Question 1 of 28
The combustion of ethane (C₂H₆) produces carbon dioxide and steam:
\[ 2 \text{C}_2\text{H}_6 (g) + 7 \text{O}_2 (g) \rightarrow 4 \text{CO}_2 (g) + 6 \text{H}_2\text{O} (l) \]
How many moles of \( \text{CO}_2 \) are produced when 5.45 mol of ethane are burned in an excess of \( \text{O}_2 \)?

Question 2 of 28
If 8.54 moles of C₅H₁₂ reacts with excess O₂, how many moles of \( \text{CO}_2 \) will be produced in the following combustion reaction?
\[ \text{C}_5\text{H}_{12} + 8 \text{O}_2 \rightarrow 6 \text{H}_2\text{O} + 5 \text{CO}_2 \]

Question 3 of 28
For the following chemical reaction, how many moles of potassium phosphate, K₃PO₄, will be produced from 8 mol of potassium hydroxide, KOH?
\[ 3 \text{KOH} + \text{H}_3\text{PO}_4 \rightarrow \text{K}_3\text{PO}_4 + 3 \text{H}_2\text{O} \]

Question 4 of 28
For the following chemical reaction, what mass of calcium hydroxide in grams will be needed to produce 4.57 mol of water?
\[ 2 \text{HCl} + \text{Ca(OH)}_2 \rightarrow \text{CaCl}_2 + 2 \text{H}_2\text{O} \]

Question 5 of 28
For the following chemical reaction what mass of hydrogen (in grams) will be produced from 1.53 mol of Aluminum?
\[ 2 \text{Al} + 3 \text{H}_2\text{SO}_4 \rightarrow 3\text{H}_2 + \text{Al}_2(\text{SO}_4)_3 \]

Question 6 of 28
For the following chemical reaction, how many moles of silver iodide will be produced from 252g of calcium iodide?
\[ \text{CaI} + 2 \text{AgNO}_3 \rightarrow 2 \text{AgI} + \text{Ca(NO}_3)_2 \]

Question 7 of 28
When heated, KClO₃ decomposes into KCl and O₂.
\[ 2 \text{KClO}_3 \rightarrow 2 \text{KCl} + 3 \text{O}_2 \]
If this reaction produced 62.3 g of KCl, how much \( \text{O}_2 \) was produced (in grams)?

Question 8 of 28
In the following reaction, how many grams of potassium phosphate, K₃PO₄, will be produced from 50.5 g of potassium hydroxide, KOH?
\[ 3 \text{KOH} + \text{H}_3\text{PO}_4 \rightarrow \text{K}_3\text{PO}_4 + 3 \text{H}_2\text{O} \]

Question 9 of 28
In the following reaction, how many grams of calcium hydroxide, Ca(OH)₂, will be needed to react with 41.3 g of hydrochloric acid, HCl?
\[ 2 \text{HCl} + \text{Ca(OH)}_2 \rightarrow \text{CaCl}_2 + 2 \text{H}_2\text{O} \]

Question 10 of 28
The combustion of propane (C₃H₈) may be described by the chemical equation:
\[ \text{C}_3\text{H}_8 (g) + 5 \text{O}_2 (g) \rightarrow 3 \text{CO}_2 (g) + 4 \text{H}_2\text{O} (l) \]
How many grams of \( \text{O}_2 \) are needed to completely burn 46.4 g of C₃H₈?
Question 11 of 28
Iodine is prepared both in the laboratory and commercially by adding Cl₂ (g) to an aqueous solution containing sodium iodide:

\[ 2 \text{NaI (aq)} + \text{Cl}_2 (g) \rightarrow \text{I}_2 (s) + 2 \text{NaCl (aq)} \]

How many grams of sodium iodide, NaI, must be used to produce 11.5 g of iodine, I₂?

Question 12 of 28
Small quantities of oxygen can be prepared in the laboratory by heating potassium chlorate, KClO₃ (s). The equation for this reaction is

\[ 2 \text{KClO}_3 (s) \rightarrow 2 \text{KCl} + 3 \text{O}_2 \]

Calculate how many grams of O₂ (g) can be produced from heating 87.1 grams of KClO₃ (s).

Question 13 of 28
Glucose (C₆H₁₂O₆) is used as an energy source by the human body. The overall reaction in the body is described by the equation:

\[ \text{C}_6\text{H}_{12}\text{O}_6 (aq) + 6 \text{O}_2 (g) \rightarrow 6 \text{CO}_2 (g) + 6 \text{H}_2\text{O (l)} \]

a) Calculate the number of grams of oxygen required to convert 53.0 g of glucose to CO₂ & H₂O.
   b) Also compute the number of grams of CO₂ produced.

Question 14 of 28
Lithium nitride reacts with water to produce ammonia and lithium hydroxide according to the equation:

\[ \text{Li}_3\text{N (s)} + 3 \text{H}_2\text{O (l)} \rightarrow \text{NH}_3 (g) + 3 \text{LiOH (aq)} \]

Heavy water is water with the isotope deuterium in place of ordinary hydrogen, and its formula is D₂O. The above reaction can be used to produce heavy ammonia, ND₃ (g), according to the equation:

\[ \text{Li}_3\text{N (s)} + 3 \text{D}_2\text{O (l)} \rightarrow \text{ND}_3 (g) + 3 \text{LiOD (aq)} \]

Calculate how many grams of heavy water are required to produce 150.0 mg of ND₃ (g). (The molar mass of deuterium, D, is 2.014 g/mole)

Question 15 of 28
What is the maximum mass of S₈ that can be produced by combining 78.0 g of each reactant?

\[ 8 \text{SO}_2 + 16 \text{H}_2\text{S} \rightarrow 3 \text{S}_8 + 16 \text{H}_2\text{O} \]

Question 16 of 28
The Ostwald process is used commercially to produce nitric acid, which is, in turn, used in many modern chemical processes. In the first step of the Ostwald process, ammonia is reacted with oxygen gas to produce nitric oxide and water:

\[ 4 \text{NH}_3 (g) + 5 \text{O}_2 (g) \rightarrow 4 \text{NO} + 6 \text{H}_2\text{O (g)} \]

What is the maximum mass of H₂O that can be produced by combining 73.7 g of each reactant?

Question 17 of 28
Balance the following combustion reaction in order to answer the following questions.

\[ \text{C}_2\text{H}_4 (g) + \text{O}_2 (g) \rightarrow \text{CO}_2 (g) + \text{H}_2\text{O (l)} \]

You are given 5.0 moles of O₂ to react with 105 g of C₂H₄. Upon completion of the reaction, will there be any remaining C₂H₄?

Question 18 of 28
Given the following chemical equation, determine how many grams of N₂ are produced by 8.55 g of H₂O₂ and 5.77 g of N₂H₄.

\[ 2 \text{H}_2\text{O}_2 (l) + \text{N}_2\text{H}_4 (l) \rightarrow 4 \text{H}_2\text{O (g)} + \text{N}_2 (g) \]
Question 19 of 28
Nitrogen and hydrogen combine at high temperature, in the presence of a catalyst, to produce ammonia. \( \text{N}_2 (g) + 3 \text{H}_2 (g) \rightarrow 2 \text{NH}_3 (g) \)
Assume 0.280 mole of \( \text{N}_2 \) and 0.903 mole of \( \text{H}_2 \) are present initially.
a) After complete reaction, how many moles of ammonia are produced?
b) How many moles of \( \text{H}_2 \) remain?
c) How many moles of \( \text{N}_2 \) remain?
d) What is the limiting reactant?

Question 20 of 28
When calcium carbonate is added to hydrochloric acid, calcium chloride, carbon dioxide and water are produced.
\( \text{CaCO}_3 (s) + 2 \text{HCl (aq)} \rightarrow \text{CaCl}_2 (aq) + \text{H}_2\text{O (l)} + \text{CO}_2 (g) \)
How many grams of calcium chloride will be produced when 28.0 g of calcium carbonate reacts with 13.0 g of hydrochloric acid?
Which reactant is in excess and how many grams of this reactant will remain after the reaction is complete?

Question 21 of 28
In the following reaction, 451.4 g of lead reacts with excess oxygen forming 355.9 g of lead (II) oxide. Calculate the percent yield of the reaction.
\( 2 \text{Pb (s)} + \text{O}_2 (g) \rightarrow 2 \text{PbO (s)} \)

Question 22 of 28
Chlorine gas can be prepared in the laboratory by the reaction of hydrochloric acid with manganese (IV) oxide:
\( 4 \text{HCl (aq)} + \text{MnO}_2 (s) \rightarrow \text{MCl}_2 (aq) + 2 \text{H}_2\text{O (l)} + \text{Cl}_2 (g) \)
You add 38.7 g of \( \text{MnO}_2 \) to a solution containing 51.1 g of \( \text{HCl} \).
a) What is the limiting reactant?
b) What is the theoretical yield of \( \text{Cl}_2 \)?
c) If the yield of the reaction is 83.1%, what is the actual yield of chlorine?

Question 23 of 28
Combining 0.386 mol of \( \text{Fe}_2\text{O}_3 \) with excess carbon produced 10.0 g of Fe.
\( \text{Fe}_2\text{O}_3 + 3 \text{C} \rightarrow 2 \text{Fe} + 3 \text{CO} \)
a) What is the actual yield of iron in moles?
b) What was the theoretical yield of iron in moles?
c) What was the percent yield?

Question 24 of 28
Table salt, \( \text{NaCl (s)} \), and sugar, \( \text{C}_12\text{H}_{22}\text{O}_{11} (s) \), are accidentally mixed. A 5.50 g sample is burned, and 2.30g of \( \text{CO}_2 (g) \) is produced. What was the mass percentage of the table salt in the mixture?

Question 25 of 28
Which of the following reactions are exothermic?
A. \( 2 \text{Mg (s)} + \text{O}_2 (g) \rightarrow 2 \text{MgO (s)} \) \( \Delta H = -1203 \text{ kJ/mol} \)
B. \( \text{NH}_3 (g) + \text{HCl (g)} \rightarrow \text{NH}_4\text{Cl (s)} \) \( \Delta H = -176 \text{ kJ/mol} \)
C. \( \text{AgCl (s)} \rightarrow \text{Ag}^+ (aq) + \text{Cl}^- (aq) \) \( \Delta H = 127 \text{ kJ/mol} \)
D. \[2 \text{Fe}_2\text{O}_3 \text{(s)} + 3 \text{C (s)} \rightarrow 4 \text{Fe (s)} + 3 \text{CO}_2 \text{(g)} \quad \Delta H = 468 \text{kJ/mol}\]
E. \[\text{C (graphite)} + \text{O}_2 \text{(g)} \rightarrow \text{CO}_2 \text{(g)} \quad \Delta H = -393.5 \text{kJ/mol}\]
F. \[\text{CH}_4 \text{(g)} + 2 \text{O}_2 \text{(g)} \rightarrow \text{CO}_2 \text{(g)} + 2 \text{H}_2\text{O (l)} \quad \Delta H = -891 \text{kJ/mol}\]

**Question 26 of 28**
Which of the following reactions are exothermic?
A. \[2 \text{Mg (s)} + \text{O}_2 \text{(g)} \rightarrow 2 \text{MgO (s)} + \text{heat}\]
B. \[\text{NH}_3 \text{(g)} + \text{HCl (g)} \rightarrow \text{NH}_4\text{Cl (s)} + \text{heat}\]
C. \[\text{AgCl (s)} + \text{heat} \rightarrow \text{Ag}^+ \text{(aq)} + \text{Cl}^- \text{(aq)}\]
D. \[2 \text{Fe}_2\text{O}_3 \text{(s)} + 3 \text{C (s)} + \text{heat} \rightarrow 4 \text{Fe (s)} + 3 \text{CO}_2 \text{(g)}\]
E. \[\text{C (graphite)} + \text{O}_2 \text{(g)} \rightarrow \text{CO}_2 \text{(g)} + \text{heat}\]
F. \[\text{CH}_4 \text{(g)} + 2 \text{O}_2 \text{(g)} \rightarrow \text{CO}_2 \text{(g)} + \text{H}_2\text{O (l)} + \text{heat}\]

**Question 27 of 28**
Based on their descriptions, classify these chemical changes as endothermic or exothermic.
A. A chemical change takes place in a container, making it feel cold to the touch.
B. Burning wood
C. A “cold pack” (often used for sports injuries) starts out at room temperature. But when you squish the liquid around, you cause two substances to mix that were originally kept separate. When those substances react, the pack quickly begins to feel cold.
D. Pocket hand warmers (often used by skiers) start out at room temperature. When you open the air-tight packaging, a substance (contained in a cloth pouch) reacts with air, and it quickly begins to feel hot.
E. A chemical change takes place in a container, making it feel hot to the touch.

**Question 28 of 28**
Sort the following processes as either exothermic or endothermic.
A. Making popcorn in a microwave oven
B. A burning match
C. Boiling water
D. Burning rocket fuel
E. The reaction inside a chemical heat pack