

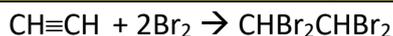
AS 91165

Demonstrate understanding of the properties of selected organic compounds

Alkanes	
Substitution reactions of alkanes with halogens (limited to monosubstitution)	
$\text{CH}_3\text{CH}_3 + \text{Br}_2 \rightarrow \text{CH}_3\text{CH}_2\text{Br} + \text{HBr}$ Similar reaction with Cl_2	Halogenation Need UV light and/or heat Swaps a H for a Br atom: Makes 2 products Orange colour of bromine is very slowly decolourised
Combustion – burning!! Needs O_2 (also oxidation reaction)	
$\text{CH}_3\text{CH}_3 + 3\frac{1}{2}\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$ Or $2\text{CH}_3\text{CH}_3 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$	<ul style="list-style-type: none"> Plentiful O_2 needed for complete combustion; clean flame Products $\text{H}_2\text{O} + \text{CO}_2$ + maximum energy released Hint. Balance in order C H O..... Limited O_2 get incomplete combustion; yellow and sooty flame Products $\text{H}_2\text{O} + \text{C} + \text{CO}$ + less energy released
Alkenes	
Addition reactions of alkenes with	
$\text{CH}_2=\text{CH}_2 + \text{H}_2 \rightarrow \text{CH}_3\text{CH}_3$	H_2/Pt catalyst and heat (Or Ni catalyst and heat) Also known as hydrogenation Turns $\text{C}=\text{C}$ into $\text{C}-\text{C}$; one product
$\text{CH}_2=\text{CH}_2 + \text{Br}_2 \rightarrow \text{CH}_2\text{BrCH}_2\text{Br}$ Similar addition reaction with Cl_2 but colour change hard to see	Halogenation; Turns $\text{C}=\text{C}$ into $\text{C}-\text{C}$; one product Orange colour of bromine is rapidly decolourised – very good test for $\text{C}=\text{C}$ / unsaturation – no need for heat.
$\text{CH}_2=\text{CH}_2 + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{OH}$	$\text{H}_2\text{O}/\text{H}^+$, heat (conc. $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$, heat) – hydration Makes an alcohol! Turns $\text{C}=\text{C}$ into $\text{C}-\text{C}$; one product
$\text{CH}_2=\text{CH}_2 + \text{HCl} \rightarrow \text{CH}_3\text{CH}_2\text{Cl}$	Hydrohalogenation, reaction with hydrogen halides. HBr has a similar reaction. Turns $\text{C}=\text{C}$ into $\text{C}-\text{C}$; one product Don't forget identification of major and minor products on addition to asymmetric alkenes – the rich get richer.
$n \text{CH}_2=\text{CH}_2 \rightarrow -(\text{CH}_2\text{CH}_2)_n$	Polymerisation; needs heat + catalyst + pressure Makes a long (unreactive) saturated molecule with $\text{C}-\text{C}$ bonds Monomer \rightarrow polymer. Usually draw 3 repeating units.  Hint: for propene draw as  and draw as "polyethene" with one CH_3 - on every other C atom in place of an H.
Oxidation of alkenes	
$\text{CH}_2=\text{CH}_2 + \text{H}_2\text{O} + [\text{O}] \rightarrow \text{CH}_2\text{OHCH}_2\text{OH}$ The $\text{H}_2\text{O} + [\text{O}]$ represents the solution of oxidising agent, MnO_4^- but we don't write the MnO_4^- in the equation	Does NOT need heat Shake with MnO_4^- ; colour change purple to brown Shake with $\text{H}^+/\text{MnO}_4^-$; colour change purple to colourless Makes a DIOL; 2 x OH groups added across double bond. Just learn it & remember it is OXIDATION reaction, not addition.
$\text{CH}_2=\text{CH}_2 + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$	Combustion is also an oxidation reaction but we don't burn alkenes as they are too useful e.g. for making into plastics. Of course it can be complete or incomplete depending on how much O_2 there is; tends to be incomplete especially as # of $\text{C}\uparrow$.

Alkynes

Addition reactions of alkynes with



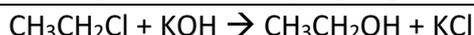
$\text{C}\equiv\text{C}$ to C-C ; one product
Orange colour of bromine is rapidly decolourised – very good test for unsaturation

Haloalkanes

Substitution reactions of haloalkanes



Heat with conc. ammonia



Heat with *aqueous* potassium hydroxide – written KOH(aq)

Elimination reactions of haloalkanes



Heat with *alcoholic* potassium hydroxide – written KOH(alc) or KOH(Et) (including identification of major and minor products for asymmetric reactants). Creates an alkene with C=C (unsaturated).

Primary amines

Acid–base reactions of amines



React with water to produce the OH^- ion that makes the solution (weakly) alkaline; identify with litmus or UI.



This is a salt (proton transfer) – no need to name!!

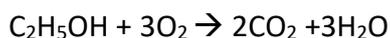
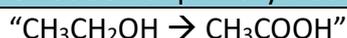
Alcohols

Substitution reactions of alcohols



With hydrogen halides, PCl_3 , PCl_5 , SOCl_2
All swap OH group for Cl atom. SOCl_2 is the best one!! 😊

Oxidation of primary alcohols



To form carboxylic acids with $\text{MnO}_4^-/\text{H}^+$, heat (purple MnO_4^- turns to colourless Mn^{2+})
or $\text{Cr}_2\text{O}_7^{2-}/\text{H}^+$, heat (orange $\text{Cr}_2\text{O}_7^{2-}$ turns to green Cr^{3+})
Also combustion (also oxidation reaction) as alcohols make good fuels, burning cleanly (complete combustion).

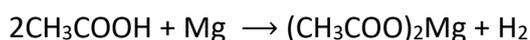
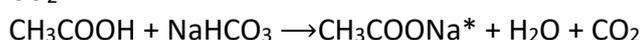
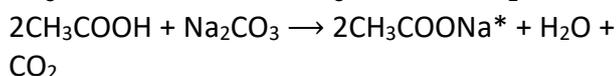
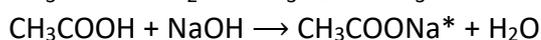
Elimination from alcohols



elimination of (including identification of major and minor products for asymmetric reactants) water from alcohols
Also known as dehydration
Conc. H_2SO_4 or conc. H_3PO_4 , heat

Carboxylic acids

Acid–base reactions (“base” could include hydroxide and carbonate and hydrogen carbonate!!)



Weak acids (pH 3-5); identify with litmus or UI.
Acid + base \rightarrow salt + water
Acid + carbonate \rightarrow salt + water + carbon dioxide
Acid + hydrogen carbonate \rightarrow salt + water + carbon dioxide
*Write the sodium salt as RCOONa or RCOO^-Na^+
Carboxylic acids would also produce hydrogen gas with a reactive metal such as Mg.

