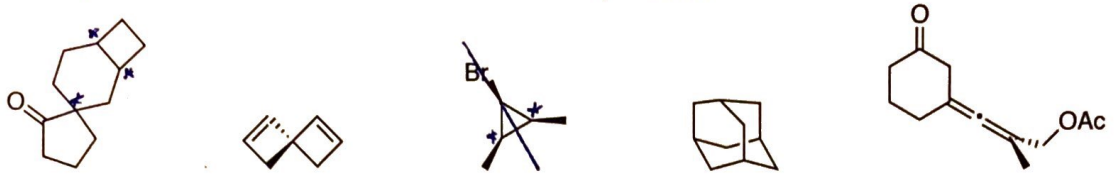
Chemistry 531
Fall 2018
Name: Answer Key

35 pts

Quiz 3

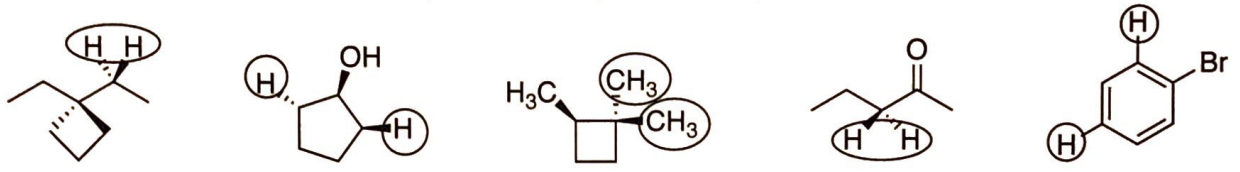
Due 10/31/18

1. Classify each molecule as chiral or achiral. (1 pt each)



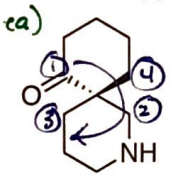
Chiral | Chiral (axial chirality) | achiral | achiral | Chiral (axial chirality)

2. Identify each set of protons or groups as homotopic, heterotopic, enantiotopic, or diastereotopic. (1 pt each)

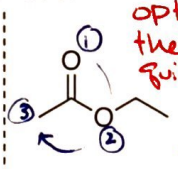


enantiotopic | diastereotopic | diastereotopic | enantiotopic | heterotopic

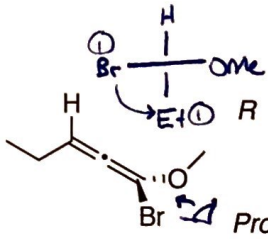
3. Circle the appropriate designation for each. (1 pt ea)



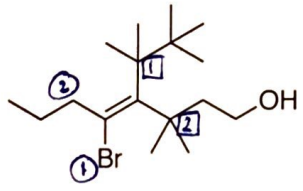
R (S) E Z
P M
Pro-R Pro-S



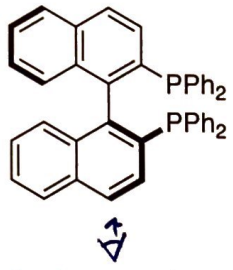
* I messed up the options for this on on the quiz
R S E Z
P M
Si face (Re face)



R S E Z
P (M)
Pro-R Pro-S

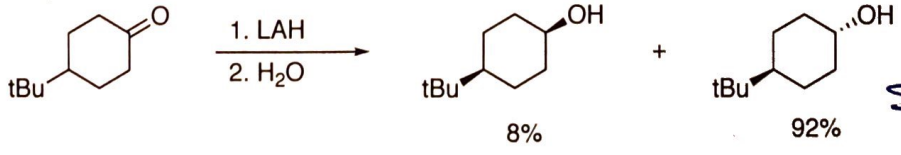


R S (E) Z
P M
Pro-R Pro-S



R S E Z
(P) M
Pro-R Pro-S

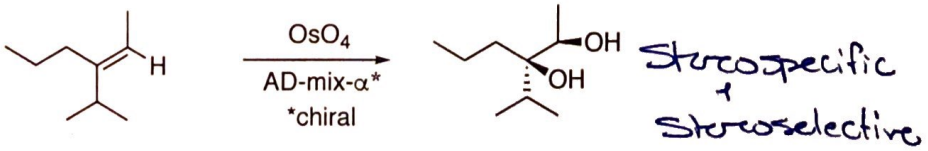
4. Label each transformation as stereoselective, stereospecific, both, or neither. (1 pt each)



1. LAH
2. H_2O

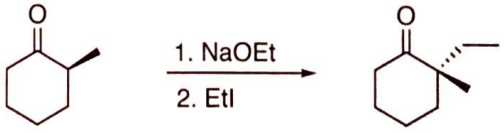
8% + 92%

Stereoselective



OsO_4
AD-mix-α*
*chiral

Stereospecific & Stereoselective



1. NaOEt
2. EtI

+ enantiomer

neither

5. The specific rotation of L-alanine in water (at 25°C) is +2.8. A chemist prepared a mixture of L-alanine and its enantiomer, and 3.50 g of the mixture was dissolved in 10.0 mL of water. This solution was then placed in a sample cell with a pathlength of 10.0 cm and the observed rotation was +0.78. Calculate the % ee of the mixture.

3 pt

$$[\alpha]_D^{25} \text{ of mix} = \frac{0.78}{(1.00\,dm)(3.50\,g/10.0\,mL)} = 2.2°$$

$$ee = \frac{\alpha_{mix}}{\alpha_{pure}} \times 100$$

$$= \frac{2.2°}{2.8°} \times 100 = 79\%\ ee$$

6. Using the steady state approximation, derive the rate law for the following reaction. The second step C→D was found to be the rate determining step.

4 pt

$$A + B \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} C \xrightarrow[RDS]{k_2} D \xrightarrow{k_3} E + F$$

ignore steps beyond RDS

$$\frac{d[C]}{dt} = k_1[A][B] - k_{-1}[C] - k_2[C] = 0$$

$$k_1[A][B] = k_{-1}[C] + k_2[C]$$

$$\frac{k_1[A][B]}{k_{-1} + k_2} = [C]$$

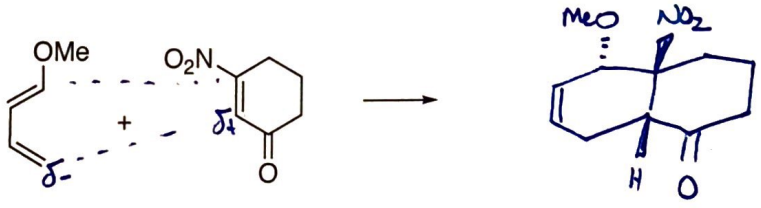
$$Rate = k_2[C]$$

$$= \frac{k_2 k_1 [A][B]}{k_{-1} + k_2}$$

$$= k_{obs}[A][B]$$

7. Predict the product with correct regiochemistry and stereochemistry for the following Diels-Alder reaction.

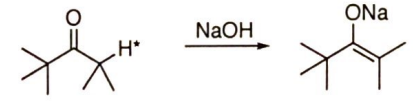
2 pt



Note: NO_2 is a more powerful withdrawing group than C=O

8. For each reaction shown below, circle all of the appropriate kinetic isotope parameters that apply.

2 pt ea

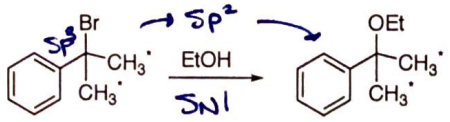


(primary) (normal) α $k_H/k_D > 1$

secondary inverse β $k_H/k_D < 1$

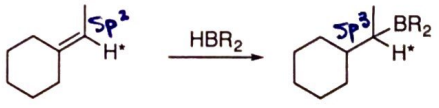
primary normal (α) $k_H/k_D > 1$

(secondary) (inverse) β (circled)



primary (normal) α $k_H/k_D > 1$

(secondary) inverse (β) $k_H/k_D < 1$



primary normal (α) $k_H/k_D > 1$

(secondary) (inverse) β $k_H/k_D < 1$