Chemistry 11 Name: _____

An Introduction to Organic Chemistry

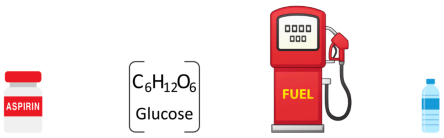
What is Organic Chemistry?

- Organic chemistry is the study of compounds that contain _____ atoms bonded to hydrogen, and often to oxygen, nitrogen, halogens, and other elements.

- Why Carbon?
  - Carbon forms 4 strong _____ bonds.
  - Can form chains, rings, and complex structures.
  - Found in living organisms and many synthetic materials.

Importance of Organic Chemistry

- Basis of _____ molecules: carbohydrates, proteins, lipids, nucleic acids
- Used in medicine (pharmaceuticals), fuels (gasoline, propane), and materials (plastics, fabrics)
- Essential for understanding life processes and modern technology

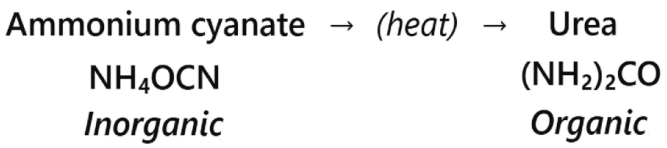


Vitalism Theory (Pre-1800s)

- Scientists believed that organic compounds could only be made by living organisms.
- They thought living cells had a special “vital force” necessary to make these substances.
- This made people believe lab _____ of organic compounds was impossible

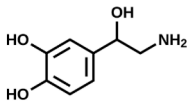
Friedrich Wöhler’s Discovery (1828)

- Friedrich Wöhler accidentally synthesized urea (an organic compound found in urine) by heating ammonium cyanate, an inorganic salt.
- This shocked the scientific community—it showed that _____ compounds could be made in the lab.
- This marked the beginning of modern organic chemistry.



Organic vs. Inorganic

Organic Compounds	Inorganic Compounds
Contains carbon-hydrogen (C-H) bonds	Usually don't contain C-H bonds
Often found in living organisms	Often from non-living sources
Can be large and complex	Often smaller, simpler



Bonding in Organic Molecules

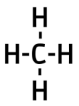
- Carbon can form:
  - Single bonds (alkanes)
  - Double bonds (alkenes)
  - Triple bonds (alkynes)
- Bonding types influence:
  - Shape of molecule
  - Reactivity
  - Physical _____ (boiling point, solubility, etc.)

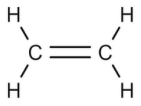
Hydrocarbons

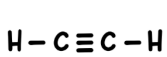
- Hydrocarbons are molecules made of only _____ and hydrogen.
- All atoms are bonded to each other by covalent bonds
- Divided into 2 classes:

Aliphatics

- Alkanes – single bonds only
- Alkenes – at least one double bond
- Alkynes – at least one triple bond

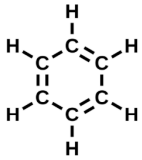




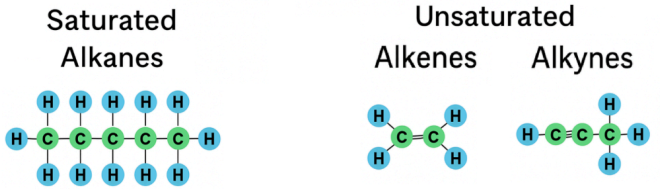


Aromatics

- Aromatic rings - often benzene



- Can be saturated or unsaturated:
  - *Saturated:* contain only single C-C bonds
  - *Unsaturated:* contain at least one double or triple C-C bond therefore fewer hydrogen atoms are attached than if all C-C bonds were single.



Aliphatics

- Basis of _____ molecules: carbohydrates, proteins, lipids, nucleic acids
- Used in medicine (pharmaceuticals), fuels (gasoline, propane), and materials (plastics, fabrics)
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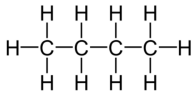
Type	General Formula	"Suffix"	C-C bond
Alkane	C_nH_{2n+2}	ane	All single
Alkene	C_nH_{2n}	ene	one double
Alkyne	C_nH_{2n-2}	yne	one triple
*Cycloalkane	C_nH_{2n}	ane	All single
*Cycloalkene	C_nH_{2n-2}	ene	One double

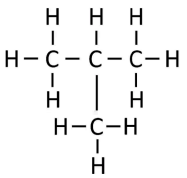
* For cyclic aliphatics, the prefix "cyclo" is used

Different Forms

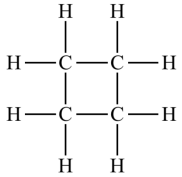
- Straight Chain: one continuous chain
  - eg. Butane, C_4H_{10}



- Branched Chain:
  - contains at least one _____ *(substituent)* which takes the place of a Hydrogen atom
  - substituent can be an alkyl group (eg. methyl = CH_3) or a halogen atom
  - eg. Methylpropane, C_4H_{10}



- Cyclic hydrocarbon: has a closed ring
  - eg. Cyclobutane, C_4H_8

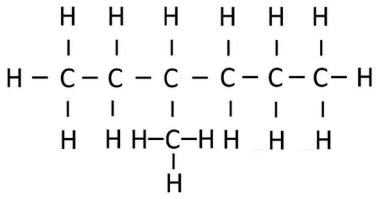


Chemistry 11 Name: _____

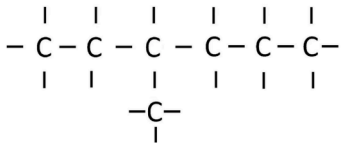
Representing Organic Compounds

Example: 3-methylhexane

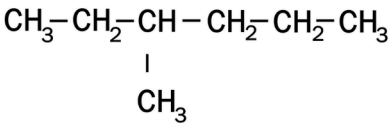
Complete Structural Diagram



Skeleton Structural Diagram



Condensed Structural Diagram



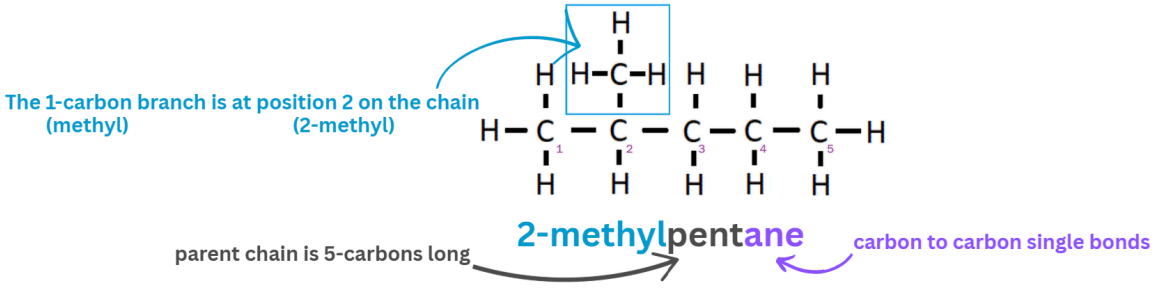
Line Structural Diagram

Prefixes used in Naming Hydrocarbons

# C atoms	1	2	3	4	5	6	7	8	9	10
Prefix	*meth*	*eth*	*prop*	*but*	*pent*	*hex*	*hept*	*oct*	*non*	*dec*

Naming Organic Compounds (IUPAC Basics)

- Prefix = number of carbon atoms (meth-, eth-, prop-, but-, pent-, etc.)
- Suffix = type of bonds or functional group
  - -ane (alkane)
  - -ene (alkene)
  - -yne (alkyne)
- Number the carbon chain to give _____ possible numbers to double/triple bonds or branches



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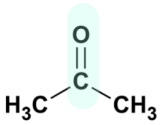
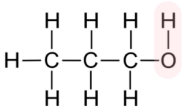
Functional Groups (Preview)

- Functional groups are specific atoms or groups that change the _____ of organic molecules.
- Examples:
  - Hydroxyl (-OH) → alcohols
  - Carboxyl (-COOH) → carboxylic acids
  - Amino ($-NH_2$) → amines
  - Halides (-Cl, -Br, -I)



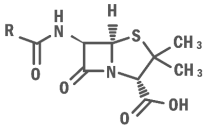


Physical Properties of Organic Compounds

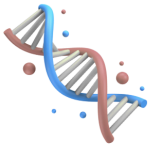
1. Boiling and Melting Points
   - As the number of carbon atoms _____, so do the boiling and melting points.
2. Intermolecular Forces
   - Dispersion Forces increase with molecular size and number of electrons, making larger molecules harder to separate.
3. Physical State by Carbon Count
   - Small hydrocarbons = gases (1–4 carbons)
   - Medium-sized = liquids (5–16 carbons)
   - Large molecules = solids (17+ carbons)

Real-Life Applications

- Pharmaceuticals: aspirin, _____
- Fuel sources: methane, gasoline
- Household: rubbing alcohol, vinegar
- Biochemistry: DNA, proteins



Penicillin



Safety with Organic Compounds

- Many are _____ – handle with care
- Use in well-ventilated spaces
- Always wear gloves and goggles
- Dispose of according to lab protocol