

Balance the following equations:

1.  $\text{Al} + \text{N}_2 \rightarrow \text{AlN}$
2.  $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_3\text{O}_4$
3.  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
4.  $\text{NH}_4\text{NO}_3 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$
5.  $\text{KI} + \text{Cl}_2 \rightarrow \text{KCl} + \text{I}_2$
6.  $\text{Pb}(\text{NO}_3)_2 + \text{HCl} \rightarrow \text{PbCl}_2 + \text{HNO}_3$
7.  $\text{BaO}_2 \rightarrow \text{BaO} + \text{O}_2$
8.  $\text{Al} + \text{H}_2\text{SO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + \text{H}_2$
9.  $\text{CH}_4 + \text{Cl}_2 \rightarrow \text{CHCl}_3 + \text{HCl}$
10.  $\text{MgCl}_2 + \text{NaOH} \rightarrow \text{Mg}(\text{OH})_2 + \text{NaCl}$
11.  $\text{AgNO}_3 + \text{CuCl}_2 \rightarrow \text{AgCl} + \text{Cu}(\text{NO}_3)_2$
12.  $\text{ZnS} + \text{O}_2 \rightarrow \text{ZnO} + \text{SO}_2$
13.  $\text{Na} + \text{H}_2\text{O} \rightarrow \text{H}_2 + \text{NaOH}$
14.  $\text{BaCl}_2 + (\text{NH}_4)_2\text{CO}_3 \rightarrow \text{BaCO}_3 + \text{NH}_4\text{Cl}$
15.  $\text{C}_6\text{H}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
16.  $\text{Na} + \text{H}_2\text{O} \rightarrow \text{NaOH} + \text{H}_2$
17.  $\text{Fe} + \text{FeCl}_3 \rightarrow \text{FeCl}_2$
18.  $\text{Ba}(\text{OH})_2 + \text{AlCl}_3 \rightarrow \text{Al}(\text{OH})_3 + \text{BaCl}_2$
19.  $\text{H}_2\text{C}_2\text{O}_4 + \text{KOH} \rightarrow \text{K}_2\text{C}_2\text{O}_4 + \text{H}_2\text{O}$
20.  $\text{C}_2\text{H}_2\text{Cl}_4 + \text{Ca}(\text{OH})_2 \rightarrow \text{C}_2\text{HCl}_3 + \text{CaCl}_2 + \text{H}_2\text{O}$
21.  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \rightarrow \text{N}_2 + \text{Cr}_2\text{O}_3 + \text{H}_2\text{O}$
22.  $\text{Zn}_3\text{Sb}_2 + \text{H}_2\text{O} \rightarrow \text{Zn}(\text{OH})_2 + \text{SbH}_3$
23.  $\text{HClO}_4 + \text{P}_4\text{O}_{10} \rightarrow \text{H}_3\text{PO}_4 + \text{Cl}_2\text{O}_7$
24.  $\text{C}_6\text{H}_5\text{Cl} + \text{SiCl}_4 + \text{Na} \rightarrow (\text{C}_6\text{H}_5)_4\text{Si} + \text{NaCl}$
25.  $\text{Sb}_2\text{S}_3 + \text{HCl} \rightarrow \text{H}_3\text{SbCl}_6 + \text{H}_2\text{S}$
26.  $\text{IBr} + \text{NH}_3 \rightarrow \text{NI}_3 + \text{NH}_4\text{Br}$
27.  $\text{KrF}_2 + \text{H}_2\text{O} \rightarrow \text{Kr} + \text{O}_2 + \text{HF}$
28.  $\text{Na}_2\text{CO}_3 + \text{C} + \text{N}_2 \rightarrow \text{NaCN} + \text{CO}$
29.  $\text{K}_4\text{Fe}(\text{CN})_6 + \text{H}_2\text{SO}_4 + \text{H}_2\text{O} \rightarrow \text{K}_2\text{SO}_4 + \text{FeSO}_4 + (\text{NH}_4)_2\text{SO}_4 + \text{CO}$

## CHEMISTRY - CHAPTER 3: EQUATIONS

### BALANCING CHEMICAL EQUATIONS - NAMES GIVEN

### Practice Sheet #2

- Potassium reacts with water yielding potassium hydroxide and hydrogen
- Chlorine reacts with potassium bromide yielding potassium chloride and bromine
- Zinc + hydrogen chloride yields zinc chloride and hydrogen
- zinc sulfide + oxygen  $\rightarrow$  . zinc oxide + sulfur dioxide
- Aluminum + sodium hydroxide  $\rightarrow$   $\text{Na}_3\text{AlO}_3$  + hydrogen
- Ammonia + oxygen  $\rightarrow$  nitrogen monoxide + water
- Phosphorus + iron(III) oxide  $\rightarrow$  tetra-phosphorus decoxide + iron
- Cupric sulfide + oxygen  $\rightarrow$  copper(I) oxide + sulfur dioxide
- sodium bicarbonate + hydrogen sulfate  $\rightarrow$  sodium sulfate + water + carbon dioxide
- Sodium carbonate + silver nitrate  $\rightarrow$  sodium nitrate + silver carbonate
- Calcium + oxygen  $\rightarrow$  calcium oxide
- Zinc + ferric oxide  $\rightarrow$  zinc oxide + iron
- Magnesium bromide + chlorine  $\rightarrow$  magnesium chloride + bromine
- Sodium + water  $\rightarrow$  sodium hydroxide + hydrogen
- Potassium nitrate  $\rightarrow$  potassium nitrite + oxygen
- Calcium oxide + hydrochloric acid  $\rightarrow$  calcium chloride + water
- Magnesium + oxygen  $\rightarrow$  magnesium oxide
- Iron + oxygen  $\rightarrow$  iron(II) oxide
- Water + dinitrogen trioxide  $\rightarrow$  nitrous acid
- Sodium oxide + water  $\rightarrow$  sodium hydroxide
- Iron(III) oxide + carbon monoxide  $\rightarrow$  iron + carbon dioxide
- Methane ( $\text{CH}_4$ ) + oxygen  $\rightarrow$  carbon dioxide + water

## EQUATIONS – PREDICTING BY TYPE OF REACTION

**Part I: Complete the word equation and write the balanced chemical equation. Give the reason for the product(s) in each case. Consult the activity series and the solubility tables.**

### Composition reactions:

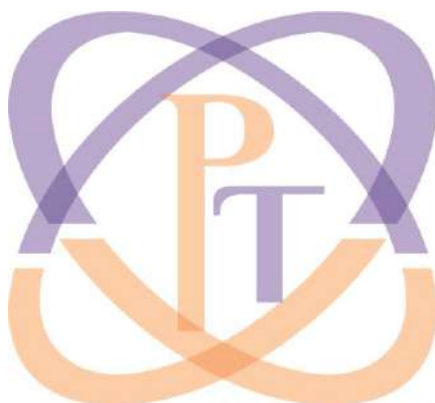
1. sodium + iodine  $\rightarrow$
2. calcium + oxygen  $\rightarrow$
3. hydrogen + chlorine  $\rightarrow$
4. calcium oxide + water  $\rightarrow$
5. dinitrogen pentoxide + water  $\rightarrow$

### Decomposition reactions:

6. nickel(II) chlorate  $\rightarrow$
7. barium carbonate  $\rightarrow$
8. zinc hydroxide  $\rightarrow$
9. mercury(II) oxide  $\rightarrow$
10. copper (II) carbonate  $\rightarrow$

### Replacement reactions:

11. aluminum + sulfuric acid  $\rightarrow$
12. potassium iodide + chlorine  $\rightarrow$
13. iron + copper (II) nitrate  $\rightarrow$
14. zinc + hydrochloric acid  $\rightarrow$
15. magnesium + silver nitrate  $\rightarrow$



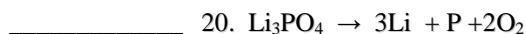
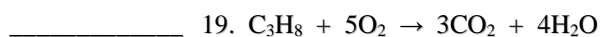
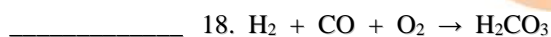
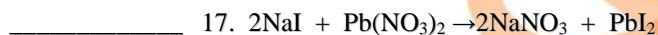
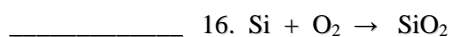
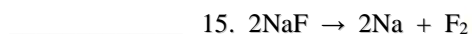
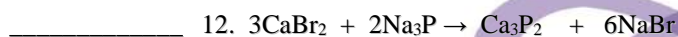
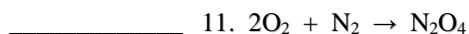
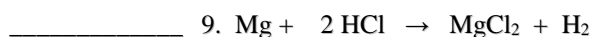
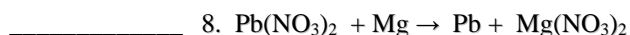
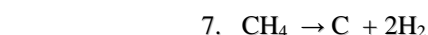
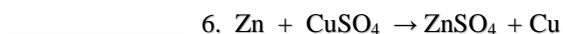
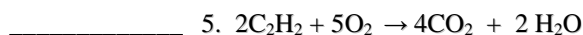
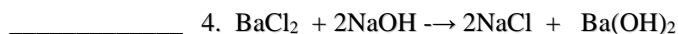
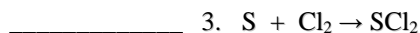
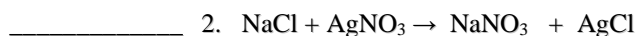
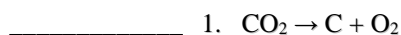
### Double Replacement (ionic reactions)

16. silver nitrate + zinc chloride  $\rightarrow$
17. copper(II) hydroxide + acetic acid  $\rightarrow$
18. iron(II) sulfate + ammonium sulfide  $\rightarrow$
19. ammonium chloride + sodium hydroxide  $\rightarrow$
20. hydrochloric acid + potassium hydroxide  $\rightarrow$

## CHEMISTRY - CHAPTER 3: EQUATIONS

### TYPES OF CHEMICAL EQUATIONS (IDENTIFICATION)

State whether each of the following equations represents a synthesis (s), decomposition(d), single replacement (sr), double replacement (dr), or combustion reaction (c).



### REACTION PREDICTION (Set #1)

If the word equation is complete, write and balance the chemical equation. If the word equation is incomplete, complete it and write the balanced chemical equation. Tell the type of reaction. Give reason(s) for the product(s)

1. barium chloride + sodium sulfate →
2. calcium + hydrochloric acid →
3. iron(II) sulfide + hydrochloric acid → hydrogen sulfide (g) +
4. zinc chloride + ammonium sulfide →
5. ammonia + oxygen → nitric acid + water
6. magnesium + nitric acid →
7. potassium + water →
8. sodium iodide + bromine →
9. silver + sulfur →
10. sodium chlorate →
11. carbon + steam (H<sub>2</sub>O) → carbon monoxide(g) + hydrogen (g)
12. zinc + lead(II) acetate →
13. iron (II) hydroxide →
14. iron(II) oxide + carbon monoxide → iron + carbon dioxide (g)
15. lead (II) acetate + hydrogen sulfide →
16. aluminum bromide + chlorine →
17. magnesium carbonate →
18. iron(II) chloride + sodium hydroxide →
19. calcium oxide + diphosphorus pentoxide →
20. chromium + oxygen →
21. sodium + water →
22. calcium carbonate + hydrochloric acid →
23. calcium hydroxide + phosphoric acid →
24. sodium carbonate + nitric acid →
25. aluminum hydroxide + sulfuric acid →
26. sodium sulfite + sulfuric acid →
27. copper + sulfuric acid → copper (II) sulfate + water + sulfur dioxide (g)
28. calcium hydroxide + ammonium sulfate → calcium sulfate + water + ammonia

## CHEMISTRY - CHAPTER 3: EQUATIONS

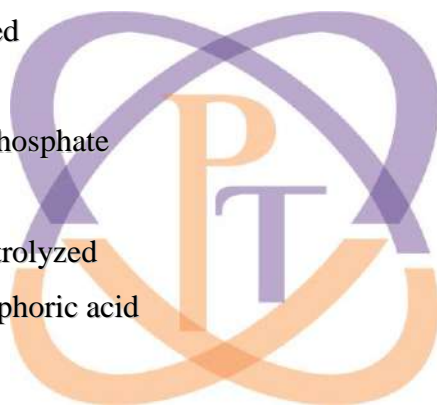
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### REACTION PREDICTION (Set #2)

In each of the following examples:

- a. State what type of reaction is expected.
- b. Write the balanced equation for those reaction that do take place.

1. aluminum plus hydrochloric acid
2. calcium hydroxide plus nitric acid
3. magnesium plus zinc nitrate
4. mercury plus oxygen
5. zinc chloride plus hydrogen sulfide
6. dinitrogen pentoxide plus water
7. sodium chlorate heated to high temperature
8. barium nitrate plus sodium chromate
9. sodium bromide plus silver nitrate
10. zinc carbonate strongly heated
11. potassium plus fluorine
12. potassium nitrate plus zinc phosphate
13. lithium oxide plus water
14. sodium chloride molten electrolyzed
15. iron(III) hydroxide plus phosphoric acid
16. sodium plus nitric acid
17. sulfur dioxide plus water
18. oxygen plus sulfur
19. sodium sulfate plus barium chloride
20. hydrogen plus oxygen
21. sodium oxide plus water
22. mercury(I) nitrate plus sodium carbonate
23. magnesium plus hydrochloric acid
24. lead(II) nitrate and sodium iodide
25. chromium(II) perchlorate and sodium sulfide

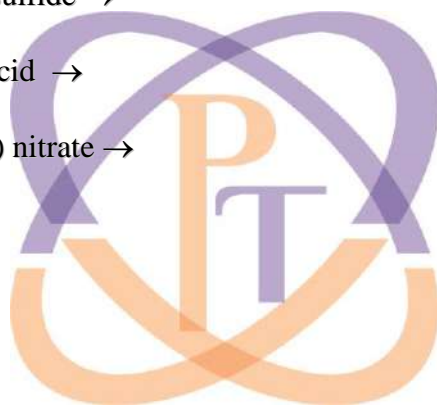


## CHEMISTRY - CHAPTER 3: EQUATIONS

### REACTION PREDICTION (Set #3)

Write a balanced chemical equation for each of the following reactions. Classify the reaction type.

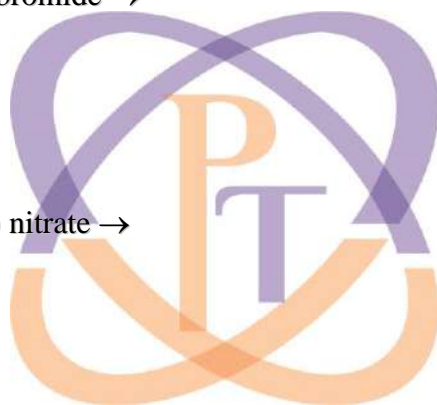
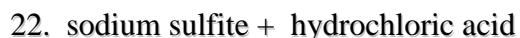
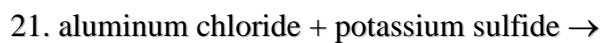
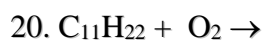
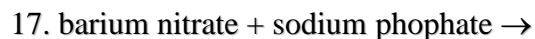
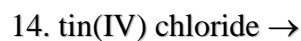
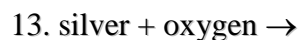
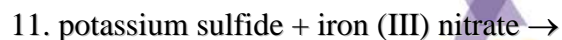
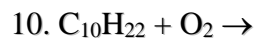
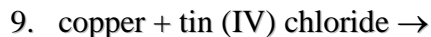
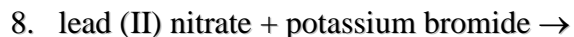
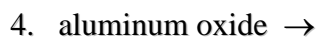
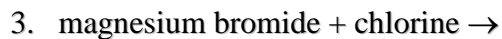
1. iron(III) oxide + hydrogen  $\rightarrow$
2. bismuth(V) oxide  $\rightarrow$
3. Manganese (II) chlorate + potassium phosphate  $\rightarrow$
4. Lead (II) acetate + sodium chromate  $\rightarrow$
5. potassium + iodine  $\rightarrow$
6. ammonium sulfate + barium nitrate  $\rightarrow$
7. zinc oxide  $\rightarrow$
8. gold(III) chloride + sodium sulfide  $\rightarrow$
9. magnesium + hydrochloric acid  $\rightarrow$
10. calcium hydroxide + iron (II) nitrate  $\rightarrow$
11.  $C_4H_{10} + O_2 \rightarrow$
12. tin(IV) sulfide  $\rightarrow$
13. silver nitrate + zinc  $\rightarrow$
14. potassium carbonate + lead (II) nitrate  $\rightarrow$
15. ammonium chloride + mercury(II) acetate  $\rightarrow$
16. iron + hydrochloric acid  $\rightarrow$
17. sodium iodide + chlorine  $\rightarrow$
18. aluminum + oxygen  $\rightarrow$
19. barium chloride + lithium sulfate  $\rightarrow$
20. sulfuric acid + calcium hydroxide  $\rightarrow$
21. iron (II) nitrate + sodium sulfite  $\rightarrow$
22.  $C_5H_{12} + O_2 \rightarrow$



## CHEMISTRY - CHAPTER 3: EQUATIONS

### REACTION PREDICTION (Set #4)

Write a balanced chemical equation for each of the following reactions. Classify the reaction type.





## CHEMISTRY - CHAPTER 3: EQUATIONS

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### REVIEW OF WRITING CHEMICAL EQUATIONS

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For each of the following equations write a formula equation.

**YOU DO NOT HAVE TO BALANCE IT.**

When applicable, write a net ionic equation.

1. Solutions of sodium fluoride and dilute hydrochloric acid are mixed.
2. A saturated solution of barium hydroxide is mixed with a solution of iron(III) sulfate.
3. A solution of ammonium sulfate is added to a potassium hydroxide solution.
4. Carbon dioxide gas is bubbled through a concentrated solution of sodium hydroxide.
5. Solid copper is added to a dilute nitric acid solution.
6. Magnesium metal is burned in nitrogen gas.
7. Sulfur dioxide gas is passed over solid calcium oxide.
8. Lead foil is immersed in silver nitrate solution.
9. A solution of ammonium sulfate is added to a saturated solution of barium hydroxide.
10. Acetic acid solution is added to a solution of sodium hydrogen carbonate.
11. Hydrogen gas is passed over hot iron(III) oxide.
12. Dilute hydrochloric acid is added to a dilute solution of mercury (I) nitrate.
13. Sodium metal is added to water.
14. Dilute sulfuric acid is added to a solution of lithium hydrogen carbonate.
15. A piece of lithium metal is dropped into a container of nitrogen gas.
16. Dilute hydrochloric acid is added to a solution of potassium sulfite.
17. Solid sodium oxide is added to water.
18. A solution of sodium sulfide is added to a solution of zinc nitrate.
19. A solution of ammonia is added to a dilute solution of acetic acid.
20. Solid calcium is added to warm water.
21. Powdered magnesium oxide is added to a container of carbon dioxide gas.
22. Gaseous hydrogen sulfide is bubbled through a solution of nickel(II) nitrate.
23. A strip of magnesium is added to a solution of silver nitrate.
24. Solid potassium chlorate is heated in the presence of manganese dioxide as a catalyst.
25. Dilute hydrochloric acid is added to a solution of potassium carbonate.
26. Sulfur trioxide gas is added to excess water.
27. Dilute sulfuric acid is added to a solution of barium chloride.
28. Solutions of zinc sulfate and sodium phosphate are mixed.
29. Solutions of silver nitrate and lithium bromide are mixed.
30. Excess hydrochloric acid solution is added to a solution of potassium carbonate.
31. Ethanol ( $C_2H_5OH$ ) is burned in excess oxygen gas.

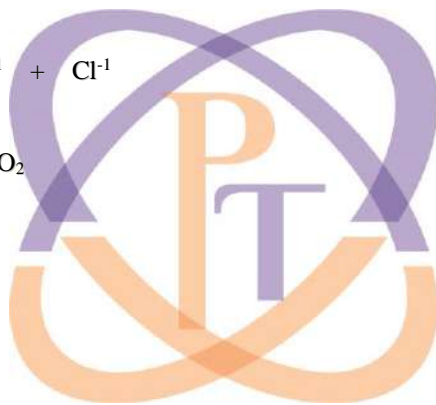
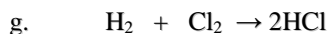
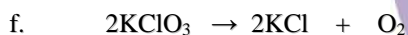
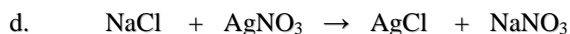
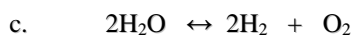
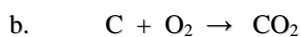
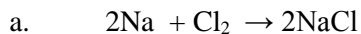
## CHEMISTRY - CHAPTER 3: EQUATIONS

### OXIDATION /REDUCTION REACTIONS

1. Assign oxidation number to each element in the following compounds:



2. Which of the following are oxidation-reduction reactions?



3. For each oxidation-reduction in Question 2 identify the:

a. substance oxidized

b. substance reduced

c. the oxidizing agent

d. the reducing agent

e. write the oxidation and reduction half-reactions

## CHEMISTRY - CHAPTER 3: EQUATIONS

### OXIDATION REDUCTION REACTIONS – BALANCING: Set #1

Balance the following equations using the ion-electron method.

- $\text{H}_2\text{S} + \text{O}_2 \rightarrow \text{SO}_2 + \text{H}_2\text{O}$
- $\text{MnO}_2 + \text{HCl} \rightarrow \text{H}_2\text{O} + \text{MnCl}_2 + \text{Cl}_2$
- zinc + hydrochloric acid  $\rightarrow$  zinc chloride + hydrogen
- iron + copper(II) sulfate  $\rightarrow$  iron (II) sulfate + copper
- copper + sulfuric acid  $\rightarrow$  copper (II) sulfate + hydrogen
- potassium dichromate + sulfur + water  $\rightarrow$  sulfur dioxide + potassium hydroxide + chromium (III) oxide
- bromine + water  $\rightarrow$  hydrobromic acid + hypobromous acid
- $\text{HCl} + \text{KMnO}_4 \rightarrow \text{H}_2\text{O} + \text{KCl} + \text{MnCl}_2 + \text{Cl}_2$
- $\text{K}_2\text{Cr}_2\text{O}_7 + \text{HCl} \rightarrow \text{KCl} + \text{CrCl}_3 + \text{H}_2\text{O} + \text{Cl}_2$
- $\text{Cu}_2\text{O} + \text{SO}_2 \rightarrow \text{CuS} + \text{O}_2$
- $\text{CS}_2 + \text{SCl}_2 \rightarrow \text{CCl}_4 + \text{S}$
- $\text{NaAu}(\text{CN})_2 + \text{Zn} \rightarrow \text{Na}_2\text{Zn}(\text{CN})_4 + \text{Au}$
- $\text{FeSO}_4 + \text{O}_2 + \text{H}_2\text{O} \rightarrow \text{FeOHSO}_4$
- $\text{HBr} + \text{Ca}(\text{BrO})_2 \rightarrow \text{CaBr}_2 + \text{Br}_2 + \text{H}_2\text{O}$
- $\text{Ca}_3(\text{PO}_4)_2 + \text{SiO}_2 \rightarrow \text{P}_4\text{O}_{10} + \text{CaSiO}_3$
- The oxidation-reduction reaction between copper and concentrated nitric acid yields the following products: copper(II) nitrate, water and nitrogen dioxide. Write a balanced equation for this reaction.
- The reaction between copper and dilute nitric acid yields the following products: copper (II) nitrate, water and nitrogen monoxide. Write the balanced equation.

**Balancing REDOX  
Reactions: Set #2**

**PROBLEMS**

Balance these equations.

1.  $\text{HNO}_3 + \text{S} \rightarrow \text{NO}_2 + \text{H}_2\text{SO}_4 + \text{H}_2\text{O}$
2.  $\text{CrCl}_3 + \text{MnO}_2 + \text{H}_2\text{O} \rightarrow \text{MnCl}_2 + \text{H}_2\text{CrO}_4$
3.  $\text{KMnO}_4 + \text{HCl} + \text{H}_2\text{S} \rightarrow \text{KCl} + \text{MnCl}_2 + \text{S} + \text{H}_2\text{O}$
4.  $\text{HNO}_3 + \text{S} \rightarrow \text{NO} + \text{H}_2\text{SO}_4$
5.  $\text{HNO}_3 + \text{H}_2\text{S} \rightarrow \text{H}_2\text{SO}_4 + \text{NO}_2 + \text{H}_2\text{O}$
6.  $\text{HNO}_3 + \text{P} \rightarrow \text{H}_3\text{PO}_4 + \text{NO}_2 + \text{H}_2\text{O}$
7.  $\text{FeCl}_3 + \text{H}_2\text{S} \rightarrow \text{FeCl}_2 + \text{HCl} + \text{S}$
8.  $\text{KOH} + \text{MnO}_2 + \text{KClO}_3 \rightarrow \text{K}_2\text{MnO}_4 + \text{KCl} + \text{H}_2\text{O}$
9.  $\text{KMnO}_4 + \text{H}_2\text{S} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{S} + \text{H}_2\text{O}$
10.  $\text{Cu} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{SO}_2 + \text{H}_2\text{O}$
11.  $\text{Cu} + \text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{NO}_2 + \text{H}_2\text{O}$
12.  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{SO}_2 + \text{H}_2\text{O}$
13.  $\text{Cu} + \text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{NO} + \text{H}_2\text{O}$
14.  $\text{MnO}_2 + \text{HCl} \rightarrow \text{MnCl}_2 + \text{H}_2\text{O} + \text{Cl}_2$
15.  $\text{KMnO}_4 + \text{H}_2\text{SO}_3 \rightarrow \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{H}_2\text{SO}_4 + \text{H}_2\text{O}$
16.  $\text{KMnO}_4 + \text{HCl} \rightarrow \text{KCl} + \text{MnCl}_2 + \text{H}_2\text{O} + \text{Cl}_2$
17.  $\text{NaCl} + \text{H}_2\text{SO}_4 + \text{MnO}_2 \rightarrow \text{Na}_2\text{SO}_4 + \text{MnSO}_4 + \text{H}_2\text{O} + \text{Cl}_2$
18.  $\text{NH}_3 + \text{CuO} \rightarrow \text{Cu} + \text{H}_2\text{O} + \text{N}_2$
19.  $\text{K}_2\text{Cr}_2\text{O}_7 + \text{HCl} + \text{H}_2\text{S} \rightarrow \text{KCl} + \text{CrCl}_3 + \text{H}_2\text{O} + \text{S}$
20.  $\text{K}_2\text{Cr}_2\text{O}_7 + \text{KI} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{Cr}_2(\text{SO}_4)_3 + \text{H}_2\text{O} + \text{I}_2$
21.  $\text{HMnO}_4 + \text{HCl} \rightarrow \text{MnCl}_2 + \text{H}_2\text{O} + \text{Cl}_2$
22.  $\text{KMnO}_4 + \text{FeSO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{Fe}_2(\text{SO}_4)_3 + \text{H}_2\text{O}$
23.  $\text{FeCl}_2 + \text{K}_2\text{Cr}_2\text{O}_7 + \text{HCl} \rightarrow \text{FeCl}_3 + \text{KCl} + \text{CrCl}_3 + \text{H}_2\text{O}$

24.  $\text{HNO}_3 + \text{I}_2 + \text{H}_2\text{O} \rightarrow \text{NO} + \text{HIO}$
25.  $\text{FeSO}_4 + \text{H}_2\text{SO}_4 + \text{HNO}_3 \rightarrow \text{Fe}_2(\text{SO}_4)_3 + \text{NO} + \text{H}_2\text{O}$
26.  $\text{Zn} + \text{HNO}_3 \rightarrow \text{Zn}(\text{NO}_3)_2 + \text{NO} + \text{H}_2\text{O}$
27.  $\text{Bi}(\text{OH})_3 + \text{K}_2\text{SnO}_2 \rightarrow \text{Bi} + \text{K}_2\text{SnO}_3 + \text{H}_2\text{O}$
28.  $\text{Bi}_2\text{S}_3 + \text{HNO}_3 \rightarrow \text{Bi}(\text{NO}_3)_3 + \text{NO} + \text{S} + \text{H}_2\text{O}$
29.  $\text{Sn} + \text{HNO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SnO}_3 + \text{NO}$
30.  $\text{Au} + \text{HNO}_3 + \text{HCl} \rightarrow \text{AuCl}_3 + \text{NO} + \text{H}_2\text{O}$
31.  $\text{KClO}_3 + \text{FeSO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{KCl} + \text{Fe}_2(\text{SO}_4)_3 + \text{H}_2\text{O}$
32.  $\text{Hg} + \text{HNO}_3 \rightarrow \text{Hg}(\text{NO}_3)_2 + \text{NO} + \text{H}_2\text{O}$
33.  $\text{H}_2\text{O} + \text{SO}_2 + \text{HNO}_3 \rightarrow \text{H}_2\text{SO}_4 + \text{N}_2\text{O}_3$
34.  $\text{NH}_3 + \text{Cl}_2 \rightarrow \text{N}_2 + \text{HCl}$
35.  $\text{SbCl}_3 + \text{HCl} + \text{NaBrO}_3 \rightarrow \text{SbCl}_5 + \text{NaBr} + \text{H}_2\text{O}$
36.  $\text{CrCl}_2 + \text{HCl} + \text{O}_2 \rightarrow \text{CrCl}_3 + \text{H}_2\text{O}$
37.  $\text{Sb}_2\text{O}_5 + \text{KI} + \text{HCl} \rightarrow \text{SbCl}_3 + \text{KCl} + \text{I}_2 + \text{H}_2\text{O}$
38.  $\text{KMnO}_4 + \text{HCl} + \text{FeCl}_2 \rightarrow \text{MnCl}_2 + \text{KCl} + \text{FeCl}_3 + \text{H}_2\text{O}$
39.  $\text{Mn}(\text{NO}_3)_2 + \text{PbO}_2 + \text{HNO}_3 \rightarrow \text{HMnO}_4 + \text{Pb}(\text{NO}_3)_2 + \text{H}_2\text{O}$
40.  $\text{H}_2\text{O}_2 + \text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{KHSO}_4 + \text{MnSO}_4 + \text{O}_2 + \text{H}_2\text{O}$

\* Answers are given only for the odd numbered exercises,