Remember that on the AP exam you may only use the periodic table. No solubility chart. However much information will be embedded in the question.

1. A strip of magnesium is added to a solution of silver nitrate

2. Aluminum metal is dropped into an solution of zinc chloride

3. Solid silver is dropped into an solution of gold(II) nitrate

4. Aluminum foil is dropped into a solution of nitric acid.

5. Solid barium is added to chlorous acid

6. Potassium metal is dropped into water

7. Chromium(II) nitrate solution is combined with iron(III) nitrate solution.

8. Iron(II) nitrate solution is mixed with cobalt(III) chloride solution

9. Liquid bromine is added to an aqueous sodium iodide solution

10. Hydrogen gas is passed over hot copper(II) oxide.

11. Small chunks of solid sodium is added to water.

12. Magnesium metal is added to a dilute solution of nitric acid.

13. Chlorine gas is bubbled into a solution of potassium iodide.

1. *The magnesium will replace the silver in solution. Remember to leave out the spectator ions.*

   $Mg + 2Ag^{+} \rightarrow Mg^{+2} + 2Ag$

2. *Remember that zinc always forms 2+ charge. Be sure and eliminate spectator ions, and remember that charge must also balance.*

   $2Al + 3Zn^{2+} \rightarrow 3Zn + 2Al^{3+}$

3. *Be sure and eliminate spectator ions, and remember that charge must also balance.*

   $2Ag + Au^{2+} \rightarrow Au + 2Ag^{+}$

4. *When hydrogens are replaced, and "take their electron back" they must leave as a diatomic molecule.*

   $2Al + 6H^{+} \rightarrow 2Al^{3+} + 3H_2$

5. *Be alert for weak acids which must be written as molecules.*

   $Ba + 2HClO_2 \rightarrow Ba^{2+} + H_2 + 2\ ClO_2^{-}$

6. *When alkali metals replace hydrogen in water, it might be easier to remember the products if you think of water as HOH, and it is the first* H^{+} *that is what is being replaced, this is why sodium hydroxide is a product, not sodium oxide.*

   $2K + 2H_2O \rightarrow 2K^{+} + 2OH^{-} + H_2$

7. *At first it might appear as if nothing would happen, but a reaction will always happen on the AP exam questions. Since there can not be any precipitation formation, and it clearly is not an acid base reaction, can think single replacement. Remember that one element must be oxidized while another is reduced. You can use your blue Reduction table to give you ideas of what charge state is preferred.*

   $Cr^{2+} + Fe^{3+} \rightarrow Cr^{3+} + Fe^{2+}$ OR $3\ Cr^{2+} + 2\ Fe^{3+} \rightarrow 3\ Cr^{3+} + 2\ Fe$

8. *This is the same type of reaction as #6.*

   $Fe^{2+} + Co^{3+} \rightarrow Fe^{3+} + Co^{2+}$

9. *Halogens can replace each other. Their reactivity follows their order within their family on the periodic table.*

   $Br_2 + I^{-} \rightarrow I_2 + Br^{-}$

10. *In this reaction that should look like a single replacement, the hydrogen is more likely to behave as a positive ion, thus it will replace the copper not the oxygen.*

    $H_2 + CuO \rightarrow H_2O + Cu$

11. *This is analogous to #6*

    $2Na + 2H_2O \rightarrow 2Na^{+} + 2OH^{-} + H_2$

12. *This is analogous to #4*

    $Mg + H^{+} \rightarrow Mg^{2+} + H_2$

13. *This is analogous to #9*

    $Cl_2 + I^{-} \rightarrow I_2 + Cl^{-}$

Remember that on the AP exam you may only use the periodic table. No solubility chart. However much information will be embedded in the question.

1. Aqueous solutions of zinc sulfate and sodium phosphate are mixed.

2. Hydrofluoric acid is combined with a solution of lead(II) nitrate.

3. Solid calcium sulfide is sprinkled into dilute hydrochloric acid.

4. An aqueous solution of lead(II) acetate reacts with hydrochloric acid.

5. Solid sodium carbonate is stirred into hydrobromic acid.

6. Nitric acid is reacted with an aqueous solution of calcium acetate.

7. Hydrochloric acid is poured over powdered potassium carbonate.

8. An aqueous solution of cadmium chloride is reacted with an aqueous solution of potassium phosphate.

9. A solution of hydrofluoric acid is poured over barium carbonate crystals.

10. Hydroiodic acid is poured over potassium sulfite.

11. An aqueous solution of barium hydroxide is reacted with an aqueous solution of iron(III) sulfate.

12. A solution of sodium hydroxide is poured into a solution of magnesium chloride.

13. Aqueous lead(II) nitrate is combined with potassium iodide.

Before you check the answer, read the hint and reconsider your own answer to see if you can improve it.

1. *We can only hope for the uncomplicated precipitation reaction.*

   $3Zn^{2+} + 2PO_4^{3-} \rightarrow Zn_3(PO_4)_2$

2. *Anytime we see "acid," we know it is in solution, but we must decide if the acid is strong or weak. Remember to write weak acids as molecules (and strong acids as ions, and possibly the anion might be a spectator and drop out of the reaction). Fluorides are not particularly soluble compounds.*

   $2HF + Pb^{2+} \rightarrow PbF_2 + 2H^+$

3. *Dihydrogen sulfide, while it is an acid, in large part it will form a gas and drive the reaction forward. Crystals/solid/ powdered all refer to a compound that should not be dissociated.*

   $CaS + 2H^+ \rightarrow H_2S + Ca^{2+}$

4. *Lead ions precipitate with most everything except, except nitrates and acetates. Don't forget that weak acids should be represented as molecules, not ions.*

   $Pb^{2+} + 2C_2H_3O_2^- + 2H^+ + 2Cl^- \rightarrow PbCl_2 + 2HC_2H_3O_2$

5. *Remember that whenever carbonic acid shows up as a product, it is a "phantom," decompose it.*

   $2H^+ + Na_2CO_3\ (\rightarrow H_2CO_3) \rightarrow H_2O + CO_2 + 2Na^+$

6. *Watch for the formation of molecular weak acids - they may show up on the product side.*

   $H^+ + C_2H_3O_2^- \rightarrow HC_2H_3O_2$

7. *Watch for the word solid... and don't forget the decomposing carbonic acid.*

   $2H^+ + K_2CO_3\ (\rightarrow H_2CO_3) \rightarrow CO_2 + H_2O + 2K^+$

8. *Whew, thank goodness for an uncomplicated precipitation reaction.*

   $3Cd^{2+} + 2PO_4^{3-} \rightarrow Cd_3(PO_4)_2$

9. *Remember that fluoride salts are often insoluble, weak acids should be represented as molecules, watch for the "phantom" − the carbonic acid that decomposes.*

   $2HF + BaCO_3 \rightarrow H_2O + CO_2 + BaF_2$

10. *Since it does not say "solution" of potassium sulfite and the acid is "poured over," the implication is the potassium sulfite is solid. Watch out for yet another "phantom," sulfurous acid. Just like carbonic acid, it too will decompose when formed.*

    $2H^+ + K_2SO_3\ (\rightarrow H_2SO_3) \rightarrow H_2O + SO_2 + 2K^+$

11. *Beware of the rarely occurring, but actually possible, double precipitate reaction ! AP would not hold you responsible for knowing that barium sulfate is insoluble. There would be some hint given in the problem.*

    $3Ba^{2+} + 6OH^- + 2Fe^{3+} + 3SO_4^{2-} \rightarrow 3BaSO_4 + 2Fe(OH)_3$

12. *Yippee ! another uncomplicated precipitation reaction. We know that magnesium hydroxide is quite insoluble from our Milk of Magnesia demonstration.*

    $2OH^- + Mg^{2+} \rightarrow Mg(OH)_2$

13. *Yeah, one of your favorites, a very yellow, precipitation reaction.*

    $2I^- + Pb^{2+} \rightarrow PbI_2$

Remember that on the AP exam you may only use the periodic table. No solubility chart. However much information will be embedded in the question.

1. A 0.40 M solution of acetic acid is reacted with a 0.20 M lithium hydroxide solution

2. A solution of nitric acid is combined with a suspension of magnesium hydroxide.

3. A solution of sulfuric acid is poured over copper(I) hydroxide crystals

4. 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.

5. Hydrogen sulfide gas is bubbled through a solution of potassium hydroxide.

6. 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.

7. Equal volumes of 0.1-molar sulfuric acid and 0.1-molar potassium hydroxide are mixed.

8. Excess potassium hydroxide solution is added to a solution of potassium hydrogen phosphate

9. Excess hydrochloric acid solution is added to a solution of sodium dihydrogen phosphate

10. 0.1 M ammonia reacts with 0.2 M hydrobromic acid.

11. A solution of ammonia is added to a dilute solution of acetic acid.

12. A solution of ammonia and hydrofluoric acid are combined.

1. *Pay close attention to whether or not you are working with strong or weak acids and remember that acetic acid is a weak acid and must be written as a molecule.*

   $HC_2H_3O_2 + OH^- \rightarrow H_2O + C_2H_3O_2^-$

2. *Remember to check the solubility of magnesium hydroxide − but the very fact that it says "suspension", you are being told solid particles.*

   $2H^+ + Mg(OH)_2 \rightarrow 2H_2O + Mg^{2+}$

3. *Remember that copper(I) hydroxide crystals must be written as a compound. Sulfuric acid is a strong acid. The reaction after splitting up the ionized species would be:* $2H^+ + SO_4^{2-} + 2CuOH \rightarrow 2H_2O + 2Cu^+ + SO_4^{2-}$ *then after eliminating the sulfate spectator ion would be* $2H^+ + 2CuOH \rightarrow 2H_2O + 2Cu^+$ *and then this would need to be reduced to whole number ratios since the directions request this, and a net ionic equation should be the same whether the acid used were* H_2SO_4 *or* HNO_3.

   $H^+ + CuOH \rightarrow H_2O + Cu^+$

4. *Pay close attention to whether or not you are working with strong or weak acids and bases, and be on the lookout for any precipitates that may form during the neutralization. In this case, "*until the same number of moles of each compound has been added" *is a distractor and does not change how you would write the reaction.*

   $H^+ + SO_4^{2-} + Ba^{2+} + OH^- \rightarrow H_2O + BaSO_4$

5. *Remember that gases are always written as molecular species, which means that any ions that result from them may not be eliminated as spectator ions.*

   $H_2S + 2\,OH^- \rightarrow 2\,H_2O + S^{2-}$

6. *Remember that the dihydrogen phosphate ion has just that; two hydrogens attached to the phosphate ion.*

   $OH^- + H_2PO_4^- \rightarrow H_2O + HPO_4^{2-}$

7. *We can only hope that you get a simple strong acid/strong base combination on the AP exam.*

   $H^+ + OH^- \rightarrow H_2O$

8. *Hydrogen phosphate, in contrast to dihydrogen phosphate has only one hydrogen attached to the phosphate ion*

   $OH^- + HPO_4^{2-} \rightarrow H_2O + PO_4^{3-}$

9. *In this case acid, H+ ions, is added to dihydrogen phosphate, which will form the weak acid, which can be present as molecules in solution. The same reaction would occur if the acid were added to the monohydrogen phosphate ion.* $H^+ + HPO_4^{2-} \rightarrow H_2PO_4^-$ *(or push even further to* H_3PO_4*, AP would likely accept either answer)*

   $H^+ + H_2PO_4^- \rightarrow H_3PO_4$

10. *Ammonia is a molecular compound that acts as a base − accepting a proton (*H^+*). Remember your strong acids.*

    $NH_3 + H^+ \rightarrow NH_4^+$

11. *Ammonia is a molecular compound that acts as a base − accepting a proton (*H^+*). Don't forget that acetic acid is a weak acid.*

    $NH_3 + HC_2H_3O_2 \rightarrow NH_4^+ + C_2H_3O_2^-$

12. *Watch out for weak acids and bases, remember that they must be written as molecules not ions.*

    $NH_3 + HF \rightarrow NH_4^+ + F^-$

Remember that on the AP exam you may only use the periodic table. No solubility chart. However much information will be embedded in the question.

1. Sodium oxide powder is sprinkled in water.

2. Dinitrogen pentoxide is bubbled through water.

3. Dinitrogen trioxide gas is bubbled into water.

4. Diphosphorus pentoxide is bubbled through water.

5. Rubidium hydride is placed into distilled water

6. Solid copper(II) hydride is dropped into water

7. Solid strontium hydride reacts with hydrochloric acid

8. Powdered barium oxide is stirred into aqueous hydrochloric acid.

9. Solid potassium oxide is added to water.

10. Sulfur dioxide is bubbled through a dilute solution of sodium hydroxide.

11. Gaseous sulfur dioxide bubbled through an aqueous solution of calcium hydroxide.

12. 1.0 M hydrochloric acid is poured over calcium oxide powder.

13. Ammonia and carbon dioxide gases are bubbled into cold distilled water.

14. Solid phosphorus pentachloride is added to excess water.

1. *Use page 4 of the Notes page. Metal oxides in water always turn into hydroxides. (Metal oxides are called basic anhydrides.) Don't forget to write substances that are substantially ionized as separate ions.*

$Na_2O + H_2O \rightarrow 2Na^+ + 2OH^-$

2. *Nonmetal oxides in water make acids, these nonmetal oxides are called acid anhydrides. Which acid forms, you ask? Make the acid that will maintain the same oxidation number in the nonmetal. In this reaction, the oxidation number of nitrogen is +5 as a reactant and as a product. Don't forget to write the strong acid as separated ions.*

$N_2O_5 + H_2O \rightarrow 2H^+ + 2NO_3^-$

3. *Note that the nitrous acid is formed because of the +3 oxidation state of nitrogen.*

$N_2O_3 + H_2O \rightarrow 2HNO_2$

4. *Another acid anhydride.*

$P_2O_5 + 3H_2O \rightarrow 2H_3PO_4$

5. *Metal hydrides (compounds in which hydrogen has an oxidation state of −1) combined with water always turn into metal hydroxides and hydrogen gas. Don't forget that soluble ionic compounds, such as the rubidium hydroxide must be written as separated ions.*

$RbH + H_2O \rightarrow Rb^+ + OH^- + H_2$

6. *Another metal hydride, but this time the hydroxide that is formed, copper (II) hydroxide is insoluble. Note that copper maintains the same oxidation state.*

$CuH_2 + 2H_2O \rightarrow Cu(OH)_2 + 2H_2$

7. *Consider first what a hydride does in water (since hydrochloric acid is a solution, made with water), thus turns into a hydroxide − then consider what that hydroxide will do in acid − neutralize and make water, this makes water drop*

$SrH_2 + 2H^+ \rightarrow Sr^{2+} + 2H_2$

8. *Remember that in #7 and #8, the hydrochloric acid is a strong acid and must be written as ionized, and the resulting soluble metal chloride product makes the chloride end up as a spectator ion, and must be dropped out of the reaction.*

$BaO + 2H^+ \rightarrow Ba^{2+} + H_2O$

9. *Another metal oxide in water − basic anhydride.*

$K_2O + H_2O \rightarrow 2K^+ + 2OH^-$

10. *This is a two-for-one reaction. The sulfur dioxide reacts as an acid anhydride, making the appropriate acid, but then it neutralizes with the soluble base. Remember the sulfur maintains its same oxidation state, +4.*

$SO_2 + OH^- \rightarrow H_2O + SO_3^{2-}$

11. *This is the same as the previous reaction, however, the calcium combines to make an insoluble precipitate of alcium sulfite − most sulfites (except for alkali sulfites) will be insoluble.*

$SO_2 + Ca^{2+} + OH^- \rightarrow H_2O + CaSO_3$

12. *Strong acid and an metal oxide, another two-for-one reactions. First the formation of the metal hydroxide in the water part of the hydrochloric acid solution, then the neutralization of that hydroxide.*

$H^+ + CaO \rightarrow H_2O + Ca^{2+}$

13. *This seems like a contradiction to Decomp #4 reaction (also listed as a "phantom" on page 5) however, a reaction must occur (or it would not be on the test), and perhaps the cold water helps keep the formation back into gases − so just assume that it is the reverse reaction, and the formation of the ions.*

$NH_3 + CO_2 + H_2O \rightarrow NH_4^+ + CO_3^{2-}$

14. *This is a tough reaction and is not likely to end up on the AP exam... but check it out on the notes page 4, 4th bullet down the page.*

$2PCl_5 + 8H_2O \rightarrow 2H_3PO_4 + 10H^+ + 10Cl^-$

Remember that on the AP exam you may only use the periodic table. No solubility chart. However much information will be embedded in the question.

1. Concentrated ammonia is is added to a solution of zinc chloride

2. A solution of aluminum chloride is reacted with excess, concentrated sodium hydroxide

3. An excess of nitric acid solution is added to a solution of tetraaminecopper(II) sulfate.

4. A solution of diamminesilver(I) chloride is treated with dilute hydrochloric.

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

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

7. Excess sodium cyanide is added to a solution of silver nitrate.

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

9. An aqueous solution of hydrochloric acid is added to a solution containing the tetraaminecadmium(II) ion.

1. *The term "concentrated" is a hint that a complex ion will be formed. How many "ligands" should you place around the positive metal ion? Although each metal has a very particular amount that it usually binds with, AP is likely to allow most any amount between 2 − 6, as long as you show the appropriate charge. Since ammonia is neutral, the same charge on zinc, 2+, is the charge of the complex ion.*

   $4NH_3 + Zn^{2+} \rightarrow [Zn(NH_3)_4]^{2+}$

2. *The terms excess and concentrated are screaming at you to make the aluminate complex ion. While it is true that aluminum takes 4 ligands, resulting in a complex ion with a 1− charge. (If you were to place 6 OH^- ions around the Al^{3+} ion, resulting in a 3− complex ion, you would still get credit.)*

   $Al^{3+} + 4OH^- \rightarrow [Al(OH)_4]^-$

3. *Since ammonia is a weak base, the addition of acid will "drag" the ammonia off the copper complex to react and produce the ammonium ion.*

   $4H^+ + [Cu(NH_3)_4]^{2+} \rightarrow Cu^{2+} + 4NH_4^+$

4. *Again, the acid pulls the ammonia off the complex ion, and a silver chloride precipitate will result.*

   $2H^+ + Cl^- + [Ag(NH_3)_2]^{2+} \rightarrow AgCl + 2NH_4^+$

5. *Ammonia is able to replace the Cl in the solid silver chloride and produce a complex ion that will be soluble*

   $2NH_3 + AgCl \rightarrow [Ag(NH_3)_2]^+ + Cl^-$

6. *Again, the term concentrated is screaming at you to make a complex ion. Again the exact amount of OH− ligands that you put with the zinc is not so important, but the resulting charge on the complex ion must be represented correctly.*

   $Zn(OH)_2 + 2OH^- \rightarrow [Zn(OH)_4]^{2-}$

7. *In AP speak, the term excess is code for complex ion! Just be sure the number of CN− ligands you attach results in the correct charge on the complex ion.*

   $Ag^+ + 2CN^- \rightarrow [Ag(CN)_2]^-$

8. *The term concentration solution, is again telling you to make a complex ion, and the term "suspension" is telling you to write the zinc hydroxide as a solid, and not as separate ions.*

   $4NH_3 + Zn(OH)_2 \rightarrow [Zn(NH_3)_4]^{2+} + 2OH^-$

9. *This is analogous to #3 above*

   $4H^+ + [Cd(NH_3)_4]^{2+} \rightarrow Cd^{2+} + NH_4^+$

Remember that on the AP exam you may only use the periodic table. No solubility chart. However much information will be embedded in the question.

1. A 27 % hydrogen peroxide solution is catalytically decomposed

2. Solid potassium chlorate is heated in the presence of a catalyst

3. Solid magnesium carbonate is heated.

4. Solid ammonium carbonate is heated.

5. Calcium sulfite is heated in a vacuum.

1. *This is a memorize, you must know this reaction. Do not get fooled into thinking that hydrogen gas is formed − it is not. Remember, in case they ask − the oxygen in peroxides always have a −1 oxidation state.*

   $2H_2O_2 \rightarrow O_2 + 2H_2O$

2. *Also a memorize − metal chlorates always turn into metal chlorides and oxygen gas.*

   $2KClO_3 \rightarrow 2KCl + 3O_2$

3. *Memorize − metal carbonates turn into metal oxides and carbon dioxide.*

   $MgCO_3 \rightarrow MgO + CO_2$

4. *This is a tricky one. It is one of the "phantoms" (pg 5 on the Notes page) Since you should have memorized that carbonates decompose to carbon dioxide, you can assume that we get CO_2 here as well, then you'd be left with $(NH_4)_2O$ (not an actual compound)...dissect that to get your friend ammonia, and voila, you are left with water as well.*

   $(NH_4)_2CO_3 \rightarrow 2NH_3 + 2H_2O + CO_2$

5. *This is probably not worth memorizing, just think in an analogous way to the carbonate decomposition...*

   $CaSO_3 \rightarrow 2CaO + SO_2$

Remember that on the AP exam you may only use the periodic table. No solubility chart. However much information will be embedded in the question.

1. Bromine vapor is passed over cadmium powder.

2. Chlorine gas is reacted with aluminum.

3. Strontium oxide is reacted with sulfur trioxide.

4. Hot bromine vapor is reacted with aluminum foil

5. The gases boron trifluoride and ammonia are mixed.

6. A mixture of solid calcium oxide and solid tetraphosphorus decoxide is heated.

7. Calcium metal is heated strongly in nitrogen gas.

8. Magnesium ribbon is burned in oxygen.

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

1. *With synthesis reactions, there isn't too much to think about, just slam it all together and build the most likely compound. Make sure you check the charges.*

   $Br_2 + Cd \rightarrow CdBr_2$

2. *Remember the order, we write metals first in ionic compounds.*

   $3Cl_2 + 2Al \rightarrow 2AlCl_3$

3. *The tricky part is recognizing that it is a synthesis that you have in front of you.*

   $SrO + SO_3 \rightarrow SrSO_4$

4. *More of the same, just watch your charges.*

   $3Br_2 + 2Al \rightarrow 2AlBr_3$

5. *This is one of AP's favorite synthesis reaction. It is actually a Lewis acid/base reaction. We will look at it a bit more closely in our acid base unit.*

   $BF_3 + NH_3 \rightarrow BF_3NH_3$

6. *In what appears to be a synthesis and you are wondering should you make phosphate or phosphite? go with the one in which the oxidation number of the P does not change. In this case, the phosphorus is maintaining its +5 oxidation state. No one else changes their oxidation numbers either.*

   $CaO + P_4O_{10} \rightarrow Ca_3(PO_4)_2$

7. *Don't forget your charges.*

   $Ca + N_2 \rightarrow Ca_3N_2$

8. *Certainly you've seen this reaction so many times.*

   $2Mg + O_2 \rightarrow 2MgO$

9. *This is the carbonate decomposition, backwards. If you learn your decomp reactions, you can often think of them in reverse as a synthesis.*

   $MgO + CO_2 \rightarrow MgCO_3$

Remember that on the AP exam you may only use the periodic table. No solubility chart. However much information will be embedded in the question.

1. Pentane is burned in oxygen

2. Propene is burned in air

3. Butene is burned in air.

4. Ethanol is burned in air.

5. Pentanol is combusted in air

6. Lithium metal is burned in air.

7. Gaseous diborane, B_2H_6, is burned in excess oxygen.

8. Carbon disulfide vapor is burned in excess oxygen.

9. Solid copper(II) sulfide is heated strongly in oxygen gas.

10. Gaseous silane (silicon tetrahydride) is burned in oxygen

11. Propanol is burning in oxygen.

12. Zinc sulfide is heated in an excess of oxygen.

1. *The challenge with the combustion reactions is knowing the formula of what they are asking you to combust. But in all likelihood, it will not be too tough. Use page 6 of the Net Ionic Notes to review organic nomenclature.*

   $C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$

2. *Remember that combustion of all CH, or CHO compounds produce carbon dioxide and water. Assume complete combustion.*

   $2C_3H_6 + 9O_2 \rightarrow 6H_2O + 6CO_2$

3. *Routine, if you can come up with the formula of the reactant. Learn your organic prefixes.*

   $C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O$

4. *Learn your organic prefixes, sketch it our, add −OH (for alcohol) on one end and fill in with the H's*

   $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

5. *Pentanol = 5 carbons and an −OH for the alcohol, fill in with the rest of H's to count up how many*

   $2C_5H_{11}OH + 15O_2 \rightarrow 10CO_2 + 12H_2O$

6. *Burning metals make the metal oxide only.*

   $4Li + O_2 \rightarrow 2Li_2O$

7. *Since CH compounds make carbon dioxide and water, assume the boron compound makes the appropriate boron oxide compound and water. Since boron is in the aluminum column, assume it combines in the same way aluminum would.*

   $B_2H_6 + 3O_2 \rightarrow B_2O_3 + 3H_2O$

8. *When elements other than metals or carbon, hydrogen, and oxygen show up − just turn them into dioxides.*

   $CS_2 + 2O_2 \rightarrow CO_2 + 2SO_2$

9. *metals make metal oxides, other elements make dioxides.*

   $2CuS + 3O_2 \rightarrow 2CuO + 2SO_2$

10. *A variation on the same theme, nonmetal dioxide and water.*

    $SiH_4 + 2O_2 \rightarrow SiO_2 + 2H_2O$

11. *Learn those organic prefixes.*

    $C_3H_7OH + 5O_2 \rightarrow 3CO_2 + 4H_2O$

12. *Again, metal oxide and nonmetal dioxide.*

    $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$