## IX. NAMING CYCLIC SYSTEMS WITH FUNCTIONAL GROUPS

This is an area which is a little deceptive. Where possible, cyclic compounds are treated in the same fashion as acyclic (non-cyclic) compounds. These guideline below are applicable to naming cycloalkenes, cycloalkynes, cyclic alcohols, cyclic amines, cycloalkyl halides and cyclic ketones. Appropriate derivatives of cyclohexane are shown below. The cyclodecyne was used as an example of a cycloalkyne because cyclohexyne does not exist as the six membered ring cannot accommodate the triple bond.

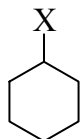**Guidelines for Naming Cyclic Compounds**

1. **When naming the ring, add the prefix 'cyclo' to designate that a ring is present**.
2. **The site of the parent functional group on the ring is assumed to be C-1.** Do not include the number of the parent group in the name.
3. **Keep the numbers of the sites of substituents to a minimum by numbering the ring in a clockwise or anticlockwise fashion, as appropriate**.
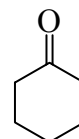4. **If a side chain bears the parent functional group, name the ring as a substituent**.
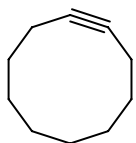
Cyclohexene   Cyclodecyne   Cyclohexanol (X=OH)   Cyclohexanone
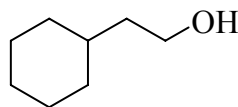**Cyclohexylamine (X = NH$_2$)**
Bromocyclohexane (X = Br)

IX.A THE RING AS A SUBSTITUENT

If the ring is attached to a carbon chain that bears the parent functional group, then name the ring as a substituent on the chain, regardless of the length of that carbon chain. For example 2-cyclohexyl-1-ethanol has the structure:

IX.B CYCLIC SYSTEMS BEARING CARBOXYL OR CARBONYL SUBSTITUENTS

The difficulty in the nomenclature of cyclic systems is the naming of systems in which the carbon of the parent functional group is attached directly onto the ring, *e.g.*, the carboxylic acid below. In such cases, the functional group is not an inherent part of the ring, because it is the parent functionality. Thus the ring carbon attached to the group cannot be designated C-1. Conversely, the ring cannot be thought of as a substituent on the carbon chain bonded to the functionality because there is no chain. Thus, a special set of parent group endings is used to define the structure, see Table 5, **which you can download from your CD**.
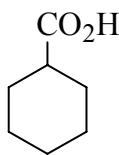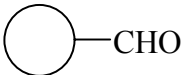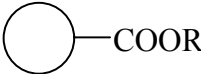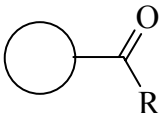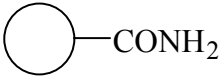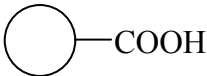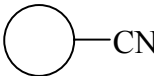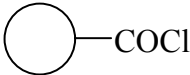
CO$_2$H

TABLE 5   Family Endings for Carbonyl or Carboxylic Acid Derivatives Directly Bonded to a Ring

STRUCTURE	NAME	STRUCTURE	NAME
◯—CHO	**Cycloalkanecarbaldehyde**	◯—COOR	**alkyl cycloalkanecarboxylate (2 words)**
◯—C(=O)—R	**cycloalkyl alkyl ketone (3 words)** **Place substituents in alphabetical order**	◯—CONH$_2$	**cycloalkanecarboxamide**
◯—COOH	**cycloalkanecarboxylic acid**	◯—CN	**cycloalkanecarbonitrile**
◯—COCl	**cycloalkanecarbonyl chloride**		

Examples

1. Give the IUPAC name for the compound below:

OBSERVATIONS/STRATEGY

Number the ring:
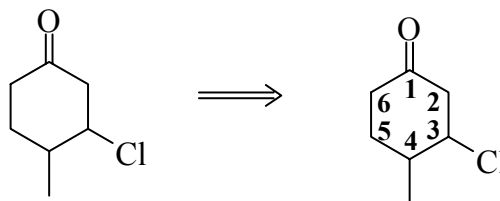
Fill out the template
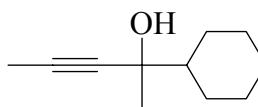
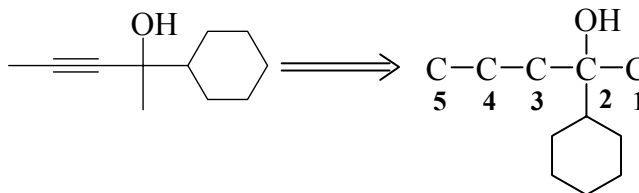|	**OBSERVATIONS**	**IMPLICATIONS**
Parent Group and Site	ketone (at C-1)	one
Longest Carbon Chain/Ring	6 carbon ring	cyclohex
# C=C or C≡C bonds and Site	none	cyclohexan
Final Word		cyclohexanone
Substituents and Sites	chlorine at C-3 CH₃ at C-4	3-chloro 4-methyl
Alphabetizing substituents		3-chloro-4-methyl

SOLUTION Compound is 3-chloro-4-methylcyclohexanone

2. Give the IUPAC name for the compound

OBSERVATIONS/STRATEGY

Redraw the structure, numbering the carbon chain

Fill out the template

|	**OBSERVATIONS**	**IMPLICATION**
Parent Group and Site	alcohol at C-2	2-.....ol
Longest Carbon Chain/Ring	5 carbon	pent
# C=C or C≡C bonds and Site	C≡C at C-3	3-pentyn
Final Word		3-pentyn-2-ol
Substituents and Sites	Cyclohexyl group at C-2	2-cyclohexyl
Alphabetizing substituents		2-cyclohexyl

SOLUTION Compound is 2-cyclohexyl-3-pentyn-2-ol

[**Note.** The cyclohexyl group is a substituent because the carbon chain bears the parent group].

3. Give the IUPAC name for the compound
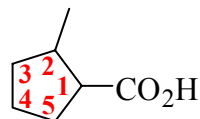
OBSERVATIONS/STRATEGY

                      This compound has the carbon of the parent functional group bonded directly to the ring. Thus, we must use the appropriate family ending, from Table 5. The other substituent is a methyl group. We must number the ring, assigning the carbon bearing the carboxylic acid C-1, and the methyl carbon C-2. There is no need to draw the template because the answer is now obvious.

SOLUTION   Compound is 2-methylcyclohexanecarboxylic acid