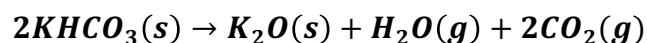
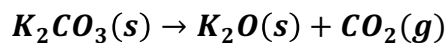


1. Vanillin, the dominant flavoring in vanilla, contains C, H, and O. When 1.05 g of this substance is completely combusted, 2.43 g of CO_2 and 0.50 g of H_2O are produced. What is the empirical formula of vanillin?
2. A mixture of $\text{N}_2(\text{g})$ and $\text{H}_2(\text{g})$ reacts in a closed container to form ammonia, $\text{NH}_3(\text{g})$. The reaction ceases before either reactant has been totally consumed. At this stage, 3.0 mol N_2 , 3.0 mol H_2 , and 3.0 mol NH_3 are present. How many moles of N_2 and H_2 were present originally?
3. A mixture containing KClO_3 , K_2CO_3 , KHCO_3 , and KCl was heated, producing CO_2 , O_2 , and H_2O gases according to the following equations:



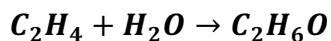


The KCl does not react under the conditions of the reaction. If 100.0 g of the mixture produces 1.80 g of H₂O, 13.20 g of CO₂, and 4.00 g of O₂, what was the composition of the original mixture? (Assume complete decomposition of the mixture.)

4. Give the oxidation number of each element in the following compounds:

- a. BrO₃⁻:
- b. H₂SO₄:
- c. CrO₄²⁻:
- d. LiAlH₄:

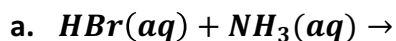
5. Your friend has heard that she can make ethanol by reacting C₂H₄ with H₂O under acidic conditions, but she's not sure how much of each starting material she needs. So she randomly mixes 101.7 g of C₂H₄ with 55.19 g of H₂O.



- a. What is the theoretical yield of ethanol in mL (ethanol density = 0.789 g/mL)?

b. How much (mass) excess reactant remains?

6. Complete and balance the following molecular equations, and then write the net ionic equation for each (note in past answer keys, we have written H^+ in net ionic equations, but it is more correct to write H_3O^+ instead. H^+ doesn't actually exist itself in solution):



b. Aqueous hydrochloric acid and sodium acetate

c. Aqueous perchloric acid and aqueous strontium hydroxide

7. Starting with solid sucrose, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$, describe how you would

a. Prepare 250 mL of a 0.250 M sucrose solution

b. Prepare 350.0 mL of 0.100 M $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ starting with 3.00 L of 1.50 M $\text{C}_{12}\text{H}_{22}\text{O}_{11}$.

