Types of Chemical Reactions

1. Synthesis
2. Decomposition
3. Single Replacement (Displacement)
4. Double Replacement (Displacement)
5. Combustion of Hydrocarbon

Synthesis:

- two or more elements or compounds combine to form one final product
- eg $C + O_2 \Rightarrow CO_2$
- eg $2H_2 + O_2 \Rightarrow 2H_2O$
- eg $N_2 + 4H_2 + Cl_2 \Rightarrow 2NH_4Cl$
- eg $CaO + CO_2 \Rightarrow CaCO_3$
- eg $BaO + H_2O \Rightarrow Ba(OH)_2$

general from of $A + B \Rightarrow AB$

Decomposition:

- reverse of synthesis
- one compound makes two or more products
- products could be elements, compounds or both
- eg $2HgO \Rightarrow 2Hg + O_2$
- eg $Fe_2(CO_3)_3 \Rightarrow Fe_2O_3 + 3CO_2$
- eg $Ba(OH)_2 \Rightarrow BaO + H_2O$

general form of $AB \Rightarrow A + B$

Hint: for synthesis and decomposition, look for small stable familiar substances (H_2O, CO_2, NH_3, HCl)

One more point: oxidation states may change when you have a synthesis or decomposition

Single Replacements :

- one individual element replaces an element in a compound
- the replaced element is now an individual element
- eg $Fe + 3NaOH \Rightarrow Fe(OH)_3 + 3Na$
- can have a cationic replacement or an anionic replacement (metals replace cations, non-metals replace anions)
- eg $2F_2 + 2MgO \Rightarrow 2MgF_2 + O_2$

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- eg $4Ag + SnCl_4 \Rightarrow 4AgCl + Sn$
- big time complications regarding oxidation states (which will always change)
- as a general rule of thumb, use the most common oxidation state available (i.e. the bold one)
- spontaneity is also a question for single replacements (does the reaction happen or not)

general form $A + BC \Rightarrow AC + B$ for cation replacement

$D + BC \Rightarrow BD + C$ for anion replacement

Double Replacements

- swapping of cation anion pairs
- oxidation states never change
- eg $NaCl + AgNO_3 \Rightarrow NaNO_3 + AgCl$
- $3Na_2SO_4 + 2Ga(IO_4)_3 \Rightarrow 6NaIO_4 + Ga_2(SO_4)_3$

general form $AB + CD \Rightarrow AD + CB$

Combustion of a Hydrocarbon

- hydrocarbons are composed of carbon and hydrogen and occasionally other atoms such as O or N
- the reactants are the hydrocarbon itself and oxygen (i.e. O_2)
- the products are the most stable oxides available for carbon (CO_2) and hydrogen (H_2O)
- the product will always be CO_2 and H_2O
- eg $C_4H_8 + 6O_2 \Rightarrow 4CO_2 + 4H_2O$
- eg $2C_6H_{14} + 19O_2 \Rightarrow 12CO_2 + 14H_2O$