Which statement about the combustion of propane (C_3H_8) is ***not*** correct?

$$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$$

A. For every propane molecule consumed, three molecules of carbon dioxide are produced.

B. For every two molecules of propane consumed, eight molecules of water are produced.

C. For every five molecules of oxygen consumed, four molecules of water are produced.

D. For every three molecules of carbon dioxide produced, five molecules of oxygen are consumed.

E. For every carbon dioxide molecule produced, four molecules of water are also produced.

One mole is defined as _____

A. 6.02 x 10^{23} particles

B. the number of particles equal to the number of atoms in exactly 16 g of oxygen-16.

C. 6.02 10^{-23} particles.

D. the number of particles equal to the number of atoms in exactly 1 g of hydrogen-1.

E. the number of particles equal to the number of atoms in exactly 1 kg of carbon in a vault at the National Bureau of Standards.

Nicotine is an alkaloid and a component of cigarettes that contribute to the addictive properties of tobacco. Mass analysis reveals that it has the empirical formula C_5H_7N. If the molar mass is 162.23 g/mol, which molecular formula is correct?

A. C_5H_7N

B. $C_{10}H_{14}N_2$

C. $C_7H_9N_3$

D. $C_{15}H_{21}N_3$

E. $C_{20}H_{28}N_4$

When are an empirical formula and a molecular formula the same?

A. always

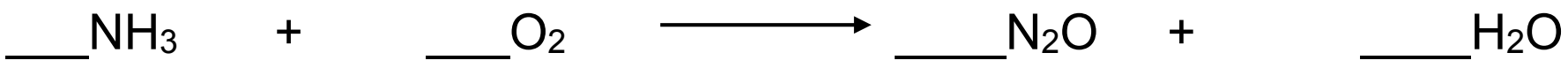
B. when the mass of the empirical formula unit is equal to the molecular mass

C. when the mass percentages of all of the elements in the two formulas are the same

D. never

E. when the molecular mass is an integer multiple of formula unit mass

Balance the following reaction:



How many moles of dinitrogen monoxide can be made from 3 moles of ammonia? (Oxygen is present in excess amounts.)

A. 2 moles

B. 1.5 moles

C. 3 moles

D. 1 mole

E. none of these

What is the formula for magnesium carbonate?

A. $MgCO_2$

B. $MnCO_3$

C. $MgCO_3$

D. Mg_2CO_3

E. $MnCO_2$

What is the molar mass of hexane (C_6H_{14})?

A. 86 g/mole

B. 20 g/mole

C. 50 g/mole

D. 72 g/mole

E. 60 g/mole

What is the mass percent of copper in malachite, $Cu_2(OH)_2CO_3$?

A. 62.3%

B. 57.5%

C. 67.0%

D. 60.8%

E. None of these

Balance the following combustion reaction. How many moles of oxygen, O_2, are needed to react with 1 mole of $C_4H_8S_2$.

$$\_\_\ C_4H_8S_2 + \_\_\ O_2 \longrightarrow \_\_\ CO_2 + \_\_\ H_2O + \_\_ SO_3$$

A. 2

B. 18

C. 5

D. 9

E. None of these

$$C_4H_8S_2 + 9\ O_2 \longrightarrow 4\ CO_2 + 4\ H_2O + 2\ SO_3$$

Ammonia, NH_3, is an important industrial chemical. It is produced using the Haber process from nitrogen, N_2 (28.0 g/mole), and hydrogen, H_2 (2.0 g/mole). How much ammonia (17.0 g/mole) can be produced from 28.0 kg of nitrogen and 2.0 kg of hydrogen,

$N_2 + 3\ H_2 \longrightarrow 2\ NH_3$

A. 11 kg

B. 34 kg

C. 23 kg

D. 0.156 kg

E. None of these

$$28 \times 10^3 g\ N_2 \times \frac{1\ mole}{28\ g\ N_2} \times \frac{2\ moles\ NH_3}{1\ mole\ N_2} \times \frac{17g}{Mole\ NH_3} = 34 \times 10^3 g\ NH_3$$

$$2.0 \times 10^3 g\ H_2 \times \frac{1\ mole}{2.0\ g\ H_2} \times \frac{2\ moles\ NH_3}{3\ mole\ H_2} \times \frac{17g}{Mole\ NH_3} = 11.33 \times 10^3 g\ NH_3$$

Ammonia, NH_3, is an important industrial chemical. It is produced using the Haber process from nitrogen, N_2 (28.0 g/mole), and hydrogen, H_2 (2 g/mole). How much ammonia (17.0 g/mole) can be produced from 20.0 g of nitrogen and excess, assuming the reaction yield is 90.0%?

$N_2 + 3\ H_2 \longrightarrow 2\ NH_3$

A. 24.28 **B. 21.9 g** C. 1.28 g D. 1.42 g E. None of these

Theoretical

$$20.0\text{ g } N_2 \times \frac{1\text{ mole}}{28\text{g } N_2} \times \frac{2\text{ moles } NH_3}{1\text{ mole } N_2} \times \frac{17\text{g}}{\text{Mole } NH_3} = 24.28\text{ g } NH_3$$

$$\text{Actual} = \frac{90\%}{100\%} \times 24.28\text{ g}$$

Actual = 21.85 g

3 sig figs = 21.9 g

Some ionic compounds can include water molecules in their solid structures in specific proportions. For example, anhydrous copper(II) sulfate forms a hydrate according to the reaction equation below. Determine the number of water molecules in the hydrate (*x* in the equation) from the following information. A 1.000 g sample of anhydrous $CuSO_4$(159.60 g/mole) adsorbed water (18.04 g/mole) and became completely hydrated. This sample then weighed 1.565 g.

$$CuSO_4(s)xH_2O \longrightarrow CuSO_4 + xH_2O$$

A. 15 B. 2 C. 4 **D. 5** E. None of these

Convert 1.000 grams of dry copper(II) sulfate to moles:

$$1.000\ g \times \frac{1\ mole}{159.60\ g} = .006266 \text{ moles copper(II) sulfate}$$

To get mass of water, subtract wet copper(II) sulfate from dry copper sulfate:
1.565 - 1.000 = 0.565g water

Convert grams of water to moles of water:

$$0.565g\ H_2O \times \frac{1\ mole\ H_2O}{18\ g} = 0.0313 \text{ moles water}$$

Divide moles of water by moles of copper(II) sulfate to get x (mole ratio)

$$\frac{0.0313}{0.00626} = 5$$

$CuSO_4(s)5H_2O$, for every mole of $CuSO_4$ there are 5 moles of water

When 2.748 grams of a pure compound that contains C, H and O, is combusted, 2.9302 g of water and 6.1395 g of carbon dioxide are produced. What is the empirical formula?

A. $C_6H_{14}O_2$ B. C_3H_7O C. CH_2O D. C_4H_8O E. C_2H_6O

$$6.135\text{ g } CO_2 \times \frac{1\text{ mole } CO_2}{44\text{ g}} \times \frac{1\text{ moles C}}{1\text{ mole } CO_2} = 0.139\text{ moles C}$$

$$2.9302\text{ g } H_2O \times \frac{1\text{ mole } H_2O}{18\text{ g}} \times \frac{2\text{ moles H}}{1\text{ mole } H_2O} = 0.325\text{ moles H}$$

0.139 moles C x 12 g/mole = 1.668 g C
0.325 moles H x 1 g/mole = 0.325 g H
2.748 g of sample - (1.668 g C + .325g H) = 0.755g O

$$0.755\text{ g O} \times \frac{1\text{ mole}}{16\text{ grams}} = .047\text{ moles O}$$

$$\frac{0.139\text{ moles C}}{.047\text{ moles O}} = 2.95 \qquad \frac{0.325\text{ moles H}}{.047\text{ moles O}} = 6.92$$

A mass of 11.60 g of phosphoric acid (H_3PO_4, 98.00 g/mol), was produced from the reaction of P_4O_{10} (283.89 g/mol) with excess water (18 g/mol). The theoretical yield is 18.4 g. What was the percent yield for this reaction?

$P_4O_{10} + 6\ H_2O \rightarrow 4\ H_3PO_4$

A. 63% B. 37% C. 21% D. 79% E. None of these

$$\frac{11.60}{18.4} \times 100\% = 63\%$$

What is the correct name for this formula: KNO_3?

A. Potassium mononitrogen trioxide

B. Krypton nitrate

C. Potassium nitrite

D. Potassium nitrate

E. Krypton nitrite

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A. Potassium mononitrogen trioxide

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D. Potassium nitrate

E. Krypton nitrite

What is the correct name for this formula: $Co_3(PO_4)_2$

A. Cobalt(III) phosphate
B. Cobalt (II) phosphate
C. Cobalt phosphate
D. Cobalt(III) phosphite
E. Tricobalt diphosphate

What color is the above compound?

A. Green
B. White
C. Colorless
D. Purple
E. Red/Brown