

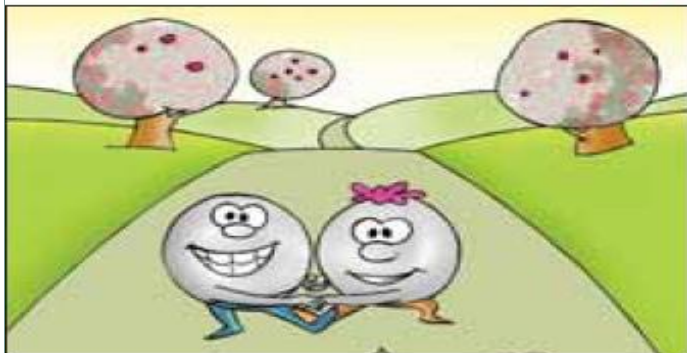
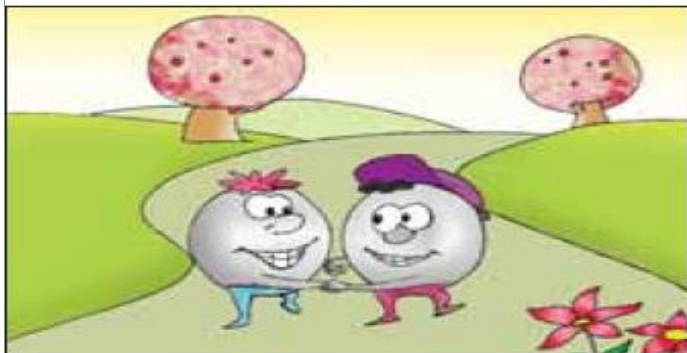
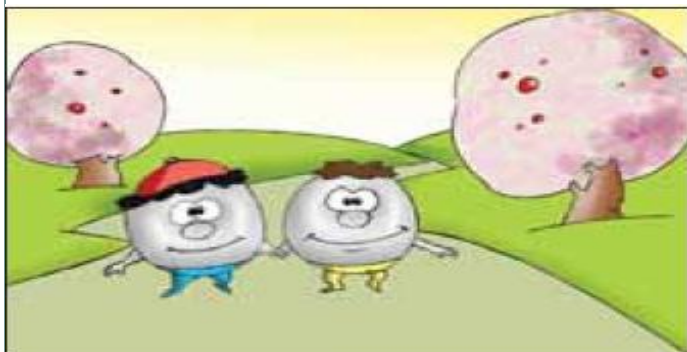
# ALKYNES



## GROUP MEMBERS:

- 1) TOKTASSYN OLZHAS
- 2) ZHARKYNULY YEDIL
- 3) SATTAROV SATZHAN
- 4) ALPYSSOV MADI

# BOND



*Alkanes, alkenes and alkynes.*

- Hydrocarbons that contain the **carbon-carbon triple bond**  $\text{-C (triple)C-}$  are called alkynes.
- Each triple bond contains **one sigma ( $\sigma$ )** and **two pi ( $\pi$ )** bonds.
- Because of the  $\pi$  bonds in their structure alkynes are unsaturated hydrocarbons.



## GENERAL FORMULA

The general formula of alkynes is  $C_nH_{2n-2}$  where  $n$  is an integer starting from 2.

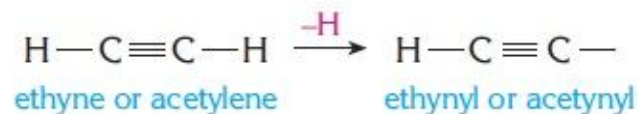
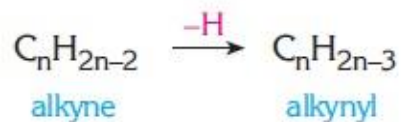
Alkynes are named by using the *-yne* suffix in place of the *-ane* suffix of alkanes.

Name	Number of Carbon	Molecular Formula	Structural Formula
Ethyne	2	$C_2H_2$	$CH \equiv CH$
Propyne	3	$C_3H_4$	$CH \equiv CCH_3$
Butyne	4	$C_4H_6$	$CH \equiv CCH_2CH_3$
Pentyne	5	$C_5H_8$	$CH \equiv C(CH_2)_2CH_3$
Hexyne	6	$C_6H_{10}$	$CH \equiv C(CH_2)_3CH_3$
Heptyne	7	$C_7H_{12}$	$CH \equiv C(CH_2)_4CH_3$
Octyne	8	$C_8H_{14}$	$CH \equiv C(CH_2)_5CH_3$
Nonyne	9	$C_9H_{16}$	$CH \equiv C(CH_2)_6CH_3$
Decyne	10	$C_{10}H_{18}$	$CH \equiv C(CH_2)_7CH_3$



## ALKYNYL GROUP

Alkynyl groups are formed from alkynes by removing one H atom. The most common alkynyl groups are ethynyl, 1-propynyl, and 1-butynyl



molecular formula	structural formula	alkynyl name
— C <sub>2</sub> H	— C ≡ C — H	Ethynyl
— C <sub>3</sub> H <sub>3</sub>	— C ≡ C — CH <sub>3</sub>	1-propynyl
— C <sub>4</sub> H <sub>5</sub>	— C ≡ C — C <sub>2</sub> H <sub>5</sub>	3-butynyl

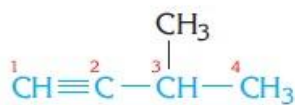


## NOMENCLATURE

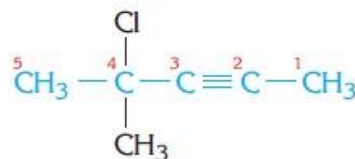
The naming of alkynes is similar to that of other hydrocarbons.

Alkynes may contain more than one triple bond. An alkyne with two triple bonds is called an **alkadiyne**.

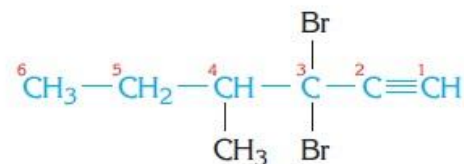
### Alkenynes



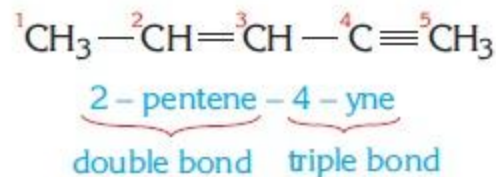
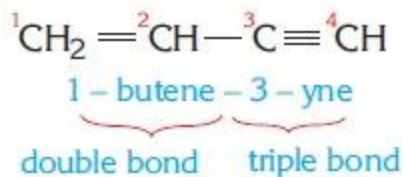
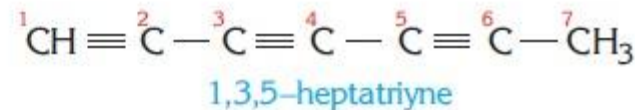
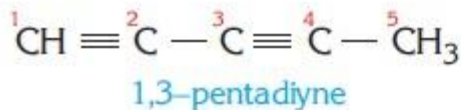
3-methyl-1-butyne



4-chloro-4-methyl-2-pentyne



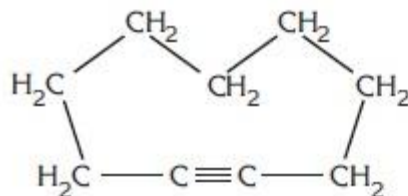
3,3-dibromo-4-methyl-1-hexyne



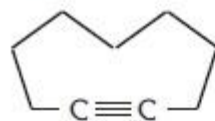
## CYCLOALKYNES

Alkynes may be cyclo compounds (cycloalkynes).

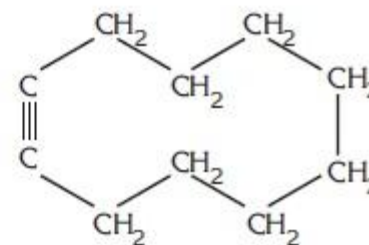
The simplest stable cycloalkyne at room temperature is cyclononyne.



cyclononyne



cyclononyne



cyclodecyne



cyclodecyne

# ISOMERISM

The triple bond may be in different locations in an alkyne, so alkynes can exhibit structural isomerism.

- For the first two members of alkynes there is only one possible position for bond, so for these cases there is no isomerism.
- Alkynes, alkadienes and cycloalkenes containing the same number of carbon atoms are isomers of each other.

Structural formula	Formula	Type of hydrocarbon	Name
$\begin{array}{c} \text{H}_2\text{C} - \text{CH} \\   \quad \quad    \\ \text{H}_2\text{C} - \text{CH} \end{array}$	$\text{C}_4\text{H}_6$	cycloalkene	cyclobutene
$\text{CH}_2 = \text{C} = \text{CH} - \text{CH}_3$	$\text{C}_4\text{H}_6$	alkadiene	1,2-butadiene
$\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$	$\text{C}_4\text{H}_6$	alkadiene	1,3-butadiene
$\text{CH} \equiv \text{C} - \text{CH}_2 - \text{CH}_3$	$\text{C}_4\text{H}_6$	alkyne	1-butyne
$\text{CH}_3 - \text{C} \equiv \text{C} - \text{CH}_3$	$\text{C}_4\text{H}_6$	alkyne	2-butyne



# PHYSICAL PROPERTIES

Similar to alkanes, alkenes.

1) Insoluble in water.

BUT

2) Soluble in organic solvents

3) Density less than water

Name	Number of Carbon Atoms	Structural Formula	Melting Point (°C)	Boiling Point (°C)	Density (water = 1)
ethyne (acetylene)	2	$\text{CH}\equiv\text{CH}$	-80.8	-75.0	
propyne	3	$\text{CH}\equiv\text{CCH}_3$	-103	-23	
1 - butyne	4	$\text{CH}\equiv\text{CCH}_2\text{CH}_3$	-125.7	8	
2 - butyne	4	$\text{CH}_3\text{C}\equiv\text{CCH}_3$	-32.3	27.0	0.691
1 - pentyne	5	$\text{CH}\equiv\text{C}(\text{CH}_2)_2\text{CH}_3$	-106	40	0.69
2 - pentyne	5	$\text{CH}_3\text{C}\equiv\text{CCH}_2\text{CH}_3$	-109	56	0.711
1 - hexyne	6	$\text{CH}\equiv\text{C}(\text{CH}_2)_3\text{CH}_3$	-132	71	0.716
2 - hexyne	6	$\text{CH}_3\text{C}\equiv\text{C}(\text{CH}_2)_2\text{CH}_3$	-89	84	0.73
3 - hexyne	6	$\text{CH}_3\text{CH}_2\text{C}\equiv\text{CCH}_2\text{CH}_3$	-101	81	0.723

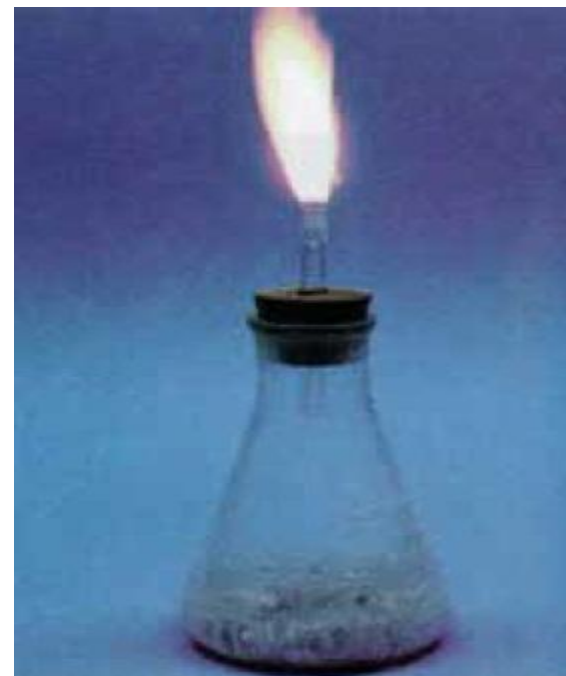


# CHEMICAL PROPERTIES

Alkynes are unsaturated compounds and their chemical properties are similar to alkenes.

Alkynes undergo combustion reactions and addition reactions, as alkenes do.

In addition, alkynes undergo substitution reactions with metals.

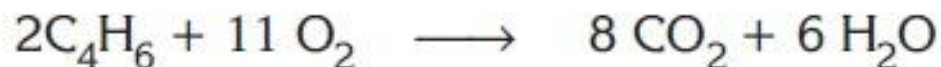
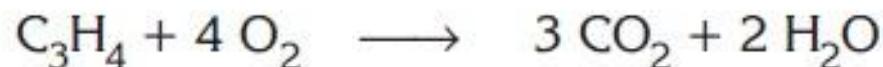
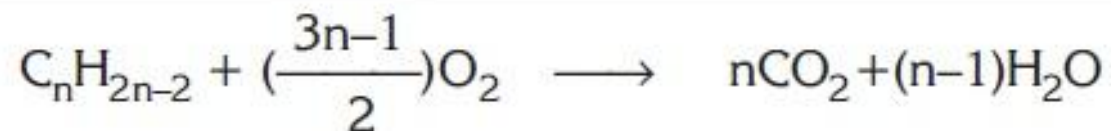


*Acetylene burns very well*

# COMBUSTION REACTIONS



Alkynes produce  $\text{CO}_2$  and  $\text{H}_2\text{O}$  when they are burnt with a sufficient amount of oxygen. The general combustion reaction is;



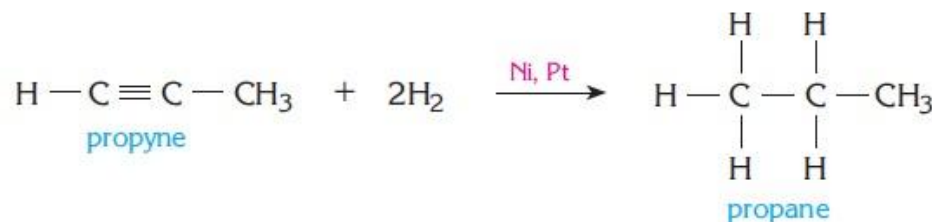
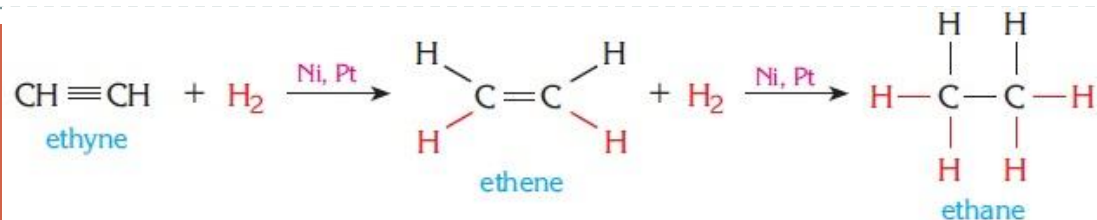
# ADDITION REACTIONS



- Addition reactions occur by breaking the  $\pi$  bonds of the triple bond. Hydrogen, halogens, hydrogen halides and water may give addition reactions with alkynes.

# ADDITION OF HYDROGEN

Two hydrogen molecules are added to one triple bond using a nickel, platinum or palladium catalyst. Alkenes are the intermediate products.



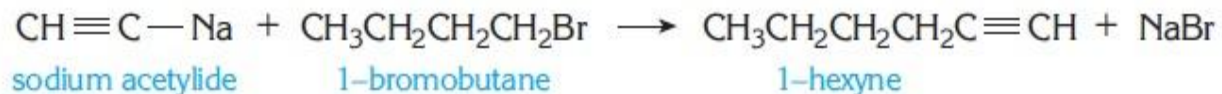
*Alkanes don't undergo hydrogenation reactions*



## PREPERATION OF ALKYNES

Alkynes can be synthesized from metallic acetylides and alkyl halides.

### BY THE REACTION OF METAL ACETYLIDES AND ALKYL HALIDES



# ACETYLENE

Acetylene, the first member of the alkyne series, is one of the major chemicals used in industry.

## PHYSICAL PROPERTIES

- 1)Very light odor
- 2)Colorless
- 3)Soluble in water
- 4)Soluble in acetone
- 5)Boiling point  $-83^{\circ}\text{C}$
- 6)Can be liquified at  $1^{\circ}\text{C}$

## CHEMICAL PROPERTIES

- 1)It burns with a bright flame
- 2)Explodes at about 15 atm pressure



*Acetylene is used for welding with  $\text{O}_2$ . At  $3300^{\circ}\text{C}$  two metals can be welded to each other.*



*Acetylene gas is used in welding.*



*In the atmosphere of Jupiter, acetylene molecules have been detected.*

# USES OF ALKYNES



- **Histrionicotoxin**
  - toxic alkyne present in South American frogs
  - used to make poison-tipped arrows
- **Ichthyothereol**
  - highly toxic alkyne found in the leaves of a Brazilian herb
  - used to kill fish
- **Calicheamicin and Esperamicin**
  - extremely toxic to cells
  - breaks double strand of DNA
  - researchers are trying to use it to develop a cancer fighting drug
- **Capillin**
  - natural plant fungicide

# THANK YOU FOR ATTENTION!!!

