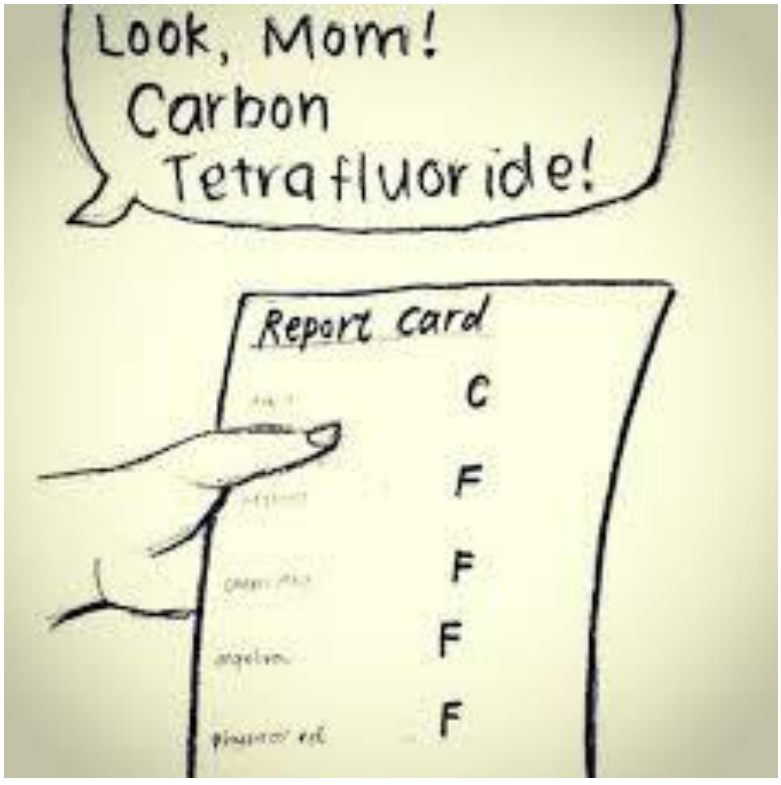
Practice Packet Unit 14: Organic Chemistry



Vocabulary

For each word, provide a short but specific definition from YOUR OWN BRAIN! No boring textbook definitions. Write something to help you remember the word. Explain the word as if you were explaining it to an elementary school student. Give an example if you can. Don't use the words given in your definition!

Organic: _____

Hydrocarbon: _____

Alkane: _____

Alkene: _____

Alkyne: _____

Saturated: _____

Unsaturated: _____

Isomer: _____

Functional Group: _____

Combustion: _____

Addition: _____

Substitution: _____

Fermentation: _____

Esterification: _____

Polymerization: _____

Saponification: _____

LESSON 1: Introduction to Organic Chemistry

Objective:

- ***Differentiate between an organic compound and an inorganic compound***
- ***Explain why organic properties make them insoluble in water and have relatively low BP***
- ***Differentiate between saturated and unsaturated hydrocarbons***
- ***Determine the name of alkanes, alkenes and alkynes using Table P and Q***

- Organic compounds contain _____ atoms which bond to one another in chains, rings, and networks to form a variety of structures. Organic compounds can be named using the IUPAC system.
- _____ are compounds that contain only carbon and hydrogen. Saturated hydrocarbons contain only single carbon-carbon bonds.
- In a multiple covalent bond, more than one pair of electrons are_____ between two atoms. _____ organic compounds contain at least one double or triple bond.

1. Which of the following are organic?

CH_4	C_2H_6	C_4H_{10}
H_2O	CO_2	$HC_2H_3O_2$

2. Which of the above are hydrocarbons?

3. Which statement correctly describes hydrocarbons?

a. nonpolar covalent substances, not soluble in water, react slowly

b. polar covalent substances, soluble in water, react slowly

c. nonpolar covalent substances, soluble in water, react slowly

d. nonpolar covalent substances, not soluble in water, react quickly

4. How many times does carbon bond and why?

5. A student investigated four different substances in the solid phase. The table below is a record of the characteristics (marked with an *X*) exhibited by each substance.

Characteristic Tested	Substance A	Substance B	Substance C	Substance D
High melting point	X		X	
Low melting point		X		X
Soluble in water	X			X
Insoluble in water		X	X	
Decomposed under high heat		X		
Stable under high heat	X		X	X
Electrolyte	X			X
Nonelectrolyte		X	X	

Which substance has characteristics most like those of an organic compound?

a. *A* B) *B* C) *C* D) *D*

Naming/Formulas of Hydrocarbons

1. For each compound fill in each blank:

	Number of Carbon atoms	Series	Molecular Formula
a. Methane	_____	_____	_____
b. Butane	_____	_____	_____
c. Propyne	_____	_____	_____
d. Pentane	_____	_____	_____
e. Octane	_____	_____	_____
f. Heptene	_____	_____	_____
g. Propene	_____	_____	_____
h. Butyne	_____	_____	_____

2. Circle all the Unsaturated Hydrocarbons above

3. For each of the following use tables P and Q to determine the name.

a. CH_4 _____
b. $C_{10}H_{20}$ _____
c. C_3H_4 _____
d. C_8H_{18} _____
e. C_5H_{12} _____
f. C_9H_{18} _____
g. C_2H_6 _____
h. C_4H_6 _____
i. C_7H_{16} _____
j. C_6H_{12} _____

4. Create a rule to determine an easy way to find the homologous series to which a compound belongs.

ASSESS YOURSELF ON THIS LESSON: _____/33

If you missed more than 5, do the Additional Practice. If not, go on to the next hw video!!!

Additional Practice:

1. For each compound fill in each blank:

	Number of Carbon atoms	Series	Molecular Formula
a. Ethyne	_____	_____	_____
b. Hexyne	_____	_____	_____
c. Ethane	_____	_____	_____
d. Propane	_____	_____	_____
e. Decene	_____	_____	_____
f. Octyne	_____	_____	_____
g. Heptane	_____	_____	_____
h. Decane	_____	_____	_____
i. Nonane	_____	_____	_____

2. Write the name:

C_2H_4 C_9H_{18} CH_4

C_5H_8 C_7H_{16} C_6H_{10}

3. What is the formula:

propene butane

octane decyne

4. Which of the above are saturated?

ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: _____/20

If you missed more than 3 you should see me for extra help and/or re-watch the lesson video assignment

Lesson 2: Structural Formulas

Objective:

- ***Differentiate between the structural formulas of alkanes, alkenes and alkynes***
- ***Construct structural formulas of alkanes, alkenes, and alkynes***

1. Draw the following alkanes:

   hexane **octane**

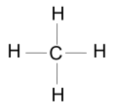
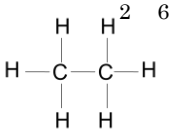
2. Draw the following alkenes:

   1-pentene **2-pentene**

3. Draw the following alkynes:

   1-pentyne **2-pentyne**

For each box write the name, molecular and structural and condense structural formulas of the compound (for multiple bonds keep them on the 1st carbon)

# C's	Alkane	Alkene	Alkyne
1	Methane CH_4  CH_4	X	X
2	Ethane C_2H_6  CH_3CH_3	Ethene C_2H_4	Ethyne C_2H_2
3			
4		1-butene C_4H_8	

1. Give the molecular formula and draw the structural and condensed formulas for the following compounds:

    a. Pentane

    b. Hexane

    c. 1-pentyne

    d. 3-hexene

ASSESS YOURSELF ON THIS LESSON: _____/23

If you missed more than 5, do the Additional Practice. If not, go on to the next hw video!!!

Additional Practice: Give the molecular formula and draw the structural and condensed formulas for the following compounds:

a. 2-Hexyne

b. Butane

c. 2-pentene

d. Propyne

ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: _____/4

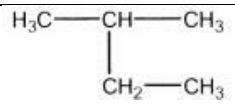
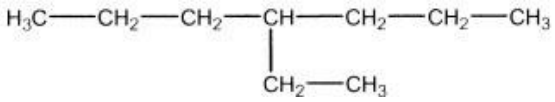
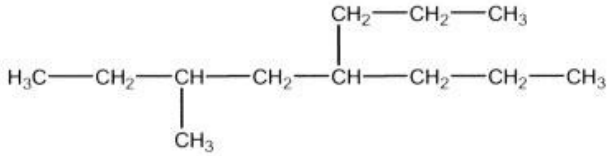
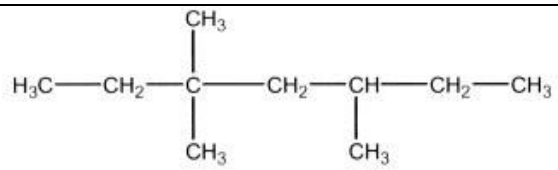
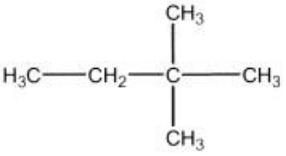
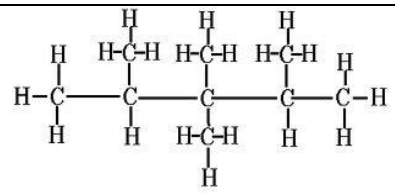
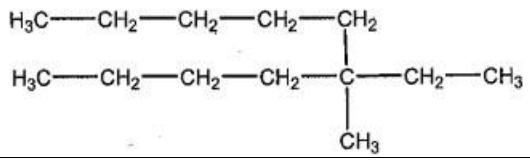
If you missed more than 1 you should see me for extra help and/or re-watch the lesson video assignment

Lesson 3: Branched Hydrocarbons

Objective:

- ***Determine the name of branched alkanes***

Name the following Branched Alkanes

	
	
	
	
	
	
*** 	

Draw the following Branched alkanes:

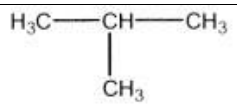
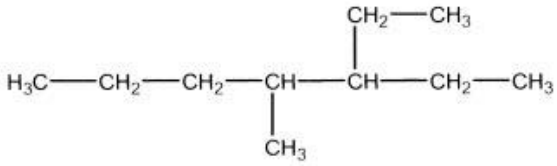
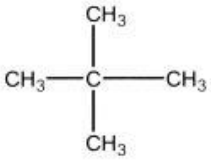
4-ethyl-octane	
3-ethyl-2,2-dimethyl-hexane	
3,3-dimethyl-pentane	
3-ethyl-2methyl-heptane	
2,2,3-trimethyl-butane	

ASSESS YOURSELF ON THIS LESSON: _____/12

If you missed more than 3, do the Additional Practice. If not, go on to the next hw video!!!

Additional Practice:

Name the following Branched Alkanes

Draw the following Branched alkanes:

2-methyl-nonane	
3-ethyl-pentane	
3-ethyl hexane	

ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: _____/6

If you missed more than 2 you should see me for extra help and/or re-watch the lesson video assignment

Lesson 4: Isomers

Objective:

- ***Identify and construct isomers of alkanes, alkenes and alkynes***

- _____ of organic compounds have the same molecular formula, but different structures and properties.

1. Record the Structural formula, molecular formula, and condensed formula for the following:

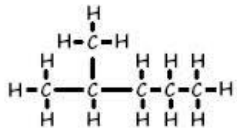
Name	Structural	Molecular	Condensed
2, 3-dimethyl butane			
2, 2-dimethyl butane			
2-heptyne			
3-hexene			
2-methyl 1-pentene			

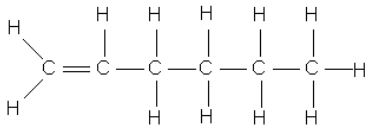
2. Are any of the above isomers? Explain your answer. _____

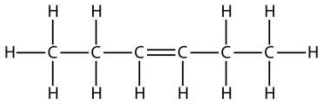
_____

3. Draw an isomer of 2-heptyne below. Give the name of your isomer: _____

4. Name the following and identify the isomers.







_____ _____ _____

5. Draw an isomer of hexane; name it.

ASSESS YOURSELF ON THIS LESSON: _____/11

If you missed more than 3, do the Additional Practice. If not, go on to the next hw video!!!

Record the following molecular and structural formulas. Then identify any isomers:

2-methyl 2-pentane

3-methyl 2-pentane

3,4-dimethyl hexane

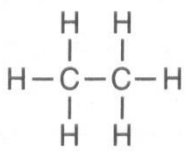
4-propyl nonane

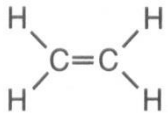
ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: _____/5

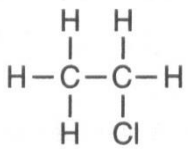
If you missed more than 1 you should see me for extra help and/or re-watch the lesson video assignment

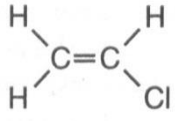
Regents Practice

1. Which formula represents an unsaturated hydrocarbon?

A) 

C) 

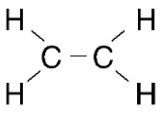
B) 

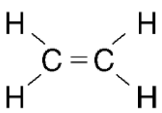
D) 

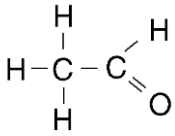
2. Which organic compound is a saturated hydrocarbon?
   A) ethyne
   B) ethanol
   C) ethene
   D) ethane

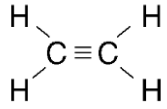
3. Which formula represents a hydrocarbon?
   A) $CH_3CH_2CH_2CHO$
   B) $CH_3CH_2CH_2CH_3$
   C) $CH_3CH_2CH_2COOH$
   D) $CH_3CH_2COOCH_3$

4. Which structural formula *correctly* represents a hydrocarbon molecule?

A) 

B) 

C) 

D) 

5. In saturated hydrocarbons, carbon atoms are bonded to each other by
   A) single covalent bonds, only
   B) double covalent bonds, only
   C) alternating single and double covalent bonds
   D) alternating double and triple covalent bonds

6. What is the general formula for the members of the alkane series?
   A) C*n*H2*n*
   B) C*n*H2*n*–2
   C) C*n*H2*n*+2
   D) C*n*H2*n*–6

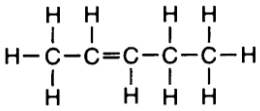
7. In which group do the hydrocarbons all belong to the same homologous series?
   A) C_2H_2, C_2H_4, C_2H_6
   B) C_2H_2, C_3H_4, C_4H_8
   C) C_2H_2, C_2H_6, C_3H_6
   D) C_2H_4, C_3H_6, C_4H_8

8. A molecule of butane and a molecule of 2-butene both have the same total number of
   A) carbon atoms
   B) single bonds
   C) hydrogen atoms
   D) double bonds

9. A double carbon-carbon bond is found in a molecule of
   A) pentane
   B) pentyne
   C) pentene
   D) pentanol

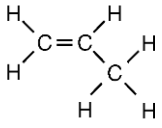
10. The multiple covalent bond in a molecule of 1-butene is a
    A) double covalent bond that has 6 shared electrons
    B) double covalent bond that has 4 shared electrons
    C) triple covalent bond that has 6 shared electrons
    D) triple covalent bond that has 4 shared electrons

11. Given the formula:



What is the IUPAC name of this compound?
   A) 2-pentene
   B) 2-butene
   C) 2-pentyne
   D) 2-butyne

12. Given the structural formula:



What is the IUPAC name of this compound?
   A) propane
   B) propanone
   C) propene
   D) propanal

13. What is the correct formula for butene?
A) C_4H_4 C) C_4H_6
B) C_4H_8 D) C_4H_{10}

14. Which general formula represents the homologous series of hydrocarbons that includes the compound l-heptyne?
A) CnH2n-6 C) CnH2n-2
B) CnH2n D) CnH2n+2

15. Which compound is an unsaturated hydrocarbon?
A) hexanal C) hexane
B) hexanoic acid D) hexyne

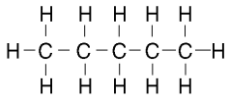
16. Given the structural formula: H−C≡C−H
What is the total number of electrons shared in the bond between the two carbon atoms?
A) 6 B) 2 C) 3 D) 4

17. Which formula represents propyne?
A) C_3H_4 C) C_3H_6
B) C_5H_8 D) C_5H_{10}

18. What is the name of a compound that has the molecular formula C_6H_6?
A) butane B) butene
B) benzene D) butyne

19. Two substances have different physical and chemical properties. Both substances have molecules that contain two carbon atoms, one oxygen atom, and six hydrogen atoms. These two substances must be
A) isomers of each other
B) isotopes of each other
C) the same compound
D) the same hydrocarbon

20. The three isomers of pentane have different
A) formula masses
B) molecular formulas
C) empirical formulas
D) structural formulas

21. Which structural formula represents a molecule that is *not* an isomer of pentane?
A)

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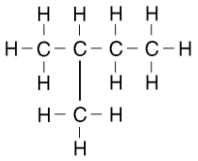
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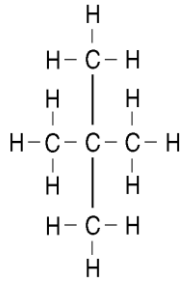
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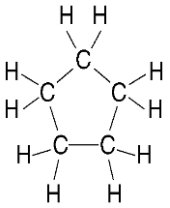
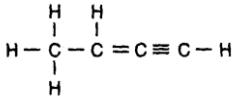
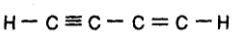
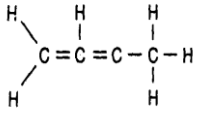
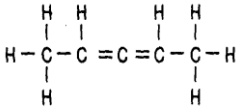


22. Which compound is an isomer of pentane?
A) butane C) propane
B) methyl butane D) methyl propane

23. What is the maximum number of covalent bonds that can be formed by one carbon atom?
A) 1 B) 2 C) 3 D) 4

24. Which structural formula *correctly* represents an organic compound?





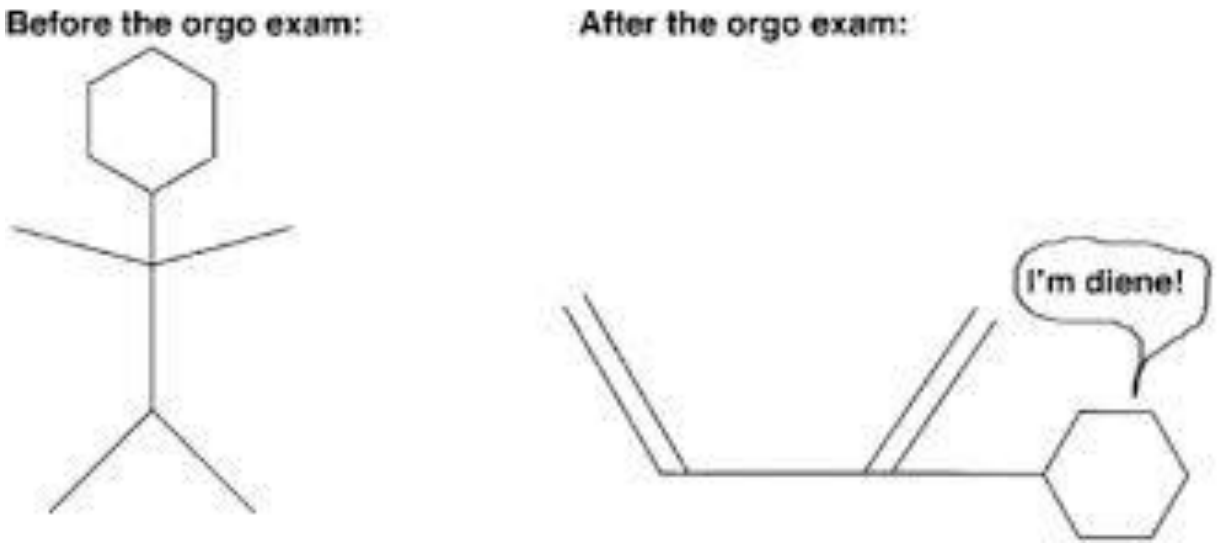
25. Atoms of which element can bond with each other to form ring and chain structures in compounds?
A) C B) Ca C) H D) Na

26. Which element must be present in an organic compound?
A) hydrogen C) oxygen
B) carbon D) nitrogen

27. Organic compounds that are essentially non-polar and exhibit weak intermolecular forces have
    A) low vapor pressure
    B) low melting points
    C) high boiling points
    D) high electrical conductivity in solution

28. A characteristic of most organic compounds is that they
    A) have low melting points
    B) have high melting points
    C) are soluble in water
    D) conduct electricity when dissolved in water

29. In general, which property do organic compounds share?
    A) high melting point
    B) high electrical conductivity
    C) readily soluble in water
    D) slow reaction



Lesson 5: Functional Groups

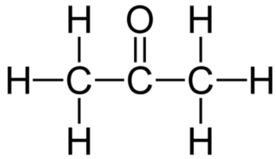
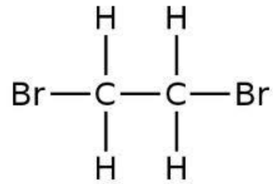
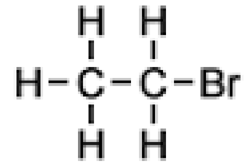
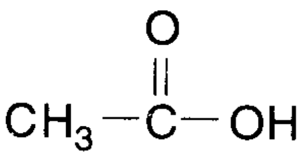
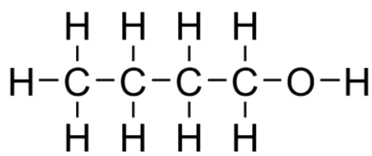
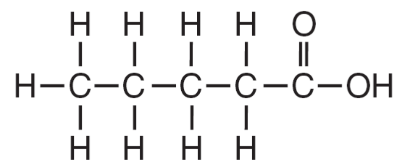
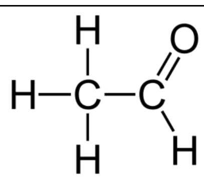
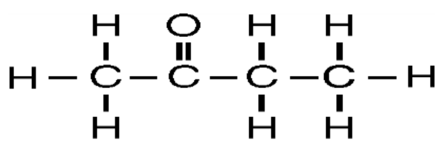
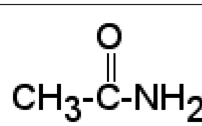
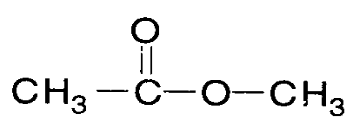
Objective:

- ***Determine the name of the organic compound based upon the functional groups***

Fill in the chart below:

Name	Functional Group	How to name	Draw the example on the reference table	Properties
Alcohol				Soluble, flammable
Ether				Soluble, anesthetic (puts you to sleep)
Aldehyde				Soluble, reactive, formaldehyde (methanal) is used to preserve specimens.
Keytone				Somewhat soluble, at least 3 Carbons, acetone (propanone) is nail polish remover
Acid				Weak acids, aka carboxylic acids.
Ester				Smell great, used in perfumes and found in fruits.
Amine				Used in dyes, found in DNA
Amide				Used in dyes

For each of the following identify the functional group and then name the compound using table R.

 Functional Group: ____________ Name : ____________________	 Functional Group: ____________ Name : ____________________	 Functional Group: ____________ Name : ____________________
 Functional Group: ____________ Name : ____________________	 Functional Group: ____________ Name : ____________________	 Functional Group: ____________ Name : ____________________
 Functional Group: ____________ Name : ____________________	 Functional Group: ____________ Name : ____________________	CH_3-O-CH_3 Functional Group: ____________ Name : ____________________
CH_3-OH Functional Group: ____________ Name : ____________________	 Functional Group: ____________ Name : ____________________	 Functional Group: ____________ Name : ____________________

For the following compounds, determine the family and draw the compound:

Name	Family	Structural Formula	Condensed Formula
Butanoic acid			
Methanal			
Butanamide			
3-iodo octane			
Methyl pentanonate			
Ethanol			

ASSESS YOURSELF ON THIS LESSON: _____/30

If you missed more than 5, do the Additional Practice. If not, go on to the next hw video!!!

Additional Practice:

For the following compounds, determine the family and draw the compound:

Name	Family	Structural Formula	Condensed Formula
2-heptanone			
Diethyl ether			
2-pentanol			
Ethanoic acid			
2-propanamine			
Hexanal			
Ethyl methanoate			

ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: _____/6

If you missed more than 1 you should see me for extra help and/or re-watch the lesson video assignment

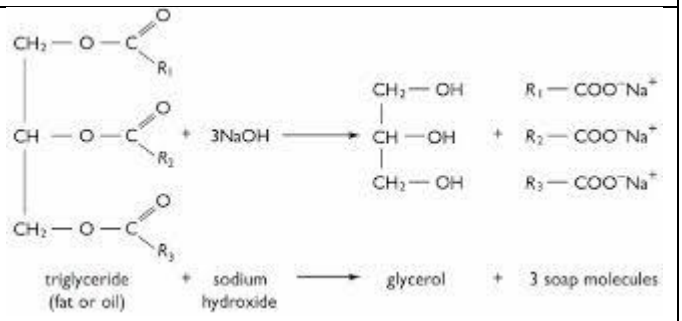
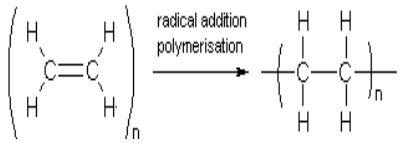
Lesson 6: Organic Reactions

Objective:

- ***Differentiate between the types of organic reactions***
- ***Compose addition and substitution reactions***

- Types of organic reactions include: addition, substitution, polymerization, esterification, fermentation, saponification, and combustion. ***(F-SCAPES)***

Fill in the chart below:

	How to Identify	Example
Addition (like synthesis)		$C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$
Substitution (like SR)		$CH_4 + Br_2 \rightarrow CH_3Br + HBr$
Combustion		$CH_4 + 2O_2 \rightarrow CO_2 + 2H_20$
Esterification		$C_3H_6COOH + C_2H_5OH \rightarrow C_3H_6COOC_2H_5 + H_2O$
Fermentation		$C_6H_{12}O_6 \rightarrow C_2H_5OH + CO_2$
Saponification		
Polymerization		

Match the reaction to its name:

___ 1. Addition	a. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_20$
___ 2. Substitution	b. $(C_{17}H_{35}COO)_3C_3H_5 + 3\ NaOH \rightarrow C_3H_5(OH)_3 + 3C_{17}H_{35}COONa$
___ 3. Combustion	c. $C_6H_{12}O_6 \rightarrow C_2H_5OH + CO_2$
___ 4. Polymerization	d. $n(CH_2CH_2) \rightarrow (CH_2CH_2)_n$
___ 5. Fermentation	e. $C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$
___ 6. Esterification	f. $C_3H_6COOH + C_2H_5OH \rightarrow C_3H_6COOC_2H_5 + H_2O$
___ 7. Saponification	g. $C_3H_6 + I_2 \rightarrow C_3H_6I_2$

Name the reaction:

1. A saturated alkane reacts with fluorine _____
2. Small alkene chains connect to form larger alkane chains _____
3. Sugar is decomposed to form an alcohol _____
4. An unsaturated hydrocarbon reacts with bromine _____
5. An alcohol and an organic acid are reacted _____
6. A base is added to a fat molecule to form a soap _____
7. Hydrocarbons are burned in the presence of oxygen _____

Draw all organic reactants and products. Then name and give the formula for the missing substance in the reaction. Give the reaction type.

1. $C_2H_4 + F_2 \rightarrow$ _____ Rxn: _____

2. $C_3H_6 + H_2 \rightarrow$ _____ Rxn: _____

ASSESS YOURSELF ON THIS LESSON: _____/18

If you missed more than 5, do the Additional Practice. If not, go on to the next hw video!!!

Additional Practice:

Draw all organic reactants and products. Then name and give the formula for the missing substance in the reaction. Give the reaction type.

1. $C_2H_6 + Cl_2 \rightarrow$ _____ + HCl Rxn: _____

2. $C_4H_{10} + Br_2 \rightarrow$ _____ + HBr Rxn: _____

3. $CH_4 + O_2 \rightarrow$ _____ + H_2O Rxn: _____

4. $C_3H_8 + O_2 \rightarrow CO_2 +$ _____ Rxn: _____

5. $C_6H_{12}O_6 \rightarrow 2CO_2 + 2$_____ Rxn: _____

6. $C_5H_{10} + F_2 \rightarrow$ _____ Rxn: _____

Challenge:

7. $C_2H_5OH + C_3H_7COOH \rightarrow H_2O +$ _____ Rxn: _____

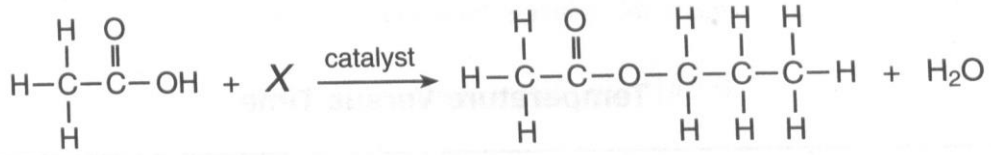
ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: _____/4

If you missed more than 1 you should see me for extra help and/or re-watch the lesson video assignment

Review:

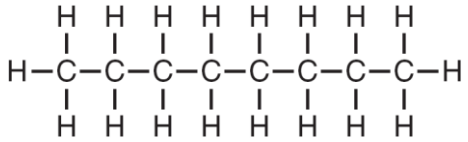
1. Base your answer to the following question on the information below.

   The incomplete equation below represents an esterification reaction. The alcohol reactant is represented by X.



   Draw the structural formula for the alcohol represented by X.

2. A gasoline engine burns gasoline in the presence of excess oxygen to form carbon dioxide and water. The main components of gasoline are isomers of octane. A structural formula of octane is shown below.



   Draw a structural formula for 2,2,4-trimethylpentane.

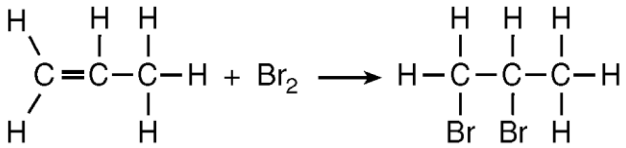
Base your answers to questions 3 and 4 on the information below.

Many esters have distinctive odors, which lead to their widespread use as artificial flavorings and fragrances. For example, methyl butanoate has an odor like pineapple and ethyl methanoate has an odor like raspberry.

3. What is a chemical name for the alcohol that reacts with methanoic acid to produce the ester that has an odor like raspberry?

4. Draw a structural formula for the ester that has an odor like pineapple.

Base your answers to questions 5 through 7 on the equation below, which represents an organic compound reacting with bromine.



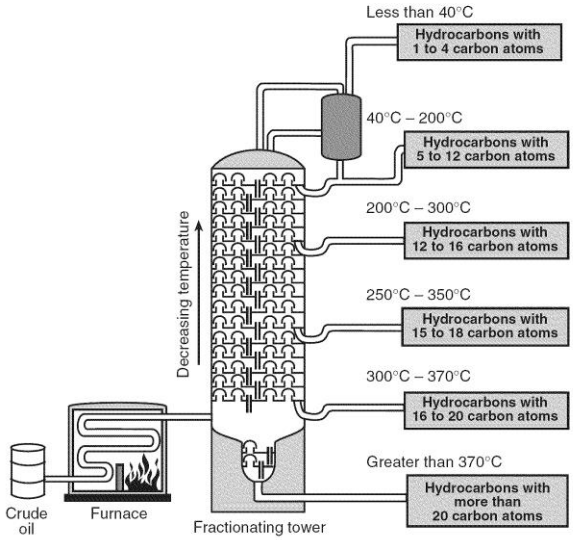
5. What is the gram-formula mass of the product in this reaction?

6. What type of organic reaction is represented by this equation?

7. What is the IUPAC name for the organic compound that reacts with Br2?

Base your answers to questions 8 through 11 on the information and diagram below and on your knowledge of chemistry.

Crude oil is a mixture of many hydrocarbons that have different numbers of carbon atoms. The use of a fractionating tower allows the separation of this mixture based on the boiling points of the hydrocarbons. To begin the separation process, the crude oil is heated to about 400°C in a furnace, causing many of the hydrocarbons of the crude oil to vaporize. The vaporized mixture is pumped into a fractionating tower that is usually more than 30 meters tall. The temperature of the tower is highest at the bottom. As vaporized samples of hydrocarbons travel up the tower, they cool and condense. The liquid hydrocarbons are collected on trays and removed from the tower. The diagram below illustrates the fractional distillation of the crude oil and the temperature ranges in which the different hydrocarbons condense.



8. How many hydrogen atoms are present in one molecule of octane?

9. Write an IUPAC name of *one* saturated hydrocarbon that leaves the fractionating tower at *less than* 40°C.

10. Describe the relationship between the strength of the intermolecular forces and the number of carbon atoms in the different hydrocarbon molecules.

11. State the trend between the boiling point of the hydrocarbons contained in the crude oil and the number of carbon atoms in these molecules.

Base your answers to questions 12 and 13 on the information below. Given the reaction between 1-butene and chlorine gas:

$$C_4H_8 + Cl_2 \longrightarrow C_4H_8Cl_2$$

12. Draw the structural formula of the product 1,2-dichlorobutane

13. Which type of chemical reaction is represented by this equation?

Base your answers to questions 14 and 15 on the information below.

Diethyl ether is widely used as a solvent.

14. Draw the structural formula for an alcohol that is an isomer of diethyl ether.

15. In the space provided draw the structural formula for diethyl ether.

16. How is the bonding between carbon atoms different in unsaturated hydrocarbons and saturated hydrocarbons?