Balance the following equations and name each reactant and product. (Use the lowest possible coefficients.)

(a) \[
\text{SO}_2(g) + \text{HF}(l) \rightarrow \text{SF}_4(g) + \text{H}_2\text{O}(l)
\]

products
SF₄
H₂O

(b) \[
\text{NH}_3(aq) + \text{O}_2(aq) \rightarrow \text{NO}(g) + \text{H}_2\text{O}(l)
\]

products
NO
H₂O

(c) \[
\text{BF}_3(g) + \text{H}_2\text{O}(l) \rightarrow \text{HF}(aq) + \text{H}_3\text{BO}_3(aq)
\]

products
HF
H₃BO₃

The balanced equation for a reaction in the process of reducing iron ore to the metal is shown below.

\[
\text{Fe}_2\text{O}_3(s) + 3 \text{ CO}(g) \rightarrow 2 \text{ Fe}(s) + 3 \text{ CO}_2(g)
\]

(a) What is the maximum mass of iron, in grams, that can be obtained from 495 g of iron(III) oxide?

(b) What mass of CO is required to react with 308 g of Fe₂O₃?

Aspirin, C₆H₄(OOCCH₃)CO₂H, is produced by the reaction of salicylic acid, C₆H₄(OH)CO₂H, and acetic anhydride (CH₃CO)₂O.
4. KT6 4.P.031. [467436]  Show Details

A mixture of CuSO₄ and CuSO₄ • 5 H₂O has a mass of 1.235 g, but after heating to drive off all the water, the mass is only 0.822 g. What is the mass percent of CuSO₄ • 5 H₂O in the mixture?

5. KT6 4.P.044. [489880]  Show Details

To find the formula of a compound composed of iron and carbon monoxide, Feₓ(CO)ᵧ, the compound is burned in pure oxygen to give Fe₂O₃ and CO₂. If you burn 1.959 g of Feₓ(CO)ᵧ and obtain 0.799 g of Fe₂O₃ and 2.200 g of CO₂, what is the empirical formula of Feₓ(CO)ᵧ? (Type your answer using the format CO₂ for CO₂.)

6. KT6 4.P.045. [467603]  Show Details

Balance the following equations. (Use the lowest possible coefficients.)

(a) the synthesis of urea, a common fertilizer  
\[ \text{CO}_2(g) + \text{NH}_3(g) \rightarrow \text{CO(NH}_2)_2(s) + \text{H}_2\text{O}(l) \]

(b) reactions used to make uranium(VI) fluoride for the enrichment of natural uranium  
\[ \text{UF}_4(s) + \text{HF}(aq) \rightarrow \text{UF}_6(s) + \text{H}_2\text{O}(l) \]

(c) The reaction to make titanium(IV) chloride, which is then converted to titanium metal.  
\[ \text{TiCl}_4(l) + \text{Mg}(s) \rightarrow \text{Ti}(s) + \text{MgCl}_2(s) \]

7. KT6 4.P.050. [489843]  Show Details

Your body deals with excess nitrogen by excreting it in the form of urea, NH₂CONH₂. The reaction producing it is the combination of arginine (C₆H₁₄N₄O₂) with water to give urea and ornithine (C₅H₁₂N₂O₂).

\[ \text{C}_6\text{H}_4\text{O}_2\text{N}_4\text{H}_2 \rightarrow \text{C}_6\text{H}_4\text{O}_2\text{N}_4\text{H}_2 + \text{C}_5\text{H}_12\text{N}_2\text{O}_2 \]

If you excrete 65 mg of urea, what quantity of arginine must have been used?

What mass of ornithine must have been produced?
Thioridazine, C$_{21}$H$_{26}$N$_2$S$_2$, is a pharmaceutical used to regulate dopamine. (Dopamine, a neurotransmitter, affects brain processes that control movement, emotional response, and ability to experience pleasure and pain.) A chemist can analyze a sample of the pharmaceutical for the thioridazine content by decomposing it to convert the sulfur in the compound to sulfate ion. This is then "trapped" as water-insoluble barium sulfate (see Figure 4.8).

$$SO_4^{2-}(aq, \text{from thioridazine}) + BaCl_2 \rightarrow BaSO_4(s) + 2 Cl^- (aq)$$

Suppose a 6 tablet sample of the drug yielded 0.397 g of BaSO$_4$. What is the thioridazine content, in milligrams, of each tablet?

9. KT6 4.P.014. [486064]  Show Details

The formation of water-insoluble silver chloride is useful in the analysis of chloride-containing substances. Consider the following unbalanced equation.

$$BaCl_2(aq) + AgNO_3(aq) \rightarrow AgCl(s) + Ba(NO_3)_2(aq)$$

(a) Balance the equation. (Use the lowest possible coefficients.)

$$[_____] BaCl_2(aq) + [_____] AgNO_3(aq) \rightarrow [_____] AgCl(s) + [_____] Ba(NO_3)_2(aq)$$

(b) What mass AgNO$_3$, in grams, is required for complete reaction with 0.142 g of BaCl$_2$?

$$[_____] g$$

What mass of AgCl is produced?

$$[_____] g$$

10. KT6 4.P.036. [486059]  Show Details

The aluminum in a 0.750 g sample of an unknown material was precipitated as aluminum hydroxide, Al(OH)$_3$, which was then converted to Al$_2$O$_3$ by heating strongly. If 0.154 g of Al$_2$O$_3$ is obtained from the 0.750 g sample, what is the mass percent of aluminum in the sample?

$$[_____] \%$$

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