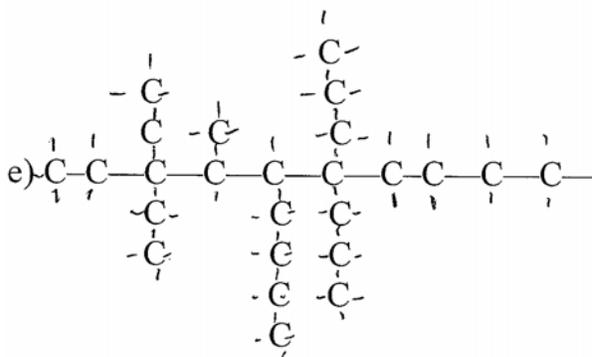
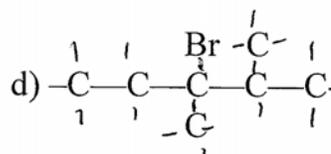
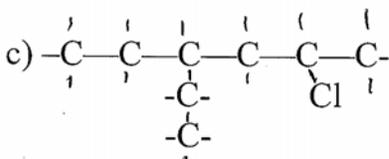
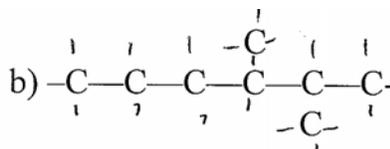
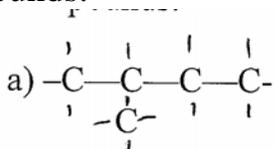
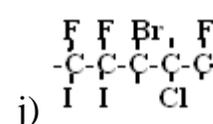
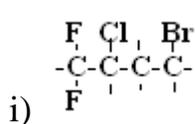
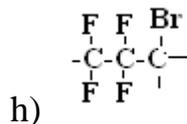


Alkane Study Guide

1. Give systematic names for each of the following chemical compounds:



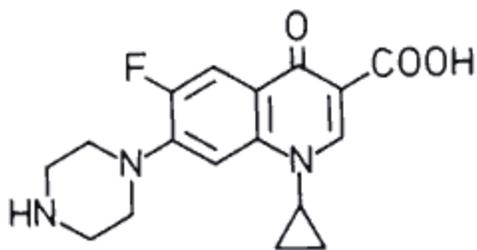
- f) 5 isomers with formula C_6H_{14} g) 4 isomers with formula $C_3H_6Cl_2$



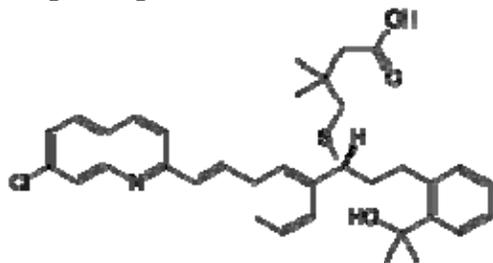
2. Draw the structure for

- 2,3-diethyl-4-methylheptane
- 3,4,5-triethyl-5-propyldecane
- 2-methyl-3-ethyl-4-propyl-5-butyl decane
- 2,2-difluoroheptane
- 2,4-dibromo-1,3-difluorobutane
- 1,3-dichloro-2-iodopropane
- 1,1,2,2-tetrafluoroethane
- 1,1,1,2,3,3 hexachloropentane
- 2,3,4-tribromo-5,5-dichloro-1-fluorooctane

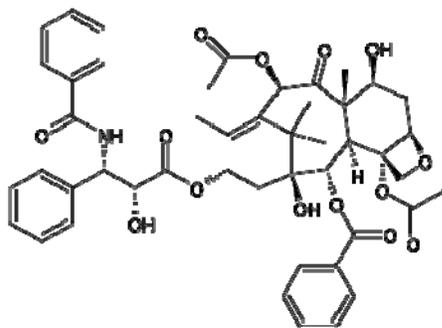
3. Draw an example of a freon molecule. Where are freons used? Why are freons being phased out? How are the new replacements different from the older freons and why are they better? What abbreviation is used in referring to the older freons? Newer freons?
4. What were some of the primary problems with using chloroform as a general anesthetic? What advantages did it have over ether? What disadvantages did it have?
5. Describe the changes that have occurred for administering albuterol. Why have those changes occurred? What is albuterol used for?
6. Explain a medical function of ethyl chloride and Frigiderm and how they work.
7. Draw a structural formula and condensed formula of cyclopropane, cyclobutane, cyclopentane, and cyclohexane. In one of these molecules the C atoms are substantially non-planar. Which molecule is it? Draw and describe its actual shape. Which molecules are stable and which are not? Explain! What was the practical use for cyclopropane in the 1960s?
8. Draw all the structural and geometric isomers of a cyclopentane molecule in which two methyl groups are added to the ring. Give the systematic names for each. Do the same for a cyclohexane molecule in which two ethyl groups are substituted on the ring.
9. Draw the structure of the following molecules:
 - a) cis-1,3-dimethylcycloheptane
 - b) trans-1,4 diethylcyclohexane
 - c) cis-1-methyl-2-propylcyclohexane
 - d) trans-1-chloro-3-iodocyclopentane
- 10.a) Label the functional groups in the molecule of ciprofloxacin (Cipro), an antibiotic. Which portion of the molecule would you expect to be particularly unstable based on bond angles?



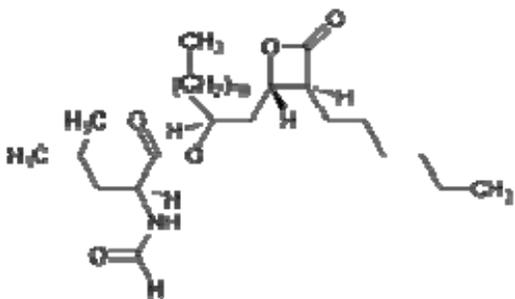
b) Label the functional groups in the molecule of montelukast (Singulair), a drug used in treatment of asthma. Which portion of the molecule would you expect to be particularly unstable based on principles learned in this unit and why?



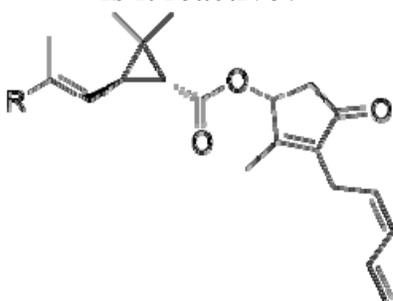
c) Label the functional groups in the molecule of paclitaxel (Taxol), an anticancer drug. Which portion of the molecule would you expect to be particularly unstable based on principles learned in this unit and why?



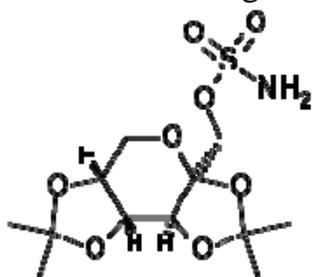
d) Label the functional groups in the molecule of orlistat (Xenical), an antiobesity drug which inhibits the formation of fat. Which portion of the molecule would you expect to be particularly unstable based on principles learned in this unit and why?



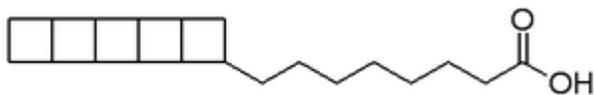
11. The structure of pyrethrin (an insecticide) is shown below. Identify the functional groups. The reactive group of pyrethrin is primarily due to one specific structure in the molecule. What is that group and why is it reactive?



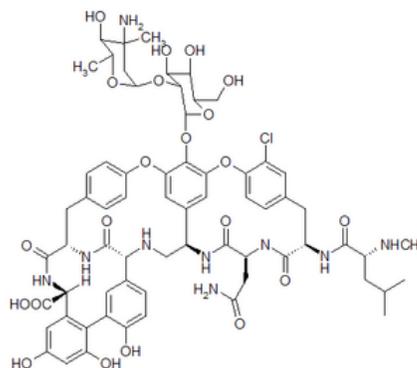
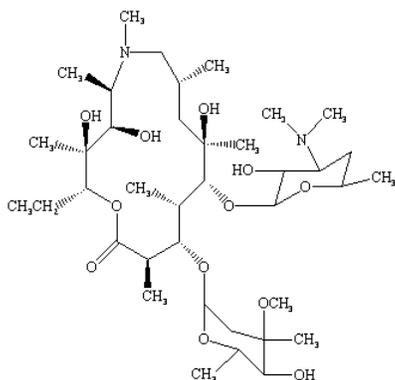
12. Topiramate (Topamax TM) is a drug marketed for treating seizures and migraine and is commonly prescribed (off-label) for many other conditions. Its structure is shown below. Identify the functional groups in topiramate. (The functional group with S is actually a sulfamate rather than a sulfonamide, because of the third O on the S; you don't have to remember that!) Give the bond angles in each ring and comment on the stability of each of those rings. What is the significance of the wedges and dashes?



13. Some specialized bacteria have membranes which contain pentacycloanammoxic acid whose structure is shown below. Comment on the stability of this compound and explain your answer.



14. The structures of two common antibiotics are shown below.



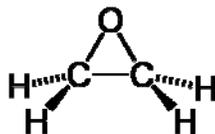
Azithromycin(Zithromax)

Vancomycin

- Identify the functional groups in each molecule
- Explain the significance of the wedge and dash notations in the structures.
- How many atoms are in the largest ring in each of azithromycin? Will it be stable or not? Explain your answer. Name the conformation of the 6-membered ring structures in these two antibiotics. Will the 6-membered rings be stable or not? Why?

Azithromycin(Zithromax) is a common antibiotic used to treat a wide variety of infections. Vancomycin is usually reserved for life threatening infections that are resistant to other antibiotics. It must be given IV and can occasionally cause anaphylactic shock and nephrotoxicity. What do we mean by nephrotoxicity and anaphylactic shock?

15. Ethylene oxide has been used as a chemical sterilizer for medical instruments that cannot withstand the high temperatures of an autoclave. What are the bond angles in ethylene oxide? Comment on its stability.



16. What is the technical term for an atom which has 4 different groups bonded to it?

17. How are molecules with a chiral center different from molecules which do not have a chiral center? Draw a one-carbon molecule with a chiral center.

18. What is the term for mirror image molecules which are not identical (“superimposable”). Draw an example of two one-carbon molecules which are enantiomers.

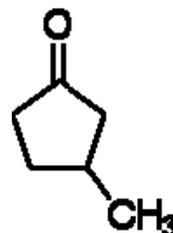
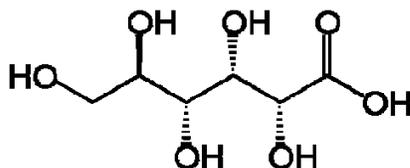
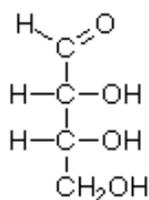
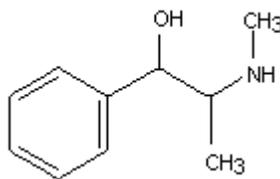
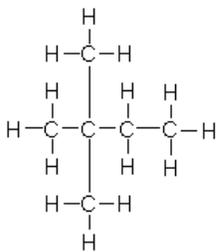
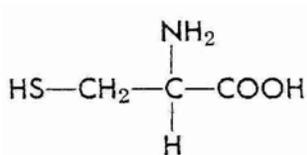
19. Give the newer terms for asymmetric C; optical isomer.

20. What sort of light is used to differentiate between two enantiomers? Explain how it is used.

21. Give 3 pairs of prefixes that are used to differentiate between pairs of enantiomers.

22. Explain why enantiomeric drugs usually have only one form that actually has high activity. Give two examples of drugs that are racemic mixtures. Define the term racemic mixture.

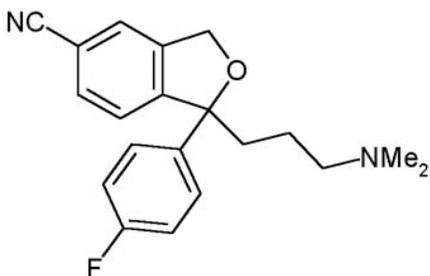
23. Label any chiral centers in the molecules below with an *.



3-methylcyclopentanone

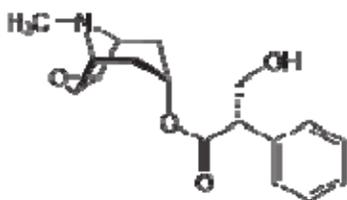
4-methylcyclohexanone

24. Citalopram (Celexa) is a commonly used antidepressant whose structure is shown below. Label the functional groups and label any chiral atoms. (Me stands for a methyl group.) Citalopram is actually a racemic mixture.

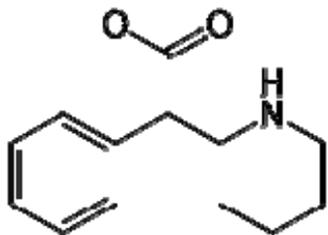


Like other drugs mentioned in the text the pure active enantiomer has been marketed. Its generic name is escitalopram or Lexapro. Compare the generic names of the racemic mixture and the pure enantiomer and explain the origin of the prefix in front of the generic name.

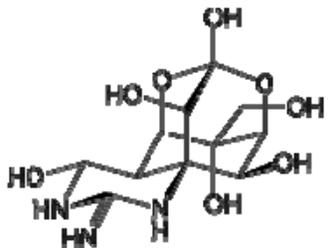
25. Scopolamine is commonly used as a patch behind the ear to reduce motion sickness. Its structure is shown below. Identify the functional groups and chiral centers in the molecule. How many members are in each ring?



26. Identify functional groups and label chiral centers in methylphenidate (Ritalin)



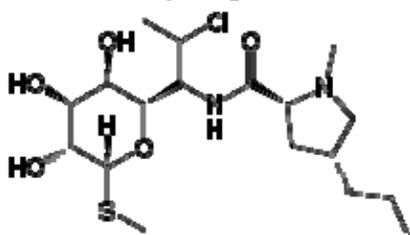
27. The structure of tetrodotoxin is a very potent neurotoxin that blocks sodium channels in cell membranes. It is found in pufferfish, western newts, blue-ringed octopi and some other organisms. Identify the functional groups in the molecule and indicate the bond angles in each of the rings.



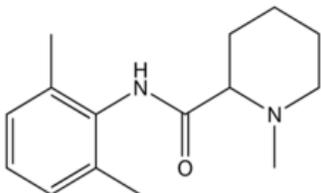
Tetrodotoxin

28. Discuss fen-phen in terms of enantiomers. Do the same for epinephrine, albuterol and Prilosec. Which of the previous molecules is marketed as a pure enantiomer?

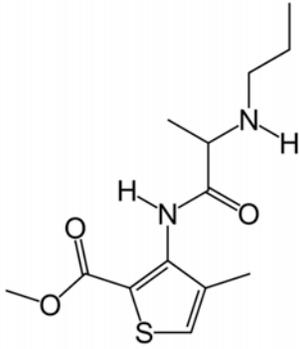
29. a) The structure of the antibiotic clindamycin is shown below. Label the functional groups and indicate chiral centers with a *.



b) Label the functional groups and chiral centers in mepivacaine, a local anesthetic.



c) Label the functional groups and chiral centers in the molecule below

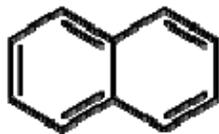


30. Discuss the solubility of alkanes in water. What happens if an OH or other polar group is substituted on an alkane chain? How long a non-polar alkane chain can be pulled into water solution by an OH group? How long a non-polar alkane chain can be pulled into water solution by an ionic group such as carboxylate or ammonium ion?

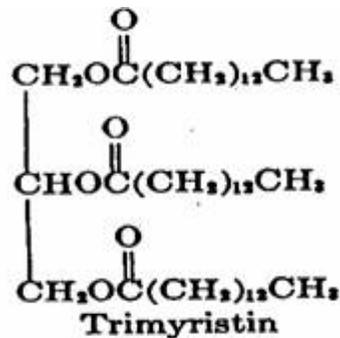
31. Predict the solubility in water of the following molecules:

a) cyclohexane

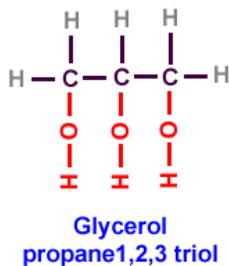
b) naphthalene =



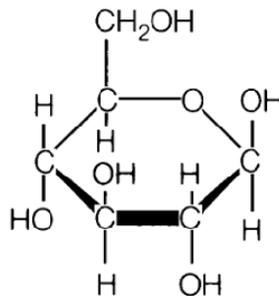
c) trimyristin =



d) glycerin

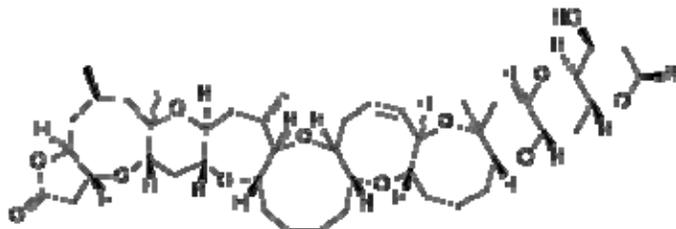


e) dextrose



32. What purification technique is used to separate petroleum into the various products (gasoline, diesel, lubricating oil)?
33. How do gasoline, diesel and lubricating oil differ in terms of a) length of C chain and b) qualitative boiling point?
34. Give two health uses of mineral oil.
35. How does petrolatum differ from mineral oil in terms of length of chain and physical properties? Name several consumer products made of petrolatum.

Brevetoxin is another potent sodium channel blocking neurotoxin that is made by a phytoplankton called *Karenia brevis*, most commonly in the eastern Gulf of Mexico. It is responsible for the “red tides” (an algal overbloom) that occurs on a regular basis. As you can see from the structure below, mother nature likes rings. Identify all the functional groups.

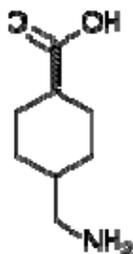


What is the significance of the wedges and dashes?

A variety of different types of plankton making different toxins can cause “red tides”. There is speculation that Exodus 7:17-18 is probably describing such an event:

“Behold, I will smite with the rod that is in mine hand upon the waters which are in the river, and they shall be turned to blood. And the fish that is in the river shall die, and river shall stink and the Egyptians shall be loathe to drink of the water of the river.”

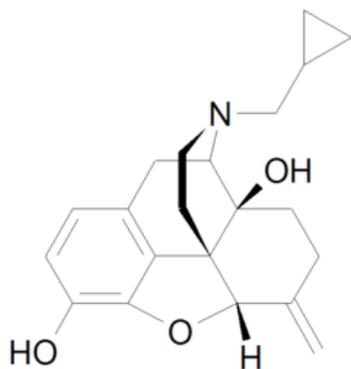
Draw the structure of tranexamic acid (Cyklokapron) showing the real conformation of the ring.



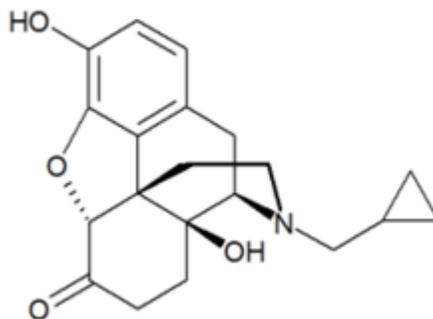
Using Google, what is tranexamic acid used for?

Chiral centers of 3-methyl-3-hydroxycyclobutanone glucuronic acid
 rhamnose

ribulose

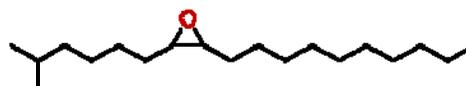


Nalmefene



Naltrexone

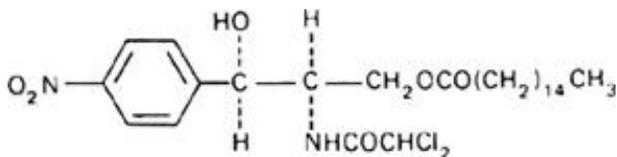
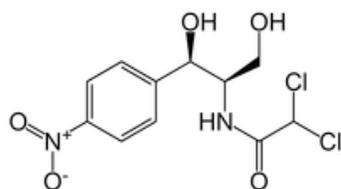
www.matrixlabsindia.com/inside/antihistamine.asp



Deltaamethrin (popular insecticide) dispalure (gypsy moth attractant)
What reactive groups are found in the above molecules?

f) chloramphenicol

chloramphenicol palmitate



15. Draw an ammonia molecule (NH₃). Label which atoms on the NH₃ molecule have partial positive and negative charges. Will ammonia be

soluble in water? Show how water molecules will arrange themselves around an ammonia molecule to maximize attractions. What is the specific name for those attractions?

2-methylcyclopentanone 2-methylcyclobutanol **Digging deeper.**

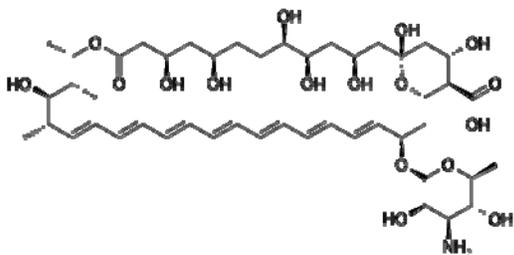
Obtain a spray can (e.g. hair spray) and see if you can guess which of the inert ingredients is being used as the propellant (the molecule under pressure that forces the spray out)

Do an internet search on halons and write a brief paper (1-2 pages, double spaced) on what their chemical structures are, their practical uses, and why their use has been phased out. Cite your references.

16. Do the same for bromomethane (methyl bromide).

17. A 2007 proposal has suggested that bromomethane (methyl bromide) be replaced with iodomethane (methyl iodide). This proposal has been met with widespread opposition from a large contingent of scientists. Do a Google search and summarize some of the reasons why there are major concerns about using methyl iodide.

The structure of the anti-fungal drug amphotericin-B is shown below. It is thought to work in a manner similar to Nystatin and natamycin. What is that mechanism and what portion of the structure is thought to play a role in that mechanism.



Amphotericin-B

Digging deeper, Crown ethers, see *Journal of Inclusion Phenomena* 6: 337-350, 1988

