CHEMICAL REACTION TYPES - #1

Write balanced chemical equations for…

1. Hydrogen gas and chlorine gas explode when exposed to light.
2. Sulphuric acid is reacted with sodium hydrogen carbonate.
3. Solutions of barium nitrate and sodium sulphate react.
4. Ethane gas (C_2H_6) burns completely in air.
5. Nitrogen gas and hydrogen gas combine.
6. Lead(IV) oxide is decomposed by heat.
7. Silver nitrate solution reacts with sodium chloride solution.
8. Potassium metal reacts on cold water.
9. Aluminum oxide is dissolved in water.
10. Zinc metal reacts in a solution of copper(II) nitrate.
11. Chlorine gas is bubbled through a solution of sodium iodide.
12. Molten sodium chloride is decomposed by electrolysis.
13. Nitric acid solution is added to sodium hydroxide solution.
14. Sulphur dioxide gas is bubbled into water.
15. Phosphoric acid neutralized a solution of magnesium hydroxide.
16. Magnesium metal reacts slowly in cold water.
17. Calcium carbonate is etched by hydrochloric acid solution.
18. Gasoline (C_8H_{18}) burns incompletely in air. No solid products are formed.
19. Iron(III) chloride solution reacts with calcium metal.
20. Copper metal reacts is sulphur vapour.
21. Hydrogen sulphide gas is bubbled through arsenic(III) chloride solution.
22. Aluminum iodide is heated strongly in the absence of air.
23. Calcium hydrogen carbonate is added to sulphuric acid solution.
24. Sulphuric acid reacts with potassium hydroxide solution.
25. Iron forms rust in damp air.

CHEMICAL REACTION TYPES - #2

Write balanced chemical equations for the following reactions.

1. Lead reacts with aqueous hydrobromic acid. (assume a lead(II) product).
2. Propane from your barbque tank burns completely.
3. Solid aluminum reacts with liquid bromine.
4. Hydrogen peroxide naturally decomposes.
5. Barium is added to water.
6. Bromine and calcium iodide solutions are mixed.
7. Butane (C_4H_{10}) burns completely in oxygen.
8. Sodium oxide is added to water.
9. Solid magnesium is mixed with phosphoric acid.
10. Calcium hydroxide and nitric acid solutions are mixed.

11. Silver oxide decomposes.
12. Diphosphorus trioxide is added to water.
13. Arsenic(III) oxide decomposes when heated.
14. Calcium is added to water.
15. Aluminium and sulphuric acid are reacted.
16. Tin(IV) nitrate and sodium hydroxide are mixed.
17. Hydrogen gas and copper(II) oxide combine.
18. Sulphuric acid and magnesium hyrdrogencarbonate react.
19. Ethane (C_2H_6) burns incompletely in oxygen.
20. Sodium is added to water.
21. Hydrochloric acid is poured over iron.
22. Solution of calcium chloride and potassium carbonate react.
23. Potassium chlorate is decomposed.
24. Nitrogen dioxide gas is bubbled through water.
25. Calcium and chloric acid mix.

CHEMICAL REACTION TYPES - #3

Write balanced chemical equations for the following reactions.

1. Solutions of ferric sulphate and calcium nitrate mix.
2. Aqueous chlorine is poured into ammonium iodide solution.
3. Hot sodium metal reacts in iodine vapour.
4. Metallic zinc reacts in copper(II) sulphate solution.
5. Hydrochloric acid and potassium hydroxide solutions react.
6. Methane gas burns completely in air.
7. Water is added to metallic lithium.
8. Iron sheet is cleaned with dilute hydrochloric acid.
9. Mercuric oxide is heated strongly.
10. Kettle scale (calcium carbonate) is removed by acetic acid (vinegar - CH_3COOH)
11. Dinitrogen pentoxide dissolves in water.
12. Sodium bicarbonate is used to counteract excess stomach acid (HCl)
13. Hydrogen gas burns in air.
14. Ammonium sulphate and barium nitrate solution s are mixed.
15. Sulphuric acid neutralized aluminum hydroxide solution.
16. Acetylene gas (C_2H_2) and oxygen explode when ignited.
17. Steam is passed over hot magnesium.

Solubility Rules

(for predicting whether a precipitate will form)

SOLUBLE

1. all nitrates, chlorates, acetates

2. all alkali metals and ammonium salts

3. all chlorides, bromides and iodides (except silver, mercury (I) and lead (II). Note: $PbCl_2$ and $PbBr_2$ a soluble in hot water.

4. all sulfates (except Ca, Ba, Sr, an Pb(II)). Note: Ag_2SO_4 and Hg_2SO_4 are slightly soluble .

<u>INSOLUBLE</u>

1. all hydroxides (except alkali metals, barium and ammonium). Note: $Sr(OH)_2$ is slightly soluble.

2. all carbonates and phosphates (except alkali metals and ammonium).

3. all sulfides (except alkali metals, alkaline earth metals and ammonium).

1. Synthesis (marriage) – two substances combine.
   $MgO + O_2 \rightarrow MgO$

2. Decomposition (divorce) – one substance breaks into two.
   Na_2CO_3 heat $Na_2O + CO_2$

3. Single Displacement (cheating) – one substance gets replaced.
   $CuSO_4 + Fe \rightarrow FeSO_4 + Cu$

4. Double displacement (swapping) – substances switch.
   $Pb(NO_3)_2 + KI \rightarrow PbI_2 + KNO_3$

5. Complete Combustion (blaze of glory) – methane bubbles.
   $CH_4 + O_2 \rightarrow CO_2 + H_2O$

6. Incomplete Combustion (low O_2 levels; difficult to predict products)
   $CH_4 + O_2 \rightarrow CO_2 + H_2O + CO + C$

7. Reaction of a <u>metal oxide with water</u> produces a <u>metal hydroxide</u>
   $MgO + H_2O \longrightarrow Mg(OH)_2$

8. Reaction of a <u>nonmetal oxide with water</u> produces an <u>oxyacid</u>
   $SO_2 + H_2O \longrightarrow H_2SO_3$

9. Reaction of a <u>metal oxide with a nonmetal oxide gives an oxysalt</u>; reaction of a <u>metal hydroxide with a nonmetal oxide produces a "hydrogen" oxysalt</u>
   $CaO(s) + SO_3(g) \longrightarrow CaSO_4(s)$
   $NaOH(s) + CO_2(g) \longrightarrow NaHCO_3(s)$

10. Reaction of an <u>acid with a base gives a salt plus water</u>

$HCl(aq) + Ca(OH)_2(aq) \longrightarrow CaCl_2(aq) + H_2O(l)$

$H_2SO_4(aq) + Fe(OH)_3(s) \longrightarrow Fe_2(SO_4)_3(aq) + H_2O(l)$

11. <u>Ammonium salts</u> react with <u>metal hydroxides and oxides in</u> an acid-base reaction to produce <u>ammonia</u>

$NH_4Cl(aq) + KOH(aq) \longrightarrow NH_3(g) + H_2O(l) + KCl(aq)$

$NH_4NO_3(s) + CaO(s) \longrightarrow NH_3(g) + H_2O(l) + Ca(NO_3)_2(s)$

12. <u>Heating an oxysalt</u> produces a <u>metal oxide plus a nonmetal oxide</u> or a <u>metal salt plus oxygen</u>

$KClO_3(s) \xrightarrow{\Delta} KCl(s) + O_2(g)$

$CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$

13. Reaction of a carbonate with a strong acid produces carbonic acid and a salt. The carbonic acid decomposes to form CO_2 and H_2O.

$BaCO_3(s) + HBr(aq) \longrightarrow BaBr_2(aq) + H_2O(l) + CO_2(g)$

$NaHCO_3(aq) + H_2SO_4(aq) \longrightarrow Na_2SO_4(aq) + CO_2(g) + H_2O(l)$

$2HNO_3 + Na_2CO_3 \rightarrow 2NaNO_3 + CO_2 + H_2O$

$H_2SO_4 + CaCO_3 \rightarrow CaSO_4 + CO_2 + H_2O$

14. A reaction between an acid and a metal oxide to form a salt and water as the only products.

$3HCl + Fe_2O_3 \rightarrow FeCl_3 + 3H_2O$

$H_2SO_4 + CuO \rightarrow CuSO_4 + H_2O$

15. A reaction between an acid and a metal, forming a metal salt and hydrogen as the only products.

$2HCl + Zn \rightarrow ZnCl_2 + H_2$

$H_2SO_4 + Mg \rightarrow MgSO_4 + H_2$