## BASIC NOMENCLATURE

A STUDENT SHOULD BE ABLE TO:

1. Give examples of, and recognize when given the structure, representatives of the following classes of compounds.
   Alkyl halides (1°, 2°, 3°)
   Alcohols (1°, 2°, 3°), ethers
   Amines (1°, 2°, 3°), amides, nitriles

2. Classify carbons and hydrogens attached to $sp^3$ carbons as 1°, 2°, or 3°.

3. Give the IUPAC names of open-chain alkanes, alkenes (including *cis* and *trans*), alkynes, alkyl halides, and alcohols having a longest chain of ten carbons or less when given the structure, and draw the structure given the name. The unbranched alkanes whose names are the basis of this are:

   | | |
   |---|---|
   | methane (1 carbon) | hexane (6 C's) |
   | ethane (2 C's) | heptane (7 C's) |
   | propane (3 C's) | octane (8 C's) |
   | butane (4 C's) | nonane (9 C's) |
   | pentane (5 C's) | decane (10 C's) |

   The names of the groups you must be able to recognize and draw are:

   methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl (the unbranched groups)
   isopropyl
   isobutyl, *sec*-butyl, *tert*-butyl
   neopentyl
   vinyl and allyl

4. Give the IUPAC name when given the structure, and give the structure given the IUPAC name, of monocyclic alkanes, alkenes, alkynes, alcohols, and alkyl halides having rings containing 3-10 carbons. These compounds may also contain halogen atoms and side chains.

5. Give the IUPAC name when given the structure, and draw the structure given the name, of bicyclic alkanes. These alkanes may have alkyl groups or halogen atoms as substituents.

6. Give the common name when given the structure, and give the structure when given the common name, of simple alcohols and alkyl halides. In the system used here compounds are named by first naming the alkyl group and then naming the functional group (e. g. ethyl alcohol, neopentyl bromide).

7. Give the common name when given the structure, and draw the structure when given the common name, of unsubstituted monocyclic alcohols and alkyl halides (e. g. cyclobutyl alcohol).

8. Draw the structure when given any of the following common names: ethylene, propylene, isobutylene, acetylene, and alkylacetylenes including any of the alkyl groups named in #3 above. Also, give the name when given the structure of any of these compounds.

9. Know the priority of various functional groups in nomenclature

| HIGHEST priority | If the group is a substituent, it is called: |
|---|---|
| Carboxylic acid | |
| Ester | |
| Acid halide | |
| Amide | |
| Nitrile | cyano |
| Aldehyde | formyl, oxo |
| Ketone | oxo |
| Alcohol | hydroxy |
| Amine | amino |
| Alkyne/alkene | |
| even priority; only if numbering tie, priority to alkene | |
| Alkyl, halo, alkoxy, phenyl/benzyl | |

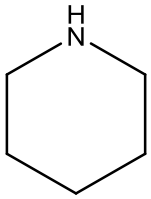
Note: there is no specific chapter on Nomenclature in your textbook as it is introduced in different chapters for particular classes of compounds. Explore on your own for Skill Builder problems in the textbook.

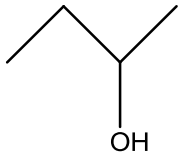
A STUDENT WHO HAS MASTERED THE OBJECTIVES PREVIOUSLY LISTED SHOULD BE ABLE TO SOLVE THE FOLLOWING PROBLEMS AND RELATED ONES:

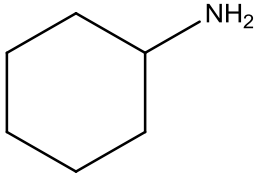
1.1 Draw the structure of an example of each of the following classes of compounds. Do not use the symbol R.

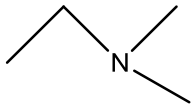
a) 2° amine b) 3° alcohol c) 1° alkyl halide

1.2 Name the functional group(s) present in each of the following molecules. Indicate 1°, 2°, or 3° when appropriate.

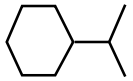
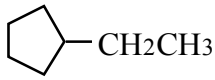
a) $CH_3CH_2OH$ b) 

c) 


d) $CH_3CHClCH_3$ b) 

c) 


2.1 How many 1°, 2°, and 3° hydrogens are present in each of the following molecules?

a) $(CH_3)_2CHCH_2CH_3$ b)  c) 


3.1 Give the IUPAC name of each of the compounds shown.

a) $CH_3CH_2CH_2CH_2CH_3$ b) $CHCl_3$ c) $CH_3CH_2CHCH_3$ (OH)

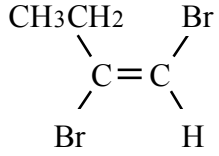
d) $CH_3CH_2CHCH_2CH_3$ ($CH_3$) e) $(CH_3)_2CHCHBrCH_2CH_3$

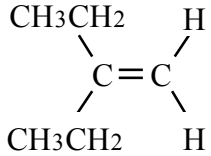
f) $(C_2H_5)_2CH(CH_2)_2CH_3$ g) $CH_3CH_2CHCH_2CHCHCH_3$ ($CH_3$, $CH_3$, $CH_2CH_2CH_3$)

h) $CH_3CBr_2CH_2CCl_3$ i) $CH_3CH_2CHCH_2CH_2CH_3$ ($CH_2OH$)

j) $(CH_3)_2CHCH_2CH_2C(CH_3)=CH_2$

k) $CH_3CH_2C(CH_3)(CH_3)-C\equiv C-CH(CH_3)_2$

l) 

m) 

3.2 Draw the structure of each of the compounds named below.

a) 2,2-dimethylbutane

b) 3,3-dimethyl-1-butanol

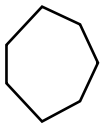
c) 4-ethyl-2,2-dimethylhexane

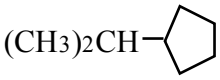
d) 1,2-dibromo-2-methylpropane

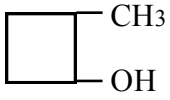
e) 4-methyl-2-pentyne

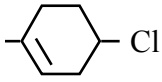
f) *cis*-1-bromo-2-pentene

4.1 Give the IUPAC name of each of the compounds shown.

a) 

b) 

c) 

d) 

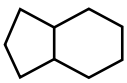
4.2 Draw the structure of each of the compounds named.

a) 1,3-dimethylcyclobutane

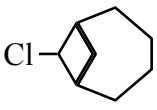
b) 4-neopentylcyclohexanol

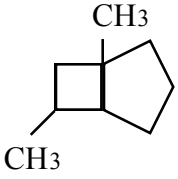
c) 4-isopropylcyclohexene

5.1 Give the name of each of the compounds shown.

a) 

b) 

c) 

d) 

5.2 Draw the structure of each of these compounds.

a) bicyclo[2.2.0]hexane

b) 2-isopropylbicyclo[1.1.0]butane

c) 1,5-diethylbicyclo[3.3.0]octane

6.1 Give the common name of each of the compounds shown.

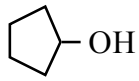
a) $CH_3CH_2OH$ b) $CH_3CH_2CH_2Cl$ c) $(CH_3)_3C\text{-}CH_2OH$ d) $FC(CH_3)_3$

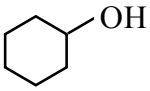
6.2 Draw the structure of each of the compounds named.

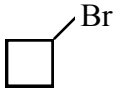
a) methyl iodide b) isobutyl alcohol

c) isopropyl alcohol d) *sec*-butyl bromide

7.1 Give the common name of each of the following compounds.

a) 


b) 


c) 


7.2 Draw the structures of the following compounds.

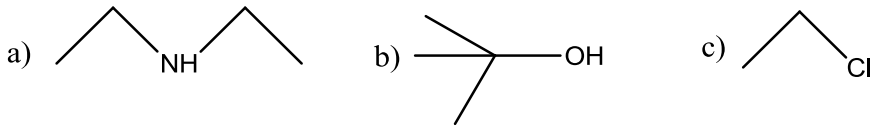
a) cyclopropyl chloride b) cyclohexyl iodide

8.1 Draw the structures of each of the following compounds.

a) propylene b) acetylene c) ethylacetylene d) ethylene

SOLUTIONS TO SAMPLE PROBLEMS:

1.1

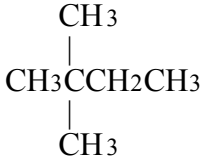


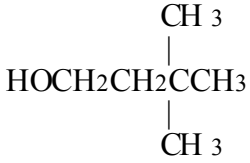

1.2 a) 1° alcohol b) 2° amine c) 2° alcohol
d) 2° alkyl halide e) 1° amine f) 3° amine

2.1 a) 9 1°H's, 2 2°H's, and 1 3°H's
b) 6 1° H's, 10 2° H's, and 2 3°H's
c) 3 1°H's, 10 2°H's, and 1 3°H's

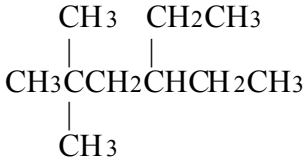
3.1 a) pentane b) trichloromethane c) 2-butanol d) 3-methylpentane
e) 3-bromo-2-methylpentane f) 3-ethylhexane g) 5-isopropyl-3-methyloctane
h) 3,3-dibromo-1,1,1-trichlorobutane i) 2-ethyl-1-pentanol j) 2,5-dimethyl-1-hexene
k) 2,5,5-trimethyl-3-heptyne l) *trans*-1,2-dibromo-1-butene m) 2-ethyl-1-butene

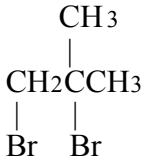
3.2 a) 2,2-dimethylbutane b) 3,3-dimethyl-1-butanol



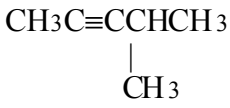



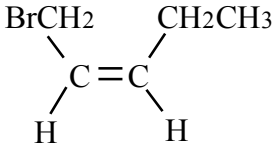

c) 4-ethyl-2,2-dimethylhexane d) 1,2-dibromo-2-methylpropane



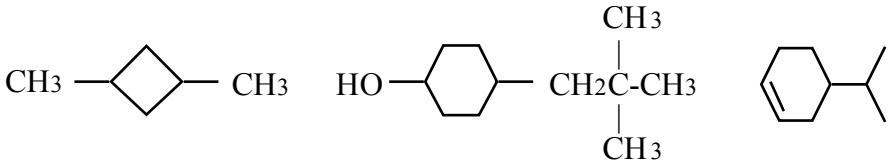

e) 4-methyl-2-pentyne f) *cis*-1-bromo-2-pentene



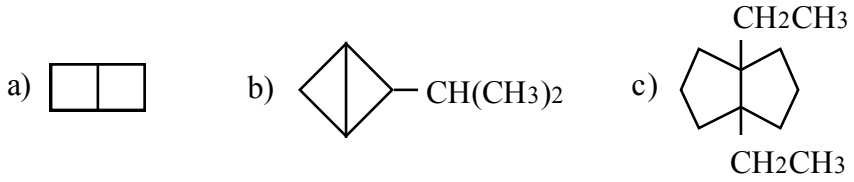

4.1 a) cycloheptane b) isopropylcyclopentane
c) 2-methylcyclobutanol d) 1,4-dichlorocyclohexene

4.2 a) 1,3-dimethylcyclobutane b) 4-neopentylcyclohexanol c) 4-isopropylcyclohexene




5.1 a) bicyclo[4.3.0]nonane b) bicyclo[3.2.1]octane
c) 7-chlorobicyclo[4.1.1]octane d) 1,6-dimethylbicyclo[3.2.0]heptane

5.2 The structures are:




6.1 a) ethyl alcohol b) propyl chloride c) neopentyl alcohol d) *tert*-butyl fluoride

6.2 a) methyl iodide b) isobutyl alcohol c) isopropyl alcohol d) *sec*-butyl bromide

$CH_3I$ $(CH_3)_2CHCH_2OH$ $(CH_3)_2CHOH$ $CH_3CHBrCH_2CH_3$

7.1 a) cyclopentyl alcohol b) cyclohexyl alcohol c) cyclobutyl bromide

7.2 a) cyclopropyl chloride b) cyclohexyl iodide

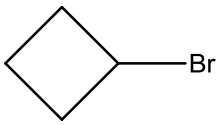

8.1 a) propylene b) acetylene c) ethylacetylene d) ethylene

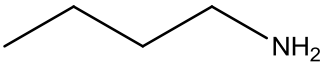
$CH_3CH=CH_2$ $H-C\equiv C-H$ $CH_3CH_2C\equiv C-H$ $H_2C=CH_2$

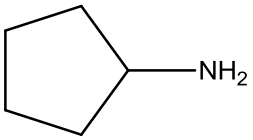
Name _____ Fourth Drill Test (Sample A)
Organic Chemistry 2210DR Answer All Questions

1. Name the functional group in each of the following compounds, indicating 1°, 2°, or 3° if appropriate.

a) $CH_3CHOHCH_2CH_3$

b) 


c) 


d) 


2. Give specific examples (don't use R) for each of the following types of compounds.

a) 3° alcohol b) 2°alkyl iodide c) 3° amine

3. Name $Cl_3CCH_2Cl$

4. Name $(CH_3)_2CH(CH_2)_3CH(CH_3)_2$

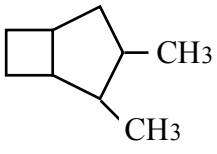
5. Draw neopentylcyclohexane

6. Draw 2,4-dibromo-3-ethylhexane

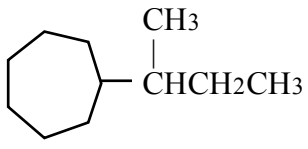
7. Name $BrCHCH_2CH_2CHCH_2CH_3$
$CH_2$ $CHOH$
$CH_3$ $CH_3$

8. Draw 3,3-dimethylcyclobutanol

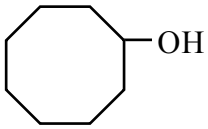
9. Name:




10. Name:

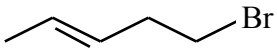


11. Name



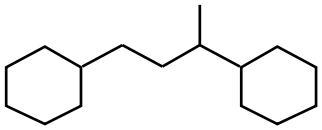

12. Draw cyclopentyl fluoride

13. Name




14. Give a structure for: propylacetylene

15. Name:



16. Give a structure for: 4-methyl-1-neopentylbicyclo[3.2.1]octane

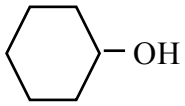
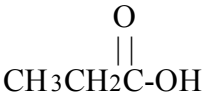
17. Give a structure for: allyl alcohol

Name _____ Fourth Drill Test (Sample B)
Organic Chemistry 2210DR Answer All Questions

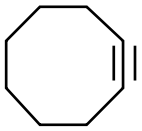
1. Draw the structure of an example (do not use R) of each of the following classes of compounds.

   a) primary alcohol b) amide c) 2° alkyl bromide

2. What family does each of the compounds shown belong to? Be specific; indicate 1°, 2°, or 3° if appropriate.

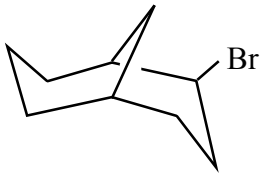
   a)  b)  c) $CH_3NHCH_3$

3. Name:



4. Give a structure for:
   1,3-di-*tert*-butylcyclohexene

5. Name:

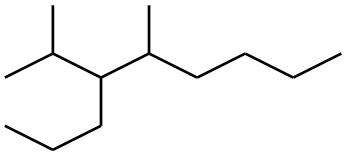



6. Give a structure for: vinyl chloride

7. Name $BrCH_2CH_2CHBr_2$

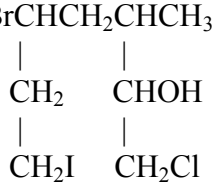
8. Give a structure for: 2,3-dimethylpentane

9. Name:



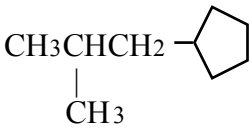
10. Give a structure for:
2,2-dimethylbicyclo[3.2.1]octane

11. Name:




12. Give a structure for:
4-*tert*-butyl-4-ethylcyclohexanol

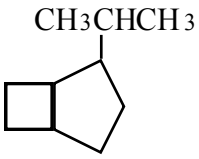
13. Name:




14. Give a structure for:

3,5-dichloro-4-iodononane

15. Name:




16. Give a structure for: *sec*-butyl alcohol

17. Name: