P H3 (pg 1 of 4) Double Replacement (Acid Base & Precipitation)

Name_____Per____

- Assume that all of the reactant compounds (salts) below are put into water, if solution is not already stated.
- First write out the product in words, then use the solubility chart to determine if a reaction *can* occur.
  (Remember, for a precipitation-type reaction to occur, both reactants must be soluble AND then one (or both) of the products must be insoluble. If all products are soluble, no reaction occurs.)
- If a precipitation type reaction does **not** occur be sure to state why it does not occur.
- If a reaction does occur, predict the products, and write a skeleton equation, then balance.
  Identify any precipitates with $_{(s)}$ or $_{(ppt)}$ symbol. (You may leave the $_{(aq)}$ off.)
- If a reaction does occur, rewrite the "molecular" equation as a net ionic equation. Because spectator ions are not written, you may be able to reduce the coefficients and simplify the balancing.

1. lead(II) nitrate is combined with aluminum chloride

2. sodium phosphate is combined with strontium chloride

3. sodium hydroxide solution is combined with *strong* hydrochloric acid solution.

4. lithium hydroxide solution is combined with *weak* phosphoric acid solution.

5. calcium carbonate is combined with copper(II) sulfate

6. calcium iodide is combined with silver chlorate

7. nickel(II) chloride is combined with potassium ferrocyanide

8. a solution of barium hydroxide is combined with *strong* hydrochloric acid solution.

9. ammonium carbonate is combined with copper(I) sulfate

10. sodium hydroxide solution is combined with *weak* acetic acid solution

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11. ammonium sulfate is combined with magnesium phosphate

12. strontium hydroxide solution is combined with *strong* nitric acid solution.

13. copper(I) sulfate is combined with lead(II) acetate

14. sodium hydroxide is combined with lead(IV) chlorate

15. tin(II) chromate is combined with sodium nitrate

16. potassium chlorate is combined with copper(II) bromide

17. potassium hydroxide solution is combined with *strong* sulfuric acid

18. a solution of calcium hydroxide is combined with *weak carbonic* acid solution

19. ammonium phosphate is combined with zinc chloride

20. calcium chloride is combined with mercury(I) chlorate

21. silver nitrate is combined with sodium bromide

 Double Replacement (Acid Base & Precipitation) ***ANSWERS***

1. Skeleton: $Pb(NO_3)_2 + AlCl_3 \rightarrow PbCl_{2\,(ppt)} + Al(NO_3)_3$
   Balanced: $3\ Pb(NO_3)_2 + 2\ AlCl_3 \rightarrow 3\ PbCl_{2\,(ppt)} + 2\ Al(NO_3)_3$
   formation of a precipitate ∴ a reaction occurs.
   Net ionic equation: $Pb^{2+} + 2\ Cl^- \rightarrow PbCl_2$

2. Skeleton: $Na_3PO_4 + SrCl_2 \rightarrow Sr_3(PO_4)_{2\,(ppt)} + NaCl$
   Balanced: $2\ Na_3PO_4 + 3\ SrCl_2 \rightarrow Sr_3(PO_4)_{2\,(ppt)} + 6\ NaCl$
   formation of a precipitate ∴ a reaction occurs.
   Net ionic equation: $2\ PO_4^{3-} + 3\ Sr^{2+} \rightarrow Sr_3(PO_4)_2$

3. Skeleton: $NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(L)}$
   Balanced: already balanced
   Net Ionic: $OH^-_{(aq)} + H^+_{(aq)} \rightarrow H_2O_{(L)}$

4. Skeleton: $LiOH_{(aq)} + H_3PO_{4(aq)} \rightarrow Li_3PO_{4(aq)} + H_2O_{(L)}$
   Balanced: $3\ LiOH_{(aq)} + H_3PO_{4(aq)} \rightarrow Li_3PO_{4(aq)} + 3\ H_2O_{(L)}$
   Net Ionic: $3\ OH^-_{(aq)} + H_3PO_{4(aq)} \rightarrow 3\ H_2O_{(L)} + PO_4^{3-}$
   (since phosphoric acid is weak, it should be represented as a molecule, not as separated ions)

5. Calcium carbonate reactant is not soluble ∴no reaction can occur.

6. Skeleton: $CaI_2 + AgClO_3 \rightarrow AgI_{(ppt)} + Ca(ClO_3)_2$
   Balanced: $CaI_2 + 2\ AgClO_3 \rightarrow 2\ AgI_{(ppt)} + Ca(ClO_3)_2$
   formation of a precipitate ∴ a reaction occurs.
   Net ionic equation: $Ag^+ + I^- \rightarrow AgI$

7. $2NiCl_2 + K_4Fe(CN)_6 \rightarrow 4KCl + Ni_2Fe(CN)_{6(ppt)}$
   formation of a precipitate ∴ a reaction occurs.
   Net ionic equation: $2\ Ni^{2+} + Fe(CN)_6^{4-} \rightarrow Ni_2Fe(CN)_6$

8. You are told a solution of barium hydroxide, so you can assume the $Ba(OH)_2$ is dissolved.
   Skeleton: $Ba(OH)_{2(aq)} + HCl_{(aq)} \rightarrow BaCl_{2(aq)} + H_2O_{(L)}$
   Balanced: $Ba(OH)_{2(aq)} + 2\ HCl_{(aq)} \rightarrow BaCl_2 + 2\ H_2O_{(L)}$
   Net Ionic: $2\ OH^-_{(aq)} + 2\ H^+_{(aq)} \rightarrow 2\ H_2O_{(L)}$ can be reduced: $OH^-_{(aq)} + H^+_{(aq)} \rightarrow H_2O_{(L)}$

9. Skeleton: $(NH_4)_2CO_3 + Cu_2SO_4 \rightarrow Cu_2CO_{3\,(ppt)} + (NH_4)_2SO_4$
   Balanced: already balanced
   formation of a precipitate ∴ a reaction occurs.
   Net ionic equation: $CO_3^{2-} + 2\ Cu^+ \rightarrow Cu_2CO_3$

10. Skeleton: $NaOH_{(aq)} + HC_2H_3O_{2(aq)} \rightarrow NaC_2H_3O_{2(aq)} + H_2O_{(L)}$
    Balanced: already balanced
    Net Ionic: $OH^-_{(aq)} + HC_2H_3O_{2(aq)} \rightarrow H_2O_{(L)} + C_2H_3O_2^-$
    (since acetic acid is weak, it should be represented as a molecule, not as separated ions)

11. Magnesium phosphate reactant is not soluble therefore no reaction can occur.

12. Strontium hydroxide is soluble enough, and since you are told "solution" you can assume dissolved.
    Skeleton: $Sr(OH)_{2(aq)} + HNO_3 \rightarrow Sr(NO_3)_2 + H_2O_{(L)}$
    Balanced: $Sr(OH)_{2(aq)} + 2\ HNO_3 \rightarrow Sr(NO_3)_2 + 2\ H_2O_{(L)}$
    Net Ionic: $2\ OH^-_{(aq)} + 2\ H^+_{(aq)} \rightarrow 2\ H_2O_{(L)}$ can be reduced: $OH^-_{(aq)} + H^+_{(aq)} \rightarrow H_2O_{(L)}$

 Double Replacement **(Acid Base & Precipitation)** ***ANSWERS***

13. Skeleton: $Cu_2SO_4 + Pb(C_2H_3O_2)_2 \rightarrow PbSO_{4\,(ppt)} + CuC_2H_3O_2$
    Balanced: $Cu_2SO_4 + Pb(C_2H_3O_2)_2 \rightarrow PbSO_{4\,(ppt)} + 2\ CuC_2H_3O_2$
    formation of a precipitate ∴ a reaction occurs.
    Net ionic equation: $SO_4^{2-} + Pb^{2+} \rightarrow PbSO_4$

14. Skeleton: $NaOH + Pb(ClO_3)_4 \rightarrow Pb(OH)_{4(ppt)} + NaClO_3$
    Balanced: $4\ NaOH + Pb(ClO_3)_4 \rightarrow Pb(OH)_{4(ppt)} + 4\ NaClO_3$
    formation of a precipitate ∴ a reaction occurs.
    Net ionic: $4\ OH^- + Pb^{4+} \rightarrow Pb(OH)_4$

15. tin(II) chromate is not soluble ∴ no reaction can occur.

16. both copper chlorate and potassium bromide products are soluble therefore no reaction can occur.

17. Skeleton: $KOH_{(aq)} + H_2SO_{4(aq)} \rightarrow 2\ H_2O_{(L)} + K_2SO_{4(aq)}$
    Balanced: $2\ KOH_{(aq)} + H_2SO_{4(aq)} \rightarrow 2\ H_2O_{(L)} + K_2SO_4$
    Net Ionic: $2\ OH^-_{(aq)} + 2\ H^+_{(aq)} \rightarrow 2\ H_2O_{(L)}$ can be reduced: $OH^-_{(aq)} + H^+_{(aq)} \rightarrow H_2O_{(L)}$

18. You are told a solution of calcium hydroxide, so you can assume the $Ca(OH)_2$ is dissolved.
    Skeleton: $Ca(OH)_{2(aq)} + H_2CO_{3(aq)} \rightarrow CaCO_{3(ppt)} + H_2O_{(L)}$
    Balanced: $Ca(OH)_{2(aq)} + H_2CO_{3(aq)} \rightarrow CaCO_{3(ppt)} + 2\ H_2O_{(L)}$
    Net Ionic: $Ca^{2+} + 2\ OH^- + H_2CO_{3(aq)} \rightarrow CaCO_{3(ppt)} + 2\ H_2O_{(L)}$
    (since carbonic acid is weak, it should be represented as a molecule, not as separated ions)

19. Skeleton: $(NH_4)_3PO_4 + ZnCl_2 \rightarrow Zn_3(PO_4)_{2\,(ppt)} + NH_4Cl$
    Balanced $2\ (NH_4)_3PO_4 + 3\ ZnCl_2 \rightarrow Zn_3(PO_4)_{2\,(ppt)} + 6\ NH_4Cl$
    formation of a precipitate ∴ a reaction occurs.
    Net ionic equation: $2\ PO_4^{3+} + 3\ Zn^{2+} \rightarrow Zn_3(PO_4)_2$

20. Skeleton: $CaCl_2 + HgClO_3 \rightarrow HgCl_{(ppt)} + Ca(ClO_3)_2$
    Balanced: $CaCl_2 + 2\ HgClO_3 \rightarrow 2\ HgCl_{(ppt)} + Ca(ClO_3)_2$
    formation of a precipitate ∴ a reaction occurs.
    Net ionic equation: $Cl^- + Hg^+ \rightarrow HgCl$

21. Skeleton: $NaBr + AgNO_3 \rightarrow AgBr_{\,(ppt)} + NaNO_3$
    Balanced: already balanced
    formation of a precipitate ∴ a reaction occurs.
    Net ionic equation: $Br^- + Ag^+ \rightarrow AgBr$