10 Questions on balancing chemical reactions

1. **Which of the following is the correctly balanced form of the reaction between hydrogen gas and oxygen gas to produce water?**

   A. $H_2+O_2 \rightarrow H_2O$
   B. $2H_2+O_2 \rightarrow 2H_2O_2$
   C. $H_2+{}^1/_2O_2 \rightarrow H2O$
   D. $2H_2+2O_2 \rightarrow 2H_2O$

2. **Which of the following is the correctly balanced form of the combustion of methane (CH_4)?**
   A. $CH_4+O_2 \rightarrow CO_2+2H_2O$
   B. $CH_4+2O_2 \rightarrow CO_2+2H_2O$
   C. $CH_4+3O_2 \rightarrow CO_2+H_2O$
   D. $2CH_4+4O_2 \rightarrow 2CO_2+4H_2O_2$

3. **Which of the following is the correctly balanced equation for the reaction of aluminum with hydrochloric acid (HCl) to produce aluminum chloride ($AlCl_3$) and hydrogen gas?**

   A. $Al+3HCl \rightarrow AlCl_3+H_2$

   B. $2Al+6HCl \rightarrow 2AlCl_3+3H_2$

   C. $Al+HCl \rightarrow AlCl_3+H_2$

   D. $2Al+3HCl \rightarrow AlCl_3+3H_2$

4. **Which of the following represents the correctly balanced reaction for the formation of ammonia (NH_3) from nitrogen and hydrogen?**
   A. $N_2+H_2 \rightarrow NH_3$
   B. $N_2+3H_2 \rightarrow 2NH_3$
   C. $2N_2+6H_2 \rightarrow 4NH_3$
   D. $N_2+H_2 \rightarrow 2NH_3$

5. **Which of the following is the correctly balanced form of the reaction of sodium hydroxide (NaOH) with sulfuric acid (H_2SO_4)?**

   A. $NaOH+H_2SO_4 \rightarrow Na_2SO_4+H_2O$
   B. $2NaOH+H_2SO_4 \rightarrow Na_2SO_4+2H_2O_2$
   C. $NaOH+H_2SO_4 \rightarrow Na_2SO4+2H_2O$
   D. $2NaOH+2H_2SO_4 \rightarrow Na_2SO_4+4H_2O$

6. **Which of the following is the correctly balanced equation for the decomposition of potassium chlorate ($KClO_3$)?**

   A. $KClO_3 \rightarrow KCl + O_2$

   B. $2KClO_3 \rightarrow 2KCl + 3O_2$

   C. $KClO_3 \rightarrow KCl + 2O_2$

   D. $2KClO_3 \rightarrow KCl + 3O_2$

7. **Which of the following represents the correctly balanced equation for the neutralization reaction between acetic acid (CH_3COOH) and sodium hydroxide (NaOH)?**

   A. $CH_3COOH + NaOH \rightarrow CH_3COONa + H2O$

   B. $CH_3COOH + NaOH \rightarrow CH_3COONa$

   C. $CH_3COOH + 2NaOH \rightarrow CH_3COONa + 2H_2O$

   D. $2CH_3COOH + 2NaOH \rightarrow CH_3COONa + H_2O_2$

8. **Which of the following equations is correctly balanced for the reaction between iron (III) oxide (Fe_2O_3) and carbon monoxide (CO) to produce iron and carbon dioxide?**

   A. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

   B. $2Fe_2O_3 + 3CO \rightarrow 4Fe + 3CO_2$

   C. $Fe_2O_3 + CO \rightarrow 2Fe + CO_2$

   D. $Fe_2O_3 + 2CO \rightarrow 2Fe + 3CO_2$

9. **Which of the following represents the correctly balanced reaction for the combustion of ethane (C_2H_6)?**

   A. $C_2H_6 + O_2 \rightarrow 2CO_2 + 3H_2O$

   B. $C_2H_6 + 3O_2 \rightarrow 2CO_2 + 3H_2O$

   C. $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

   D. $C_2H_6 + 2O_2 \rightarrow 2CO_2 + H_2O$

10. **Which of the following is the correctly balanced equation for the reaction between silver nitrate ($AgNO_3$) and sodium chloride (NaCl) to produce silver chloride (AgCl) and sodium nitrate ($NaNO_3$)?**

    A. $AgNO_3+NaCl \rightarrow AgCl+NaNO_3$

    B. $2AgNO_3+NaCl \rightarrow 2AgCl+NaNO_3$

    C. $AgNO_3+2NaCl \rightarrow AgCl+NaNO_3$

    D. $AgNO_3+NaCl \rightarrow 2AgCl+2NaNO_3$

Answer and Explanations:

Here are the correct answers for each question on balancing chemical reactions, along with explanations for why the other options are incorrect:

1. **Which of the following is the correctly balanced form of the reaction between hydrogen gas and oxygen gas to produce water?**
    - **Correct Answer: B. $2H_2+O_2 \rightarrow 2H_2O_2$**
    - **Explanation**:
        - **A. $H_2+O_2 \rightarrow H_2O$:** Incorrect because there are two oxygen atoms on the left but only one on the right.
        - **C. $H_2+12O_2 \rightarrow H_2O$:** Incorrect because, while balanced in terms of atoms, coefficients should be whole numbers in balanced chemical equations.
        - **D. $2H_2+2O_2 \rightarrow 2H_2O_2$:** Incorrect because this suggests there are extra oxygen atoms that do not balance out.
2. **Which of the following is the correctly balanced form of the combustion of methane (CH4)?**
    - **Correct Answer: B. $CH_4+2O_2 \rightarrow CO_2+2H_2O$**
    - **Explanation**:
        - **A. $CH_4+O_2 \rightarrow CO_2+2H_2O$:** Incorrect because there are not enough oxygen atoms to balance the equation.
        - **C. $CH_4+3O_2 \rightarrow CO_2+H_2O$:** Incorrect because it overstates the number of oxygen atoms needed.
        - **D. $2CH_4+4O_2 \rightarrow 2CO_2+4H_2O_2$:** Incorrect because it is unnecessarily doubled; the simplest whole number coefficients are preferred.

3. **Which of the following is the correctly balanced equation for the reaction of aluminum with hydrochloric acid (HCl) to produce aluminum chloride ($AlCl_3$) and hydrogen gas?**
    - **Correct Answer: B. $2Al+6HCl \rightarrow 2AlCl_3+3H_2$**
    - **Explanation**:
        - **A. $Al+3HCl \rightarrow AlCl_3+H_2$:** Incorrect because the number of hydrogen and chlorine atoms are not balanced.
        - **C. $Al+HCl \rightarrow AlCl_3+H_2$:** Incorrect because the number of aluminum, hydrogen, and chlorine atoms are not balanced.
        - **D. $2Al+3HCl \rightarrow AlCl_3+3H_2$:** Incorrect because the number of chlorine atoms does not balance.
4. **Which of the following represents the correctly balanced reaction for the formation of ammonia (NH_3) from nitrogen and hydrogen?**
    - **Correct Answer: B. $N_2+3H_2 \rightarrow 2NH_3$**
    - **Explanation**:
        - **A. $N_2+H_2 \rightarrow NH_3$:** Incorrect because the number of hydrogen atoms does not balance.
        - **C. $2N_2+6H_2 \rightarrow 4NH_3$:** Incorrect because, while balanced, the coefficients are not in their simplest form.
        - **D. $N_2+H_2 \rightarrow 2NH_3$:** Incorrect because the number of hydrogen atoms does not balance.
5. **Which of the following is the correctly balanced form of the reaction of sodium hydroxide (NaOH) with sulfuric acid (H_2SO4)?**
    - **Correct Answer: B. $2NaOH+H_2SO_4 \rightarrow Na_2SO_4+2H_2O_2$**
    - **Explanation**:
        - **A. $NaOH+H_2SO_4 \rightarrow Na_2SO_4+H_2O$:** Incorrect because the sodium and oxygen atoms are not balanced.
        - **C. $NaOH+H_2SO_4 \rightarrow Na_2SO_4+2H_2O$:** Incorrect because the number of sodium atoms does not balance.
        - **D. $2NaOH+2H_2SO_4 \rightarrow Na_2SO_4+4H_2O$:** Incorrect because it overstates the number of sulfuric acid molecules.

6. **Which of the following is the correctly balanced equation for the decomposition of potassium chlorate ($KClO_3$)?**
    - **Correct Answer: B. $2KClO_3 \rightarrow 2KCl + 3O_2$**
    - **Explanation**:
        - **A. $KClO_3 \rightarrow KCl + O_2$:** Incorrect because the number of oxygen atoms does not balance.
        - **C. $KClO_3 \rightarrow KCl + 2O_2$:** Incorrect because the number of oxygen atoms does not balance.
        - **D. $2KClO_3 \rightarrow KCl + 3O_2$:** Incorrect because the number of potassium and chlorine atoms does not balance.

7. **Which of the following represents the correctly balanced equation for the neutralization reaction between acetic acid (CH_3COOH) and sodium hydroxide ($NaOH$)?**
    - **Correct Answer: A. $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$**
    - **Explanation**:
        - **B. $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$:** Incorrect because water (H_2O) is formed in neutralization, not hydrogen gas.
        - **C. $CH_3COOH + 2NaOH \rightarrow CH_3COONa + 2H_2O$:** Incorrect because the coefficients do not match the number of atoms involved in the reaction.
        - **D. $2CH_3COOH + 2NaOH \rightarrow CH_3COONa + H_2O$:** Incorrect because it doubles the reactants unnecessarily without balancing the products.

8. **Which of the following equations is correctly balanced for the reaction between iron (III) oxide (Fe_2O_3) and carbon monoxide (CO) to produce iron and carbon dioxide?**
    - **Correct Answer: A. $Fe_2O_3+3CO \rightarrow 2Fe+3CO_2$**
    - **Explanation**:
        - **B. $2Fe_2O_3+3CO \rightarrow 4Fe+3CO_2$:** Incorrect because the number of oxygen atoms does not balance.
        - **C. $Fe_2O_3+CO \rightarrow 2Fe+CO_2$:** Incorrect because the number of oxygen and carbon atoms do not balance.
        - **D. $Fe_2O+2CO \rightarrow 2Fe+3CO_2$:** Incorrect because the number of carbon atoms does not balance.
9. **Which of the following represents the correctly balanced reaction for the combustion of ethane (C_2H_6)?**
    - **Correct Answer: C. $2C_2H_6+7O_2 \rightarrow 4CO_2+6H_2O$**
    - **Explanation**:
        - **A. $C_2H_6+O_2 \rightarrow 2CO_2+3H_2O$:** Incorrect because the number of oxygen atoms does not balance.
        - **B. $C_2H_6+3O_2 \rightarrow 2CO_2+3H_2O$:** Incorrect because the number of oxygen atoms does not balance.
        - **D. $C_2H_6+2O_2 \rightarrow 2CO_2+H_2O$:** Incorrect because the number of oxygen atoms does not balance.

10. **Which of the following is the correctly balanced equation for the reaction between silver nitrate ($AgNO_3$) and sodium chloride (NaCl) to produce silver chloride (AgCl) and sodium nitrate ($NaNO_3$)?**
    - **Correct Answer: A. $AgNO_3+NaCl \rightarrow AgCl+NaNO_3$**
    - **Explanation**:
        - **B. $2AgNO_3+NaCl \rightarrow 2AgCl+NaNO_3$:** Incorrect because it suggests twice as many silver nitrate and silver chloride molecules without balancing the sodium or nitrate ions correctly.
        - **C. $AgNO_3+2NaCl \rightarrow AgCl+NaNO_3$:** Incorrect because it introduces an extra sodium chloride molecule, making the number of sodium and chloride ions unbalanced.
        - **$AgNO_3+NaCl \rightarrow 2AgCl+2NaNO_3$:** Incorrect because it doubles the number of products without correctly reflecting the initial number of reactants.

The balanced equation should reflect a 1:1:1:1 stoichiometry for all reactants and products in this single replacement reaction, as represented in choice A.