Average 11
Low score 31
High score 98

KEY

***Student Name* (first, last):**

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Student Number:

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CHEMISTRY 3311

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SECOND MIDTERM EXAMINATION

March 13, 2012

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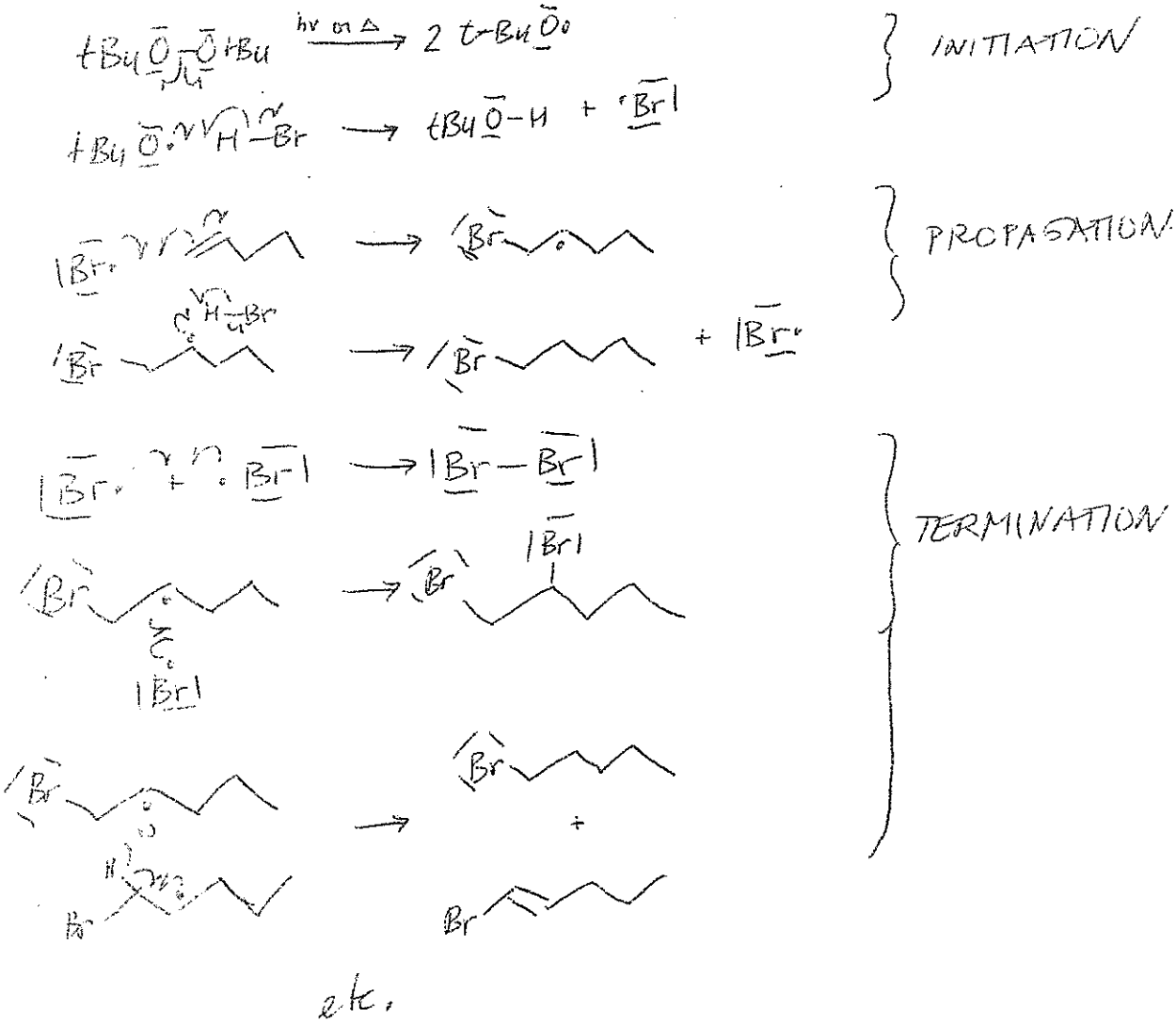
1. (20 points) Check the correct statements only and make no other marks:

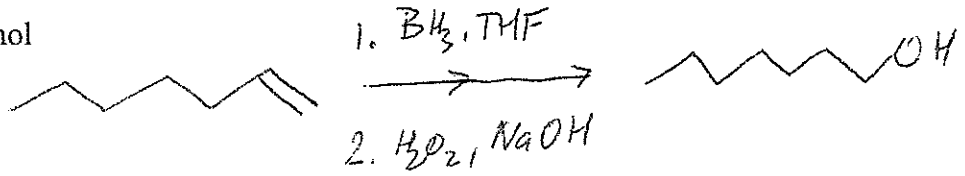
( ) An electrostatic potential map (EPM) is a picture of the total electron density in a molecule, color coded to show areas of negative charge in red and areas of positive charge in blue.
(X) The chair-chair interconversion in *cis*-decalin (bicyclo[4.4.0]decane) is facile.
( ) A reaction of an achiral reactant with an achiral reagent cannot yield a chiral product.
(X) 2-Chlorobutane is chiral.
( ) A molecule that contains two or more asymetric carbons must be chiral.
(X) The axial conformer of chlorocyclohexane has a less negative heat of formation than the equatorial conformer.
( ) Specific rotation of a compound will decrease by a factor of three if its concentration is tripled.
(X) Grignard reagents RMgBr react with water to produce hydrocarbons RH.
(X) (2*S*, 3*S*)-pentanediol and (2*R*, 3*R*)-pentanediol are enantiomers.
( ) (*E*)-2-butene and (*Z*)-2-butene are enantiomers.
( ) A chiral molecule must contain an asymmetric atom.
( ) The two twist-boat conformations of cyclohexane are diastereomers of each other.
(X) The two chair conformations of methylcyclohexane are diastereomers of each other.
( ) The bond dissociation energy of the H-S bond is higher than that of the H-O bond.
(X) Catalytic hydrogenation is a syn addition reaction.
(X) The bridgehead alkene, bicyclo[2.2.2]oct-1(2)-ene, is less stable than the isomer without a bridgehead double bond, bicyclo[2.2.2]oct-2-ene.
( ) 2-Fluoroethanol has a higher pK_a than ethanol.
(X) A reaction of an optically inactive reactant with an achiral reagent cannot yield an optically active product.
( ) Both *cis*-cycloheptene and *trans*-cycloheptene are stable at room temperature.
(X) 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).

2. (25 pts) Write a plausible mechanism for the addition of HBr to 1-pentene 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.

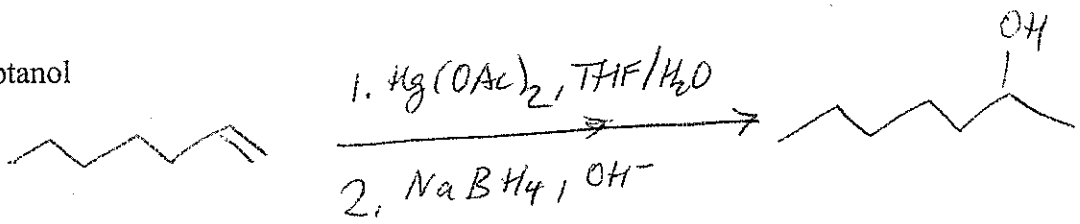


3. (10 pts) Propose two-step procedures that will convert 1-heptene into the following products. Show all steps and all reagents (no mechanisms, no curved arrows, no solvents).

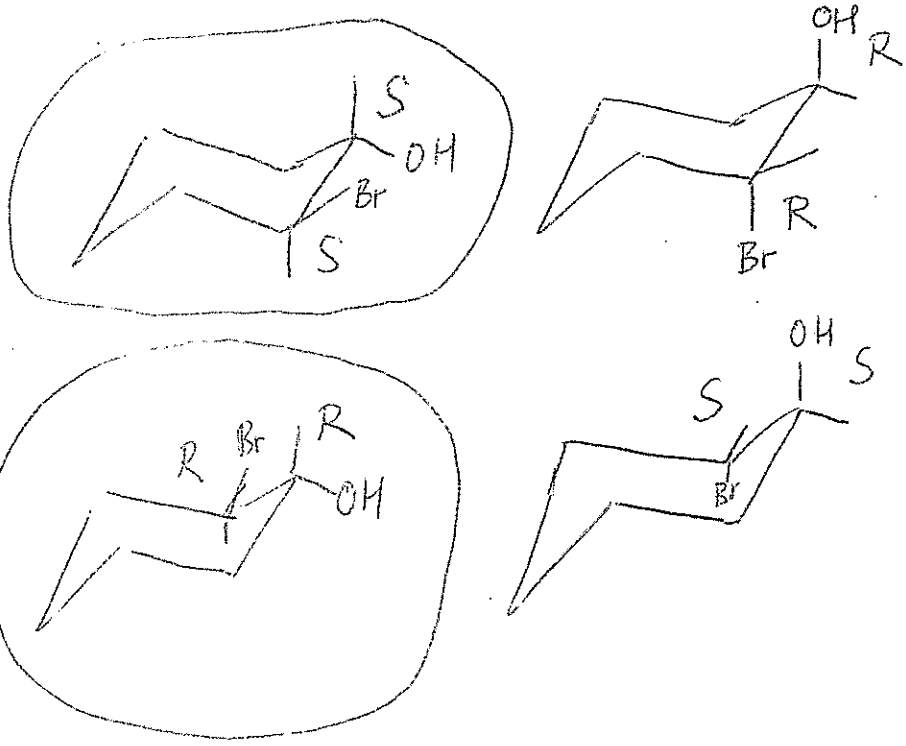
(a) 1-heptanol



(b) 2-heptanol

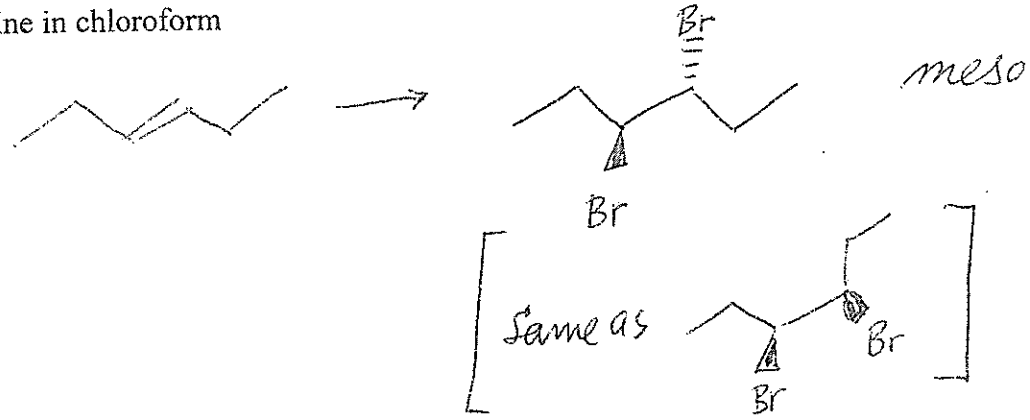


4. (30 pts) Draw 3-dimensional views of all conformations of all bromohydrin products of the addition of Br_2 in water to cyclohexene and write down the R or S configuration of each asymmetric carbon in each structure. Circle the most stable conformer or conformers. Do not write the same structure more than once.



5. (15 pts) Write the structures of the principal organic product from the reactions of the following reagents with (*E*)-3-hexene. If necessary for complete identification of products, include stereochemical information (labels such as *R* or *S*, racemic or meso, etc.) Do not show mechanisms or curved arrows.

(a) bromine in chloroform



(b) 1. ozone, 2. aqueous hydrogen peroxide