**Chemistry 20 – Lesson 23**

**Reactions in Solution**

**Practice problems**

1. Hydrochloric acid is added to a solution of barium hydroxide.

2 HCl (aq) + Ba(OH)2 (aq) **→**  BaCl2 (aq) + 2 HOH (l) (non–ionic)

2 H+ (aq) + 2 Cl– (aq) + Ba2+ (aq) + 2 OH– (aq) **→** Ba2+ (aq) + 2 Cl– (aq) + 2 HOH (l) (total ionic)

H+ (aq) + OH– (aq) **→** HOH (l)  (net ionic)

2. Magnesium metal is added to an aqueous solution of hydrogen bromide.

Mg (s) + 2 HBr (aq) **→** MgBr2 (aq) + H2 (g) (non–ionic)

Mg (s) + 2 H+ (aq) + 2 Br– (aq) **→** Mg2+ (aq) + 2 Br– (aq) + H2 (g) (total ionic)

Mg (s) + 2 H+ (aq) **→** Mg2+ (aq) + H2 (g) (net ionic)

3. Calcium metal reacts with water.

Ca (s) + 2 HOH (l) **→**  H2 (g) + Ca(OH)2 (aq) (non–ionic)

Ca (s) + 2 HOH (l) **→** H2 (g) + Ca2+ (aq) + 2 OH– (aq) (total ionic)

Ca (s) + 2 HOH (l) **→** H2 (g) + Ca2+ (aq) + 2 OH– (aq) (net ionic)

4. Aqueous solutions of potassium sulfate and barium chloride are mixed.

K2SO4 (aq) + BaCl2 (aq) **→**  BaSO4 (s) + 2 KCl (aq) (non–ionic)

2 K+(aq) + SO42−(aq) + Ba2+ (aq) + 2 Cl– (aq) **→** BaSO4 (s) + 2 K+ (aq) + 2 Cl– (aq) (total ionic)

SO42−(aq) + Ba2+ (aq) **→** BaSO4 (s) (net ionic)

5. An aqueous solution of washing soda, Na2CO3, is added to remove Mg2+ (aq) from water.

Mg2+(aq) + 2 Na+ (aq) + CO32−(aq) **→** 2 Na+ (aq) + MgCO3 (s) (total ionic)

Mg2+(aq) + CO32−(aq) **→** MgCO3 (s) (net ionic)

**Assignment**

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1. Potassium metal reacts with water.

/3 **K (s) + 2 HOH (l) → H2 (g) + 2 KOH (aq) (non–ionic)**

**K (s) + 2 HOH (l) → H2 (g) + 2 K+ (aq) + 2 OH– (aq) (total ionic)**

**K (s) + 2 HOH (l) → H2 (g) + 2 K+ (aq) + 2 OH– (aq) (net ionic)**

2. A lead (II) acetate solution reacts with a sodium sulfide solution to yield a precipitate.

/3 **Pb(CH3COO)2 (aq) + Na2S (aq) → 2 NaCH3COO (aq) + PbS (s) (non–ionic)**

**Pb2+(aq) + 2 CH3COO−(aq) + 2 Na+(aq) + S2–(aq) → 2 CH3COO−(aq) + 2 Na+(aq) + PbS(s) (total)**

**Pb2+(aq) + S2–(aq) → PbS(s) (net ionic)**

3. Solutions of sodium sulfate and barium bromide are added together.

/3 **Na2SO4 (aq) + BaBr2 (aq) → BaSO4 (s) + 2 NaBr (aq) (non–ionic)**

**2 Na+(aq) + SO42−(aq) + Ba2+ (aq) + 2 Br– (aq) → BaSO4 (s) + 2 Na+ (aq) + 2 Br– (aq) (total ionic)**

**SO42−(aq) + Ba2+ (aq) → BaSO4 (s) (net ionic)**

4. An aqueous solution of sodium carbonate is used to remove calcium ions from water.

/3 **Ca2+(aq) + 2 Na+ (aq) + CO32−(aq) → 2 Na+ (aq) + CaCO3 (s) (total ionic)**

**Ca2+(aq) + CO32−(aq) → CaCO3 (s) (net ionic)**

5. A precipitate forms when potassium iodide is mixed with lead (II) nitrate.

/3 **Pb(NO3)2 (aq) + 2 KI (aq) → 2 KNO3 (aq) + PbI2 (s) (non–ionic)**

**Pb2+(aq) + 2 NO3−(aq) + 2 K+(aq) + 2 I–(aq) → 2 K+(aq) + 2 NO3–(aq) + PbI2 (s) (total ionic)**

**Pb2+(aq) + 2 I–(aq) → PbI2 (s) (net ionic)**

6. A calcium nitrate solution is added to a solution of sodium carbonate.

/3 **Ca(NO3)2 (aq) + Na2CO3 (aq) → 2 NaNO3 (aq) + CaCO3 (s) (non–ionic)**

**Ca2+(aq) + 2 NO3−(aq) + 2 Na+(aq) + CO32–(aq) → 2 Na+(aq) + 2 NO3–(aq) + CaCO3 (s) (total)**

**Ca2+(aq) + CO32– (aq) → CaCO3 (s) (net ionic)**

7. A precipitate forms when iron (III) nitrate reacts with sodium phosphate.

/3 **Fe(NO3)3 (aq) + Na3PO4 (aq) → FePO4 (s) + 3 NaNO3 (aq) (non–ionic)**

**Fe3+(aq) + 3 NO3−(aq) + 3 Na+(aq) + PO43−(aq) → FePO4 (s) + 3 Na+(aq) + 3 NO3−(aq) (total ionic)**

**Fe3+(aq) + PO43−(aq) → FePO4 (s) (net ionic)**

8. **Pb2+(aq) + S2−(aq) → PbS (s)**



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9. **Cl2 (aq) + 2 I−(aq) → 2 Cl−(aq) + I2 (s)**



/6



10. **Fe3+(aq) + 3 OH–(aq)**  **→ Fe(OH)3 (s)**



/6

