formula

Ionic

metal + non metal

NaCl

Sodium Chloride

$Cu^{+2}O^{-2}$ vs $Cu_2^{+1}O^{-2}$

copper (II) oxide vs copper (I) oxide

ῶ polyatomic ion

$CaCO_3$

Calcium carbonate

Covalent

* prefix system

2 non-metals

↳ binary (2 elements)

CO_2 - carbon dioxide

H_2O - dihydrogen monoxide

Acids → H ___

Oxy acids

H ___ (polyatomic ion)

$H_2\overset{-2}{\boxed{SO_4}}$ vs $H_2\overset{-2}{\boxed{SO_3}}$

sulfate → sulfuric acid

sulfite → sulfurous acid

binary acids H ___ (non-metal)

hydro ___ ic acid

HCl - hydrochloric acid

HF - hydrofluoric acid

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one gas: $PV = nRT$

before/after: $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

direct relation (↑↑ or ↓↓): $\frac{V_1}{T_1} = \frac{V_2}{T_2}$, $\frac{P_1}{T_2} = \frac{P_2}{T_2}$, $\frac{V_1}{n_2} = \frac{V_2}{n_2}$, $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

indirect relation (↑↓ or ↓↑) $P_1V_1 = P_2V_2$

$\%\ error = \frac{actual\ value - collected\ value}{actual\ value} \times 100$

$P_T = \Sigma\ P_1, P_2, P_3 \ldots$

$\chi_i = \frac{n_1}{n_2} = \frac{P_1}{P_2}$

$n = \frac{m}{M}$ $m = n(M)$ $M = \frac{m}{n}$

$\#\ of\ particles = n \times \frac{6.02 \times 10^{23}}{1.00\ mol}$

$P_g > P_{atm}$: $P_g = P_{atm} + P_l$

$P_g < P_{atm}$: $P_g = P_{atm} - P_l$

$P_g = P_{atm}$: $P_g = P_{atm}$

$\Delta h\ (mm) = P_l\ mm\ Hg$

1.00 atm = 760 mm Hg = 760 torr
= 101.3 kPa = 14.7 psi = 1.01 bar

1 mg ÷ 1000 = 0.001g
1 mL ÷ 1000 = 0.001L
1 mm ÷ 10 = 10 cm

molar volume = L / mol
molar mass = g / mol
density (D) = g / L

molar volume = $\frac{M}{D} = \frac{g}{mol} \times \frac{L}{g} = \frac{L}{mol}$

empirical formula: DO NOT ROUND UNTIL RATIO

element → mass (÷ M) → moles (÷ smallest n) → ratio (round; × by 2 if .5; × by 3 if .33 or .66) → formula

molecular formula = EM x? → MM

EF x? → MF

(multiply subscripts)

$\%\ composition = \frac{mass\ element}{mass\ molecule} \times 100$

how many H atoms in 125 g CH_3Cl?

$M = 12.01 + 3(1.01) + 35.45 = 50.49\ g/mol$

mass → n_T → n_H → # H atoms

$$125\ g \times \frac{1\ mol\ T}{50.49\ g} \times \frac{3\ mol\ H}{1\ mol\ T} \times \frac{6.02 \times 10^{23}\ atoms}{1\ mol\ H}$$

$= 4.47 \times 10^{24}$ H atoms

6.

$\Delta h = 199.8 - 136.5$

$P_L = 63.3\ mm\ Hg \times \frac{101.3\ kPa}{760\ mm\ Hg}$

$= 8.44\ kPa$

$P_{atm} = 17.4\ psi \times \frac{101.3\ kPa}{14.7\ psi}$

$= 120\ kPa$

$P_g > P_{atm}$

$P_g = P_{atm} + P_L$

$= 120 + 8.44$

$= 128\ kPa$

13. How many atoms are in a drop of mercury that has a diameter of 1.0 mm? (Volume of a sphere is $4\Pi r^3/3$; density of mercury = 13.6 g/cm^3)

$PV = nRT$

$n = \frac{PV}{RT}$

$n = \frac{m}{M}$

$M = \frac{m}{n}$

$M = 200.59\ g/mol$

$D = 13.6\ g/cm^3 = 136\ g/mm^3$

$V = \frac{4\Pi r^3}{3} = 0.524\ mm^3$

$m = 71.2\ g$

$\frac{136\ g}{1\ mm^3} = \frac{m}{0.524\ mm^3}$

$m = 136(0.524)\ g$

$m = 71.2\ g$

$n = \frac{m}{M}$

$n = \frac{71.2\ g}{200.59\ g/mol}$

$n = 0.355\ mol\ Hg$

$0.355\ mol \times \frac{6.02 \times 10^{23}\ atoms}{1\ mol}$

$= 2.1 \times 10^{23}$ Hg atoms

In an experiment, 28.6 mL of hydrogen gas was collected over water at a pressure of 762 mm Hg and a temperature of 15 °C. If the vapour pressure of water at 15°C is 13 mm Hg, what mass of hydrogen was obtained?

$T = 15°C = 288\ K$
$V = 0.028.6\ L$
$P_T = 762\ torr$
$P_{H_2O} = 13\ torr$

$P_{H_2} = P_T - P_{H_2O}$
$= 762 - 13$
$= 749\ torr$

$749\ torr \times \frac{1\ atm}{760\ torr}$
$= 0.992\ atm$

$P_{H_2} \rightarrow n_{H_2} \rightarrow$ mass H_2

$PV = nRT$
$n_{H_2} = \frac{P_{H_2}V}{RT}$

$n_{H_2} = \frac{(0.992\ atm)(0.0286\ L)}{\left(\frac{0.0821\ atm \cdot L}{mol \cdot K}\right)(288\ K)}$

$n_{H_2} = 0.0012\ mol\ H_2$

$m = n_{H_2}(M)$
$m = 0.0012\ (2(1.01))$
$m = 0.0024\ g$
$m = 2.4\ mg$
$m = 2.4 \times 10^{-3}\ g$

14. $D = 0.601\ g/mL$

$V = 15\ mL$

mass = ?

$M = 4(12.01) + 10(1.01)$
$= 58.14\ g/mol$

$MV = 22.4\ L/mol$

$\frac{0.601\ g}{1\ mL} = \frac{m}{15\ mL}$
$m = 9.0\ g$

$mv = \frac{M}{D}$
$= \frac{200.59\ g}{1\ mol} \times \frac{1\ mL}{13.546\ g}$
$MV = 14.8\ mL/mol$

16.
$D = 19.42\ g/cm^3$

$\frac{19.42\ g}{1\ cm^3} = \frac{m}{5.0\ cm^3}$
$m = 5.0(19.42\ g)$
$m = 97.1\ g$

$n = \frac{m}{M}$
$= \frac{97.1\ g}{196.97\ g/mol}$

$n = 0.49\ mol\ Au$

17.
$MV = \frac{M}{D}$

$= \frac{159.8\ g}{1\ mol} \times \frac{1\ mL}{3.53\ g}$

$= 45.27\ mL/mol$

$\frac{45.27\ mL}{1\ mol} = \frac{15.0\ mL}{n}$

$\frac{15.0}{45.27} = n$

$n = 0.33\ mol\ Br_2 \times \frac{6.02 \times 10^{23}}{1\ mol}$
$= 1.99 \times 10^{23}$ molecules Br_2