# Science 1206

Unit 2: Chemical Reactions

Worksheet 12: Balancing Chemical Reactions

The most important point to remember when dealing with chemical equations is that the amount of an element on one side of the equation must equal the amount of that element on the other side of the equation. This is true for each element involved in the reaction. This rule is referred to as the law of conservation of mass.

When balancing chemical reactions you may add coefficients in front of the compounds to balance the reaction, but you can not change the subscripts. Changing the subscripts changes the compounds.

**Steps for Balancing Equations:**

There are four basic steps to balance a chemical equation:

1) Write the correct formula for the reactants and the products. DO NOT TRY TO BALANCE IT YET! You write the correct formulas first! Once you write them correctly, DO NOT CHANGE THE FORMULAS!

2) Find the number of atoms for each element on the left side . Compare against the number of the atoms of the same element on the right side.

3) Determine where to place coefficients in front of the formulas so that the left side has the same number of atoms as the right side for each element in order to balance the equation.

4) CHECK YOUR ANSWER TO SEE IF:
- The number of atoms on both sides of the equation are now balanced
- The coefficients are in the lowest possible whole ratios. (Reduce)

Here are some helpful hints for balancing:

- Take one element at a time, working from left to right except for Hydrogen (H) and Oxygen(O). Save H for next to last, and O until last.

- If everything balances except for O, and there is no way to balance O with a whole number, double all coefficients and try again. (Remember, O is diatomic as an element.

- Polyatomic ions that appear on both sides of the equation should be balanced as independents units.

KEY

## IDENTIFYING/BALANCING CHEMICAL REACTIONS

For each of the following:
(a) Choose the correct responses for the balancing of each reaction.
(b) Identify the reaction type.
Write your answers on the summary sheet.

1) ___ $NaOH_{(aq)}$ + __ $CaBr_{2\ (aq)}$ → __ $Ca(OH)_{2\ (s)}$ + ___ $NaBr_{(aq)}$

A. 1,1,1,1
B. 2,1,1,2
C. 2,2,1,2
**Type of reaction:** _____
A. synthesis
B. decomposition
C. single replacement
D. double replacement
E. combustion

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2) ____ $N_{2\ (g)}$ + ____ $H_{2\ (g)}$ → ____ $NH_{3\ (g)}$

A. 1,3,2
B. 1,3,1
C. 1,2,1
**Type of reaction:** _____
A. synthesis
B. decomposition
C. single replacement
D. double replacement
E. combustion

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3) ____ $C_3H_{8\ (g)}$ + ____ $O_{2\ (g)}$ → ____ $CO_{2\ (g)}$ + ____ $H_2O_{\ (g)}$

A. 1,3,3,4
B. 1,4,3,4
C. 1,5,3,4
**Type of reaction:** _____
A. synthesis
B. decomposition
C. single replacement
D. double replacement
E. combustion

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4) ____ $Pb_{(s)}$ + ____ $H_3PO_{4\ (aq)}$ → ____ $H_{2\ (g)}$ + ____ $Pb_3(PO_4)_{2\ (s)}$

A. 3,2,3,1
B. 3,3,3,1
C. 3,4,3,1
**Type of reaction:** _____
A. synthesis
B. decomposition
C. single replacement
D. double replacement
E. combustion

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5) ____ $Li_3N$ + ____ $NH_4NO_3$ → ____ $LiNO_3$ + ____ $(NH_4)_3N$

A. 1,2,2,1
B. 1,3,2,1
C. 1,3,3,1
Type of reaction: _____
A. synthesis
B. decomposition
C. single replacement
D. double replacement
E. combustion

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6) ____ $HBr$ + ____ $Al(OH)_3$ → ____ $HOH$ + ____ $AlBr_3$

A. 3,1,1,1
B. 3,1,3,1
C. 3,1,2,1
Type of reaction: _____
A. synthesis
B. decomposition
C. single replacement
D. double replacement
E. combustion

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

A. 1,2,1
B. 1,2,2
C. 2,2,3
Type of reaction: _____
A. synthesis
B. decomposition
C. single replacement
D. double replacement
E. combustion

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8) ____ $H_2$ (g) + ____ $O_2$ (g) → ____ $H_2O$ (l)

A. 1,2,1
B. 2,1,2
C. 2,2,1
Type of reaction: _____
A. synthesis
B. decomposition
C. single replacement
D. double replacement
E. combustion

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9) ____ $NH_{3\,(g)}$ → ____ $N_{2\,(g)}$ + ____ $H_{2\,(g)}$

A. 2,1,2
B. 2,1,3
C. 2,2,1
Type of reaction: _____
A. synthesis
B. decomposition
C. single replacement
D. double replacement
E. combustion

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10) ____ $Li_{(s)}$ + ____ $AgNO_{3\,(aq)}$ → ____ $Ag_{(s)}$ + ____ $LINO_{3\,(aq)}$

A. 3,2,1,1
B. 2,1,1,1
C. 1,1,1,1
Type of reaction: _____
A. synthesis
B. decomposition
C. single replacement
D. double replacement
E. combustion

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**emistry: *Balancing Chemical Equations***

***ctions:*** *First, balance each of the chemical equations below. Then, classify each reaction as* ***synthesis, decomposition, single-replacement,*** *or* ***double-replacement.*** *To earn full credit, write the words o when classifying.*

**ance the equation...** **...and classify it.**

____ Sb + ____ $Cl_2$ → ____ $SbCl_5$ _____

____ Mg + ____ $O_2$ → ____ MgO _____

____ $CaCl_2$ → ____ Ca + ____ $Cl_2$ _____

____ $NaClO_3$ → ____ NaCl + ____ $O_2$ _____

____ Fe + ____ HCl → ____ $FeCl_2$ + ____ $H_2$ _____

____ CuO + ____ $H_2$ → ____ Cu + ____ $H_2O$ _____

____ Al + ____ $H_2SO_4$ → ____ $Al_2(SO_4)_3$ + ____ $H_2$ _____

____ $MgBr_2$ + ____ $Cl_2$ → ____ $MgCl_2$ + ____ $Br_2$ _____

____ $SnO_2$ + ____ C → ____ Sn + ____ CO _____

____ $Pb(NO_3)_2$ + ____ $H_2S$ → ____ PbS + ____ $HNO_3$ _____

____ HgO → ____ Hg + ____ $O_2$ _____

____ $KClO_3$ → ____ KCl + ____ $O_2$ _____

____ $N_2$ + ____ $H_2$ → ____ $NH_3$ _____

____ NaBr + ____ $Cl_2$ → ____ NaCl + ____ $Br_2$ _____

____ Zn + ____ $AgNO_3$ → ____ $Zn(NO_3)_2$ + ____ Ag _____

____ Sn + ____ $Cl_2$ → ____ $SnCl_4$ _____

____ $Ba(OH)_2$ → ____ BaO + ____ $H_2O$ _____

***SCIENCE 1206 Section 2:**
For each of the following skeleton chemical equations:

a) ***Identify the type of reaction***. Remember that the five identifiable types of reactions are **synthesis (composition), decomposition, single displacement (replacement), double displacement (replacement), and hydrocarbon combustion.**

b) ***Balance the equation***.

1) ___ $Na_3PO_{4\,(aq)}$ + ____KOH (aq) → ____NaOH (aq) + ___$K_3PO_4$ (aq)

2) ___$MgCl_2$ (aq) + ___$Li_2CO_3$ (aq) → ___ $MgCO_3$ (s) + ____ LiCl (aq)

3) ___$C_8H_{12}$ (l0 + ___$O_2$ (g) → $CO_2$ (g) + __$H_2O$ (g)

4) ___Pb (s) +___$FeSO_4$ (aq) → ___$PbSO_4$ (aq) + ___Fe (s)

5) ____$CaCO_{3\,(s)}$ → ___CaO (s) + ___$CO_{2\,(g)}$

6) ___$P_{4\,(s0}$ + ___$O_2$ (g) → ___$P_2O_{3\,(s)}$

7) ___$RbNO_{3\,(aq)}$ + ___$BeF_{2\,(aq)}$ → ___$Be(NO_3)_{2\,(aq)}$ + ___RbF (aq)

8) ___$AgNO_{3\,(aq)}$ + ___Cu (s) → ___$Cu(NO_3)_{2\,(aq)}$ + ___Ag (s)

9) ___$C_3H_6O$ (l) + ___$O_{2\,(g)}$ → ___$CO_2$ (g) + ___$H_2O$ (g)

10) ___$C_6H_{6\,(g)}$ + ___Fe (s) → $Fe(C_6H_5)_{2\,(s)}$

11) ___$SeCl_{8\,(s)}$ + ___$O_2$ (g) → ___$SeO_{2\,(s)}$ + $3Cl_{2\,(g)}$

12) ___$MgI_{2\,(aq)}$ + ___$Mn(SO_3)_{2\,(aq)}$ → ___$MgSO_{3\,(\,)}$ + ___$MnI_{4\,(\,)}$

13) ___$O_{3\,(g)}$ → ___O (g) + ___$O_{2\,(g)}$

14) ___$NO_{2\,(g)}$ → ___$O_{2\,(g)}$ + ___$N_{2\,(g)}$

**SCIENCE 1206 SUMMARY SHEET NAME:**_____
**IDENTIFYING CHEMICAL REACTION TYPE and BALANCING CHEMICAL REACTIONS**

*For each of the following;*
*(a) Balance the skeleton equations and*
*(b) Indicate which of the 5 types of chemical reaction is represented.*

1) ___ $NaOH_{(aq)}$ + ___ $CaBr_{2(aq)}$ → ___ $Ca(OH)_{2(s)}$ + ___ $NaBr_{(aq)}$

Type of reaction: _____

2) ___ $N_{2(g)}$ + ___ $H_{2(g)}$ → ___ $NH_{3(g)}$

Type of reaction: _____

3) ___ $C_3H_{8(g)}$ + ___ $O_{2(g)}$ → ___ $CO_{2(g)}$ + ___ $H_2O_{(g)}$

Type of reaction: _____

4) ___ $Pb_{(s)}$ + ___ $H_3PO_{4(aq)}$ → ___ $H_{2(g)}$ + ___ $Pb_3(PO_4)_{2(s)}$

Type of reaction: _____

5) ___ $Li_3N$ + ___ $NH_4NO_3$ → ___ $LiNO_3$ + ___ $(NH_4)_3N$

Type of reaction: _____

6) ___ $HBr_{(aq)}$ + ___ $Al(OH)_{3(aq)}$ → ___ $HOH_{(l)}$ + ___ $AlBr_3$

Type of reaction: _____

7) ___ $KClO_{3(s)}$ $\xrightarrow{\Delta}$ ___ $KCl_{(s)}$ + ___ $O_{2(g)}$

Type of reaction: _____

8) ___ $H_{2(g)}$ + ___ $O_{2(g)}$ → ___ $H_2O_{(g)}$

Type of reaction: _____

9) ___ $NH_{3(g)}$ → ___ $N_{2(g)}$ + ___ $H_{2(g)}$

Type of reaction: _____