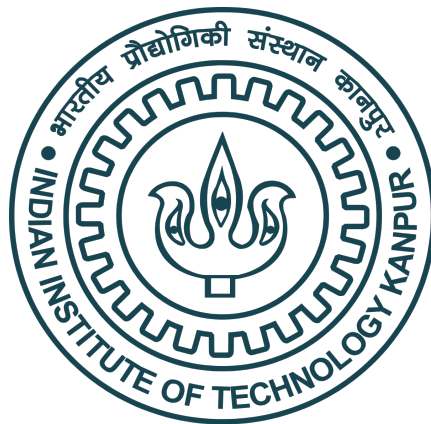


# Lecture 4

## Organic Chemistry: Fundamentals and Applications (CSO201A)



**Dr. Srinivas Dharavath**

**Assistant Professor**

**Department of Chemistry**

**Indian Institute of Technology, Kanpur**

**Kanpur- 208016**

**E-mail: [srinivasd@iitk.ac.in](mailto:srinivasd@iitk.ac.in)**

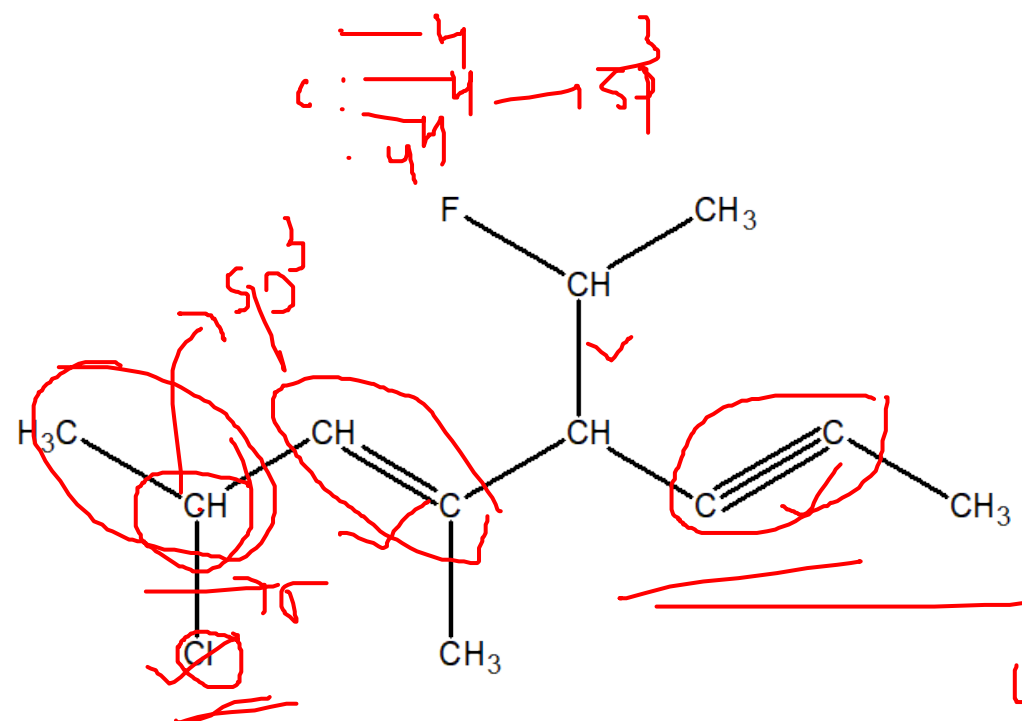


# IUPAC nomenclature of organic compounds

International Union of Pure and Applied Chemistry (IUPAC)

Hand-drawn red lines consisting of a long horizontal line, a shorter line below it, and a small squiggle to the right.

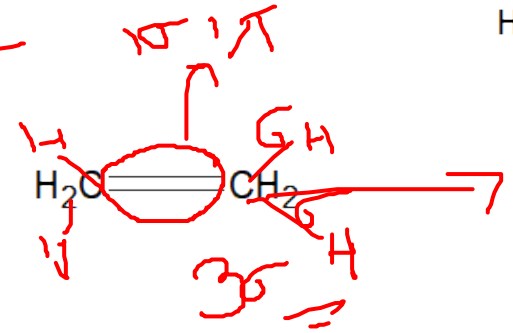
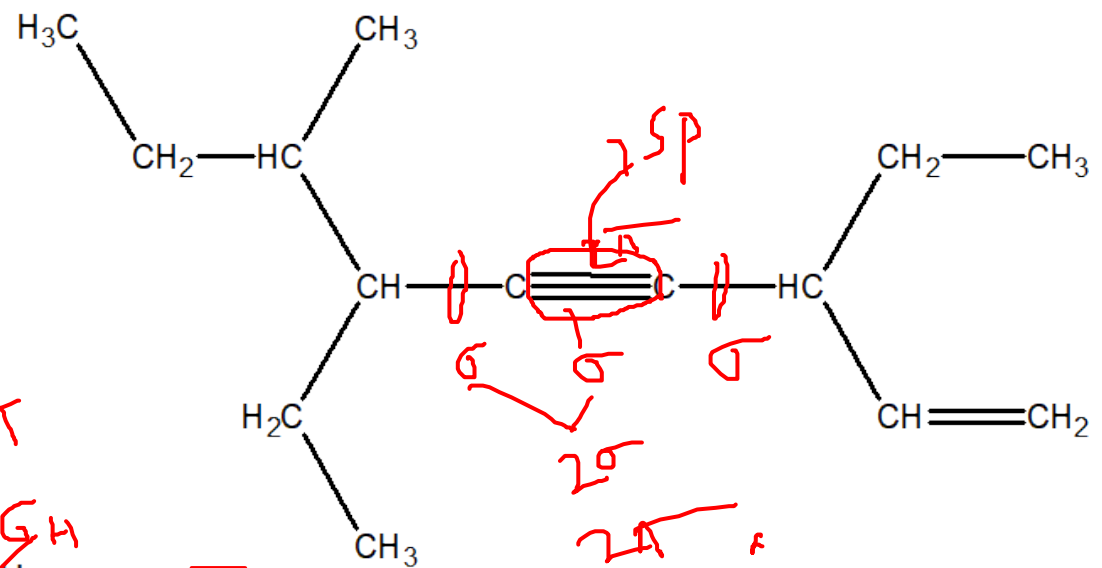
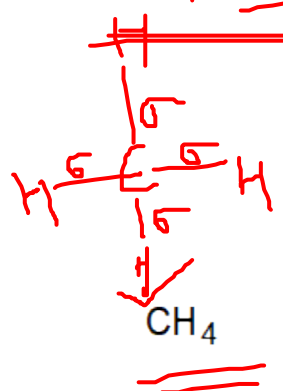
You will be able to name simple to complex alkanes, alkenes and alkynes by the end of this class

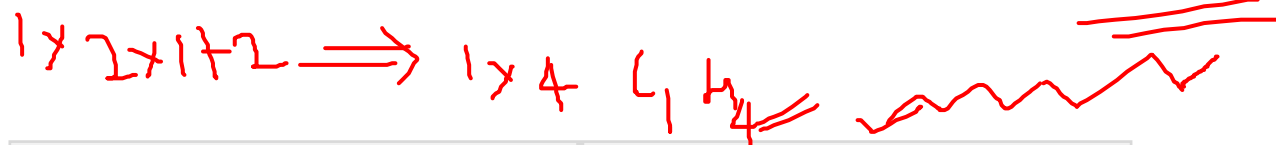
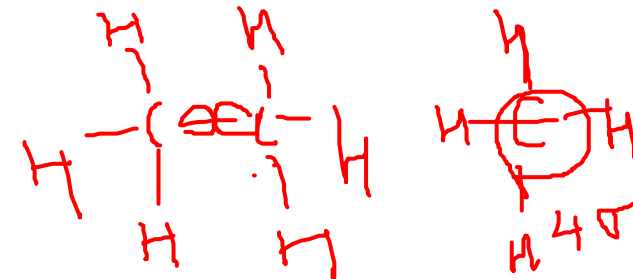
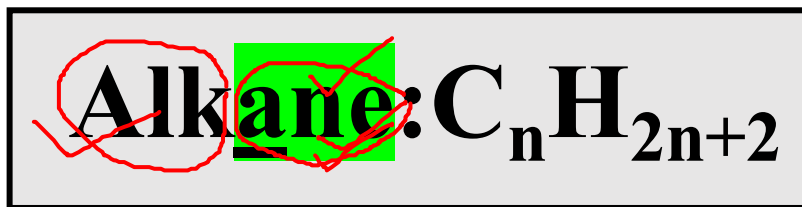


$s + 3p \rightarrow C \equiv C$

Handwritten notes:

- $C_nH_{2n+2}$  (Alkane)
- $C_nH_{2n}$  (Alkene)
- $C_nH_{2n-2}$  (Alkyne)





$\text{C}_1 \rightarrow$ meth	$\text{C}_6 \rightarrow$ hex
$\text{C}_2 \rightarrow$ eth	$\text{C}_7 \rightarrow$ hept
$\text{C}_3 \rightarrow$ prop	$\text{C}_8 \rightarrow$ oct
$\text{C}_4 \rightarrow$ but	$\text{C}_9 \rightarrow$ non
$\text{C}_5 \rightarrow$ pent	$\text{C}_{10} \rightarrow$ dec

$\text{CH}_4$	$\longrightarrow$	Methane
$\text{C}_2\text{H}_6$	$\longrightarrow$	Ethane
$\text{C}_3\text{H}_8$	$\longrightarrow$	Propane
$\text{C}_4\text{H}_{10}$	$\longrightarrow$	Butane
$\text{C}_5\text{H}_{12}$	$\longrightarrow$	Pentane



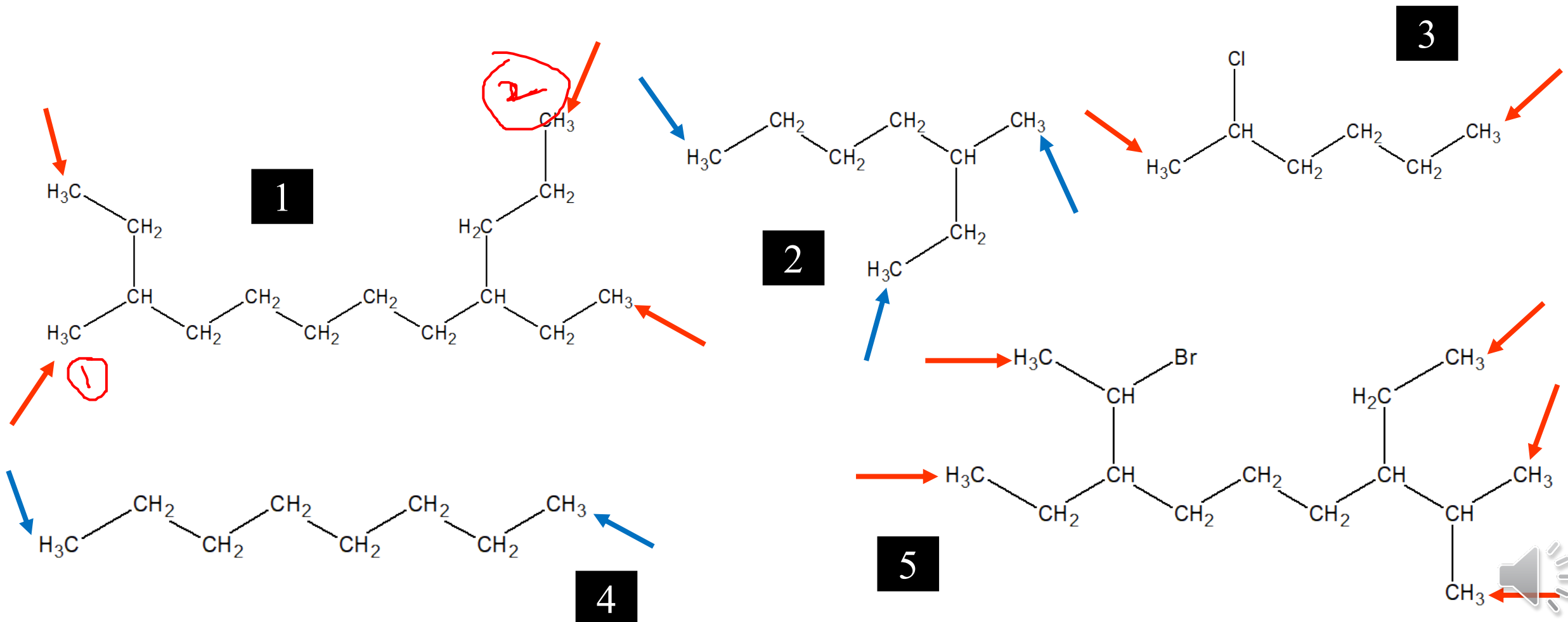
# Classwork: Alkanes

## Branched chains:

1. Choose the longest carbon chain/ the one with more substituents.

## Unbranched chains:

1. Number of carbons + functional group.



# Classwork: Alkanes

## Branched chains:

1. Choose the longest carbon chain ✓
2. If substituents attached, choose the one with more substituents.
3. If only one substituent: substituent gets lower number.

**Straight Chain:** carbon chain & suffix (ane/ene/yne)

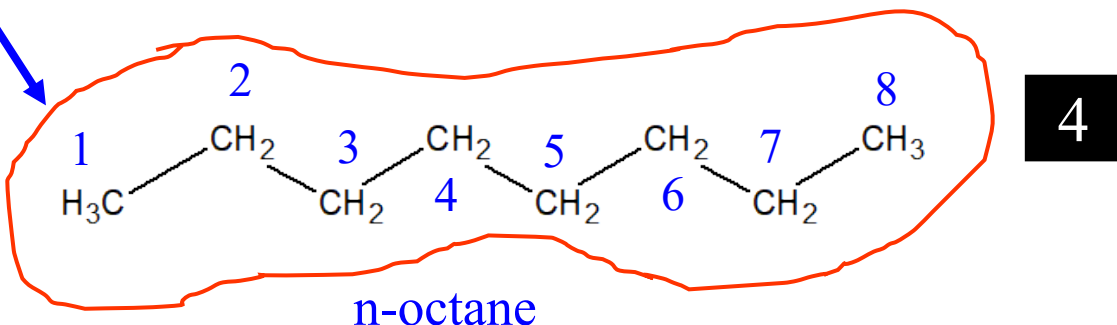
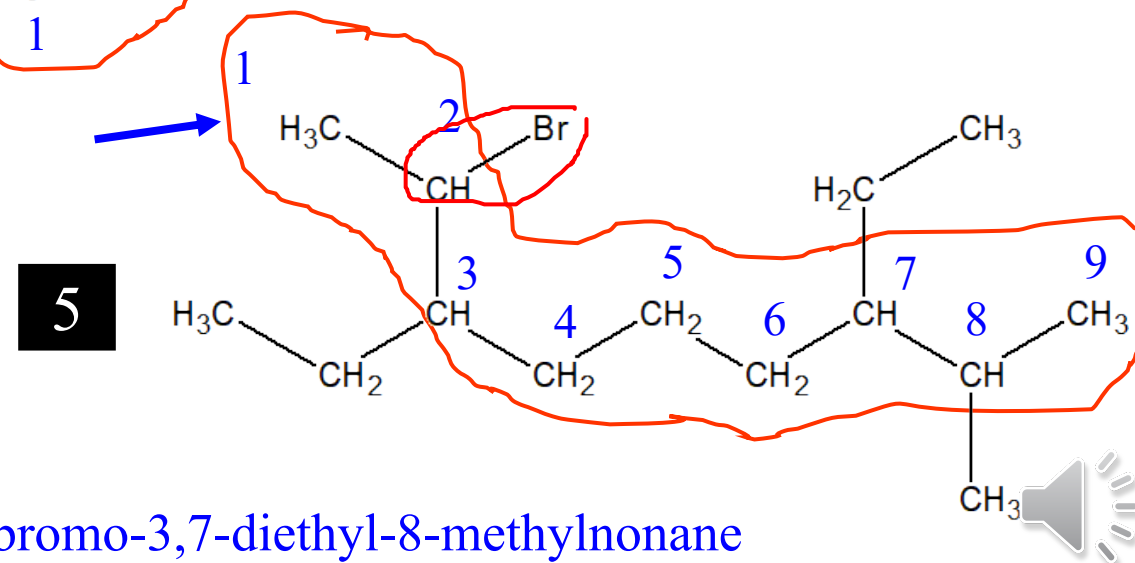
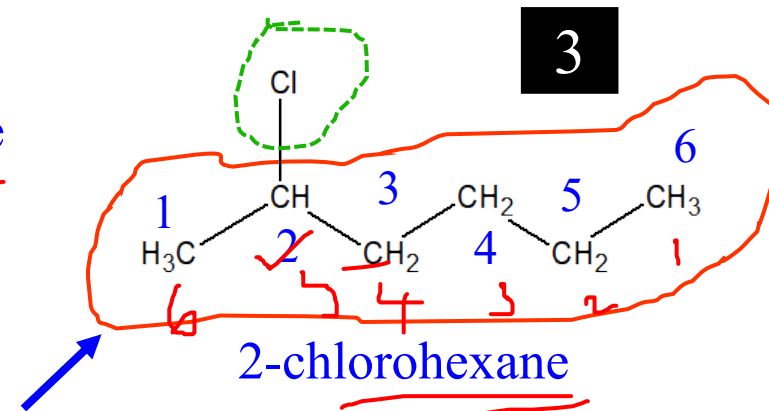
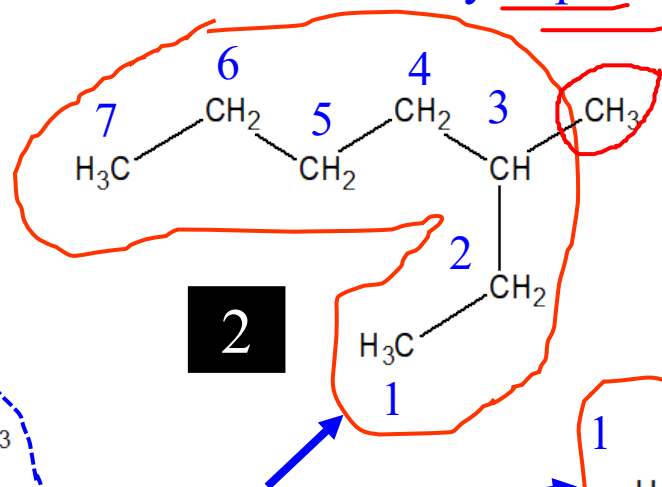
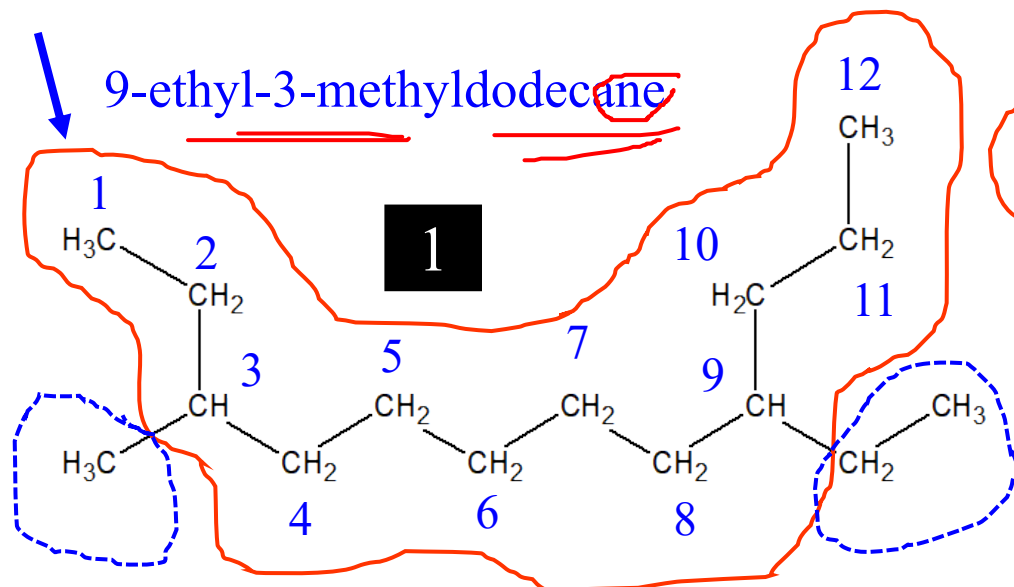
3-methylheptane

9-ethyl-3-methyldodecane

2-chlorohexane

2-bromo-3,7-diethyl-8-methylnonane

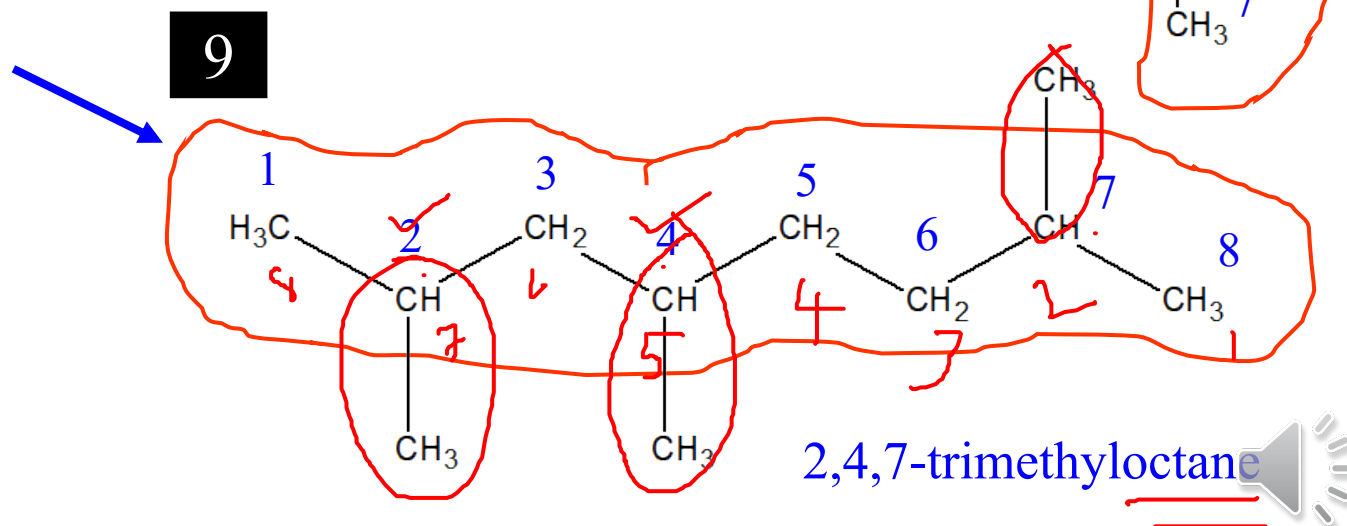
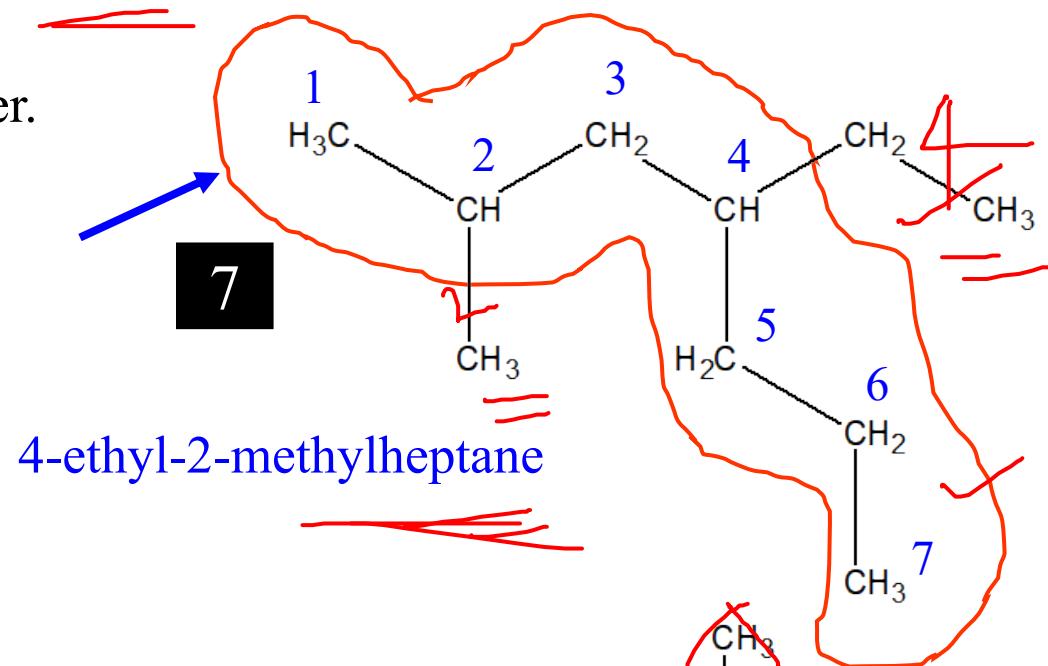
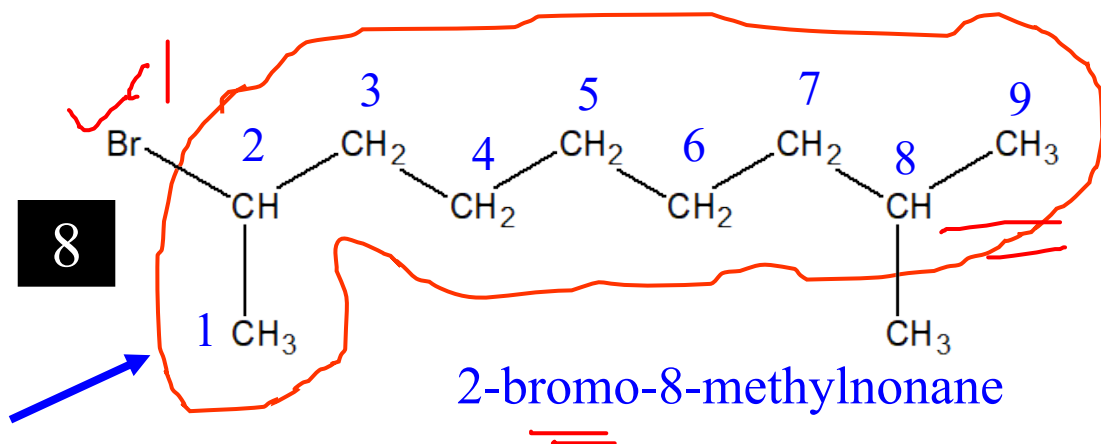
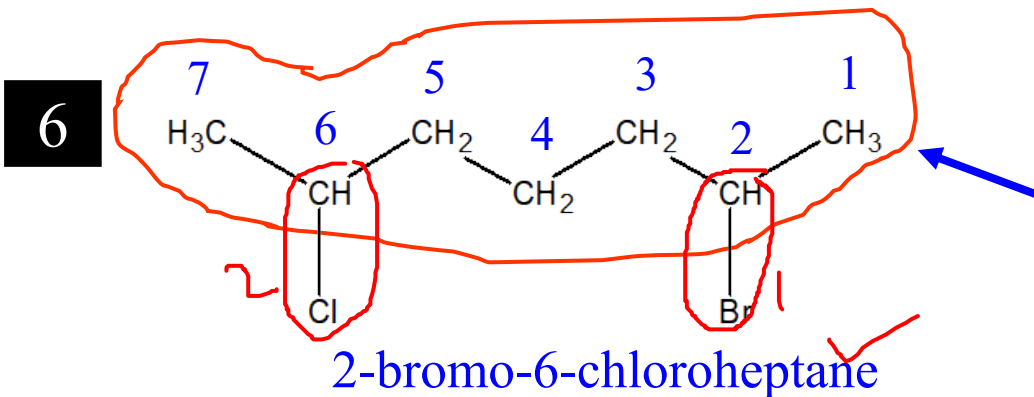
n-octane



# Classwork: Alkanes

## Branched chains:

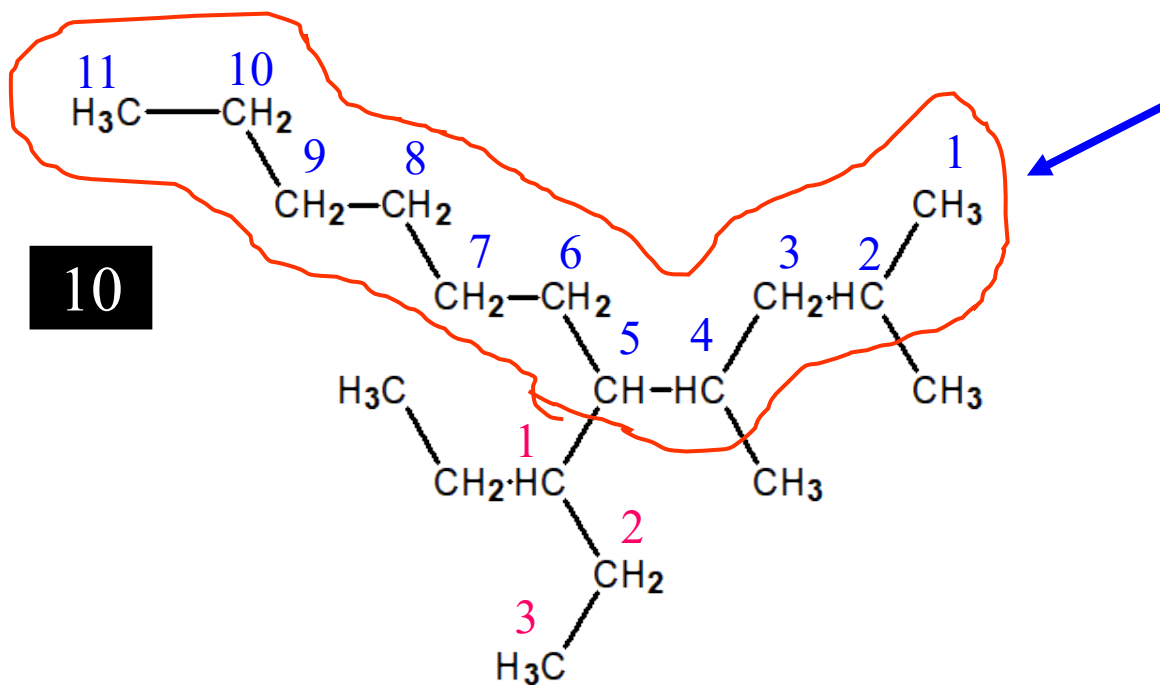
4. If 2/more identical substituents: use di, tri, tetra etc.
5. If 2/more different substituents: first substituent gets lower number.
6. If 2 substituents are at the same positions from their ends:  
assign less number to the one that comes first in alphabetical order.



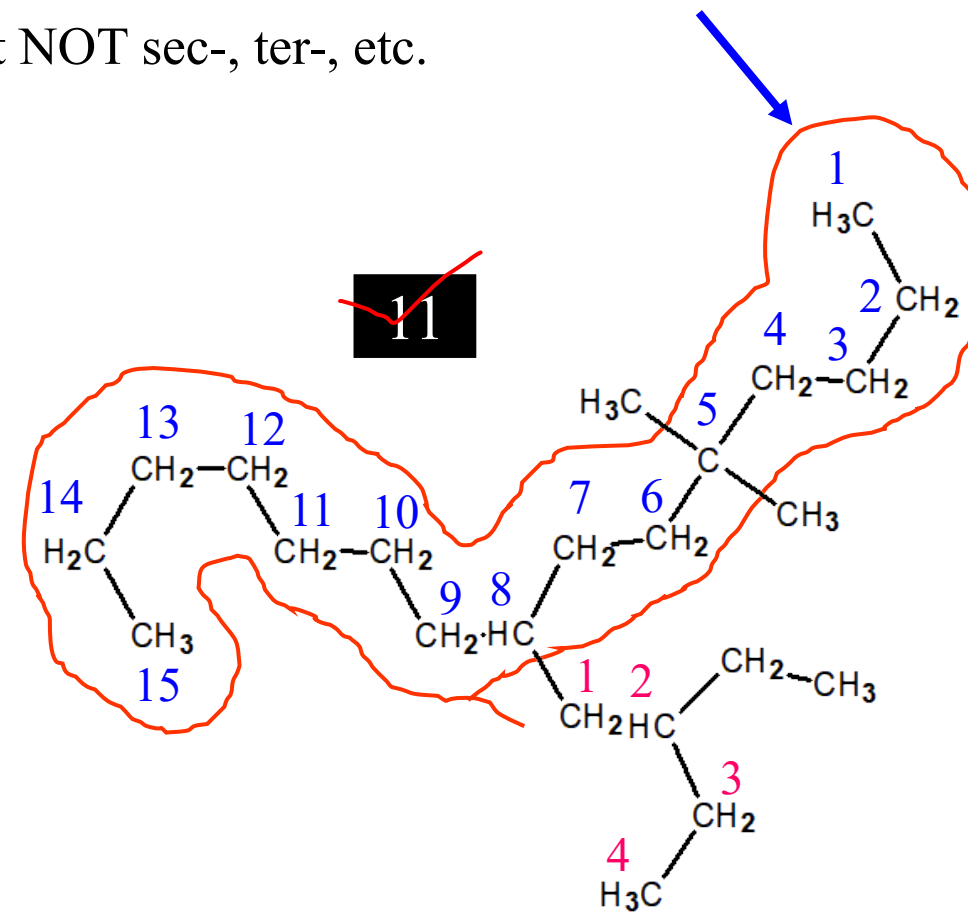
# Classwork: Alkanes

## Naming the 'branched substituents':

7. Assign '1' to the substituent's carbon attached to the parent chain, everything is same.
8. Make it right as substituent: "ane to yl".
9. Alphabetical order: iso, neo taken into consideration but NOT sec-, ter-, etc.



5-(1-ethylpropyl)-2,4-dimethylundecane



8-(2-ethylbutyl)-5,5-dimethylpentadecane



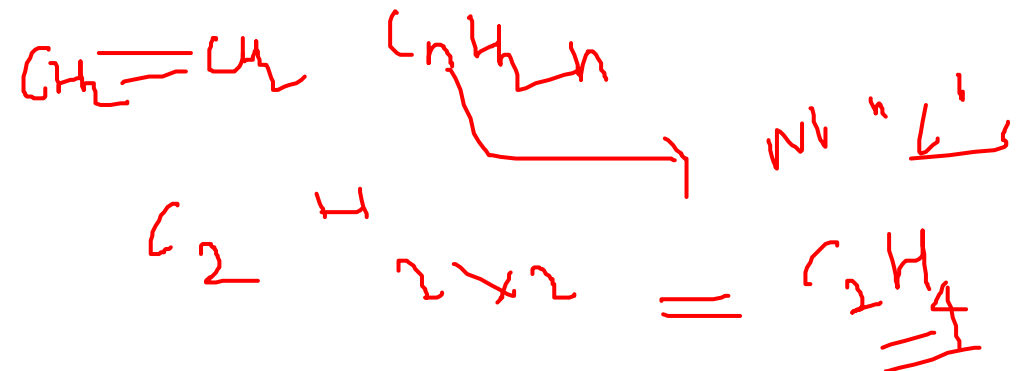


**Alkene:  $C_nH_{2n}$**



$C_1 \rightarrow$ meth	$C_6 \rightarrow$ hex
$C_2 \rightarrow$ eth	$C_7 \rightarrow$ hept
$C_3 \rightarrow$ prop	$C_8 \rightarrow$ oct
$C_4 \rightarrow$ but	$C_9 \rightarrow$ non
$C_5 \rightarrow$ pent	$C_{10} \rightarrow$ dec

$C_2H_4$	$\longrightarrow$	Ethene
$C_3H_6$	$\longrightarrow$	Propene
$C_4H_8$	$\longrightarrow$	Butene
$C_5H_{10}$	$\longrightarrow$	Pentene

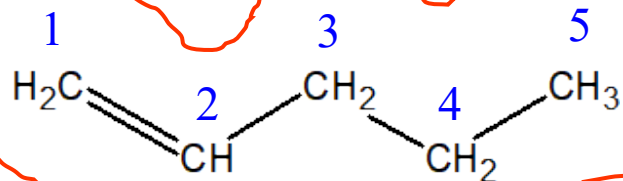


# Classwork: Alkenes

1. Parent chain must include double bond.
2. Double bond gets priority over substituents and gets lower number possible.
3. If 2/more double bonds present, suffix= 'adiene' or 'atriene' etc.

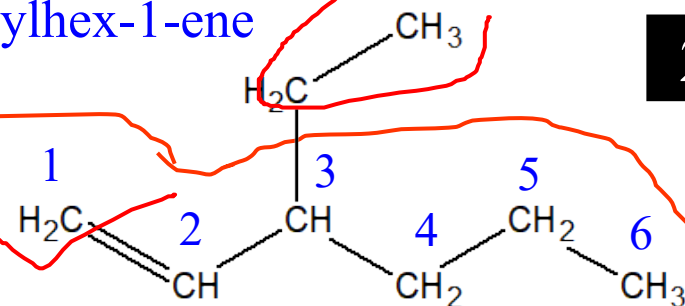
pent-1-ene

1



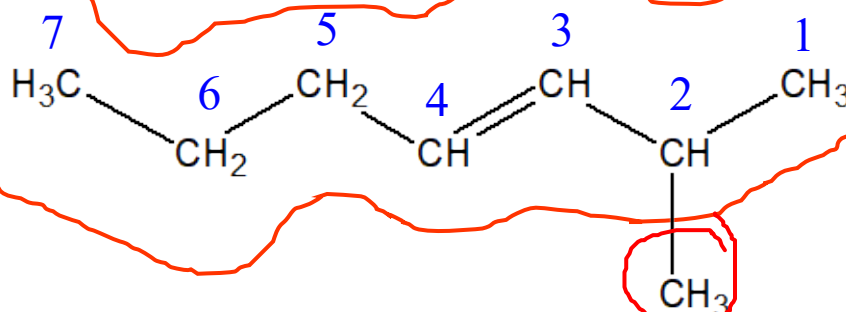
3-ethylhex-1-ene

2



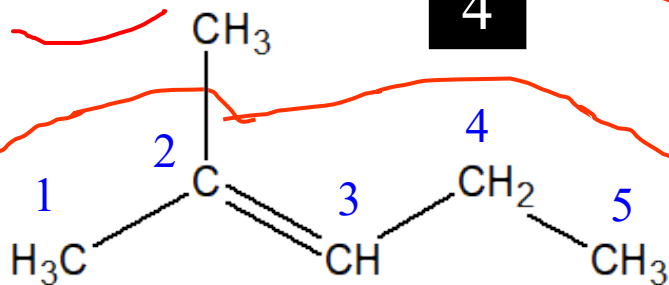
2-methylhept-3-ene

3



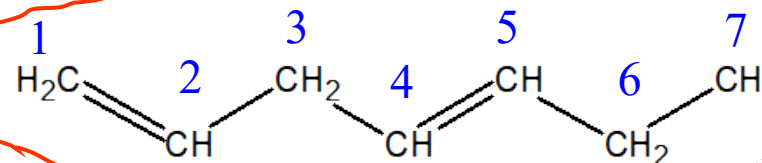
2-methylpent-2-ene

4



hepta-1,4-diene

5



**Alkyne:**  $C_nH_{2n-2}$



$C_1 \rightarrow$  meth

$C_2 \rightarrow$  eth

$C_3 \rightarrow$  prop

$C_4 \rightarrow$  but

$C_5 \rightarrow$  pent

$C_6 \rightarrow$  hex

$C_7 \rightarrow$  hept

$C_8 \rightarrow$  oct

$C_9 \rightarrow$  non

$C_{10} \rightarrow$  dec



Ethyne



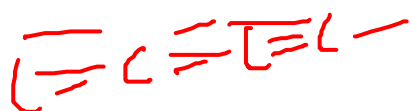
Propyne



Butyne



Pentyne



# IUPAC Basic Rules: Review

## Common Rules: (alkanes, alkenes & alkynes)

1. Choose the longest carbon chain ✓
2. If substituents attached, choose the one with more substituents. ✓
3. If only one substituent: substituent gets lower number. ✓
4. If 2/more identical substituents: use di, tri, tetra etc.
5. If 2/more different substituents: first substituent gets lower number. ✓
6. If 2 substituents are at the same positions from their ends: assign less number to the one that comes first in alphabetical order. ✓

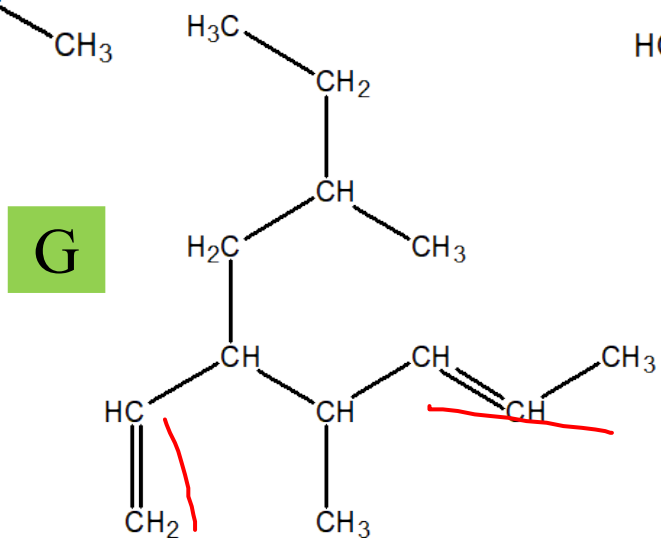
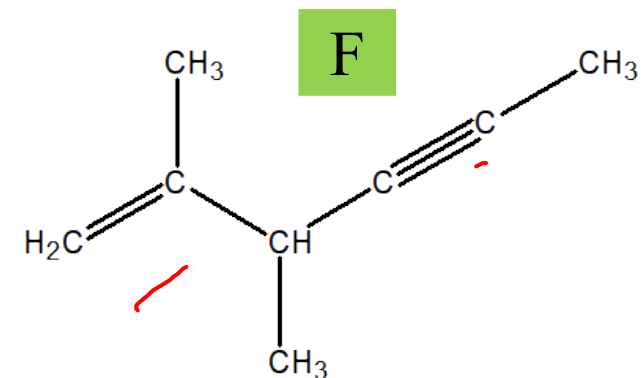
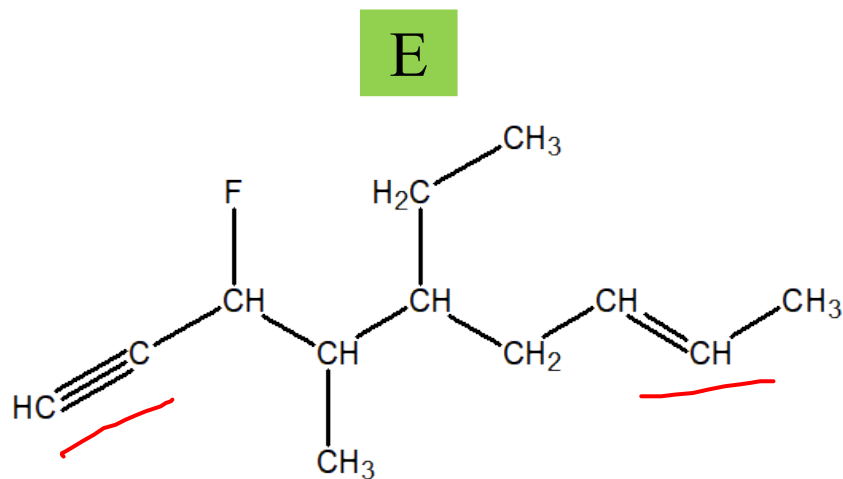
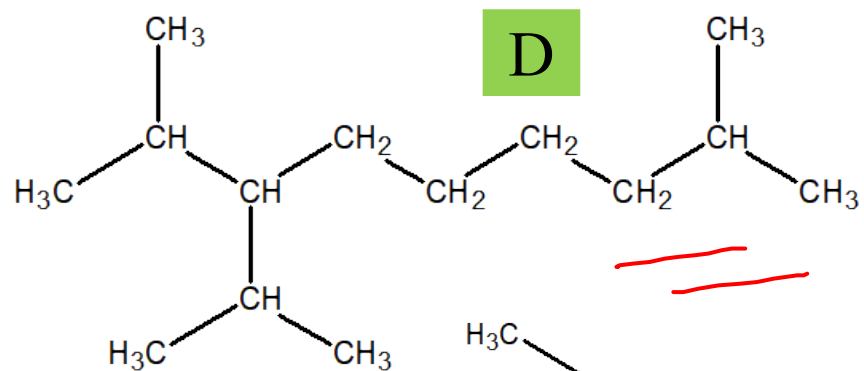
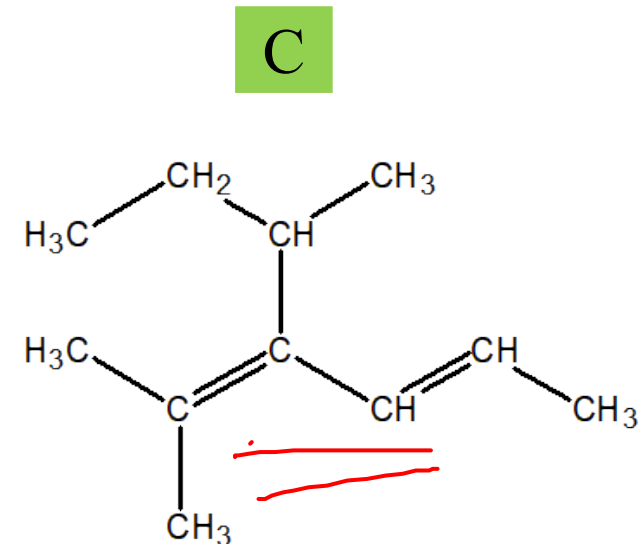
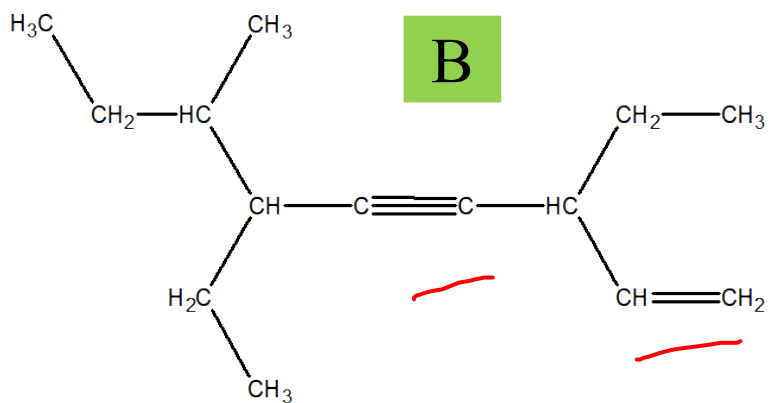
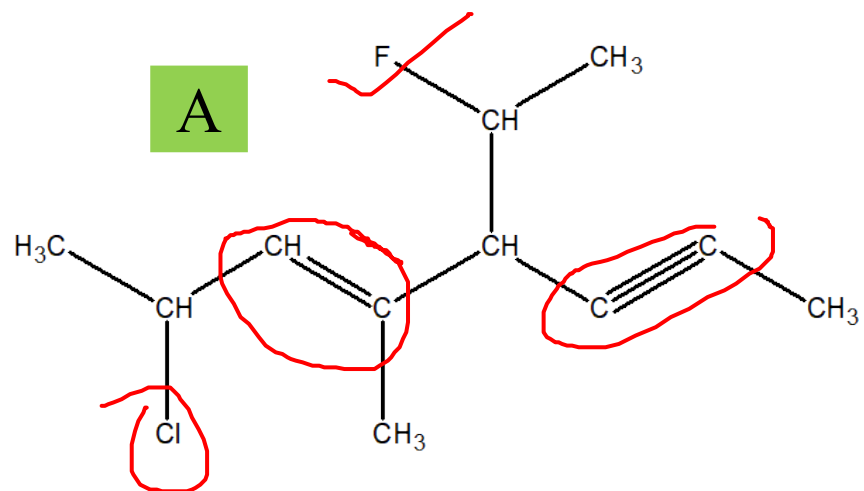
## Alkenes:

1. Parent chain must include double bond. ✓
2. Double bond gets priority over substituents and gets lower number. ✓
3. If 2/more double bonds present, suffix= 'adiene' or 'atriene' etc.
4. Usually, double and triple bonds have equal priority. ✓

## Alkynes:

1. Parent chain must include triple bond. ✓
2. If both 'db' and 'tb' at same position from either ends: double bond gets priority over triple bond and gets lower number. ✓
3. If 2/more triple bonds present, suffix= 'adiyne' or 'atriyne' etc.
4. If both db and tb are present, name as 'en-yne'. ✓





**PRACTICE**

