Chemistry 101 **ANSWER KEY**

REVIEW QUESTIONS
Chapter 1

1. Express each of the following numbers in scientific notation, with 3 significant figures:

a) 2,900,000 **2.90×10^{6}**

b) 0.005865 **5.87×10^{-3}**

c) 0.000004563 **4.56×10^{-6}**

d) 410870 **4.11×10^{5}**

2. Perform the following operations with the correct number of significant digits:

a) $$\frac{14.854\text{-}14.828\text{ g}}{3.852\text{ g}} = \frac{\mathbf{0.026}}{\mathbf{3.852}} = \mathbf{6.7\times10^{-3}} \quad \textbf{or} \quad \mathbf{0.0067}$$

b) $$\frac{(6.626 \times 10^{-34})(2.98 \times 10^{8})}{4.73 \times 10^{6}} = \mathbf{4.17 \times 10^{-32}}$$

c) $$\frac{(3.4 \times 10^{-8})^{2}(2.55 \times 10^{28})}{(8.2 \times 10^{6})^{3}} = \frac{\mathbf{2.\underline{9}478\times10^{13}}}{\mathbf{5.\underline{5}14\times10^{20}}} = \mathbf{5.3\times10^{-8}}$$

3. The following data was collected by four different students while determining the mass of an unknown sample. The true value is 6.72 g.

A)	6.71 g, 6.75 g, 6.70 g	**6.72 g**
B)	6.56 g, 6.76 g, 6.84 g	**6.72 g**
C)	6.50 g, 6.48 g, 6.52 g	**6.50 g**
D)	6.41 g, 6.72 g, 6.55 g	**6.56 g**

a) Which set of data has high accuracy, but low precision? **B**

b) Which set of data has low accuracy, but high precision? **C**

c) Which set of data has good accuracy and precision? **A**

4. If an oxygen molecule is moving at 4.78 x 10^4 cm/s, what is its speed in mi/hr?

$$\frac{4.78 \times 10^4\ \cancel{cm}}{1\ \cancel{s}} \times \frac{1\ \cancel{km}}{10^5\ \cancel{cm}} \times \frac{1\ mi}{1.609\ \cancel{km}} \times \frac{3600\ \cancel{s}}{1\ hr} = 1.07 \times 10^3\ mi/hr$$

5. If the gasoline in a full 20.0-gallon tank weighs 116 lb, what is the density of gasoline in g/mL?

$$\frac{116\ \cancel{lb}}{20.0\ \cancel{gal}} \times \frac{453.6\ g}{1\ \cancel{lb}} \times \frac{1\ \cancel{gal}}{3.786\ \cancel{L}} \times \frac{1\ \cancel{L}}{10^3\ mL} = 0.695\ g/mL$$

6. Dry sand has a density of 1.5 g/cm^3. A child's sandbox measuring 4.0 ft by 5.0 ft is filled with sand to a depth of 6.0 in. What is the mass of the sand in kg?

$$\text{Length} = 5.0\ \cancel{ft} \times \frac{12\ \cancel{in}}{1\ \cancel{ft}} \times \frac{2.54\ cm}{1\ \cancel{in}} = 1\underline{5}2\ cm$$

$$\text{Width} = 4.0\ \cancel{ft} \times \frac{12\ \cancel{in}}{1\ \cancel{ft}} \times \frac{2.54\ cm}{1\ \cancel{in}} = 1\underline{2}2\ cm$$

$$\text{Depth} = 6.0\ \cancel{in} \times \frac{2.54\ cm}{1\ \cancel{in}} = 1\underline{5}.2\ cm$$

$$\text{Volume} = 1\underline{5}2\ cm \times 1\underline{2}2\ cm \times 1\underline{5}.2\ cm = 2.8 \times 10^5\ cm^3$$

$$\text{Mass} = 2.8 \times 10^5\ \cancel{cm^3} \times \frac{1.5\ \cancel{g}}{1\ \cancel{cm^3}} \times \frac{1\ kg}{10^3\ \cancel{g}} = 420\ kg$$

7. A cylindrical glass tube 15.0 cm in length is filled with ethanol. The mass of the ethanol needed to fill the tube is found to be 9.64 g. Calculate the inner diameter of the tube in cm, if the density of ethanol is 0.789 g/mL.

$$\text{Vol. of cylinder} = \text{Vol. of ethanol} = 9.64\ \cancel{g} \times \frac{1\ mL}{0.789\ \cancel{g}} = 12.\underline{2}2\ mL$$

$$\text{Vol. of cylinder} = \pi\, r^2\, h$$

$$r = \sqrt{\frac{V}{\pi h}} = \sqrt{\frac{12.\underline{2}2\ cm^3}{\pi\ (15.0\ cm)}} = 0.509\ cm$$

$$\text{diamter} = 2\, r = 2\ (0.509\ cm) = 1.02\ cm$$

8. A antibiotic suspension for infants contains 80 mg of antibiotic per 0.80 mL of suspension. The recommended dose for this antibiotic is 15 mg/ kg of body weight. How many mL of suspension should be given to an infant weighing 14 lb?

$$14\ \cancel{lb} \times \frac{453.6\ g}{1\ \cancel{lb}} \times \frac{1\ \cancel{kg}}{10^3\ \cancel{g}} \times \frac{15\ \cancel{mg\ antibiotic}}{1\ \cancel{kg}} \times \frac{0.80\ mL\ \ suspension}{80\ \cancel{mg\ antibiotic}} = 0.95\ mL$$

9. A fish tank is 20.0 in long, 20.0 in deep and 10.0 in high. What is the maximum volume of water, in liters, that the fish tank can hold?

$$V = (20.0\ in)(20.0\ in)(10.0\ in) = 4.00\text{x}10^3\ in^3$$

$$V = (4.00\text{x}10^3\ \cancel{in}^3) \times \left(\frac{2.54\ cm}{1\ \cancel{in}}\right)^3 = 6.55\text{x}10^4\ cm^3$$

$$V = (6.55\text{x}10^4\ \cancel{cm}^3) \times \left(\frac{1\ L}{10^3\ \cancel{cm}^3}\right) = 65.5\ L$$

10. Table salt contains 39.33% by mass sodium. The FDA recommends that adults consume less than 2.40 g of sodium per day. A particular snack contains 1.25% of salt in the mix. What mass of the snack mix can an adult consume and still be within FDA limit?

$$2.40\ \cancel{g\ Na} \times \frac{100\ \cancel{g\ salt}}{39.33\ \cancel{g\ Na}} \times \frac{100\ \cancel{g\ mix}}{1.25\ \cancel{g\ salt}} = 488\ g\ mix$$