

# **CHAPTER 14**

## **ORGANIC CHEMISTRY**

- **What is organic chemistry?**
- **How to distinguish organic and inorganic compound?**
- **Hydrocarbon**
- **Bond order**
- **Prefixes**
- **Molecular formulae (ane, ene, yne)**
- **Graphical formulae (ane, ene, yne)**
- **Structural formulae (ane, ene, yne)**
- **IUPAC (ane, ene, yne, ol)**
- **Isomers**

# What is organic chemistry?

## Definition

### At one time

**Chemistry of carbon compounds**

**Living things**

**Both animal and vegetable**

**Organic chemistry is the chemistry of carbon compounds derived from living things, both animal and vegetable.**

### In modern

**Chemistry of carbon compounds**

**Carbon to Carbon bond**

**Carbon to Hydrogen bond**

**Organic chemistry is the chemistry of carbon compounds in which there is at least one carbon to carbon bond or carbon to hydrogen bond.**

# How to distinguish organic and inorganic compound?

| Organic compounds                                                                                                                                                                                                                                                                                                           | Inorganic compounds               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <b>Compounds (contained Carbon)</b><br><b>Except</b><br><b>Oxide of carbon (<math>\text{CO}</math> , <math>\text{CO}_2</math>)</b><br><b>Carbonic acid (<math>\text{H}_2\text{CO}_3</math>)</b><br><b>Salts of carbonate (<math>\text{Na}_2\text{CO}_3</math>, <math>\text{CaCO}_3</math>, ---<math>\text{CO}_3</math>)</b> | <b>Compounds (without carbon)</b> |



# Hydrocarbon

## Hydrocarbon

### Saturated H/C

#### Alkane (ကိုနီး)

(-) single bond



Substitution

### Unsaturated H/C

#### Alkene (ကင်း)

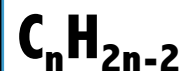
(=) double bond



Addition

#### Alkyne (ကိုင်း)

(≡) triple bond



Substitution&Addition

**Saturated**

**Alkane**

**Unreactive**



**Alkene**



**Unsaturated**

**Alkyne**

**Reactive**

**The most saturated H/C =**

**The most unsaturated H/C =**

**The most reactive H/C =**

**The most unreactive H/C =**

# Bond order = Valence

| Elements                      | Integer electronic Structure | Valence | Bond order |
|-------------------------------|------------------------------|---------|------------|
| Carbon ( <sub>6</sub> C)      |                              |         |            |
| Hydrogen ( <sub>1</sub> H)    |                              |         |            |
| Nitrogen ( <sub>7</sub> N)    |                              |         |            |
| Oxygen ( <sub>8</sub> O)      |                              |         |            |
| Fluorine ( <sub>9</sub> F)    |                              |         |            |
| Phosphorus ( <sub>15</sub> P) |                              |         |            |
| Sulphur ( <sub>16</sub> S)    |                              |         |            |
| Chlorine ( <sub>17</sub> Cl)  |                              |         |            |

# Prefixes for Carbon number(1-10)

| Carbon number | Prefixes |
|---------------|----------|
| 1             | meth     |
| 2             | eth      |
| 3             | prop     |
| 4             | but      |
| 5             | pent     |
| 6             | hex      |
| 7             | hept     |
| 8             | oct      |
| 9             | non      |
| 10            | dec      |

## **Molecular formulae**

**General formula** ဝဲ  
'n' တန်ဖိုးသွင်းတာ  
**Molecular formula**

## Alkanes ( $C_nH_{2n+2}$ )

| No. of Carbon | Name    | Molecular formulae |
|---------------|---------|--------------------|
| 1             | methane |                    |
| 2             | ethane  |                    |
| 3             | propane |                    |
| 4             | butane  |                    |
| 5             | pentane |                    |
| 6             | hexane  |                    |
| 7             | heptane |                    |
| 8             | octane  |                    |
| 9             | nonane  |                    |
| 10            | decane  |                    |

## Alkenes ( $C_nH_{2n}$ )

| No. of Carbon | Name    | Molecular formulae |
|---------------|---------|--------------------|
|               |         |                    |
| 2             | ethene  |                    |
| 3             | propene |                    |
| 4             | butene  |                    |
| 5             | pentene |                    |
| 6             | hexene  |                    |
| 7             | heptene |                    |
| 8             | octene  |                    |
| 9             | nonene  |                    |
| 10            | decene  |                    |

## Alkyes ( $C_nH_{2n-2}$ )

| No. of Carbon | Name    | Molecular formulae |
|---------------|---------|--------------------|
|               |         |                    |
| 2             | ethyne  |                    |
| 3             | propyne |                    |
| 4             | butyne  |                    |
| 5             | pentyne |                    |
| 6             | hexyne  |                    |
| 7             | heptyne |                    |
| 8             | octyne  |                    |
| 9             | nonyne  |                    |
| 10            | decyne  |                    |

## Structural formulae

C ခွဲရေးမယ်  
**Bond** တွေထည့်မယ်  
ဘယ်နှစ်ချောင်းရှိလဲ  
ဘယ်နှစ်လုံးထည့်မလဲ

## Alkanes ( $C_nH_{2n+2}$ )

| No. of Carbon | Name    | Structural formulae |
|---------------|---------|---------------------|
| 1             | methane |                     |
| 2             | ethane  |                     |
| 3             | propane |                     |
| 4             | butane  |                     |
| 5             | pentane |                     |
| 6             | hexane  |                     |
| 7             | heptane |                     |
| 8             | octane  |                     |
| 9             | nonane  |                     |
| 10            | decane  |                     |

## Alkenes ( $C_nH_{2n}$ )

| No. of Carbon | Name      | Structural formulae |
|---------------|-----------|---------------------|
|               |           |                     |
| 2             | ethene    |                     |
| 3             | propene   |                     |
| 4             | 1-butene  |                     |
| 5             | 1-pentene |                     |
| 6             | 1-hexene  |                     |
| 7             | 1-heptene |                     |
| 8             | 1-octene  |                     |
| 9             | 1-nonene  |                     |
| 10            | 1-decene  |                     |

## Alkynes ( $C_nH_{2n-2}$ )

| No. of Carbon | Name      | Structural formulae |
|---------------|-----------|---------------------|
|               |           |                     |
| 2             | ethyne    |                     |
| 3             | propyne   |                     |
| 4             | 1-butyne  |                     |
| 5             | 1-pentyne |                     |
| 6             | 1-hexyne  |                     |
| 7             | 1-heptyne |                     |
| 8             | 1-octyne  |                     |
| 9             | 1-nonyne  |                     |
| 10            | 1-decyne  |                     |

## Graphical formulae

C ခွဲရေးမယ်  
**Bond** တွေထည့်မယ်  
ဘယ်နှစ်ချောင်းရှိလဲ  
ဘယ်နှစ်ချောင်းထည့်မလဲ

## Alkanes ( $C_nH_{2n+2}$ )

| No. of Carbon | Name    | Graphical formulae |
|---------------|---------|--------------------|
| 1             | methane |                    |
| 2             | ethane  |                    |
| 3             | propane |                    |
| 4             | butane  |                    |
| 5             | pentane |                    |

| No. of Carbon | Name    | Graphical formulae |
|---------------|---------|--------------------|
| 6             | hexane  |                    |
| 7             | heptane |                    |
| 8             | octane  |                    |
| 9             | nonane  |                    |
| 10            | decane  |                    |

## Alkenes ( $C_nH_{2n}$ )

| No. of Carbon | Name      | Graphical formulae |
|---------------|-----------|--------------------|
|               |           |                    |
| 2             | ethene    |                    |
| 3             | propene   |                    |
| 4             | 1-butene  |                    |
| 5             | 1-pentene |                    |

| No. of Carbon | Name      | Graphical formulae |
|---------------|-----------|--------------------|
| 6             | 1-hexene  |                    |
| 7             | 1-heptene |                    |
| 8             | 1-octene  |                    |
| 9             | 1-nonene  |                    |
| 10            | 1-decene  |                    |

## Alkynes ( $C_nH_{2n-2}$ )

| No. of Carbon | Name      | Graphical formulae |
|---------------|-----------|--------------------|
|               |           |                    |
| 2             | ethyne    |                    |
| 3             | propane   |                    |
| 4             | 1-butyne  |                    |
| 5             | 1-pentyne |                    |

| No. of Carbon | Name      | Graphical formulae |
|---------------|-----------|--------------------|
| 6             | 1-hexyne  |                    |
| 7             | 1-heptyne |                    |
| 8             | 1-octyne  |                    |
| 9             | 1-nonyne  |                    |
| 10            | 1-decyne  |                    |

## R (Alkyl) အုပ်စု

| Alkane ( $C_nH_{2n+2}$ )    | Alkyl, R ( $C_nH_{2n+1}$ ) |
|-----------------------------|----------------------------|
| Methane<br>$CH_4$           | Methyl                     |
| Ethane<br>$CH_3-CH_3$       | Ethyl                      |
| Propane<br>$CH_3-CH_2-CH_3$ | n-propyl                   |
|                             | iso-propyl                 |

## X (Halide) အုပ်စု

|    |   |          |
|----|---|----------|
| X  | = | Halide   |
| Cl | = | Chloride |
| Br | = | Bromide  |
| I  | = | Iodide   |

**The radicals derived from alkanes are called alkyl radicals.**

| Name                                                 | Formulae |
|------------------------------------------------------|----------|
| Ethyl chloride                                       |          |
| Alkyl iodide                                         |          |
| n-propyl halide                                      |          |
| iso-propyl bromide                                   |          |
| Methyl chloride                                      |          |
| Formulae                                             | Name     |
| RI                                                   |          |
| CH <sub>3</sub> Br                                   |          |
| CH <sub>3</sub> -CH <sub>2</sub> -CH <sub>2</sub> Cl |          |
| CH <sub>3</sub> -CHX-CH <sub>3</sub>                 |          |
| CH <sub>3</sub> -CH <sub>2</sub> Br                  |          |

# IUPAC=Geneva system (International Union of Pure and Applied Chemistry)

## Alkane

Formula → Name

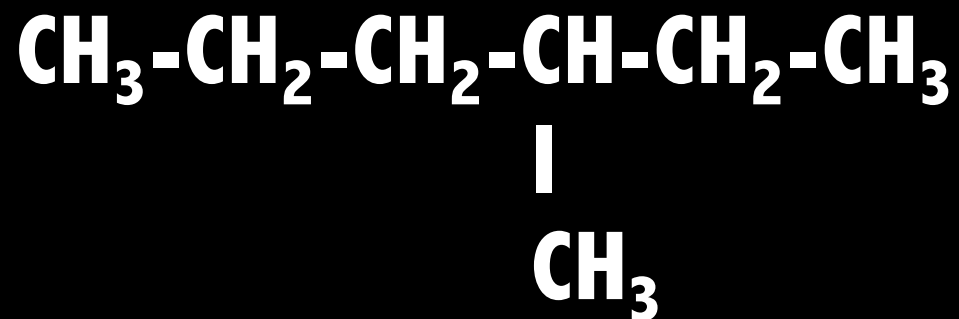
အရှည်ဆုံးကိုရွေး  
အစားထိုးနဲ့နီးတဲ့ဘက် အမှတ်စဉ်စပြီးတပ်  
အစားထိုးနံပါတ်/အစားထိုးအမည်/အရှည်ဆုံးအမည်

Name → Formula

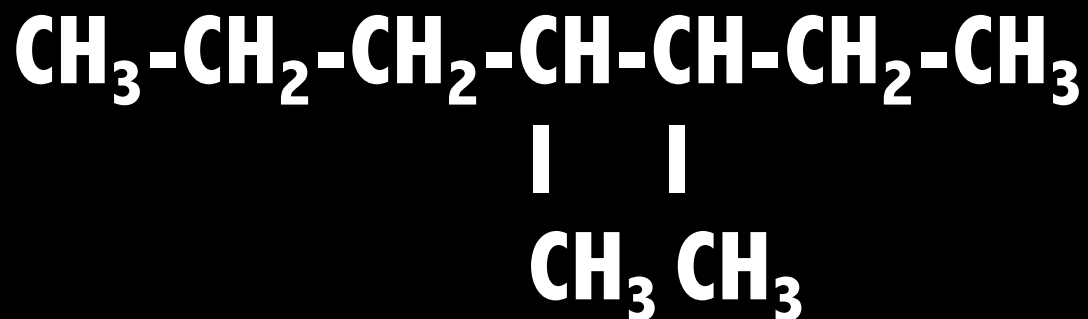
C နေရာချ  
Bond နေရာချ  
အစားထိုးနေရာချ  
H ဖြည့်

**Formula → Name**

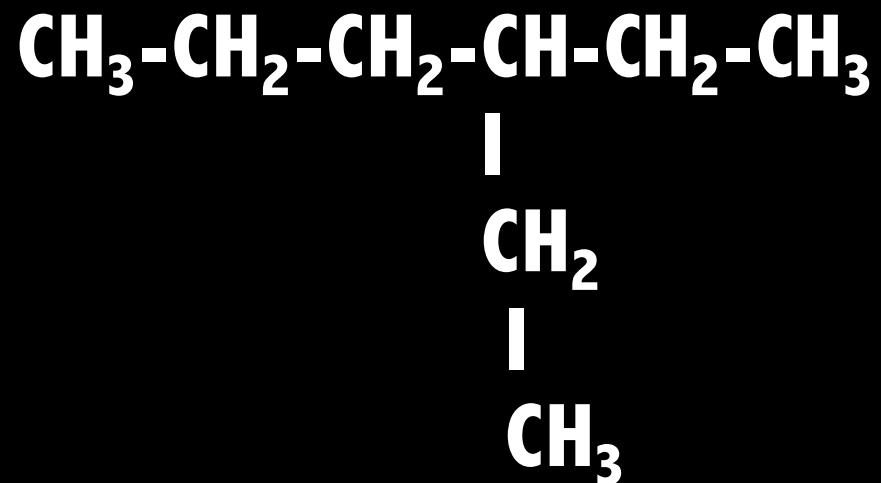
### Example 1



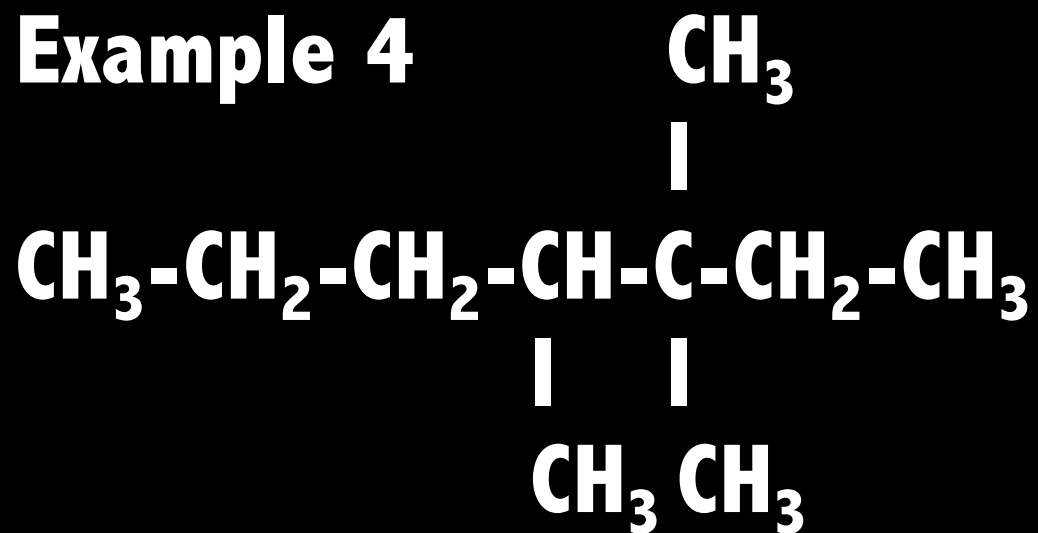
### Example 2



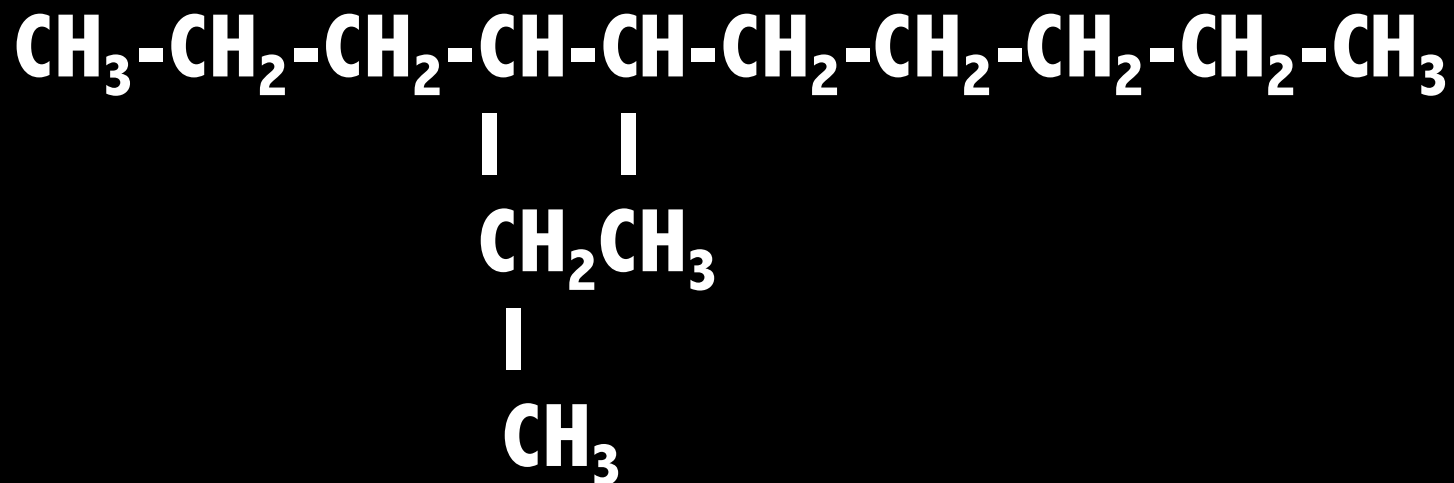
### Example 3



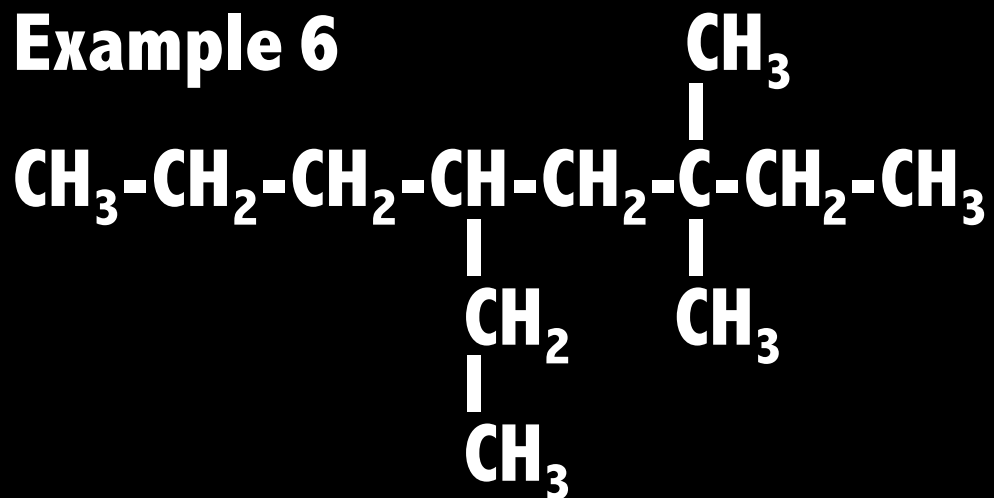
### Example 4



### Example 5



### Example 6



**Name → Formula**

## **Example 7**

**4,4,5-trimethyl octane**

## **Example 8**

**2-methyl 4-ethyl hexane**

# Alkene

**Formula → Name**

အရှည်ဆုံးကိုရွေး  
(=)နဲ့နီးတဲ့ဘက် အမှတ်စဉ်စပြီးတပ်  
အစားထိုးနံပါတ်/အစားထိုးအမည်/  
(=)နံပါတ်/အရှည်ဆုံးအမည်

**Name → Formula**

C နေရာချ  
Bond နေရာချ  
အစားထိုးနေရာချ  
H ဖြည့်

**Formula → Name**

### Example 9



### Example 10



**Name → Formula**

**Example 11**

**5-methyl 1-hexene**

**Example 12**

**4-methyl 2-heptene**

# Alkyne

**Formula → Name**

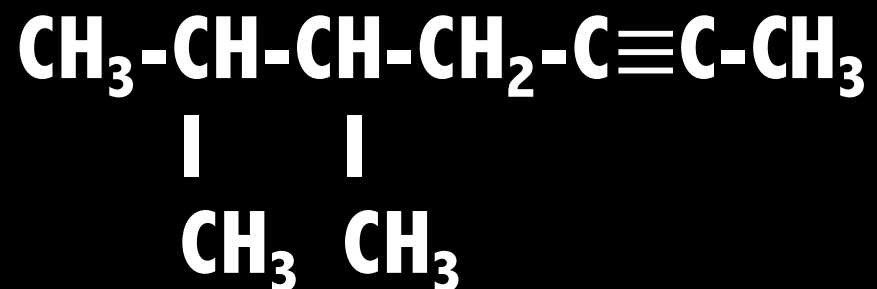
အရှည်ဆုံးကိုရွေး  
(≡)နဲ့နီးတဲ့ဘက် အမှတ်စဉ်စပြီးတပ်  
အစားထိုးနံပါတ်/အစားထိုးအမည်/  
(≡)နံပါတ်/အရှည်ဆုံးအမည်

**Name → Formula**

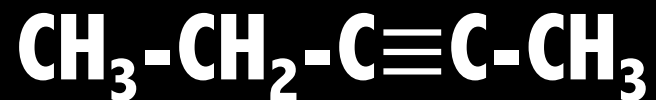
C နေရာချ  
Bond နေရာချ  
အစားထိုးနေရာချ  
H ဖြည့်

**Formula → Name**

### Example 13



### Example 14



**Name → Formula**

## **Example 15**

**3-methyl 1-butyne**

## **Example 16**

**2-butyne**

# Alcohol

**Formula → Name**

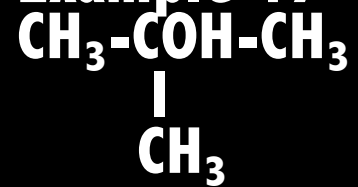
အရှည်ဆုံးကိုရွေး  
(OH)နဲ့နီးတဲ့ဘက် အမှတ်စဉ်စပြီးတပ်  
အစားထိုးနံပါတ်/အစားထိုးအမည်/  
(OH)နံပါတ်/အရှည်ဆုံးအမည်

**Name → Formula**

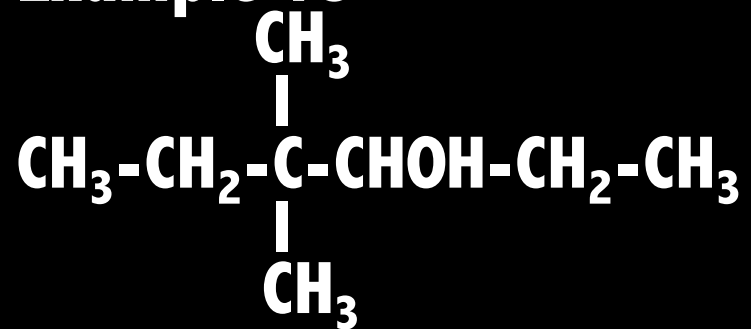
Cနေရာချ  
OHနေရာချ  
အစားထိုးနေရာချ  
Hဖြည့်

**Formula → Name**

**Example 17**



**Example 18**



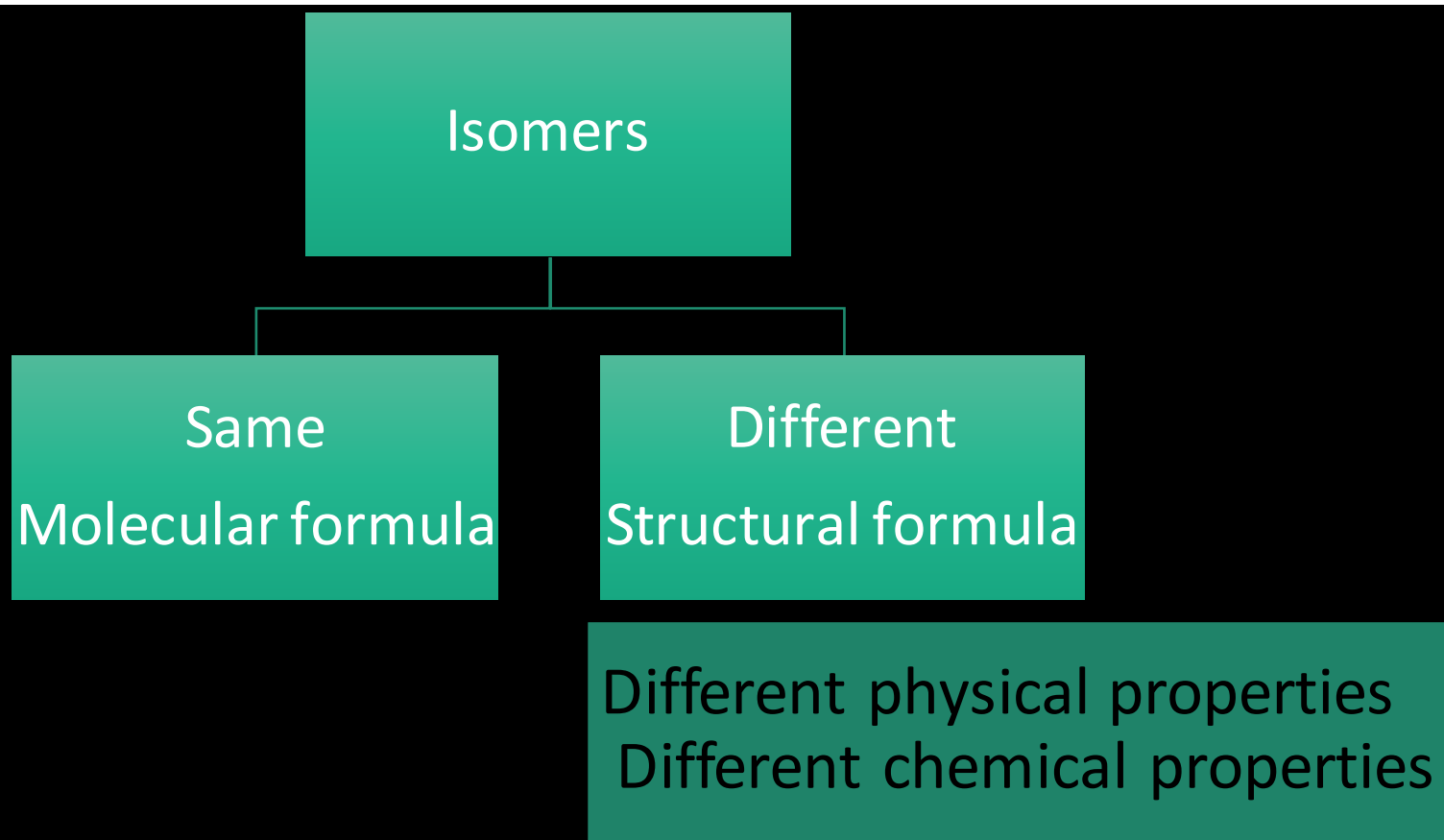
**Name → Formula**

## **Example 19**

**2-methyl propan-2-ol**

## **Example 20**

**butan-1-ol**



**Compounds having the same molecular formula but different structural formulae have different physical and chemical properties are called structural isomers.**

## Butane isomers

| Molecular formula | Structural formula                                       | Trivial Name | IUPAC name       |
|-------------------|----------------------------------------------------------|--------------|------------------|
| $C_4H_{10}$       | $CH_3-CH_2-CH_2-CH_3$                                    | n-butane     | butane           |
| $C_4H_{10}$       | $\begin{array}{c} CH_3-CH-CH_3 \\   \\ CH_3 \end{array}$ | iso-butane   | 2-methyl propane |

# Butene isomers

| Molecular formula | Structural formula                                              | Trivial Name                      | IUPAC name         |
|-------------------|-----------------------------------------------------------------|-----------------------------------|--------------------|
| $C_4H_8$          | $CH_3-CH_2-CH=CH_2$                                             | 1-butylene (or) $\alpha$ butylene | 1-butene           |
| $C_4H_8$          | $CH_3-CH=CH-CH_3$                                               | 1-butylene (or) $\beta$ butylene  | 2-butene           |
| $C_4H_8$          | $  \begin{array}{c}  CH_3-C=CH_2 \\    \\  CH_3  \end{array}  $ | iso-butylene                      | 2-methyl 1-propene |

## Butyne isomers

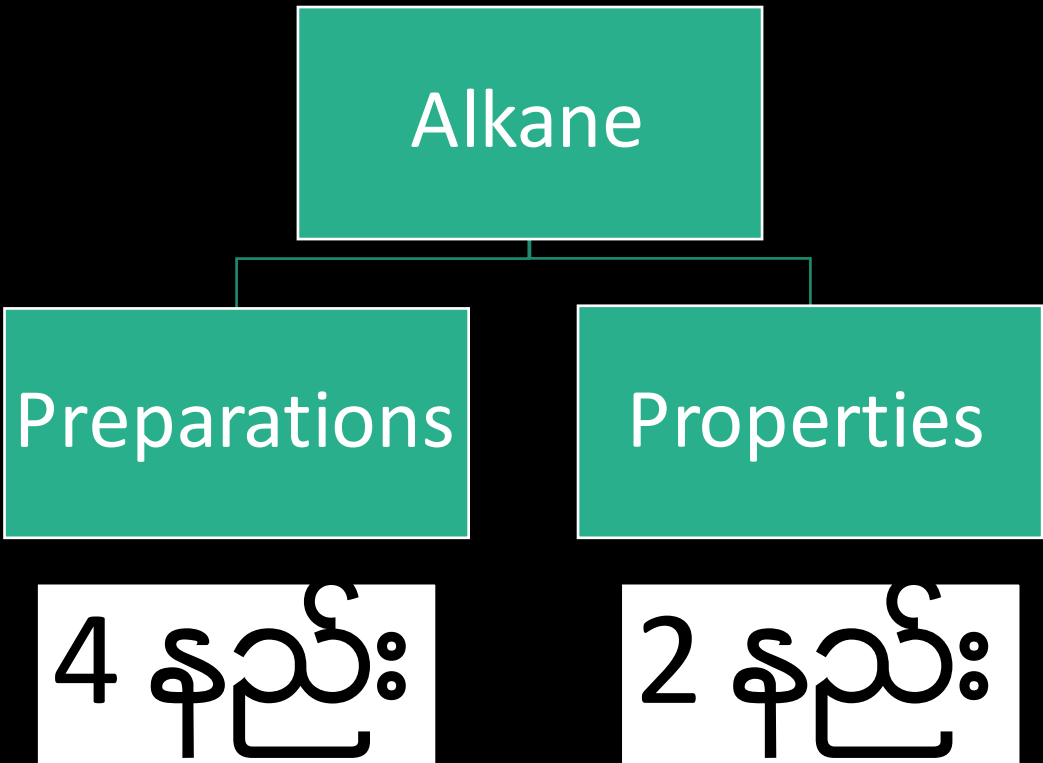
| Molecular formula      | Structural formula                                | Trivial Name       | IUPAC name |
|------------------------|---------------------------------------------------|--------------------|------------|
| $\text{C}_4\text{H}_6$ | $\text{CH}_3\text{-CH}_2\text{-C}\equiv\text{CH}$ | ethyl acetylene    | 1-butyne   |
| $\text{C}_4\text{H}_6$ | $\text{CH}_3\text{-C}\equiv\text{C-CH}_3$         | dimethyl acetylene | 2-butyne   |

# **Alkanes**

- **Preparations of alkanes**
- **Properties of alkanes**
- **Exercises**

| RCOONa                                                  |  |
|---------------------------------------------------------|--|
| CH <sub>3</sub> COONa                                   |  |
| CH <sub>3</sub> -CH <sub>2</sub> COONa                  |  |
| CH <sub>3</sub> -CH <sub>2</sub> -CH <sub>2</sub> COONa |  |

Alkane



```
graph TD; A[Alkane] --> B[Preparations]; A --> C[Properties]; B --> D[4 နည်း]; C --> E[2 နည်း]
```

Preparations

4 နည်း

Properties

2 နည်း

# Preparations of alkanes

## (1) $\text{RCOONa}$ is heated with sodalime

$\text{COO}$  ကစ  $\text{NaO}$  မှာဆုံး  
အတွင်းကဟာချင်းပေါင်း  
အပြင်ကဟာချင်းပေါင်း

## (2) Reduction of $\text{RI}$ with $\text{HI}$

$\text{RI} + \text{HI}$  အကြောင်းဆိုင်  
I တွေအရင်ပိုင်း  
ပိုင်းတာချင်းပေါင်း  
မပိုင်းတာချင်းပေါင်း

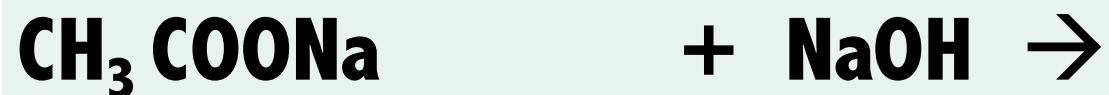
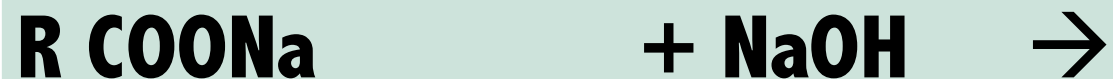
## (3) Reduction of $\text{RI}$ with $\text{H}_2$

$\text{RI}$  နဲ့  $\text{H}_2$   $\text{Pt/Pd}$  ကူ  
 $\text{H}_2$  ကို ၂လုံးခွဲ  
 $\text{R}$  ကဆွဲ I ကဆွဲ

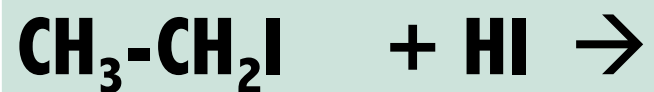
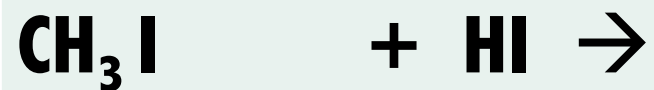
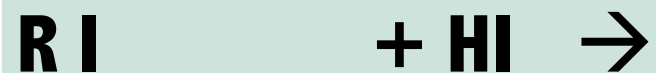
## (4) Reduction of alkene with $\text{H}_2$

ene နဲ့  $\text{H}_2$  Nickelလောင်းပြီး ဥပပကူ  
မကူချင်ရင်  $\text{Pt/Pd}$ ပေး  
ရှေ့ပို့နောက်ပို့တချောင်းဖြုတ်

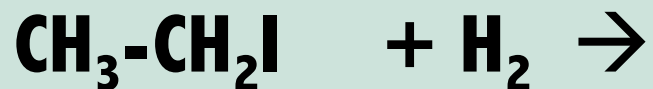
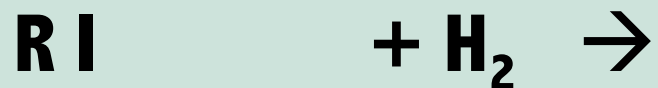
**(1) RCOONa is heated with soda lime (NaOH+CaO)**



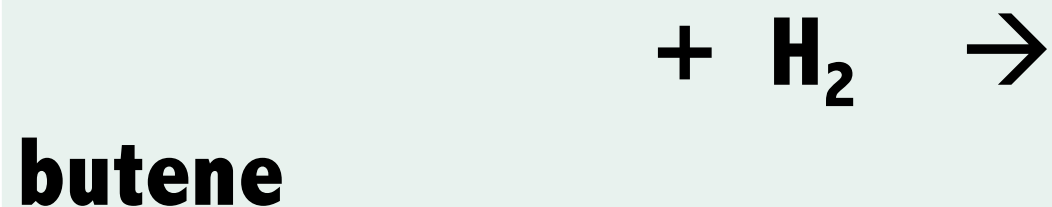
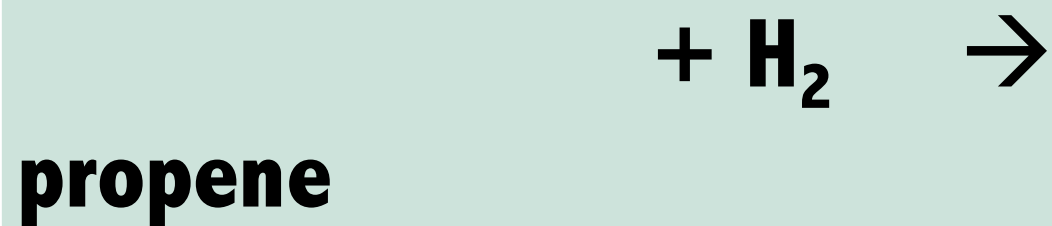
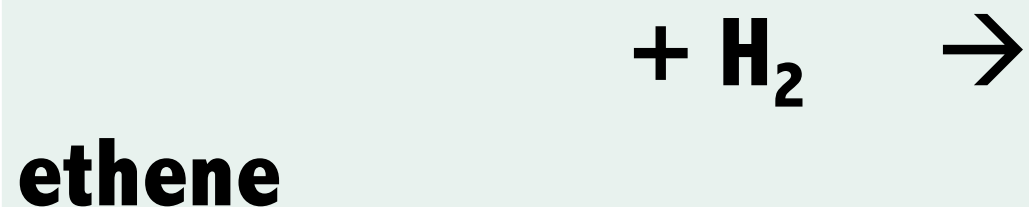
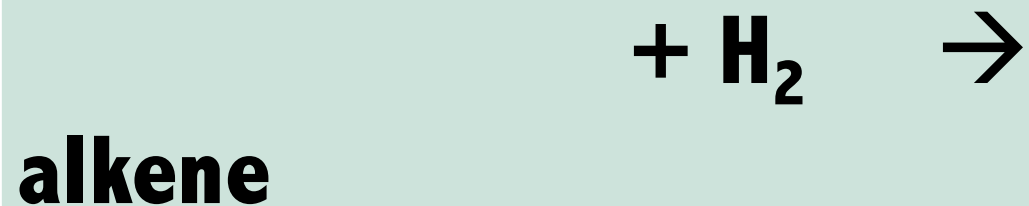
## (2) Reduction of RI with HI



### (3) Reduction of RI with H<sub>2</sub>



## **(4) Reduction of alkene with H<sub>2</sub>**



# Properties of alkanes

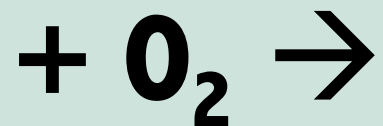
## (1) Combustion

**Combustion** ဆို  $O_2$  ပေါင်း  
 $CO_2$  နဲ့ ရေ နဲ့ ပြောင်း

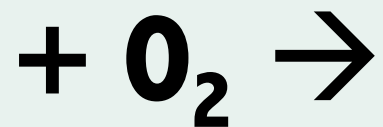
## (2) Substitution of chlorine (Chlorination)

$Cl_2$  နဲ့ ပေါင်းရင် **diffused sunlight** မြှားပေါ်တင်  
H နေရာ Cl ထည့် သိုင်/လင်း/ဖောင်း/တက်ထရာထွက်

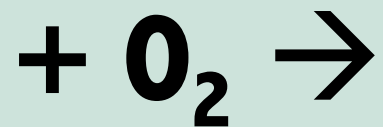
## **(1) Combustion**



**methane**



**ethane**



**propane**

## (2) Substitution of chlorine (Chlorination)



**methane**

# Alkene

```
graph TD; A[Alkene] --> B[Preparations]; A --> C[Properties]; B --> D[2 နည်း]; C --> E[5 နည်း];
```

Preparations

2 နည်း

Properties

5 နည်း

# ROH (Alcohol)

| Structural formulae                                   | Names | Common name |
|-------------------------------------------------------|-------|-------------|
| <b>CH<sub>3</sub>OH</b>                               |       |             |
| <b>CH<sub>3</sub>-CH<sub>2</sub>OH</b>                |       |             |
| <b>CH<sub>3</sub>-CH<sub>2</sub>-CH<sub>2</sub>OH</b> |       |             |
| <b>CH<sub>3</sub>-CHOH-CH<sub>3</sub></b>             |       |             |

# Preparations of alkenes

## (1) Dehydration of alcohol

**ROH alcohol**

**160** ဖြူပြင်းရော

**Ene** + ရေ ထွက်မှာပေါ့

ဓာတ်ကုပစ္စည်းနေရာ

**Al<sub>2</sub>O<sub>3</sub> alumina 350**ပါ

**Ethanol** ဆို **ethene** ရေ

**Propanol** ဆို **propene** ရေ

## (2) Dehydrohalogenation of alkyl halide

**KOH** နဲ့ ပေါင်းလိုက် **ethanol**

နဲ့အပူတိုက်

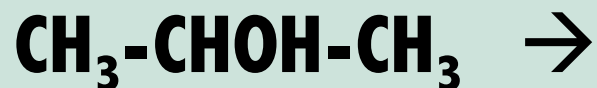
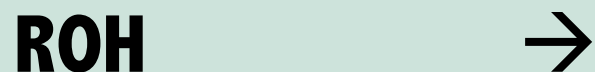
**K** က **halide** ဆို

**OH** က **H** ကိုဆွဲ

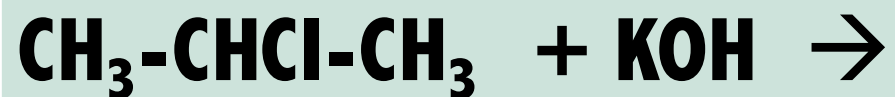
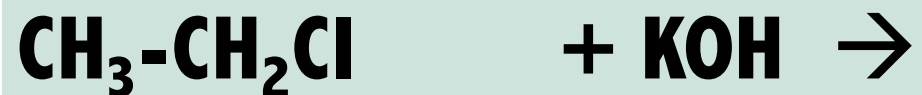
**Ene** တွေထွက်

# Preparations of alkenes

## (1) Dehydration of alcohol



## **(2) Dehydrohalogenation of alkyl halide**



# Properties of alkenes

## (1) Combustion

**Combustion**

ဆီ  $O_2$  ပေါင်း  
 $CO_2$  နဲ့ ရေ နဲ့ ပြောင်း

## (2) Addition reaction

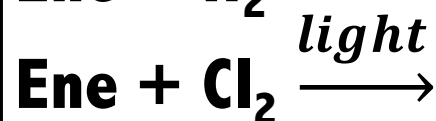
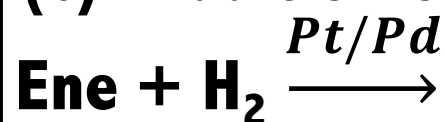
**Addition reaction**

ရေ၊ ပိုနောက်ပို တစ်ဆောင်းဖြုတ်

(a) **Addition of  $H_2$  (hydrogenation)**

(b) **Addition of  $X_2$  (halogenation)**

(c) **Addition of  $HX$  (hydrohalogenation)**



### (3) Formation of ozonide (Ozonolysis)

$O_3$  နဲ့ ပေါင်း **chloroform**

**0** ကို **3** လုံးခွဲ **ozonide** တွေထွက်

**Ozonide** ကို ဖြိုမယ်ဆိုရင် **Zn dust** လို  
ဘယ်တစ်ခြမ်း/ညာတစ်ခြမ်း/အပေါ်တစ်ခြမ်း

### (4) Hydroxylation

ရေနံကွင်းခတ် **nascent (0)** ပေါင်းကြတော့မယ်ဆို

**OH** ဘယ်ညာခွဲပြီးထည့် **glycol** လေးတွေထွက်

**1 %** / ပိုပါ / **cold dilute** / **violet** / **colourless**

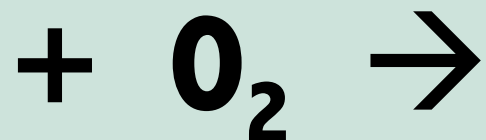
### (5) polymerization

$n \frac{\text{ethene}}{\text{propene}}$  **1000** အထက် ပူအောင်ပြင်း

**Single bond** တစ်ဝက်ဖြတ် **poly**  $\frac{\text{ethene}}{\text{propene}}$  ထွက်

# Properties of alkenes

## (1) Combustion



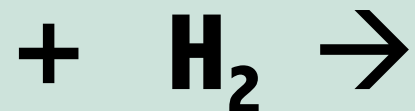
**ethene**



**propene**

## **(2) Addition reaction**

### **(a) Addition of hydrogen (Hydrogenation)**



**ethene**



**propene**

## **(b) Addition of halogen (halogenation)**



**ethene**



**propene**



**ethene**



**propene**

## **(c) Addition of hydrohalogen (Hydrohalogenation)**



**ethene**



**propene**

### (3) Formation of ozonide (ozonolysis)

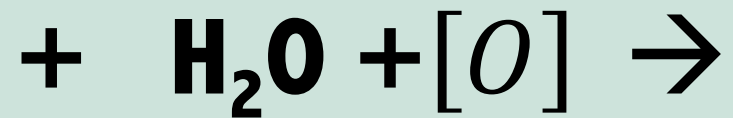


**ethene**

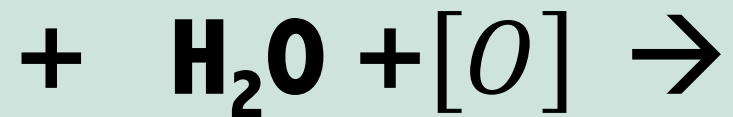


**propene**

## (4) Hydroxylation



**ethene**



**propene**

## **(5) Polymerization**

**ethene**

**propene**