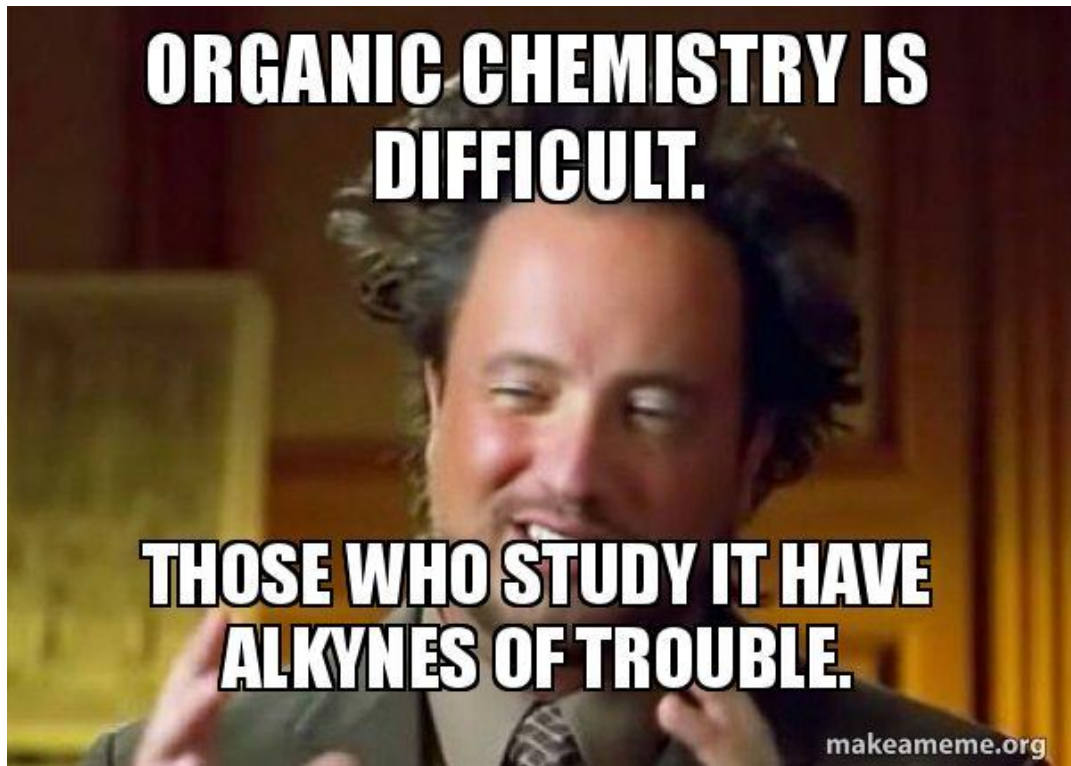


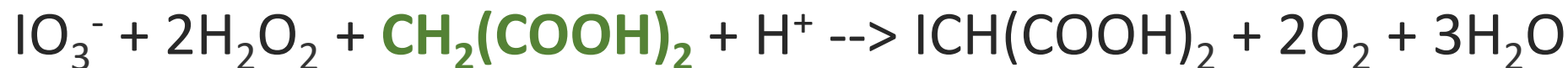
Nov 4-8 Practice Problems



Due dates:

- I know nothing about your midterm!
- Review 6 is this week
- No quiz this week
- Office hours this week: Friday
November 8th, 11:45 to 12:45 in Pulp
and Paper Building 104

Demonstration from notes

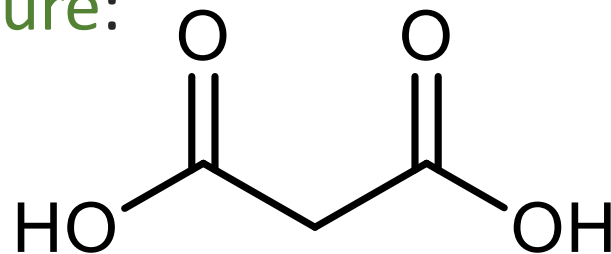


Common name: malonic acid (*Latin 'mālum', meaning 'apple'*)

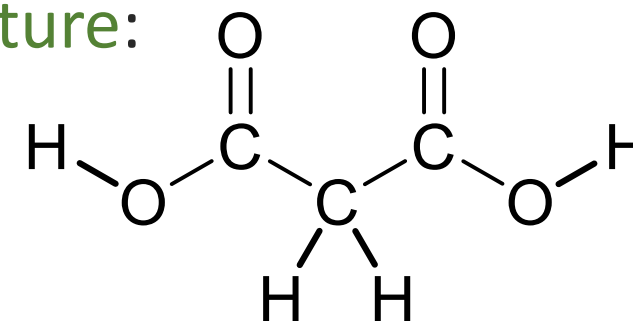
IUPAC name: propanedioic acid

Molecular formula: $\text{C}_3\text{H}_4\text{O}_4$

Skeletal structure:



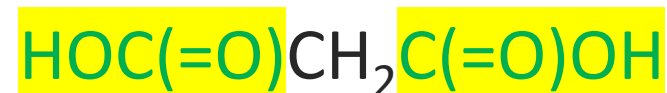
Expanded structure:



Lets try to figure out the condensed:

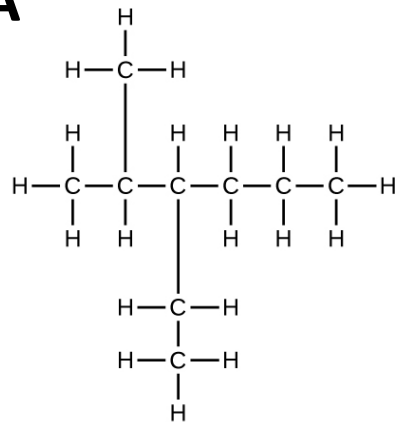


Simplify the condensed:

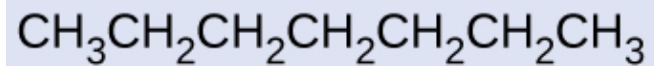


Q1: Draw the following expanded (Kekule) or condensed structures as skeletal diagrams

A

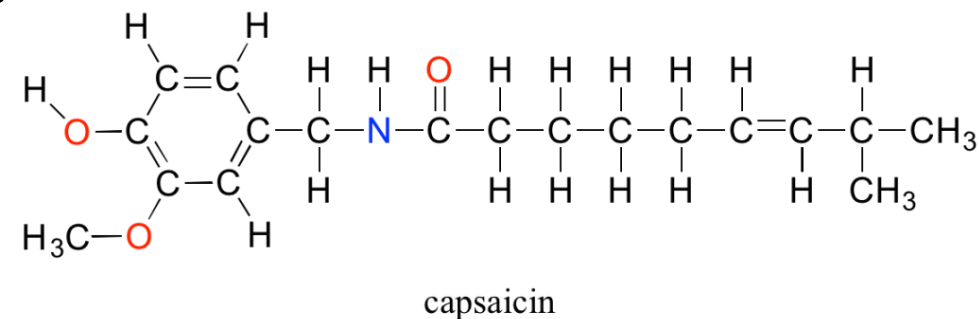


B



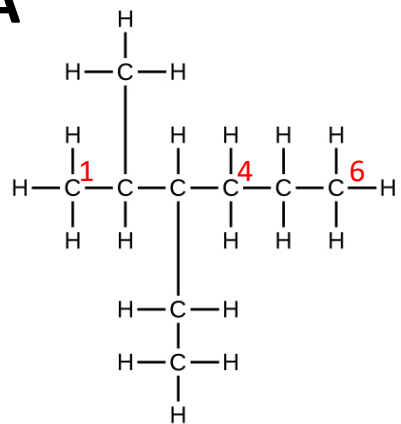
Note that this was not the ideal condensed structure. The completely corrected condensed structure would be CH3(CH2)5CH3

C

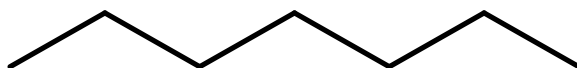
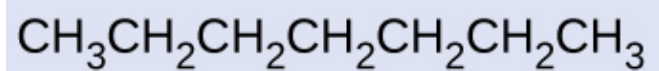


Q1: Draw the following expanded (Kekule) or condensed structures as skeletal diagrams

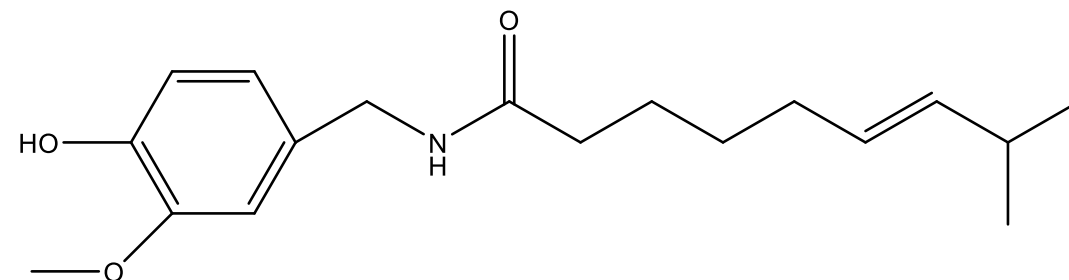
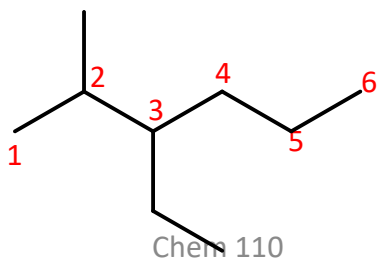
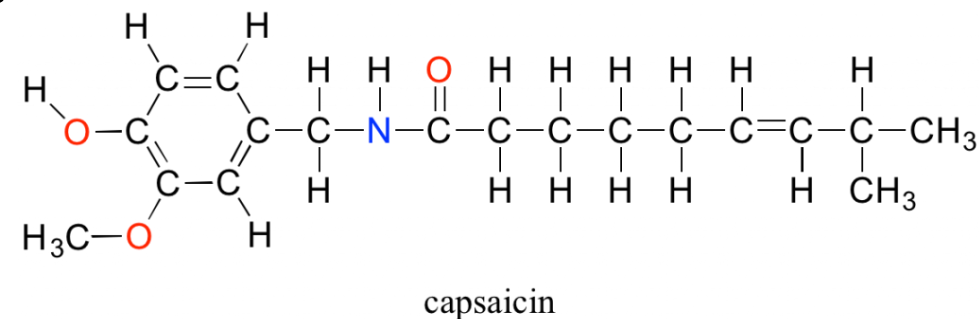
A



B

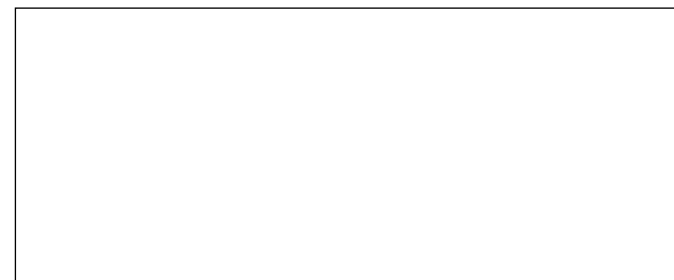
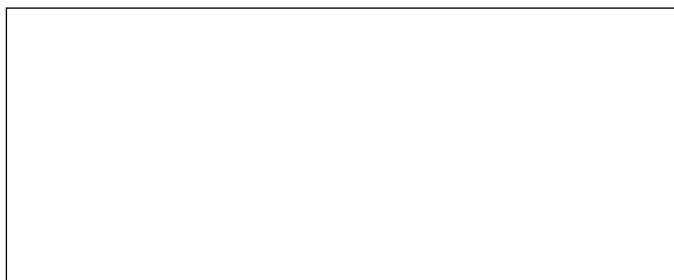
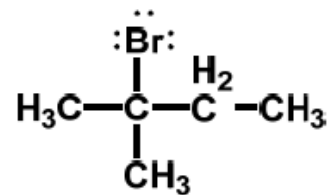
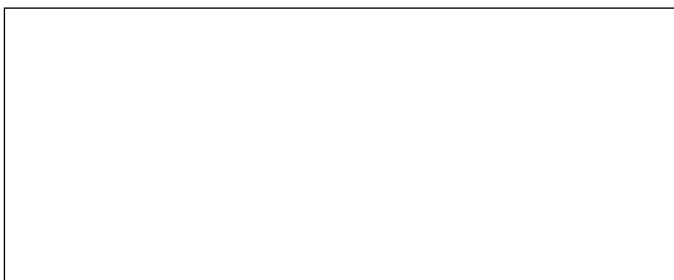


C

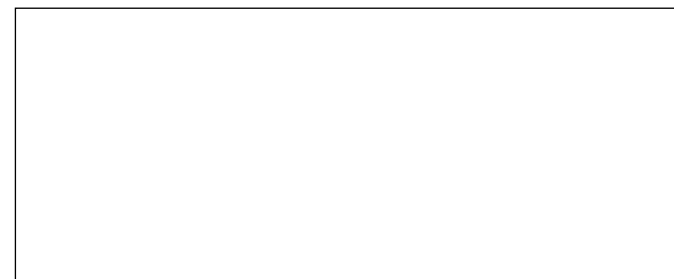
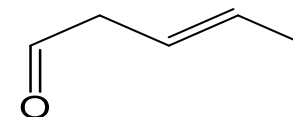
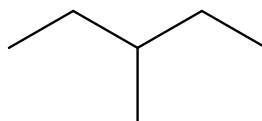
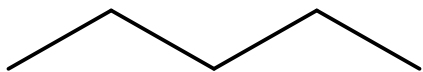


Q2: Draw the following structures as described

As skeletal structures

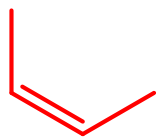
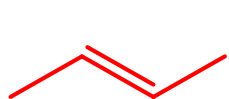


As expanded structures

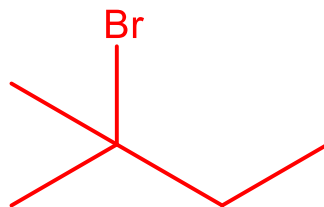
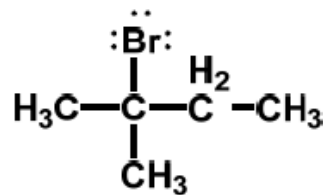


Q2: Draw the following structures as described

As skeletal structures



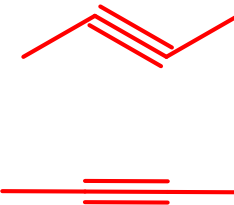
With no other info,
this is also ok



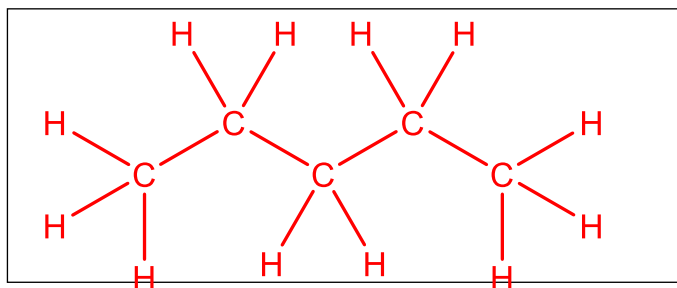
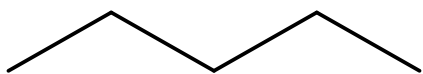
show the sp³
shape



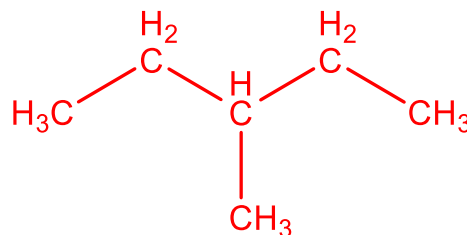
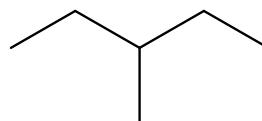
Remember that
alkynes are sp, so
draw STRAIGHT
(not zigzag)



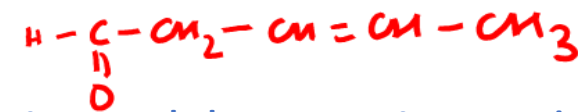
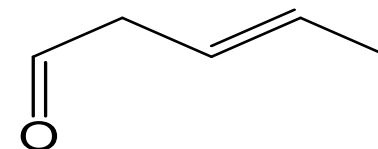
As expanded structures



Chem 110

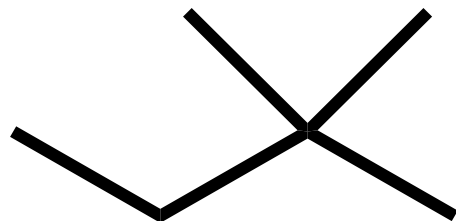


This is the
CONDENSED
structure



In expanded structures, I am not picky –
you can draw them straight or with the
zigzag. You can draw in the bonds to H; or
just write all the H with the C. (BUT NEVER
DRAW AN SP as a zigzag!)

Answer: Which of the following is the correct condensed representation of the following skeletal structure:



- A. $\text{CH}_3(\text{CH}_2)_4\text{CH}_3$
- B. $\text{CH}_3(\text{CH}_2)_2\text{CH}(\text{CH}_3)_2$
- C. $\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_3$
- D. $(\text{CH}_3\text{CH}_2)_2\text{CHCH}_3$

The answer written from right to left would also be fine $(\text{CH}_3)_3\text{CCH}_2\text{CH}_3$

Also note: these are all structures (skeletal, condensed, expanded) that tell you about how each atom is connected. This matters.

The “formula” only tells you how many of each atom. (i.e. for this one it is C_6H_{14})

How molecules are connected impacts the chemistry and properties!

Naming – summary of most important rules

Figuring out the numbering

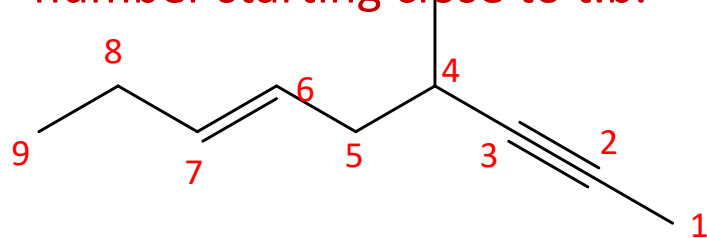
- A) Find the longest chain (give it the base name)
- B) Number longest chain in order so that
 - i. the **alkene** or **alkyne** takes the “lowest number” priority (i.e. closer to #1 on the chain)
 - ii. (if no alkene/alkyne), so that all substituents get lowest possible number
 - iii. In either case, if there is a tie then go with alphabetical order (e.g., ene gets lower number than yne; or a methyl gets lower number than propyl)

Writing the name

- A) Put everything in alphabetical order no matter WHICH number it got (note that di, tri does not count)
- B) Base name goes last
- C) Separate out multiple numbers with commas “,”
- D) Separate out every substituent with a dash “-”

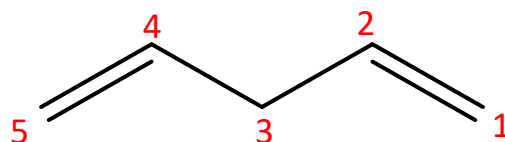
Q3: Provide the correct name for the following

number starting close to t.b.

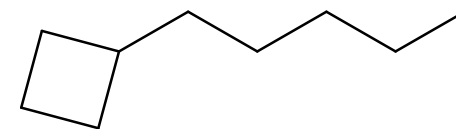


4-methylnon-6-en-2-yne

Re-draw if it helps!
 $\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}=\text{CH}_2$

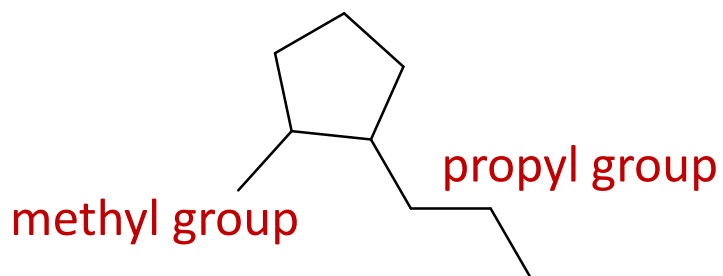


penta-1,4-diene
also ok: 1,4-pentadiene



pentylcyclobutane

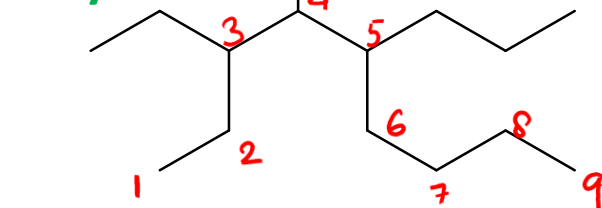
Even though the side chain is longer, the base name still goes to the ring



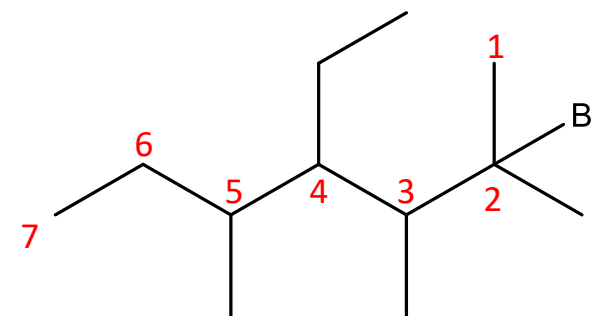
1-methyl-2-propylcyclopentane

If a tie, give substituents their numbers by alphabetical order

Find path of longest chain
ethyl **methyl** **propyl**



3-ethyl-4-methyl-5-propylnonane

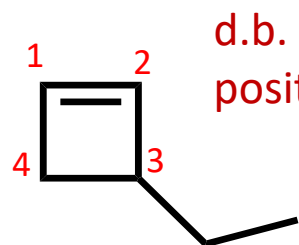
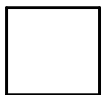


2-bromo-4-ethyl-2,3,5-trimethylheptane

Q4: Draw the following molecules

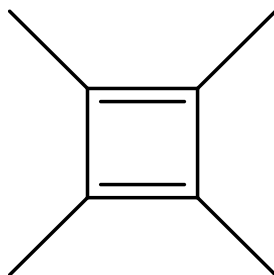
3-ethylcyclobutene

Start with base name

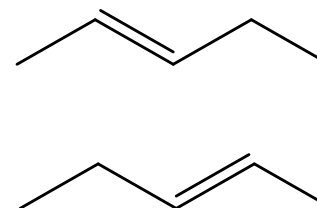


d.b. gets positions 1 and 2

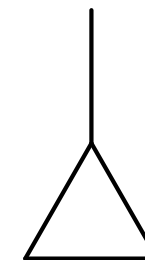
1,2,3,4-tetramethylcyclobuta-1,3-diene



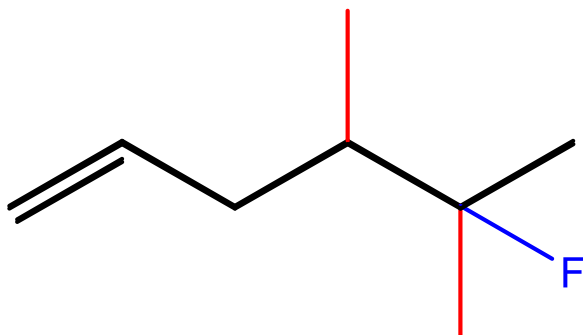
2-pentene (or pent-2-ene)



methylcyclopropane

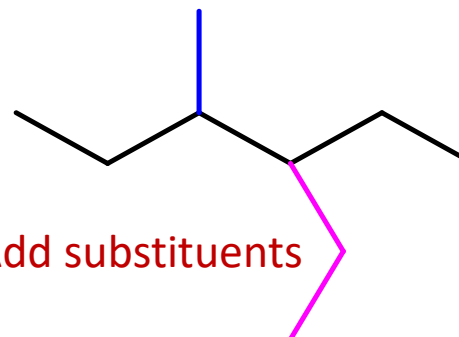
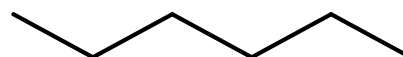


5-fluoro-4,5-dimethylhex-1-ene



3-ethyl-4-methylhexane

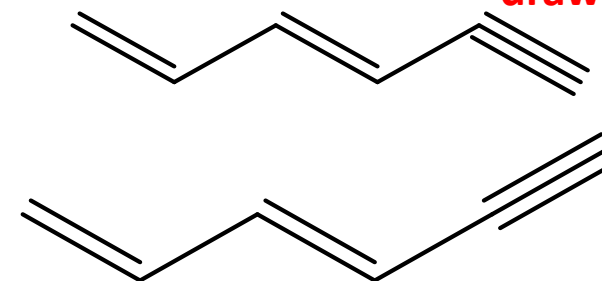
start with base name



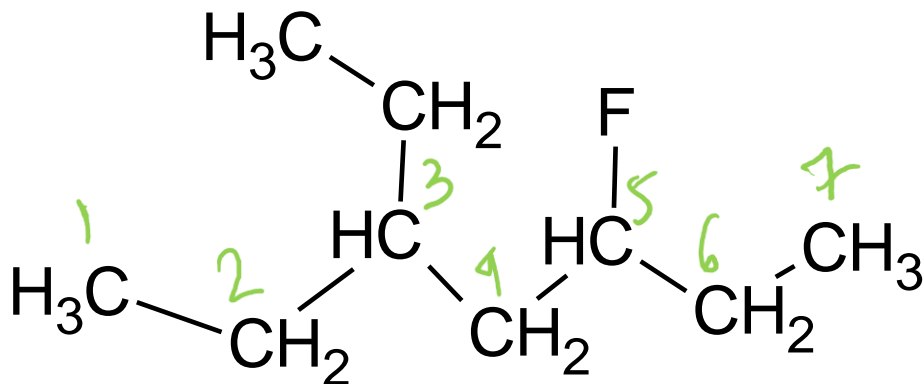
Add substituents

1,3-hexdien-5-yne
(or hexa-1,3-dien-5-yne)

sp so must draw linear!

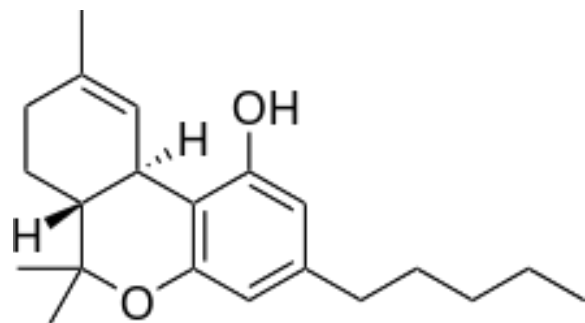


Answer: Name the following compound:

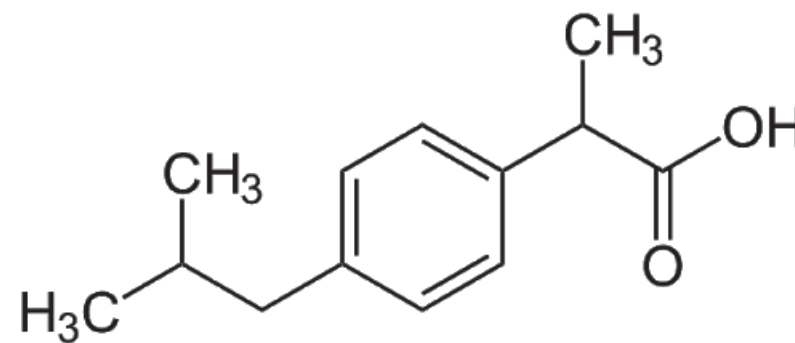
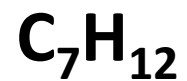


- A. 3-ethyl-5-fluoroheptane
- B. 3-fluoro-5-ethylheptane
- C. 5-ethyl-3-fluoroheptane
- D. 3,5-ethyl-fluoroheptane

Q5: Calculate the units of unsaturation in the following molecules

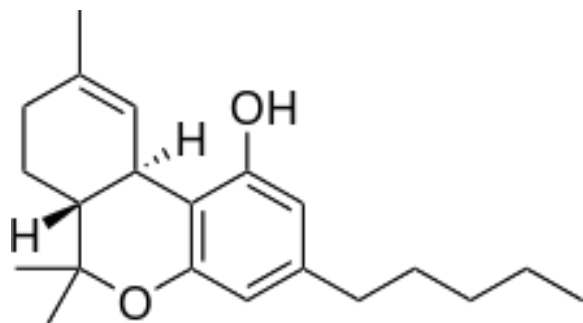


THC

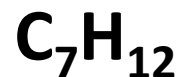


Ibuprofen (Advil)

Q5: Calculate the units of unsaturation in the following molecules



THC



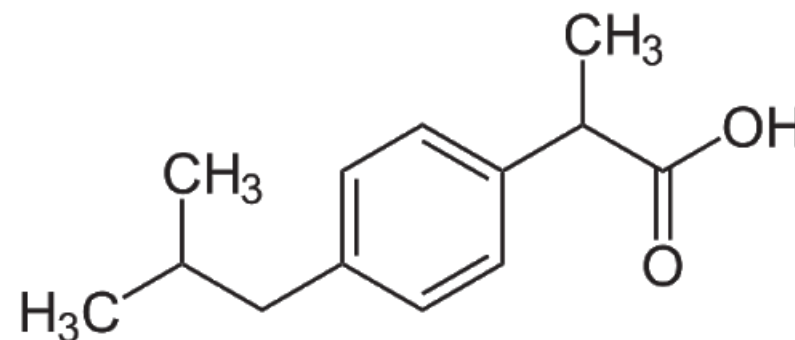
How many hydrogens in the saturated molecule with 7 carbons? (C_nH_{2n+2}) H = 16

- 1) Difference: 16-12
- 2) 4/2 = 2 units of unsaturation

Look at the structure (easiest way here)

- Double bond – 1 unit of unsaturation = 4
- Triple bond – 2 units of unsaturation = 0
- Each ring – 1 unit of unsaturation = 3

7 units of unsaturation



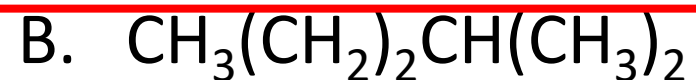
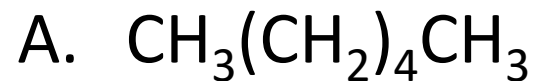
Ibuprofen (Advil)

Look at the structure

- Double bond – 1 unit of unsaturation = 4
- Triple bond – 2 units of unsaturation = 0
- Each ring – 1 unit of unsaturation = 1

5 units of unsaturation

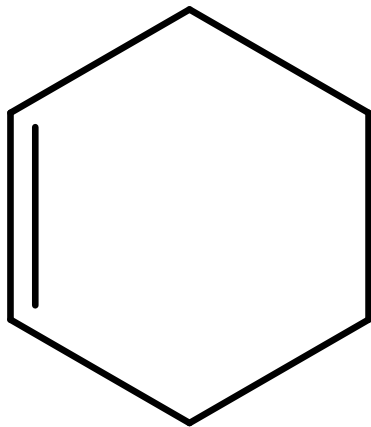
Answer: Which of the following will have the highest boiling point?



When comparing alkanes of the same length – the unbranched alkane has the highest intermolecular forces and the highest boiling point.

Q6: Draw the structure of a cycloalkene with 6 carbons (1 double bond). Determine the chemical formula. How many degrees of unsaturation?

Q6: Draw the structure of a cycloalkene with 6 carbons (1 double bond). Determine the chemical formula. How many degrees of unsaturation?

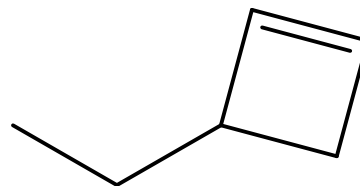
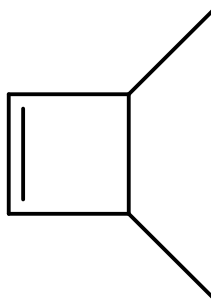
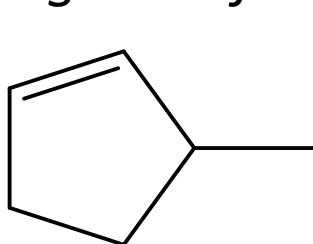


Saturated version of this (6 carbons) would be the alkane: C_6H_{14}

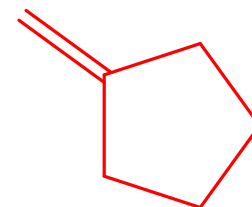
How many hydrogens in the saturated molecule with 6 carbons? (C_nH_{2n+2}) $H = 14$

- 1) Difference: $14 - 10$
- 2) $4 / 2 = 2$ units of unsaturation

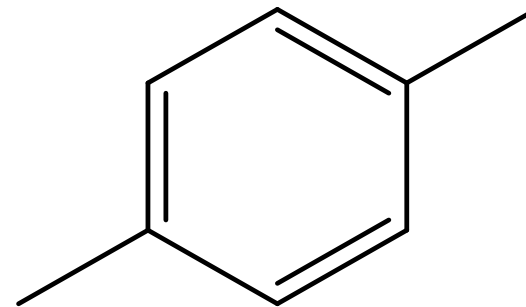
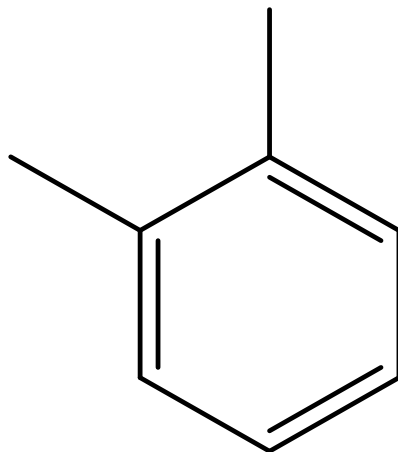
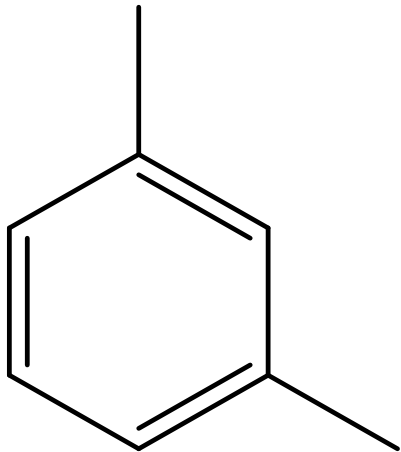
Note many “structures” would be possible given the question, but the formula and degrees of unsaturation would remain the same.



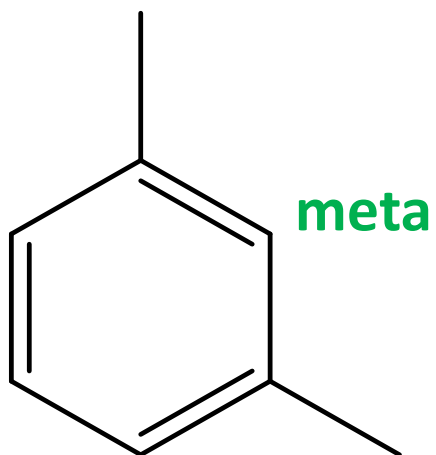
this would be wrong though same formula & units ☹️



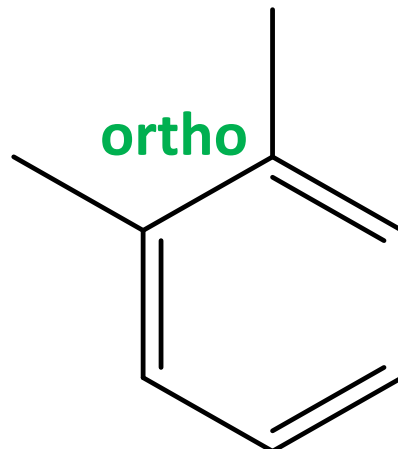
Q7: Identify these aromatic molecules using IUPAC. Indicate if the substituents are meta, ortho, or para to each other



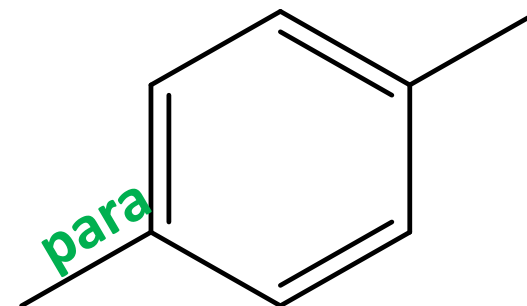
Q7: Identify these aromatic molecules using IUPAC. Indicate if the substituents are meta, ortho, or para to each other



1,3-dimethylbenzene



1,2-dimethylbenzene



1,4-dimethylbenzene

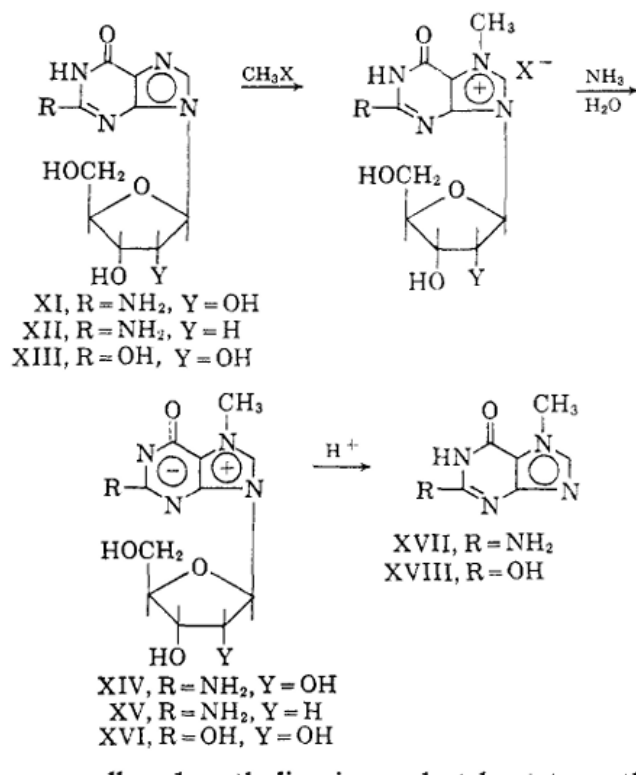
Drawing structures with ChemDraw

196

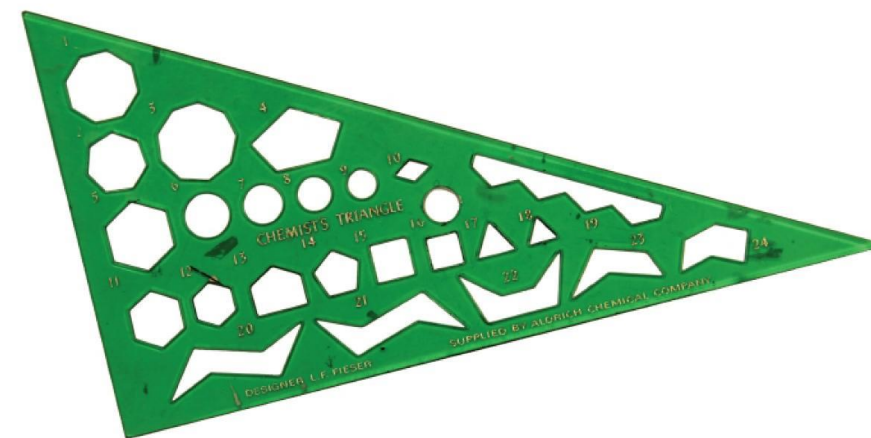
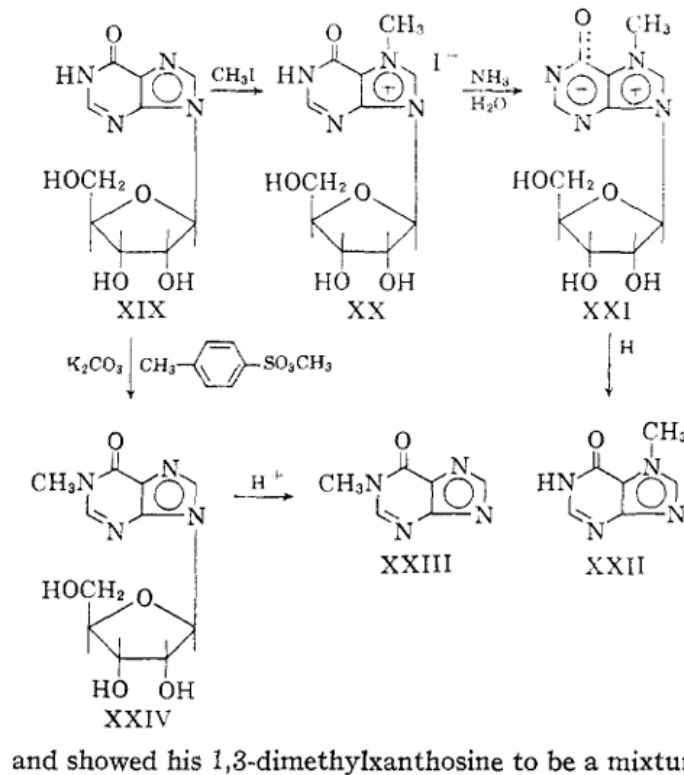
JESSE W. JONES AND ROLAND K. ROBINS

Vol. 85

REACTION SCHEME II



REACTION SCHEME III



Journal of the American Chemical Society 1963, 85, 2, 193-201

Drawing structures with ChemDraw

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Software, systems & apps - Software available to install

Camtasia Studio (Techsmith)	Students access at many computer labs on campus Faculty & Staff download and install from the Software Licensing site. Requires you to log in with your McGill credentials.	For software-related issues, contact TechSmith . View Camtasia tutorials on the TechSmith website. See also Recording lectures with screen recording software (Camtasia)
ChemOffice Professional suite	Students, Faculty & Staff Register with ChemOffice . You MUST use your McGill email address.	For software-related issues, contact PerkinElmer .
	Students, Faculty & Staff	For software-related issues, contact

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