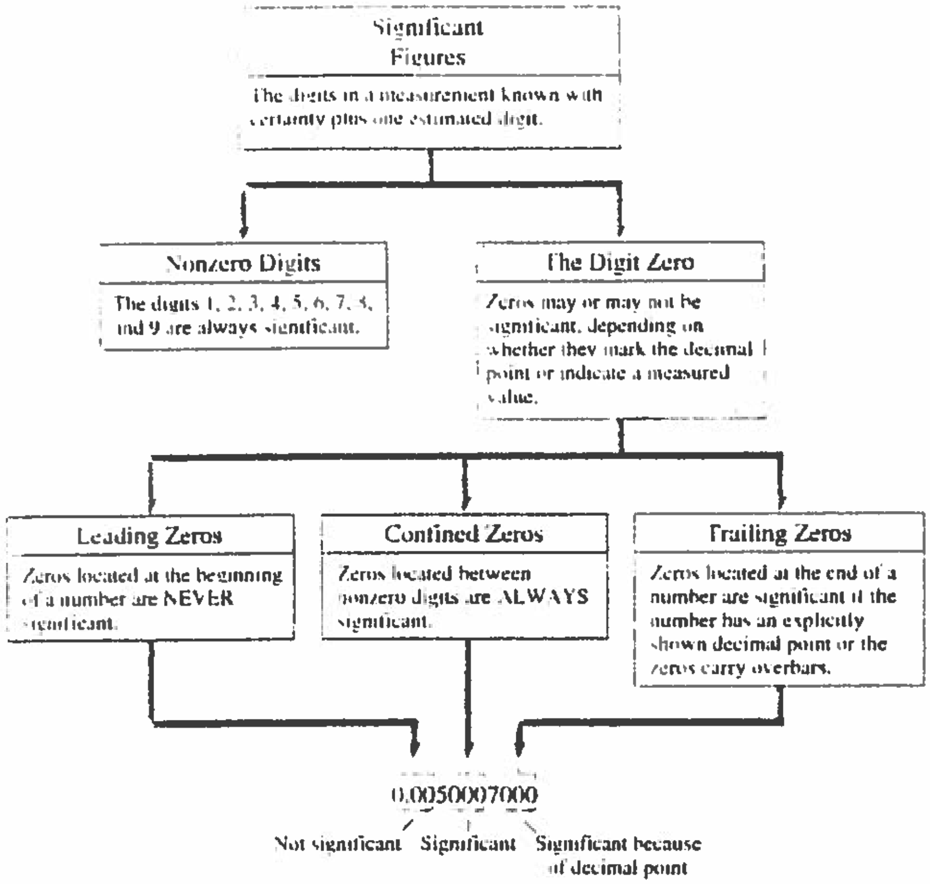
Recitation 1

Name: ______________________ Major: A/Key



Problem 1.1: Indicate the number of significant figures in the following numbers:

a) 0.00678 3

b) 37.020 5

c) 4.790×10^6 4

d) 105000 3 (if $1.05000 \times 10^5 \rightarrow$ 6 S.F

if $1.050 \times 10^5 \rightarrow$ 4 S.F)

Problem 1.2: Write the following numbers using scientific notation. Be sure to include the correct number of significant figures in your answer.

a) 0.0076 7.6×10^{-3}

b) 0.0250 2.50×10^{-2}

c) 1,210,500 1.2105×10^{6}

Table 1.3	Selected Prefixes Used in the Metric System		
Prefix	**Abbreviation**	**Meaning**	**Example**
mega-	M	10^6 (million)	1 megaton = 1×10^6 tons
kilo-	k	10^3 (thousand)	1 kilogram (kg) = 1×10^3 g
deci-	d	10^{-1} (tenth)	1 decimeter (dm) = 1×10^{-1} m
centi-	c	10^{-2} (one hundredth)	1 centimeter (cm) = 1×10^{-2} m
milli-	m	10^{-3} (one thousandth)	1 millimeter (mm) = 1×10^{-3} m
micro-	μ	10^{-6} (one millionth)	1 micrometer (μm) = 1×10^{-6} m
nano-	n	10^{-9} (one billionth)	1 nanometer (nm) = 1×10^{-9} m
pico-	p	10^{-12}	1 picometer (pm) = 1×10^{-12} m
femto-	f	10^{-15}	1 femtometer (fm) = 1×10^{-15} m

Problem #2: Perform the following conversions and give your result in proper scientific notation.

a) 10.5 mL to L

$$10.5\ \cancel{mL} \times \frac{10^{-3}\ L}{1\ \cancel{mL}} = 10.5 \times 10^{-3}\ L = \boxed{1.05 \times 10^{-2}\ L}$$

b) 7.86 mm to m

$$7.86\ \cancel{mm} \times \frac{10^{-3}\ m}{1\ \cancel{mm}} = \boxed{7.86 \times 10^{-3}\ m}$$

c) .0056 kg to dg

$$5.6 \times 10^{-3}\ kg \times \frac{10^{3}\ g}{1\ kg} \times \frac{1\ dg}{10^{-1}\ g} = \boxed{5.6 \times 10^{1}\ dg}$$

d) 125.0 μs to Ms

$$1.250 \times 10^{2}\ \mu s \times \frac{10^{-6}\ s}{\mu s} \times \frac{1\ Ms}{10^{6}\ s} =$$

$$= \boxed{1.250 \times 10^{-10}\ Ms}$$

e) 4.58 cm to pm

$$4.58\ cm \times \frac{10^{-2}\ m}{1\ cm} \times \frac{1\ pm}{10^{-12}\ m} =$$

$$= \boxed{4.58 \times 10^{10}\ pm}$$

Significant Figures in Calculations:

1) Multiplication and Division: ***For multiplication and division, the number of significant figures in the answer should not be greater than the number of significant figures in the least precise measurement.***
2) Addition & Subtraction: Values must be converted to common units before adding or subtracting (that includes powers of ten). ***For addition and subtraction, the answer should have the same number of decimal places as the quantity with the fewest number of decimal places***
3) In multi-step calculations retain all figures in your calculator until the end, then **use order of operations to determine the significant figures for the result.**
4) Conversion factors always have less uncertainty than data.

Problem #3: Perform the following calculations and express your results using scientific notation with the appropriate number of significant figures.

a. 13.57 g + 7.062 g + 205.064 g.

$$\begin{array}{r} 13.57\text{X} \\ 7.062 \\ 205.064 \\ \hline 225.696 \end{array} = \boxed{225.70\ g} = \boxed{2.2570 \times 10^2}$$

b. 415. 098 g – 7.94 g. =

$407.16\ g =$ ~~[illegible]~~ $= \boxed{4.0716 \times 10^2\ g}$

c. 18.65 g ÷ 72.3 mL. Will this object float or sink in water?

$= \boxed{0.258\ g/mL}$ (Float) $= \boxed{2.58 \times 10^{-1}\ \frac{g}{mL}}$

d. 13.57 cm × 7.6 cm. $= 103.132 =$

$= \underbrace{100}_{2\ S.F} cm^2 = \boxed{\underbrace{1.0}_{2\ S.F} \times 10^2\ cm^2}$

Problem #4: Perform each of the following temperature conversions. Sig Figs!

a) 32 °F to °C °C = 5/9 (°F -32)

$°C = \frac{5}{9}(32-32) = \boxed{0\ °C}$

b) 27 °C to °F °F = 9/5 °C + 32

$°F = \frac{9}{5} \cdot 27 + 32 = 80.6°F. = \boxed{81°}$

c) -27 °C to K K = °C + 273.15

$K = (-27) + 273 = \boxed{246\ K}$

Problem #5: The total time in minutes for a class that lasted 2.76 hours, 353 minutes and 45,980 seconds.

353 min

$+\ 2.76\ hr \times \frac{60\ min}{1\ hr} = 166\ min$

$+\ 45{,}980\ s\ \frac{1\ min}{60\ s} = 766.33\ min$

Total: $\boxed{1285\ min}$

Useful Conversion Factors and Relationships

Length

SI unit: meter (m)

1 km = 0.621 37 mi
1 mi = 5280 ft
= 1.6093 km
1 m = 1.0936 yd
1 in. = 2.54 cm (exactly)
1 cm = 0.393 70 in.
1 Å = 10^{-10} m

Mass

SI unit: kilogram (kg)

1 kg = 10^3 g = 2.2046 lb
1 lb = 16 oz = 453.59 g
1 amu = $1.660 54 \times 10^{-27}$ kg

Temperature

SI unit: Kelvin (K)

0 K = −273.15°C
= −459.67°F
K = °C + 273.15
°C = $\frac{5}{9}$(°F − 32°)
°F = $\frac{9}{5}$(°C) + 32°

Energy (derived)

SI unit: Joule (J)

1 J = 1 $(kg \cdot m^2)/s^2$
1 J = 0.239 01 cal
= 1 C × 1 V
1 cal = 4.184 J
1 eV = 1.602×10^{-19} J

Pressure (derived)

SI unit: Pascal (Pa)

1 Pa = 1 N/m^2
= 1 $kg/(m \cdot s^2)$
1 atm = 101,325 Pa
= 760 mm Hg (torr)
= 14.70 lb/in^2
1 bar = 10^5 Pa

Volume (derived)

SI unit: cubic meter (m^3)

1 L = 10^{-3} m^3
= 1 dm^3
= 10^3 cm^3
= 1.0567 qt
1 gal = 4 qt
= 3.7854 L
1 cm^3 = 1 mL
1 in^3 = 16.4 cm^3

Problem #6: In 1989 the Exxon Valdez ran aground and spilled 240,000 barrels of crude oil off the coast of Alaska, leaving a 0.5 mm thick layer of oil covering the waters of Prince William Sound. Using the conversion factors given below, determine the area of the oil slick in square miles. 1 barrel = 42 gallons

$V = A \cdot h$

V = volume
A = area
h = thickness

$A = \dfrac{V}{h}$

→ See back.

$$V = 2.4 \times 10^5 \text{ barrels} \times \frac{42 \text{ gal}}{1 \text{ barrel}} \times \frac{3.7854 \text{ L}}{1 \text{ gal}} \times \frac{10^3 \text{ cm}^3}{\text{L}} =$$

$$= \underbrace{3.8\underline{2}}_{2 \text{ S.F}} \times 10^{10} \text{ cm}^3$$

$$A = \frac{3.8\underline{2} \times 10^{10} \text{ cm}^3}{0.5 \text{ mm}} \times \frac{10 \text{ mm}}{1 \text{ cm}} = \underbrace{7.\underline{6}3}_{1 \text{ S.F}} \times 10^{11} \text{ cm}^2$$

$$7.\underline{6} \times 10^{11} \text{ cm}^2 \times \left(\frac{1 \text{ m}}{10^2 \text{ cm}}\right)^2 \times \left(\frac{1 \text{ km}}{10^3 \text{ m}}\right)^2 \times \left(\frac{1 \text{ mi}}{1.6093 \text{ km}}\right)^2$$

$$= 2\underline{9} \text{ mi}^2 = \boxed{30 \text{ mi}^2 = 3 \times 10^1 \text{ mi}^2}$$