

Chemistry 12 - Organic Families

Chapter 6.1 Organic families

1. Can organic compounds be made from inorganic compounds? Give an example.

2. What percentage of chemical compounds are organic compounds? _____

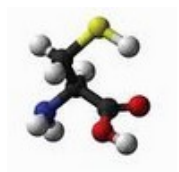
3. Explain the difference between synthetic and natural organic compounds.

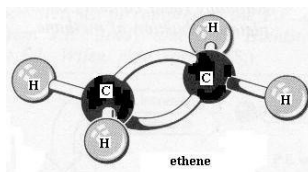
4. Explain why the **type of atoms present** in a molecule as well as their **overall shape** is so significant to the chemistry of organic substances.

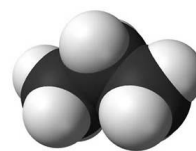
5. What determines the 'family' that a particular organic substance belongs to? Name three families.

6. Why is it helpful to know what family a molecule belongs to?

7. Why is the ball and stick model preferred over the space filled model? Identify each of the types of models from the pictures below.







8. Why is the space filled model actually more realistic even though organic chemists prefer ball and stick?

9. Fill in the table below.

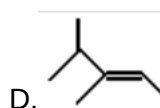
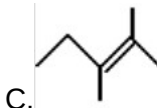
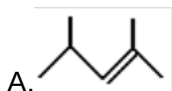
Bonds around C atom	Geometric Shape	Geometric shape and angles between bonds
Four single bonds		
One double bond and two singles		
Two double bonds		
One triple bond and one single		

Chapter 6.2 Hydrocarbons and 6.3 Branched Chain Hydrocarbons (Two Chapters Combined)

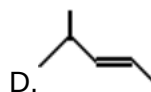
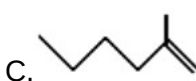
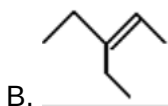
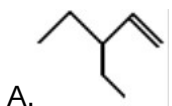
10. What is a hydrocarbon? Give some examples.

11. Practicing alkene nomenclature:

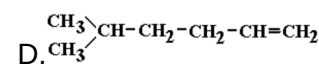
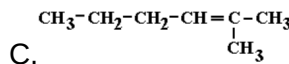
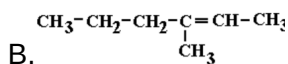
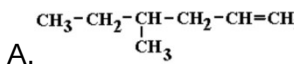
i. Which of the molecules below is 3,4-dimethylpent-2-ene?



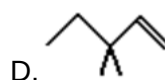
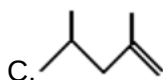
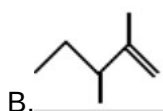
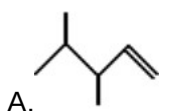
ii. Which molecule is 3-ethylpent-2-ene?



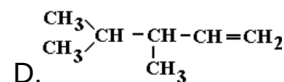
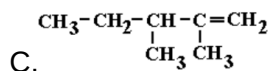
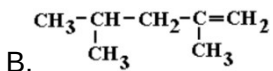
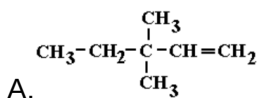
iii. Which molecule is 5-methylhex-1-ene?



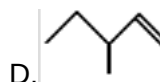
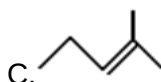
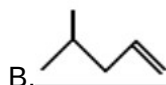
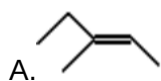
iv. Which molecule is 3,3-dimethylpent-1-ene?



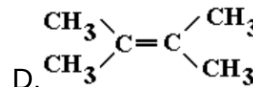
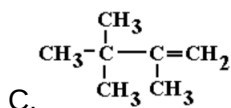
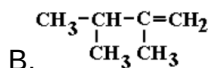
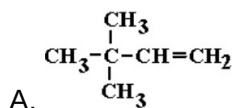
v. Which molecule is 3,4-dimethylpent-1-ene?



vi. Which molecule is **2-methylpent-2-ene**?



vii. Which molecule is **2-methylbut-2-ene**?



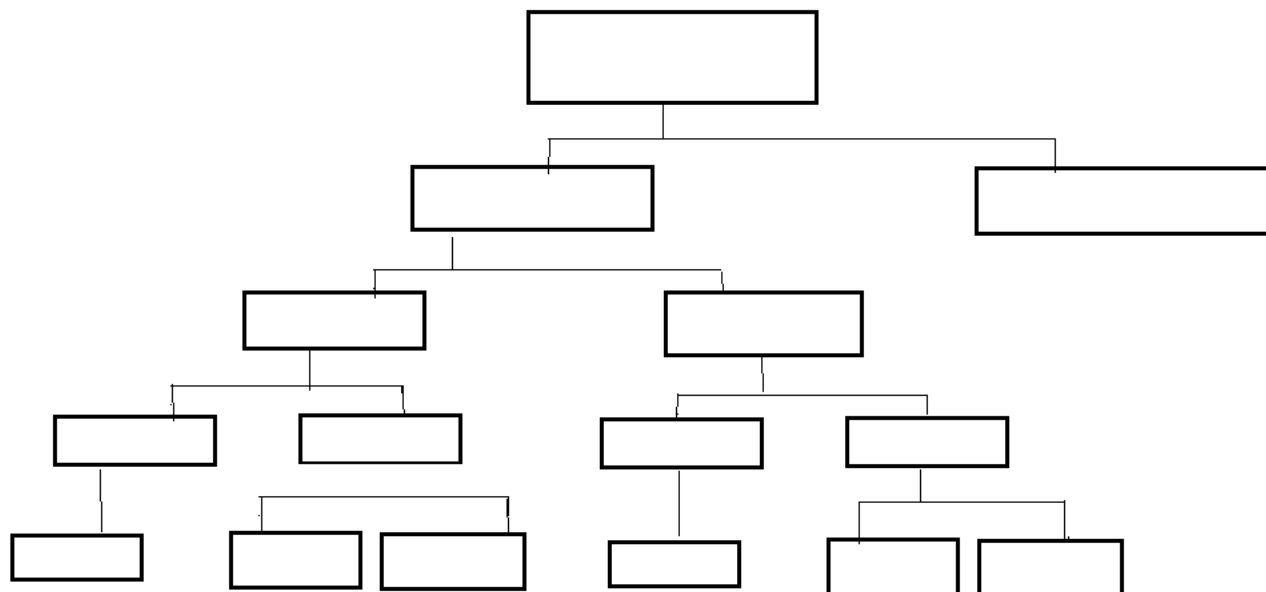
12. Name the following molecules.



13. Fill in the table below.

Use the word bank: (some words are used more than once)

Saturated, Hydrocarbons, Unsaturated, Alkanes, Cycloalkanes, Aliphatics, Cycloalkenes, Alkynes, Chain, Alkanes, Cycloalkynes, Cyclic, Aromatics



14. Naming of alkane side groups

No. of C	1	2	3	4	5	6	7	8	9	10
Stem name										

Other common side groups are:

Side group	F	Cl	Br	I	NO ₂
Name of side group					

15. Naming alkanes, alkenes and alkynes

a) Look for a functional group (i.e. double bond or triple bond).

b) Look for the longest chain attached to this functional group and start numbering such that the functional group has the lowest number in this longest chain.

c) Determine the location (carbon number) of all the side groups and start the naming of the compound with the side group that is closest to the start of the alphabet. Put commas between numbers and a dash between words and numbers. Notice it is the name of the side group not the di, tri etc. that determines the order in a name.

i.e. 1,2,2-tribromo-3,3-dimethyl hexane

16. Classify the compound then name it.

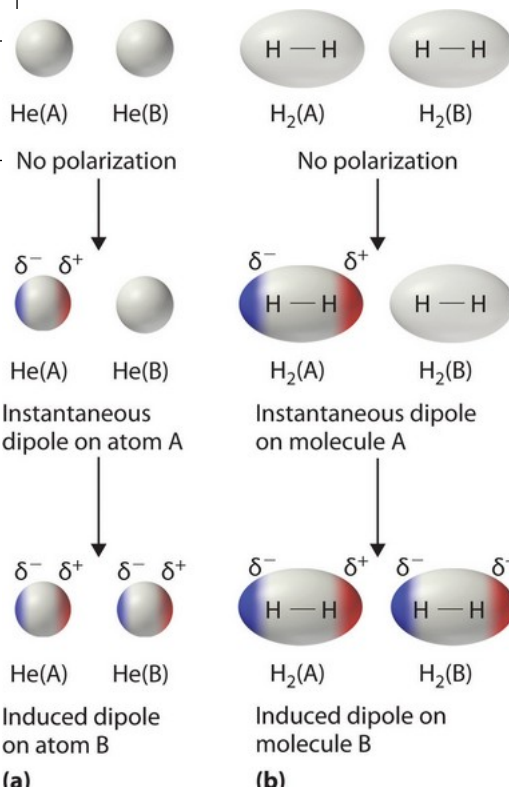
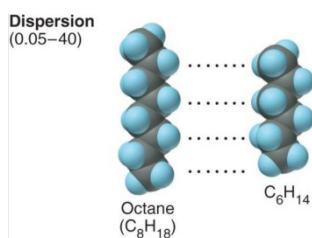
Compound	Aromatic/ Aliphatic	Chain/Cyclic	Saturated/ Unsat	Name
$\text{CH}_3 - \text{C} \equiv \text{C} - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_2 - \text{CH}_3$				
$\text{CH}_3 - \underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{C}}} - \text{CH}_2 - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_3$				
$\text{CH}_3 - (\text{CH}_2)_6 - \text{CH}_3$				
$\text{CH}_2 = \underset{\text{CH}_3}{\text{C}} - \text{CH}_3$				

Practice naming aliphatics and aromatics

at: http://hrsbstaff.ednet.ns.ca/benoitn/chem11/units/4.%20Organic/unit_organic.htm

Structure and Bonding of Hydrocarbons

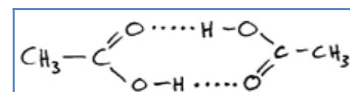
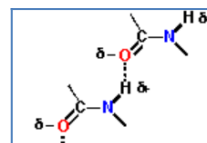
17. What are dispersion forces? How does this type of force relate to hydrocarbons.



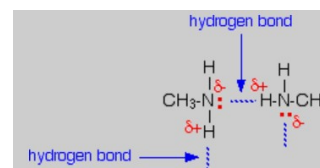
18. Are dispersion forces, intramolecular or intermolecular forces.

19. Explain what a non-polar molecule is and why dispersion forces are important to non-polar molecules.

20. What types of atoms inside organic compounds can cause hydrogen bonding forces to occur.



21. Are hydrogen bonding forces stronger or weaker than dispersion forces?



22. Explain how the additional effect of hydrogen bonding could affect properties such as melting and boiling point, and solubility in water.

23. Explain how size of a hydrocarbon could affect melting and boiling point as well as solubility if it is a substance that can undergo hydrogen bonding.

Alkane	Boiling point (°C)	Alcohol	Boiling point (°C)
methane	- 164	methanol	65
ethane	- 89	ethanol	79
propane	- 42	1-propanol	97
butane	- 0,5	1-butanol	117
pentane	36	1-pentanol	138
hexane	69	1-hexanol	156

24. Which compound in each pair would be more soluble in water? Explain your answer.

a) Ethanol or ethane?

b) Ethanoic acid or ethanol?

c) Ethane or Hexane?

25. Which organic compound would have a higher density and which will have a lower boiling point?
Explain your answer.

a) 2,2 dimethyl butane or butane?

b) Oxalic acid or pentane?

Isomers of Alkenes

26. Describe the difference between a structural isomer and a geometric isomer.

27. Draw four structural isomers of C_5H_{12} and name these isomers



28. Draw two geometric isomers of C_3H_6



29. Draw both structural and geometric isomers of C_4H_8

30. State the difference between cis and trans.

31. Look at the data below for cis and trans but-2-ene and identify which geometric isomer is more tightly packed and has stronger dispersion forces and why dispersion forces might be higher.

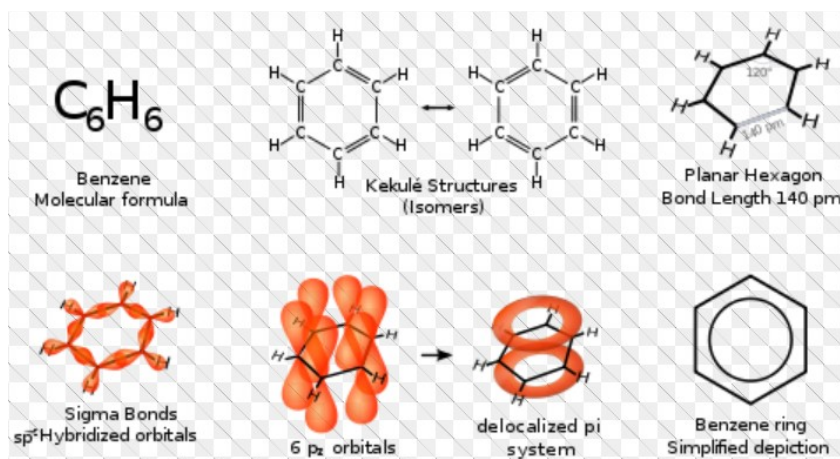
Compound	Melting pt. (°C)	Boiling pt. (°C)	Density (g/mL)
Cis-but-2-ene	-139	4	0.615
Trans-but-2-ene	-105.6	1	0.598

32. Comparing and contrasting the properties of Alkanes, Alkenes and Alkynes

Property	Alkane	Alkene	Alkyne
Electrical conductivity			
Melting and Boiling pt.	<hr/> <hr/> <hr/> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/> <hr/>
Solubility	<hr/> <hr/>	<hr/> <hr/>	<hr/> <hr/>
Combustion reaction			
Substitution reaction	<hr/> <hr/> <hr/> <hr/> <hr/>		
Addition reactions		<hr/> <hr/> <hr/> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/> <hr/>

Chapter 6.4 Aromatic Hydrocarbons





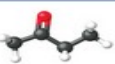




33. Describe some of the unique features of the benzene ring found in all aromatics.



34. Describe how the unique features of benzene affect the reactions aromatic substances undergo.

Chapter 6.5 Functional Groups:

35. It is important to be able to identify the following functional groups. Remember the functional group determines what you will consider to be the longest chain and will affect the ending of the substances name.

Compound Name	Structure of Compound and Functional Group (red)	Example	
		Formula	Name
	$C=C$	C_2H_4 	ethene
	$C\equiv C$	C_2H_2 	ethyne
	$R-\ddot{O}-H$	CH_3CH_2OH 	ethanol
	$\begin{array}{c} :O: \\ \\ R-C-H \end{array}$	CH_3CHO 	ethanal
	$\begin{array}{c} :O: \\ \\ R-C-R' \end{array}$	$CH_3COCH_2CH_3$ 	methyl ethyl ketone
	$\begin{array}{c} :O: \\ \\ R-C-\ddot{O}-H \end{array}$	CH_3COOH 	acetic acid
	$\begin{array}{c} :O: \\ \\ R-C-\ddot{O}-R' \end{array}$	$CH_3CO_2CH_2CH_3$ 	ethyl acetate
	$R-\ddot{N}-H \quad R-\ddot{N}-H \quad R-\ddot{N}-R''$ $\quad \quad \quad \quad \quad \quad \quad \quad \quad $ $\quad \quad \quad H \quad \quad \quad R' \quad \quad \quad R'$	$C_2H_5NH_2$ 	ethylamine
	$\begin{array}{c} :O: \\ \\ R-C-\ddot{N}-R' \\ \quad \quad \\ \quad \quad H \end{array}$	CH_3CONH_2 	acetamide

36. Fill in the table below.

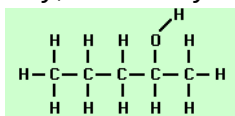
Substances configuration	Priority Functional Group	Name
$\begin{array}{c} H-C-OH \\ \\ O \end{array}$		
$\begin{array}{c} H \\ \\ N-CH_2-CH_2-H \\ \\ H_3C \end{array}$		
$\begin{array}{c} O \\ \\ H_3C-C-H \end{array}$		
$CH_3-CH_2-\underset{\substack{ \\ OH}}{CH}-CH_2-CH_2-CH_3$		
$\begin{array}{c} H_3C \\ \diagdown \\ N-H \\ \diagup \\ H_3C \end{array}$		
$\begin{array}{c} CH_3-C-OCH_3 \\ \\ O \end{array}$		
$\begin{array}{c} O-CH_3 \\ \\ H_3C-C=O \end{array}$		

$ \begin{array}{c} \text{F} \\ \\ \text{F}-\text{C}-\text{C}-\text{OH} \\ \quad \\ \text{F} \quad \text{O} \end{array} $		
$ \begin{array}{c} \text{H} \\ \\ \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3 \\ \\ \text{OH} \end{array} $		
$ \begin{array}{c} \text{H}_3\text{C} \\ \diagdown \\ \text{C}=\text{O} \\ \diagup \\ \text{H}_3\text{C} \end{array} $		
$ \begin{array}{c} \text{O} \quad \quad \text{O} \\ \diagdown \quad \diagup \\ \text{C}-\text{C} \\ \diagup \quad \diagdown \\ \text{HO} \quad \text{OH} \end{array} $		
$ \begin{array}{c} \text{O} \\ \\ \text{H}-\text{C}-\text{C}_6\text{H}_5 \end{array} $		
$ \begin{array}{c} \text{O} \\ \\ \text{H}_3\text{C}-\text{C}_{\text{H}_2}-\text{C}_{\text{H}_2}-\text{C}-\text{N}-\text{CH}_2\text{CH}_3 \\ \quad \quad \\ \quad \quad \text{H} \end{array} $		

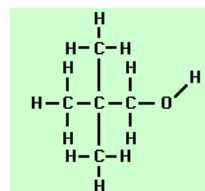
37. Describe the difference between a primary, secondary and tertiary alcohol.

38. Identify whether the following alcohols are primary, secondary or tertiary alcohols.

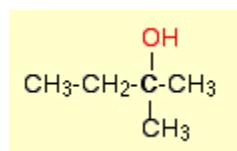
a) _____



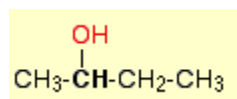
b) _____



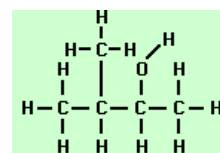
c) _____



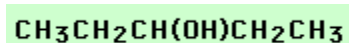
d) _____



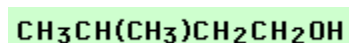
e) _____



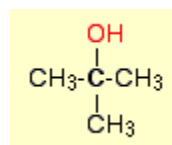
f) _____



g) _____



h) _____



39. Compare and contrast the melting point, boiling point and solubility in water of the following compounds.

Organic Compound	Melting Point (M.P.) and Boiling Point (B.P.)	Solubility in Water
Butane		
1-Butanol or But-1-ol		
2-Butanol or But-2-ol		
But-1,4-diol		
2-Methyl-2-propanol		
Organic Compound	Melting Point (M.P.) and Boiling Point	Solubility in Water

	(B.P.)	
Butanal		
2-Butanone or But-2-one		
Butanoic acid		
Ethylethanoate		
1-butanamine		
Organic Compound	Melting Point (M.P.) and Boiling Point (B.P.)	Solubility in Water

Ethylethanamide		
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40. a) Rank the following organic compounds in the order of their decreasing reactivity with sodium.

Butane, 1-Butanol, 2-Butanol, But-1,4-diol (1,4-Butanol), 2-methyl-2-propanol

_____ > _____ > _____ > _____

b) Rank the following organic compounds in the order of their decreasing reactivity with an oxidizing agent such as acidified dichromate ions.

Propane, 1-Propanol (or Prop-1-ol), 2-Propanol (or Prop-2-ol or Isopropanol (CH₃)₂CHOH)

_____ > _____ > _____

41. Review the rules for naming substances using p. 92 of the WACE Study Guide.

Note: The main thing to add to what the students learned last year is the order of priority for naming substances. For example if a substance has a carboxyl group than the longest chain attached to the carboxyl group determines that end part of the substances name. The priority is:

- | | |
|--------------------|-----------------------------|
| 1. Carboxylic acid | 5. Alcohols |
| 2. _____ | 6. Amines |
| 3. Aldehydes | 7. Alkenes and Alkynes |
| 4. Ketones | 8. Alkyl groups and halides |