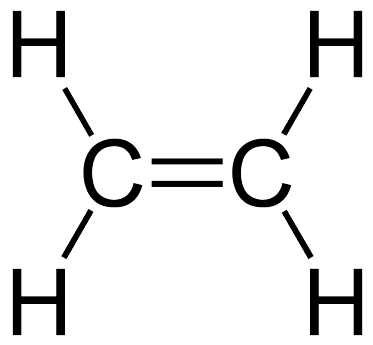
1.2 Alkenes & Alkynes

UNSATURATED HYDROCARBONS

… contain double or triple bonds between carbon atoms. For example:

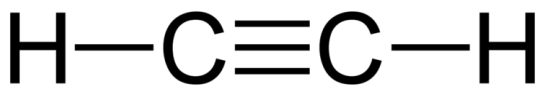
a) ETHENE

(C_2H_4)



b) ETHYNE

(C_2H_2)



ALKENES

- contain at least 1 carbon-carbon double bond
- general formula (C_nH_{2n})
- ex. ethene

ALKYNES

- contain at least 1 carbon-carbon triple bond
- general formula (C_nH_{2n-2})
- ex. ethyne

ALIPHATIC HYDROCARBONS

Alkanes, alkenes, and alkynes are all aliphatic hydrocarbons. They have a structure based on straight or branched chains of hydrocarbons or rings of carbon atoms.

RULES FOR NAMING ALKENES & ALKYNES

- ID the parent chain/ring that contains the multiple bond
- ID double bond (-ene) or triple bond (-yne)
- if multiple double or triple bonds, use prefixes (ex. diene, triene, etc.)
- number the carbon chain so the first carbon with the multiple bond has the lowest number
- number and name any substituent groups
- if the double/triple bond is in the middle of the chain number carbons from the end

SOME EXAMPLES:

$CH_2=CHCH_2CH_3$ would be but-1-ene

(old system 1-butene)

$CH_3CH=CHCH_3$ would be but-2-ene

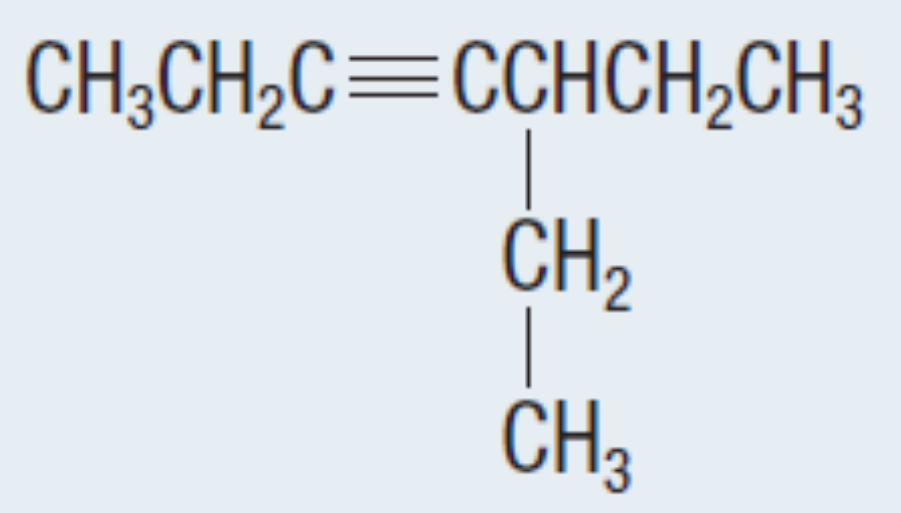
(old system 2-butene)

$CH_3CH=CHCH=CHCH=CHCH_3$

would be octa-2,4,6-triene

(old system 2,4,6-octatriene)

NAME THE FOLLOWING:



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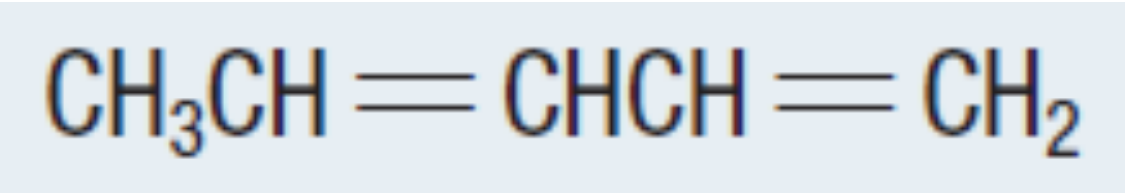

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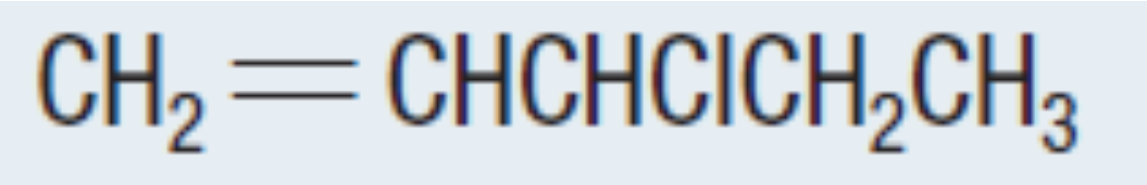
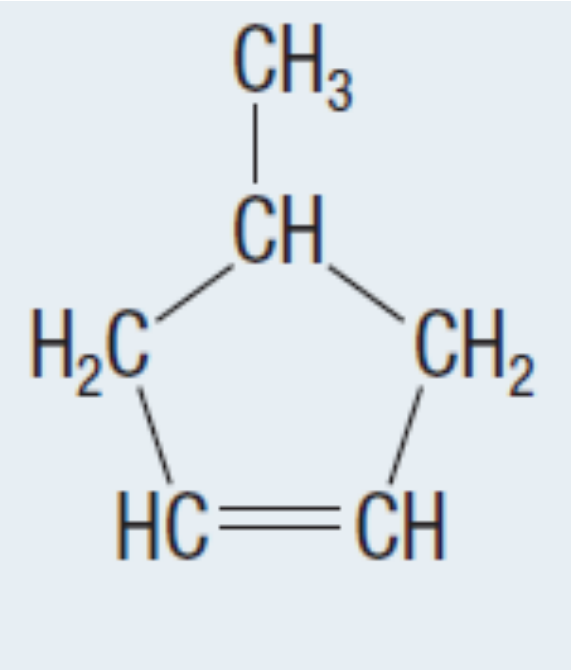


NAME THE FOLLOWING:



RULES FOR DRAWING ALKENES & ALKYNES

- draw the parent chain from the last part of the name
- ID the carbon atom where the multiple bond is attached
- draw the multiple bonds and substituents

DRAW THE FOLLOWING:

2-methylpenta-1,4-diene

DRAW THE FOLLOWING:

4,5-dimethylhept-2-yne

PRACTICE TIME!

pp. 21 # 1 & 2

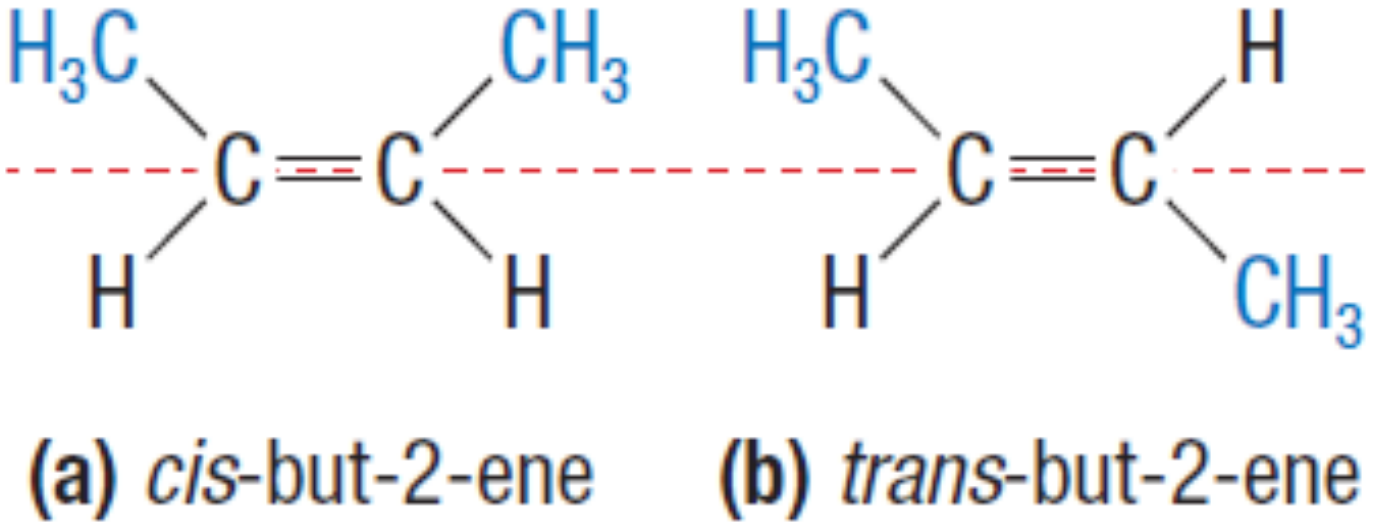
Cis-Trans ISOMERISM

Stereoisomers have the same kind and numbers of atoms bonded in the same order but have different arrangements in space (think 3D!)

Cis isomers have the groups of interest on the same side of the double bond.

Trans isomers have the groups of interest on opposite sides of the double bond.

STEREOISOMERS OF BUT-2-ENE



(a) *cis*-but-2-ene **(b)** *trans*-but-2-ene

FUNCTIONAL GROUPS

- a group of atoms within a molecule that determines the properties of the molecule (ex. solubility, MP, BP, and chemical reactivity)

- multiple bonds are considered to be functional groups b/c they affect properties of the molecule also

REACTIONS OF ALKENES & ALKYNES

Alkenes and alkynes are more reactive than alkanes because multiple bonds are less stable than single bonds.

They undergo **ADDITION REACTIONS**.

This is when atoms from a molecule are added to another molecule to form a single molecule.

ADDITION REACTION #1
HYDROGENATION

ethene + hydrogen gas ------> ethane

ADDITION REACTION #2
HALOGENATION

a halogen reacts with an alkene or an alkyne

propene + chlorine -------> 1, 2-dichloropropane

ADDITION REACTION #2
HALOGENATION

a halogen reacts with an alkene or an alkyne

propyne + bromine -------> cis-1,2-dibromopropene

ADDITION REACTION #3
HYDRATION

water reacts with an unsaturated hydrocarbon and produces and alcohol

ethene + water --------> ethanol

MARKOVNIKOV'S RULE

"the rich get richer"

When a hydrogen halide or a water molecule reacts with an alkene, the hydrogen atom will bond to the carbon atom in the multiple bond that has the most H atoms already attached to it

ADDITION REACTION #4
HYDROHALOGENATION

but-1-ene + hydrogen bromide ------> 2-bromobutane

HOMEWORK:

p. 26 #1, 2 (practice)

p. 27 #2-10