### Prediction Problem Practice 14

<table>
<thead>
<tr>
<th>DR</th>
<th>1. Solutions of sodium iodide and lead (II) nitrate are mixed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>2. Liquid bromine is shaken with a sodium iodide solution.</td>
</tr>
<tr>
<td></td>
<td>a. What state of matter will the elemental product be?</td>
</tr>
<tr>
<td>ABN</td>
<td>3. Solutions of sodium hydroxide plus perchloric acid</td>
</tr>
<tr>
<td>Syn</td>
<td>4. Sulfur trioxide gas is added to excess water.</td>
</tr>
<tr>
<td></td>
<td>a. Will the solution be acidic or basic?</td>
</tr>
<tr>
<td>D</td>
<td>5. Solid calcium carbonate is strongly heated.</td>
</tr>
<tr>
<td></td>
<td>a. If heat isn’t used, will the reactant decompose on its own?</td>
</tr>
<tr>
<td>Redox</td>
<td>6. Solid iron (III) oxide is heated in excess carbon monoxide.</td>
</tr>
<tr>
<td></td>
<td>a. What is the reducing agent?</td>
</tr>
<tr>
<td>CI</td>
<td>7. Concentrated (15M) ammonia solution is added to in excess to a solution of copper (II) nitrate.</td>
</tr>
<tr>
<td>Anhydrides</td>
<td>8. Barium solid is placed in water.</td>
</tr>
<tr>
<td>C</td>
<td>9. Methane is burned.</td>
</tr>
</tbody>
</table>

### Prediction Problem Practice 15

<table>
<thead>
<tr>
<th>DR</th>
<th>1. Solutions of silver nitrate and sodium chromate are mixed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>2. Granules of zinc are placed in a solution of copper (II) chloride</td>
</tr>
<tr>
<td></td>
<td>a. What color is the starting solution?</td>
</tr>
<tr>
<td>ABN</td>
<td>3. Equal volumes of 0.1 M hydrochloric acid and 0.1 M potassium hydroxide are mixed.</td>
</tr>
<tr>
<td>Syn</td>
<td>4. Excess chlorine gas is passed over hot iron filings.</td>
</tr>
<tr>
<td></td>
<td>a. What would happen to the rate of reaction if a large solid chunk of iron is used instead of filings?</td>
</tr>
<tr>
<td>D</td>
<td>5. Zinc carbonate is heated strongly.</td>
</tr>
<tr>
<td>Redox</td>
<td>6. A solution of potassium iodide is added to an acidified solution of potassium dichromate.</td>
</tr>
<tr>
<td></td>
<td>a. What word in this problem hints that this is a redox reaction?</td>
</tr>
<tr>
<td>CI</td>
<td>7. Solid silver chloride is dissolved in excess ammonia solution.</td>
</tr>
<tr>
<td>Anhydrides</td>
<td>8. Water is added to solid calcium hydride.</td>
</tr>
<tr>
<td>C</td>
<td>9. Nonane is burned.</td>
</tr>
</tbody>
</table>

### Prediction Problem Practice 16

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A concentrated solution of hydrochloric acid is added to powdered manganese dioxide and gently heated.</td>
</tr>
</tbody>
</table>
|   | a. Manganese dioxide is typically used as a _____.
| 2 | A small piece of sodium metal is added to distilled water. |
|   | a. How is sodium metal stored? |
| 3 | A solution of ammonia is added to a dilute solution of acetic acid. |
| 4 | An excess of ammonia is bubbled through a solution saturated with silver chloride. |
| 5 | Calcium metal is added to a dilute solution of hydrochloric acid. |
| 6 | Ethane is burned. |
| 7 | Liquid hydrogen peroxide is heated. |
| 8 | Solutions of sodium iodide and lead (II) nitrate are mixed. |
|   | a. What color would be produced when the sodium iodide solution is flame tested? |
| 9 | Sulfur dioxide gas reacts with oxygen gas. |
### Prediction Problem Practice 17

1. A solution of sulfuric acid is added to a solution of barium hydroxide until the same number of moles of each compound had been added.

   a. What would the final pH be if more sulfuric acid is added than barium hydroxide?
2. Barium oxide is added to distilled water.
3. Pellets of lead are dropped into hot sulfuric acid.
4. A suspension of zinc hydroxide is treated with concentrated OH- solution.
   a. How does a suspension differ from a solution?
5. Propylene is combusted.
6. Silver chlorate is decomposed with heat.
   a. Would either of the products be able to be dissolved in water?
7. Solid boron is combined with fluorine gas.
8. Solid potassium is dropped into a solution of calcium oxide.
9. Solutions of manganese (II) sulfate and ammonium sulfide are mixed.

### Prediction Problem Practice 18

1. A bar of zinc metal is immersed in a solution of copper (II) sulfate.
   a. Could the reaction of copper solid added to zinc sulfate happen?
2. A concentrated solution of ammonia is added to a solution of zinc iodide.
   a. Can ammonia be used by plants?
3. A solution of tin (II) chloride is added to a solution of iron (III) sulfate.
4. Ammonia decomposes.
   a. What state of matter are the products in?
5. An excess of sodium hydroxide solution is added to a solution of magnesium nitrate.
6. Chromium metal is heated with oxygen.
   a. Would this be considered a redox reaction?
7. Equal volumes of 0.1 M hydrochloric acid and 0.1 M sodium hydrogen phosphate are mixed.
8. Hydrogen sulfide gas is burned in the presence of oxygen.
9. Liquid phosphorus trichloride is poured into a large excess of water.

### Prediction Problem Practice 19

1. A concentrated solution of ammonia is added to a suspension of zinc hydroxide.
   a. Can you ionize suspensions?
2. A solution of sodium sulfide is added to a solution of zinc nitrate.
3. Aluminum metal is added to a solution of copper (I) chloride.
4. Equal volumes of 0.1 M hydrochloric acid and 0.1 M sodium hydroxide solution.
5. Excess water is added to solid calcium hydride.
   a. Would the resulting solution be acidic or basic? How do you tell?
6. Heptane is burned in excess oxygen.
7. Hydrogen peroxide solution is added to an acidified solution of iron (II) sulfate.
   a. The chemistry department has 30% H₂O₂. Describe the bottle used to store this strength of hydrogen peroxide.
8. Solid ammonium carbonate is heated strongly.
9. Solid calcium oxide is exposed to a stream of carbon dioxide gas.
Prediction Problem Practice 20
1. Sodium hydroxide solution reacts with hydrochloric acid.
   a. What pH range would the sodium hydroxide fall into?
2. A solution of tin (II) sulfate is added to a solution of iron (III) sulfate.
   a. What type of reaction is this? What in the problem acts as a hint for you?
3. Sodium bicarbonate is heated strongly
   a. What is the common name for sodium bicarbonate?
4. Liquid hexane is burned in the presence of oxygen.
5. A suspension of copper (II) hydroxide is treated with an excess ammonia water.
   a. What color is the copper (II) hydroxide suspension?
6. Solid barium peroxide is added to cold dilute sulfuric acid.
   a. What is the oxidation number for the oxygen on the reactant side of the reaction?
7. Water is added to a sample of solid magnesium nitride.
   a. What is the molar mass of water?
8. Solid calcium oxide is exposed to a stream of carbon dioxide gas.
9. A strip of magnesium is added to a solution of silver nitrate.

Prediction Problem Practice 21
1. Solutions of sodium iodide and lead (II) nitrate are mixed.
2. Liquid phosphorus trichloride is poured into a large excess of water.
   a. Could you ionize the phosphorus trichloride if it was a solution instead of a liquid?
3. An excess of ammonia is bubbled through a solution saturated with silver chloride.
   a. Does silver chloride have a high solubility in water or low?
4. Solid potassium chlorate is heated in the presence of a manganese dioxide catalyst.
5. Lithium metal is burned in air.
   a. What state of matter will the product(s) be in?
6. Calcium metal is added to a dilute solution of hydrochloric acid.
7. A concentrated solution of ammonia is added to a solution of zinc iodide.
8. Barium solid is placed in water.
   a. What type of IMF holds the barium atoms together?
9. An excess of sodium hydroxide solution is added to a solution of magnesium nitrate.

Prediction Problem Practice 22
1. Chromium metal is heated with oxygen.
   a. What is the common ion state of chromium?
2. An excess of chlorine gas is added to pure acetylene ($C_2H_2$).
3. Sulfur trioxide gas is added to excess water.
4. Liquid hydrogen peroxide is heated.
   a. What is the bond angle between the H-O-O in hydrogen peroxide?
5. Hydrogen peroxide solution is added to an acidified potassium iodide solution.
   a. What is the hybridization of the O atoms in hydrogen peroxide?
6. Dilute hydrochloric acid is added to a solution of potassium carbonate.
7. A bar of zinc metal is immersed in a solution of copper (II) sulfate.
8. Solutions of ammonia and hydrofluoric acid are mixed.
   a. What is the shape of ammonia? Is it polar or nonpolar?
9. Ethanol is burned in oxygen.
   a. What is the most common source of ethanol made in SD?
Prediction Problem Practice 23
1. Excess concentrated sulfuric acid is added to solid calcium phosphate
2. Solid calcium hydride is added to distilled water.
3. Glucose produced by plants is burned by your body.
   a. Name an isomer of glucose?
4. Hydrogen peroxide is added to an acidified solution of potassium dichromate.
5. Carbon dioxide gas is bubbled through a concentrated solution of sodium hydroxide
   a. Will the resulting solution be acidic or basic?
6. Sodium hydroxide solution is added to a precipitate of aluminum hydroxide in water.
   a. Will the resulting products conduct electricity?
7. Solid aluminum chloride is added to water.
8. Iron fillings are added to a solution of copper (II) sulfate.
   a. If silver filings were used instead of iron, would copper still precipitate?

Prediction Problem Practice 24 – ERROR Fixed
1. An excess of nitric acid is added to a solution of $[\text{Cu(NH}_3\text{)}_4]SO_4$ (tetraaminecopper (II) sulfate)
2. A solution of potassium iodide is electrolyzed.
   a) What color is gaseous iodine?
   b) Are either product water soluble? If yes, name the product(s).
3. Concentrated hydrochloric acid is added to solid manganese (II) sulfide.
4. Diethyl ether is ignited in air.
   a) Which species in this reaction system is a volatile liquid?
5. Equal volumes of 0.1 M hydrochloric acid and 0.1 M sodium hydrogen phosphate are mixed.
   a) What is the pH of the strong acid?
6. Fine iron wire is heated in oxygen.
   a) In this reaction, how many moles of electrons are transferred per mole of iron?
7. Metallic copper is heated with concentrated sulfuric acid.
8. Methyl iodide ($\text{CH}_3\text{I}$) is heated with a solution of sodium hydroxide.

Prediction Problem Practice 25
1. A piece of calcium is heated in an atmosphere of pure nitrogen.
   a) Write the formula for the substance that is oxidized in this reaction.
2. A sample of 2-decanol is burned in excess oxygen.
   a) In this reaction system, what is the molar ratio of gaseous products to gaseous reactants?
3. A strip of copper is immersed in a solution of dilute nitric acid.
   a) What is the phase of the product formed in the reduction half reaction?
4. Excess dilute nitric acid is added to a solution containing the tetraaminecadmium (II) ion.
5. Solutions of dilute sulfuric acid and strontium hydroxide are mixed.
   a) What is the color of the precipitate formed?
6. Solutions of potassium phosphate and zinc nitrate are mixed.
7. Sulfur dioxide gas is bubbled through an acidified solution of potassium dichromate.
Prediction Problem Practice 26
1. A bar of manganese metal is added to a solution of zinc nitrate.
   a) Describe the nature of the bonding in the original sample of manganese.
2. A small quantity of dilute potassium hydroxide solution is poured into dilute nitrous acid solution.
   a) Write the formulas for each member of one conjugate acid-base pair in this reaction.
3. Crystals of calcium fluoride are added to hot concentrated sulfuric acid.
   a) Write the formula for the proton acceptor in this reaction.
4. Excess concentrated sodium hydroxide solution is added to solid aluminum hydroxide.
   a) Which reactant can act either as an acid or a base, depending on the nature of the reaction mixture or other substance present? Explain.
5. Solutions of tin (II) nitrate and cobalt (III) nitrate are mixed.
   a) Write the formula for the species that is the reducing agent in this reaction.

Prediction Problem Practice 27

<table>
<thead>
<tr>
<th>DR</th>
<th>SR</th>
<th>ABN</th>
<th>Syn</th>
<th>D</th>
<th>Redox</th>
<th>Cl</th>
<th>Anhydrides</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sodium nitrite is dissolved in water.</td>
<td></td>
</tr>
</tbody>
</table>

Prediction Problem Practice 28

<table>
<thead>
<tr>
<th>DR</th>
<th>SR</th>
<th>ABN</th>
<th>Syn</th>
<th>D</th>
<th>Redox</th>
<th>Cl</th>
<th>Anhydrides</th>
<th>C</th>
</tr>
</thead>
</table>

Prediction Problem Practice 29

<table>
<thead>
<tr>
<th>DR</th>
<th>SR</th>
<th>ABN</th>
<th>Syn</th>
<th>D</th>
<th>Redox</th>
<th>Cl</th>
<th>Anhydrides</th>
<th>C</th>
</tr>
</thead>
</table>