

# BIO-ORGANIC CHEMISTRY

## (Organic Chemistry for Biology Students)

### (SQBS 1603)

# Introduction to Organic Chemistry

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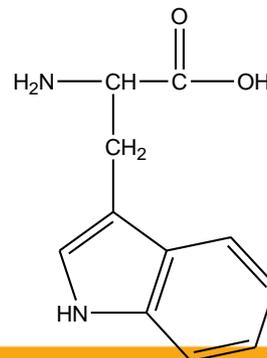
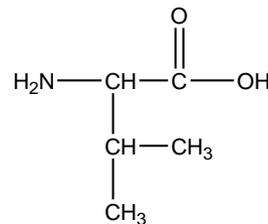
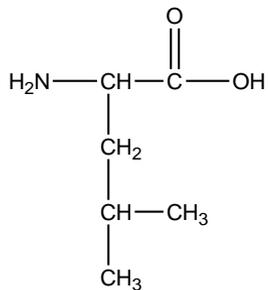
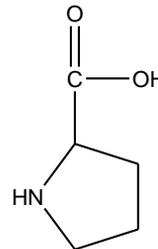
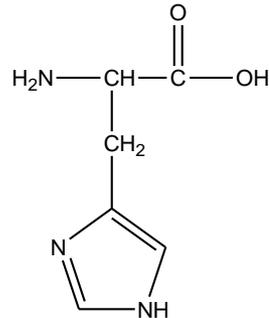
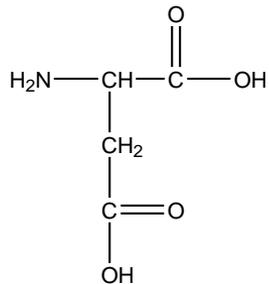
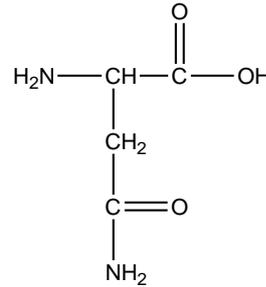
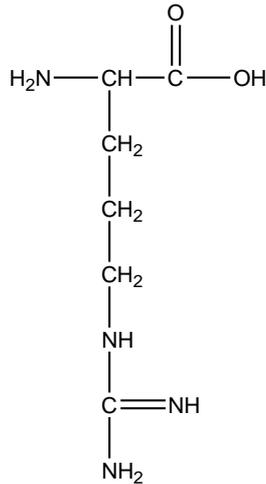
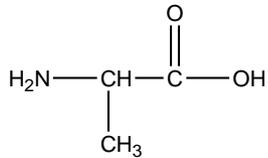
Department of Biotechnology and Medical Engineering

Faculty of Biosciences and Medical Engineering

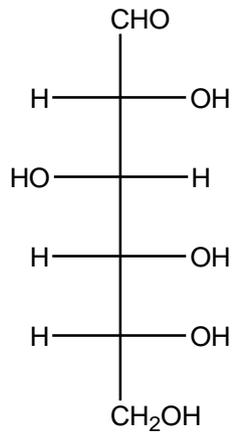


Spot the similarity

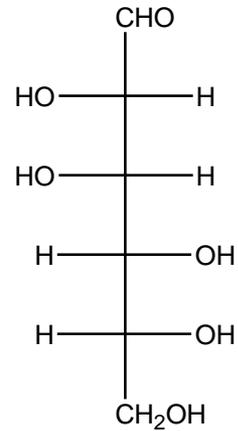
Amino acids



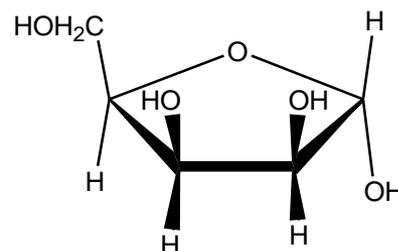
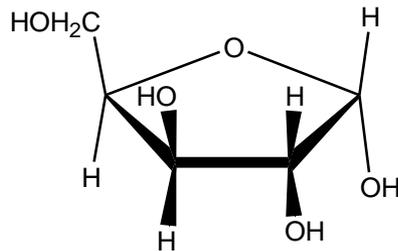
Glucose



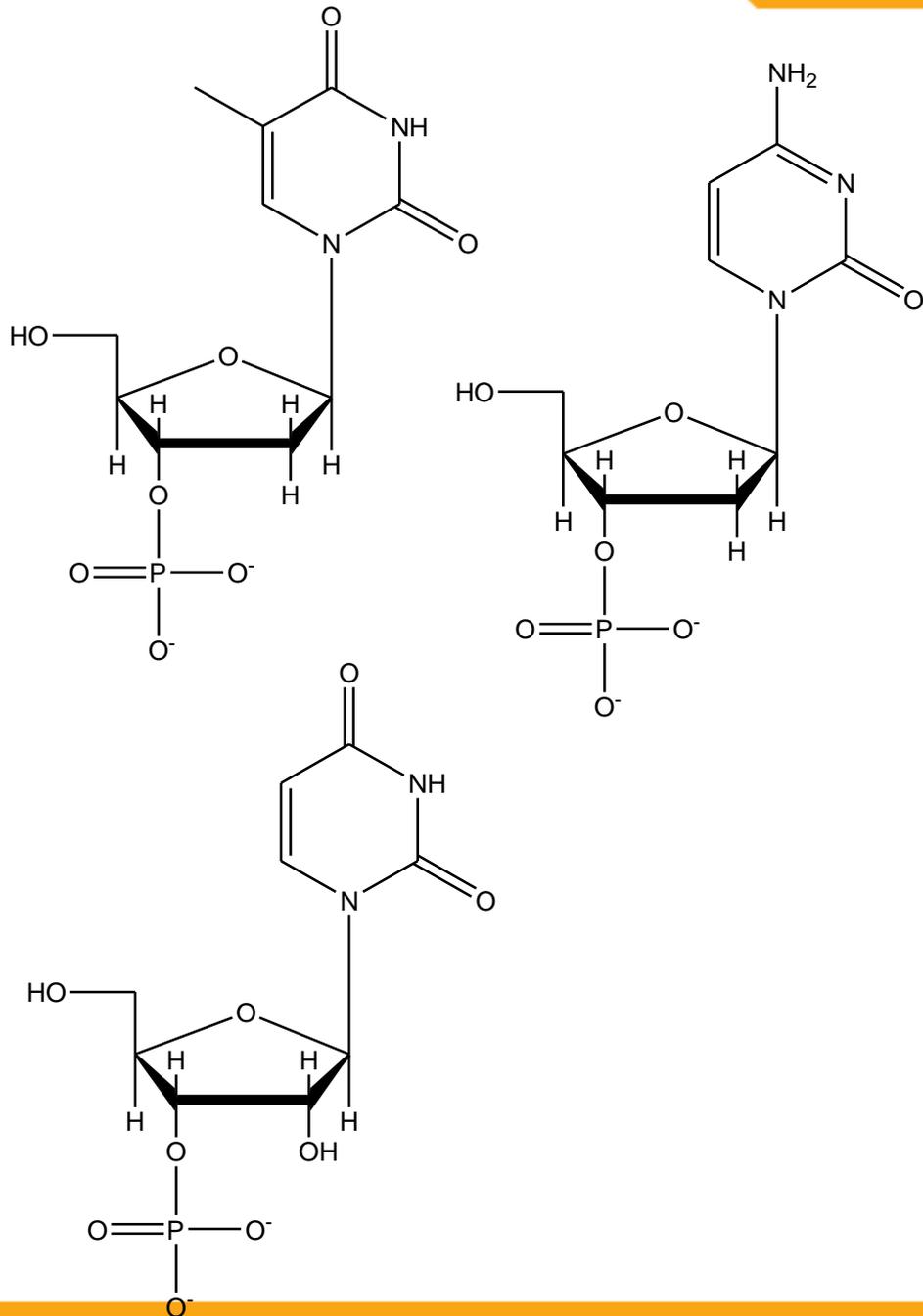
Mannose



Spot the  
similarity



Monosaccharide



Spot the  
similarity

DNA & RNA

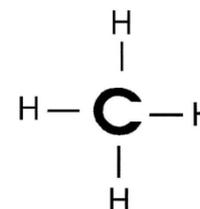
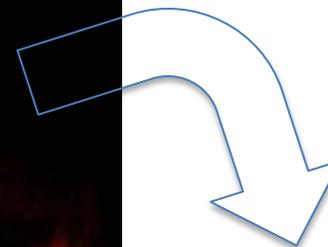
# Structure of amino acid, monosaccharide, DNA and RNA composed of organic compound

Similarity:

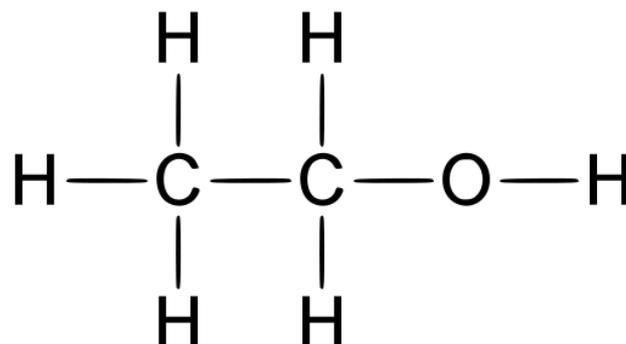
- C-H
- C-C

## Characteristics features of organic compounds

- Examples
  - Methane

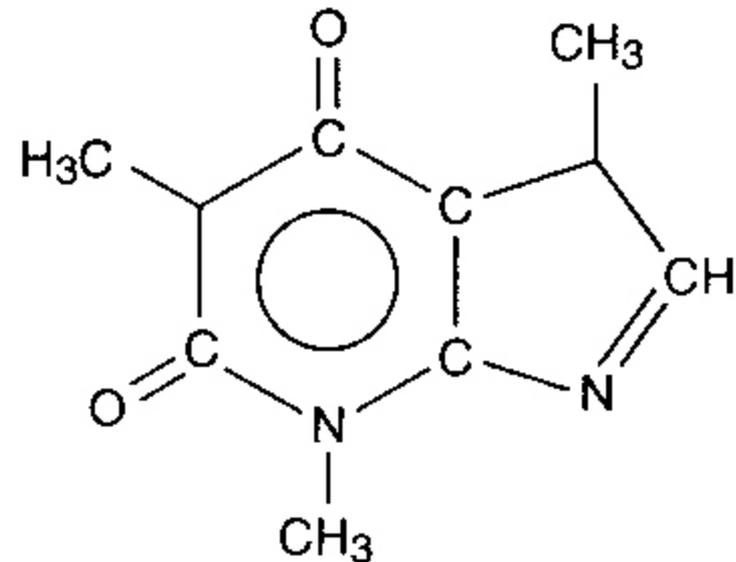


- Ethanol



## Characteristics features of organic compounds

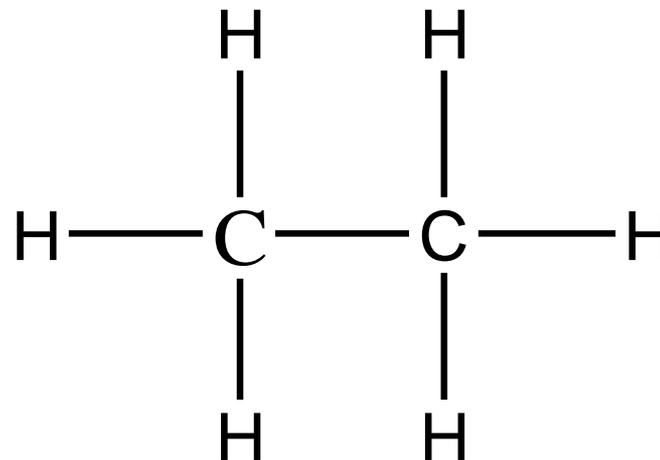
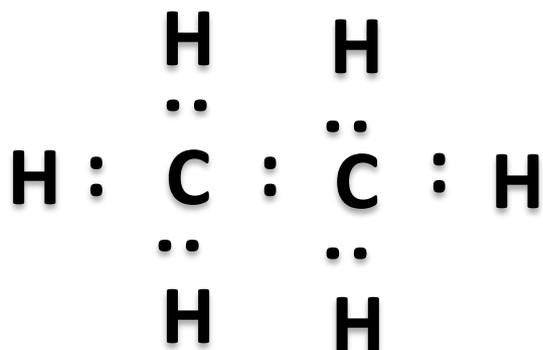
- Caffeine



## Characteristics features of organic compounds

Organic compounds = Carbon (C) + Hydrogen (H)

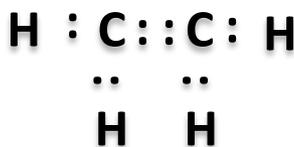
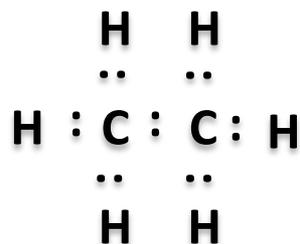
- C  $\rightarrow$  4 covalent bonds.
- H  $\rightarrow$  one covalent bond.



## Characteristics features of organic compounds

### Bonding of carbon-carbon:

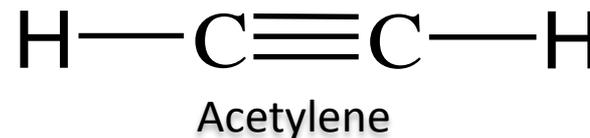
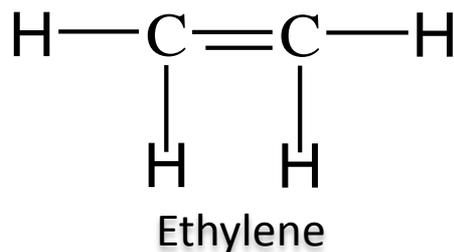
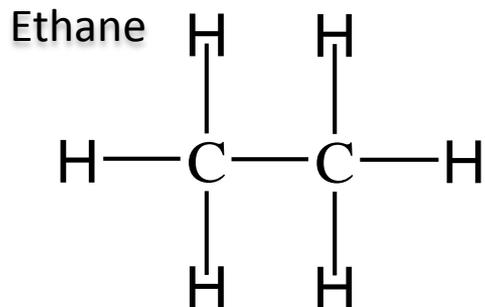
- single, double or triple.



Each C forms four  
single bonds

A double bond  
contains four  
electrons

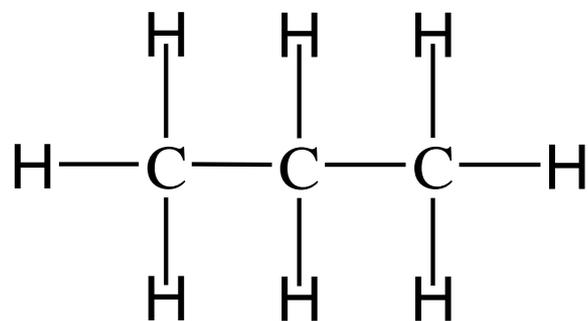
A triple bond  
contains six  
electrons



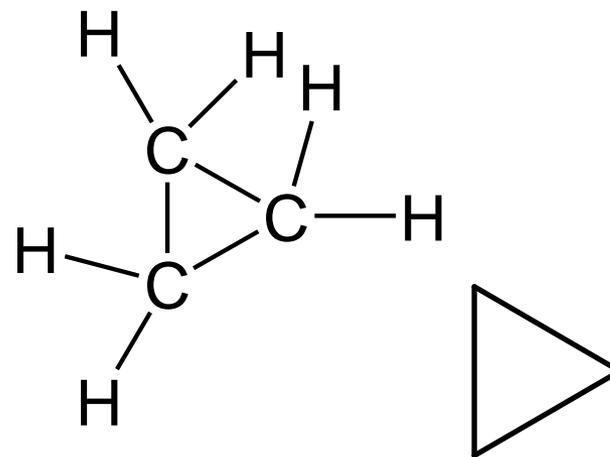
## Characteristics features of organic compounds

### Organic compounds:

- Chain (acyclic) or cyclic

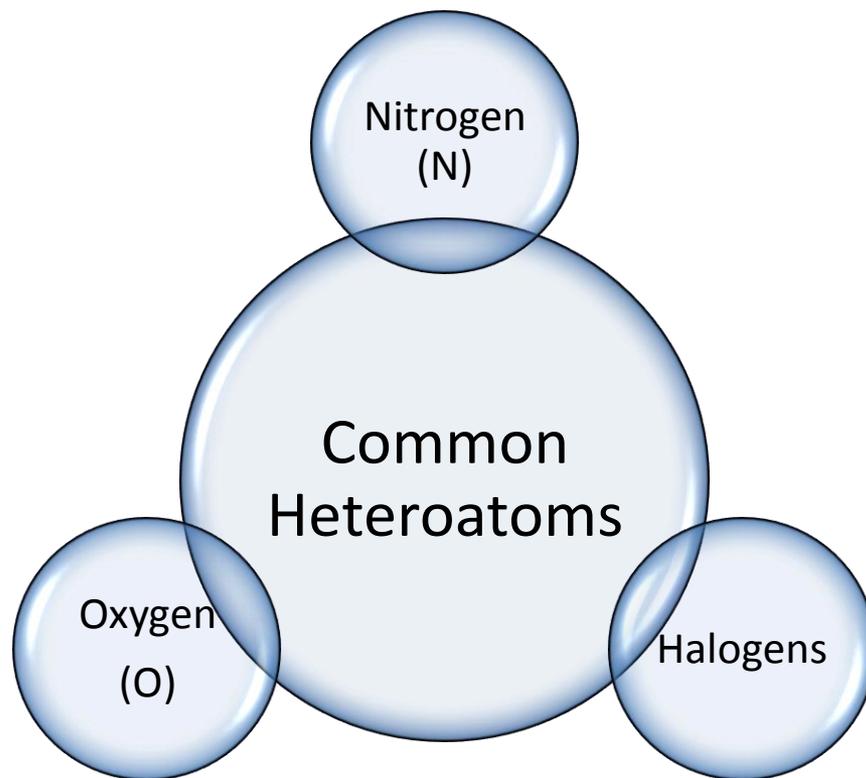


Propane



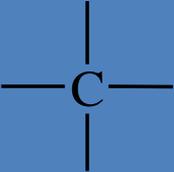
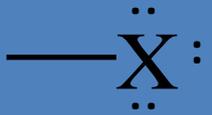
Cyclopropane

## Characteristics features of organic compounds



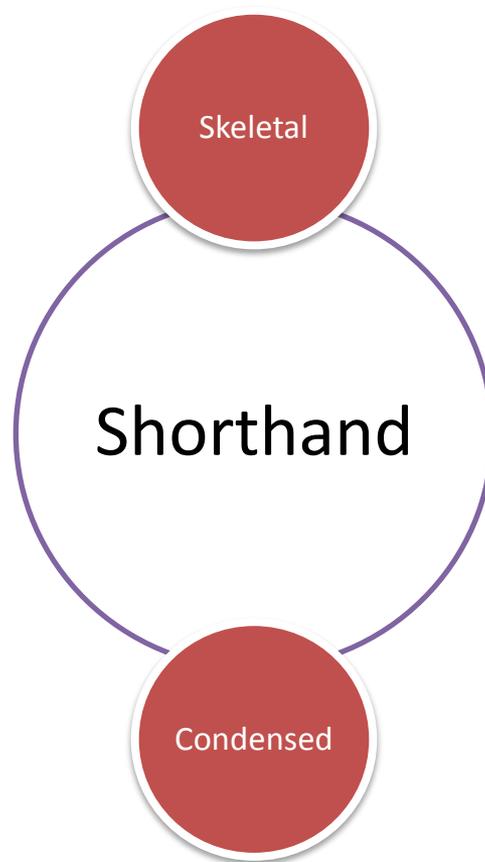
## Characteristics features of organic compounds

- Typical bonding patterns

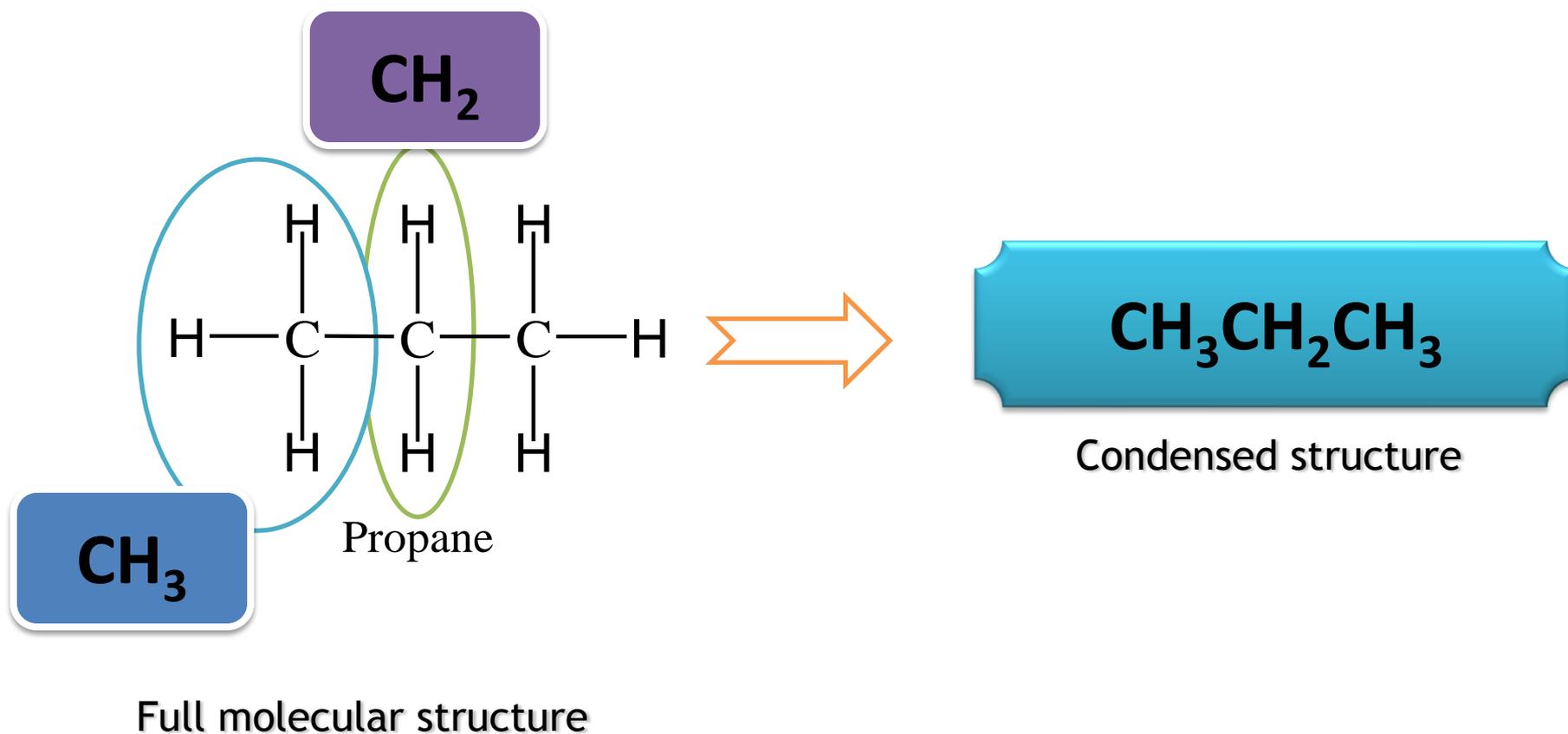
					 <b>X : F, Cl, Br, I</b>
	Hydrogen	Carbon	Nitrogen	Oxygen	Halogen
Number of bonds	1	4	3	2	1
Number of nonbonded electron pairs	0	0	1	2	3

# Drawing Organic Molecules

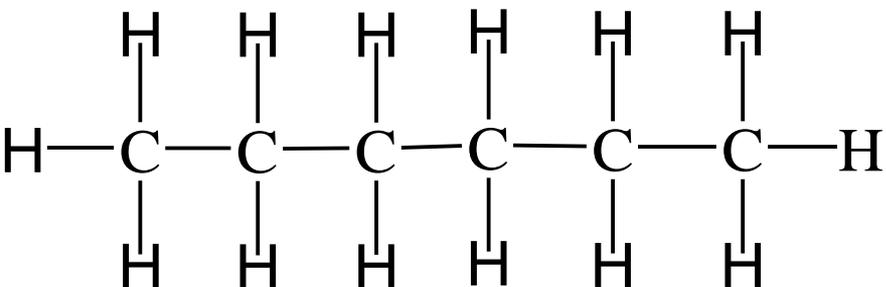
Because organic molecules often contain many atoms  
→ shorthand methods to simplify their structure.



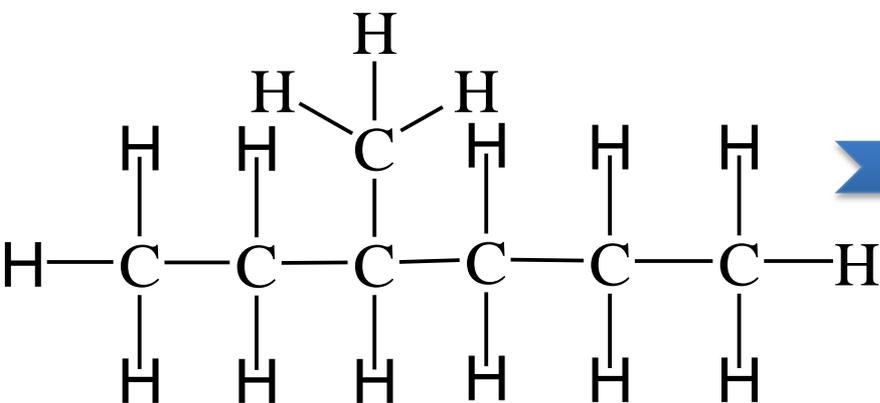
# Condensed structures



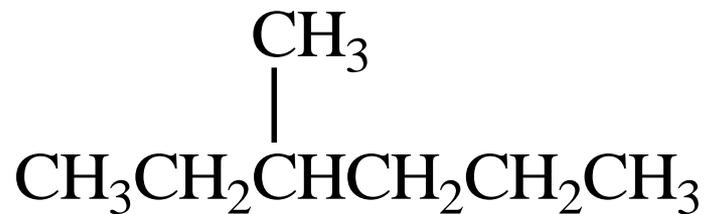
# Condensed structures



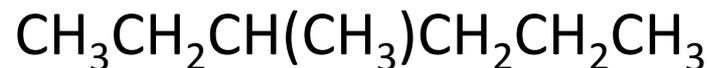
Or



Full molecular structure

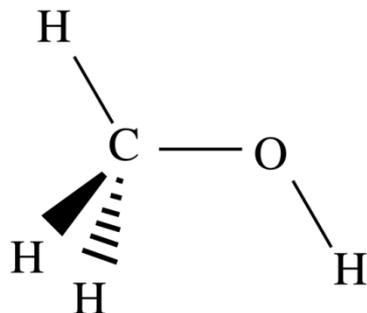
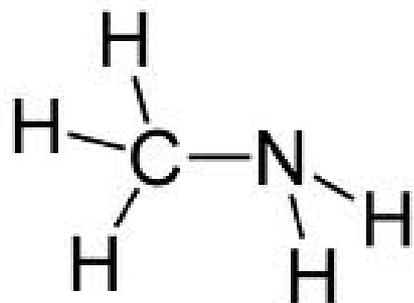


Or



Condensed structure

# Condensed structures



Full molecular structure

Condensed structure

# Skeletal Structure

Assume there is carbon atoms at the junction of any two lines or at the end of any lines.

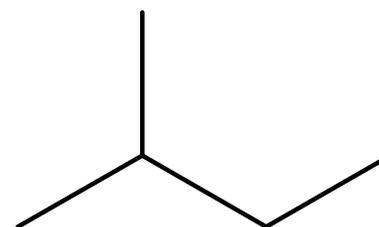
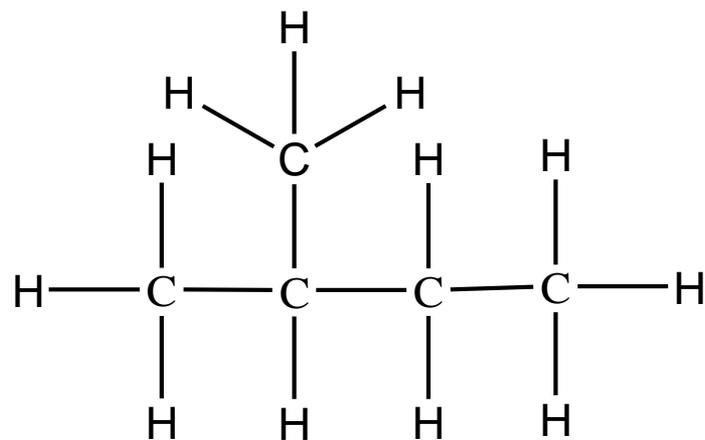
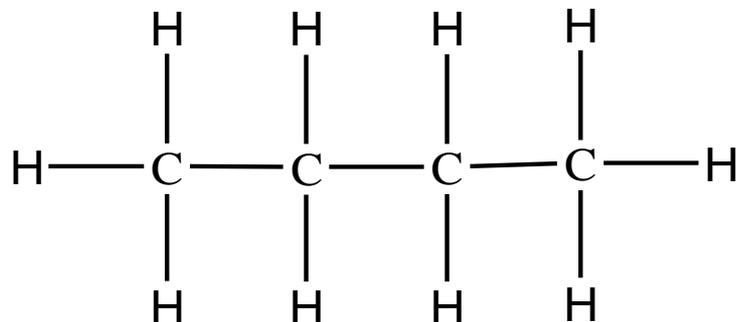


Assume there are enough hydrogens around each carbon to give it four bonds.



Draw in all heteroatoms and the hydrogens directly bonded to them.

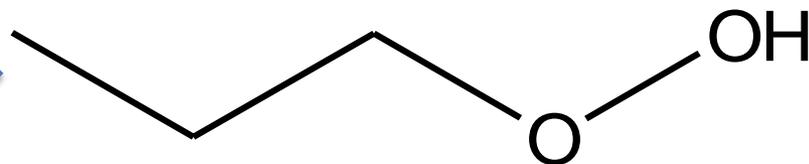
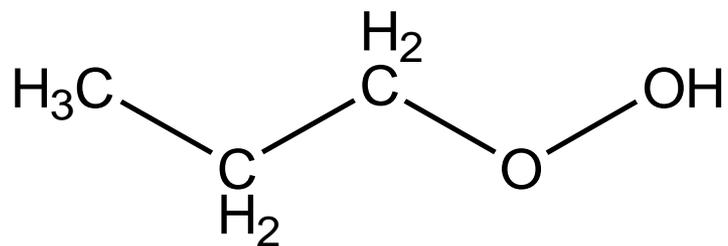
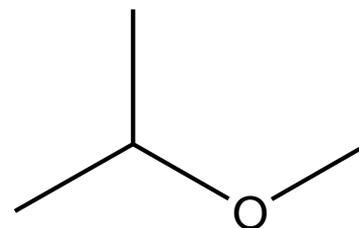
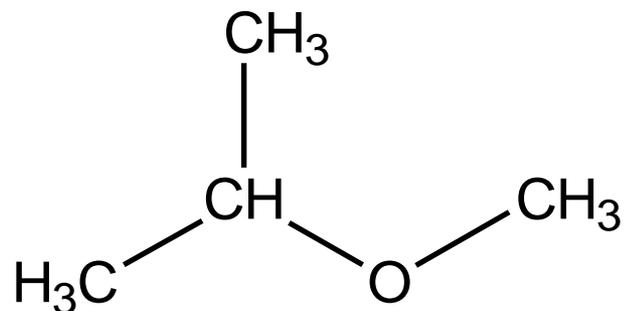
# Skeletal Structure



Full molecular structure

Skeletal structure

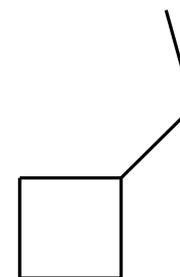
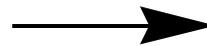
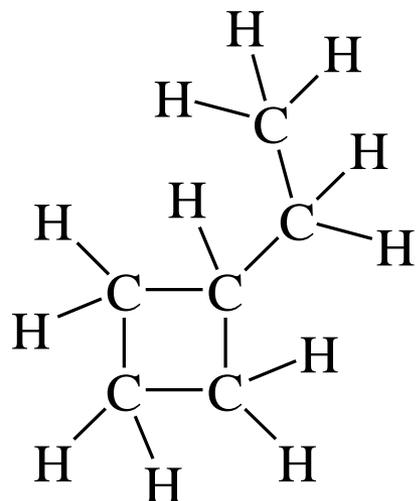
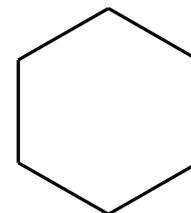
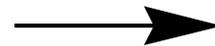
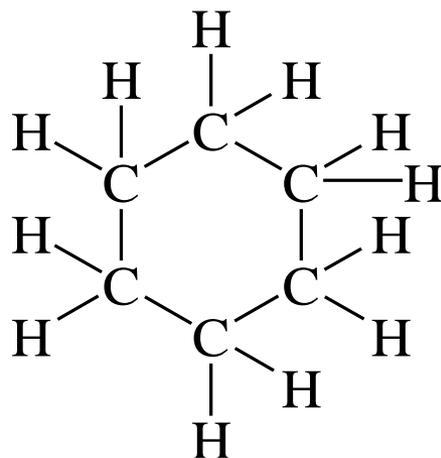
# Skeletal Structure



Full molecular structure

Skeletal structure

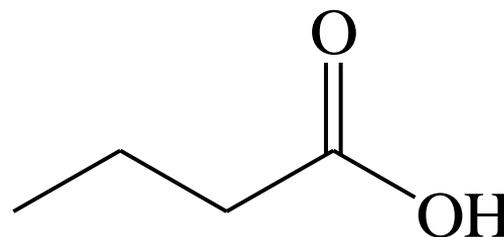
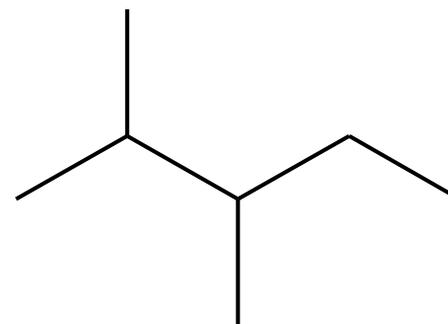
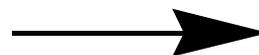
# Skeletal Structure



Full molecular structure

Skeletal structure

# Condensed Structure and Skeletal Structure



Condensed structure

Skeletal structure

# REFERENCES

- Crowe, J., Bradshaw, T. and Monk, P. (2006), *Chemistry for the Biosciences: The Essential Concepts*, Oxford University Press, Oxford.
- Horton, H.R., Moran, L.A., Scrimgeour, K.G., Perry, M.D. and Rawn J.D. (2006). *Principles of Biochemistry*, 4<sup>th</sup> Edition. Pearson International Edition.
- Smith, J.G. (2010). *General, Organic and Biological Chemistry*. McGraw-Hill Higher Education.
- Denniston, K.J., Topping, J.J. and Caret, R.L. (2008). *General, Organic and Biochemistry*, 6<sup>th</sup> edition. McGraw-Hill Higher Education.

# MY PROFILE



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