Chem 106: Class

Week 16

- Sign in Roster @ front of lab
- Pick up papers
  Handout
- Polymers / Slime Handout

Chem 106: Class

Week 16

- Sign in Roster @ front of lab
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Chem 106: Next Week's Class

EXAM 3: 4-Dec
All Materials/Activities Reading, Viewing, & Doing from Week #12 including Acids-Bases, through today's class.

Preparation: Practice Questions, Worksheets, Post labs, embedded i-clicker, & Guiding Questions

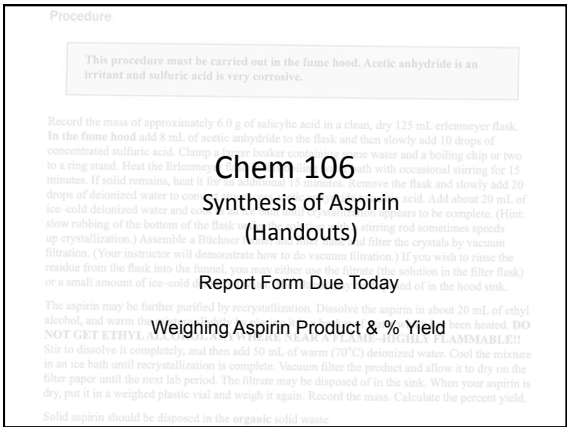
90 min.: 20 Multiple Choice (4pts ea); 10 T/F (2pts ea) plus ~ 5 problems (~5-6 pts ea); 3 pages 2-sided handwritten notes + Periodic Table

Chem 106: FINAL Exam

Final EXAM, 11-Dec., Monday 1:00 PM - 3:00 PM
PS 221
Comprehensive including Global Warming

Suggested Preparation: Review 3 "Hour" Exams; that include Practice Questions, Worksheets, Post labs, embedded i-clicker, & Guiding Questions

120 min.: 30 Multiple Choice (4pts ea); 15 T/F (2pts ea) plus ~ 8 problems (~6 pts ea); 200 pts. Total
Study Guide: Maximum 5 pages 2-sided handwritten notes + Periodic Table; if final score (%) is higher than lowest hour exam, it will replace it



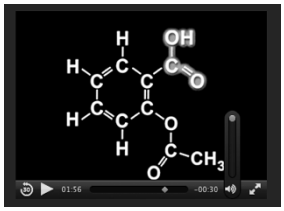
Chem 106

Synthesis of Aspirin
(Handouts)

Report Form Due Today

Weighing Aspirin Product & % Yield

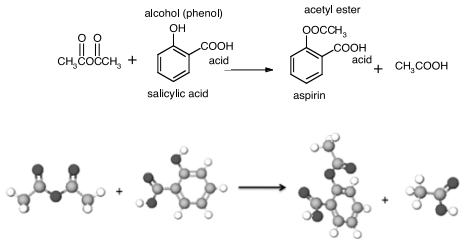
Representing Organic Molecules
Aspirin



http://chemconnections.org/general/movies/Representations.MOV

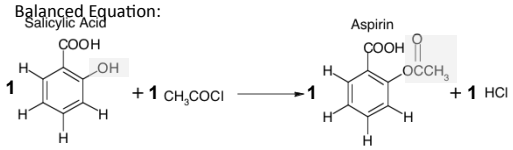
Chem 106

Synthesis of Aspirin
(Handouts)



Mass Calculations: Reactants ⟷ Products

- How many grams of aspirin are theoretically produced from 6.0 g of salicylic acid with an excess of acetyl chloride, C_2H_3OCl?
- Balanced Equation:



$C_7H_6O_3$	C_2H_3OCl	$C_9H_8O_4$	HCl
MW = 138.12	MW = 78.49	MW = 180.15	MW= 36.45

Mass Calculations: Reactant ⟶ Product

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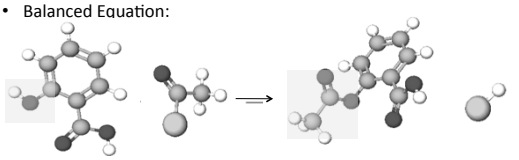

$C_7H_6O_3$	C_2H_3OCl	$C_9H_8O_4$	HCl
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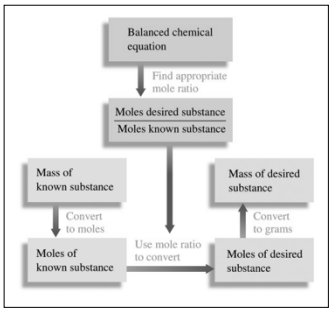
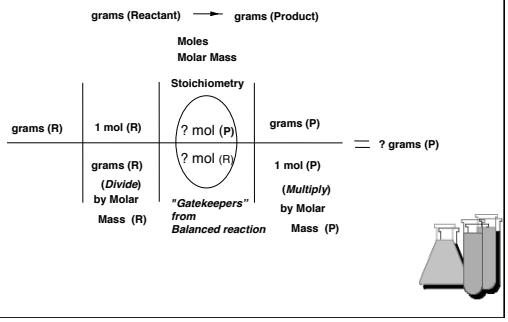
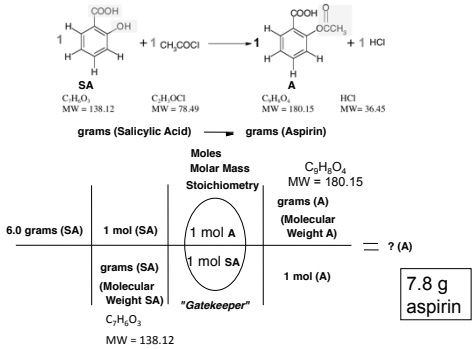
Mass Calculations: Reactants ⟷ Products



*Theoretical (Yield) Mass Calculations Reactant ⟶ **Product***



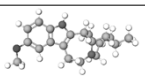
Mass Calculations:



Percent Yield

- In synthesis as in any experiment, it is very difficult and at most times impossible to be perfect. Therefore the actual yield (g) is measured and compared to the theoretical calculated yield (g). This is the percent yield:
- % Yield = actual (g) / theoretical (g) x 100

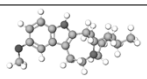
QUESTION



- A synthetic reaction produced 2.45g of Ibogaine, $C_{20}H_{26}N_2O$, a natural product with strong promise in treating heroin addiction (at least in Europe), the calculated theoretical yield was 3.05g, what is the % yield?

A) 19.7% B) 39.4% C) 80.3% D) 160.6%

Answer



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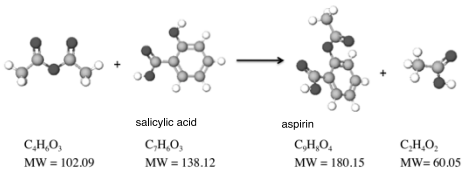
A) 19.7% B) 39.4% C) 80.3% D) 160.6%

% yield = 2.45g / 3.05g x 100
= 80.3%

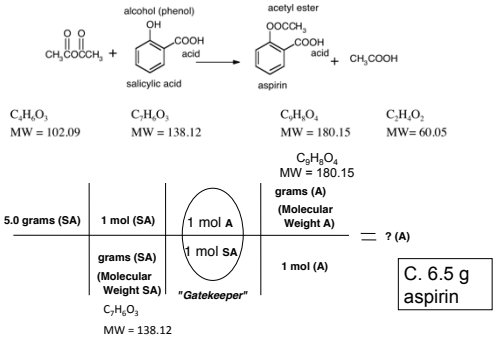
QUESTION

- How many grams of aspirin are theoretically produced from 5.0 g of salicylic acid reacting with an excess of acetic anhydride, $C_4H_6O_3$?
- Balanced Equation:



A) 3.8 g B) 5.0 g C) 6.5 g D) 7.8 g

Answer



C. 6.5 g aspirin

QUESTION

- Noelle's synthesis of aspirin, $C_9H_8O_2$, produced 5.90g. The calculated theoretical yield was 6.50g; what is her % yield?

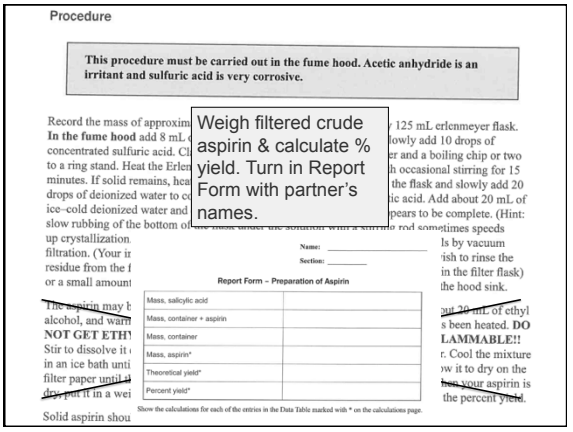
A) 47.5% B) 80.3% C) 90.6% D) 110%

Answer

- Noelle's synthesis of aspirin, $C_9H_8O_2$, produced 5.90g. The calculated theoretical yield was 6.50g; what is her % yield?

A) 47.5% B) 80.3% C) 90.6% D) 110%

% yield = 5.90 g / 6.50 g x 100
= 90.6 %



Procedure

This procedure must be carried out in the fume hood. Acetic anhydride is an irritant and sulfuric acid is very corrosive.

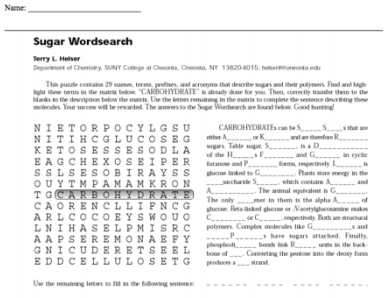
Weigh filtered crude aspirin & calculate % yield. Turn in Report Form with partner's names.

Name: _____
Section: _____

Report Form – Preparation of Aspirin

Mass, salicylic acid	
Mass, container + aspirin	
Mass, container	
Mass, aspirin*	
Theoretical yield*	
Percent yield*	

Show the calculations for each of the entries in the Data Table marked with * on the calculations page.



Name: _____

Sugar Wordsearch

Terry L. Helser
Department of Chemistry, SUNY College at Oneonta, Oneonta, NY 13820-4015; helserth@oneonta.edu

This puzzle contains 29 names, terms, prefixes, and acronyms that describe sugars and their polymers. Find and highlight these terms in the matrix below. "CARBOHYDRATE" is already done for you. Then, correctly transfer them to the blanks in the description below the matrix. Use the letters remaining in the matrix to complete the sentence describing these molecules. Your success will be rewarded. The answers to the Sugar Wordsearch are found below. Good hunting!

N I E T O R P O C Y L G S U
N I T I H C G L U C O S E G
K E T O S E S S E S O D L A
E A G C H E X O S E I P E R
S S L S E S O B I R A Y S S
O U Y T M P A M A M K R O N
T G C A R B O H Y D R A T E
C A O R E N C L L I F N C G
A R L C O C O E Y S W O U O
L N I H A S E L P M I S R C
A A P S E R E M O N A E F Y
G N I C U D E R E T S E E L
E D D C E L L U L O S E T G

CARBOHYDRATEs can be S_____, S_____, ____s that are either A_____ or K_____ and are therefore R_____ sugars. Table sugar, S_____, is a D_____ of the H_____s F_____ and G_____, in cyclic furanose and P_____ forms, respectively. L_____ is glucose linked to G_____. Plants store energy in the ____saccharide S_____, which contains A_____ and A_____. The animal equivalent is G_____. The only ____mer in them is the alpha A_____, of glucose. Beta-linked glucose or *N*-acetylglucosamine makes C_____ or C_____, respectively. Both are structural polymers. Complex molecules like G_____s and _____P_____s have sugars attached. Finally, phosphoES_____ bonds link R_____ units in the backbone of ___. Converting the pentose into the deoxy form produces a ___ strand.

Use the remaining letters to fill in the following sentence: _____ ____ _____ _____

Wordsearch Due Today

https://chem.libretexts.org/LibreTexts/Diablo_Valley_College/DVC_Chem_106%3A_Rusay/Vocabulary_III#global%25252Bwarming

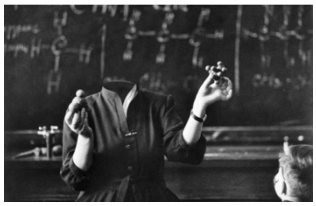
ChemWiki / Libretext login & password required to complete & submit writing

Global Warming, Your Carbon Footprint & Your Future

Capstone Writing Project

Essay Due 1-Dec (Friday)

Chem 106: Class/ Lab



Lipids:
fats, oils, waxes,
terpenes (C_{5x}-carbon formulas), eg. steroids

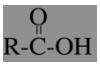
Lipids: Fats & Oils

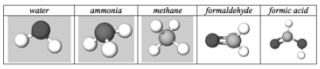
Lipids are natural plant & animal products more soluble in non-polar solvents like gasoline than in water.

Combustion (burning) of one gram: of carbohydrate produces 4 to 5 Calories, protein produces 4 to 5 Calories, **fat produces 9 to 10 Calories — more than twice that of either sugars or proteins.**

Lipids

Common Functional Groups

Name	General Formula	
Alcohols	R–OH	R contains 3 (–OH) groups in total Note: glycerol is not a lipid.
Ethers	R–O–R′	
Amines	$R–NH_2$	
Carboxylic Acids		(R is very large)



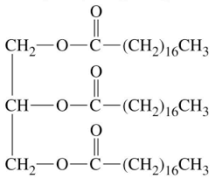
Lipids

Common Functional Groups

Name	General Formula	
Aldehydes		
Ketones		
Carboxylic Acids		(R is very large)
Esters		(R is very large)
Amides		

Molecular Formula: $C_{57}H_{110}O_6$
Molecular weight: 891.4797

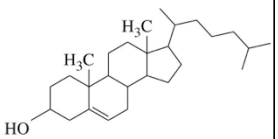
Examples of complex lipids



tristearin, a fat

$\Delta_c H°_{solid}$	-35806.7 ± 1.8	kJ/mol

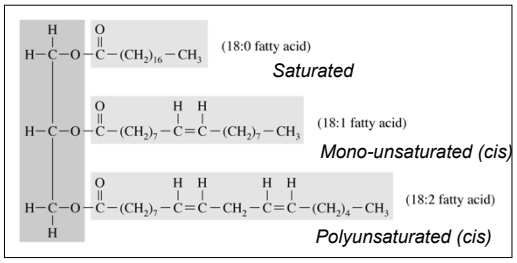
Examples of simple lipids



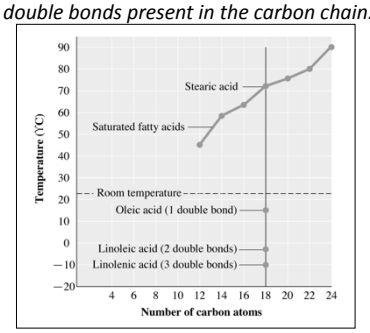
cholesterol, a steroid

α-pinene, a terpene

Structure of a mixed triacylglycerol in which three different fatty acid residues are present.



The melting point of a fatty acid depends on the length of the carbon chain and on the number of double bonds present in the carbon chain.



Question

Which of the following statements regarding fatty acids is false?

A) Fatty acid can have one or more carbon -carbon double bonds.

B) Naturally occurring fatty acids have an odd number of carbons.

C) The configuration of the double bond(s) is (are) generally *cis* in naturally occurring fatty acids.

D) Unsaturated fatty acids have a lower melting point than saturated ones.

Answer

Which of the following statements regarding fatty acids is false?

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B) Naturally occurring fatty acids have an odd number of carbons.

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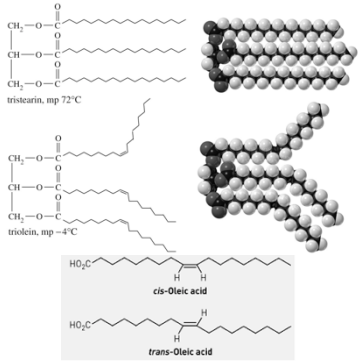
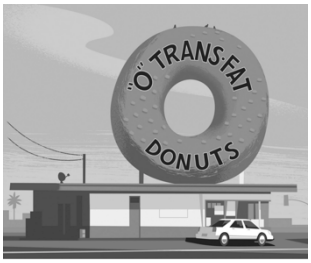
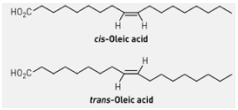
D) Unsaturated fatty acids have a lower melting point than saturated ones.

How do fat molecules differ?

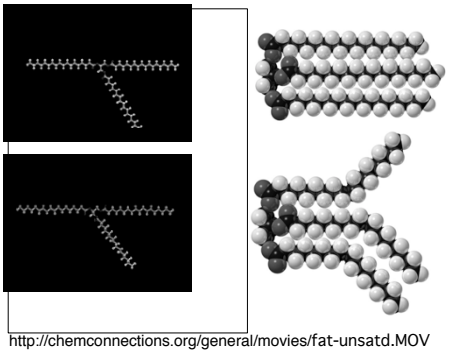




http://chemconnections.org//general/chem106/The%20Worst%20Fat%20in%20the%20Food%20Supply%20-%20The%20New%20York%20Times.pdf

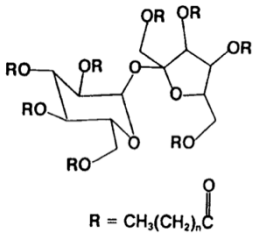


http://chemconnections.org/general/movies/fat-satd.MOV



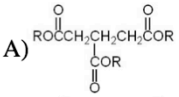
http://chemconnections.org/general/movies/fat-unsatd.MOV

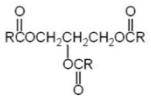
Substitute for fat: Olestra

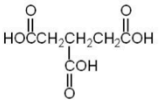


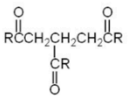
Question

- Which one of the following is a fat, triacylglycerol (triglyceride)?

A) 

B) 

C) 

D) 

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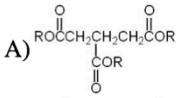
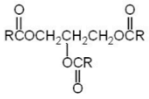
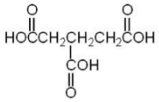
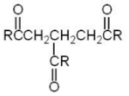
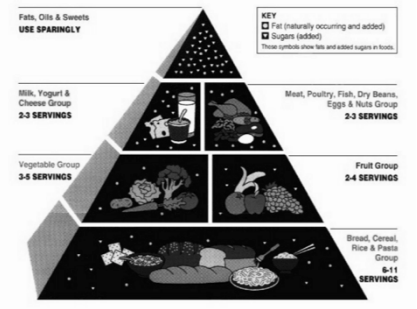
- A) 
B) 
- C) 
D) 

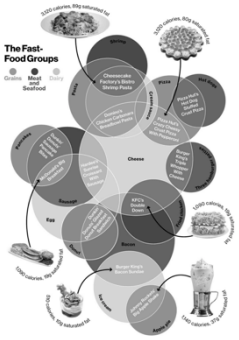
Composition of common fats and oils

Dietary fat/oil	% Saturated fat	% Monounsaturated fat	% Polyunsaturated fat
Canola oil	6	58	36
Safflower oil	9	13	78
Sunflower oil	11	20	69
Corn oil	13	25	62
Olive oil	14	77	9
Soybean oil	15	24	61
Peanut oil	18	48	34
Cottonseed oil	27	19	54
Lard	41	47	12
Palm oil	51	39	10
Beef tallow	52	44	4
Butterfat	66	30	4
Coconut oil	92	6	2

The collapse of movie theater popcorn sales!



Food Pyramid, April 2016



Businessweek, April 2013

The human body is 60-70 percent water, blood is ~90 percent, the brain and muscles are ~75 percent , and bones are ~20 percent by mass. * A human can survive for a month or more without eating food, but only 1-2 weeks without drinking water.

How much energy is required to raise the water in your body from 25ºC (average room temperature) to 37ºC (average body temperature [that is, chemical - biological temperature])? *Assume that there is the equivalent of 5 liters of water, d = 1.0 g/mL in your body. The heat capacity of water is 4.184 J/g ºC (1.00 cal /g ºC); (0.001 Cal / g ºC); (0.001 kcal /g ºC)*

How many grams of fat would need to be burned? *(9 Cal/g)*

How much energy is required to raise the water in your body from 25ºC (average room temperature) to 37ºC (average body temperature [that is, chemical - biological temperature])? *Assume that there is the equivalent of 5 liters of water, d = 1.0 g/mL in your body. The heat capacity of water is 4.184 J/g ºC (1.00 cal /g ºC); (0.001 Cal / g ºC); (0.001 kcal /g ºC)*

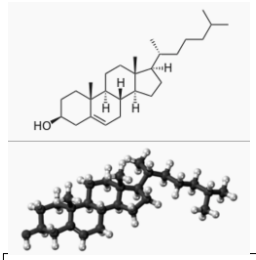
(37º - 25ºC)* 5,000 mL * *1.0 g/mL * 4.184 J/g ºC* = 250 kJ = 60 Cal

How many grams of fat would need to be burned? *(9 Cal/g)*

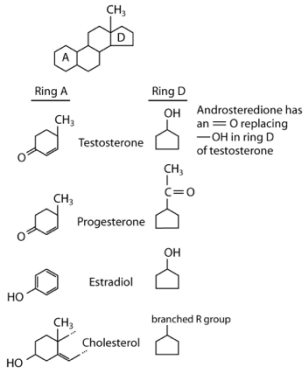
60 Cal / *9 Cal/g* = 6.7 g

… but how long does it last before you need more?

Steroids

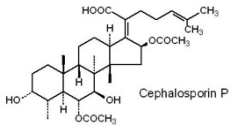


- *What is cholesterol?*
- *Is there such a thing as "good" vs. "bad" cholesterol?*
- *How does it relate to fat?*



Question

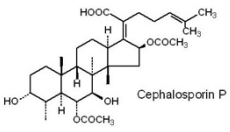
- The backbone structure of cephalosporin P is classified as a



- A) fatty acid. B) steroid.
- C) cholesterol. D) amino acid.

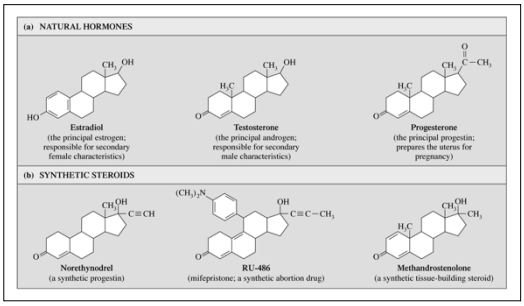
Answer

- The backbone structure of cephalosporin P is classified as a



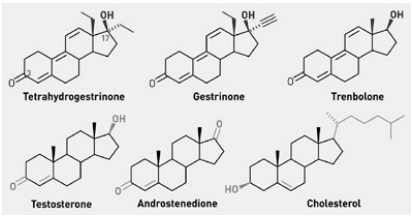
- A) fatty acid. B) steroid.
- C) cholesterol. D) amino acid.

Structures of selected steroids. (Sex hormones and synthetic compounds that have similar actions.)



http://www.cbsnews.com/videos/russias-dark-secret/

Anabolic Steroids



Synthetic Polymers

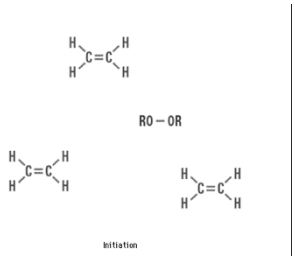
Polymers

Polymers

Macromolecules which are made from small molecules, monomers, or co-monomers which structurally repeat themselves.

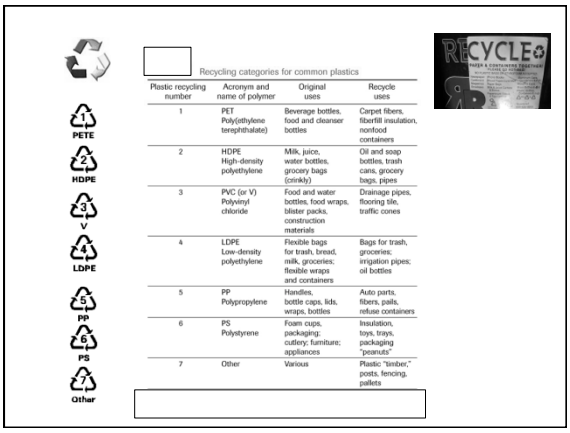
Monomer	**Polymer**
Ethylene	Polyethylene
Vinyl chloride	Polyvinyl chloride
Tetrafluoroethylene	Teflon
Proteins	Amino Acids

Polyethylene: Polymerization Mechanism



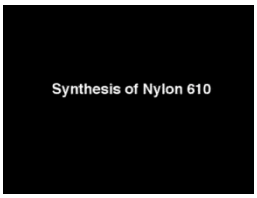
Waste / Recycling?

~250 billion pounds produced annually, worldwide.



Nylon

A macromolecule which is a poly-amide.



-HN$(CH_2)_6$-**NHCO**$(CH_2)_x$CO-

https://www.youtube.com/watch?v=bNh5hK2f6TM

Chem 106 / Dr. Rusay

POLYMER CHEMISTRY
Nylon, Slime & "Silly Putty"

View the preparation of nylon via the condensation reaction of a diamine with a dicarboxylic acid derivative on YouTube *https://www.youtube.com/watch?v=bNh5hK2f6TM*

You and a partner will prepare either *Slime* or *Silly Putty*. Consult with another team's partners and decide who will prepare *Slime*, and who will prepare *Silly Putty*. Then, follow the respective instructions which follow.

***Slime*:** *https://www.youtube.com/watch?v=emlW5Jh-AHc*

1. Obtain a Ziploc bag.
2. Add 50 mL of 4% Polyvinyl Alcohol (PVA) solution to the bag.
3. Add 5 mL of 4% Borax solution ($Na_2B_4O_7 \cdot 10H_2O$) to the bag with a few drops of food coloring if you choose to. *A gel like material will form on adding.*
4. Mix the bag's contents thoroughly being careful not to tear or break the bag. The gel can be kneaded into a ball; use nitrile gloves if you choose to knead the material. *It will stretch if pulled slowly, but shears when quickly twisted.*

Slime @ home: YouTube *https://www.youtube.com/watch?v=emlW5Jh-AHc*

https://www.youtube.com/watch?v=7KYv5s_yVm0