CHM 110: Exchange reactions: Practice set #1: Answers

Complete and balance these chemical reactions. Include phase labels. If no reaction occurs, write "NR".

1)
$$H_3PO_4(aq) + 3KOH(aq) \rightarrow 3H_2O(l) + K_3PO_4(aq)$$

The formation of the water molecule drives this reaction.

2)
$$MgCl_2(aq) + Ca(NO_3)_2(aq) \rightarrow NR$$

This mixture would form no molecules, and neither potential product is insoluble in water. So, no reaction is observed.

3)
$$Ca(NO_3)_2(aq) + Na_2CO_3(aq) \rightarrow CaCO_3(s) + 2NaNO_3(aq)$$

This reaction is driven by the formation of insoluble calcium carbonate.

4)
$$\underline{2}(NH_4)_3PO_4(aq) + \underline{3}Cu(NO_3)_2(aq) \rightarrow Cu_3(PO_4)_2(s) + 6NH_4NO_3(aq)$$

This reaction is driven by the formation of insoluble copper(II) phosphate. In an exchange reaction, transition metal ions do not change their charge.

5)
$$2$$
AgNO₃(aq) + MgCl₂(aq) $\rightarrow 2$ AgCl(s) + Mg(NO₃)₂(aq)

This reaction forms solid silver(I) chloride (usually just called silver chloride, since silver is one of the few transition metals that normally forms only one kind of ion).

6)
$$Zn(NO_3)_2(aq) + \underline{2}NaOH(aq) \rightarrow Zn(OH)_2(s) + 2NaNO_3(aq)$$

This reaction forms solid zinc(II) hydroxide (usually just called zinc hydroxide. Like silver, zinc is one of the few transition metals that normally forms only one kind of ion).

7)
$$KC_2H_3O_2(aq) + HCl(aq) \rightarrow HC_2H_3O_2(aq) + KCl(aq)$$

This reaction proceeds because acetic acid, a <u>weak</u> acid that exists in solution mainly as molecules, is formed.

8)
$$2HC_2H_3O_2(aq) + K_2CO_3(aq) \rightarrow H_2O(l) + CO_2(g) + 2KC_2H_3O_2(aq)$$

This reaction forms the unstable weak acid carbonic acid, which breaks down into water and carbon dioxide. The carbon dioxide is given off as a gas, and bubbles would be observed forming in this mixture.

9)
$$CuCl_2(aq) + Cr(NO_3)_3(aq) \rightarrow NR$$

This mixture would form no molecules, and neither potential product is insoluble in water. So, no reaction is observed.

10)
$$CrCl_3(aq) + 3KOH(aq) \rightarrow Cr(OH)_3(s) + 3KCl(aq)$$

This reaction produces insoluble chromium(III) chloride.

11)
$$\underline{2}NH_4OH(aq) + H_2SO_4(aq) \rightarrow (NH_4)_2SO_4(aq) + 2H_2O(l)$$

The stable molecule water is formed by this reaction. This is another neutralization.

12)
$$\underline{\mathbf{2}}$$
HBr(aq) + K₂SO₃(aq) \rightarrow H₂O(\boldsymbol{l}) + SO₂(\mathbf{g}) + 2KBr(aq)

This reaction forms the unstable weak acid sulfurous acid, which breaks down into water and sulfur dioxide. The sulfur dioxide is given off as a gas, and bubbles would be observed forming in this mixture.

13)
$$HCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + HNO_3(aq)$$

This reaction forms solid silver chloride.

14)
$$\underline{2}$$
FeBr₃(aq) + $\underline{3}$ Na₂S(aq) \rightarrow Fe₂S₃(s) + 6NaBr(aq)

Solid iron(III) sulfide forms in this reaction.

15)
$$\underline{2}$$
Na₃PO₄(aq) + $\underline{3}$ FeCl₂(aq) \rightarrow 6NaCl(aq) + Fe₃(PO₄)₂(s)

Solid iron(II) phosphate forms here. Remember that the charge on a transition metal ion does not change in an exchange reaction.