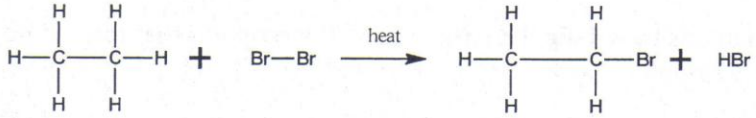
# Types of Organic Reactions – Worksheet #8

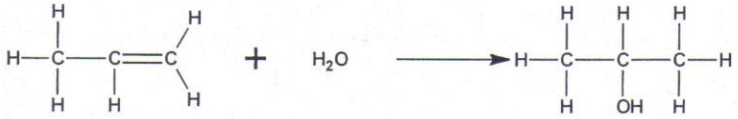
1. Identify the type of organic reaction represented by each of the following equations:

a.




substitution (replace H with Br on alkane)

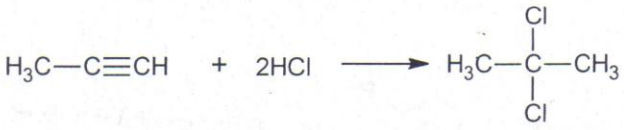
b.




addition (hydration)

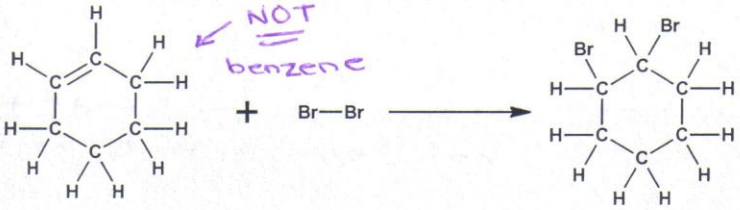
* note Markovnikov's Rule

c.



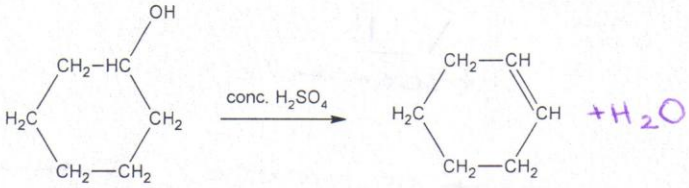

double addition

d.



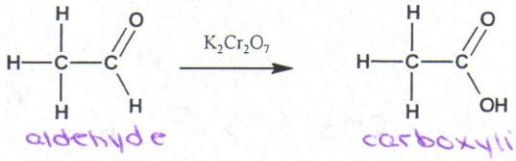

addition (halogenation of an alkene)

e.



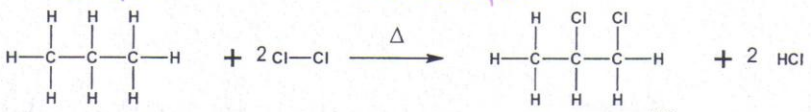

elimination (acid-catalyzed dehydration)

f.



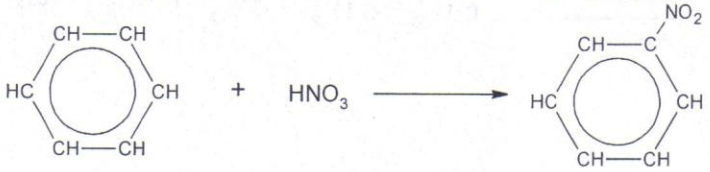

mild oxidation

g.



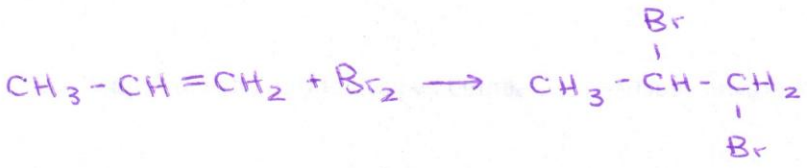

substitution (with 2 mol $Cl_2$)

h.



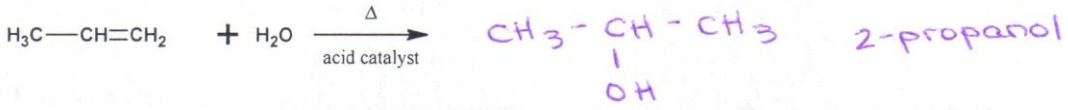

substitution

2. Write the equation for the addition reaction involving propene and bromine.

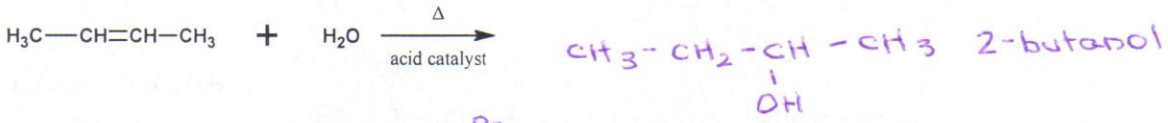


3. Complete the following equations by writing the structures of the products that form. If no reaction occurs, write "no reaction".

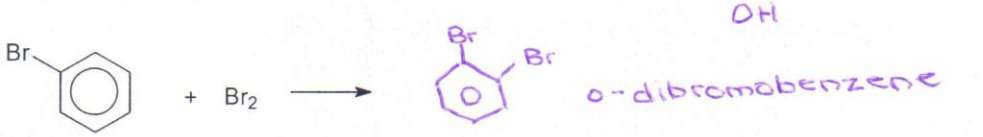
a.




b.

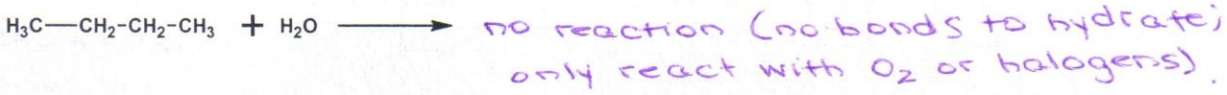



c.

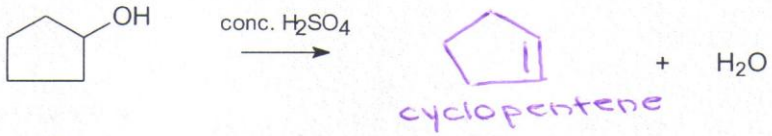



( 3 possible products but ortho isomer is favoured)

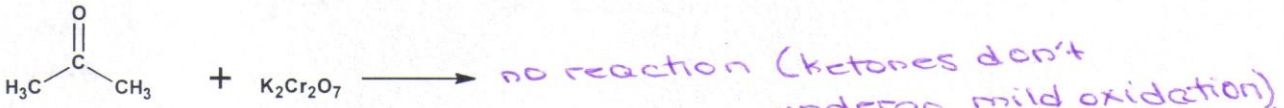
d.




e.




f.




g.


h.

4. a) Write the equation for the complete oxidation (combustion) of 2-butanol.

$C_4H_9OH + 6O_2 \longrightarrow 4CO_2 + 5H_2O$

b) Write the equation for the mild oxidation of 2-butanol with $KMnO_4$.

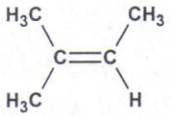
$CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-CH_3 \xrightarrow{KMnO_4} CH_3-\overset{\displaystyle O}{\overset{\|}{C}}-CH_2-CH_3$

5. Write the equation for the addition of hydrochloric acid to ethene. What is the name of the product formed?

$CH_2=CH_2 + HCl \longrightarrow CH_3-CH_2Cl$ (chloroethane).

6. Predict the product formed when HCl is reacted with each of the following compounds. Use Markovnikov's Rule to predict the product.

a. $H_3C-CH=CH_2$ $\quad CH_3-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_3$ 2-chloropropane

b.  $\quad CH_3-\underset{\displaystyle Cl}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_2-CH_3$ 2-chloro-2-methylbutane

c. $H_3C-C\equiv CH$ $\quad CH_3-\underset{\displaystyle Cl}{\underset{|}{C}}=CH_2$ 2-chloropropene. $\longrightarrow CH_3-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_3$ 2,2-dichloropropane

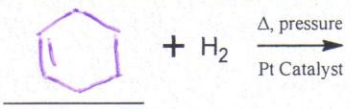
7. Describe the chemical test that could be carried out to distinguish between hexane and hexene.

unknown + bromine ($Br_2$) at room temp. If sol'n turns from brown to clear, it's hexene. Alkanes (hexane) require heat for the reaction to occur.

8. Write the equation for the substitution reaction involving one molecule of each of ethane and bromine.

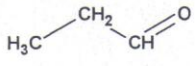
$CH_3-CH_3$ ethane + bromine $\longrightarrow$ $CH_3-CH_2-Br$ bromoethane + hydrogen bromide.

9. What is the structure of the missing organic reactant in each of the following:



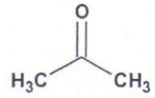

cyclohexene $\qquad$ cyclohexane

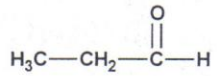
10. Write the structure of the carboxylic acid that forms when the following aldehyde is oxidized:



$CH_3-CH_2-\overset{\displaystyle O}{\overset{\|}{C}}-OH$ propanoic acid

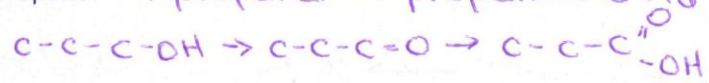
11. Which of these two compounds is easily oxidized by $KMnO_4$? Write the structure of the organic product of the oxidation.

a.  no reaction

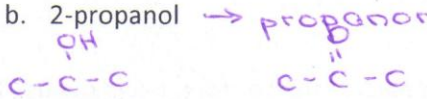
b.  forms propanoic acid $CH_3-CH_2-C(=O)-OH$.

12. What are the products of the mild oxidation of

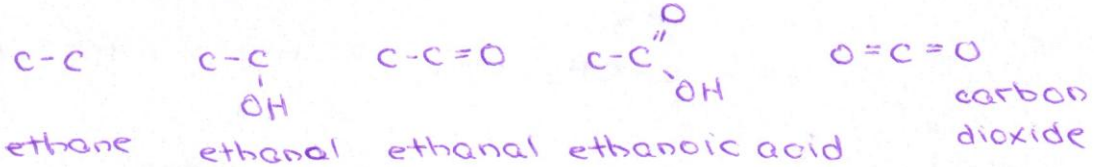
a. 1-propanol → propanal → propanoic acid



b. 2-propanol → propanone



13. a) Draw the following expanded structures for these compounds.




b)Using oxidation numbers for carbon, show that this sequence of compounds represents an oxidation process: