Writing and Balancing Equations Worksheet
Chemistry Level 4

Part 1: For each chemical word equation below, first write the formula for each reactant and product. Then write the complete chemical equation; include the physical state for each substance. Balance each equation by following the procedure you learned in class.

1. Hydrogen and oxygen gas react to form water.
   \[ 2H_2(g) + O_2(g) \rightarrow 2H_2O(l) \]

2. Aqueous lead (II) chloride reacts with aqueous sodium sulfate to produce a lead (II)
   sulfate precipitate and aqueous sodium chloride.
   \[ PbCl_2(aq) + Na_2SO_4(aq) \rightarrow PbSO_4(s) + 2 NaCl(aq) \]

3. Silicon reacts with chlorine gas to form liquid silicon tetrachloride.
   \[ Si(s) + 2Cl_2(g) \rightarrow SiCl_4(l) \]

4. Aqueous chlorine and aqueous potassium bromide react to make a solution of
   potassium chloride and bromine.
   \[ Cl_2(aq) + 2 KBr(aq) \rightarrow 2 KCl(aq) + Br_2(l) \]

5. Sodium metal combines with chlorine gas to form crystalline sodium chloride.
   \[ 2 Na(s) + Cl_2(g) \rightarrow 2 NaCl(s) \]

   \[ N_2(g) + 3H_2(g) \rightarrow 2 NH_3(g) \]

7. Solid sodium hydrogen carbonate decomposes to make aqueous sodium carbonate,
   carbon dioxide gas, and water.
   \[ 2NaHCO_3(s) \rightarrow Na_2CO_3(aq) + CO_2(g) + H_2O(l) \]

8. Aluminum combines with oxygen gas to form solid aluminum oxide.
   \[ 4 Al(s) + 3O_2(g) \rightarrow 2 Al_2O_3(s) \]

9. Methane gas undergoes combustion with oxygen to produce carbon dioxide and
   water.
   \[ CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g) \]
10. Zinc reacts with aqueous hydrogen chloride to form aqueous zinc chloride and hydrogen gas.

\[ \text{Zn}(s) + 2\text{HCl}(aq) \rightarrow \text{ZnCl}_2(aq) + \text{H}_2(g) \]

11. Lithium metal combines with oxygen to form lithium oxide.

\[ 4\text{Li}(s) + \text{O}_2(g) \rightarrow 2\text{Li}_2\text{O}(s) \]

12. Aqueous silver nitrate reacts with solid copper to form a copper (II) nitrate solution and silver crystals.

\[ 2\text{AgNO}_3(aq) + \text{Cu}(s) \rightarrow \text{Cu(NO}_3)_2(aq) + 2\text{Ag}(s) \]

13. Gaseous propane \((\text{C}_3\text{H}_8)\) fuel burns in oxygen to form carbon dioxide and water.

\[ \text{C}_3\text{H}_8(g) + 5\text{O}_2(g) \rightarrow 3\text{CO}_2(g) + 4\text{H}_2\text{O}(g) \]

14. Solid calcium carbonate decomposes to produce calcium oxide and carbon dioxide.

\[ \text{CaCO}_3(s) \rightarrow \text{CaO}(s) + \text{CO}_2(g) \]

15. A sodium hydroxide solution neutralizes a hydrogen chloride solution to form a solution of sodium chloride and water.

\[ \text{NaOH}(aq) + \text{HCl}(aq) \rightarrow \text{NaCl}(aq) + \text{H}_2\text{O}(l) \]

16. Solid mercury (II) oxide decomposes to form liquid mercury metal and oxygen.

\[ 2\text{HgO}(s) \rightarrow 2\text{Hg}(l) + \text{O}_2(g) \]

17. Iron metal reacts with water to form iron (III) oxide and hydrogen gas.

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


\[ 2\text{Al}(s) + 6\text{HCl}(aq) \rightarrow 2\text{AlCl}_3(aq) + 3\text{H}_2(g) \]

19. Potassium metal reacts violently with water to form a basic solution of potassium hydroxide and releasing hydrogen gas.

\[ 2\text{K}(s) + 2\text{H}_2\text{O}(l) \rightarrow 2\text{KOH}(aq) + \text{H}_2(g) \]

20. Ammonia gas and oxygen combine to form dinitrogen monoxide and water vapor.

\[ 2\text{NH}_3(g) + 2\text{O}_2(g) \rightarrow \text{N}_2\text{O}(g) + 3\text{H}_2\text{O}(g) \]
Part 2: Answer the following questions.

21. Explain why an equation must be balanced in order to accurately represent a chemical reaction.

Law of Conservation of Mass

#atoms must be preserved

22. Balance the following equations by filling in the appropriate coefficient on the line.
   a. \( \text{____ P}_4(s) + \text{____ O}_2(g) \rightarrow \text{____ P}_4\text{O}_{10}(s) \)
   b. \( \text{____ KClO}_3(s) \rightarrow \text{____ KCl(s)} + \text{____ O}_2(g) \)
   c. \( \text{____ Al(s)} + \text{____ CuCl}_2(aq) \rightarrow \text{____ Cu(s)} + \text{____ AlCl}_3(aq) \)
   d. \( \text{____ C}_2\text{H}_6(g) + \text{____ O}_2(g) \rightarrow \text{____ CO}_2(g) + \text{____ H}_2\text{O}(g) \)
   e. \( \text{____ Al(NO}_3)_3(aq) + \text{____ H}_2\text{SO}_4 \rightarrow \text{____ Al}_2(\text{SO}_4)_3(aq) + \text{____ HNO}_3(aq) \)
   f. \( \text{____ C}_2\text{H}_6(g) + \text{____ O}_2(g) \rightarrow \text{____ CO}_2(g) + \text{____ H}_2\text{O}(g) \)
   g. \( \text{____ Mg(s)} + \text{____ FeCl}_3(aq) \rightarrow \text{____ MgCl}_2(aq) + \text{____ Fe(s)} \)
   h. \( \text{____ C}_3\text{H}_5(\text{NO}_3)_3 \rightarrow \text{____ CO}_2(g) + \text{____ N}_2(g) + \text{____ H}_2\text{O}(l) + \text{____ O}_2(g) \)

23. List the reaction types for each reaction in #22.
   a. synthesis/combustion
   b. decomposition
   c. single replacement (cationic)
   d. combustion
   e. double replacement
   f. combustion
   g. single replacement (cationic)
   h. decomposition