- **36. a.** reactants: sodium and water; products: hydrogen and sodium hydroxide
 - **b.** reactants: carbon dioxide and water; products: oxygen and glucose
- **37.** Dalton said that the atoms of reactants are rearranged to form new substances as products.
- 38. The arrow separates the reactants from the products and indicates a reaction that progresses in the forward direction. A plus sign separates individual reactants and individual products from one another.
- 39. a. Gaseous ammonia and oxygen react in the presence of a platinum catalyst to produce nitrogen monoxide gas and water vapor.
 b. Aqueous solutions of sulfuric acid and barium chloride are mixed to produce a precipitate of barium sulfate and aqueous hydrochloric acid.
 c. The gas dipitrogen trioxide

c. The gas dinitrogen trioxide reacts with water to produce an aqueous solution of nitrous acid.

p347

40. A catalyst speeds up a chemical reaction.

p347

- **41. a.** C + 2F + 2G \rightarrow CF₂G₂ **b.** F + 3W + S + 2P \rightarrow FW₃SP₂
- 42. A formula is a unique identifier of a substance. A different formula would indicate a different substance, not the one that is taking part in the reaction you are trying to balance.
- **43.** a. $2PbO_2 \rightarrow 2PbO + O_2$
 - **b.** $2\text{Fe}(\text{OH})_3 \rightarrow \text{Fe}_2\text{O}_3 + 3\text{H}_2\text{O}$
 - c. $(NH_4)_2CO_3 \rightarrow 2NH_3 + H_2O + CO_2$
 - c. $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$

44. a single product

p347

45. a. $2Mg + O_2 \rightarrow 2MgO$

b.
$$4P + 5O_2 \rightarrow 2P_2O_5$$

c. Ca + S
$$\rightarrow$$
 CaS

46. a single reactant

47. a.
$$2Ag_2O \xrightarrow{\Delta} 4Ag + O_2$$

b.NH₄NO₃
$$\xrightarrow{\Delta}$$
N₂O + 2H₂O

48. a. no reaction

b.
$$Zn(s) + 2AgNO_3(aq) \rightarrow P347$$

 $Zn(NO_3)_2(aq) + 2Ag(s)$
c. $2AI(s) + 3H_2SO_4(aq) \rightarrow AI_2(SO_4)_3(aq) + 3H_2(g)$
49. a. $H_2C_2O_4(aq) + 2KOH(aq) \rightarrow K_2C_2O_4(aq) + 2H_2O(l)$
b. $CdBr_2(aq) + Na_2S(aq) \rightarrow CdS(s) + 2NaBr(aq)$
50. oxygen

51. a. $C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O_3$

b. $C_3H_6O + 4O_2 \rightarrow 3CO_2 + 3H_2O$

52. a. $3Hf + 2N_2 \rightarrow Hf_3N_4$; combination

- b. Mg +H₂SO₄ → MgSO₄ + H₂; single replacement
- c. $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$; combustion
- **d.** Pb(NO₃)₂ + 2NaI \rightarrow PbI₂ + 2NaNO₃; double replacement
- **e.** 3Fe $+ 2O_2 \rightarrow Fe_3O_4$; combination

p347