Chemical Quantities Review Sheet

1. Find the number of molecules of carbon dioxide in 4.56 moles of CO_2.

g: 4.56 mol CO_2

w: ? mlc CO_2

$$4.56 \text{ mol } CO_2 \left| \frac{6.02 \times 10^{23} \text{ mlc } CO_2}{1 \text{ mol } CO_2} \right. =$$

$$2.75 \times 10^{24} \text{ mlc } CO_2$$

2. Find the number of moles of lead in 647 grams of lead. (Pb)

g: 647 g Pb

w: ? mol Pb

1 mol Pb = 207.2 g Pb

$$647 \text{ g Pb} \left| \frac{1 \text{ mol Pb}}{207.2 \text{ g Pb}} \right. =$$

3.12 mol Pb

3. Calculate the molar mass of one mole of $C_{15}H_{34}O_4$.

the mass of one mole

C $15 \times 12.0g = 180.$

H $34 \times 1.0g = 34.$

O $4 \times 16.0g = 64.0$

278 g/mol

4. Calculate the number of moles in 358 g of aluminum hydroxide ($Al(OH)_3$).

g: 358 g $Al(OH)_3$

w: ? mol $Al(OH)_3$

$$\frac{358\ g\ Al(OH)_3 \mid 1\ mol\ Al(OH)_3}{78.0\ g\ Al(OH)_3} = 4.59\ mol\ Al(OH)_3$$

Al $1 \times 27.0g = 27.0g$

O $3 \times 16.0g = 48.0g$

H $3 \times 1.0g = 3.0g$

78.0g

5. Calculate the mass of 6.42×10^5 molecules of $C_3H_9O_5$.

g

g: 6.42×10^5 mlc $C_3H_9O_5$

w: ? g $C_3H_9O_5$

C $3 \times 12.0g = 36.0$
H $9 \times 1.0g = 9.0$
O $5 \times 16.0g = 80.0$
$125.0g$

$$\frac{6.42 \times 10^5 \text{ mlc } C_3H_9O_5}{} \left| \frac{1 \text{ mol } C_3H_9O_5}{6.02 \times 10^{23} \text{ mlc } C_3H_9O_5} \right| \frac{125.0 \text{ g } C_3H_9O_5}{1 \text{ mol } C_3H_9O_5} = 1.33 \times 10^{-16} \text{ g } C_3H_9O_5$$

6. A compound is 63.3% xenon and 36.7% fluorine by mass. Calculate the empirical formula.

g

% → g

$$\frac{63.3 \text{ g Xe}}{} \left| \frac{1 \text{ mol Xe}}{131.3 \text{ g Xe}} \right. = 0.48210... / 0.48210 = 1$$

$$\frac{36.7 \text{ g F}}{} \left| \frac{1 \text{ mol F}}{19.0 \text{ g F}} \right. = 1.9315... / 0.48210 = 4$$

XeF_4

another ex:

MF $C_2H_4 \Rightarrow$ EF CH_2

% to mass
mass to mol
÷ by small
round to whole

7. Caffeine is 49.5% C, 5.20% H, 28.9% N, and 16.5% O. The molecular mass is 194.0 g. Calculate the empirical formula and the molecular formula.

C 4 X12.0=48
H 5 X1.0=5.0
N 2 X14.0=28.0
O 1 X16.0=16.0
97.0

$49.5\text{g C} \left| \frac{1\text{mol C}}{12.0\text{g C}} \right. = 4.125/1.03125... = 4$

$5.20\text{g H} \left| \frac{1\text{mol H}}{1.0\text{g H}} \right. = 5.20/1.03125... = 5$

$28.9\text{g N} \left| \frac{1\text{mol N}}{14.0\text{g N}} \right. = 2.0642.../1.03125... = 2$

$16.5\text{g O} \left| \frac{1\text{mol O}}{16.0\text{g O}} \right. = 1.03125../1.03125.. = 1$

EF: $C_4H_5N_2O$

MF: $C_8H_{10}N_4O_2$

MM: 194.0g

$n = \frac{194.0\text{g}}{97.0\text{g}} = 2$

$(C_4H_5N_2O)_2$

$C_8H_{10}N_4O_2$

8. Find the number of moles, molecules, and atoms that an 18.0 g sample of H_2O contains.

H 2 X 1.0 = 2.0
O 1 X 16.0 = 16.0
18.0

g: 18.0g H_2O
w: ? mol H_2O

$18.0\text{g H}_2\text{O} \left| \frac{1\text{mol H}_2\text{O}}{18.0\text{g H}_2\text{O}} \right. = 1.00\text{ mol H}_2\text{O}$

g: 18.0g H_2O
w: ? mlc H_2O

$18.0\text{g H}_2\text{O} \left| \frac{1\text{mol H}_2\text{O}}{18.0\text{g H}_2\text{O}} \right| \frac{6.02\text{x}10^{23}\text{ mlc H}_2\text{O}}{1\text{mol H}_2\text{O}} =$

$6.02\text{x}10^{23}$ mlc H_2O

g: 18.0g H_2O
w: ? atoms
1 mlc H_2O = 3 atoms

$18.0\text{g H}_2\text{O} \left| \frac{1\text{mol H}_2\text{O}}{18.0\text{g H}_2\text{O}} \right| \frac{6.02\text{x}10^{23}\text{ mlc H}_2\text{O}}{1\text{mol H}_2\text{O}} \left| \frac{3\text{ atoms}}{1\text{ mlc H}_2\text{O}} \right. =$

$1.81\text{x}10^{24}$ atoms

9. Determine the number of moles in 345 liters of dinitrogen pentoxide (N_2O_5) at STP.

g: 345L N_2O_5
w: ? mol N_2O_5

$$345\,\text{L}\,N_2O_5 \left| \frac{1\,\text{mol}\,N_2O_5}{22.4\,\text{L}\,N_2O_5} \right. = \boxed{15.4\,\text{mol}\,N_2O_5}$$

10. How many grams of calcium are in 240.0 g of $CaCO_3$? (Hint: find the percent composition first!)

% = part/whole × 100

Ca 1 × 40.1 g = 40.1 / 100.1 × 100 = 40.1% Ca
C 1 × 12.0 g = 12.0 / 100.1 × 100 = 12.0% C
O 3 × 16.0 g = 48.0 / 100.1 × 100 = 48.0% O

$\frac{48.0}{100.1\,\text{g}}$ ← whole

$$\frac{40.1}{100} = \frac{x\,\text{g Ca}}{240.0\,\text{g}}$$

$100x = 9624 = \boxed{96.2\,\text{g Ca}}$