CHAPTER 0

UNITS AND MEASUREMENTS

0.1 Solve for x in the following algebraic equations:

(a) $3x + 1 = 5$

(b) $2x - 1 = 5$

(c) $\frac{3}{2} = \frac{1}{2x}$

(d) $\frac{3x+1}{2} = 2$

(e) $\frac{2x-1}{3} = 2$

(f) $\frac{2}{3} = \frac{1}{3x}$

0.2 Compute the following calculations involving scientific notation:

(a) $\frac{6.5 \times 10^3}{3 \times 10^2}$

(b) $\frac{6.1 \times 10^{-3}}{3 \times 10^4}$

(c) $\frac{1.3 \times 10^{-3}}{2.5 \times 10^{-2}}$

(d) $\frac{2.4 \times 10^{-3}}{5 \cdot 4.6 \times 10^{-6}}$

(e) $\frac{1}{3 \cdot 4 \times 10^{-1}}$

(f) $\frac{1}{4 \cdot 1 \times 10^{-4}}$

0.3 Indicate the magnitude measured in the following measurements: (a) 2 L (b) 5 cm

0.4 Indicate the magnitude measured in the following measurements: (a) 100 Kg (b) 10h

0.5 Answer the following questions: (a) Indicate the metric base unit for mass (b) Indicate the metric base unit for time (c) Indicate metric base unit for volume

0.6 Answer the following questions: (a) Indicate basic unit of mass in the SI (b) What magnitude measures the amount of space occupied by a substance

PREFIXES & CONVERSION FACTORS

0.7 Fill the gap in the following unit equalities or conversion factors: $1Km = $ _____ m

0.8 Fill the gap in the following unit equalities or conversion factors: $1cm = $ _____ m

0.9 Fill the gap in the following unit equalities or conversion factors: $\dfrac{1nm}{\rule{2cm}{0.4pt}\, m}$

0.10 Fill the gap in the following unit equalities or conversion factors: $\dfrac{1fs}{\rule{2cm}{0.4pt}\, s}$

0.11 Fill the gap in the following unit equalities or conversion factors:

$1Tm = $ _____ m

$1dm = $ _____ m

$1cg = $ _____ g

$1ms = $ _____ s

$1qt = $ _____ mL

$1L = $ _____ dm^3

$1lb = $ _____ g

$1in = $ _____ cm

0.12 Fill the gap in the following unit equalities or conversion factors:

(a) $\dfrac{1km}{\rule{2cm}{0.4pt}\, m}$

(b) $\dfrac{1cm}{\rule{2cm}{0.4pt}\, m}$

(c) $\dfrac{1ms}{\rule{2cm}{0.4pt}\, s}$

(d) $\dfrac{\rule{2cm}{0.4pt}\, L}{10^{-3}L}$

(e) $\dfrac{\rule{2cm}{0.4pt}\, L}{10^{-2}L}$

(f) $\dfrac{\rule{2cm}{0.4pt}\, g}{10^{-1}g}$

USING CONVERSION FACTORS

0.13 Fill the gap in the following unit conversion:

$$70\,cm \times \frac{\rule{2cm}{0.4pt}\, m}{1\,cm} = 0.7m$$

0.14 The following conversion factor is used to convert $100\mu m$ into m. Fill in the gaps:

$$100\,\mu m \times \frac{\rule{2cm}{0.4pt}\, m}{1\,\mu m} = 1 \times 10^{-4}m$$

0.15 The following conversion factor is used to convert $40m$ into nm. Fill in the gaps:

$$40\,m \times \frac{1nm}{\rule{2cm}{0.4pt}\, m} = 4 \times 10^{10}nm$$

0.16 Complete the following unit conversion:

$$100\,Gm \times \frac{\rule{2cm}{0.4pt}\, m}{\rule{1cm}{0.4pt}\,Gm} = \rule{2cm}{0.4pt}\, m$$

0.17 Complete the following unit conversion:

$$50\,km \times \frac{\rule{2cm}{0.4pt}\, m}{\rule{1cm}{0.4pt}\,km} = \rule{2cm}{0.4pt}\, m$$

0.18 Complete the following unit conversion:

$$2\,\cancel{m} \times \frac{\rule{2cm}{0pt}\,cm}{\rule{2cm}{0pt}\,\cancel{m}} = \rule{2cm}{0pt}\,cm$$

0.19 Complete the following unit conversion:

$$0.3\,\cancel{m} \times \frac{\rule{2cm}{0pt}\,mm}{\rule{2cm}{0pt}\,\cancel{m}} = \rule{2cm}{0pt}\,mm$$

0.20 Complete the following unit conversion:

(a) $0.5\,\mu\cancel{g} \times \dfrac{\rule{2cm}{0pt}\,g}{\rule{2cm}{0pt}\,\mu\cancel{g}} = \rule{2cm}{0pt}\,g$

(b) $125\,\cancel{L} \times \dfrac{\rule{1.5cm}{0pt}\,mL}{\rule{1.5cm}{0pt}\,\cancel{L}} = \rule{1.5cm}{0pt}\,mL$

(c) $100\,\cancel{nm} \times \dfrac{\rule{1.5cm}{0pt}\,m}{\rule{1.5cm}{0pt}\,\cancel{nm}} = \rule{1.5cm}{0pt}\,m$

0.21 The following conversion factor is used to convert $30cm$ into km. Fill in the gaps:

$$30\,\cancel{cm} \times \frac{\rule{2cm}{0pt}\,\cancel{m}}{1\,\cancel{cm}} \times \frac{1km}{\rule{1.5cm}{0pt}\,\cancel{m}} = 3 \times 10^{-4}km$$

0.22 The following conversion factor is used to convert $50dm$ into cm. Fill in the gaps:

$$50\,\cancel{dm} \times \frac{\rule{2cm}{0pt}\,\cancel{m}}{1\,\cancel{dm}} \times \frac{1cm}{\rule{1.5cm}{0pt}\,\cancel{m}} = 500cm$$

0.23 Fill the gap in the following conversion factors:

$$20\,\cancel{cm} \times \frac{1 \times 10^{-2}m}{1\,\cancel{cm}} \times \frac{1mm}{1 \times 10^{-3}\,\cancel{m}} = \rule{2cm}{0pt}\,mm$$

0.24 Set up the conversion factor to convert 500cm into inches:

$$50\,\cancel{cm} \times \frac{\rule{2cm}{0pt}}{\rule{2cm}{0pt}} = \rule{2cm}{0pt}\,in$$

0.25 Fill the gap in the following conversion factors:

$$20\,\cancel{cm} \times \frac{\rule{2cm}{0pt}}{\rule{2cm}{0pt}} = 7.87in$$

0.26 Compute the following power of ten calculations:

(a) $(10^2)^2$ (c) $(10^{-6})^2$

(b) $(10^2)^3$ (d) $(10^{-2})^2$

0.27 Set up the conversion factor to convert $400cm^2$ into m^2:

$$400\,\cancel{cm^2} \times \frac{\rule{2cm}{0pt}}{\rule{2cm}{0pt}} = \rule{2cm}{0pt}\,m^2$$

0.28 Fill the gap in the following unit equalities or conversion factors:

$1cm^2 = \rule{2cm}{0pt}\,m^2$ $1cm^3 = \rule{2cm}{0pt}\,m^3$

$1dm^3 = \rule{2cm}{0pt}\,m^3$ $1dm^2 = \rule{2cm}{0pt}\,m^2$

SIGNIFICANT FIGURES

0.29 Carry the following calculations with the correct number of digits or significant figures:

(a) $0.2301 + 0.123$ (c) $88.1 - 87.57$

(b) $0.2301 - 1.12$ (d) $24.56 + 2.4$

0.30 Carry the following calculations with the correct number of digits or significant figures:

(a) 523×5000 (c) 27.0×0.01

(b) $5/0.123$ (d) $345.13/100$

0.31 Indicate the number of SFs. (a) 0.0032 m (b) 5100 m (c) 0.510 m (d) 0.0051 m (e) 500 m (f) 45.030

0.32 Which of the following measurents contains the designated CORRECT number of significant figures? (a) 0.05600 cm (5 SF) (b) 0.0304 cm (3 SF) (c) 456 000 cm (3 SF) (d) 1.304 cm (2 SF) (e) 3.12050 cm (4 SF)

DENSITY

0.33 Determine the density (g/mL) of a 0.01 L sample of a salt solution that has a mass of 50 g.

0.34 Which one of the following substances will float in gasoline, which has a density of 0.66 g/mL? Assume no mixing: (a) table salt (2.16 g/mL) (b) balsa wood (0.16 g/mL) (c) sugar (1.59 g/mL) (d) aluminum (2.70 g/mL) (e) mercury (13.6 g/mL)

0.35 You have a large water tank used as a cooler in a party and you have a bunch of cans: a coke can, a diet coke can, a water can and a schweppes can. You add all unopened cans on the tank. Describe the final vertical distribution of cans in the tank. Which can will stay on top and which will sink in more?

0.36 A nugget of gold with a mass of 521 g is added to 50.0 mL of water. The water level rises to a volume of 77.0 mL. What is the measured density of the gold?

0.37 A graduated cylinder contains 28.0 mL of water. What is the new water level after 35.6 g of silver metal is submerged in the water if the density of silver is 10g/mL?

Answers **0.1** (a) 0.33 (b) 3 (c) 0.33 (d) 1 (e) 3.5 (f) 0.5 **0.2** (a) 21.66 (b) 2.03×10^{-7} (c) 0.052 (d) 104.35 (e) 8.3×10^{-1} (f) 650 **0.3** (a) 2 L (volume) (b) 5 cm (length) **0.4** (a) 100 Kg (mass) (b) 10h (time) **0.5** (a) g (b) s (c) L **0.6** (a) kg (b) the volume **0.7** 1×10^{3} **0.8** 1×10^{-2} **0.9** 1×10^{-9} **0.10** 1×10^{-15} **0.11** $1\text{Tm} = 10^{12}\text{m}$ $1\text{dm} = 10^{-1}\text{m}$ $1\text{cg} = 10^{-2}\text{g}$ $1\text{ms} = 10^{-3}\text{s}$ $1\text{qt} = 1\text{mL}$ $1\text{L} = 1dm^3$ $1\text{lb} = 454\text{g}$ $1\text{in} = 2.54\text{cm}$ **0.12** (a) $\dfrac{1\text{km}}{10^{3}\text{m}}$ (b) $\dfrac{1\text{cm}}{10^{-2}\text{m}}$ (c) $\dfrac{1\text{ms}}{10^{-3}\text{s}}$ (d) $\dfrac{\text{mL}}{10^{-3}\text{L}}$ (e) $\dfrac{\text{cL}}{10^{-2}\text{L}}$ (f) $\dfrac{\text{dg}}{10^{-1}\text{g}}$ **0.13** 1×10^{-2} **0.14** $1 \cdot 10^{-6}$ **0.15** $1 \cdot 10^{-9}$ **0.16** $1 \cdot 10^{12}m$ **0.17** $5 \cdot 10^{4}m$ **0.18** $2 \cdot 10^{-2}cm$ **0.19** $3 \cdot 10^{2}mm$ **0.20** (a) $0.5\,\mu\cancel{g} \times \dfrac{1 \times 10^{-6}g}{\mu\cancel{g}} = 5 \times 10^{-7}g$ (b) $125\cancel{L} \times \dfrac{mL}{1 \times 10^{-3}\cancel{L}} = 1.25 \times 10^{5}mL$ (c) $100\,\cancel{nm} \times \dfrac{1 \times 10^{-9}m}{\cancel{nm}} = 1 \times 10^{-7}m$ **0.21** $1 \cdot 10^{-2}; 10 \cdot 10^{3}$ **0.22** $1 \cdot 10^{-1}; 1 \cdot 10^{-2}$ **0.23** 200 **0.24** $19.68in$ **0.25** $\dfrac{1in}{2.54\,\cancel{cm}}$ **0.26** (a) $(10^{2})^{2} = 10^{4}$ (b) $(10^{2})^{3} = 10^{6}$ (c) $(10^{-6})^{2} = 10^{-12}$ (d) $(10^{-2})^{2} = 10^{-4}$ **0.27** $0.04m^2$ **0.28** $1\text{cm}^2 = 1 \times 10^{-4}\text{m}^2$ $1\text{dm}^3 = 1 \times 10^{-3}\text{m}^3$ $1\text{cm}^3 = 1 \times 10^{-6}\text{m}^3$ $1\text{dm}^2 = 1 \times 10^{-2}\text{dm}^2$ **0.29** (a) $0.2301 + 0.123 = 0.353$ (b) $0.2301 - 1.12 = -0.89$ (c) $88.1 - 87.57 = 0.5$ (d) $24.56 + 2.4 = 27.0$ **0.30** (a) $523 \times 5000 = 3000000$ (b) $5/0.123 = 40$ (c) $27.0 \times 0.01 = 0.3$ (d) $345.13/100 = 3$ **0.31** (a) 0.0032 m (2SF) (b) 5100 m (2SF) (c) 0.510 m (3SF) (d) 0.0051 m (2SF) (e) 500 m (1SF) (f) 45.030 m (6SF) **0.32** 456 000 (3 SF) **0.33** $5g \cdot ml^{-1}$ **0.34** balsa wood (0.16 g/mL) **0.35** from top to bottom: coke, diet, schweppes, water **0.36** 19.3 g/mL **0.37** $31.56mL$