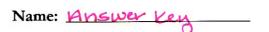**Chemistry I Adv.**
Even More Stoichiometry

Name: *Answer Key*

1. Aspartame is an artificial sweetener that is 160 times sweeter than sucrose (table sugar) when dissolved in water. It is marketed as Nutra-Sweet. The molecular formula of aspartame is $C_{14}H_{18}N_2O_5$.

    a. Calculate the molar mass of aspartame.

    294.3 g/mol

    b. How many moles of molecules are present in 10.0 g aspartame?

    $? \text{ mol asp} = 10.0 \text{ g asp} \times \dfrac{1 \text{ mol asp}}{294.3 \text{ g asp}} = 0.0340 \text{ mol asp}$

    c. Calculate the mass in grams of 1.56 mol aspartame?

    $? \text{ g asp} = 1.56 \text{ mol asp} \times \dfrac{294.3 \text{ g asp}}{1 \text{ mol asp}} = 459 \text{ g asp}$

    d. How many molecules are in 5.0 mg aspartame?

    $? \text{ molec asp} = 5.0 \text{ mg asp} \times \dfrac{1 \text{ g asp}}{1000 \text{ mg asp}} \times \dfrac{1 \text{ mol asp}}{294.3 \text{ g asp}} \times \dfrac{6.022 \times 10^{23} \text{ molec asp}}{1 \text{ mol asp}} =$

    $1.0 \times 10^{19} \text{ molec asp}$

    e. How many atoms of nitrogen are in 1.2 g of aspartame?

    $? \text{ atoms N} = 1.2 \text{ g asp} \times \dfrac{1 \text{ mol asp}}{294.3 \text{ g asp}} \times \dfrac{2 \text{ mol N}}{1 \text{ mol asp}} \times \dfrac{6.022 \times 10^{23} \text{ atoms N}}{1 \text{ mol N}} =$

    $4.9 \times 10^{21} \text{ atoms N}$

    f. What is the mass in grams of 1.0×10^9 molecules of aspartame?

    $? \text{ g asp} = 1.0 \times 10^9 \text{ molec asp} \times \dfrac{1 \text{ mol asp}}{6.022 \times 10^{23} \text{ molec asp}} \times \dfrac{294.3 \text{ g asp}}{1 \text{ mol asp}} =$

    $4.9 \times 10^{-13} \text{ g asp}$

    g. What is the mass in grams of one molecule of aspartame?

    $? \text{ g asp} = 1 \text{ molec asp} \times \dfrac{1 \text{ mol asp}}{6.022 \times 10^{23} \text{ molec asp}} \times \dfrac{294.3 \text{ g asp}}{1 \text{ mol asp}} =$

    $4.9 \times 10^{-22} \text{ g asp}$

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2. Dimethylnitrosamine, $(CH_3)_2N_2O$, is a carcinogenic substance that may be formed in foods, beverages, or gastric juices from the reaction of nitrite ion (used as a food preservative) with other substances.

   a. What is the molar mass of dimethylnitrosamine?

   74.1 g/mol

   b. How many moles of $(CH_3)_2N_2O$ molecules are present in 250 mg dimethylnitrosamine?

   ? mol DMN = 250 mg DMN × $\frac{1 \text{ g DMN}}{1000 \text{ mg DMN}}$ × $\frac{1 \text{ mol DMN}}{74.1 \text{ g DMN}}$ =

   0.0034 mol DMN

   c. What is the mass of 0.050 mol dimethylnitrosamine?

   ? g DMN = 0.050 mol DMN × $\frac{74.1 \text{ g DMN}}{1 \text{ mol DMN}}$ = 3.7 g DMN

   d. How many atoms of hydrogen are in 1.0 mol dimethylnitrosamine?

   ? atoms H = 1.0 mol DMN × $\frac{6 \text{ mol H}}{1 \text{ mol DMN}}$ × $\frac{6.022 \times 10^{23} \text{ atoms H}}{1 \text{ mol H}}$ =

   3.6×10^{24} atoms H

   e. What is the mass of 1.0×10^6 molecules of dimethylnitrosamine?

   ? g DMN = 1.0×10^6 molec DMN × $\frac{1 \text{ mol DMN}}{6.022 \times 10^{23} \text{ molec DMN}}$ × $\frac{74.1 \text{ g DMN}}{1 \text{ mol DMN}}$ =

   1.2×10^{-16} g DMN

   f. What is the mass in grams of one molecule of dimethylnitrosamine?

   $\frac{1.2 \times 10^{-16} \text{ g DMN}}{1.0 \times 10^6}$ = 1.2×10^{-22} g DMN

   you can get here using stoichiometry, too!