

Mole Conversion Practice Test

Name:

Date:

Block:

1 L = 1000 mL

1 kg = 1000 g

1 g = 1000 mg

- C 1. The percentage of **calcium** (by mass) in the molecule $\text{Ca}_3\text{Fe}_2(\text{SiO}_4)_3$ is
 a) 7.89 % b) 22.0 % c) 23.7 % d) 54.4 %

Show your work below:

$$\frac{\text{molar mass Ca}}{\text{molar mass total}} \times 100\% = \frac{(3 \times 40.08)}{(3 \times 40.08) + (2 \times 55.85) + (3 \times 28.09) + (12 \times 16.00)} \times 100\% = \boxed{23.66\%}$$

2 decimal places

- A 2. A molecular formula tells us:

- a) The actual number of atoms of each element in a compound
 b) The lowest ratio of atoms of each element in a compound
 c) All possible multiples of an empirical formula
 d) The concentration of that compound in a solution

- C 3. What are the units for molarity?

- a) g/L b) mol/mL c) mol/L d) L/mol

- D 4. The empirical formula tells us:

- a) the actual number of atoms in a compound
 b) the concentration of a compound
 c) the molar mass of a compound
d) the lowest ratio of each element in a compound

- A 5. Another term for molarity is:

- a) concentration b) molar mass c) molecular formula d) moles/gram

- A 6. What is the mass of a single molecule of water?

- a) 3.0×10^{-23} grams b) 1.0 gram c) 6.0×10^{-22} gram d) 18.0 grams e) 2.9×10^{23} grams

$$1 \text{ molecule} \times \frac{1 \text{ mol}}{6.022 \times 10^{23} \text{ molecules}} \times \frac{18.02 \text{ g}}{1 \text{ mol}} =$$

- A 7. At the same temperature and pressure, which sample of gas contains the same number of particles as one liter of oxygen, O_2 ?

- a) one liter of He
 b) three liters of CO_2
 c) two liters of Ne
 d) two liters of H_2
 e) four liters of SO_3

$$\text{STP} = \frac{22.4 \text{ L}}{1 \text{ mol}}$$

$$1 \text{ L} \times \frac{1 \text{ mol}}{22.4 \text{ L}} \times \frac{6.022 \times 10^{23} \text{ particles}}{1 \text{ mol}} = 3 \times 10^{22} \text{ particles}$$

ex. C_5H_{12}

ex. CH_4

Written:

$$1+4+2+3+9+2$$

atoms

1. How many atoms are in $\text{Ni}(\text{H}_2\text{O})_2(\text{NH}_3)_3\text{Cl}_2$?

$$\boxed{21 \text{ atoms}}$$

2. What is the mass of a 250.0 mL sample of hydrogen sulfide (H_2S) at STP?

$$= 0.2500 \text{ L}$$

g

$$0.2500 \text{ L} \times \frac{1 \text{ mol}}{22.4 \text{ L}} \times \frac{34.09 \text{ g}}{1 \text{ mol}} = 0.380468$$

$$= \boxed{0.3805 \text{ g H}_2\text{S}}$$

$\frac{\text{L}}{\text{mol}}$

3. At STP, argon gas has a molar volume of $\frac{22.4 \text{ L}}{1 \text{ mol}}$.

4. How many molecules of potassium iodide are in 10.0g of potassium iodide?



$$10.0 \text{ g} \times \frac{1 \text{ mol}}{166.00 \text{ g}} \times \frac{6.022 \times 10^{23} \text{ molecule}}{1 \text{ mol}} = \boxed{3.63 \times 10^{22} \text{ molecules KI}}$$

molecules

5. A 0.600 mol sample of an unknown gas has a mass of 52.8 g. This gas is a compound of carbon and fluorine. Find the molecular formula.

$$\frac{52.8 \text{ g}}{0.600 \text{ mol}} = \frac{88 \text{ g}}{1 \text{ mol}}$$

$$\text{C} : \underline{12.01 \text{ g/mol}} \quad \text{F} : \underline{19.00 \text{ g/mol}} \quad \left. \vphantom{\begin{matrix} \text{C} \\ \text{F} \end{matrix}} \right\} \text{guess \& check}$$



$\frac{\text{L}}{\text{mol}}$

6. An experiment is conducted to calculate the molar volume. The following data is collected:

Moles of N_2 gas	0.00166 mol
Volume of N_2 collected	47.2 mL
Room temperature	21.0°C
Pressure	100.4 kPa

→ 0.0472 L
} not at STP!

Calculate the molar volume of N_2 at 21.0°C and 100.4 kPa using the data.

$$\frac{0.0472 \text{ L}}{0.00166 \text{ mol}} = \boxed{28.4 \text{ L}} \quad \left. \vphantom{\frac{0.0472 \text{ L}}{0.00166 \text{ mol}}} \right\} \text{cannot use } \frac{22.4 \text{ L}}{1 \text{ mol}}$$

L

7. Find the volume occupied by 21.6g of N_2H_4 gas at STP.

$$21.6 \text{ g} \times \frac{1 \text{ mol}}{32.06 \text{ g}} \times \frac{22.4 \text{ L}}{1 \text{ mol}} = \boxed{15.1 \text{ L N}_2\text{H}_4}$$

- g 8. The molar volume of H_2 at $21.0^\circ C$, 100.4 kPa is 24.3 L/mol . Calculate the mass of 0.213 L of H_2 .

$$0.213 \text{ L} \times \frac{1 \text{ mol}}{24.3 \text{ L}} \times \frac{2.02 \text{ g}}{1 \text{ mol}} = \boxed{0.0177 \text{ g } H_2}$$

- $\frac{\text{g}}{\text{mol}}$ 9. Aspartame is an artificial sweetener that is 160 times sweeter than sucrose (table sugar) when dissolved in water. It is marketed as NutraSweet. The molecular formula for aspartame is $C_{14}H_{18}N_2O_5$.

a. Calculate the molar mass of aspartame.

$$(14 \times 12.01) + (18 \times 1.01) + (2 \times 14.01) + (5 \times 16.00) = \boxed{294.34 \text{ g/mol}}$$

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

$$10.0 \text{ g} \times \frac{1 \text{ mol}}{294.34 \text{ g}} \times \frac{6.022 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = \boxed{2.05 \times 10^{22} \text{ molecules}}$$

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

$$1.56 \text{ mol} \times \frac{294.34 \text{ g}}{1 \text{ mol}} = \boxed{459 \text{ g}}$$

molecules d. How many molecules are in 5.0 mg of aspartame?

$$= 0.0050 \text{ g}$$
$$0.0050 \text{ g} \times \frac{1 \text{ mol}}{294.34 \text{ g}} \times \frac{6.022 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = \boxed{1.0 \times 10^{19} \text{ molecules}}$$

- g 10. Nitrosyl chloride ($NOCl$) is a gas used in the synthesis of some pharmaceutical compounds. Find the mass of a 5.62 mL sample of nitrosyl chloride at STP.

$$= 0.00562 \text{ L}$$

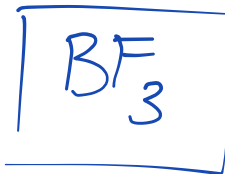
$$0.00562 \text{ L} \times \frac{1 \text{ mol}}{22.4 \text{ L}} \times \frac{65.46 \text{ g}}{1 \text{ mol}} = \boxed{0.0164 \text{ g } NOCl}$$

11. Find the empirical formula for the following compounds:

a) 15.9% B, 84.1% F

$$B: 15.9 \text{ g} \times \frac{1 \text{ mol}}{10.81 \text{ g}} = 1.47 \text{ mol}_B \rightarrow \text{smallest} \rightarrow 1 \text{ B}$$

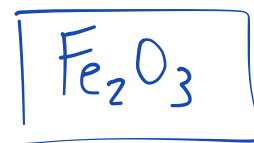
$$F: 84.1 \text{ g} \times \frac{1 \text{ mol}}{19.00 \text{ g}} = 4.43 \text{ mol}_F = \frac{4.43}{1.47} = 3 \text{ F}$$



b) 70.0% Fe, 30.0% O

$$\text{Fe}: 70.0 \text{ g} \times \frac{1 \text{ mol}}{55.85 \text{ g}} = 1.25 \text{ mol}_{\text{Fe}} \rightarrow \text{smallest} \rightarrow 1 \text{ Fe} \quad (2 \times)$$

$$\text{O}: 30.0 \text{ g} \times \frac{1 \text{ mol}}{16.00 \text{ g}} = 1.88 \text{ mol}_O = \frac{1.88}{1.25} = 1.5 \text{ O}$$



$\frac{\text{mol}}{\text{L}}$ or M 12. What molar concentration of KCl is produced by measuring out 1.0g KCl and adding water up to 0.350L of solution?

$$\frac{1.0 \text{ g}}{0.350 \text{ L}} \times \frac{1 \text{ mol}}{74.55 \text{ g}}$$

$$= \frac{0.038 \text{ mol}}{\text{L}}$$

$$\boxed{0.038 \text{ M}}$$