Intermediate IUPAC Nomenclature VIII

Aldehydes and Ketones

Class II Carbonyls – Aldehydes and Ketones:

- Aldehydes have the general group –CHO where a carbon is double bonded to an oxygen (a carbonyl) and also has a hydrogen attached. Ketones have the general group –COR where a carbon is double bonded to an oxygen (a carbonyl) and has two alkyl groups attached. Carbonyl groups are polar but do not donate hydrogens to H-bonds so have moderate boiling points and slight water solubility.

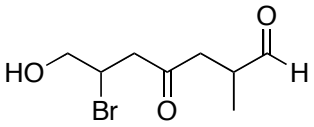
- Aldehydes have naming priority over ketones, both aldehydes and ketones have are higher priority than alcohols and are lower priority than carboxylic acid derivatives

- IUPAC Nomenclature of *class II carbonyls* follows these steps:
  1) Find the longest chain of continuous carbons that includes the **carbon** attached to the *carbonyl*. This is now the main chain. Name this chain as if it were a straight chain alkane.
     a. If the carbonyl is an *aldehyde* drop the –e ending and add –al.
     b. If the carbonyl is a *ketone* drop the –e ending and add –one.
  2) Count the carbons in the main chain left to right and right to left. The direction you *first* run into the carbon attached to the *carbonyl* is the direction use to number the chain.
     a. In *aldehydes* the *carbonyl* carbon is always C-1.
     b. If the numbers are the same go to the next highest priority functional group or substituent and follow its priority rules.
  3) Give each substituent a number according to which carbon it's attached to. Numbers for alkenes and alkynes correspond to the lower numbered of the two carbons in the bond.
     a. If both aldehydes and ketones are in the same molecule the aldehyde gets the –al ending and the ketone becomes an oxo-substituent.
  4) List the substituents in alphabetical order in front of the main chain as you would in an alkane. Alkenes and alkynes are always listed as –ene or –yne at the end of the name.
  5) Multiple substituents of the same kind are combined and given a prefix to indicate the number. (di-, tri-, tetra-) these prefixes do not count towards alphabetical order unless they are part of a branched substituent.
  6) List any relevant stereochemistry *(R,S,E,Z)* in parenthesis in front of the substituents. Stereochemistry is italicized.

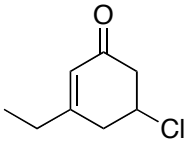
Notes: Carbonyls as substituents are oxo- groups.

Notes: Cycloalkanes with a single carbon –CHO (formyl) group attached are given the base name: cycloalkanecarbaldehyde.

Examples:

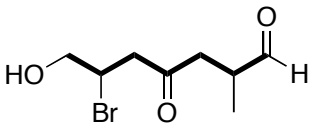


Compound A

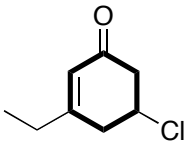


Compound B

1)

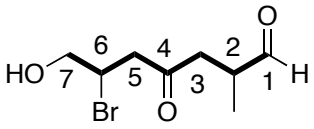


a **heptane**

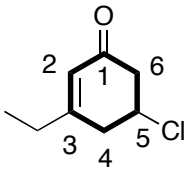


a **cyclohexane**

2)

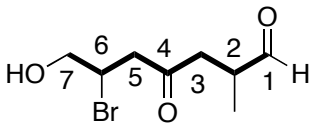


The aldehyde is the highest priority substituent. So we number the molecule R-->L. The postions of the other substituents are not relevent.

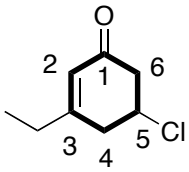


The ketone is the highest priority substituent and so it gets to be position 1. The next highest priority substituent is the alkene so it gets the lowest numbers it can 2,3 is lower than 5,6 so we number counter-clockwise.

3)



2-methyl
4-oxo-
6-bromo
7-hydroxy



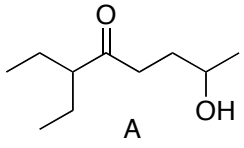
2-ene
3-ethyl
5-chloro

4,5,6)

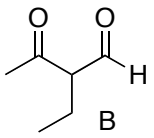
6-bromo-7-hydroxy-2-methyl-4-oxoheptanal

(Z)-5-chloro-3-ethylcyclohex-2-enone
or
(Z)-5-chloro-3-ethyl-2-cyclohexenone

Practice Carbonyl Nomenclature:



A



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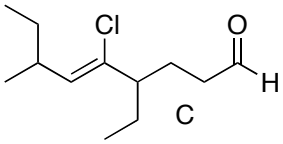

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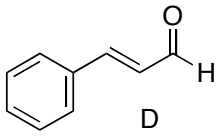

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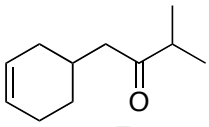

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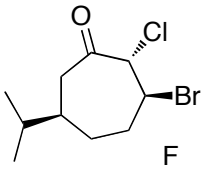

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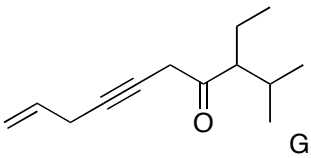

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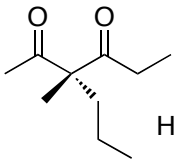

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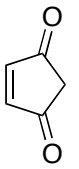

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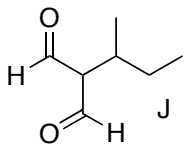

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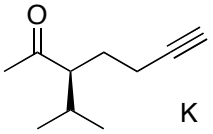

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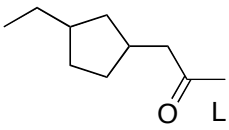

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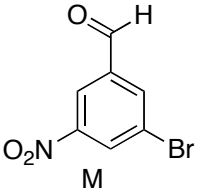

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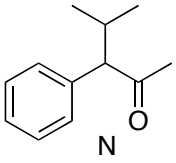

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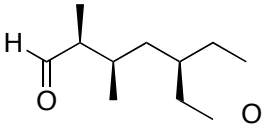

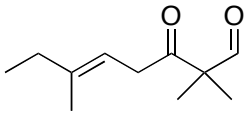

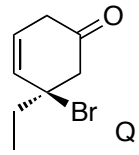

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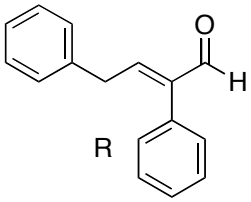

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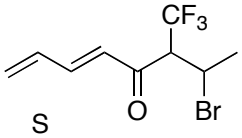

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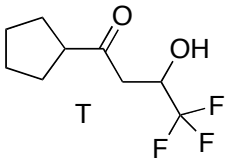

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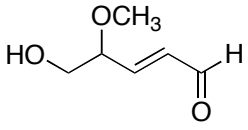

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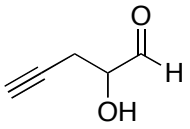

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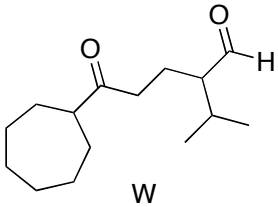

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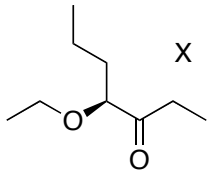

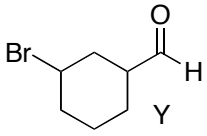

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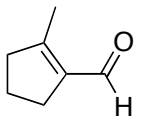

Z

Practice Carbonyl Nomenclature Key:

Compound A: 3-ethyl-7-hydroxy-4-octanone or
3-ethyl-7-hydroxyoctan-4-one

Compound B: 2-ethyl-3-oxobutanal

Compound C: *(5Z)*-5-chloro-4-ethyl-7-methyl-5-nonenal

Compound D: *trans*-3-phenyl-2-propenal or
(2E)-3-phenylprop-2-enal

Compound E: 1-(3-cyclohexenyl)-3-methyl-2-butanone

Compound F: *(2S,3S,6R)*-3-bromo-2-chloro-6-isopropylcycloheptanone

Compound G: 3-ethyl-2-methyldec-9-en-6-yn-4-one

Compound H: *(3R)*-3-methyl-3-propyl-2,4-hexanedione

Compound I: cyclopent-4-ene-1,3-dione

Compound J: 2-*sec*-butyl-1,3-propanedial or
2-(1-methylpropyl)-1,3-propanedial

Compound K: *(3S)*-3-isopropylhept-6-yn-2-one or
(3S)-3-(1-methylethyl)hept-6-yn-2-one

Compound L: 1-(3-ethylcyclopentyl)-2-propanone

Compound M: 3-bromo-5-nitrobenzaldehyde

Compound N: 3-phenyl-4-methyl-2-pentanone

Compound O: *(2S,3R)*-5-ethyl-2,3-dimethylheptanal

Compound P: *(6E)*-3,3,7-trimethylnon-6-ene-2,4-dione

Compound Q: *(3Z,5R)*-5-bromo-5-ethylcyclohex-3-enone

Compound R: *(2E)*-2,4-diphenylbut-2-enal

Compound S: *(5E)*-2-bromo-3-(1,1,1-trifluormethyl)oct-5,7-dien-4-one

Compound T: 1-cyclopentyl-4,4,4-trifluoro-3-hydroxy-1-butanone

Compound U: *trans*-5-hydroxy-4-methoxypent-2-enal

Compound V: 2-hydroxy-4-pentynal

Compound W: 5-cycloheptyl-2-(1-methylethyl)-5-oxopentanal or
5-cycloheptyl-2-isopropyl-5-oxopentanal

Compound X: *(4S)*-4-ethoxy-3-octanone

Compound Y: 3-bromocyclohexanecarbaldehyde

Compound Z: *(1E)*-2-methylcyclopent-1-enecarbaldehyde