Significant Figures

Rules for Counting Sig. Fig.

1. **All** non-zero digits are significant

2. Zeroes
a) zeroes between non-zero digits are significant
Ex. 507 3
"sandwich" zero
b) leading zeroes are not significant
Ex. 0.00004 1

c) Trailing zeroes to the right of a number are significant if **the number has a decimal point**. If the number ends in zero and has no decimal point, we assume that the trailing zeroes are not significant.
Ex. 480.0 (4 sig figs)
Ex. 4800 (2 sig figs)

How many significant figures in the following?

a) 38.4703 mL - ___ sig. figs
b) 0.0052 g - ___ sig. figs
c) 0.05700 s - ___ sig. figs
d) 6.19×10^8 years - ___ sig. figs

Significant Figures and Calculations

1. Multiplication and Division

The result of the operation is reported as having as many significant figures as the measurement with the fewest significant figures.

Ex. (6.221 cm) x (5.2 cm) = 32 cm^2

4 2

2. Addition and Subtraction

The result of the operation is reported to the same number of **decimal places** as that of the term with the least number of **decimal places**.

Ex. 20.4

1.322

\+ 83 ←

104.722

105

Measuring Matter

All forms of matter are normally measured by count, mass or volume.

Mole (mol) - SI unit for measuring the amount of a substance
A mole of any substance contains 6.02×10^{23} representative particles.

6.02×10^{23} is referred to as **Avagadro's number**

Representative particles refers to the species present in a substance, usually atoms, molecules or formula units.

Fe **O_2** **NaCl**

Ex. one mole of atoms = 6.02×10^{23} atoms
one mole of molecules = 6.02×10^{23} molecules

Converting Number of Particles to Moles

$$\text{moles} = \text{representative particles} \times \frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ representative particles}}$$

Ex. How many moles are found in 1.60×10^{18} atoms of silicon?

$$\text{moles} = 1.60 \times 10^{18} \text{ atoms} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}}$$

$$= \frac{1.60 \times 10^{18} \text{ mol}}{6.02 \times 10^{23}}$$

$$= 0.000002658 \text{ mol}$$

$$= 0.00000266 \text{ mol}$$

$$2.66 \times 10^{-6} \text{ mol}$$

Converting Moles to Number of Particles

$$\text{representative particles} = \text{moles} \times \frac{6.02 \times 10^{23} \text{ representative particles}}{1 \text{ mole}}$$

Ex. How many molecules are found in 3.40 mol of sugar?

molecules?

mol = 3.40 mol

$$3.40 \text{ mol} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = 2.05 \times 10^{24} \text{ molecules}$$

Ex. How many atoms are found in 4.17 mol of propane (C_3H_8)?

$$4.17 \text{ mol} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol}} = 2.51 \times 10^{24} \text{ atoms}$$

How many moles are in 2.14×10^{24} molecules of NO_2?

$$2.14 \times 10^{24} \text{ molecules} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molecules}}$$

$$= \frac{2.14 \times 10^{24}}{6.02 \times 10^{23}} \text{ mol} = 3.55 \text{ mol}$$

How many atoms are in 8.08 moles of C_3H_8?

Homework

p. 291 #3,4
p. 292 #5,6