

AP* CHEMISTRY EQUATIONS BY TYPE

Double Replacement

1. Hydrogen sulfide is bubbled through a solution of silver nitrate.
2. An excess of sodium hydroxide solution is added to a solution of magnesium nitrate.
3. Solutions of sodium iodide and lead nitrate are mixed.
4. A solution of ammonia is added to a solution of ferric chloride.
5. Solutions of silver nitrate and sodium chromate are mixed.
6. Excess silver acetate is added to a solution of trisodium phosphate.
7. Manganese(II) nitrate solution is mixed with sodium hydroxide solution.
8. A saturated solution of calcium hydroxide is added to a solution of magnesium chloride.
9. Hydrogen sulfide gas is added to a solution of cadmium nitrate.
10. Dilute sulfuric acid is added to a solution of barium acetate.
11. A precipitate is formed when solutions of trisodium phosphate and calcium chloride are mixed.
12. A solution of copper(II) sulfate is added to a solution of barium hydroxide.
13. Equal volumes of dilute equimolar solutions of sodium carbonate and hydrochloric acid are mixed.
14. Solid barium peroxide is added to cold dilute sulfuric acid.
15. Excess hydrochloric acid solution is added to a solution of potassium sulfite.
16. Dilute sulfuric acid is added to a solution of barium chloride.
17. A solution of sodium hydroxide is added to a solution of ammonium chloride.
18. Dilute hydrochloric acid is added to a solution of potassium carbonate.
19. Gaseous hydrogen sulfide is bubbled through a solution of nickel(II) nitrate.
20. A solution of sodium sulfide is added to a solution of zinc nitrate.
21. Concentrated hydrochloric acid is added to solid manganese(II) sulfide.
22. Solutions of tri-potassium phosphate and zinc nitrate are mixed.
23. Dilute acetic acid solution is added to solid magnesium carbonate.
24. Gaseous hydrofluoric acid reacts with solid silicon dioxide.
25. Equimolar amounts of trisodium phosphate and hydrogen chloride, both in solution, are mixed.
26. Ammonium chloride crystals are added to a solution of sodium hydroxide.
27. Hydrogen sulfide gas is bubbled through a solution of lead(II) nitrate.
28. Solutions of silver nitrate and sodium chromate are mixed.
29. Solutions of sodium fluoride and dilute hydrochloric acid are mixed.
30. A saturated solution of barium hydroxide is mixed with a solution of iron(III) sulfate.
31. A solution of ammonium sulfate is added to a potassium hydroxide solution.
32. A solution of ammonium sulfate is added to a saturated solution of barium hydroxide.
33. Dilute sulfuric acid is added to solid calcium fluoride.
34. Dilute hydrochloric acid is added to a dilute solution of mercury(I) nitrate.
35. Dilute sulfuric acid is added to a solution of lithium hydrogen carbonate.
36. Dilute hydrochloric acid is added to a solution of potassium sulfite.
37. Carbon dioxide gas is bubbled through water containing a suspension of calcium carbonate.
38. Excess concentrated sulfuric acid is added to solid calcium phosphate.
39. Hydrogen sulfide gas is bubbled into a solution of mercury(II) chloride.

40. Solutions of zinc sulfate and sodium phosphate are mixed.
41. Solutions of silver nitrate and lithium bromide are mixed.
42. Solutions of manganese(II) sulfate and ammonium sulfide are mixed.
43. Excess hydrochloric acid solution is added to a solution of potassium sulfite.

Single Replacement

1. A piece of aluminum metal is added to a solution of silver nitrate.
2. Aluminum metal is added to a solution of copper(II) chloride.
3. Hydrogen gas is passed over hot copper(II) oxide.
4. Small chunks of solid sodium are added to water.
5. Calcium metal is added to a dilute solution of hydrochloric acid.
6. Magnesium turnings are added to a solution of iron(III) chloride.
7. Chlorine gas is bubbled into a solution of sodium bromide.
8. A strip of magnesium is added to a solution of silver nitrate.
9. Solid calcium is added to warm water.
10. Liquid bromine is added to a solution of potassium iodide.
11. Chlorine gas is bubbled into a solution of potassium iodide.
12. Lead foil is immersed in silver nitrate solution.
13. Solid zinc strips are added to a solution of copper(II) sulfate.
14. Sodium metal is added to water.
15. A bar of zinc metal is immersed in a solution of copper(II) sulfate.
16. A small piece of sodium metal is added to distilled water.

Anhydrides

1. Excess water is added to solid calcium hydride.
2. Solid lithium hydride is added to water.
3. Liquid phosphorus trichloride is poured into a large excess of water.
4. Solid sodium carbide is added to an excess of water.
5. Solid magnesium nitride is added to excess deuterium oxide.
6. Water is added to a sample of pure phosphorus tribromide.
7. Water is added to a sample of pure sodium hydride.
8. Dinitrogen trioxide gas is bubbled into water.
9. Solid phosphorus pentachloride is added to excess water.
10. Solid dinitrogen pentoxide is added to water.
11. Sulfur trioxide gas is added to excess water.
12. Solid sodium oxide is added to water.
13. Phosphorus(V) oxytrichloride is added to water.
14. Water is added to a sample of solid magnesium nitride.
15. Solid potassium oxide is added to water.
16. Solid sodium cyanide is added to water.
17. Trisodium phosphate crystals are added to water.
18. Solid lithium oxide is added to excess water.
19. Solid barium oxide is added to distilled water.
20. Solid calcium hydride is added to distilled water.
21. Phosphorous(V) oxide powder is sprinkled over distilled water.

Combustion

1. Lithium metal is burned in air.
2. The hydrocarbon hexane is burned in excess oxygen.
3. Gaseous diborane, B_2H_6 , is burned in excess oxygen.
4. A piece of solid bismuth is heated strongly in oxygen.
5. Solid zinc sulfide is heated in an excess of oxygen.
6. Propanol is burned completely in air.
7. Excess oxygen gas is mixed with ammonia gas in the presence of platinum.
8. Gaseous silane, SiH_4 , is burned in oxygen.
9. Ethanol is completely burned in air.
10. Solid copper(II) sulfide is heated strongly in oxygen gas.
11. Ethanol is burned in oxygen.
12. Carbon disulfide vapor is burned in excess oxygen.

Redox

1. Iron(III) ions are reduced by iodide ions.
2. Potassium permanganate solution is added to concentrated hydrochloric acid.
3. Magnesium metal is added to dilute nitric acid, giving as one of the products a compound in which the oxidation number for nitrogen is -3.
4. A solution of potassium iodide is electrolyzed.
5. Potassium dichromate solution is added to an acidified solution of sodium sulfite.
6. Solutions of potassium iodide, potassium iodate, and dilute sulfuric acid are mixed.
7. A solution of tin(II) sulfate is added to a solution of iron(III) sulfate.
8. Metallic copper is heated with concentrated sulfuric acid.
9. Manganese(IV) oxide is added to warm, concentrated hydrobromic acid.
10. Chlorine gas is bubbled into cold dilute sodium hydroxide.
11. Solid iron(III) oxide is heated in excess carbon monoxide.
12. Hydrogen peroxide solution is added to acidified potassium iodide solution.
13. Hydrogen peroxide is added to an acidified solution of potassium dichromate.
14. Sulfur dioxide gas is bubbled through an acidified solution of potassium permanganate.
15. A solution containing tin(II) ions is added to an acidified solution of potassium dichromate.
16. Solid silver sulfide is warmed with dilute nitric acid.
17. A dilute solution of sulfuric acid is electrolyzed between platinum electrodes.
18. Pellets of lead are dropped into hot sulfuric acid.
19. Potassium permanganate solution is added to a solution of oxalic acid, $H_2C_2O_4$, acidified with a few drops of sulfuric acid.
20. Powdered iron is added to a solution of iron(III) sulfate.
21. A concentrated solution of hydrochloric acid is added to powdered manganese dioxide and gently heated.
22. A strip of copper metal is added to a concentrated solution of sulfuric acid.
23. Copper(II) sulfide is oxidized by dilute nitric acid.
24. A solution of copper(II) sulfate is electrolyzed using inert electrodes.
25. A solution of potassium iodide is added to an acidified solution of potassium dichromate.
26. Hydrogen peroxide solution is added to a solution of iron(II) sulfate.
27. Solid silver is added to a dilute nitric acid(6M) solution.

28. A solution of formic acid, HCOOH , is oxidized by an acidified solution of potassium dichromate.
29. A piece of iron is added to a solution of iron(III) sulfate.
30. An acidified solution of potassium permanganate is added to a solution of sodium sulfite.
31. A solution of tin(II) chloride is added to a solution of iron(III) sulfate.
32. Concentrated hydrochloric acid solution is added to solid manganese(IV) oxide and the reactants are heated.
33. A strip of copper is immersed in dilute nitric acid.
34. Potassium permanganate solution is added to an acidic solution of hydrogen peroxide.
35. Solid copper is added to a dilute nitric acid solution.
36. Chlorine gas is bubbled into a cold solution of dilute sodium hydroxide.
37. A solution of potassium permanganate is mixed with an alkaline solution of sodium sulfite.
38. Solid sodium dichromate is added to an acidified solution of sodium iodide.
39. Hydrogen gas is passed over hot iron(III) oxide.
40. Solutions of potassium iodide and potassium iodate are mixed in acid solution.
41. Hydrogen peroxide is added to an acidified solution of sodium bromide.
42. Chlorine gas is bubbled into a cold, dilute solution of potassium hydroxide.
44. A solution of iron(II) nitrate is exposed to air for an extended period of time.
45. A stream of chlorine gas is passed through a solution of cold, dilute sodium hydroxide.
46. A solution of tin(II) chloride is added to an acidified solution of potassium permanganate.
47. A concentrated solution of hydrochloric acid is added to solid potassium permanganate.
48. A solution of potassium dichromate is added to an acidified solution of iron(II) chloride.

Acid-Base Neutralizations

1. Solutions of ammonia and hydrofluoric acid are mixed.
2. Hydrogen sulfide gas is bubbled through a solution of potassium hydroxide.
3. A solution of sulfuric acid is added to a solution of barium hydroxide until the same number of moles of each compound has been added.
4. A solution of sodium hydroxide is added to a solution of sodium dihydrogen phosphate until the same number of moles of each compound has been added.
5. Dilute nitric acid is added to crystals of pure calcium oxide.
6. Equal volumes of 0.1-molar sulfuric acid and 0.1-molar potassium hydroxide are mixed.
7. A solution of ammonia is added to a dilute solution of acetic acid.
8. Excess sulfur dioxide gas is bubbled through a dilute solution of potassium hydroxide.
9. Sulfur dioxide gas is bubbled into an excess of a saturated solution of calcium hydroxide.
10. A solution of sodium hydroxide is added to a solution of calcium hydrogen carbonate until the number of moles of sodium hydroxide added is twice the number of moles of the calcium salt.
11. Equal volumes of 0.1M hydrochloric acid and 0.1M sodium monohydrogen phosphate are mixed.
12. Hydrogen sulfide gas is bubbled through excess potassium hydroxide solution.
13. Ammonia gas and carbon dioxide gas are bubbled into water.
14. Carbon dioxide gas is bubbled through a concentrated solution of sodium hydroxide.
15. Acetic acid solution is added to a solution of sodium hydrogen carbonate.

16. Excess potassium hydroxide solution is added to a solution of potassium dihydrogen phosphate.
17. Carbon dioxide gas is bubbled through a concentrated solution of potassium hydroxide.

Complex Ions

1. Concentrated(15M) ammonia solution is added in excess to a solution of copper(II) nitrate.
2. An excess of nitric acid solution is added to a solution of tetraamminecopper(II) sulfate.
3. Dilute hydrochloric acid is added to a solution of diamminesilver(I) nitrate.
4. Solid aluminum nitrate is dissolved in water.
5. A suspension of copper(II) hydroxide is treated with an excess of ammonia water.
6. A solution of diamminesilver(I) chloride is treated with dilute nitric acid.
7. An excess of concentrated ammonia solution is added to freshly precipitate copper(II) hydroxide.
8. Excess dilute nitric acid is added to a solution containing the tetraamminecadmium(II) ion.
9. An excess of ammonia is bubbled through a solution saturated with silver chloride.
10. Solid aluminum oxide is added to a solution of sodium hydroxide.
11. A concentrated solution of ammonia is added to a solution of zinc iodide.
12. An excess of sodium hydroxide solution is added to a solution of aluminum chloride.
13. A concentrated solution of ammonia is added to a solution of copper(II) chloride.
14. Excess concentrated sodium hydroxide solution is added to solid aluminum hydroxide.
15. Excess concentrated ammonia solution is added to a suspension of silver chloride.
16. Pellets of aluminum metal are added to a solution containing an excess of sodium hydroxide.
17. A suspension of zinc hydroxide is treated with concentrated sodium hydroxide solution.
18. Silver chloride is dissolved in excess ammonia solution.
19. Sodium hydroxide solution is added to a precipitate of aluminum hydroxide in water.
20. A drop of potassium thiocyanate is added to a solution of iron(III) chloride.
21. A concentrated solution of ammonia is added to a suspension of zinc hydroxide.
22. Excess concentrated potassium hydroxide solution is added to a precipitate of zinc hydroxide.
23. A solution of ammonium thiocyanate is added to a solution of iron(III) chloride.
24. Excess sodium cyanide is added to a solution of silver nitrate.

Addition

1. The gases boron trifluoride and ammonia are mixed.
2. A mixture of solid calcium oxide and solid tetraphosphorus decaoxide is heated.
3. Solid calcium oxide is exposed to a stream of carbon dioxide gas.
4. Solid calcium oxide is heated in the presence of sulfur trioxide gas.
5. Calcium metal is heated strongly in nitrogen gas.
6. Excess chlorine gas is passed over hot iron filings.
7. Powdered magnesium oxide is added to a container of carbon dioxide gas.
8. A piece of lithium metal is dropped into a container of nitrogen gas.
9. Magnesium metal is burned in nitrogen gas.
10. Sulfur dioxide gas is passed over solid calcium oxide.
11. Samples of boron trichloride gas and ammonia gas are mixed.

Decomposition

1. A solution of hydrogen peroxide is heated.
2. Solid magnesium carbonate is heated.
3. A solution of hydrogen peroxide is catalytically decomposed.
4. Solid potassium chlorate is heated in the presence of manganese dioxide as a catalyst.
5. Sodium hydrogen carbonate is dissolved in water.
6. Solid ammonium carbonate is heated.

KEY TO AP CHEMISTRY EQUATIONS BY TYPE
1968-82, 1985-88, 1990-93, 1995

Double Replacement

- Hydrogen sulfide is bubbled through a solution of silver nitrate.
$$\text{H}_2\text{S} + \text{Ag}^+ \rightarrow \text{Ag}_2\text{S} + \text{H}^+$$
- An excess of sodium hydroxide solution is added to a solution of magnesium nitrate.
$$\text{OH}^- + \text{Mg}^{2+} \rightarrow \text{Mg}(\text{OH})_2$$
- Solutions of sodium iodide and lead nitrate are mixed.
$$\text{I}^- + \text{Pb}^{2+} \rightarrow \text{PbI}_2$$
- A solution of ammonia is added to a solution of ferric chloride.
$$\text{NH}_3 + \text{H}_2\text{O} + \text{Fe}^{3+} \rightarrow \text{NH}_4^+ + \text{Fe}(\text{OH})_3$$
- Solutions of silver nitrate and sodium chromate are mixed.
$$\text{Ag}^+ + \text{CrO}_4^{2-} \rightarrow \text{Ag}_2\text{CrO}_4$$
- Excess silver acetate is added to a solution of trisodium phosphate.
$$\text{Ag}^+ + \text{PO}_4^{3-} \rightarrow \text{Ag}_3\text{PO}_4$$
- Manganese(II) nitrate solution is mixed with sodium hydroxide solution.
$$\text{Mn}^{2+} + \text{OH}^- \rightarrow \text{Mn}(\text{OH})_2$$
- A saturated solution of calcium hydroxide is added to a solution of magnesium chloride.
$$\text{Mg}^{2+} + \text{OH}^- \rightarrow \text{Mg}(\text{OH})_2$$
- Hydrogen sulfide gas is added to a solution of cadmium nitrate.
$$\text{H}_2\text{S} + \text{Cd}^{2+} \rightarrow \text{CdS} + \text{H}^+$$
- Dilute sulfuric acid is added to a solution of barium acetate.
$$\text{H}^+ + \text{SO}_4^{2-} + \text{Ba}^{2+} + \text{C}_2\text{H}_3\text{O}_2^- \rightarrow \text{BaSO}_4 + \text{HC}_2\text{H}_3\text{O}_2$$
- A precipitate is formed when solutions of trisodium phosphate and calcium chloride are mixed.
$$\text{PO}_4^{3-} + \text{Ca}^{2+} \rightarrow \text{Ca}_3(\text{PO}_4)_2$$
- A solution of copper(II) sulfate is added to a solution of barium hydroxide.
$$\text{Cu}^{2+} + \text{SO}_4^{2-} + \text{Ba}^{2+} + \text{OH}^- \rightarrow \text{Cu}(\text{OH})_2 + \text{BaSO}_4$$
- Equal volumes of dilute equimolar solutions of sodium carbonate and hydrochloric acid are mixed.
$$\text{H}^+ + \text{CO}_3^{2-} \rightarrow \text{HCO}_3^-$$
- Solid barium peroxide is added to cold dilute sulfuric acid.
$$\text{BaO}_2 + \text{H}^+ + \text{SO}_4^{2-} \rightarrow \text{BaSO}_4 + \text{H}_2\text{O}_2$$
- Excess hydrochloric acid solution is added to a solution of potassium sulfite.
$$\text{H}^+ + \text{SO}_3^{2-} \rightarrow \text{H}_2\text{O} + \text{SO}_2$$
- Dilute sulfuric acid is added to a solution of barium chloride.
$$\text{SO}_4^{2-} + \text{Ba}^{2+} \rightarrow \text{BaSO}_4$$
- A solution of sodium hydroxide is added to a solution of ammonium chloride.
$$\text{NH}_4^+ + \text{OH}^- \rightarrow \text{NH}_3 + \text{H}_2\text{O}$$
- Dilute hydrochloric acid is added to a solution of potassium carbonate.
$$\text{H}^+ + \text{CO}_3^{2-} \rightarrow \text{H}_2\text{O} + \text{CO}_2$$
- Gaseous hydrogen sulfide is bubbled through a solution of nickel(II) nitrate.
$$\text{H}_2\text{S} + \text{Ni}^{2+} \rightarrow \text{NiS} + \text{H}^+$$
- A solution of sodium sulfide is added to a solution of zinc nitrate.

- $S^{2-} + Zn^{2+} \rightarrow ZnS$
- Concentrated hydrochloric acid is added to solid manganese(II) sulfide.
 $H^+ + MnS \rightarrow H_2S + Mn^{2+}$
 - Solutions of tri-potassium phosphate and zinc nitrate are mixed.
 $PO_4^{3-} + Zn^{2+} \rightarrow Zn_3(PO_4)_2$
 - Dilute acetic acid solution is added to solid magnesium carbonate.
 $HC_2H_3O_2 + MgCO_3 \rightarrow H_2O + CO_2 + Mg^{2+} + C_2H_3O_2^-$
 - Gaseous hydrofluoric acid reacts with solid silicon dioxide.
 $HF + SiO_2 \rightarrow H_2O + SiF_4$
 - Equimolar amounts of trisodium phosphate and hydrogen chloride, both in solution, are mixed.
 $PO_4^{3-} + H^+ \rightarrow HPO_4^{2-}$
 - Ammonium chloride crystals are added to a solution of sodium hydroxide.
 $NH_4Cl + OH^- \rightarrow NH_3 + H_2O + Cl^-$
 - Hydrogen sulfide gas is bubbled through a solution of lead(II) nitrate.
 $H_2S + Pb^{2+} \rightarrow PbS + H^+$
 - Solutions of silver nitrate and sodium chromate are mixed.
 $Ag^+ + CrO_4^{2-} \rightarrow Ag_2CrO_4$
 - Solutions of sodium fluoride and dilute hydrochloric acid are mixed.
 $F^- + H^+ \rightarrow HF$
 - A saturated solution of barium hydroxide is mixed with a solution of iron(III) sulfate.
 $Ba^{2+} + OH^- + Fe^{3+} + SO_4^{2-} \rightarrow BaSO_4 + Fe(OH)_3$
 - A solution of ammonium sulfate is added to a potassium hydroxide solution.
 $NH_4^+ + OH^- \rightarrow NH_3 + H_2O$
 - A solution of ammonium sulfate is added to a saturated solution of barium hydroxide.
 $NH_4^+ + SO_4^{2-} + Ba^{2+} + OH^- \rightarrow NH_3 + H_2O + BaSO_4$
 - Dilute sulfuric acid is added to solid calcium fluoride.
 $H^+ + SO_4^{2-} + CaF_2 \rightarrow CaSO_4 + HF$
 - Dilute hydrochloric acid is added to a dilute solution of mercury(I) nitrate.
 $Cl^- + Hg_2^{2+} \rightarrow Hg_2Cl_2$
 - Dilute sulfuric acid is added to a solution of lithium hydrogen carbonate.
 $H^+ + HCO_3^- \rightarrow H_2O + CO_2$
 - Dilute hydrochloric acid is added to a solution of potassium sulfite.
 $H^+ + SO_3^{2-} \rightarrow H_2O + SO_2$
 - Carbon dioxide gas is bubbled through water containing a suspension of calcium carbonate.
 $CO_2 + CaCO_3 + H_2O \rightarrow HCO_3^- + Ca^{2+}$
 - Excess concentrated sulfuric acid is added to solid calcium phosphate.
 $H_2SO_4 + Ca_3(PO_4)_2 \rightarrow H_3PO_4 + CaSO_4$ (or $Ca^{2+} + SO_4^{2-}$)
 - Hydrogen sulfide gas is bubbled into a solution of mercury(II) chloride.
 $H_2S + Hg^{2+} \rightarrow HgS + H^+$

Single Replacement

- A piece of aluminum metal is added to a solution of silver nitrate.

- $\text{Al} + \text{Ag}^+ \rightarrow \text{Al}^{3+} + \text{Ag}$
- Aluminum metal is added to a solution of copper(II) chloride.
 $\text{Al} + \text{Cu}^{2+} \rightarrow \text{Al}^{3+} + \text{Cu}$
 - Hydrogen gas is passed over hot copper(II) oxide.
 $\text{H}_2 + \text{CuO} \rightarrow \text{H}_2\text{O} + \text{Cu}$
 - Small chunks of solid sodium are added to water.
 $\text{Na} + \text{H}_2\text{O} \rightarrow \text{Na}^+ + \text{OH}^- + \text{H}_2$
 - Calcium metal is added to a dilute solution of hydrochloric acid.
 $\text{Ca} + \text{H}^+ \rightarrow \text{Ca}^{2+} + \text{H}_2$
 - Magnesium turnings are added to a solution of iron(III) chloride.
 $\text{Mg} + \text{Fe}^{3+} \rightarrow \text{Mg}^{2+} + \text{Fe}$
 - Chlorine gas is bubbled into a solution of sodium bromide.
 $\text{Cl}_2 + \text{Br}^- \rightarrow \text{Cl}^- + \text{Br}_2$
 - A strip of magnesium is added to a solution of silver nitrate.
 $\text{Mg} + \text{Ag}^+ \rightarrow \text{Mg}^{2+} + \text{Ag}$
 - Solid calcium is added to warm water.
 $\text{Ca} + \text{H}_2\text{O} \rightarrow \text{Ca}^{2+} + \text{OH}^- + \text{H}_2$
 - Liquid bromine is added to a solution of potassium iodide.
 $\text{Br}_2 + \text{I}^- \rightarrow \text{Br}^- + \text{I}_2$
 - Chlorine gas is bubbled into a solution of potassium iodide.
 $\text{Cl}_2 + \text{I}^- \rightarrow \text{Cl}^- + \text{I}_2$
 - Lead foil is immersed in silver nitrate solution.
 $\text{Pb} + \text{Ag}^+ \rightarrow \text{Pb}^{2+} + \text{Ag}$
 - Solid zinc strips are added to a solution of copper(II) sulfate.
 $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$
 - Sodium metal is added to water.
 $\text{Na} + \text{H}_2\text{O} \rightarrow \text{Na}^+ + \text{OH}^- + \text{H}_2$
 - A bar of zinc metal is immersed in a solution of copper(II) sulfate.
 $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$

Anhydrides

- Excess water is added to solid calcium hydride.
 $\text{H}_2\text{O} + \text{CaH}_2 \rightarrow \text{Ca}^{2+} + \text{OH}^- \text{ or } (\text{Ca}(\text{OH})_2) + \text{H}_2$
- Solid lithium hydride is added to water.
 $\text{LiH} + \text{H}_2\text{O} \rightarrow \text{Li}^+ + \text{OH}^- + \text{H}_2$
- Liquid phosphorus trichloride is poured into a large excess of water.
 $\text{PCl}_3 + \text{H}_2\text{O} \rightarrow \text{H}_3\text{PO}_3 + \text{H}^+ + \text{Cl}^-$
- Solid sodium carbide is added to an excess of water.
 $\text{Na}_4\text{C} + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_2 + \text{Na}^+ + \text{OH}^-$
- Solid magnesium nitride is added to excess deuterium oxide.
 $\text{Mg}_3\text{N}_2 + \text{D}_2\text{O} \rightarrow \text{Mg}(\text{OD})_2 + \text{ND}_3$
- Water is added to a sample of pure phosphorus tribromide.
 $\text{H}_2\text{O} + \text{PBr}_3 \rightarrow \text{H}_3\text{PO}_3 + \text{H}^+ + \text{Br}^-$
- Water is added to a sample of pure sodium hydride.

- $\text{H}_2\text{O} + \text{NaH} \rightarrow \text{Na}^+ + \text{OH}^- + \text{H}_2$
- Dinitrogen trioxide gas is bubbled into water.
 $\text{N}_2\text{O}_3 + \text{H}_2\text{O} \rightarrow \text{HNO}_2$
 - Solid phosphorus pentachloride is added to excess water.
 $\text{PCl}_5 + \text{H}_2\text{O} \rightarrow \text{H}_3\text{PO}_4 + \text{H}^+ + \text{Cl}^-$
 - Solid dinitrogen pentoxide is added to water.
 $\text{N}_2\text{O}_5 + \text{H}_2\text{O} \rightarrow \text{H}^+ + \text{NO}_3^-$
 - Sulfur trioxide gas is added to excess water.
 $\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}^+ + \text{SO}_4^{2-}$
 - Solid sodium oxide is added to water.
 $\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow \text{Na}^+ + \text{OH}^-$
 - Phosphorus(V) oxytrichloride is added to water.
 $\text{POCl}_3 + \text{H}_2\text{O} \rightarrow \text{H}_3\text{PO}_4 + \text{H}^+ + \text{Cl}^-$
 - Water is added to a sample of solid magnesium nitride.
 $\text{H}_2\text{O} + \text{Mg}_3\text{N}_2 \rightarrow \text{Mg}(\text{OH})_2 + \text{NH}_3$
 - Solid potassium oxide is added to water.
 $\text{K}_2\text{O} + \text{H}_2\text{O} \rightarrow \text{K}^+ + \text{OH}^-$
 - Solid sodium cyanide is added to water.
 $\text{NaCN} + \text{H}_2\text{O} \rightarrow \text{HCN} + \text{Na}^+ + \text{OH}^-$
 - Trisodium phosphate crystals are added to water.
 $\text{Na}_3\text{PO}_4 + \text{H}_2\text{O} \rightarrow \text{Na}^+ + \text{OH}^- + \text{HPO}_4^{2-}$ (or H_2PO_4^-)
 - Solid lithium oxide is added to excess water.
 $\text{Li}_2\text{O} + \text{H}_2\text{O} \rightarrow \text{Li}^+ + \text{OH}^-$
 - Solid barium oxide is added to distilled water.
 $\text{BaO} + \text{H}_2\text{O} \rightarrow \text{Ba}^{2+} + \text{OH}^-$
 - Solid calcium hydride is added to distilled water.
 $\text{CaH}_2 + \text{H}_2\text{O} \rightarrow \text{Ca}^{2+} + \text{OH}^-$ or $(\text{Ca}(\text{OH})_2) + \text{H}_2$

Combustion

- Lithium metal is burned in air.
 $\text{Li} + \text{O}_2 \rightarrow \text{Li}_2\text{O}$
- The hydrocarbon hexane is burned in excess oxygen.
 $\text{C}_6\text{H}_{14} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- Gaseous diborane, B_2H_6 , is burned in excess oxygen.
 $\text{B}_2\text{H}_6 + \text{O}_2 \rightarrow \text{B}_2\text{O}_3 + \text{H}_2\text{O}$
- A piece of solid bismuth is heated strongly in oxygen.
 $\text{Bi} + \text{O}_2 \rightarrow \text{Bi}_2\text{O}_3$
- Solid zinc sulfide is heated in an excess of oxygen.
 $\text{ZnS} + \text{O}_2 \rightarrow \text{ZnO} + \text{SO}_2$
- Propanol is burned completely in air.
 $\text{C}_3\text{H}_7\text{OH} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- Excess oxygen gas is mixed with ammonia gas in the presence of platinum.
 $\text{O}_2 + \text{NH}_3 \xrightarrow{\text{Pt}} \text{NO}_2 + \text{H}_2\text{O}$
- Gaseous silane, SiH_4 , is burned in oxygen.

- $\text{SiH}_4 + \text{O}_2 \rightarrow \text{SiO}_2 + \text{H}_2\text{O}$
 9. Ethanol is completely burned in air.
 $\text{C}_2\text{H}_5\text{OH} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
 10. Solid copper(II) sulfide is heated strongly in oxygen gas.
 $\text{CuS} + \text{O}_2 \rightarrow \text{CuO} + \text{SO}_2$
 11. Ethanol is burned in oxygen.
 $\text{C}_2\text{H}_5\text{OH} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$

Redox

- Iron(III) ions are reduced by iodide ions.
 $\text{Fe}^{3+} + \text{I}^- \rightarrow \text{Fe}^{2+} + \text{I}_2$
- Potassium permanganate solution is added to concentrated hydrochloric acid.
 $\text{MnO}_4^- + \text{H}^+ + \text{Cl}^- \rightarrow \text{Mn}^{2+} + \text{Cl}_2 + \text{H}_2\text{O}$
- Magnesium metal is added to dilute nitric acid, giving as one of the products a compound in which the oxidation number for nitrogen is -3.
 $\text{Mg} + \text{H}^+ + \text{NO}_3^- \rightarrow \text{NH}_4^+ + \text{Mg}^{2+} + \text{H}_2\text{O}$
- A solution of potassium iodide is electrolyzed.
 $\text{I}^- + \text{H}_2\text{O} \rightarrow \text{I}_2 + \text{H}_2 + \text{OH}^-$
- Potassium dichromate solution is added to an acidified solution of sodium sulfite.
 $\text{Cr}_2\text{O}_7^{2-} + \text{SO}_3^{2-} + \text{H}^+ \rightarrow \text{Cr}^{3+} + \text{SO}_4^{2-} + \text{H}_2\text{O}$
- Solutions of potassium iodide, potassium iodate, and dilute sulfuric acid are mixed.
 $\text{I}^- + \text{IO}_3^- + \text{H}^+ \rightarrow \text{H}_2\text{O} + \text{I}_2$
- A solution of tin(II) sulfate is added to a solution of iron(III) sulfate.
 $\text{Sn}^{2+} + \text{Fe}^{3+} \rightarrow \text{Sn}^{4+} + \text{Fe}^{2+}$
- Metallic copper is heated with concentrated sulfuric acid.
 $\text{Cu} + \text{H}_2\text{SO}_4 \rightarrow \text{Cu}^{2+} + \text{SO}_2 + \text{H}_2\text{O}$
- Manganese(IV) oxide is added to warm, concentrated hydrobromic acid.
 $\text{MnO}_2 + \text{H}^+ + \text{Br}^- \rightarrow \text{Mn}^{2+} + \text{Br}_2 + \text{H}_2\text{O}$
- Chlorine gas is bubbled into cold dilute sodium hydroxide.
 $\text{Cl}_2 + \text{OH}^- \rightarrow \text{ClO}^- + \text{Cl}^- + \text{H}_2\text{O}$
- Solid iron(III) oxide is heated in excess carbon monoxide.
 $\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow \text{Fe} + \text{CO}_2$
- Hydrogen peroxide solution is added to acidified potassium iodide solution.
 $\text{H}_2\text{O}_2 + \text{H}^+ + \text{I}^- \rightarrow \text{H}_2\text{O} + \text{I}_2$
- Hydrogen peroxide is added to an acidified solution of potassium dichromate.
 $\text{H}_2\text{O}_2 + \text{H}^+ + \text{Cr}_2\text{O}_7^{2-} \rightarrow \text{H}_2\text{O} + \text{Cr}^{3+} + \text{O}_2$
- Sulfur dioxide gas is bubbled through an acidified solution of potassium permanganate.
 $\text{SO}_2 + \text{H}^+ + \text{MnO}_4^- \rightarrow \text{Mn}^{2+} + \text{H}_2\text{O} + \text{SO}_4^{2-}$
- A solution containing tin(II) ions is added to an acidified solution of potassium dichromate.
 $\text{Sn}^{2+} + \text{H}^+ + \text{Cr}_2\text{O}_7^{2-} \rightarrow \text{Cr}^{3+} + \text{Sn}^{4+} + \text{H}_2\text{O}$
- Solid silver sulfide is warmed with dilute nitric acid.
 $\text{Ag}_2\text{S} + \text{H}^+ + \text{NO}_3^- \rightarrow \text{Ag}^+ + \text{S} + \text{NO}_2 + \text{H}_2\text{O}$
- A dilute solution of sulfuric acid is electrolyzed between platinum electrodes.
 $\text{H}_2\text{O} \rightarrow \text{H}_2 + \text{O}_2$
- Pellets of lead are dropped into hot sulfuric acid.
 $\text{Pb} + \text{H}^+ + \text{SO}_4^{2-} \rightarrow \text{H}_2\text{O} + \text{SO}_2 + \text{Pb}^{2+}$ (or PbSO_4)

19. Potassium permanganate solution is added to a solution of oxalic acid, $\text{H}_2\text{C}_2\text{O}_4$, acidified with a few drops of sulfuric acid.

$$\text{MnO}_4^- + \text{H}_2\text{C}_2\text{O}_4 + \text{H}^+ \rightarrow \text{Mn}^{2+} + \text{CO}_2 + \text{H}_2\text{O}$$
20. Powdered iron is added to a solution of iron(III) sulfate.

$$\text{Fe} + \text{Fe}^{3+} \rightarrow \text{Fe}^{2+}$$
21. A concentrated solution of hydrochloric acid is added to powdered manganese dioxide and gently heated.

$$\text{H}^+ + \text{Cl}^- + \text{MnO}_2 \rightarrow \text{Cl}_2 + \text{Mn}^{2+} + \text{H}_2\text{O}$$
22. A strip of copper metal is added to a concentrated solution of sulfuric acid.

$$\text{Cu} + \text{H}^+ + \text{SO}_4^{2-} \rightarrow \text{Cu}^{2+} + \text{SO}_2 + \text{H}_2\text{O}$$
23. Copper(II) sulfide is oxidized by dilute nitric acid.

$$\text{CuS} + \text{H}^+ + \text{NO}_3^- \rightarrow \text{Cu}^{2+} + \text{NO} + \text{H}_2\text{O} + \text{S}$$
24. A solution of copper(II) sulfate is electrolyzed using inert electrodes.

$$\text{Cu}^{2+} + \text{H}_2\text{O} \rightarrow \text{O}_2 + \text{H}^+ + \text{Cu}$$
25. A solution of potassium iodide is added to an acidified solution of potassium dichromate.

$$\text{I}^- + \text{H}^+ + \text{Cr}_2\text{O}_7^{2-} \rightarrow \text{I}_2 + \text{Cr}^{3+} + \text{H}_2\text{O}$$
26. Hydrogen peroxide solution is added to a solution of iron(II) sulfate.

$$\text{H}_2\text{O}_2 + \text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{H}_2\text{O}$$
27. Solid silver is added to a dilute nitric acid (6M) solution.

$$\text{Ag} + \text{H}^+ + \text{NO}_3^- \rightarrow \text{Ag}^+ + \text{NO} + \text{H}_2\text{O}$$
28. A solution of formic acid, HCOOH , is oxidized by an acidified solution of potassium dichromate.

$$\text{HCOOH} + \text{H}^+ + \text{Cr}_2\text{O}_7^{2-} \rightarrow \text{H}_2\text{O} + \text{Cr}^{3+} + \text{CO}_2$$
29. A piece of iron is added to a solution of iron(III) sulfate.

$$\text{Fe} + \text{Fe}^{3+} \rightarrow \text{Fe}^{2+}$$
30. An acidified solution of potassium permanganate is added to a solution of sodium sulfite.

$$\text{H}^+ + \text{MnO}_4^- + \text{SO}_3^{2-} \rightarrow \text{Mn}^{2+} + \text{SO}_4^{2-} + \text{H}_2\text{O}$$
31. A solution of tin(II) chloride is added to a solution of iron(III) sulfate.

$$\text{Sn}^{2+} + \text{Fe}^{3+} \rightarrow \text{Sn}^{4+} + \text{Fe}^{2+}$$
32. Concentrated hydrochloric acid solution is added to solid manganese(IV) oxide and the reactants are heated.

$$\text{H}^+ + \text{Cl}^- + \text{MnO}_2 \rightarrow \text{Mn}^{2+} + \text{Cl}_2 + \text{H}_2\text{O}$$
33. A strip of copper is immersed in dilute nitric acid.

$$\text{Cu} + \text{H}^+ + \text{NO}_3^- \rightarrow \text{Cu}^{2+} + \text{NO} + \text{H}_2\text{O}$$
34. Potassium permanganate solution is added to an acidic solution of hydrogen peroxide.

$$\text{MnO}_4^- + \text{H}^+ + \text{H}_2\text{O}_2 \rightarrow \text{Mn}^{2+} + \text{O}_2 + \text{H}_2\text{O}$$
35. Solid copper is added to a dilute nitric acid solution.

$$\text{Cu} + \text{H}^+ + \text{NO}_3^- \rightarrow \text{Cu}^{2+} + \text{NO} + \text{H}_2\text{O}$$
36. Chlorine gas is bubbled into a cold solution of dilute sodium hydroxide.

$$\text{Cl}_2 + \text{OH}^- \rightarrow \text{ClO}^- + \text{Cl}^- + \text{H}_2\text{O}$$
37. A solution of potassium permanganate is mixed with an alkaline solution of sodium sulfite.

$$\text{MnO}_4^- + \text{OH}^- + \text{SO}_3^{2-} \rightarrow \text{SO}_4^{2-} + \text{H}_2\text{O} + \text{MnO}_4^{2-} \text{ (or } \text{MnO}_2\text{)}$$
38. Solid sodium dichromate is added to an acidified solution of sodium iodide.

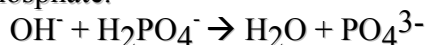
$$\text{Na}_2\text{Cr}_2\text{O}_7 + \text{H}^+ + \text{I}^- \rightarrow \text{Cr}^{3+} + \text{I}_2 + \text{H}_2\text{O} + \text{Na}^+$$
39. Hydrogen gas is passed over hot iron(III) oxide.

- $\text{H}_2 + \text{Fe}_2\text{O}_3 \rightarrow \text{Fe} + \text{H}_2\text{O}$
40. Solutions of potassium iodide and potassium iodate are mixed in acid solution.
 $\text{I}^- + \text{IO}_3^- + \text{H}^+ \rightarrow \text{I}_2 + \text{H}_2\text{O}$
41. Hydrogen peroxide is added to an acidified solution of sodium bromide.
 $\text{H}_2\text{O}_2 + \text{H}^+ + \text{Br}^- \rightarrow \text{Br}_2 + \text{H}_2\text{O}$
42. Chlorine gas is bubbled into a cold, dilute solution of potassium hydroxide.
 $\text{Cl}_2 + \text{OH}^- \rightarrow \text{Cl}^- + \text{ClO}^- + \text{H}_2\text{O}$
43. A solution of iron(II) nitrate is exposed to air for an extended period of time.
 $\text{Fe}^{2+} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$

Acid-Base Neutralizations

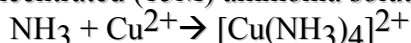
1. Solutions of ammonia and hydrofluoric acid are mixed.
 $\text{NH}_3 + \text{HF} \rightarrow \text{NH}_4^+ + \text{F}^-$
2. Hydrogen sulfide gas is bubbled through a solution of potassium hydroxide.
 $\text{H}_2\text{S} + \text{OH}^- \rightarrow \text{H}_2\text{O} + \text{S}^{2-}$
3. A solution of sulfuric acid is added to a solution of barium hydroxide until the same number of moles of each compound has been added.
 $\text{H}^+ + \text{SO}_4^{2-} + \text{Ba}^{2+} + \text{OH}^- \rightarrow \text{H}_2\text{O} + \text{BaSO}_4$
4. A solution of sodium hydroxide is added to a solution of sodium dihydrogen phosphate until the same number of moles of each compound has been added.
 $\text{OH}^- + \text{H}_2\text{PO}_4^- \rightarrow \text{HPO}_4^{2-} + \text{H}_2\text{O}$
5. Dilute nitric acid is added to crystals of pure calcium oxide.
 $\text{H}^+ + \text{CaO} \rightarrow \text{H}_2\text{O} + \text{Ca}^{2+}$
6. Equal volumes of 0.1-molar sulfuric acid and 0.1-molar potassium hydroxide are mixed.
 $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$
7. A solution of ammonia is added to a dilute solution of acetic acid.
 $\text{NH}_3 + \text{HC}_2\text{H}_3\text{O}_2 \rightarrow \text{NH}_4^+ + \text{C}_2\text{H}_3\text{O}_2^-$
8. Excess sulfur dioxide gas is bubbled through a dilute solution of potassium hydroxide.
 $\text{SO}_2 + \text{OH}^- \rightarrow \text{H}_2\text{O} + \text{SO}_3^{2-}$
9. Sulfur dioxide gas is bubbled into an excess of a saturated solution of calcium hydroxide.
 $\text{SO}_2 + \text{Ca}^{2+} + \text{OH}^- \rightarrow \text{CaSO}_3 + \text{H}_2\text{O}$
10. A solution of sodium hydroxide is added to a solution of calcium hydrogen carbonate until the number of moles of sodium hydroxide added is twice the number of moles of the calcium salt.
 $\text{OH}^- + \text{Ca}^{2+} + \text{HCO}_3^- \rightarrow \text{H}_2\text{O} + \text{CaCO}_3$
11. Equal volumes of 0.1M hydrochloric acid and 0.1M sodium monohydrogen phosphate are mixed.
 $\text{H}^+ + \text{HPO}_4^{2-} \rightarrow \text{H}_2\text{PO}_4^-$
12. Hydrogen sulfide gas is bubbled through excess potassium hydroxide solution.
 $\text{H}_2\text{S} + \text{OH}^- \rightarrow \text{H}_2\text{O} + \text{S}^{2-}$
13. Ammonia gas and carbon dioxide gas are bubbled into water.
 $\text{NH}_3 + \text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{NH}_4^+ + \text{CO}_3^{2-}$
14. Carbon dioxide gas is bubbled through a concentrated solution of sodium hydroxide.
 $\text{CO}_2 + \text{OH}^- \rightarrow \text{CO}_3^{2-} + \text{H}_2\text{O}$
15. Acetic acid solution is added to a solution of sodium hydrogen carbonate.
 $\text{HC}_2\text{H}_3\text{O}_2 + \text{HCO}_3^- \rightarrow \text{H}_2\text{O} + \text{CO}_2 + \text{C}_2\text{H}_3\text{O}_2^-$

16. Excess potassium hydroxide solution is added to a solution of potassium dihydrogen phosphate.

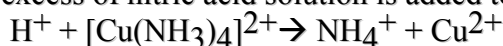


Complex Ions

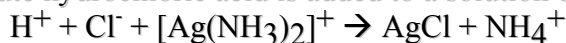
1. Concentrated (15M) ammonia solution is added in excess to a solution of copper(II) nitrate.



2. An excess of nitric acid solution is added to a solution of tetraamminecopper(II) sulfate.



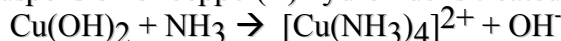
3. Dilute hydrochloric acid is added to a solution of diamminesilver(I) nitrate.



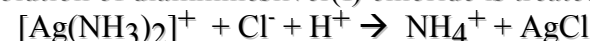
4. Solid aluminum nitrate is dissolved in water.



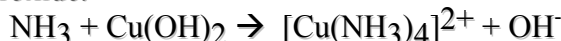
5. A suspension of copper(II) hydroxide is treated with an excess of ammonia water.



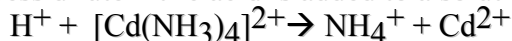
6. A solution of diamminesilver(I) chloride is treated with dilute nitric acid.



7. An excess of concentrated ammonia solution is added to freshly precipitated copper(II) hydroxide.



8. Excess dilute nitric acid is added to a solution containing the tetraamminecadmium(II) ion.



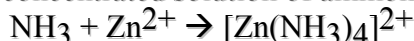
9. An excess of ammonia is bubbled through a solution saturated with silver chloride.



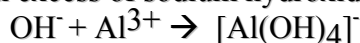
10. Solid aluminum oxide is added to a solution of sodium hydroxide.



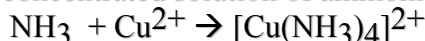
11. A concentrated solution of ammonia is added to a solution of zinc iodide.



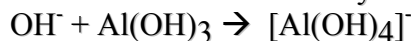
12. An excess of sodium hydroxide solution is added to a solution of aluminum chloride.



13. A concentrated solution of ammonia is added to a solution of copper(II) chloride.



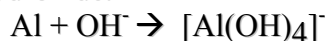
14. Excess concentrated sodium hydroxide solution is added to solid aluminum hydroxide.



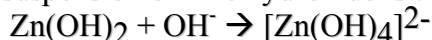
15. Excess concentrated ammonia solution is added to a suspension of silver chloride.



16. Pellets of aluminum metal are added to a solution containing an excess of sodium hydroxide.



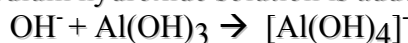
17. A suspension of zinc hydroxide is treated with concentrated sodium hydroxide solution.



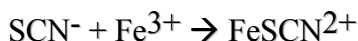
18. Silver chloride is dissolved in excess ammonia solution.



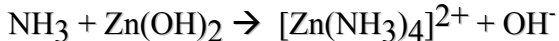
19. Sodium hydroxide solution is added to a precipitate of aluminum hydroxide in water.



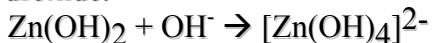
20. A drop of potassium thiocyanate is added to a solution of iron(III) chloride.



21. A concentrated solution of ammonia is added to a suspension of zinc hydroxide.

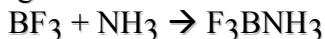


22. Excess concentrated potassium hydroxide solution is added to a precipitate of zinc hydroxide.

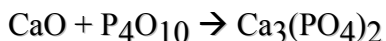


Addition

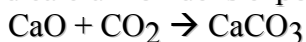
1. The gases boron trifluoride and ammonia are mixed.



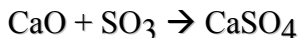
2. A mixture of solid calcium oxide and solid tetraphosphorus decaoxide is heated.



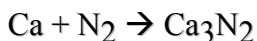
3. Solid calcium oxide is exposed to a stream of carbon dioxide gas.



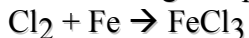
4. Solid calcium oxide is heated in the presence of sulfur trioxide gas.



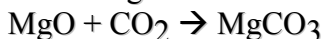
5. Calcium metal is heated strongly in nitrogen gas.



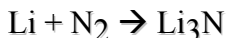
6. Excess chlorine gas is passed over hot iron filings.



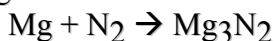
7. Powdered magnesium oxide is added to a container of carbon dioxide gas.



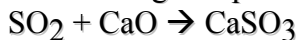
8. A piece of lithium metal is dropped into a container of nitrogen gas.



9. Magnesium metal is burned in nitrogen gas.

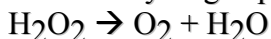


10. Sulfur dioxide gas is passed over solid calcium oxide.



Decomposition

1. A solution of hydrogen peroxide is heated.



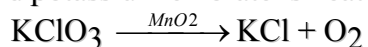
2. Solid magnesium carbonate is heated.



3. A solution of hydrogen peroxide is catalytically decomposed.



4. Solid potassium chlorate is heated in the presence of manganese dioxide as a catalyst.



5. Sodium hydrogen carbonate is dissolved in water.

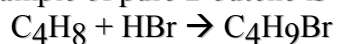


6. Solid ammonium carbonate is heated.

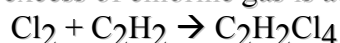


ORGANIC

1. A sample of pure 2-butene is treated with hydrogen bromide gas.



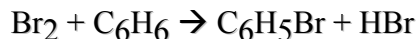
2. An excess of chlorine gas is added to pure acetylene.



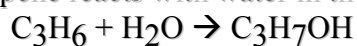
3. Ethyl acetate is treated with a solution of sodium hydroxide.



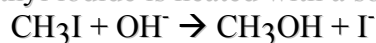
4. Benzene is treated with bromine in the presence of a catalyst.



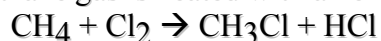
5. Propene reacts with water in the presence of a catalyst.



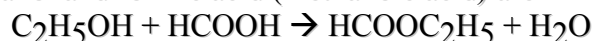
6. Methyl iodide is heated with a solution of sodium hydroxide.



7. Methane gas is heated with an excess of chlorine gas.



8. Ethanol and formic acid (methanoic acid) are mixed **and warmed**.



9. Ethene (ethylene) gas is bubbled through a solution of bromine.

