

Student Name (first, last):

Student Number:

CHEMISTRY 3311
SECOND MIDTERM EXAMINATION

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1. (20 points) Check the correct statements only:

- The bond dissociation energy of the H-I bond is higher than that of the H-Br bond.
- An orbital is a region of space where an electron is likely to be found.
- 2-Butanol is chiral.
- A molecule that contains at least one asymmetric carbon must be chiral.
- An electrostatic potential map (EPM) is a picture of the total electron density in a molecule, color coded to show areas of negative charge in red and areas of positive charge in blue.
- 2,2,2-Trifluoroethanol has a higher pK_a than ethanol.
- An electrostatic potential map (EPM) is a picture of the ease with which a positive point charge can be brought from infinity to various locations in a molecule (red, easier, and blue, harder).
- Individual enantiomers of a compound rotate the plane of polarized light by the same amount; one clockwise (dextrorotatory, positive angle of rotation), the other counterclockwise (levorotatory, negative angle of rotation).
- Specific rotation of a compound will increase by a factor of two if its concentration is doubled.
- Specific rotation of a racemic mixture is the average of the specific rotations of the two enantiomers present in the mixture.
- (2*S*, 3*S*)-pentanediol and (2*S*, 3*R*)-pentanediol are enantiomers.
- (*E*)-2-butene and (*Z*)-2-butene are diastereomers.
- A chiral molecule must contain an asymmetric atom.
- The two twist-boat conformations of cyclohexane are enantiomers of each other.
- The two chair conformations of methylcyclohexane are enantiomers of each other.
- The axial conformer of chlorocyclohexane has a more negative heat of formation than the equatorial conformer.
- The chair-chair interconversion in *trans*-decalin (bicyclo[4.4.0]decane) is facile.
- Bicyclo[2.2.1]hept-1(2)-ene is more stable than bicyclo[2.2.1]hept-2-ene.
- Both *cis*-cyclohexene and *trans*-cyclohexene are stable at room temperature.
- Hydroboration is a syn addition reaction.

2. (30 pts) Write a plausible mechanism for the addition of ethanethiol to cyclopentene in the presence of a small amount of di-*tert*-butyl peroxide and heat or UV radiation (include all steps and intermediates and use proper curved arrows to indicate electron movement in each step). If the individual stages of the process have names, state them.

3. (10 pts) Propose two-step procedures that will convert 1-hexene into the following products. Show all steps and all reagents (no mechanisms, no curved arrows, no solvents).

(a) 1-hexanol

(b) 2-hexanol

4. (30 pts) Draw 3-dimensional views of all conformations of all products of the addition of Br_2 to cyclohexene and write down the R or S configuration of each asymmetric carbon in each structure. Circle the most stable conformer or conformers.

5. (10 pts) Write the structures of the principal organic product from the reactions of the following reagents with propene (do not show mechanisms or curved arrows).

(a) bromine in water

(b) 1. ozone, 2. dimethyl sulfide