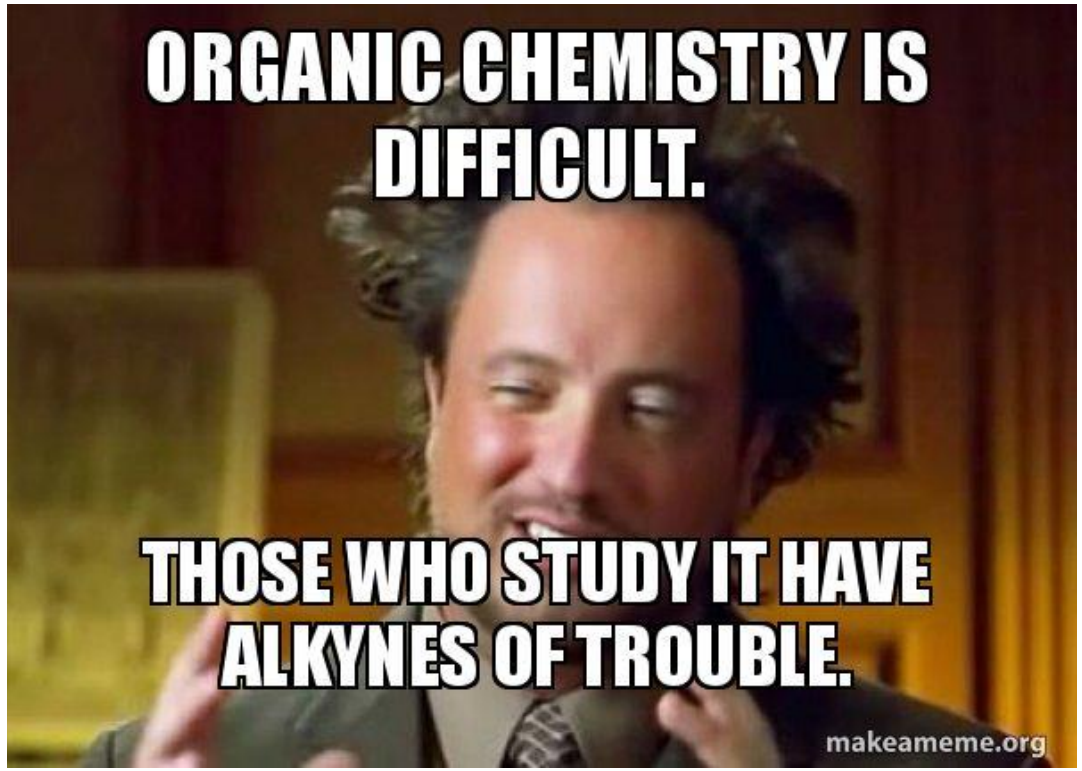
Nov 4-8 Practice Problems



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

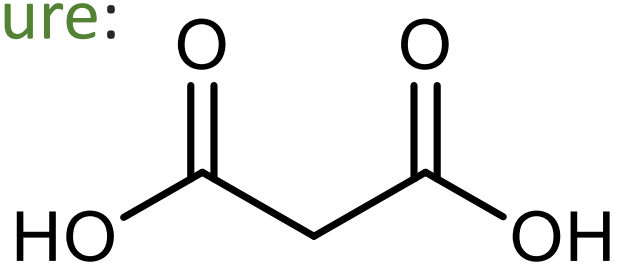
$IO_3^- + 2H_2O_2 + \mathbf{CH_2(COOH)_2} + H^+ \rightarrow ICH(COOH)_2 + 2O_2 + 3H_2O$

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

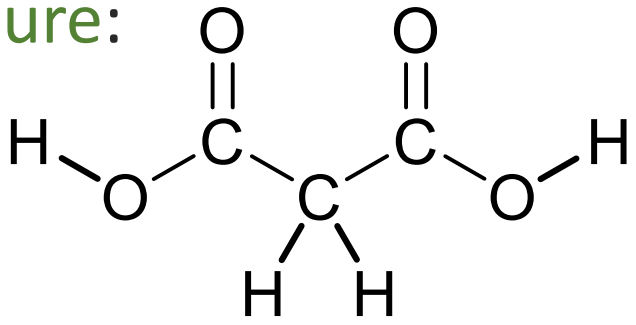
IUPAC name: propanedioic acid

Molecular formula: $C_3H_4O_4$

Skeletal structure:



Expanded structure:



Lets try to figure out the condensed:

$HOC(=O)CH_2C(=O)OH$

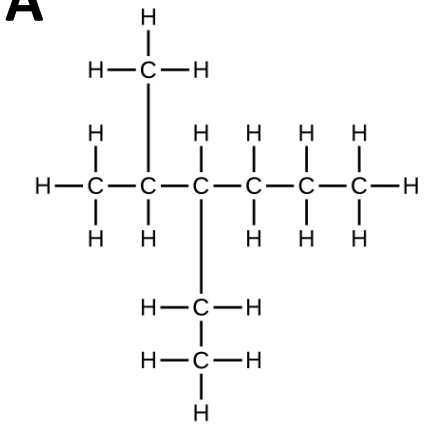
Simplify the condensed:

$HOC(=O)CH_2C(=O)OH$

$CH_2(COOH)_2$

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

A

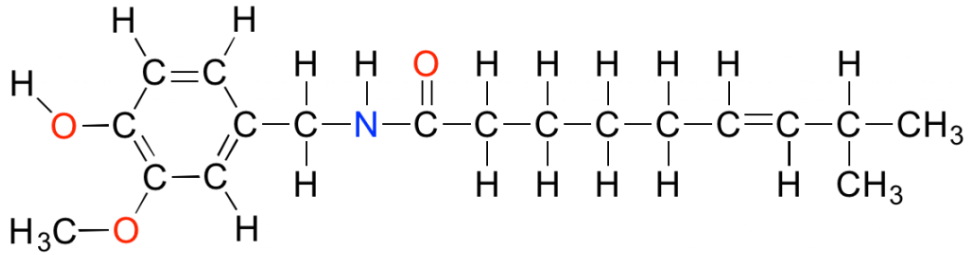


B

$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$

Note that this was not the ideal condensed structure. The completely corrected condensed structure would be $CH_3(CH_2)_5CH_3$

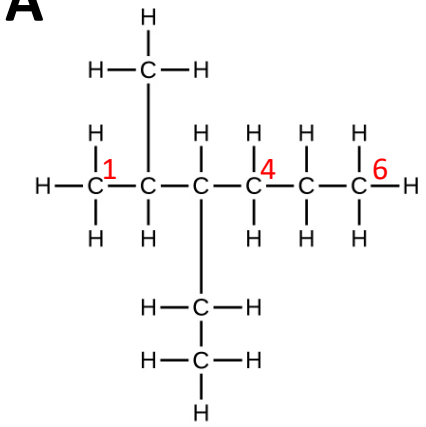
C



capsaicin

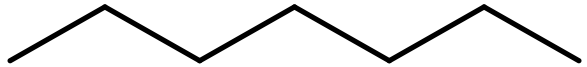
Q1: Draw the following expanded (Kekule) or condensed structures as skeletal diagrams

A

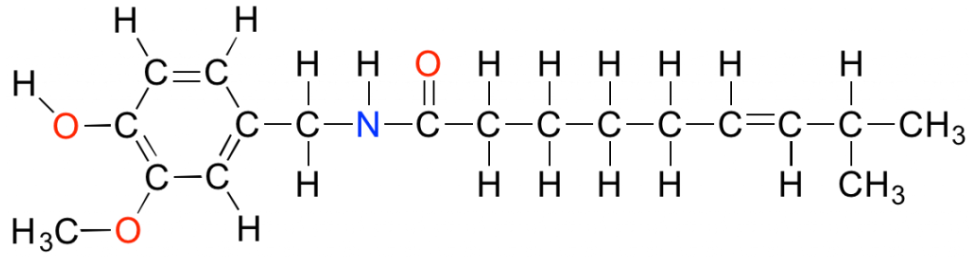


B

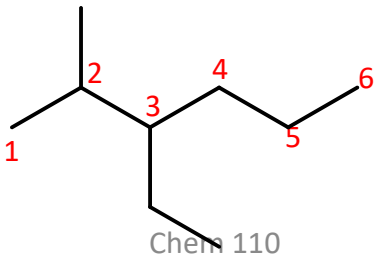
$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$

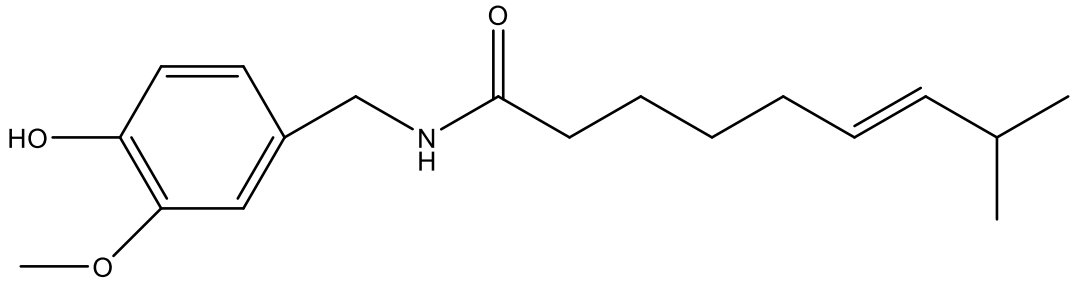


C



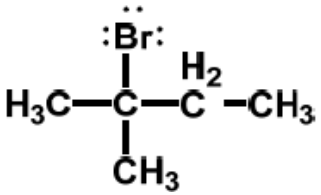
capsaicin



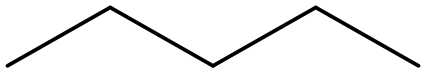


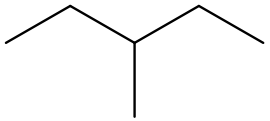
Q2: Draw the following structures as described

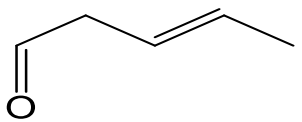
As skeletal structures



As expanded structures

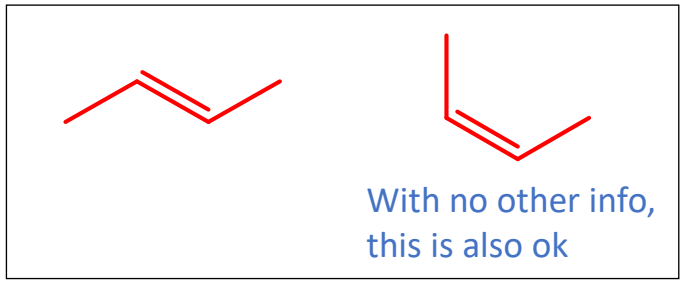


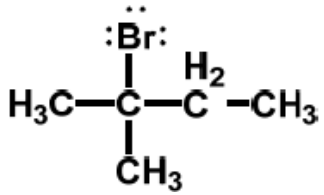


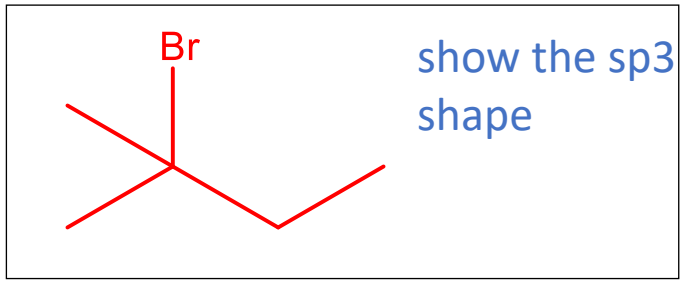


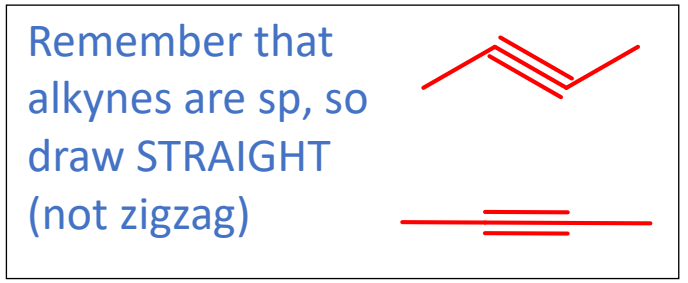
Q2: Draw the following structures as described

As skeletal structures

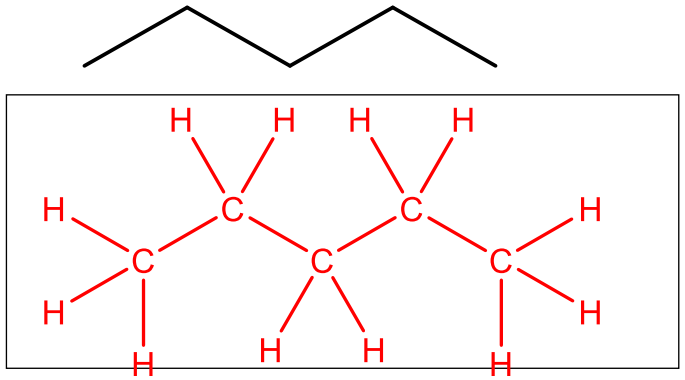


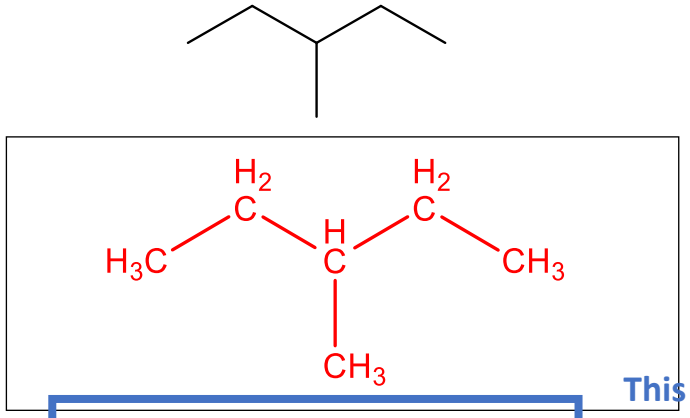






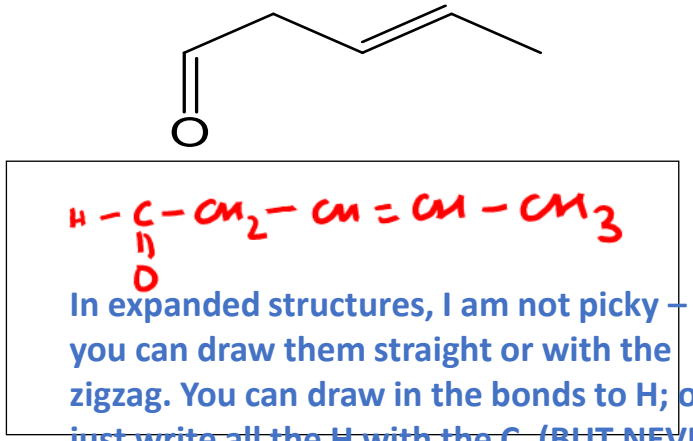
As expanded structures



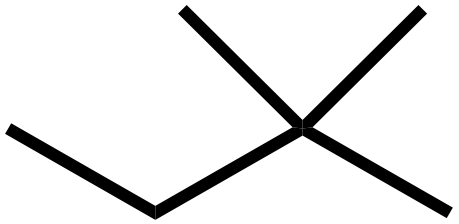


$CH_3CH(CH_2CH_3)_2$

This is the CONDENSED structure



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



A. $CH_3(CH_2)_4CH_3$

B. $CH_3(CH_2)_2CH(CH_3)_2$

C. $CH_3CH_2C(CH_3)_3$

D. $(CH_3CH_2)_2CHCH_3$

The answer written from right to left would also be fine $(CH_3)_3CCH_2CH_3$

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

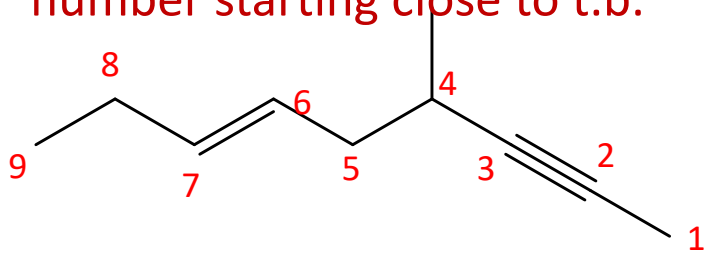
A) Find the longest chain (give it the base name)
B) Number longest chain in order so that
   i. the alk**ene** or alk**yne** takes the "lowest number" priority (i.e. closer to #1 on the chain)
   ii. (if no alkene/alkyne), so that all substituents get lowest possible number
   iii. In either case, if 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

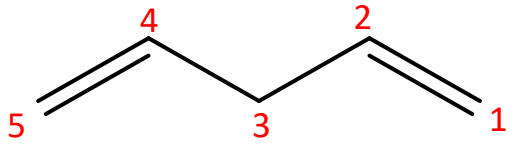
number starting close to t.b.



4-methylnon-6-en-2-yne

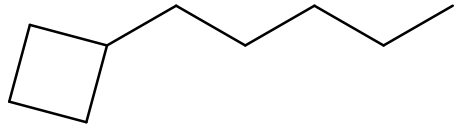
Re-draw if it helps!

$CH_2=CH-CH_2-CH=CH_2$



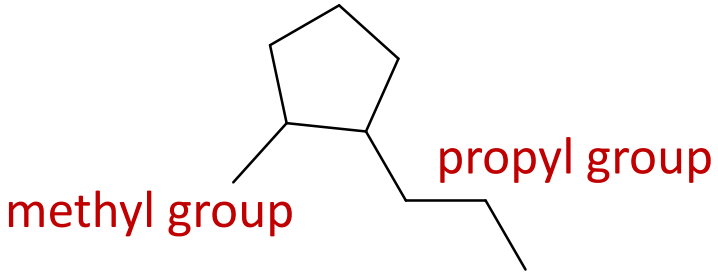
penta-1,4-diene

also ok: 1,4-pentadiene



pentyl**cyclobutane**

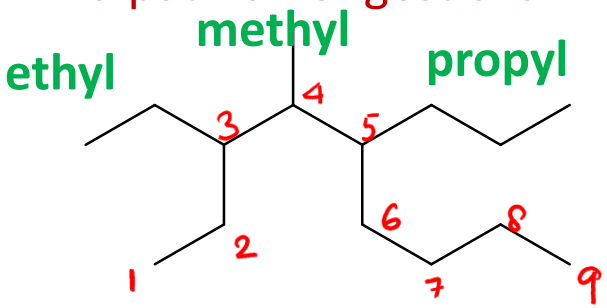
Even though the side chain is longer, the base name still goes to the ring



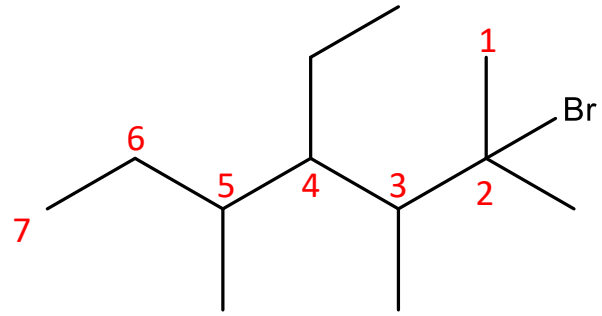
1-methyl-2-propylcyclopentane

If a tie, give substituents their numbers by alphabetical order

Find path of longest chain



3-ethyl-4-methyl-5-propylnonane

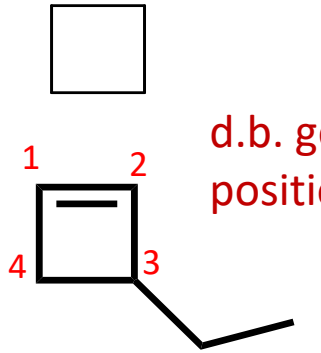


2-bromo-4-ethyl-2,3,5-trimethylheptane

Q4: Draw the following molecules

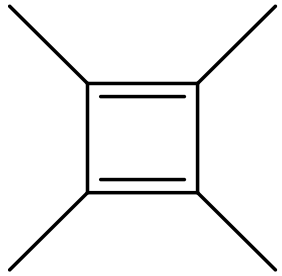
3-ethylcyclobutene

Start with base name

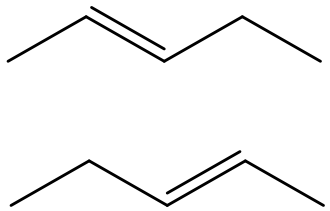


d.b. gets positions 1 and 2

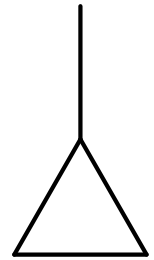
1,2,3,4-tetramethylcyclobuta-1,3-diene



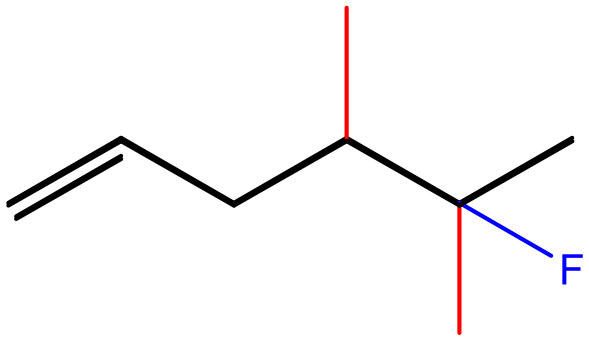
2-pentene (or pent-2-ene)



methylcyclopropane

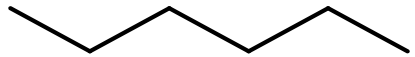


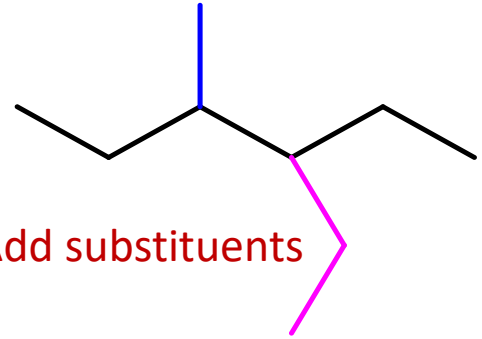
5-fluoro-4,5-dimethylhex-1-ene



3-ethyl-4-methylhexane

start with base name

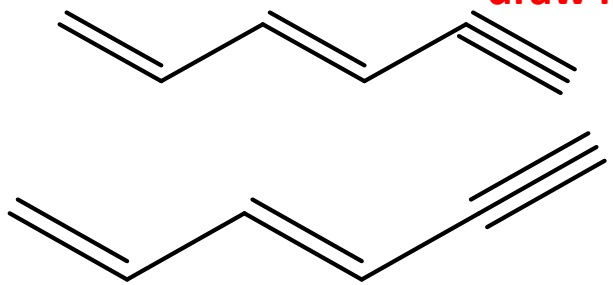




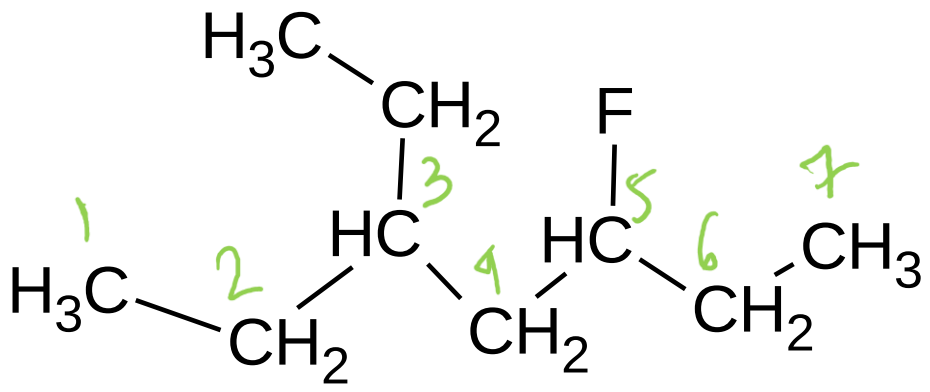
Add substituents

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

sp so must draw linear!

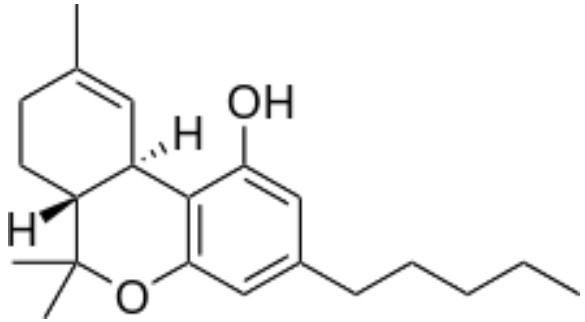


Answer: Name the following compound:



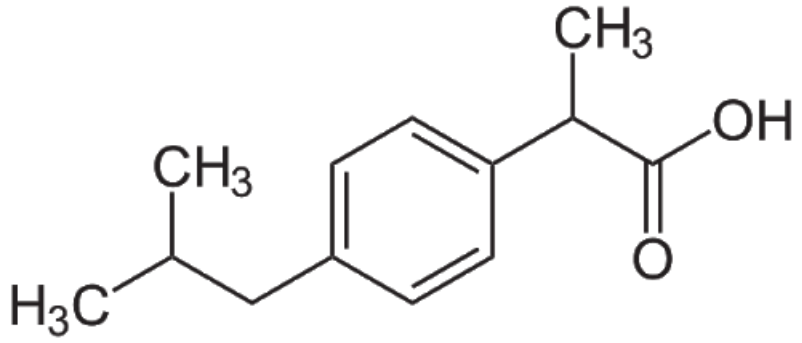
A. 3-ethyl-5-fluoroheptane
B. 3-fluoro-5-ethylheptane
C. 5-ethyl-3-fluoroheptane
D. 3,5-ethyl-fluoroheptane

Q5: Calculate the units of unsaturation in the following molecules



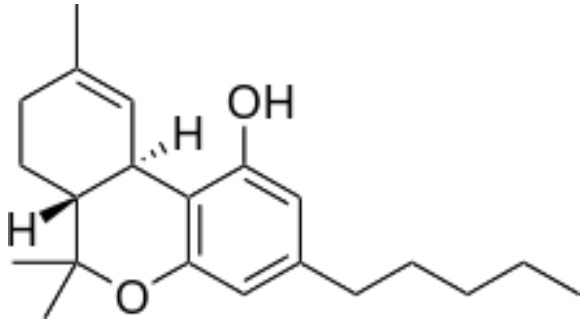
THC

C_7H_{12}



Ibuprofen (Advil)

Q5: Calculate the units of unsaturation in the following molecules

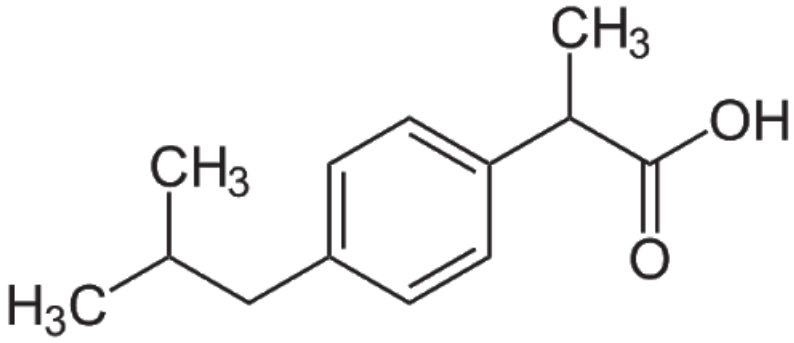


THC

C_7H_{12}

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



Ibuprofen (Advil)

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

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?

A. $CH_3(CH_2)_4CH_3$
B. $CH_3(CH_2)_2CH(CH_3)_2$
C. $CH_3CH_2C(CH_3)_3$
D. $(CH_3CH_2)_2CHCH_3$

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?

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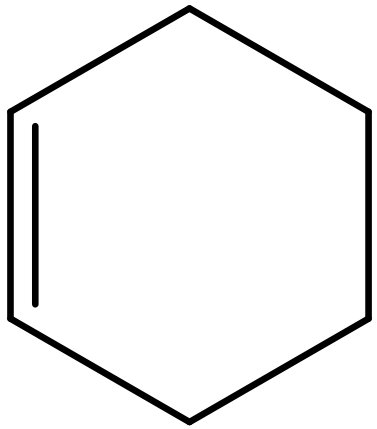


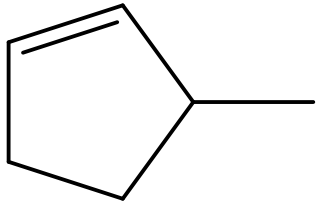
C_6H_{10}

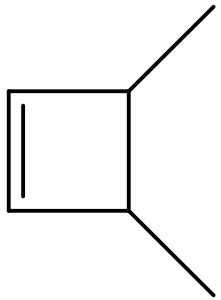
Saturated version of this (6 carbons) would be the alkane: C_6H_{14}

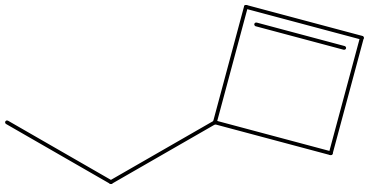
How many hydrogens in the saturated molecule with 6 carbons? (C_nH_{2n+2}) H = 14

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

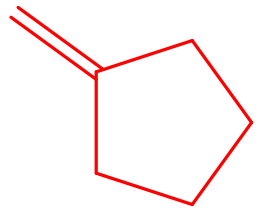
Note many "structures" would be possible given the question, but the formula and degrees of unsaturation would remain the same.



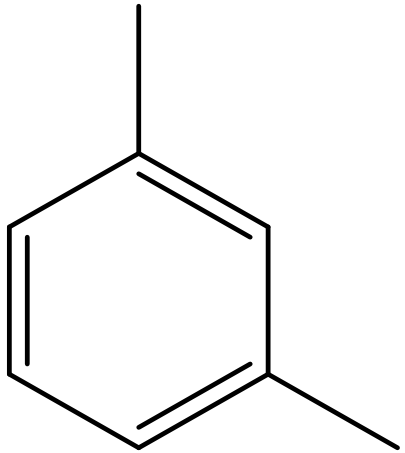


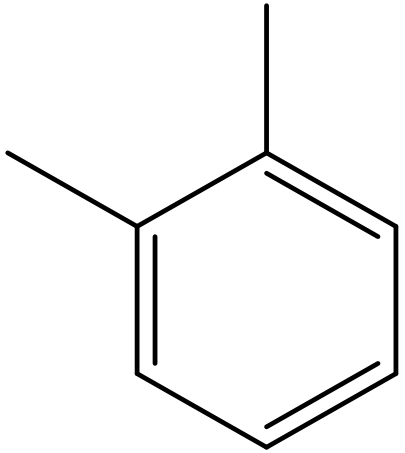


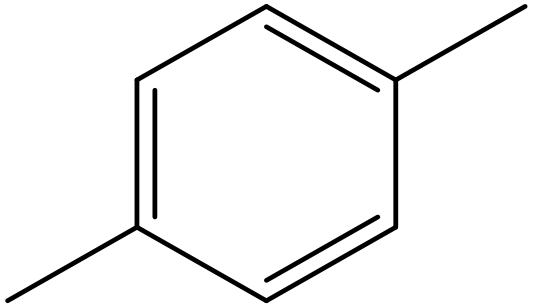
this would be wrong though same formula & units ☹



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







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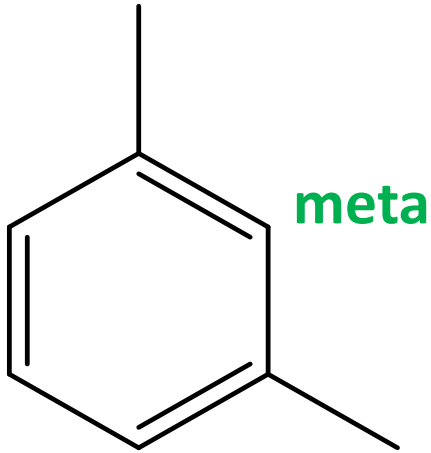
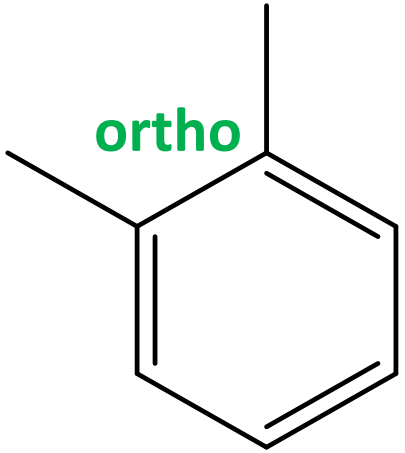
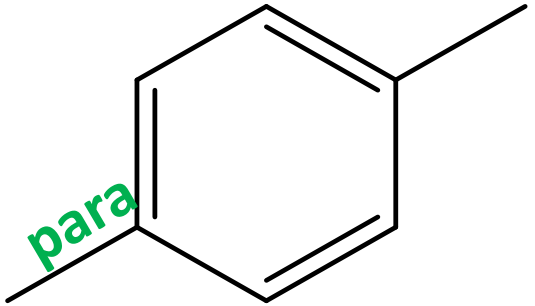


1,3-dimethylbenzene

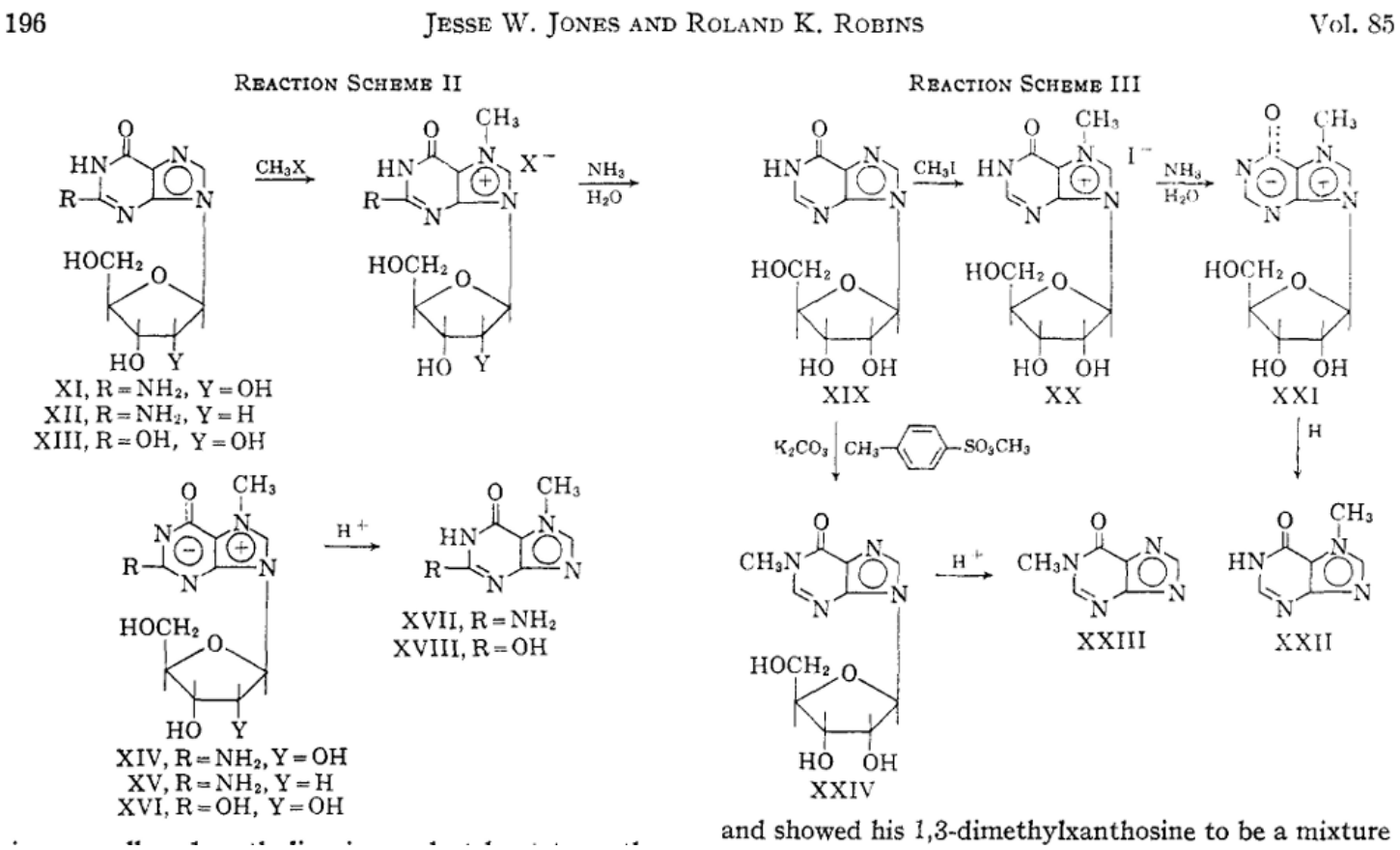


1,2-dimethylbenzene



1,4-dimethylbenzene

Drawing structures with ChemDraw


196 JESSE W. JONES AND ROLAND K. ROBINS Vol. 85

REACTION SCHEME II

XI, R = NH_2, Y = OH
XII, R = NH_2, Y = H
XIII, R = OH, Y = OH

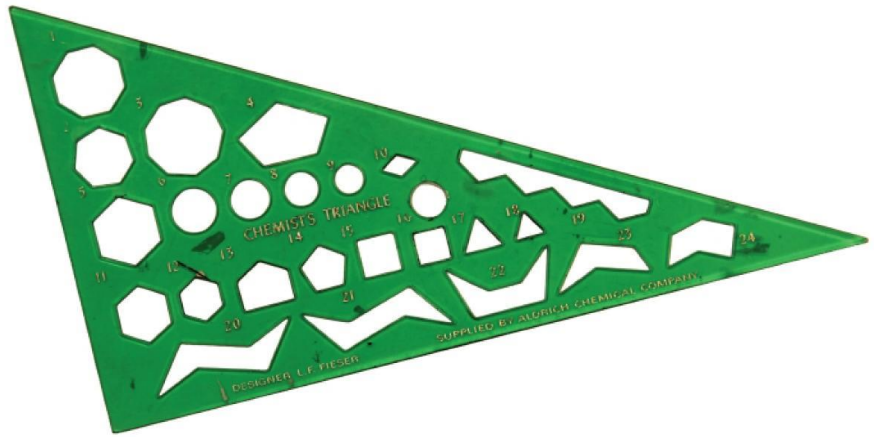
XIV, R = NH_2, Y = OH
XV, R = NH_2, Y = H
XVI, R = OH, Y = OH

XVII, R = NH_2
XVIII, R = OH

REACTION SCHEME III

XIX
XX
XXI
XXII
XXIII
XXIV

and showed his 1,3-dimethylxanthosine to be a mixture



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Drawing structures with ChemDraw