Chemical Reactions
there are 5 types...

Synthesis
Decomposition
Single Replacement
Double Replacement
Combustion
Synthesis
Describe, and 2 example reactions:

2 or more smaller chemical substances combine into a new, larger compound.

Hydrogen gas and oxygen gas combine into water.

\[ 2P_{(S)} + 5F_{2(G)} \rightarrow 2PF_{5(G)} \]
Decomposition
Describe, and 2 example reactions:

One larger chemical compound breaking up into 2 or more smaller substances.

$$2\text{NH}_3\!(\text{g}) \rightarrow 3\text{H}_2\!(\text{g}) + \text{N}_2\!(\text{g})$$

$$2\text{H}_2\text{O}_2\!(\text{aq}) \rightarrow 2\text{H}_2\text{O}\!(\text{l}) + \text{O}_2\!(\text{g})$$
Single Replacement
Describe, and 2 example reactions:

An atom bumps out one ion from an aqueous solution. Table J is used for these.

\[ \text{Mg}(S) + 2\text{HCl}(AQ) \rightarrow \text{MgCl}_2(AQ) + \text{H}_2(G) \]
\textit{The Mg bumps out the H}^{+1} \textit{& forms Mg}^{+2} \textit{ion in solution}

\[ \text{NaOH}(AQ) + \text{Li}(S) \rightarrow \text{LiOH}(AQ) + \text{Na}(S) \]
\textit{The Li bumps out the Na}^{+1} \textit{& forms Li}^{+1} \textit{ion in solution}

\[ \text{Ag}(S) + \text{HCl}(AQ) \rightarrow \times \text{ no reaction} \]
\textit{The Ag cannot bump out the H}^{+1} \textit{ion from solution}
Double Replacement
Describe, and 2 example reactions:

You must start with 2 AQUEOUS SOLUTIONS, the cations switch anions with each other. Use Table F to determine solubility in water.

$\text{(NH}_4\text{)}_2\text{CrO}_4(\text{aq}) + \text{Ba(NO}_3\text{)}_2(\text{aq}) \rightarrow 2\text{NH}_4\text{NO}_3(\text{aq}) + \text{BaCrO}_4(\text{s})$

Ammonium chromate and barium nitrate solutions react and form ammonium nitrate solution and barium chromate precipitate

According to Table F, both ionic compounds in the reactants are soluble, or will dissolve in water (aqueous).

Only one product, ammonium nitrate, is aqueous. The other product, the barium chromate, is insoluble; insoluble means it will form a precipitate in water.
Combustion

Describe, and 2 example reactions:

A hydrocarbon (any molecule of just hydrogen and carbon - in any ratio) combines rapidly with oxygen, releasing carbon dioxide, water, and lots of energy.

Butane combusts...

\[2\text{C}_4\text{H}_{10}(\text{G}) + 13\text{O}_2(\text{G}) \rightarrow 8\text{CO}_2(\text{G}) + 10\text{H}_2(\text{G})\]

Octane combusts too...

\[2\text{C}_8\text{H}_{18}(\text{L}) + 25\text{O}_2(\text{G}) \rightarrow 16\text{CO}_2(\text{G}) + 18\text{H}_2\text{O}(\text{G})\]

The only products of combustion are water and carbon dioxide.
Any hydrocarbon will do, balance slowly.
Name this reaction... answers on next slide

<table>
<thead>
<tr>
<th>balanced reaction (no phases)</th>
<th>type of reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{H}_3\text{PO}_4 + 3\text{KOH} \rightarrow \text{K}_3\text{PO}_4 + 3\text{H}_2\text{O}$</td>
<td></td>
</tr>
<tr>
<td>$\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}_2$</td>
<td></td>
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<tr>
<td>$\text{C}<em>{10}\text{H}</em>{22} + 3\text{O}_2 \rightarrow 20\text{CO}_2 + 22\text{H}_2\text{O}$</td>
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</tr>
<tr>
<td>$3\text{Li} + \text{AlCl}_3 \rightarrow 3\text{LiCl} + \text{Al}$</td>
<td></td>
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<tr>
<td>$\text{C}<em>6\text{H}</em>{12}\text{O}_6 \rightarrow 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2$</td>
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</tr>
<tr>
<td>$\text{Ti} + \text{NiSO}_4 \rightarrow \text{TiSO}_4 + \text{Ni}$</td>
<td></td>
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<tr>
<td>$\text{Al(OH)}_3 + 3\text{HBr} \rightarrow \text{AlBr}_3 + 3\text{H}_2\text{O}$</td>
<td></td>
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<tr>
<td>$3\text{Rb} + \text{P} \rightarrow \text{Rb}_3\text{P}$</td>
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<td>balanced reaction</td>
<td>type of reaction</td>
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<td>-------------------------------------------------------</td>
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</tr>
<tr>
<td>H₃PO₄ + 3KOH ——&gt; K₃PO₄ + 3H₂O</td>
<td>double replacement</td>
</tr>
<tr>
<td>H₂ + O₂ ——&gt; H₂O₂</td>
<td>synthesis</td>
</tr>
<tr>
<td>C₁₀H₂₂ + 31O₂ ——&gt; 20CO₂ + 22H₂O</td>
<td>combustion</td>
</tr>
<tr>
<td>3Li + AlCl₃ ——&gt; 3LiCl + Al</td>
<td>synthesis</td>
</tr>
<tr>
<td>C₆H₁₂O₆ ——&gt; 2C₂H₅OH + 2CO₂</td>
<td>decomposition</td>
</tr>
<tr>
<td>Ti + NiSO₄ ——&gt; TiSO₄ + Ni</td>
<td>single replacement</td>
</tr>
<tr>
<td>Al(OH)₃ + 3HBr ———&gt; AlBr₃ + 3H₂O</td>
<td>double replacement</td>
</tr>
<tr>
<td>3Rb + P ———&gt; Rb₃P</td>
<td>synthesis</td>
</tr>
</tbody>
</table>
How to prepare for Friday...

Know 5 types of chemical reactions by name, know how to write the abstractions of these five reactions, know a real example reaction both as a word equation as well as a balanced chemical reaction.

Know the difference between coefficients, which you can change in balancing reactions, from subscripts, which you can’t change once you write the compound correctly.

Know TOPIC-B, tests for gases in the lab, and how to use both Table J and Table F. Know when to use them too.

Know your vocabulary, aqueous, endothermic vs. exothermic, cation, anion, atom, phases, soluble, insoluble, synthesis, decomposition, combustion, single and double replacement, precipitate.

Know why some single replacement reactions DO NOT occur.

Know why chromium makes three different oxides, what the formulas and names for these three oxides are. (see next slide)
Chromium makes 3 different cations, +2, +3, and +6 as shown on your periodic table of elements.

Chromium II oxide is $\text{CrO}_2$ - (in a 1:1 ratio)
this chromium ion is $\text{Cr}^{+2}$

Chromium III oxide $\text{Cr}_2\text{O}_3$ - (in a 2:3 ratio)
this chromium ion is $\text{Cr}^{+3}$

Chromium VI oxide $\text{CrO}_3$ - (in a 1:3 ratio)
this chromium ion is $\text{Cr}^{+6}$

The Roman Numeral matches the number of electrons lost by that particular cation.