Worksheet: Writing and Balancing Chemical Reactions

1. Balance the following equations and indicate the type of reaction as formation, decomposition, single replacement, double replacement, hydrocarbon combustion, or other.

a. ____ $Cu_{(s)}$ + ____ $O_{2\,(g)} \rightarrow$ ____ $CuO_{(s)}$
b. ____ $H_2O_{(l)} \rightarrow$ ____ $H_{2\,(g)}$ + ____ $O_{2\,(g)}$
c. ____ $Fe_{(s)}$ + ____ $H_2O_{(g)} \rightarrow$ ____ $H_{2\,(g)}$ + ____ $Fe_3O_{4\,(s)}$
d. ____ $AsCl_{3\,(aq)}$ + ____ $H_2S_{(aq)} \rightarrow$ ____ $As_2S_{3\,(s)}$ + ____ $HCl_{(aq)}$
e. ____ $CuSO_4 \bullet 5\,H_2O_{(s)} \rightarrow$ ____ $CuSO_{4\,(s)}$ + ____ $H_2O_{(g)}$
f. ____ $Fe_2O_{3\,(s)}$ + ____ $H_{2\,(g)} \rightarrow$ ____ $Fe_{(s)}$ + ____ $H_2O_{(l)}$
g. ____ $CaCO_{3\,(s)} \rightarrow$ ____ $CaO_{(s)}$ + ____ $CO_{2\,(g)}$
h. ____ $Fe_{(s)}$ + ____ $S_{8\,(s)} \rightarrow$ ____ $FeS_{(s)}$
i. ____ $H_2S_{(aq)}$ + ____ $KOH_{(aq)} \rightarrow$ ____ $H_2O_{(l)}$ + ____ $K_2S_{(aq)}$
j. ____ $NaCl_{(l)} \rightarrow$ ____ $Na_{(l)}$ + ____ $Cl_{2\,(g)}$
k. ____ $Al_{(s)}$ + ____ $H_2SO_{4\,(aq)} \rightarrow$ ____ $H_{2\,(g)}$ + ____ $Al_2(SO_4)_{3\,(aq)}$
l. ____ $H_3PO_{4\,(aq)}$ + ____ $NH_4OH_{(aq)} \rightarrow$ ____ $H_2O_{(l)}$ + ____ $(NH_4)_3PO_{4\,(aq)}$
m. ____ $C_3H_{8\,(g)}$ + ____ $O_{2\,(g)} \rightarrow$ ____ $CO_{2\,(g)}$ + ____ $H_2O_{(l)}$
n. ____ $Al_{(s)}$ + ____ $O_{2\,(g)} \rightarrow$ ____ $Al_2O_{3\,(s)}$
o. ____ $CH_{4\,(g)}$ + ____ $O_{2\,(g)} \rightarrow$ ____ $CO_{2\,(g)}$ + ____ $H_2O_{(l)}$
p. ____ $K_2SO_{4\,(aq)}$ + ____ $BaCl_{2\,(aq)} \rightarrow$ ____ $KCl_{(aq)}$ + ____ $BaSO_{4\,(s)}$
q. ____ $C_5H_{12\,(l)}$ + ____ $O_{2\,(g)} \rightarrow$ ____ $CO_{2\,(g)}$ + ____ $H_2O_{(g)}$
r. ____ $Ca(OH)_{2\,(aq)}$ + ____ $NH_4Cl_{(aq)} \rightarrow$ ____ $NH_4OH_{(aq)}$ + ____ $CaCl_{2\,(aq)}$
s. ____ $V_2O_{5\,(s)}$ + ____ $Ca_{(s)} \rightarrow$ ____ $CaO_{(s)}$ + ____ $V_{(s)}$
t. ____ $Na_{(s)}$ + ____ $ZnI_{2\,(aq)} \rightarrow$ ____ $NaI_{(aq)}$ + ____ $Zn_{(s)}$
u. ____ $C_7H_6O_{3\,(l)}$ + ____ $O_{2\,(g)} \rightarrow$ ____ $CO_{2\,(g)}$ + ____ $H_2O_{(l)}$
v. ____ $Ca_{(s)}$ + ____ $N_{2\,(g)} \rightarrow$ ____ $Ca_3N_{2\,(s)}$
w. ____ $Fe_2O_{3\,(s)}$ + ____ $H_{2\,(g)} \rightarrow$ ____ $Fe_{(s)}$ + ____ $H_2O_{(l)}$
x. ____ $C_{15}H_{30\,(l)}$ + ____ $O_{2\,(g)} \rightarrow$ ____ $CO_{2\,(g)}$ + ____ $H_2O_{(g)}$
y. ____ $BN_{(s)}$ + ____ $F_{2\,(g)} \rightarrow$ ____ $BF_{3\,(s)}$ + ____ $N_{2\,(g)}$
z. ____ $C_{12}H_{26\,(l)}$ + ____ $O_{2\,(g)} \rightarrow$ ____ $CO_{2\,(g)}$ + ____ $H_2O_{(g)}$

2. Predict the product(s) along with the states, indicate the type of reaction, and balance the following chemical reactions.

a. A solution of lead (II) nitrate is mixed with a solution of sodium iodide.
b. Solid zinc sulfide reacts with oxygen in the air.
c. Liquid butane ($C_4H_{10\,(l)}$) is used as a fuel to ignite a lighter.
d. Barium hydroxide solution is neutralized by adding hydrochloric acid ($HCl_{(aq)}$).
e. Copper metal is placed in a solution of silver nitrate.
f. Sulfur burns in oxygen to make sulfur dioxide gas.
g. A solution of aluminum sulfate is mixed with a solution of calcium hydroxide.
h. Zinc metal is placed in sulfuric acid ($H_2SO_{4\,(aq)}$).
i. Aluminum powder is placed in a container filled with chlorine gas.
j. Sucrose undergoes cellular respiration.

Answers

Question 1

a. $2\ Cu_{(s)} + O_{2\ (g)} \rightarrow 2\ CuO_{(s)}$ **(formation)**

b. $2\ H_2O_{(l)} \rightarrow 2\ H_{2\ (g)} + O_{2\ (g)}$ **(decomposition)**

c. $3\ Fe_{(s)} + 4\ H_2O_{(g)} \rightarrow 4\ H_{2\ (g)} + Fe_3O_{4\ (s)}$ **(single replacement)**

d. $2\ AsCl_{3\ (aq)} + 3\ H_2S_{(aq)} \rightarrow As_2S_{3\ (s)} + 6\ HCl_{(aq)}$ **(double replacement)**

e. $CuSO_4 \bullet 5\ H_2O_{(s)} \rightarrow CuSO_{4\ (s)} + 5\ H_2O_{(g)}$ **(other – dehydration or decomposition)**

f. $Fe_2O_{3\ (s)} + 3\ H_{2\ (g)} \rightarrow 2\ Fe_{(s)} + 3\ H_2O_{(l)}$ **(single replacement)**

g. $CaCO_{3\ (s)} \rightarrow CaO_{(s)} + CO_{2\ (g)}$ **(other or decomposition)**

h. $8\ Fe_{(s)} + S_{8\ (s)} \rightarrow 8\ FeS_{(s)}$ **(formation)**

i. $H_2S_{(aq)} + 2\ KOH_{(aq)} \rightarrow 2\ H_2O_{(l)} + K_2S_{(aq)}$ **(double replacement)**

j. $2\ NaCl_{(l)} \rightarrow 2\ Na_{(l)} + Cl_{2\ (g)}$ **(decomposition)**

k. $2\ Al_{(s)} + 3\ H_2SO_{4\ (aq)} \rightarrow 3\ H_{2\ (g)} + Al_2(SO_4)_{3\ (aq)}$ **(single replacement)**

l. $H_3PO_{4\ (aq)} + 3\ NH_4OH_{(aq)} \rightarrow 3\ H_2O_{(l)} + (NH_4)_3PO_{4\ (aq)}$ **(double replacement)**

m. $C_3H_{8\ (g)} + 5\ O_{2\ (g)} \rightarrow 3\ CO_{2\ (g)} + 4\ H_2O_{(l)}$ **(hydrocarbon combustion)**

n. $4\ Al_{(s)} + 3\ O_{2\ (g)} \rightarrow 2\ Al_2O_{3\ (s)}$ **(formation)**

o. $CH_{4\ (g)} + 2\ O_{2\ (g)} \rightarrow CO_{2\ (g)} + 2\ H_2O_{(l)}$ **(hydrocarbon combustion)**

p. $K_2SO_{4\ (aq)} + BaCl_{2\ (aq)} \rightarrow 2\ KCl_{(aq)} + BaSO_{4\ (s)}$ **(double replacement)**

q. $C_5H_{12\ (l)} + 8\ O_{2\ (g)} \rightarrow 5\ CO_{2\ (g)} + 6\ H_2O_{(g)}$ **(hydrocarbon combustion)**

r. $Ca(OH)_{2\ (aq)} + 2\ NH_4Cl_{(aq)} \rightarrow 2\ NH_4OH_{(aq)} + CaCl_{2\ (aq)}$ **(double replacement)**

s. $V_2O_{5\ (s)} + 5\ Ca_{(s)} \rightarrow 5\ CaO_{(s)} + 2\ V_{(s)}$ **(single replacement)**

t. $2\ Na_{(s)} + ZnI_{2\ (aq)} \rightarrow 2\ NaI_{(aq)} + Zn_{(s)}$ **(single replacement)**

u. $C_7H_6O_{3\ (l)} + 7\ O_{2\ (g)} \rightarrow 7\ CO_{2\ (g)} + 3\ H_2O_{(l)}$ **(hydrocarbon combustion)**

v. $3\ Ca_{(s)} + N_{2\ (g)} \rightarrow Ca_3N_{2\ (s)}$ **(formation)**

w. $Fe_2O_{3\ (s)} + 3\ H_{2\ (g)} \rightarrow 2\ Fe_{(s)} + 3\ H_2O_{(l)}$ **(single replacement)**

x. $2\ C_{15}H_{30\ (l)} + 45\ O_{2\ (g)} \rightarrow 30\ CO_{2\ (g)} + 30\ H_2O_{(g)}$ **(hydrocarbon combustion)**

y. $2\ BN_{(s)} + 3\ F_{2\ (g)} \rightarrow 2\ BF_{3\ (s)} + N_{2\ (g)}$ **(single replacement)**

z. $2\ C_{12}H_{26\ (l)} + 37\ O_{2\ (g)} \rightarrow 24\ CO_{2\ (g)} + 26\ H_2O_{(g)}$ **(hydrocarbon combustion)**

Question 2

a. $Pb(NO_3)_{2\ (aq)} + 2\ NaI_{(aq)} \rightarrow PbI_{2\ (s)} + 2\ NaNO_{3\ (aq)}$ **(double replacement)**

b. $8\ ZnS_{(s)} + 4\ O_{2\ (g)} \rightarrow 8\ ZnO_{(s)} + S_{8\ (s)}$ **(single replacement)**

c. $2\ C_4H_{10\ (l)} + 13\ O_{2\ (g)} \rightarrow 8\ CO_{2\ (g)} + 10\ H_2O_{(g)}$ **(hydrocarbon combustion)**

d. $Ba(OH)_{2\ (aq)} + 2\ HCl_{(aq)} \rightarrow BaCl_{2\ (aq)} + 2\ H_2O_{(l)}$ **(double replacement)**

e. $Cu_{(s)} + 2\ AgNO_{3\ (aq)} \rightarrow Cu(NO_3)_{2\ (aq)} + 2\ Ag_{(s)}$ **(single replacement)**

f. $S_{8\ (s)} + 8\ O_{2\ (g)} \rightarrow 8\ SO_{2\ (g)}$ **(formation)**

g. $Al_2(SO_4)_{3\ (aq)} + 3\ Ca(OH)_{2\ (aq)} \rightarrow 2\ Al(OH)_{3\ (s)} + 3\ CaSO_{4\ (s)}$ **(double replacement)**

h. $Zn_{(s)} + H_2SO_{4\ (aq)} \rightarrow ZnSO_{4\ (aq)} + H_{2\ (g)}$ **(single replacement)**

i. $2\ Al_{(s)} + 3\ Cl_{2\ (g)} \rightarrow 2\ AlCl_{3\ (s)}$ **(formation)**

j. $C_{12}H_{22}O_{11\ (s)} + 12\ O_{2\ (g)} \rightarrow 12\ CO_{2\ (g)} + 11\ H_2O_{(l)}$ **(hydrocarbon combustion)**