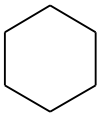
Worksheets for Organic Chemistry

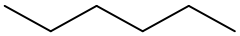
Worksheet 1
Alkanes
Question 1.

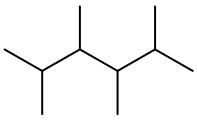
Provide IUPAC names for the following structures

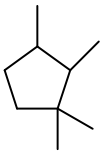
a) 

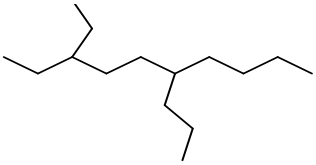
b) 

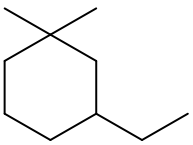
c) 

d) 

e) 

f) 

g) 

h) 

Question 2. Draw the structures of the following compounds:

a) 2,2,4-trimethylhexane

b) 1,1,2-trichlorobutane

c) 2,2-dimethylpropane

d) 3-ethyl-2,4,5-trimethyloctane

e) 5-butyl-2,2-dimethylnonane

f) 1,1,1-trichloroethane

Question 3. Explain why the following molecules have an incorrect name. What is the correct name?

a) 1,3-dimethylbutane

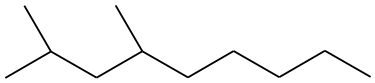
b) 4-methylpentane

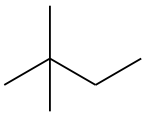
c) 2,2-diethylbutane

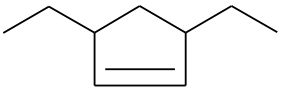
d) 2-ethyl-3-methylpentane

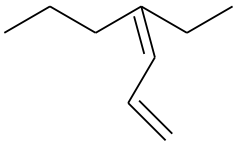
Worksheet 2
Hydrocarbons
Question 1.

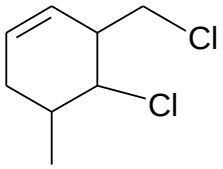
Give the systematic name for the following compounds.

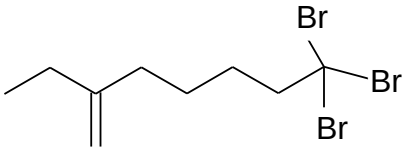
a. 

b. 

c. 

d. 

e. 

f. 

Question 2.

Draw structures corresponding to the following names. Which name is incorrect and what is its correct name.

a. 2-methyl-3-ethylhexane

b. trans-1-chloro-1-pentene

c. 3,3-dipropyl-1-butyne

d. hexachloro-1,3-butadiene

e. 1-iodo-3-methylcycloheptene

f. 1,2-dicyclopentylethene

g. 2,3-dibromo-4-(methylethyl)nonane

h. 3-(2-bromoethyl)-1-hexene

Question 3.

Give the structure of the major organic product of the following reactions.

a. hexane and chlorine

b. 1-hexene and chlorine

c. 1-hexene and hydrogen chloride gas

d. 1-hexyne and excess chlorine

e. 1-hexene and dilute sulfuric acid

Question 4.

Comment on the following observations

.

a. Hydrocarbons have low boiling points compared to other organic compounds of similar formula weights.

b. There are no cyclic alkynes, nor are there any cis/trans isomers of alkynes.

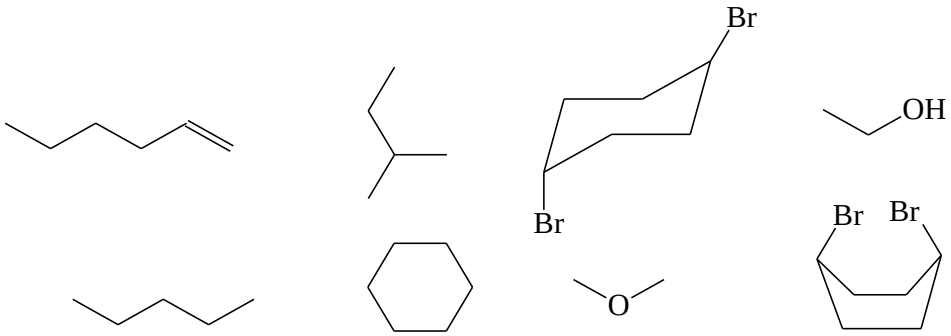
c. Treatment of an alkane with chlorine requires UV radiation to cause reaction, whereas an alkene will react instantly.

d. The product of the reaction of an alkane with chlorine is unpredictable.

Worksheet 3
Isomers and Alkenes/Alkynes Worksheet

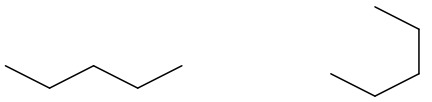
ISOMERS

Question 1. Pick out the pairs of isomers, for each pair state whether they are structural, geometric or conformational isomers.

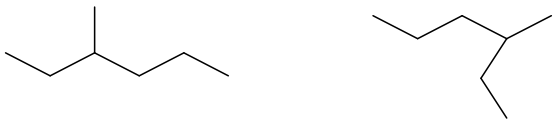


Question 2. Identify the pairs in each set as identical or as structural isomers.

a)

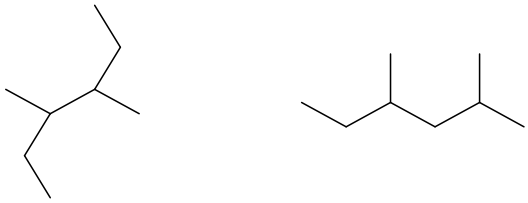


b)

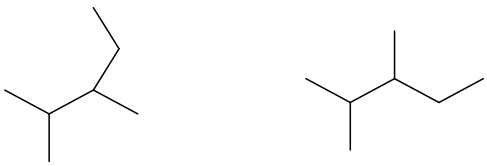


c)

d)



e)



Question 3. Draw isomers for the following molecular formulas

a) C_6H_{14} (5 isomers)

b) C_5H_{12} (3 isomers)

c) C_7H_{16}

d) C_5H_{10}

e) C_4H_8

f) C_7H_{14}

Question 4. Indicate which of the following compounds show geometric isomerism, draw the structures and specify them as cis or trans

a) 1-butene

b) 2-butene

c) 1,1-dichloroethene

d) 1,2-dichloroethene

e) 2-methyl-2-butene

f) 1-pentene

g) 1-chloropropene

h) 1-chloro-2-methyl-2-butene

Worksheet 4
Alkenes/Alkynes

Question 1.

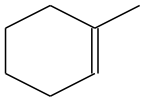
Predict the **products** of the reaction of 2-methyl-2-pentene with each of the following. **Name each product.**

a) HBr b) dilute sulfuric acid c) Br_2 d) dilute $KMnO_4$ e) HOBr f) H_2 Pd/C

Question 2.

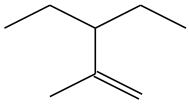
a) Draw the products expected from the following reactions
b**)** Name the reactant and product

a)



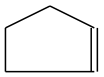
+ HBr ⟶

b) Only name the starting material.



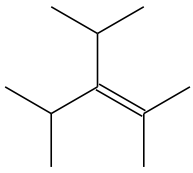
+ Dilute sulfuric acid ⟶

c)



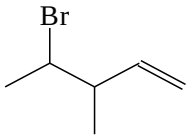
+ Br 2 ⟶

d)



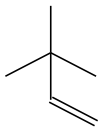
+ HCl ⟶

e) Only name the starting material



+ $KMnO_4$ ⟶

f) Only name the starting material



+ dilute sulfuric acid

g) + 1 equiv. HBr

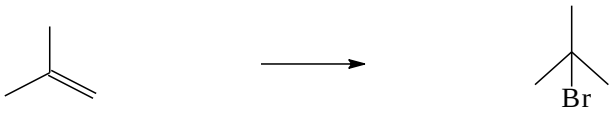
h) + 2 equiv HBr

i) + excess H_2, Pd/C

Question 3.

For the following reactions, provide the reagent necessary to effect the transformation.

a)



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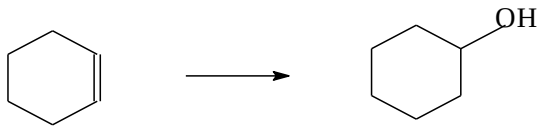
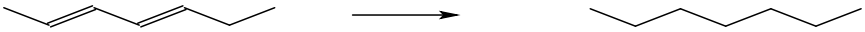


c)



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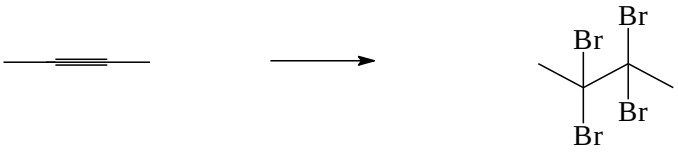


Question 4.

Describe how to distinguish between the members of each pair of compounds by a simple chemical test. For each pair, describe the test and what you expect to observe.

a) cyclohexane and 1-hexene

b) 1-hexene and 2-chlorohexane

b) 1,1-dimethylcyclopentane and 2,3-dimethyl-2-butene

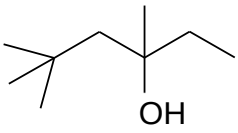
Worksheet 5

Hydroxy Compounds

Question 1.

Give systematic names for the following compounds.

a.



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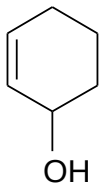
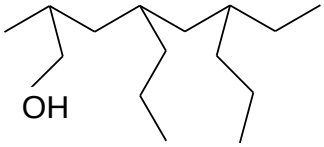
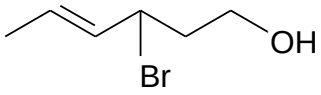


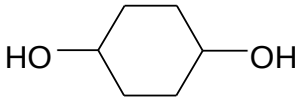
c.



d.



e.



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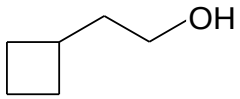
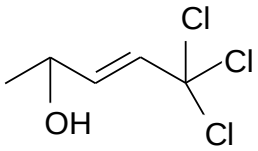
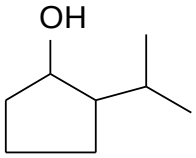


h.



i.



Question 2.

Draw structures corresponding to the following names.

a. 2-methyl-2-propanol

b. cis-but-2-en-1-ol

c. 1,1-diiodo-2-hexanol

d. 4-(2-chloroethyl)-4-heptanol

e. ethan-1,2-diol

f. 2,3,4-trimethyl-1-octanol

g. 3-fluoro-3-methyl-2-pentanol

h. 3-cyclohexylcyclopentanol

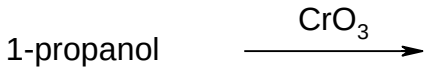
Question 3.

Classify the alkanols in question 1 as primary, secondary or tertiary.

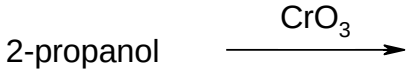
Question 4.

Give the structure of the major organic product of the following reactions

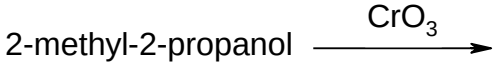
a.



b.



c.



Question 5.

Explain the following observations.

a. Cyclohexanol has a b.p. of 161^0C while that of cyclohexane is 69^0C

b. Ethanol is soluble in water but cyclohexanol is not.

c. 1-pentanol has a b.p. of 139^0C, but that of its isomer, 2-methyl-2-butanol, is 102^oC.

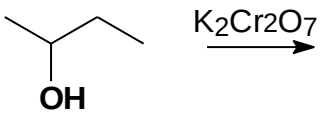
Worksheets 6

Alkanols/Alkyl halides/Alkanals/Alkanones and functional group tests

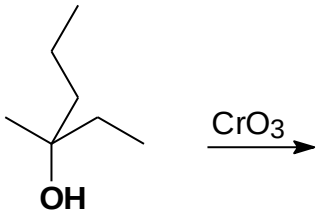
Question 1.

a) Predict the products of the following reactions
b) Name the starting materials and products.

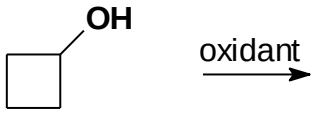
a)



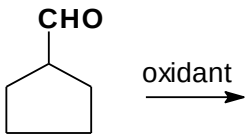
b)



c)



d)



Question 2. Provide structures for the following molecules:

a) 5-methyl-2-hexanol

b) 2,2-dimethyl-1-propanol

c) 2-propyn-1-ol

d) 3-heptanone

e) 3-chloro-1-butanal

f) 3-penten-2-one

g) 2-methyl-3-hexen-1-al

h) 3-ethyl-3-methyl-1-pentanol

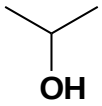
i) 2,4-dimethyl-2,4-hexandiol

j) tetrachloroethene

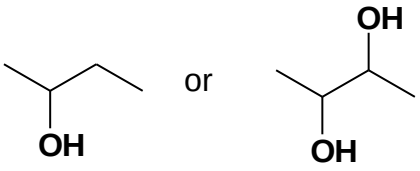
Question 3.

The boiling point of a molecule is determined by its formula weight and the types of functional groups it contains. Arrange the following compounds in order of **decreasing boiling points**. Explain your reasoning.

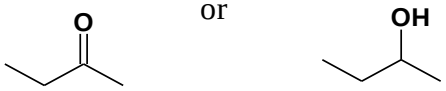
a) $CH_3CH_2CH_3$, $CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$, $CH_3CH_2CH_2CH_2CH_3$

b) $CH_3CH_2CH_2CH_3$ or 

c)



d)



Question 4. Explain the following observations

a) propanol is more water soluble than propane

b) propanol is more water soluble than propanone

Question 5.

How would you distinguish between the following molecules using simple tests that can be performed in the laboratory. Describe what you would expect to observe.

a) pentane and 2-pentanone

b) pentanal and 2-pentanone

Question 6.

Five organic liquids are subjected to a series of distinguishing tests to help determine their identity. The results are tabulated below. From the following list of possibilities, determine the identity of each liquid. Note that there may be more than one answer.

Possible compounds: pentane, 1-pentene, 2-pentanol, 3-pentanone, pentanal, 2-methyl-2-pentanol.

Liquid	Bromine	Jones Reagent	Sodium	2,4-DNP	Fehlings
A	red solution	green solution	no reaction	orange precipitate	red precipitate
B	colorless	orange solution	no reaction	yellow solution	blue solution
C	red solution	orange solution	gas evolved	yellow solution	blue solution
D	red solution	green solution	gas evolved	yellow solution	blue solution
E	red solution	orange solution	no reaction	yellow solution	blue solution

Liquid	Identity
A	
B	
C	
D	
E	

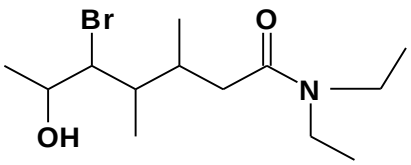
Question 7: Draw possible structures for the formula $C_4H_6Cl_2$, identify the cis and trans isomers.

Worksheet 7

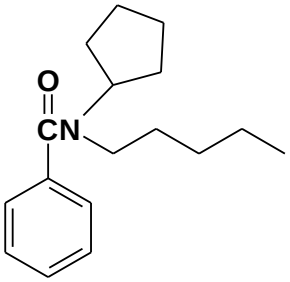
Carboxylic Acids and Derivatives

Question 1. Name the following molecules.

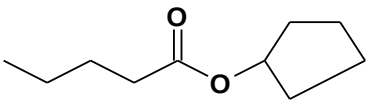
a)



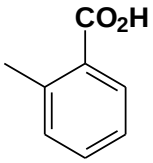
b)



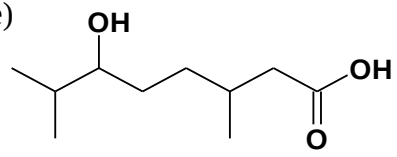
c)



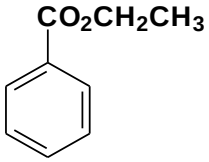
d)



e)



f)



Question 2. Provide structures for the following names

a) 2-bromo-3-methylbutanoic acid

b) methyl 3-methylbutanoate

c) ethanamide

d) N,N-dimethylmethanamide

e) 3-methylbutanamide