CHAPTER 0

MATH SKILLS

0.1 Solve for x in the following algebraic equations: (a) $\frac{3x+1}{2} = 2$ (b) $\frac{2x-1}{3} = 2$ (c) $\frac{2}{3} = \frac{1}{3x}$

0.2 Solve for x in the following algebraic equations: (a) $3x + 1 = 5$ (b) $2x - 1 = 5$ (c) $\frac{3}{2} = \frac{1}{2x}$

0.3 Compute the following calculations involving scientific notation: (a) $\frac{6.5\times10^{3}}{3\times10^{2}}$ (b) $\frac{6.1\times10^{-3}}{3\times10^{4}}$ (c) $\frac{1.3\times10^{-3}}{2.5\times10^{-2}}$

0.4 Compute the following calculations involving scientific notation: (a) $\frac{2.4\times10^{-3}}{(5)(4.6\times10^{-6})}$ (b) $\frac{1}{(3)(4\times10^{-1})}$ (c) $\frac{1}{(4)(1\times10^{-4})}$

UNITS OF MEASUREMENTS AND SYSTEMS OF UNITS

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

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

0.7 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

0.8 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

SIGNIFICANT FIGURES

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

(a) $0.2301 + 0.123$
(b) $0.2301 - 1.12$
(c) $88.1 - 87.57$
(d) $24.56 + 2.4$

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

(a) 523×5000
(b) $5/0.123$
(c) 27.0×0.01
(d) $345.13/100$

0.11 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

0.12 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)

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0.13 Round the following numbers to 3SFs: (a) 12849m (b) 5111s (c) 2.4566×10^{-3}Kg (d) 0.051376cm (e) 573456mm (f) 0.0293845μm

0.14 Round the following numbers to 1SFs: (a) 12849m (b) 5111s (c) 2.4566×10^{-3}Kg (d) 0.051376cm (e) 573456mm (f) 0.0293845μm

PREFIXES & CONVERSION FACTORS

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

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

0.17 Fill the gap in the following unit equalities or conversion factors: $\frac{1nm}{\text{\_\_\_\_}m}$

0.18 Fill the gap in the following unit equalities or conversion factors: $\frac{1fs}{\text{\_\_\_\_}s}$

0.19 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

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

(a) $\frac{1\text{km}}{\square\text{m}}$

(b) $\frac{1\text{cm}}{\square\text{m}}$

(c) $\frac{1\text{ms}}{\square\text{s}}$

(d) $\frac{\square\text{L}}{10^{-3}\text{L}}$

(e) $\frac{\square\text{L}}{10^{-2}\text{L}}$

(f) $\frac{\square\text{g}}{10^{-1}\text{g}}$

Using Conversion Factors

0.21 Fill the gap in the following unit conversion:

$$70\cancel{cm} \times \frac{\square m}{1\cancel{cm}} = 0.7m$$

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

$$100\cancel{\mu m} \times \frac{\square m}{1\cancel{\mu m}} = 1 \times 10^{-4}m$$

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

$$40\cancel{m} \times \frac{1nm}{\square\cancel{m}} = 4 \times 10^{10}nm$$

0.24 The following conversion factor is used to convert $500m$ into μm. Fill in the gaps:

$$500\cancel{m} \times \frac{1\mu m}{\square\cancel{m}} = 5 \times 10^{8}\mu m$$

0.25 Complete the following unit conversion:

$$100\cancel{Gm} \times \frac{\square m}{\square\cancel{Gm}} = \square m$$

0.26 Complete the following unit conversion:

$$50\cancel{km} \times \frac{\square m}{\square\cancel{km}} = \square m$$

0.27 Complete the following unit conversion:

$$2\cancel{m} \times \frac{\square cm}{\square\cancel{m}} = \square cm$$

0.28 Complete the following unit conversion:

$$0.3\cancel{m} \times \frac{\square mm}{\square\cancel{m}} = \square mm$$

0.29 Complete the following unit conversion:

(a) $0.5\cancel{\mu g} \times \frac{\square\text{g}}{\square\cancel{\mu g}} = \square\text{g}$

(b) $125\cancel{L} \times \frac{\square\text{mL}}{\square\cancel{L}} = \square\text{mL}$

0.30 Complete the following unit conversion:

(a) $100\cancel{\text{nm}} \times \frac{\square\text{m}}{\square\cancel{\text{nm}}} = \square\text{m}$

(b) $10\cancel{\text{dm}} \times \frac{\square\text{m}}{\square\cancel{\text{dm}}} = \square\text{m}$

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

$$30\cancel{cm} \times \frac{\square\cancel{m}}{1\cancel{cm}} \times \frac{1km}{\square\cancel{m}} = 3 \times 10^{-4}km$$

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

$$50\cancel{dm} \times \frac{\square\cancel{m}}{1\cancel{dm}} \times \frac{1cm}{\square\cancel{m}} = 500cm$$

0.33 Fill the gap in the following conversion factors:

$$20\cancel{cm} \times \frac{1 \times 10^{-2}m}{1\cancel{cm}} \times \frac{1mm}{1 \times 10^{-3}\cancel{m}} = \square mm$$

0.34 Fill the gap in the following conversion factors:

$$5\cancel{mm} \times \frac{1 \times 10^{-3}m}{1\cancel{mm}} \times \frac{1nm}{1 \times 10^{-9}\cancel{m}} = \square nm$$

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

$$50\cancel{cm} \times \frac{\square}{\square} = \square in$$

0.36 Fill the gap in the following conversion factors:

$$20\cancel{cm} \times \frac{\square}{\square} = 7.87in$$

0.37 Compute the following power of ten calculations:

(a) $(10^2)^2$

(b) $(10^2)^3$

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

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

0.38 Compute the following power of ten calculations:

(a) $(10^1)^3$

(b) $(10^3)^4$

(c) $(10^{-5})^2$

(d) $(10^{-4})^5$

0.39 Set up the following conversion factor:

$$400\cancel{cm^2} \times \frac{\quad}{\quad} = \quad m^2$$

0.40 Set up the following conversion factor:

$$0.4\cancel{mm^3} \times \frac{\quad}{\quad} = \quad m^3$$

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

$1\text{cm}^2 =$ ____ m^2 $\quad 1\text{cm}^3 =$ ____ m^3

$1\text{dm}^3 =$ ____ m^3 $\quad 1\text{dm}^2 =$ ____ m^2

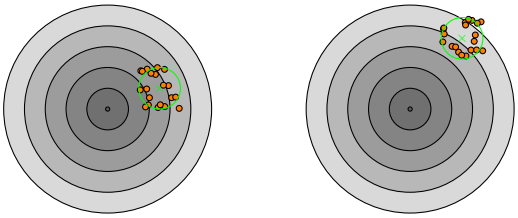
0.42 Fill the gap in the following unit equalities or conversion factors:

$1\text{mm}^2 =$ ____ m^2 $\quad 1\mu\text{m}^2 =$ ____ m^2

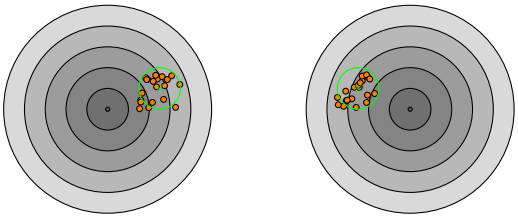
$1\text{nm}^2 =$ ____ m^2 $\quad 1k\text{m}^2 =$ ____ m^2

MEASUREMENTS AND UNCERTAINTY

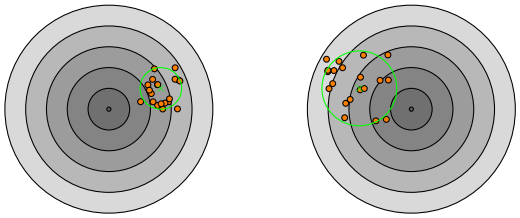
0.43 Compare the precision and accuracy of the following measurements:



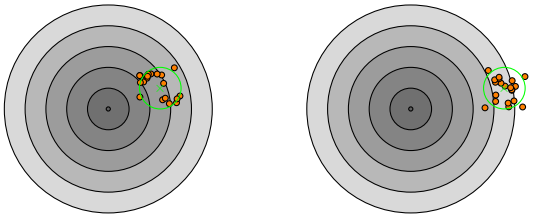
0.44 Compare the precision and accuracy of the following measurements:



0.45 Compare the precision and accuracy of the following measurements:



0.46 Compare the precision and accuracy of the following measurements:



MATTER

0.47 Classify the following objects as an element, compound, and homogeneous mixture, a heterogeneous mixture or none of the others: (a) an energy drink (b) helium (a gas) (c) sulfur (a solid) (d) milk (e) milkshake (f) gelato (g) air (h) granite (i) uranium (a solid)

0.48 Classify the following objects as an element, compound, and homogeneous mixture, a heterogeneous mixture or none of the others: (a) a copper wire (b) a chocolate cookie (c) a chocolate-chip cookie (d) vinegar (e) ice (f) baking soda (g) aluminum foil (h) vitamin C

0.49 Which of the following is a property of a solid?(a) It takes the shape of the container. (b) It fills the volume of the container. (c) The particles move at a rapid rate. (d) The interactions between its particles are very weak. (e) The particles have fixed positions and are very close together.

0.50 Which of the following is a property of a liquid? (a) It takes the shape of the container. (b) it has no volume. (c) The particles move at a rapid rate. (d) The interactions between its particles are unesxistent. (e) The particles have fixed positions and are very close together.

0.51 Which of the following is a property of a gas? (a) It has no shape. (b) It fills the volume of the container. (c) The particles move slowly. (d) The interactions between its particles are strong. (e) The particles have fixed positions and are very close together.

0.52 Which of the following is a property of a gas and a liquid? (a) It flows. (b) It takes the shape of the container. (c) It has no shape. (d) It fills the volume of the container. (e) The particles move slowly. (f) The interactions between its particles are strong. (g) The particles move at a rapid rate. (h) The interactions between its particles are unesxistent. (i) The particles have fixed positions and are very close together.

Density

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

0.54 Determine the density (g/mL) of a 0.05 L sample of a salt solution that has a mass of 10 g.

0.55 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)

0.56 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?

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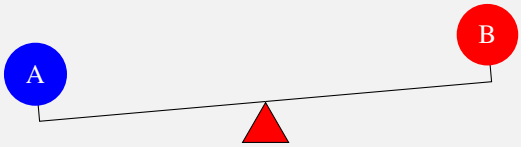
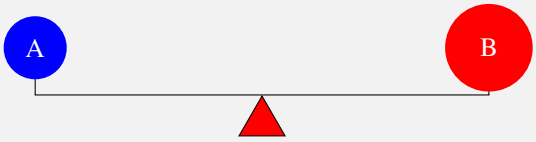
0.57 A nugget of gold with a mass of 521 g is added to 50.0 mL of water. The water level rises to a volume of 77.0 mL. What is the measured density of the gold?

0.58 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?

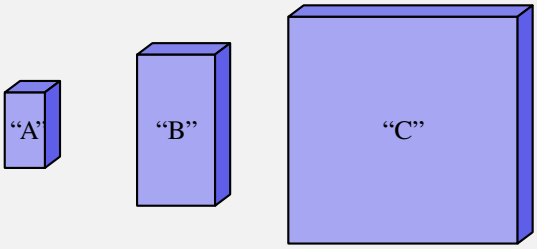
0.59 Which of the circles is more dense: A or B.



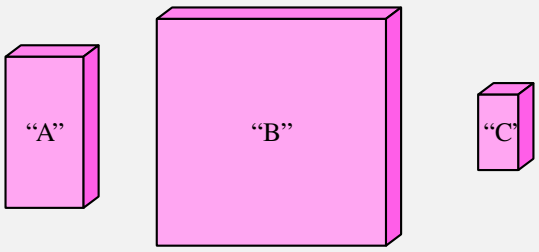
0.60 Which of the circles is more dense: A or B.



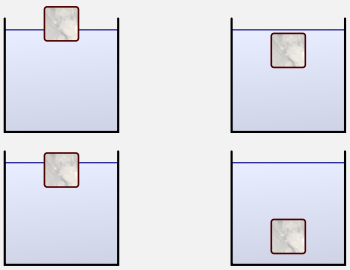
0.61 The objects below have all the same mass but represent different metals cobalt, gold, and palladium. Given that the density of cobalt is 8g/mL, whereas the density of gold is 19g/mL and the density of palladium is 12g/mL, identify each object as cobalt, gold, and palladium.



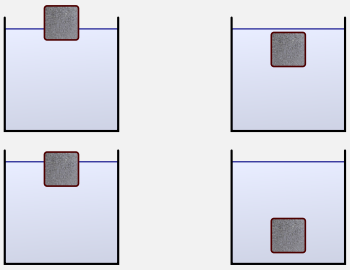
0.62 The objects below have all the same mass but represent different metals iron, nickel, and tungsten. Given that the density of iron is 7g/mL, whereas the density of nickel is 9g/mL and the density of tungsten is 20g/mL, identify each object as iron, nickel, or tungsten.



0.63 The diagrams below represent a solid immersed in a liquid, with some of the solids floating and others sinking. Match the diagrams with the description: (a) The density of the solid is 1.1 times the density of the liquid (b) The density of the solid is the same the density of the liquid (c) The density of the solid is 0.8 times the density of the liquid (d) The density of the solid is 0.5 times the density of the liquid



0.64 The diagrams below represent a solid immersed in a liquid of density 0.9g/mL, with some of the solids floating and others sinking. Match the diagrams with the description: (a) The density of the solid is 1.2g/mL (b) The density of the solid is 0.9g/mL (c) The density of the solid is 0.7g/mL (d) The density of the solid is 0.4g/mL



0.65 Answer the following questions involving specific gravity: (a) A sample has a density of 0.9g/mL. How much is its specific gravity? (b) A sample has a specific gravity of 1.20. How much is its density? (c) True or false: an orange juice sample should have a specific gravity larger than one.

0.66 Answer the following questions involving specific gravity: (a) True or false: an olive oil sample should have a specific gravity larger than one. (b) A sample has a mass of 5mg and a specific gravity of 0.87. Calculate its volume in mL.

0.67 Answer the following questions involving dosages: (a) An IV solution needs to be delivered at a rate of 120mL/h. How long it takes to deliver 200mL? (b) Infant Tylenol is given from a 160mg/5mL suspension based on the infant's weight. A 12lb infant requires 2.5mL. How many milligrams of Tylenol are contained in the dosage given?

0.68 Answer the following questions involving dosages: (a) A patient requires 1g of medication given every three hours. The medication in stock was found in tablets of 200mg. How many tablets do you need in three days? (b) A medication needs to be given based on the patient's body weight as 2mg/Kg. If a patient weighs 70Kg and the mediation stock is 100mg/mL, how many mL are needed?

Answers **0.1** (a) 1 (b) 3.5 (c) 0.5 **0.2** (a) 0.33 (b) 3 (c) 0.33 **0.3** (a) 21.66 (b) 2.03×10^{-7} (c) 0.052 **0.4** (a) 104.35 (b) 8.3×10^{-1} (c) 650 **0.5** (a) 2 L (volume) (b) 5 cm (length) **0.6** (a) 100 Kg (mass) (b) 10h (time) **0.7** (a) g (b) s (c) L **0.8** (a) kg (b) the volume **0.9** (a) $0.2301 + 0.123 = 0.353$ (b) $0.2301 - 1.12 = -0.89$ (c) $88.1 - 87.57 = 0.5$ (d) $24.56 + 2.4 = 27.0$ **0.10** (a) $523 \times 5000 = 3000000$ (b) $5/0.123 = 40$ (c) $27.0 \times 0.01 = 0.3$ (d) $345.13/100 = 3$ **0.11** (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) **0.12** 456 000 (3 SF) **0.13** (a) 12900m (b) 5110s (c) 2.45×10^{-3}Kg (d) 0.0514cm (e) (f) 0.0294μm **0.14** (a) 10000m (b) 5000s (c) 2×10^{-3}Kg (d) 0.05cm (e) 600000mm (f) 0.03μm **0.15** 1×10^{3} **0.16** 1×10^{-2} **0.17** 1×10^{-9} **0.18** 1×10^{-15} **0.19** 1Tm $= 10^{12}$m 1dm $= 10^{-1}$m 1cg $= 10^{-2}$g 1ms $= 10^{-3}$s 1qt $=$ 1mL 1L $= 1dm^3$ 1lb $=$ 454g 1in $=$ 2.54cm **0.20** (a) $\frac{\text{1km}}{10^3\text{m}}$ (b) $\frac{\text{1cm}}{10^{-2}\text{m}}$ (c) $\frac{\text{1ms}}{10^{-3}\text{s}}$ (d) $\frac{\text{mL}}{10^{-3}\text{L}}$ (e) $\frac{\text{cL}}{10^{-2}\text{L}}$ (f) $\frac{\text{dg}}{10^{-1}\text{g}}$ **0.21** 1×10^{-2} **0.22** $1 \cdot 10^{-6}$ **0.23** $1 \cdot 10^{-9}$ **0.24** $1 \cdot 10^{-6}$ **0.25** $1 \cdot 10^{12}m$ **0.26** $5 \cdot 10^{4}m$ **0.27** $2 \cdot 10^{-2}cm$ **0.28** $3 \cdot 10^{2}mm$ **0.29** (a) $0.5\cancel{\mu g} \times \frac{1 \times 10^{-6}g}{\cancel{\mu g}} = 5 \times 10^{-7}g$ (b) $125\cancel{L} \times \frac{mL}{1 \times 10^{-3}\cancel{L}} = 1.25 \times 10^{5}mL$ **0.30** (a) $100\cancel{nm} \times \frac{1 \times 10^{-9}m}{\cancel{nm}} = 1 \times 10^{-7}m$ (b) $10\cancel{dm} \times \frac{1 \times 10^{-1}m}{\cancel{dm}} = 1m$ **0.31** $1 \cdot 10^{-2}; 10 \cdot 10^{3}$ **0.32** $1 \cdot 10^{-1}; 1 \cdot 10^{-2}$ **0.33** 200 **0.34** 5×10^{-6} **0.35** $19.68in$ **0.36** $\frac{1in}{2.54\cancel{cm}}$ **0.37** (a) $(10^2)^2 = 10^4$ (b) $(10^2)^3 = 10^6$ (c) $(10^{-6})^2 = 10^{-12}$ (d) $(10^{-2})^2 = 10^{-4}$ **0.38** (a) 10^3 (b) 10^{12} (c) 10^{10} (d) 10^{20} **0.39** $0.04m^2$ **0.40** $4 \times 10^{-10}m^3$ **0.41** 1cm^2 $= 1 \times 10^{-4}$m^2 1dm^3 $= 1 \times 10^{-3}$m^3 1cm^3 $= 1 \times 10^{-6}$m^3 1dm^2 $= 1 \times 10^{-2}$dm^2 **0.42** 1mm^2 $= 1 \times 10^{-6}$m^2 1nm^2 $= 1 \times 10^{-18}$m^2 1μm^2 $= 1 \times 10^{-12}\mu$m^2 1km^2 $= 1 \times 10^{6}\mu$m^2 **0.43** more accurate same precision (left), less accurate same precision (right) **0.44** same accuracy and precision **0.45** same precision, more accurate (left), less accurate (right) **0.46** same accuracy, more precise (left), less precise (right) **0.47** (a) a energy drink (Homogeneous mixture) (b) helium gas (element) (c) sulfur (element) (d) milk (homogeneous mixture) (e) milkshake (Homogeneous mixture) (f) gelato (Homogeneous mixture) (g) air (Homogeneous mixture) (h) granite (Heterogeneous mixture) (i) uranium (element) **0.48** (a) a copper wire (Element) (b) a chocolate cookie (Homogeneous mixture) (c) a chocolate-chip cookie (Heterogeneous mixture) (d) vinegar (Homogeneous mixture) (e) ice (Compound) (f) baking soda(Compound) (g) aluminum foil(element) (h) vitamin C(compound) **0.49** The particles have fixed positions and are very close together. **0.50** It takes the shape of the container. **0.51** It fills the volume of the container. **0.52** It flows;It takes the shape of the container. **0.53** $5g \cdot ml^{-1}$ **0.54** $0.2g \cdot ml^{-1}$ **0.55** balsa wood (0.16 g/mL) **0.56** from top to bottom: coke, diet, schweppes, water **0.57** 19.3 g/mL **0.58** $31.56mL$ **0.59** A **0.60** A **0.61** A is gold, B is palladium and C is cobalt. **0.62** A is nickel, B is iron and C is tungsten. **0.63** (a) bottom left (b) top right (c) bottom right (d) top left **0.64** (a) bottom left (b) top right (c) bottom right (d) top left **0.65** (a) 0.9 (b) A1.20 g/mL (c) true **0.66** (a) false (b) 5.7×10^{-3}mL **0.67** (a) 1.7h (b) 80mg **0.68** (a) 120 tablets (b) 1.4mL