Chemistry 11 – Unit 4 Review: Chemical Reactions

1. **Balance the following equations**

a. $NH_3 + O_2 \rightarrow NO + H_2O$

b. $(NH_4)_2C_2O_4 + AlCl_3 \rightarrow Al_2(C_2O_4)_3 + NH_4Cl$

c. $C_{13}H_{28} + O_2 \rightarrow CO_2 + H_2O$

d. $Fe + H_2SO_4 \rightarrow Fe_2(SO_4)_3 + H_2$

e. $P_4 + Cl_2 \rightarrow PCl_5$

f. $Na_2Cr_2O_7 + HCl \rightarrow NaCl + CrCl_3 + H_2O + Cl_2$

g. $H_3PO_4 + Ca(OH)_2 \rightarrow Ca_3(PO_4)_2 + H_2O$

h. $Ba(CH_3COO)_2 \rightarrow Ba + C + H_2 + O_2$

i. $C_6H_{13}OH + O_2 \rightarrow CO_2 + H_2O$

j. $MgSO_4 \cdot 6H_2O \rightarrow MgSO_4 + H_2O$

Write a **balanced chemical equation** for each of the following **including the phases**.

Don't forget ***diatomic*** elements!

1. Aluminum metal reacts with bromine gas to form solid aluminum bromide.

   Answer _____
   ___

2. Dilute hydrochloric acid neutralizes a solution of aluminum hydroxide to form water & aluminum chloride solution.

   Answer _____
   ___

3. Liquid butanol (C_4H_9OH) is burned in oxygen to produce the gases carbon dioxide and water.

   Answer _____
   ___

4. Powdered barium nitrate is added a solution of lithium sulphate to form a precipitate of barium sulphate and aqueous lithium nitrate.

   Answer _____
   ___

5. Liquid ammonia (NH_3) and phosphoric acid react to form crystals of ammonium phosphate.

   Answer _____
   ___

6. Nitrogen dioxide in air reacts with pure rain water to form nitric acid and gaseous nitrogen monoxide.

   Answer _____

7. Liquid bromine reacts with sodium iodide crystals to produce iodine gas and liquid sodium bromide.

   Answer _____

8. A chunk of calcium is placed in water to produce hydrogen gas and calcium hydroxide solution.

   Answer _____
   ___

9. At 150°C hexane vapour (C_6H_{14}) burns in oxygen to produce carbon dioxide and water.

   Answer _____
   ___

10. Aqueous hydrogen peroxide (H_2O_2) decomposes to form water and oxygen gas

    Answer _____
    ___

Name the **REACTION TYPE** occurring and **BALANCE** the following: **(2 marks each)** unless otherwise indicated

1. **$Na + H_2O \rightarrow NaOH + H_2$** **1.**_____

2. **$C_6H_{10}S_3 + O_2 \rightarrow SO_2 + CO_2 + H_2O$** **2.**_____

3. **$P_4O_{10} + H_2O \rightarrow H_3PO_4$** **3.**_____

4. **Nitrogen gas + fluorine gas → nitrogen trifluoride gas**

4._____

5. **$Al_2(SO_4)_3 + NaOH \rightarrow Na_2SO_4 + Al(OH)_3$** **5.**_____

6. **$H_2O_2 \rightarrow O_2 + H_2O$** **6.**_____

7. **$C_4H_9 + O_2 \rightarrow CO_2 + H_2O$** **7.**_____

8. **$K + H_2O \rightarrow KOH + H_2$** **8.**_____

9. **$Al(NO_3)_3 + H_2SO_4 \rightarrow Al_2(SO_4)_3 + HNO_3$** **9.**_____

WRITE FORMULA, **BALANCE** the following word equations: ***INCLUDE PHASES***

1. **Potassium chlorate as a solid will react over time to form potassium chloride powder and oxygen gas will be released.**

2. **When solid sodium hydroxide reacts with liquid sulfuric acid (H_2SO_4), aqueous sodium sulfate, water, and HEAT are formed.**

Classify the following reactions as **endothermic** or **exothermic.**

a. **$C + 2\ H_2 \rightarrow CH_4$** **$\Delta H = -74.9$ kJ**

a._____

b. **$N_2 + O_2 + 90.4kJ \rightarrow 2NO(g)$**

b. _____

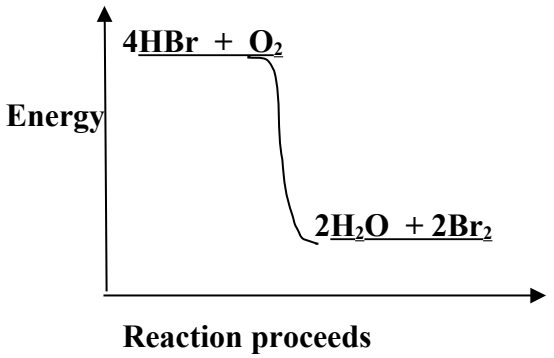
c. **$2\ Al + Fe_2O_3 \rightarrow Al_2O_3 + 2\ Fe + 800kJ$**

c. _____

d. **$4\ C_3H_7 + 18\ O_2 \rightarrow 12\ CO_2 + 14\ H_2O$** **$\Delta H = +13kJ$**

d. _____

e.



e._____

Predict the products, balance the equation and name the type of reaction.

a) **HI** + **$Ca(OH)_2$** →

a)_____

b) **$Cl_{2\ (aq)}$** + **$KBr_{\ (aq)}$** →

b)_____

c) **$MgCl_2$** + **Na** →

c)_____

d) **C_2H_3OH** + **O_2** →

d)_____

e) **$NaOH$** + **$BaCl_2$** →

e)_____

Solve each of the following problems. Show ALL the steps of your calculations and INCLUDE a BALANCED CHEMICAL EQUATION for each problem.

1. 56.8g of PCl_5 decomposed into PCl_3 and Cl_2. How many grams of each product are formed?

2. Glucose, $C_6H_{12}O_6$, can be converted to ethanol, C_2H_6O, and carbon dioxide by fermentation. How many grams of the ethanol and of the gas can be formed by using 1.00kg of glucose?

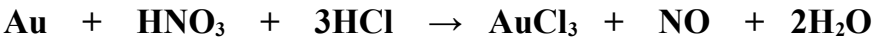
3. Hydrogen sulphide reacts with potassium permanganate to produce potassium sulphate, manganese dioxide and hydrogen gas.

   a) How many grams of hydrogen sulphide must be used to react completely with 6.32g of potassium permanganate?

   b) What volume of hydrogen gas would be produced if the experiment is done at S.T.P.?

4. Nitrogen is converted in the atmosphere to nitric oxide (nitrogen monoxide) during lightening storms. How many grams of nitrogen would be required to produce 25.0g of nitric oxide in this way?

5. Gold dissolves in the acid mixture known as *aqua regia* according to the following reaction:



$$\mathbf{Au + HNO_3 + 3HCl \rightarrow AuCl_3 + NO + 2H_2O}$$

a) How much gold (III) chloride will be produced in this reaction when one starts with 5.00mg of gold?

b) What is the minimum volume of 16M nitric acid that must be added initially to dissolve this amount of gold?

6. What mass of anhydrous copper (II) sulphate may be obtained by heating 100.0g of copper (II) sulphate pentahydrate?

7. How many grams of iron (II) oxide and vanadium (V) oxide are produced from a reaction in which 2.00g of vanadium (II) oxide and 5.75g of iron (III) oxide are mixed under appropriate conditions?

8. How many grams of carbon dioxide can be obtained from the action of 100.0g of sulphuric acid on 100.0g of calcium carbonate?

9. A solution of lead (II) nitrate is mixed with a solution of sodium iodide forming a yellow precipitate, lead (II) iodide and sodium nitrate.

   a) If you have 0.083g of $Pb(NO_3)_2$ and 0.300g of NaI, what mass of PbI_2 would you get?

   b) If you have 0.662g of $Pb(NO_3)_2$ and 0.300g of NaI, what mass of PbI_2would you get?

10. 15.0g of Al and 72.0g of HCl are allowed to react to collect hydrogen gas. Determine the mass of the gaseous product.

11. A mixture of 16.3g of zinc and 21.6g of bromine was heated until the synthesis reaction was completed. Calculate the mass of the solid product.

12. 10.0g of powdered iron, Fe, is heated with 10.0g of sulphur, S_8, in an open crucible to the reaction temperature. Determine the mass of the solid formed, iron (III) sulphide, in this synthesis reaction.