Group Activity 1: Significant Figures, Units, and Conversion Factors

1. A. How many significant figures are in each of the following numbers?

5.40 _____

3.97×10^{-5} _____

30000 _____

250. _____

1.4895 _____

1.400 _____

235.40 _____

B. Complete the following calculations to the appropriate number of sig. figs.:

234.52 + 25.2 =

1420 x 320. =

$(6.274 \times 10^{3}) \times (1.56 \times 10^{-2}) =$

529 ÷ 1.30 =

430. - 44.67 =

$(1.343 \times 10^{2}) + (1.5654 \times 10^{2}) =$

2. The average speed (u_{rms}) of a collection of gaseous molecules is given by the following formula:

$$u_{rms} = \sqrt{\frac{3RT}{M}}$$

where T is the temperature of the sample, M is the molar mass of the gaseous compound, and R is a constant related to the distribution of the available kinetic energy over the molecules in the sample (R = 8.314 J mol^{-1} K^{-1}). What is u_{rms} for nitrogen gas (M = 28.02 g mol^{-1}) at 298.15 K?

3. Methanol (methyl alcohol or wood alcohol) is a potential automotive fuel, either in pure form or mixed with gasoline. Some fleet vehicles, such as municipal buses, have been modified to burn methanol-containing fuels. These fuels are also used by some race cars. A particular automobile modified to use a mixture of 85.0% methanol and 15.0% gasoline by mass gets 25.5 mi/gal. The fuel has a density of 0.775 g/mL. How many kilograms of methanol does the automobile consume in a trip of 808 km?

Potentially helpful information.

Conversion factors:

Length	1 m = 1.094 yd	1 mi = 5280 ft	1 ft = 12 in
	1 km = 10^3 m	1 mi = 1760 yd	1 Å = 10^{-10} m
	1 m = 10^2 cm (centimeters)		1 in = 2.54 cm (exact)
	1 m = 10^3 mm (millimeters)		
Mass	1 kg = 2.205 lb	1 lb = 453.6 g	1 amu = 1.6605 x 10^{-27} kg
	1 oz (ounce) = 28.35 g		
Volume	1 L = 1000 mL = 1.06 qt	1 ft^3 = 28.32 L	
	1 mL = 1 cm^3 = 0.03381 oz	1 gal = 3.785412 L = 4 qt	
Pressure	1 atm = 760. mmHg	1 torr = 1 mmHg	
	1 atm = 14.6959 lb/in^2 (psi)	1 atm = 101,325 Pa	
	1 Pa = 1 N/m^2	1 bar = 100 kPa	
Energy	1 eV = 1.602 x 10^{-19} J	1 cal = 4.184 J (exact)	
Force	1 N = 0.22481 lb		

Compound Units:

Newton (N): 1 N = 1 kg.m/s^2 Joule (J): 1 J = 1 N.m = kg.m^2/s^2

Metric prefixes:

kilo (k) = 10^3	mega (M) = 10^6	giga (G) = 10^9	tera (T) = 10^{12}	peta (P) = 10^{15}
centi (c) = 10^{-2}	micro (μ) = 10^{-6}	nano (n) = 10^{-9}	pico (p) = 10^{-12}	femto (f) = 10^{-15}

Physical Constants:

mass of electron	0.000549 amu
mass of proton	1.00728 amu
mass of neutron	1.00867 amu
Avogadro's Number (N_A)	6.0221367 x 10^{23}
speed of light	2.99792 x 10^8 m/s
acceleration due to gravity	9.80665 m/s^2