Name: key Date: _____

Types of Chemical Reaction Worksheet

Balance the reactions and indicate which type of chemical reaction (synthesis, decomposition, single-replacement, double-replacement or combustion) is being represented:

1. 2 NaBr + ___ $Ca(OH)_2$ → ___ $CaBr_2$ + 2 NaOH Reaction Type : Double R.

2. 2 NH_3+ ___ H_2SO_4 → ___ $(NH_4)_2SO_4$ Reaction Type : Sythesis

3. ~~2~~ 4 C_5H_9O + 27 O_2 → ~~8~~ 10 20 CO_2 + ~~4~~ 18 H_2O Reaction Type : combustion

   29 - 2 = 27

4. 3 Pb + 2 H_3PO_4 → 3 H_2 + ___ $Pb_3(PO_4)_2$ Reaction Type : single R.

5. ___ Li_3N + 3 NH_4NO_3 → 3 $LiNO_3$ + ___ $(NH_4)_3N$ Reaction Type : double R

6. 3 HBr + ___ $Al(OH)_3$ → 3 ~~H_2O~~ HOH + ___ $AlBr_3$ Reaction Type : DR

7. ___ Na_3PO_4 + 3 KOH → 3 NaOH + ___ K_3PO_4 Reaction Type DR

8. ___ $MgCl_2$ + ___ Li_2CO_3 → ___ $MgCO_3$ + 2 LiCl Reaction Type DR

9. ___ C_6H_{12} + 9 O_2 → 6 CO_2 + 6 H_2O Reaction Type C

✓10. ___ Pb + ___ $FeSO_4$ → ___ $PbSO_4$ + ___ Fe Reaction Type SR

✓11. ___ $CaCO_3$ → ___ CaO + ___ CO_2 Reaction Type D

12. ___ P_4 + 3 O_2 → 2 P_2O_3 Reaction Type S

13. 2 $RbNO_3$ + ___ BeF_2 → ___ $Be(NO_3)_2$ + 2 RbF Reaction Type DR

14. 2 $AgNO_3$ + ___ Cu → ___ $Cu(NO_3)_2$ + 2 Ag Reaction Type S

15. ___ C_3H_6O + 4 O_2 → 3 CO_2 + 3 H_2O Reaction Type C

16. 2 C_5H_5 + ___ Fe → ___ $Fe(C_5H_5)_2$ Reaction Type S

17. ___ $SeCl_6$ + ___ O_2 → ___ SeO_2 + 3 Cl_2 Reaction Type ~~[illegible]~~ SR

Worksheet 4b.8 – Mixed Predictions

NAME _____

Use the General Cases to predict the products of each reaction. Balance each equation when done. Identify each reaction type in the blank at the right.

General Case:

Synthesis:	$A + B \rightarrow AB$
Decomposition:	$AB \rightarrow A + B$
Single Replacement:	$AX + B \rightarrow BX + A$
Double Replacement:	$AX + BY \rightarrow BX + AY$
Combustion:	$C_xH_y + O_2 \rightarrow CO_2 + H_2O$

REACTION:

___C_5H_{12} + 6 O_2 → 5 CO_2 6 H_2O	C
___Zn + 2 HCl → $ZnCl_2$ + H_2	SR
2 Na_2O → 4 Na + O_2	D
2 Li + ___Cl_2 → 2 LiCl	S
___Na_2SO_4 (aq) + 2 LiCl → 2 NaCl (aq) + Li_2SO_4 (aq)	DR
2 C_4H_{10} + ~~6~~ 13 O_2 → ~~4~~ 8 CO_2 + ~~5~~ 10 H_2O	C
2 Al_2O_3 → 4 Al + $3O_2$	D
2 Al + 3 I_2 → 2 AlI_3	S
3 $Zn(OH)_2$ (aq) + ___$Al_2(CO_3)_3$ (aq) → 3 $ZnCO_3$ (s) + 2 $Al(OH)_3$ (s)	DR
2 $FeCl_3$ → 2 Fe + 3 Cl_2	D

Worksheet 4b.9 – Mixed Predictions

NAME _____

Use the General Cases to predict the products of each reaction. Balance each equation when done. Identify each reaction type in the blank at the right.

General Case:

Synthesis:	$A + B \rightarrow AB$
Decomposition:	$AB \rightarrow A + B$
Single Replacement:	$AX + B \rightarrow BX + A$
Double Replacement:	$AX + BY \rightarrow BX + AY$
Combustion:	$C_xH_y + O_2 \rightarrow CO_2 + H_2O$

REACTION:

3 $CuCl_2$ (aq) + 2 Na_3PO_4 (aq) → $Cu_3(PO_4)_2$ (s) + 6 NaCl (aq)	DR
2 $C_{12}H_{26}$ + 37 O_2 → ~~12~~ 24 CO_2 + ~~13~~ 26 H_2O	C
2 $FeCl_3$ → 2 Fe + 3 Cl_2	D
___ K_2SO_4 + 2 Li → Li_2SO_4 + 2 K	SR
4 Na + ___ O_2 → 2 Na_2O	S
___ C_3H_8 + 5 O_2 → 3 CO_2 + 4 H_2O	C
___ $KMnO_4$ + ___ Li → $LiMnO_4$ + K	SR
2 Na_3P (aq) + 3 $Ba(OH)_2$ (aq) → 6 NaOH (aq) + Ba_3P_2	DR
2 H_2O → 2 H_2 + O_2	D
2 HCl (aq) + ___ $Ca(OH)_2$ (aq) → 2 HOH (l) + $CaCl_2$ (aq)	DR

Worksheet 4b.10 – Mixed Predictions

NAME _____

Predict the products of each reaction. Balance each equation when done. Identify each reaction type in the blank at the right.

REACTION:

2 Mg + __ O_2 → 2 MgO _____ S _____

2 $AlCl_3$ → 2 Al + 3 Cl_2 _____ D _____

4 Na + __ O_2 → 2 Na_2O _____ S _____

__ HCl (aq) + __ NaOH (aq) → HOH (l) + NaCl (aq) _____ DR _____

3 $Pb(SO_4)_2$ (aq) + 4 $Al(C_2H_3O_2)_3$ (aq) → 3 $Pb(C_2H_3O_2)_4$ (aq) + 2 $Al_2(SO_4)_3$ (aq) _____ DR

2 C_4H_{10} + 13 O_2 → 8 CO_2 + 10 H_2O _____ C _____

2 H_3PO_4 (aq) + 3 $MgCO_3$ (aq) → 3 H_2CO_3 (aq) + $Mg_3(PO_4)_2$ (s) _____ DR _____

~~__ $HgCl_2$ + __ NaSCN → H~~ _____

~~__ PtO_2 + __ H_2 →~~ _____

__ $CaCO_3$ (aq) + 2 NaCl (aq) → $CaCl_2$ (aq) + Na_2CO_3 (aq) _____ DR _____

__ Ag + __ HNO_3 → No Rxn _____ SR _____

2 NCl_3 → N_2 + 3 Cl_2 _____ D _____

~~__ $MgSO_4 \cdot 7H_2O$ →~~ _____

Worksheet 4b.11 – Mixed Predictions

NAME _____

Predict the products of each reaction. Balance each equation when done. Identify each reaction type in the blank at the right.

REACTION:

2 Sr + __ O_2 → 2 SrO	S
2 Na + 2 ~~H_2O~~ HOH → 2 NaOH + H_2	SR
__ Zn + 2 HCl → $ZnCl_2$ + H_2	SR
2 ICl → I_2 + Cl_2	D
2 $Fe(OH)_3$ + 3 H_2SO_4 → $Fe_2(SO_4)_3$ + 6 HOH	DR
2 C_6H_{14} + ~~9.5~~ 19 O_2 → ~~6~~ 12 CO_2 + ~~7~~ 14 H_2O	C
2 $Au(OH)_3$ + 3 Na_2CO_3 → $Au_2(CO_3)_3$ + 6 NaOH	DR
__ $SrCl_2$ + 2 NaOH → 2 NaCl + $Sr(OH)_2$	DR
2 OCl_2 → O_2 + 2 Cl_2	D
2 $AgNO_3$ + __ H_2SO_4 → Ag_2SO_4 + 2 HNO_3	DR
2 Zn + __ O_2 → 2 ZnO	S
__ $Mg(OH)_2$ + 2 NaF → MgF_2 + 2 NaOH	DR
2 $C_{30}H_{62}$ + 91 O_2 → ~~30~~ 60 CO_2 + ~~31~~ 62 H_2O	C
__ $Mg(NO_3)_2$ + ~~2~~ 2 ~~H_2O~~ HOH → $Mg(OH)_2$ + 2 HNO_3	DR
__ Au_2S_3 → 2 Au + 3S	D
3 $Ti(MnO_4)_4$ + 2 Fe_2O_3 → 4 $Fe(MnO_4)_3$ + 3 TiO_2	DR
~~__ MnF_2 + __ O_2 →~~	
__ CO_2 → C + O_2	D

Name _____ Period _____ Date _____

Net Ionic Equations

Write the net ionic equations for the following reactions.
If only the reactants are given, predict the products and balance the equation first.

$Pb(NO_3)_2$ (aq) + 2 KCl (aq) → $PbCl_2$ (s) + KNO_3 (aq)

Net Ionic: $Pb^{+2}_{(aq)} + 2Cl^-_{(aq)} \rightarrow PbCl_2(s)$

2 HCl (aq) + $Ba(OH)_2$ (aq) → $BaCl_2$ (aq) + 2 ~~H_2O~~ (l)
HOH

Net Ionic: $H^+_{(aq)} + OH^-_{(aq)} \rightarrow HOH(l)$

_____ K_3PO_4 (aq) + _____ $Al(NO_3)_3$ (aq) → $3KNO_3(aq) \rightarrow AlPO_4(s)$

Net Ionic: $Al^{+3}_{(aq)} + PO_4^{-3}_{(aq)} \rightarrow AlPO_4(s)$

beryllium iodide + strontium sulfate -->
+2 −1 +2 −2

Molecular Equation (chemical Reaction): $BeI_2(aq) + SrSO_4(aq) \rightarrow BeSO_4(aq) + SrI_2(aq)$

Net Ionic: No Rxn

magnesium sulfide + nitric acid → Mg
+2 −2 +1 −1

Molecular equation: $MgS_{(aq)} + 2HNO_3(aq) \rightarrow H_2S(aq) + Mg(NO_3)_2(aq)$

Net Ionic:

No Rxn

Practice Problems (Chapter 5): Balancing and Reactions

CHEM 30A

I suggest that you complete these practice problems in **pencil** because you may need to erase and change coefficients as you balance the chemical equations.

Combine

Balance the following equations (show your check), and answer the accompanying questions.

1. 2 SO_2 + ___ O_2 → 2 SO_3

What type of reaction is this? (circle one)
~~combination~~, decomposition, single replacement, double replacement, combustion, acid-base
synthesis

2. 2 Al + 3 MnO_2 $\xrightarrow{\Delta}$ 3 Mn + 2 Al_2O_3

What does the delta symbol (triangle) over the arrow mean? change in heat

What type of reaction is this? (circle one)
~~combination~~, decomposition, single replacement, double replacement, combustion, acid-base
synthesis

3. ___ Bi_2S_3 + 6 HCl → 2 $BiCl_3$ + 3 H_2S

What type of reaction is this? (circle one)
~~combination~~, decomposition, single replacement, double replacement, combustion, acid-base
synthesis

4. 2 PbO_2 $\xrightarrow{\Delta}$ 2 PbO + ___ O_2

What type of reaction is this? (circle one)
~~combination~~, decomposition, single replacement, double replacement, combustion, acid-base
synthesis

5. 3 H_2SO_4 + 2 $Al(OH)_3$ → 6 ~~H_2O~~ HOH + ___ $Al_2(SO_4)_3$

What type of reaction is this? (circle one)
~~combination~~, decomposition, single replacement, double replacement, combustion, acid-base
synthesis

6. ___ C_3H_8 + 5 O_2 → 3 CO_2 + 4 H_2O

What type of reaction is this? (circle one)
~~combination~~, decomposition, single replacement, double replacement, combustion, acid-base
synthesis

Write formula equations from the following word equations, then balance them (show your check).

7. phosphoric acid + calcium hydroxide → calcium phosphate + water

$2\ H_3PO_4 + 3\ Ca(OH)_2 \rightarrow Ca_3(PO_4)_2 + 6\ HOH$

8. zinc carbonate + hydrochloric acid → zinc chloride + water + carbon dioxide

$ZnCO_3 + 2\ HCl \rightarrow ZnCl_2 + H_2O + CO_2$

9. silver nitrate + aluminum chloride → silver chloride + aluminum nitrate

$3\ AgNO_3 + AlCl_3 \rightarrow 3\ AgCl + Al(NO_3)_3$

10. silver oxide $\xrightarrow{\Delta}$ silver + oxygen

$2\ Ag_2O \xrightarrow{\Delta} 4\ Ag + O_2$

Predict the products for the following combination reactions and balance them (show your check). The product of each reaction is a charge neutral ionic compound.

11. $2\ Mg_{(s)} + __\ O_{2(g)} \rightarrow 2\ MgO$

12. $2\ Al_{(s)} + 3\ Br_{2(l)} \rightarrow 2\ AlBr_3$

Predict the products for the following single replacement reactions and balance them (show your check). If no reaction occurs, write "no reaction" on the product side of the arrow.

13. $__\ Cu_{(s)} + __\ FeCl_{3(aq)} \rightarrow$ No Rxn

14. $2\ Al_{(s)} + 6\ HBr_{(aq)} \rightarrow 2\ AlBr_3 + 3\ H_2$

15. $__\ H_{2(g)} + __\ Al_2O_{3(aq)} \rightarrow$ No Rxn

16. $__\ Cl_{2(g)} + 2\ HBr_{(aq)} \rightarrow 2\ HCl + Br_2$

17. $__\ I_{2(s)} + __\ HCl_{(aq)} \rightarrow$ No Rxn

Activity Series:

Metals (and Hydrogen) form cations	**Non-Metals (Halogens)** form anions
K	F_2
Ca	Cl_2
Na	Br_2
Mg	I_2
Al	
Zn	
Fe	
Ni	
Sn	
Pb	
H	
Cu	
Ag	
Hg	
Au	

increasing activity

Predict the products for the following double replacement reactions and balance them (show your check). Use the solubility rules to determine if a precipitate (solid) will form. Label the phase of insoluble products as solid and soluble products as aqueous.

18. ___ $Cu(NO_3)_{2(aq)}$ + ___ $FeCl_{3(aq)}$ → $Fe(NO_3)_{3\,(aq)}$ + $CuCl_{2\,(aq)}$ No Rxn

19. ___ $Ba(C_2H_3O_2)_{2(aq)}$ + ___ $(NH_4)_2SO_{4(aq)}$ → $BaSO_{4\,(s)}$ + $2NH_4C_2H_3O_{2\,(aq)}$

20. 2 $KCl_{(aq)}$ + ___ $Pb(NO_3)_{2(aq)}$ → $2KNO_{3\,(aq)}$ + $PbCl_{2\,(s)}$

21. ___ $Na_2CO_{3(aq)}$ + ___ $CaBr_{2(aq)}$ → $2NaBr_{(aq)}$ + $CaCO_{3\,(s)}$

22. ___ $CaCl_{2(aq)}$ + 2 $AgNO_{3(aq)}$ → $Ca(NO_3)_2$ + $2AgCl_{(s)}$

Complete the following combustion reactions (in air) and balance them (show your check).

23. 2 $C_2H_{2(g)}$ + 5 $O_{2(g)}$ → ~~4~~ 4 CO_2 + ~~1~~ 2 H_2O

24. ___ $C_3H_{8(g)}$ + 5 $O_{2(g)}$ → $3CO_2$ + $4H_2O$

~~**25.** ___ $C_2H_5OH_{(l)}$ + ___ $O_{2(g)}$ →~~

26. ___ $CH_{4(g)}$ + 2 $O_{2(g)}$ → CO_2 + $2H_2O$

Predict the products for the following acid-base neutralization reactions and balance them (show your check).

27. 3 $HBr_{(aq)}$ + ___ $Al(OH)_{3(s)}$ → $3HOH_{(l)}$ + $AlBr_{3\,(aq)}$

28. ___ $HCl_{(aq)}$ + ___ $CaCO_{3(s)}$ → $H_2CO_{3\,(aq)}$ + $CaCl_{2\,(aq)}$ No Rxn

29. ___ $H_2SO_{4(aq)}$ + 2 $KOH_{(aq)}$ → $2HOH_{(l)}$ + $K_2SO_{4\,(aq)}$

30. 2 $H_3PO_{4(aq)}$ + 3 $Ba(OH)_{2(aq)}$ → $6HOH_{(l)}$ + $Ba_3(PO_4)_{2\,(s)}$