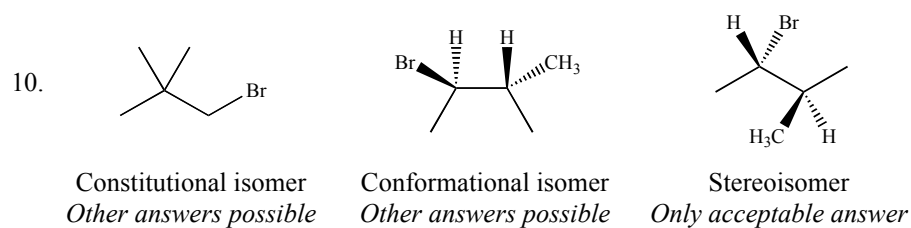


Statistics: High score, average, and low score will be posted on the course web site after exam grading is complete. The exam is ready to be picked up when these numbers are posted.

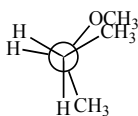
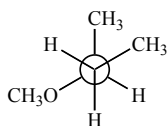
Some questions have more than one answer, even though only one answer may be listed here.

To see the projected course grade cutoffs, consult the grading scale on the Chemistry 30A course web page.

- $C_{26}H_{37}NO_3$
- $(EN = 3.5) > N (EN 3.0) > C (EN 2.5) > H (EN 2.1)$
- O–H
- Alcohol, amine, benzene ring, and ester
- Alkyne or nitrile
- Molecule **A** has 7 lone pairs (*two on each oxygen plus one on nitrogen*), 13 sp^2 carbons (*the benzene ring carbons and the carbonyl carbon*), and 13 sp^3 carbons (*all the remaining carbons*).
- Molecule **A** has 1 sp^3 carbon stereocenter. Of these 1 has an *R* configuration and 0 are *S*. *Priorities: substituted benzene ring > non-substituted benzene ring > CH_2 > H*.
- (a) Four electron groups. *Three alkyl groups and one lone pair.*
 (b) Tetrahedral
 (c) sp^3 orbitals
 (d) A bit more than 109.5° . *Alkyl groups are larger than lone pairs.*
- (a) 2-Bromo-2-methylbutane
 (b) 2-Chloro-3-ethylhexane
 (c) 1-Fluoro-4,4-dimethylcyclohexane *When deciding which end of the parent chain to begin the numbering, the functional group (fluoroalkane) gets priority over alkyl groups. Thus 4-fluoro-1,1-dimethylcyclohexane is incorrect because the fluoroalkane could be 1 instead of 4, even though $4+1+1 < 1+4+4$.*



11. Most stable conformation Least stable conformation



CH_3O is larger than CH_3 .

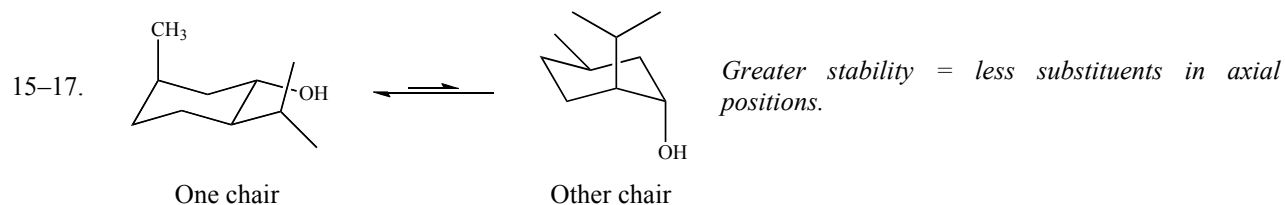
12. Torsional strain

13. Barrier to rotation = energy difference between most stable and least stable conformations. Most stable conformation has H/H and H/CH₃ gauche interactions, which (by the given numbers) cause no strain. The least stable conformation has 2 x H/H eclipse plus 1 x CH₃/CH₃ eclipse = 4.5 kcal mol⁻¹ strain energy.

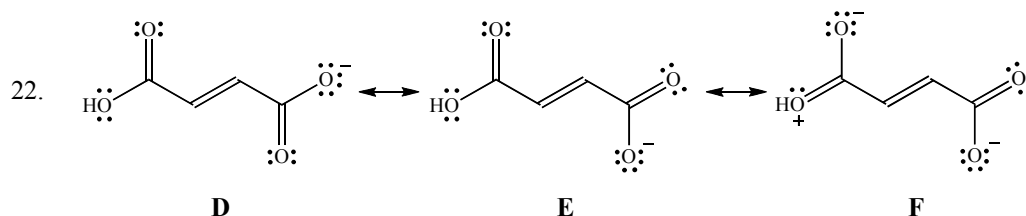
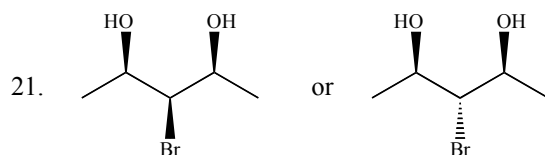
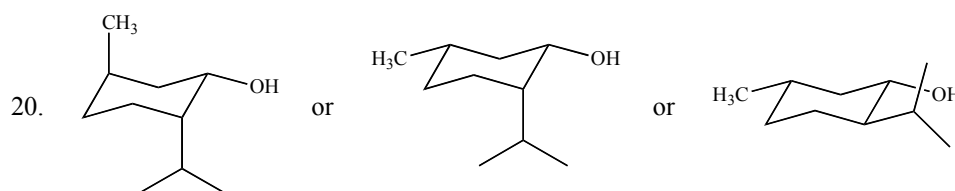
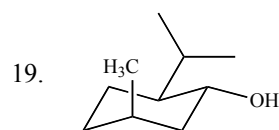
14. 1.0 kcal mol⁻¹

I chose this number for the strain caused by the eclipsing of two fluorine atoms because fluorine atoms are about the same size as hydrogen atoms, and therefore we assume the eclipsing strain is approximately equal as well.

Also acceptable: 1.4 kcal mol⁻¹ if you explain that fluorine is a bit larger than hydrogen.



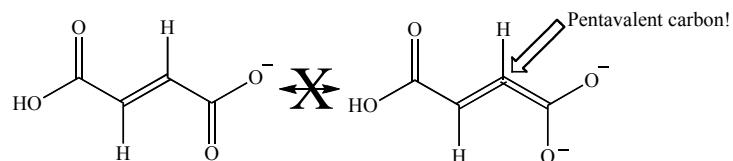
18. There is one enantiomer and six diastereomers of the structure in the One Chair box. *The molecule has 3 stereocenters, and therefore 2³ = 8 (at the most) stereoisomers. Eight - One Chair - One Chair's enantiomer = six diastereomers.*



23. Least significant: **F**. This is the least significant contributor because it has avoidable formal charges.

24. Structure **G** is not a legitimate resonance contributor because it has more electrons than structure **D**. *Resonance contributors differ in the assignment of the electrons but not the number of electrons.*

Also acceptable: Structure **G** is not a legitimate resonance contributor because it has a pentavalent carbon.



25. (a) Functional group: A group of atoms whose bonding is the same from molecule to molecule.
- (b) Constitutional isomer: Isomers that differ in the sequence of atom connectivity.
- (c) Strain: An increase in potential energy due to a deviation from ideal molecular geometry.
26. Not possible. *Enantiomers are stereoisomers, which, by definition, cannot be interconverted by rotation around one or more single bonds.*