

CHEMISTRY 11 UNIT REVIEW:

Organic Chemistry



Name: _____

Answer Key

Block: _____

TEST DATE: _____

Oct 18th + 19th

A. Give short answers to the following (be careful to give what is asked for):

1. Non-cyclic hydrocarbons having only single C-C bonds are called

1. *alkanes*

2. Draw the structure that is common to all aromatic hydrocarbons

2.  *(benzene)*

3. Give the formula for the simplest alkene

3. *C₂H₄*

4. 2-methylbutane and pentane are related to each other; they are ? of each other

4. *isomers*

5. Give the formula for the simplest alkene to have geometric isomers

-butene

5. *C₄H₈*

6. Name the simplest alcohol that has structural isomers

6. *propanol*

7. Large molecules formed by a simple unit repeating over and over are called

7. *polymers*

8. Organic compounds typically have low melting points. True or false?

8. *True (due to covalent bonds)*

9. A hydrocarbon having double or triple C to C bonds can have H atoms added to it. Such hydrocarbons are said to be...

9. *unsaturated*

10. Alkynes can have geometric isomers. True or false?

-cis-trans

10. *no (180° bonds)*

11. The terms *cis* and *trans* are used to distinguish between ? of a compound

11. *geometric isomers*

12. An ester is formed by the joining of an acid and a(n)

carboxylic

12. *alcohol*

13. A functional group gives molecules specific properties. True or false?

13. *True*

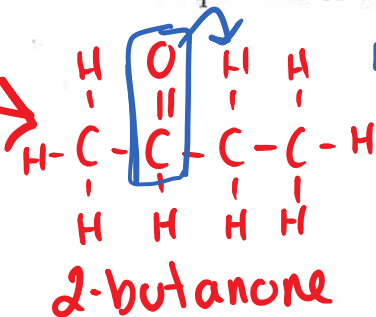
14. There is only one possible structure for butanone. True or false?

14. *True*

15. Why are there so many carbon compounds compared to compounds of other elements?

15. *• 4 bonds
• many isomers
• form long + saturated chains
• bond covalently with other atoms etc...*

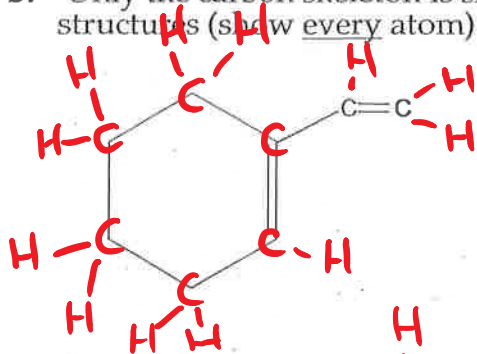
we didn't do reactions



moving the carbonyl C=O would not change number or compound.

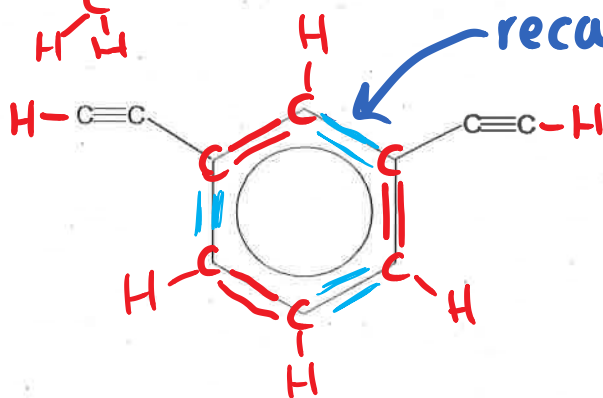
B. Only the carbon skeleton is shown for the following substances. Fully expand these structures (show every atom) and give their chemical formulas (eg. C_2H_6).

1.



Formula: $C_{10}H_{12}$

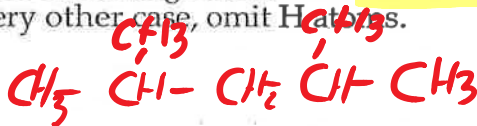
2.



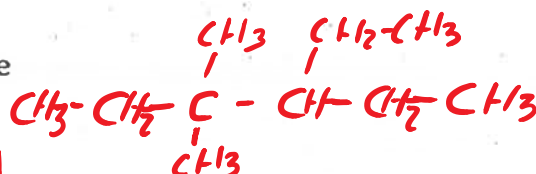
Formula: $C_{10}H_{16}$

C. Give the structural diagrams for the following substances. Show all atoms attached to the carbons of a double bond. In every other case, omit H atoms.

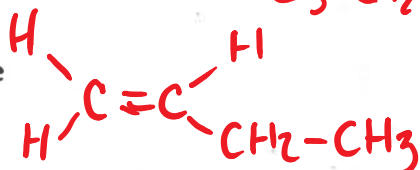
1. 2,4-dimethylpentane



2. 4-ethyl-3,3-dimethylhexane

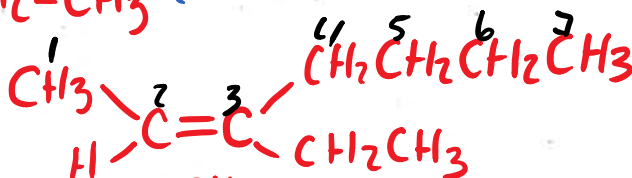


3. 1-butene

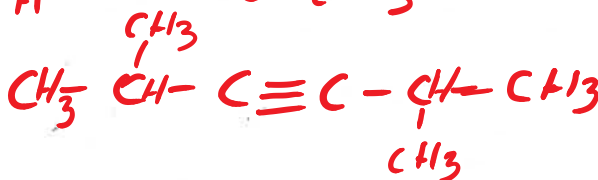


(note 1-butene is not cis or trans)

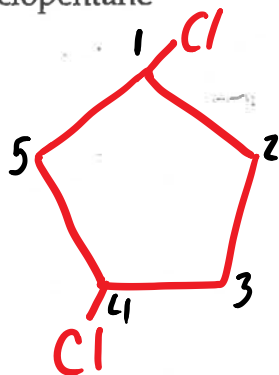
4. cis-3-ethyl-2-heptene



5. 2,5-dimethyl-3-hexyne

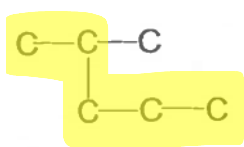


6. 1,4-dichlorocyclopentane



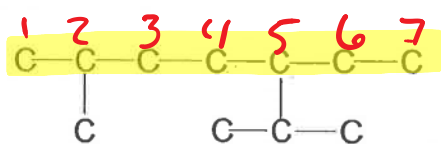
D. Name these compounds (don't forget to check for isomers where applicable):

1.



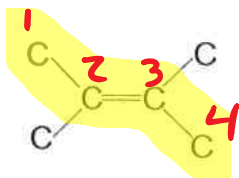
2-methylpentane

2.



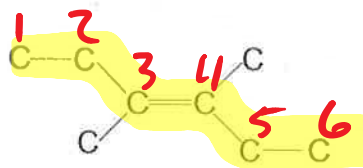
2-methyl-5-isopropylheptane

3.



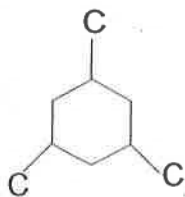
2,3-dimethyl-2-butene

4.



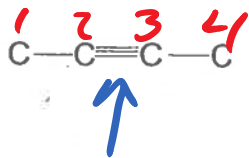
3,4-dimethyl-3-hexene

5.



1,3,5-trimethylcyclohexane

6.



2-butyne

triple
bond
= alkyne

E. For each of the following, say which functional group the compound represents and give the structural diagram of the compound. (Show carbon skeleton only-- leave H's out except those in functional groups)

1. ethanal

Functional group: aldehyde

2. propanoic acid

Functional group: carboxylic acid

3. 2-aminobutane

Functional group: amine (1°)

4. methoxyethane

Functional group: ether

5. 3,3-dimethyl-2-hexanone

Functional group: ketone

6. 1-butyl ethanoate

Functional group: ester

7. 3-methyl-3-pentanol

Functional group: alcohol

8.1 Review Questions

(answer key on following page)

1. How is a condensed structural formula different from a carbon skeleton formula? Use an example.

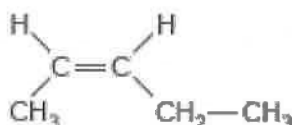
2. Draw carbon skeleton structural formulas for all of the isomers of the alkane with seven carbon atoms. Under each diagram, write the isomer's name.

3. What is the difference between a structural isomer and a geometric isomer? Use an example in your answer.

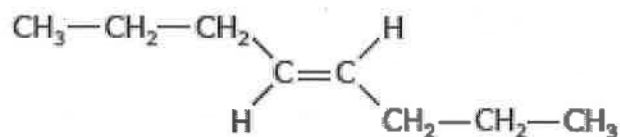
4. Draw 1-pentene. Does this molecule exhibit *cis-trans* isomerism? Explain.

5. Classify the following as being *cis* or *trans* isomers:

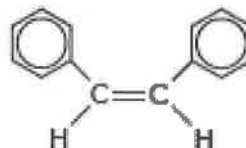
(a)



(b)



(c)



6. An important nutrient for your body is fat. Infants require a diet high in fat for brain development. Your body needs fats for energy and to dissolve certain vitamins. Fats in foods are classified as saturated, unsaturated, and polyunsaturated. Animal products contain a high level of saturated fats. What is meant by the term "saturated"?

7. (a) Unsaturated fats are generally a liquid at room temperature. What is meant by the term "unsaturated"?

(b) Which of the following are unsaturated: alkanes, alkenes, alkynes, cycloalkanes, aromatics?

8. Classify the following as alkane, alkene, alkyne, cycloalkane, or aromatic without drawing the structure. Some may have more than one classification.

(a) C_5H_{10} _____

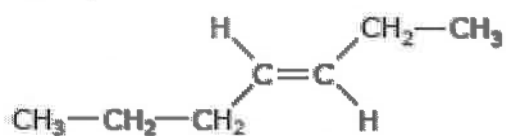
(b) $C_{15}H_{32}$ _____

(c) C_9H_{16} _____

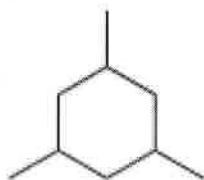
(d) C_6H_6 _____

9. Name the following compounds.

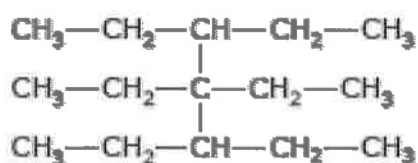
(a)



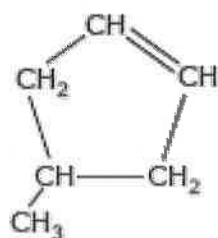
(b)



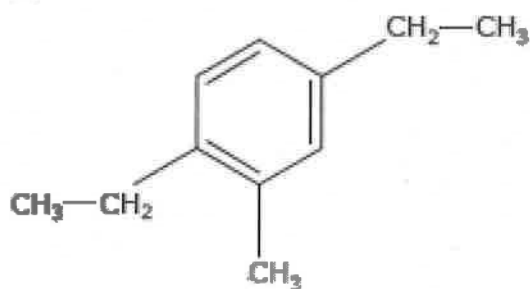
(c)



(d)



(e)



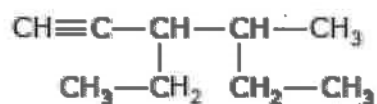
(f)



(g)



(h)



10. Draw condensed structural formulas for the following compounds.

(a) 4-ethyl-3,5-dimethylnonane

(b) 5,6-dimethyl-3-heptyne

(c) *trans*-2-heptene

(d) 1,3-dimethyl-2-propylcycloheptane

(e) 4,5,5-trimethyl-2-heptyne

(f) ethylcyclohexane

(g) 4-ethyl-3,3-dimethyloctane

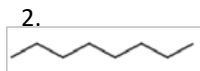
(h) 3-cyclopentyl-5,5-dimethyl-1-hexene

8.1 Review : ANSWER KEY

1. A condensed structural formula shows H atoms. A carbon skeleton formula does not. Example:



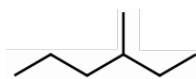
CH₃-CH₂-CH₃ versus



heptane



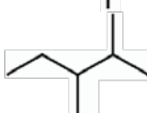
2-methylhexane



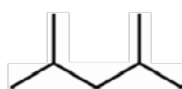
3-methylhexane



2,2-dimethylpentane



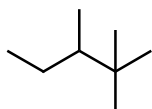
2,3-dimethylpentane



2,4-dimethylpentane



3-ethylpentane



2,2,3-trimethylpentane

10.

a-e



3. Structural isomers – organic molecules with the same chemical formula, but a different placement of atoms.

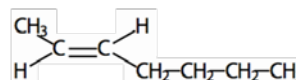
Geometric isomers – organic molecules with the same structure, but a different orientation across the double bond.

Example: C₆H₁₂

- Structural isomers: 2-methylhexene, and 3-methylhexene

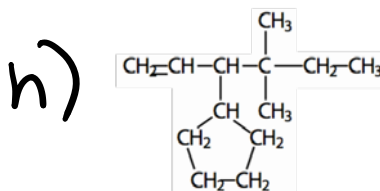
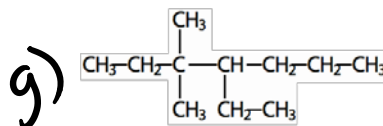
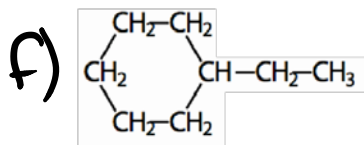
- Geometric isomers: cis-3-hexene, and trans-3-hexene

4.

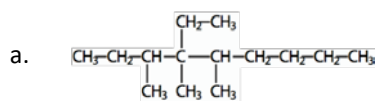


No – because of the two H atoms on the first C atom

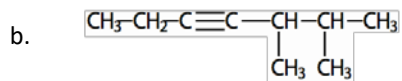
5. a. cis b. trans c. cis
6. Saturated – molecules that contain double or triple bonds
7. Unsaturated – molecules that contain double or triple bonds. Alkenes, alkynes, and aromatics are unsaturated.
8. a. cycloalkane or alkene
b. alkane
c. alkyne
d. aromatic
9. a. trans-3-heptane
b. 1,3,5-trimethylcyclohexane
c. 3,4,4,5-tetraethylheptane
d. 4-methyl-1-cyclopentyne
e. 1,4-diethyl-2-methylbenzene
f. 4-ethyl-2,6-dimethylheptane
g. 3-methyl-2-hexene
h. 3-ethyl-4-methyl-1-hexyne



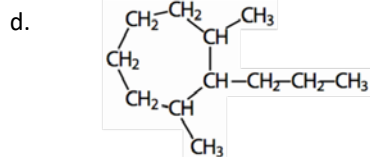
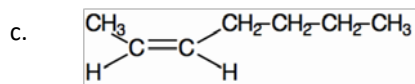
#10



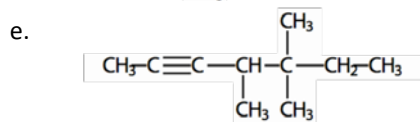
f.



g.



h.



8.2 Review Questions

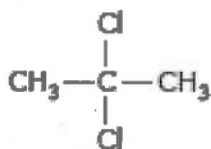
answers on following page)

1. What elements other than carbon and hydrogen commonly appear in organic molecules?
2. What is a functional group? Give two examples of a functional group.
3. Alkyl halides contain one or more of which family of elements?
4. Complete the following table:

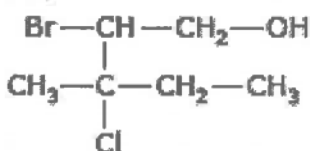
Name of group	Atoms and their arrangement
hydroxyl	
carbonyl	
carboxyl	

5. Name the following compounds:

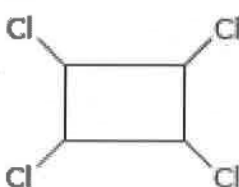
(a)



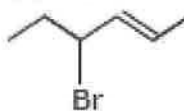
(b)



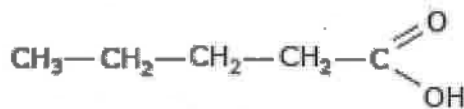
(c)



(d)



(e)



(f)



6. Draw condensed structural formulae for each compound below.

(a) cyclopentanol

(b) 1,1-dichloroethene

(c) 2-methyl-3-pentanol

(d) 2-chloropropane

(e) 1,1-dichloro-3,3-dimethyl-2-hexanol

(f) 2,3,5-tribromocyclohexanol

7. Both organic and inorganic compounds may contain an -OH group. In an ionic compound, what is the name of the -OH group? In an organic compound?

8. Which functional groups contain only the following?

(a) single bonded oxygen atoms

(b) double bonded oxygen atoms

(c) both single and double bonded oxygen atoms

9. How is an amide different than a carboxylic acid? How are they similar?

10. For each of the following compounds named, classify the compound according to its functional group. For some compounds, more than one functional group may be used. Draw condensed structural formulas for as many of these as you can.

(a) 2,3-dichloropentane

(b) 2-decyne

(c) *trans*-3-hexene

(d) 1,2-dimethylbenzene

(e) 2-chloro-2-pentanol

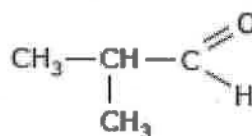
(f) 3-methylbutanamide

(g) propanal

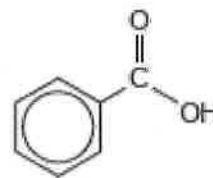
(h) pentanoic acid

11. Classify the following molecules according to their functional group.

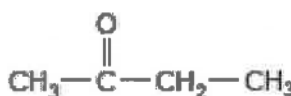
(a)



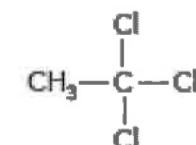
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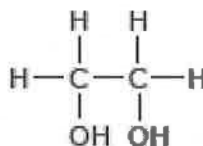
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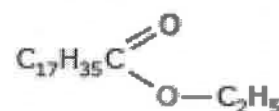
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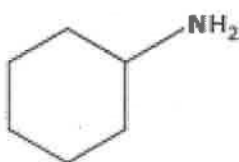
(e)



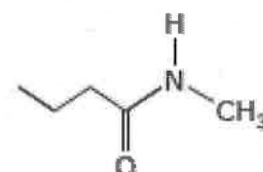
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(g)

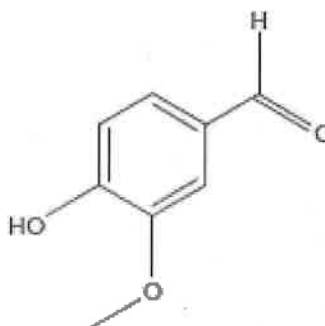


(h)



12. The following molecules are common organic compounds. For each molecule, circle and identify each functional group present. These molecules contain more than one functional group.

(a) vanillin (a food flavoring)



8.2 Review : ANSWER KEY 10.

- Oxygen and nitrogen are also common in organic compounds.
- A functional group is an atom, group of atoms, or organisation of bonds in an organic molecule that reacts in a characteristic manner. Examples include alkenes, alkynes, alcohols, ethers, ester, etc.
- Halogens.

Name of Group	Atoms and their arrangement
Hydroxyl	
Carbonyl	
Carboxyl	

- Complete the following table:
- 2,2-dichloropropane
 - 2-bromo-3-chloro-3-methyl-1-pentanol
 - 1,2,3,4-tetrachlorocyclobutane
 - 4-bromo-2-hexene
 - pentanoic acid
 - 1,3,5-trifluorobenzene

6.

-
-
-
-
-
-

11. a.

-
-
-
-
-
-

- Carboxylic Acid
- Ketone
- Alkyl Halide
- Alcohol
- Ester
- Amine
- Amide
- Alkene
- Ether

12

- In an ionic compound, the -OH group is a hydroxide group. In an organic compound, the -OH group is a hydroxyl group or an alcohol group.
- Alcohols, ethers
 - Aldehydes, ketones, carboxylic acid, esters, amides
 - Carboxylic acid, and esters

- alkyl halide
- alkyne
- alkene
- aromatic
- alkyl halide and alcohol
- amide
- aldehyde
- carboxylic acid

Aldehyde

a.

9. An amide contains a nitrogen atom bonded to a carbon that is double bonded to an oxygen atom. A carboxylic acid does not contain a nitrogen atom. Both amides and carboxylic acids contain a carbon atom that is double bonded to an oxygen atom.