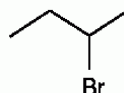


YOUR NAME _____

150 points total. Please answer directly onto the exam paper. You may use molecular models.

1. (42 points) (a) Draw the structure of the S isomer of the chiral molecule, 2-bromobutane (the non-specific structure shown below).



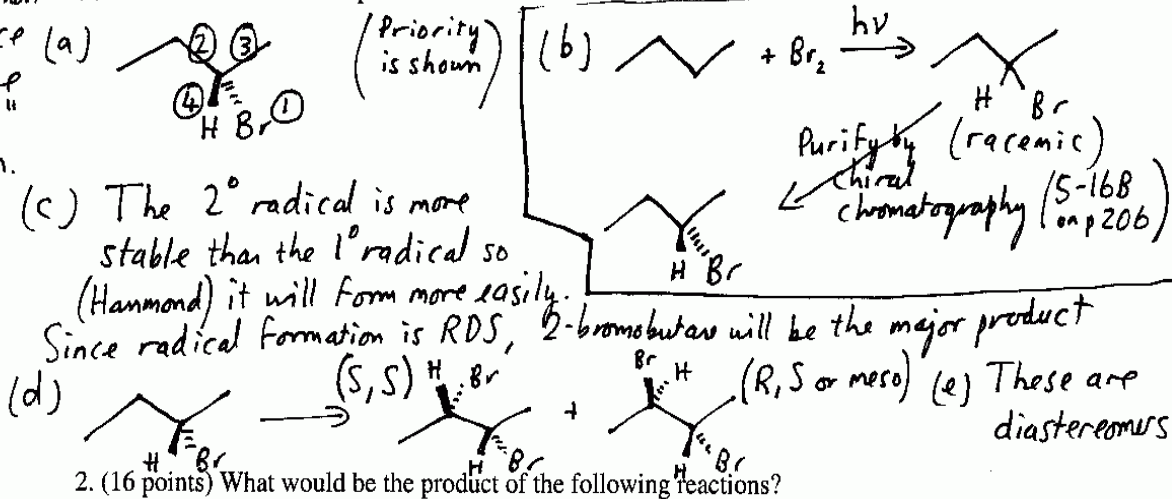
- (b) Describe how you could prepare pure (S)-2-bromobutane (as one pure enantiomer) starting from butane.

- (c) In your synthesis shown in (b), explain briefly why 2-bromobutane is preferred as a product over 1-bromobutane.

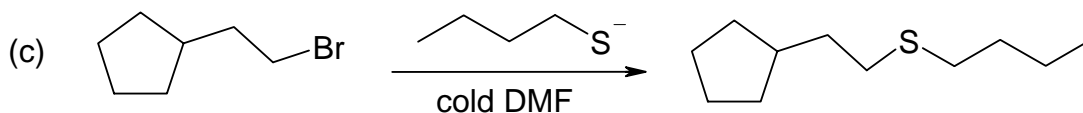
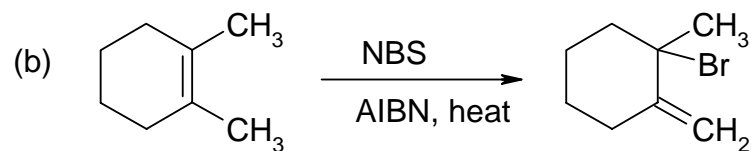
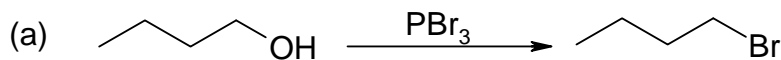
- (d) If pure (S)-2-bromobutane is heated with bromine in the presence of light, the major products are stereoisomers of 2,3-dibromobutane. Draw all of the possible stereoisomers which could be formed in this reaction.

Note:
I will give
you more
space
on the
"real"
exam.

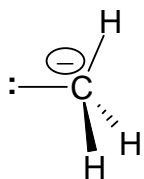
- (e) What are the relationships between these stereoisomers?



2. (21 points) What would be the major product of the following reactions?



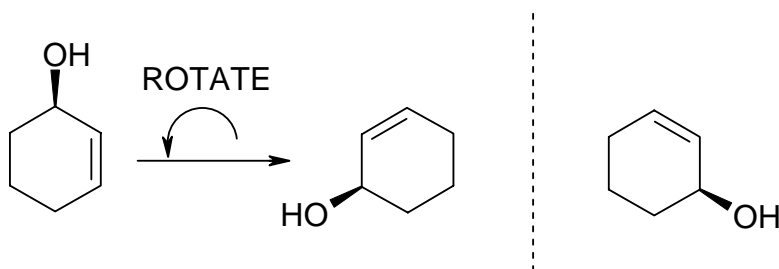
3. (12 points) Draw a 3-D structure for the CH_3^- carbanion. Is the carbon here sp , sp^2 , or sp^3 ? What is the angle between the C-H bonds? Is this ion electrophilic or nucleophilic?



Carbon is sp^3 , with approximately a 109° bond angle. Being so electron-rich, the carbon is very nucleophilic.

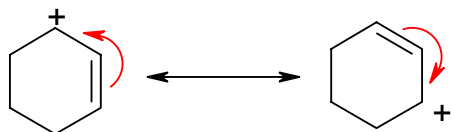
4. (28 points) Describe the relationship between the following pairs of isomers as enantiomers, structural isomers, geometric isomers, resonance forms or identical. [Structures are on the next page]

(a) Enantiomers.

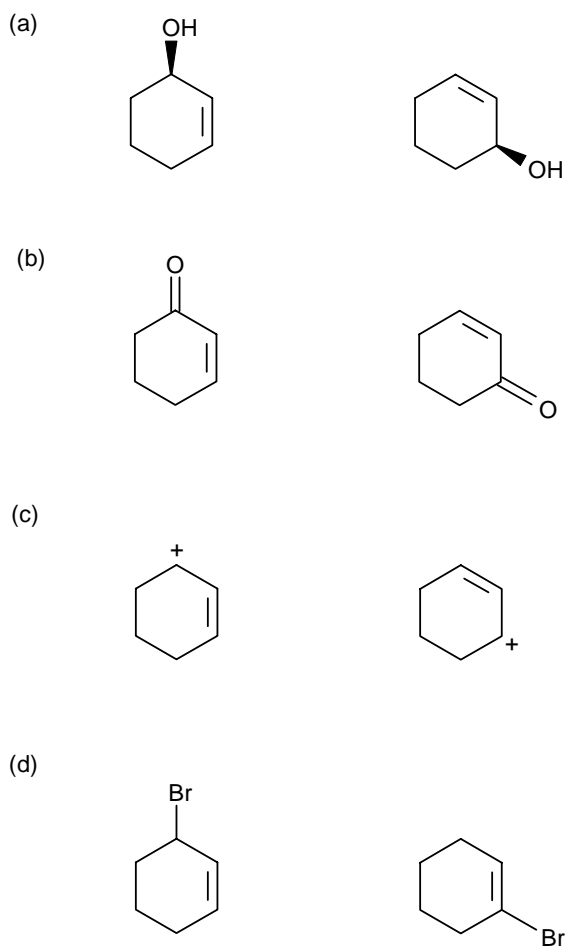


(b) Identical. This is an achiral molecule- so if we rotate then turn it over we get the same compound.

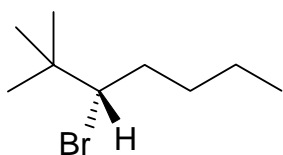
(c) Resonance forms



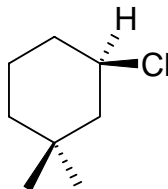
(d) Structural isomers. In one the Br is attached to the alkene carbon, in the other it is not.



6. (12 points) Give a systematic name (including R/S stereochemistry) for the following:



(3S)-bromo-2,2-dimethylheptane



(1R)-chloro-3,3-dimethylcyclohexane

or *(3R)*-chloro-1,1-dimethylcyclohexane is OK.

7. (18 points) Which of the following pairs would react the faster with 1-bromobutane? Briefly explain each answer.

(a) OH^- or SH^- ?

SH^- will react faster, because sulfur is a larger atom, more polarizable, and also less electro-ve.

(b) SH^- or H_2S ?

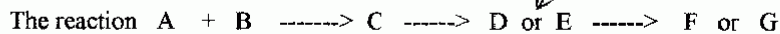
SH^- will react faster, because the negative charge makes the atom (S here) more nucleophilic.

(c) OH^- or F^- ?

OH^- will react faster, because O is less electronegative, and OH^- is a stronger base.

4.

Note that these are two alternative pathways



is essentially irreversible at -70°C but it is reversible at 100°C . It can give rise to either F (which arises from intermediate D) or G (which arises from intermediate E) as a product. With either product, the reaction is exothermic, and the second step is rate determining. Product F predominates at -70°C but at 100°C , G is the major product.

(a) Draw a reaction coordinate diagram which is appropriate for the information given.

(b) Which product is more stable, F or G?

