Mole Review

How many moles are there in 100 grams of $KMnO_4$?

$$100\text{ g } KMnO_4 \times \frac{1\text{ mol}}{158.0336\text{ g } KMnO_4} = \boxed{0.633\text{ mol } KMnO_4}$$

How many litres of Chlorine gas would be present if I have 10.25 moles at STP?

$$10.25\text{ mol } Cl_2 \times \frac{22.4\text{ L } Cl_2}{1\text{ mol } Cl_2} = \boxed{229.6\text{ L } Cl_2}$$

How many particles of NaCl are there in 0.000256 moles?

$$0.000256\text{ mol NaCl} \times \frac{6.02\times10^{23}\text{ particles}}{1\text{ mol NaCl}} = \boxed{1.54\times10^{20}\text{ particles NaCl}}$$

If I have 0.124 L of oxygen gas at STP, how many moles is that?

$$0.1242\text{ L } O_2 \times \frac{1\text{ mol } O_2}{22.4\text{ L } O_2} = \boxed{0.00554\text{ mol } O_2}$$

How many moles are present in 5.6×10^{20} particles of $FeSO_4$?

$$5.6\times10^{20}\text{ particles } FeSO_4 \times \frac{1\text{ mol } FeSO_4}{6.02\times10^{23}\text{ part.}} = \boxed{0.0009302\text{ mol } FeSO_4}$$

How many grams of $Ca(NO_3)_2$ are there in 0.1056 moles?

$$0.1056\text{ mol } Ca(NO_3)_2 \times \frac{164.0898\text{ g } Ca(NO_3)_2}{1\text{ mol } Ca(NO_3)_2} = \boxed{17.33\text{ g } Ca(NO_3)_2}$$

How many litres of chlorine gas at STP would there be if it weighed 100.02 grams?

$$100.02\text{ g } Cl_2 \times \frac{1\text{ mol}}{70.906\text{ g}} \times \frac{22.4\text{ L } Cl_2}{1\text{ mol } Cl_2} = \boxed{31.65\text{ L } Cl_2}$$

How many particles of $GaCl_2$ would there be in 23.5 grams of it?

$$23.5\text{ g } GaCl_2 \times \frac{1\text{ mol } GaCl_2}{140.626\text{ g } GaCl_2} \times \frac{6.02\times10^{23}\text{ part.}}{1\text{ mol } GaCl_2}$$

$$= \boxed{1.006\times10^{23}\text{ particles } GaCl_2}$$

How many particles of oxygen gas would there be if I have 0.052L of it at 0°C and 1 atm?

$$0.052\text{L } O_2 \times \frac{1 \text{ mol } O_2}{22.4 \text{ L } O_2} \times \frac{6.02 \times 10^{23} \text{ part. } O_2}{1 \text{ mol } O_2} = \boxed{1.398 \times 10^{21} \text{ particles } O_2}$$

How many atoms of oxygen would there be in 120.56 grams of $KMnO_4$?

$$120.56 \text{ g } KMnO_4 \times \frac{1 \text{ mol } KMnO_4}{158.0336 \text{ g } KMnO_4} \times \frac{6.02 \times 10^{23} \text{ part.}}{1 \text{ mol } KMnO_4} \times \frac{4 \text{ atoms Oxygen}}{1 \text{ particle } KMnO_4}$$

$$= \boxed{1.84 \times 10^{24} \text{ atoms Ox}}$$

Calculate the percent composition of each element in $CaSO_4 \cdot 2H_2O$.

$\rightarrow$ M.M = 172.1644 g/mol

$$\%Ca = \frac{40.08}{172.1644 \text{ g/mol}} \times 100 = \boxed{= 23.6\%}$$

$$\%S \quad \frac{32.06}{172.1644} \times 100 = \boxed{= 18.6\%}$$

$$\%O \quad \frac{6(15.9994)}{172.1644} \times 100 = \boxed{= 55.8\%}$$

$$\%H \quad \frac{4(1.007)}{172.1644} \times 100 = \boxed{= 2.3\%}$$

Calculate the percent composition of each element in $NaCH_3COO$.

$$\%Na \quad \frac{22.9898}{82.0314} \times 100 = \boxed{= 28.0\%}$$

$$\%C \quad \frac{2(12.011)}{82.0314} \times 100 = \boxed{= 29.3\%}$$

$$\%H \quad \frac{3(1.007)}{82.0134} \times 100 = \boxed{= 3.7\%}$$

$$\%O = \frac{2(15.999)}{82.0314} \times 100 = \boxed{= 39.0\%}$$

What would the molarity of 500mL of a KCl solution created with 0.189 moles of it?

$M = ?$

$mol = 0.189$

$V_L = 0.500L$

$$M = \frac{mol}{V_L} \qquad M = \frac{0.189 \text{ mol}}{0.500L} \qquad \boxed{= 0.378M}$$

What would be the molarity of a solution created by adding enough water to 1.56 grams of NaOH to make the volume 500mL?

$M = ?$

$$mol = 0.039 \text{ mol} \leftarrow 1.56 \text{ g NaOH} \times \frac{1 \text{ mol}}{39.9962 \text{ g}}$$

$V_L = 0.500L$

$$M = \frac{0.039 \text{ mol}}{0.500L} \qquad \boxed{= 0.078M}$$

What would be the volume necessary to create a 4.56M from 1.23 moles of HCl?

$$M = \frac{mol}{V_L} \qquad V_L = \frac{mol}{M} \qquad V_L = \frac{1.23 \text{ mol}}{4.56 M} \qquad \boxed{= 0.2697M}$$

What would be the new molarity of solution if 100mL of water were added to 50mL of a 0.056M solution?

$M_c = 0.056M$

$V_c = 50 mL$

$M_d = ?$

$V_d = 150 mL$

$$M_c V_c = M_d V_d$$

$$M_d = \frac{V_c M_c}{V_d}$$

$$M_d = \frac{0.050L(0.056 M)}{0.150L} \qquad \boxed{= 0.019M}$$

How much water must be added to 145mL of a 10M solution of HCl to make molarity 0.05M? $V_d = \frac{M_c V_c}{M_d}$ water $= V_d - V_c$

$V_d = \frac{(10M)(0.145L)}{0.05M} = 29L$ $= 29L - 0.145L$

$= 28.86L$

What volume would be necessary to create a 1.12M solution with 0.25 moles of $NaNO_3$? $M = \frac{mol}{V_L}$ $V_L = \frac{mol}{M}$ $= \frac{.25\ mol}{1.12M}$

$= 0.223L$

How many grams of $CuSO_4$ are necessary to create 250mL of a 0.1M solution?

$mol = M \times V_L$

$= (0.1M)(0.250L)$

$= 0.025\ mol$

$0.025\ mol\ CuSO_4 \times \frac{159.603}{1\ mol\ CuSO_4}$

$= 3.99g$

What would the molarity of a solution be if I added enough water to 10.25 grams of $CaCl_2$ to make the volume of solution 350mL?

$10.25g\ CaCl_2 \times \frac{1\ mol}{110.986g} = 0.0924\ CaCl_2$

$M = \frac{0.0924\ mol}{0.350L}$

$= 0.264M$

What would be the new molarity if I add 100mL of water to 50mL of a 1.25M solution? $M_c V_c = M_d V_d$ $M_d = \frac{(1.25M)(0.050L)}{0.150L}$

$= 0.417M$

How much water needs to be added to 100mL of 0.5M in order to create a 0.325M solution? $M_c V_c = M_d V_d$ water $= V_d - V_c$

$V_d = \frac{(0.100L)(0.5M)}{0.325M} = 0.154L$ $= 0.154L - 0.100L$

$= 0.054L$

Calculate the empirical formula of a compound that contains 43.64% phosphorus and 56.36% oxygen. $43.64g\ P$, $56.36g\ Ox$

$43.64g\ P \times \frac{1\ mol}{30.973g} = 1.408969\ mol\ P$

$56.36g\ Ox \times \frac{1\ mol}{15.999g\ Ox} = 3.52263\ mol\ Ox$

P $\frac{1.40...\ mol\ P}{1.40...\ mol\ P} = 1.0000$

Ox $\frac{3.522...\ mol\ Ox}{1.40...\ mol\ P} = 2.500...$

P $1.000 \times 2 = 2.0$

Ox $2.5 \times 2 = 5.0$

P_2O_5

Find the empirical formula for a molecule that is 41% Carbon, 4.6% Hydrogen, and 54.4% Oxygen. 41g C; 4.6g H; 54.4g Ox

$C_3H_4O_3$

$41\,g\,C \times \frac{1\,mol}{12.011\,g} = 3.41351\,mol\,C$

$4.6\,g\,H \times \frac{1\,mol}{1.007\,g} = 4.56802\,mol\,H$

$54.4\,g\,O_x \times \frac{1\,mol}{15.999\,g} = 3.400127\,mol\,O_x$

C: $\frac{3.41\ldots mol\,C}{3.400\ldots mol\,O} = 1.004 \times 3 = 3$

H: $\frac{4.56\ldots mol\,H}{3.400\ldots mol\,O} = 1.34 \times 3 = 4$

O_x: $\frac{3.40\ldots mol\,O}{3.40\ldots mol\,O} = 1.0 \times 3 = 3$

Determine the true formula for a molecule that has an empirical formula of C_3H_7 and a molar mass of 740.15g/mol.

→ 43.0823

$$T.F. = \frac{M.T.F}{M.E.F.} = \frac{740.15\ g/mol}{43.0823\ g/mol} = 17$$

$C_{51}H_{119}$

What is the true formula of a molecule that has a molar mass of 936.73g/mol and an empirical formula of $C_3H_6N_7O$?

→ 156.1216 g/mol

$$T.F. = \frac{M.T.F.}{M.E.F.} = \frac{936.73}{156.1216} = 6.$$

$C_{18}H_{36}N_{42}O_6$