P G9 (pg 1 of 4) Identifying and Balancing Chemical Equations

Name______________________

1. Balance the skeleton equation below. Then write the net ionic equation.
   What type of reaction is this? Identify the precipitate.

   $$Pb(NO_3)_2 \quad + \quad AlCl_3 \quad \rightarrow \quad PbCl_2 \quad + \quad Al(NO_3)_3$$

2. Balance the skeleton equation below that represents lithium combining with copper(II) chloride. Then write the net ionic equation. What type of reaction is this?

   $$Li_{(s)} \quad + \quad CuCl_{2(aq)} \quad \rightarrow \quad LiCl_{(aq)} \quad + \quad Cu_{(s)}$$

3. Acetone, nail polish remover is flammable. Balance the equation that represents the burning of this carbohydrate. What type of reaction is this?

   $$C_3H_6O_{(g)} \quad + \quad O_{2(g)} \quad \rightarrow \quad CO_{2(g)} \quad + \quad H_2O_{(g)}$$

4. The reaction below represents the formation of ammonia. This is only the skeleton equation, balance it. What type of reaction is this?

   $$N_{2(g)} \quad + \quad H_{2(g)} \quad \rightarrow \quad NH_{3(g)}$$

5. Aluminum oxide can be broken into its constituent elements and is represented below. This is only the skeleton equation, balance it. What type of reaction is this?

   $$Al_2O_{3(s)} \quad \rightarrow \quad Al_{(s)} \quad + \quad O_{2(g)}$$

6. Balance the reaction below. What type of reaction is this?

   $$SO_{2(g)} \quad + \quad O_{2(g)} \quad + \quad H_2O_{(l)} \quad \rightarrow \quad H_2SO_{4(aq)}$$

7. The reaction below represents the preparation of carbon disulfide by reacting carbon with sulfur dioxide. This is only the skeleton equation, balance it. Not all reactions fit neatly into one of our five categories. This one does not.

   $$C_{(s)} \quad + \quad SO_{2(g)} \quad \rightarrow \quad CS_{2(s)} \quad + \quad CO_{(g)}$$

8. Write and balance an equation (and net ionic equation) for the combination (in water) of calcium bromide with sodium ferrocyanide. Be sure and identify the precipitate. What type of reaction is this?

9. Write and balance the reaction (and net ionic) of zinc sulfate combined with aluminum. What type of reaction is this?

10. Write a balanced equation, for the burning of sucrose, $C_{12}H_{22}O_{11}$ What type of reaction is this?

11. Iron(III) oxide is formed from its elements. When this occurs slowly, it is known as rusting. Write the balanced equation that describes this reaction. What type of reaction is this? This is an exothermic reaction, the same one that occurs in the hermetically sealed single-use hand warmer packs.

12. Just adding heat will decompose sodium chlorate. Write the balanced equation that represents this reaction. What type of reaction is this?

13. Balance the skeleton equation below. This is another reaction that does not fit neatly into one of the five categories.

    $$CuFeS_{2(s)} \quad + \quad O_{2(g)} \quad \rightarrow \quad Cu_{(s)} \quad + \quad FeO_{(s)} \quad + \quad SO_{2(g)}$$

14. Write and balance the equation (and net ionic equation) that represents sodium phosphate combining with strontium chloride (in water). What type of reaction is this?

15. Write the balanced equation (and net ionic equation) that represents a piece of potassium dropped into a solution of calcium acetate. What type of reaction is this?

16. Ethane, C_2H_6 can be burned in oxygen. Write the balanced equation that represents this reaction. What type of reaction is this?

17. Write and balance the equation that represents the reaction between potassium and oxygen gas. What type of reaction is this?

18. Electricity can be used to convert water into two gases. Write the balanced equation that represents this reaction. What type of reaction is this?

19. Balance the skeleton equation below.

$$PbS + SrO \rightarrow Pb + SrS + SrSO_4$$

20. Write the balanced equation for the heating of solid nickel(III) carbonate.

21. Write a balanced equation in each case when a chemical reaction can occur, then convert to a net ionic equation if appropriate. If there would be no reaction, write the reactants with an NR after the arrow and explain why it is no reaction. Classify the reaction as synthesis, decomposition, single replacement, double replacement, or combustion. Include the $_{(ppt)}$ symbol for any precipitates that form.
    a. Pentanol ($C_5H_{11}OH$) is burned.
    b. Calcium carbonate crystals are decomposed by heating. turning into the oxide salt and carbon dioxide.
    c. Nitrogen and hydrogen gases combine to make a new gas, nitrogen trihydride.
    d. A piece of calcium metal is added to a solution of aluminum nitrate.
    e. A solution of aluminum bromide is added to a solution of silver nitrate.
    f. A piece of magnesium is added to sulfuric acid solution.
    g. The formation of aluminum chloride from its elements.
    h. Sodium chloride is heated very strongly in the presence of pure oxygen gas.

22. Explain what happened in question 2(d) above. Be sure to discuss who lost electrons (and how many) and who gained electrons (and how many).

23. A student decomposes crystals of mercury(I) oxide and collects the gas that is produced in test tubes.
    a. Write the balanced equation for the decomposition.
    b. How should the student test this gas and what should they observe?

24. A student tosses a piece of potassium into water in a test tube. A reaction occurs and the gas is collected.
    a. Write the balanced equation for the decomposition.
    b. How should the student test this gas and what should they observe?
    c. Write the balanced equation that represents the reaction that occurs during the test for the gas.

25. A student drops a piece of gallium metal into a solution of copper(II) nitrate and a chemical reaction occurs.
    a. Write a balanced reaction to describe the chemical reaction that occurs.
    b. What can be concluded about the reactivity of the metals gallium and copper?
    c. What would happen to the color of the solution during this reaction?

26. A student combines an aqueous solution of sodium cyanide with an aqueous solution of lead(II) nitrate. A yellow precipitate forms. Write a balanced equation to describe this reaction. Be sure and identify the precipitate.
    a. Then write the net ionic equation.

(In single and double replacement reactions, that are done in solution, the aqueous compounds are not identified and the $_{(aq)}$ will be assumed. Anytime there is a precipitate, $_{(ppt)}$ should be written in the overall equation.)

1. $3\ Pb(NO_3)_{2(aq)} + 2\ AlCl_{3(aq)} \rightarrow 3\ PbCl_{2\ (ppt)} + 2\ Al(NO_3)_{3(aq)}$ double replacement
net ionic: $3\ Pb^{+2} + 6\ Cl^{-} \rightarrow 3\ PbCl_2$ can be reduced: $Pb^{2+} + 2\ Cl^{-} \rightarrow PbCl_2$

2. $2\ Li_{(s)} + CuCl_{2(aq)} \rightarrow 2\ LiCl_{(aq)} + Cu_{(s)}$ single replacement, redox
net ionic: $2\ Li + Cu^{2+} \rightarrow 2\ Li^{+} + Cu$ the coefficients are needed to balance the charge

3. $C_3H_6O_{(g)} + 4\ O_{2(g)} \rightarrow 3\ CO_{2(g)} + 3\ H_2O_{(g)}$ combustion, redox

4. $N_{2(g)} + 3\ H_{2(g)} \rightarrow 2\ NH_{3(g)}$ synthesis, redox

5. $2\ Al_2O_3 \rightarrow 4\ Al_{(s)} + 3\ O_{2(g)}$ decomposition, redox

6. $2\ SO_{2(g)} + O_{2(g)} + 2\ H_2O_{(l)} \rightarrow 2\ H_2SO_{4(aq)}$ synthesis, redox

7. $5\ C_{(s)} + 2\ SO_{2(g)} \rightarrow CS_2 + 4\ CO_{(g)}$ redox, but not one of the other five types

8. $CaBr_{2(aq)} + Na_4Fe(CN)_{6(aq)} \rightarrow Ca_2Fe(CN)_{6(ppt)} + NaBr_{(aq)}$ double replacement
net ionic: $Ca^{2+} + Fe(CN)_6^{4-} \rightarrow Ca_2Fe(CN)_6$

9. $3\ ZnSO_4 + 2\ Al \rightarrow Al_2(SO_4)_{3(aq)} + 3\ Zn_{(s)}$ single replacement, redox
net ionic: $3\ Zn^{2+} + 2\ Al \rightarrow 2Al^{3+} + 3\ Zn$ the coefficients are needed to balance the charge

10. $C_{12}H_{22}O_{11} + 12\ O_{2(g)} \rightarrow 12\ CO_{2(g)} + 11\ H_2O_{(g)}$ combustion, redox

11. $4\ Fe_{(s)} + 3\ O_{2(g)} \rightarrow 2\ Fe_2O_{3(s)}$ synthesis, combustion, redox

12. $2\ NaClO_{3(s)} \rightarrow 2\ NaCl_{(s)} + 3O_{2(g)}$ decomposition, redox

13. $2\ CuFeS_{2(s)} + 5\ O_{2(g)} \rightarrow 2\ Cu_{(s)} + 2\ FeO + 4\ SO_2$ redox, but not one of the other five types

14. $2\ Na_3PO_{4(aq)} + 3\ SrCl_{2(aq)} \rightarrow Sr_3(PO_4)_{2(ppt)} + 6\ NaCl_{(aq)}$ double replacement
net ionic: $2\ PO_4^{3-} + 3\ Sr^{2+} \rightarrow Sr_3(PO_4)_2$

15. $Ca(C_2H_3O_2)_2 + 2\ K_{(s)} \rightarrow 2\ K\ C_2H_3O_2 + Ca_{(s)}$ single replacement, redox
net ionic: $Ca^{2+} + 2\ K \rightarrow 2\ K^{+} + Ca$ the coefficients are needed to balance the charge

16. $2\ C_2H_6 + 7\ O_{2(g)} \rightarrow 4\ CO_{2(g)} + 6\ H_2O_{(g)}$ combustion, redox

17. $4\ K_{(s)} + O_{2(g)} \rightarrow 2\ K_2O_{(s)}$ synthesis, combustion, redox

18. $2\ H_2O \rightarrow 2\ H_{2(g)} + O_{2(g)}$ decomposition, redox

19. $4\ PbS + 4\ SrO \rightarrow 4\ Pb + 3\ SrS + SrSO_4$ redox, but not one of the other five types

20. $Ni_2(CO_3)_{3(s)} \rightarrow Ni_2O_{3(s)} + 3\ CO_{2(a)}$ decomposition

21.
a $2\ C_5H_{11}OH_{(g)} + 15\ O_{2\ (g)} \rightarrow 10\ CO_{2\ (g)} + 12\ H_2O_{(g)}$ (Net ionic is the same equation.)
b $CaCO_{3\ (s)} \rightarrow CaO_{(s)} + CO_{2\ (g)}$ (Net ionic is the same equation.)
c $N_{2\ (g)} + 3\ H_{2\ (g)} \rightarrow 2\ NH_{3\ (g)}$ (Net ionic is the same reaction.)
d $3\ Ca_{(s)} + 2\ Al(NO_3)_{3\ (aq)} \rightarrow 3\ Ca(NO_3)_2 + 2\ Al_{(s)}$
NET: $3\ Ca_{(s)} + 2\ Al^{3+} \rightarrow 3\ Ca^{2+} + 2\ Al_{(s)}$
e $AlBr_{3\ (aq)} + 3\ AgNO_{3\ (aq)} \rightarrow Al(NO_3)_{3\ (aq)} + 3\ AgBr_{(ppt)}$
NET: $3Br^{-} + 3\ Ag^{+} \rightarrow 3\ AgBr_{(ppt)}$ Which you could reduce to: $Br^{-1} + Ag^{+1}$? $AgBr_{(ppt)}$
f $Mg_{(s)} + H_2SO_{4\ (aq)} \rightarrow MgSO_{4\ (aq)} + H_{2\ (g)}$
NET: $Mg_{(s)} + 2H^{+} \rightarrow Mg^{2+} + H_{2\ (g)}$
g $2\ Al_{(s)} + 3\ Cl_{2\ (g)} \rightarrow 2\ AlCl_{3\ (s)}$ (Net ionic is the same reaction.)
h $2NaCl_{(s)} + 3O_{2(g)} \rightarrow 2NaClO_{3(s)}$ (Net ionic is the same reaction.)

22. $3\ Ca_{(s)} + 2\ Al(NO_3)_{3\ (aq)} \rightarrow 3\ Ca(NO_3)_2 + 2\ Al_{(s)}$
In this reaction, the calcium starts out with no charge as a piece of pure metal. When it reacts, it loses 2 valence electrons to the nitrate, as the aluminum atom gains it's 3 valence electrons back again and becomes a piece of pure aluminum metal with no charge. Thus in the balanced equation, 3 calcium atoms lose a total of 6 electrons (2 each) while 2 aluminum atoms gain a total of 6 electrons (3 each).

23. $2\ Hg_2O \rightarrow 4\ Hg_{(s)} + O_{2\ (g)}$
After collecting the gas, the student could apply the splint test. Nothing would happen if a flaming splint were inserted in the tube with the collected gas, however, if the splint was blown out, but still glowing, it would relight when inserted in the tube with the collected gas.

24. a $2\,K_{(s)} + 2\,H_2O_{(l)} \rightarrow 2\,KOH_{(aq)} + H_{2\,(g)}$

 b Unlike in question 3, when the collected gas in this problem is tested with a flaming splint, there is a small popping sound heard. This is due to the small explosion that occurs when the collected hydrogen gas reacts with oxygen.

 c $2\,H_{2\,(g)} + O_{2\,(g)} \rightarrow 2\,H_2O_{(g)}$

25. a $2\,Ga_{(s)} + 3\,Cu(NO_3)_{2\,(aq)} \rightarrow 2\,Ga(NO_3)_{3\,(aq)} + 3\,Cu_{(s)}$

 b Gallium must be more active than copper.

 c The solution would be blue-green to start due to the copper ions, as the reaction proceeded, the copper would come out of solution as copper metal and the blue-green color would be lost.

26. $2\,NaCN_{(aq)} + Pb(NO_3)_{2\,(aq)} \rightarrow Pb(CN)_{2\,(ppt)} + 2\,NaNO_{3\,(aq)}$

 In this reaction, the precipitate that forms must be the lead cyanide since it can NOT be the sodium nitrate since alkali-nitrate salts are always soluble.