Very Last Minute
AP® Net Ionic Equation
Attack Strategies

These probably won't get you a 15 on Question 4, BUT they WILL HELP YOU BEAT THE NATIONAL AVERAGE. The national average on this question is usually between 7—8. If you can consistently score 11—12, that puts you WAY ahead of the game!

First, the minimum knowledge required to survive this question…

Solubility rules:

1. Big Mamma: All nitrates are **soluble**.

2. Big Daddy: All IA metals and ammonium salts are **soluble**.

3. Halides: All are **soluble** except silver, mercury or lead.

4. Strong acids: **hydrochloric, hydrobromic, hydroiodic, nitric, perchloric, sulfuric**—WRITE THESE DISSOCIATED *except* concentrated sulfuric, it really is 97% H_2SO_4 and 3% water in the jug, so water is way outnumbered and the molecules don't dissociate completely. If carbonic acid is formed as a product → $CO_2 + H_2O$.

5. Strong bases: hydroxides [and oxides] of IA and IIA* metals—write these bases dissociated.

WRITE ALL WEAK ACIDS AND BASES AS MOLECULES—be on the look out for BF_3 and its cousins BCl_3, etc. They are classic Lewis acids and when reacting with ammonia (a classic weak Lewis base), the product is F_3BNH_3 (just smash everything together) since nitrogen donated its unshared electron pair to boron in an act of extreme generosity and formed a coordinate covalent bond. Lewis **A**cids **A**ccept an electron pair.

* The "little guys" in the IIA's have solubility issues, write Be and Mg UNdissociated—calcium can go either way, the big guys are soluble. HF is not a strong acid since it's the little guy as well in the halogen series. The little guys make a stronger bond with OH^- or H^+ and do not dissociate as much in water. Also remember that the IA metals are named the *alkali* metals and the IIA's are the *alkaline earth* metals. What does "alkaline" mean? BASIC, so put them in water as metals, they dissolve and you make OH^-. Put IA metals in water and KABOOM! KABOOM = formation of explosive hydrogen gas, H_2.

TURN THIS PUPPY OVER FOR THE ATTACK STRATEGIES!

Attack Strategies

Before trying to figure out the "answers", ***scan the words*** on question 4 (a) thru (c) and do the following: [don't write any products until you've done all SIX things!]

1. Cross out the word ~~***nitrate***~~ any time it appears on the page.

2. Circle any word that implies solid or gas. (powdered, turnings, chunk, vapor, etc.)

3. Cross out any ~~IA meta~~l that you see UNLESS it is associated with a circled solid or gas word.

4. Underline **halides** then ask yourself if silver, mercury or lead is present—if not you can cross the halide off as well such as with hydro~~**chloric**~~ acid. The H^+ is the reacting species. (Bring the halide back as a reacting ion IF you need to oxidize something $halide^{-1} \rightarrow halogen_2$.)

5. Circle "burned in air" or "combines with oxygen" or anything that implies combustion and celebrate!

6. Circle the word ***concentrated***. Get very excited if you see ***excess concentrated***. It means you have entered the land of complex coordinated ions (excess is not necessary, but often appears). Sounds scary, but VERY easy. LOSE THE FEAR!

Now, focus on the reactions you just marked. WRITE THE REACTANT SETS FOR ALL THREE. Spend 3 minutes writing products using the solubility rules and strong acid-base guidelines listed on the other side of this page. To get the easy three points involved with step SIX above do the following:

Write the reactants. On the product side, open a set of brackets [ ]. Put the metal ion in the brackets first then open a set of parentheses [M ion( )]. Next put a subscript on the parentheses that is twice the charge on the metal—I'm not proud of this, but it will earn credit. For a +2 metal it becomes $[M^{2+}(\ )_4]$. Finally, plop the ligand inside the parentheses and do the math to get the charge. If the ligand is ammonia or water, the ligand is neutral, so our example carries a +2 overall charge, $[M^{2+}(\ )_4]^{2+}$, if the ligand is hydroxide or a halide, which are both negative one, then our example becomes $[M^{2+}(OH)_4]^{2-}$. Other ligands are possible, like SCN^-, the thiocyanate ion and other polyatomic ions you should recognize.

Additional knowledge that contributes to survival:

- metal oxides + water $\rightarrow$ bases (ask yourself strong or weak? Dissociate the strong)
- nonmetal oxides + water $\rightarrow$ acids (ask yourself strong or weak? Dissociate the strong)
- metal carbonate heated $\rightarrow$ CO_2 + metal oxide
- Redox, "acidified"? H^+ is a reactant and water is a product.
- React a metal with oxygen $\rightarrow$ metal oxide
- React a nonmetal with oxygen [combustion] $\rightarrow$ make oxides of the nonmetal(s), NOT always CO_2 & H_2O!