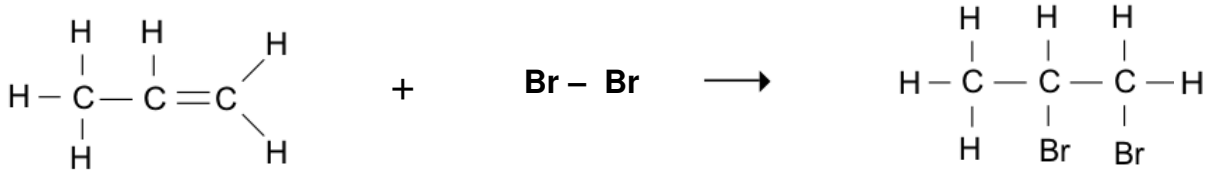
Unit 2, Lesson #4: Chemical Reactions of Hydrocarbons

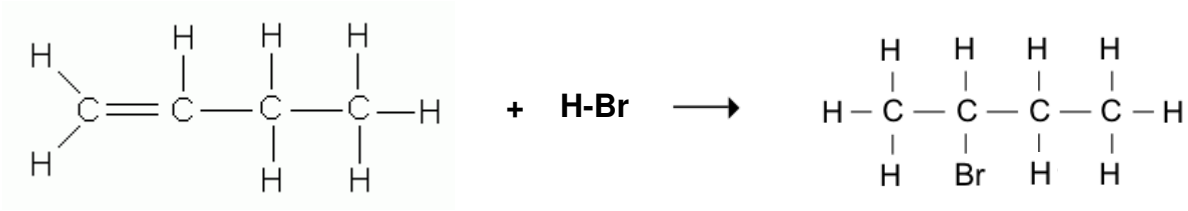
Homework:

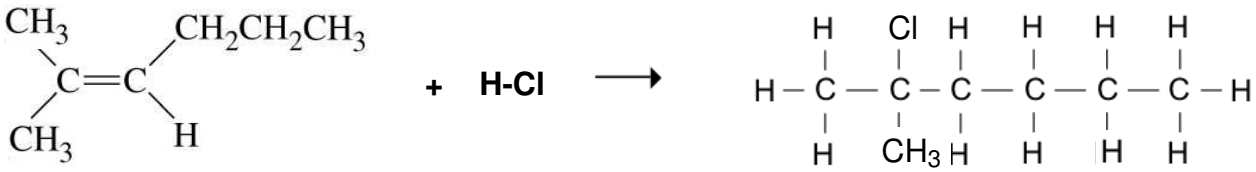
1. Read pages 57 – 60 and 65 – 70.
2. On page 68, do questions 7 and 8

Page 68

7a) 

7b) 

7c) 

7d) 

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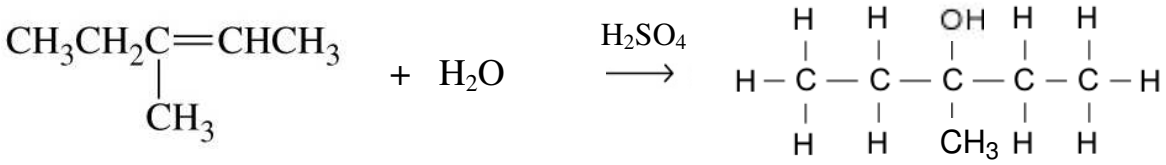
8a) 

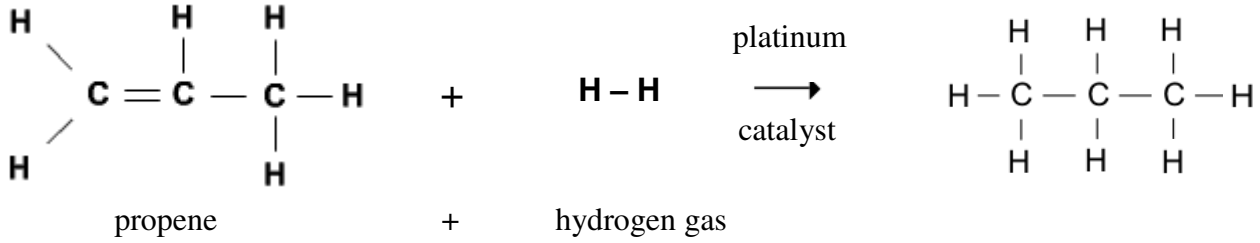
propene + hydrogen chloride (g)

8b) 

ethene + bromine liquid

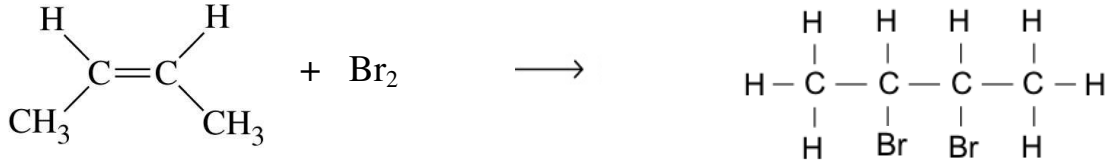
8c) 

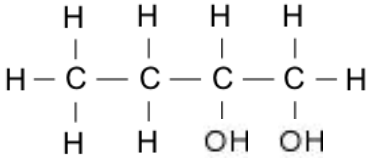
3-methyl-2-pentene + water (could also start with 2-ethyl-1-butene)

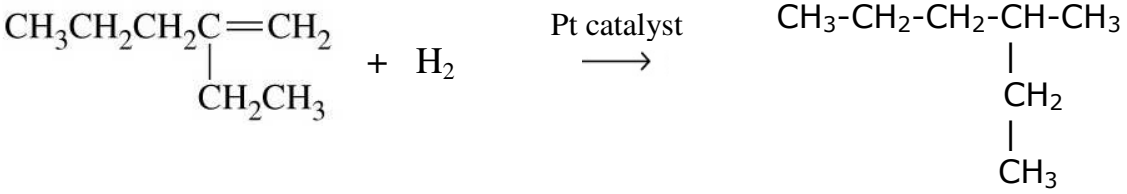
8d) 

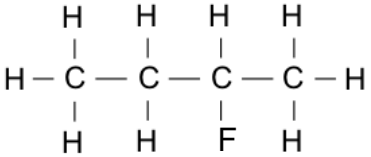
propene + hydrogen gas

3. Draw the products of the following reactions. Use Markovnikov's Rule where applicable.

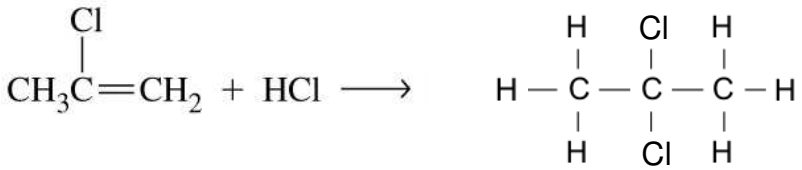
a) 

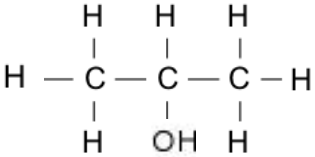
b) $CH_3CH_2CH{=}CH_2 + KMnO_4 \xrightarrow{NaOH}$  $+ KMnO_2$

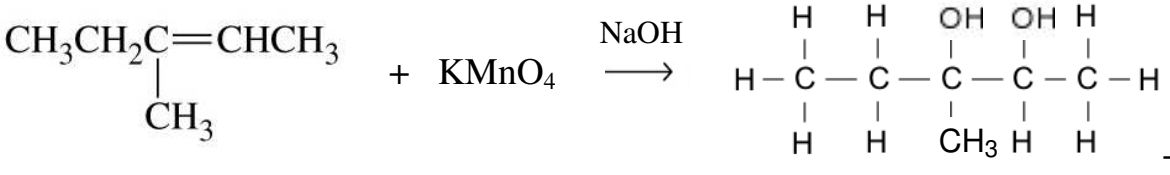
c) 

d) $CH_3CH_2CH_2CH_3 + HF \xrightarrow{\lambda}$  $+ H_2$

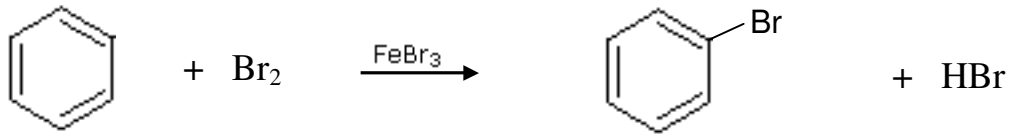
Fluorine can replace any hydrogen

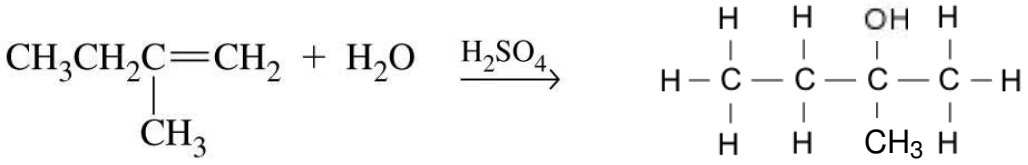
e) 

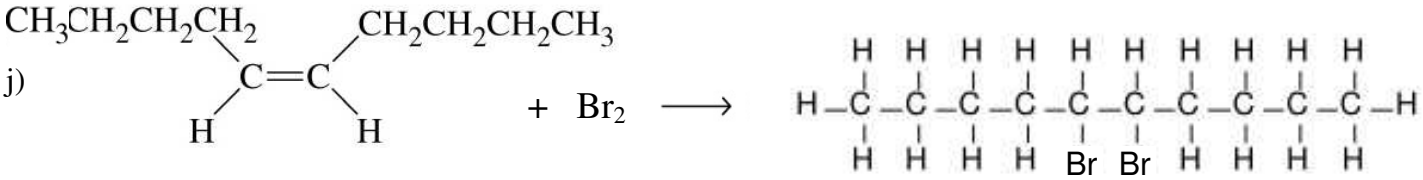
f) $CH_3CH{=}CH_2 + H_2O \xrightarrow{H_2SO_4}$ 

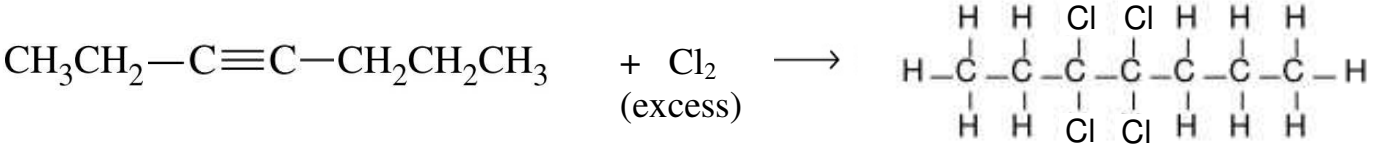
g) 

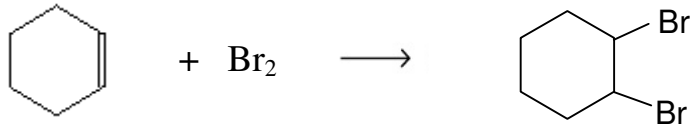
$+ KMnO_2$

h) 

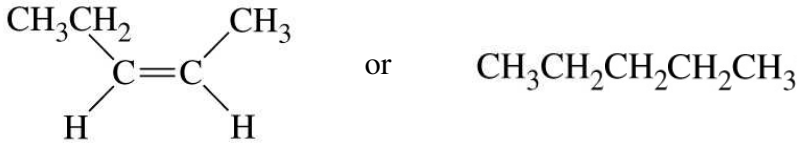
i) 

j) 

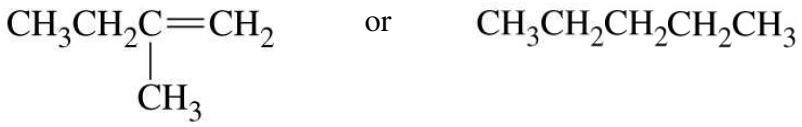
k) 

l) 

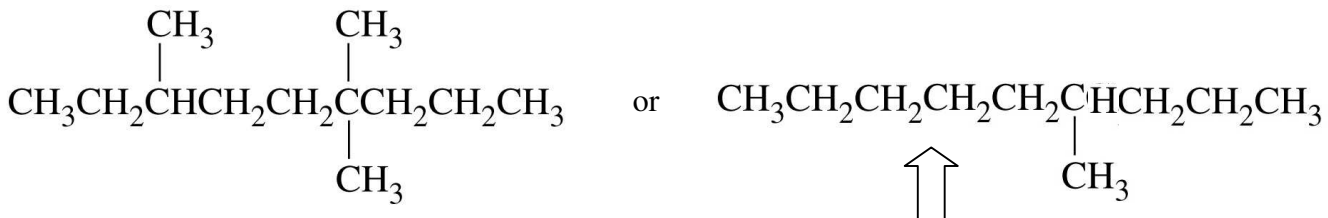
4. Which of the following pairs of molecules will have a higher melting point? Explain for each pair.

a) 

Pentane (no double bond) has a higher melting point because it has a straighter chain. This means that molecules can get closer to one another, so London Dispersion Forces (LDFs) will be stronger, increasing melting point.

b) 

Pentane (no double bond or branching) has a higher melting point because it has a straighter chain, so stronger London Dispersion Forces (LDFs) and higher melting point.

c) 

4-methylnonane has a higher melting point because it has fewer branches, so stronger London Dispersion Forces (LDFs) and higher melting point.

d) $CH_3CH_2CH_2CH_2CH_2CH_2CH_3$ or $CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3$

Octane has a higher melting point because it has a longer carbon chain, so there are more atoms to create temporary dipoles. LDFs are stronger, resulting in a higher melting point.

5. Write the balanced chemical reactions for the combustion of the following hydrocarbons. Include the states of all reactants and products.

a) octane

$2\ C_8H_{18}\ (l) + 25\ O_2\ (g) \rightarrow 16\ CO_2\ (g) + 18\ H_2O\ (v)$

Because water is liquid at SATP, in the gas state, it is correctly referred to as a vapour (v).

b) 2-pentene

$2\ C_5H_{10}\ (l) + 15\ O_2\ (g) \rightarrow 10\ CO_2\ (g) + 10\ H_2O\ (v)$

c) cyclopropane

$2\ C_3H_6\ (g) + 9\ O_2\ (g) \rightarrow 6\ CO_2\ (g) + 6\ H_2O\ (v)$

d) 3-heptyne

$C_7H_{12}\ (l) + 10\ O_2\ (g) \rightarrow 7\ CO_2\ (g) + 6\ H_2O\ (v)$

6. Arrange the following compounds in order of ***increasing*** reactivity. Explain why you put them in this order:

cyclohexane < benzene < cyclohexene

This is the order of reactivity because single bonds (cyclohexane) are less reactive than aromatics (benzene, which are 1 ½ bonds long) which are less reactive than double bonds (cyclohexene).

7. Describe two different chemical tests you could perform to distinguish between butane and 1-butene. What are three different physical properties of these substances that could be used to distinguish them?

butane	**1-butene**
• does not react with liquid bromine (Br_2) • does not react with potassium permanganate ($KMnO_4$) • higher melting point • higher boiling point • more dense than 1-butene because straighter chain	• turns liquid bromine from brown/orange to colourless • turns potassium permanganate ($KMnO_4$) from purple to brown • lower melting point • lower boiling point • less dense than butane because the carbon chain is not as straight, so the molecules will not be able to fit together as tightly