times 10^8)r - 3.04 \times 10^{16} = 0$.

Comparing to the standard quadratic equation $ax^2 + bx + c = 0$,

we have $a = 1$; $b = 1.93 \times 10^8$; and $c = 3.04 \times 10^{16}$.

Solving for $r = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \boxed{3.0 \times 10^8 \text{ km}}$.