A Voyage through Equations

After working on this worksheet, you should be able to do the following:

1) Given an equation, you should be able to tell what kind of reaction it is.

2) Predict the products of a reaction when given the reactants.

Section 1: Identify the type of reaction

For the following reactions, indicate whether the following are examples of synthesis, decomposition, combustion, single displacement, double displacement, or acid-base reactions:

1) $Na_3PO_4 + 3\ KOH \rightarrow 3\ NaOH + K_3PO_4$ _____

2) $MgCl_2 + Li_2CO_3 \rightarrow MgCO_3 + 2\ LiCl$ _____

3) $C_6H_{12} + 9\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$ _____

4) $Pb + FeSO_4 \rightarrow PbSO_4 + Fe$ _____

5) $CaCO_3 \rightarrow CaO + CO_2$ _____

6) $P_4 + 3\ O_2 \rightarrow 2\ P_2O_3$ _____

7) $2\ RbNO_3 + BeF_2 \rightarrow Be(NO_3)_2 + 2\ RbF$ _____

8) $2\ AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2\ Ag$ _____

9) $C_3H_6O + 4\ O_2 \rightarrow 3\ CO_2 + 3\ H_2O$ _____

10) $2\ C_5H_5 + Fe \rightarrow Fe(C_5H_5)_2$ _____

11) $SeCl_6 + O_2 \rightarrow SeO_2 + 3Cl_2$ _____

12) $2\ MgI_2 + Mn(SO_3)_2 \rightarrow 2\ MgSO_3 + MnI_4$ _____

13) $O_3 \rightarrow O^{\cdot} + O_2$ _____

14) $2\ NO_2 \rightarrow 2\ O_2 + N_2$_____

Section 2: Practicing equation balancing

Before you can write a balanced equation for a problem which asks you to predict the products of a reaction, you need to know how to balance an equation. Because some of you may not fully remember how to balance an equation, here are some practice problems:

1) __ C_6H_6 + __ O_2 → __ H_2O + __ CO_2

2) __ NaI + __ $Pb(SO_4)_2$ → __ PbI_4 + __ Na_2SO_4

3) __ NH_3 + __ O_2 →__ NO + __ H_2O

4) __ $Fe(OH)_3$ → __ Fe_2O_3 + __ H_2O

5) __ HNO_3 + __ $Mg(OH)_2$ → __H_2O + __ $Mg(NO_3)_2$

6) __ H_3PO_4 + __ NaBr → __ HBr + __ Na_3PO_4

7) __ C + __ H_2 → __ C_3H_8

8) __ CaO + __ MnI_4 → __ MnO_2 + __ CaI_2

9) __ Fe_2O_3 + __ H_2O → __ $Fe(OH)_3$

10) __ C_2H_2 + __ H_2 → __ C_2H_6

11) __ VF_5 + __ HI → __ V_2I_{10} + __ HF

12) __ OsO_4 + __ $PtCl_4$ → __ PtO_2 + __ $OsCl_8$

13) __ CF_4 + __ Br_2 → __ CBr_4 + __ F_2

14) __ Hg_2I_2 + __ O_2 → __ Hg_2O + __ I_2

15) __ $Y(NO_3)_2$ + __ $GaPO_4$ → __ YPO_4 + __ $Ga(NO_3)_2$

Section 3: Predicting the products of chemical reactions

Predict the products of the following reactions:

1) __ Ag + __$CuSO_4$ →

Type:_____

2) __ NaI + __ $CaCl_2$ →

Type:_____

3) __ O_2 + __ H_2 →

Type:_____

4) __ HNO_3 + __ $Mn(OH)_2$ →

Type:_____

5) __ $AgNO_2$ + __ $BaSO_4$ →

Type:_____

6) __ HCN + __ $CuSO_4$ →

Type:_____

7) __ H_2O + __ AgI →

Type:_____

8) __ HNO_3 + __$Fe(OH)_3$ →

Type:_____

9) __ LiBr + __ $Co(SO_3)_2$ →

Type:_____

10) __ $LiNO_3$ + __Ag →

Type:_____

11) __ N_2 + __ O_2 →

Type:_____

12) __ H_2CO_3 →

Type:_____

13) __ $AlCl_3$ + __ Cs →

Type:_____

14) __ $Al(NO_3)_3$ + __ Ga →

Type:_____

15) __ H_2SO_4 + __ NH_4OH →

Type:_____

16) __ CH_3COOH + __ O_2 →

Type:_____

17) __ C_4H_8 + __ O_2 →

Type:_____

18) __ KCl + __ $Mg(OH)_2$ →

Type:_____

19) __ Zn + __ $Au(NO_2)_2$ →

Type:_____

20) __ KOH + __ H_2SO_4 →

Type:_____

21) __ BaS + __ $PtCl_2$ →

Type:_____

22) __ Na_2O →

Type:_____

A Voyage through Equations ANSWER KEY

Section 1: Identify the type of reaction

1) $Na_3PO_4 + 3\ KOH \rightarrow 3\ NaOH + K_3PO_4$ **DOUBLE DISPLACEMENT**

2) $MgCl_2 + Li_2CO_3 \rightarrow MgCO_3 + 2\ LiCl$ **DOUBLE DISPLACEMENT**

3) $C_6H_{12} + 9\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$ **COMBUSTION**

4) $Pb + FeSO_4 \rightarrow PbSO_4 + Fe$ **SINGLE DISPLACEMENT**

5) $CaCO_3 \rightarrow CaO + CO_2$ **DECOMPOSITION**

6) $P_4 + 3\ O_2 \rightarrow 2\ P_2O_3$ **SYNTHESIS**

7) $2\ RbNO_3 + BeF_2 \rightarrow Be(NO_3)_2 + 2\ RbF$ **DOUBLE DISPLACEMENT**

8) $2\ AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2\ Ag$ **SINGLE DISPLACEMENT**

9) $C_3H_6O + 4\ O_2 \rightarrow 3\ CO_2 + 3\ H_2O$ **COMBUSTION**

10) $2\ C_5H_5 + Fe \rightarrow Fe(C_5H_5)_2$ **SYNTHESIS**

11) $SeCl_6 + O_2 \rightarrow SeO_2 + 3Cl_2$ **SINGLE DISPLACEMENT**

12) $2\ MgI_2 + Mn(SO_3)_2 \rightarrow 2\ MgSO_3 + MnI_4$ **DOUBLE DISPLACEMENT**

13) $O_3 \rightarrow O\cdot + O_2$ **DECOMPOSITION**

14) $2\ NO_2 \rightarrow 2\ O_2 + N_2$ **DECOMPOSITION**

Section 2: Practicing equation balancing

1) $\underline{2}\ C_6H_6 + \underline{15}\ O_2 \rightarrow \underline{6}\ H_2O + \underline{12}\ CO_2$

2) $\underline{4}\ NaI + \underline{1}\ Pb(SO_4)_2 \rightarrow \underline{1}\ PbI_4 + \underline{2}\ Na_2SO_4$

3) $\underline{2}\ NH_3 + \underline{2}\ O_2 \rightarrow \underline{1}\ NO + \underline{3}\ H_2O$

4) $\underline{2}\ Fe(OH)_3 \rightarrow \underline{1}\ Fe_2O_3 + \underline{3}\ H_2O$

5) $\underline{2}\ HNO_3 + \underline{1}\ Mg(OH)_2 \rightarrow \underline{2}\ H_2O + \underline{1}\ Mg(NO_3)_2$

6) $\underline{1}\ H_3PO_4 + \underline{3}\ NaBr \rightarrow \underline{3}\ HBr + \underline{1}\ Na_3PO_4$

7) $\underline{3}\ C + \underline{4}\ H_2 \rightarrow \underline{1}\ C_3H_8$

8) $\underline{2}\ CaO + \underline{1}\ MnI_4 \rightarrow \underline{1}\ MnO_2 + \underline{2}\ CaI_2$

9) $\underline{1}\ Fe_2O_3 + \underline{3}\ H_2O \rightarrow \underline{2}\ Fe(OH)_3$

10) $\underline{1}\ C_2H_2 + \underline{2}\ H_2 \rightarrow \underline{1}\ C_2H_6$

11) 2 VF_5 + 10 HI → 1 V_2I_{10} + 10 HF

12) 1 OsO_4 + 2 $PtCl_4$ → 2 PtO_2 + 1 $OsCl_8$

13) 1 CF_4 + 2 Br_2 → 1 CBr_4 + 2 F_2

14) 2 Hg_2I_2 + 1 O_2 → 2 Hg_2O + 2 I_2

15) 1 $Y(NO_3)_2$ + 1 $GaPO_4$ → 1 YPO_4 + 1 $Ga(NO_3)_2$

Section 3: Predicting the products of chemical reactions

1) 2 Ag + 1 $CuSO_4$ → 1 Ag_2SO_4 + 1 Cu — Type: **Single Displacement**

2) 2 NaI + 1 $CaCl_2$ → 2 NaCl + 1 CaI_2 — Type: **Double Displacement**

3) 1 O_2 + 1 H_2 → 2 H_2O — Type: **Synthesis**

4) 2 HNO_3 + 1 $Mn(OH)_2$ → 2 H_2O + 1 $Mn(NO_3)_2$ — Type: **Acid-Base**

5) 2 $AgNO_2$ + 1 $BaSO_4$ → 1 Ag_2SO_4 + 1 $Ba(NO_2)_2$ — Type: **Double Displacement**

6) 2 HCN + 1 $CuSO_4$ → 1 H_2SO_4 + 1 $Cu(CN)_2$ — Type: **Double Displacement**

7) 1 H_2O + 1 AgI → 1 HI + 1 AgOH — Type: **Double Displacement**

8) 3 HNO_3 + 1 $Fe(OH)_3$ → 3 H_2O + 1 $Fe(NO_3)_3$ — Type: **Acid-Base**

9) 4 LiBr + 1 $Co(SO_3)_2$ → 2 Li_2SO_3 + 1 $CoBr_4$ — Type: **Double Displacement**

10) 1 $LiNO_3$ + 1 Ag → 1 $AgNO_3$ + 1 Li — Type: **Single Displacement**

11) 1 N_2 + 2 O_2 → 2 NO_2 — Type: **Synthesis**

12) 1 H_2CO_3 → 1 CO_2 + 1 H_2O — Type: **Decomposition**

13) 1 $AlCl_3$ + 3 Cs → 3 CsCl + 1 Al — Type: **Single Displacement**

14) 1 $Al(NO_3)_3$ + 1 Ga → 1 $Ga(NO_3)_3$ + 1 Al — Type: **Single Displacement**

15) 1 H_2SO_4 + 2 NH_4OH → 2 H_2O + 1 $(NH_4)_2SO_4$ — Type: **Acid-Base**

16) 1 CH_3COOH + 1 O_2 → 1 CO_2 + 2 H_2O — Type: **Combustion**

17) 1 C_4H_8 + 6 O_2 → 4 CO_2 + 4 H_2O — Type: **Combustion**

18) 2 KCl + 1 $Mg(OH)_2$ → 2 KOH + 1 $MgCl_2$ — Type: **Double Displacement**

19) 1 Zn + 1 $Au(NO_2)_2$ → 1 $Zn(NO_2)_2$ + 1 Au — Type: **Single Displacement**

20) 2 KOH + 1 H_2SO_4 → 1 K_2SO_4 + 2 H_2O — Type: **Acid-Base**

21) 1 BaS + 1 $PtCl_2$ → 1 $BaCl_2$ + 1 PtS — Type: **Double Displacement**

22) 2 Na_2O → 4 Na + 1 O_2 — Type: **Decomposition**