

**Chemistry 2521**  
**Fall 2007; Midterm 3 Exam**

This exam has 7 problems on 9 pages. Make sure your copy is complete and correct.

Printed Name (Last, First) Key

**Scores:**

Problem 1: 10

Problem 2: 10

Problem 3: 20

Problem 4: 20

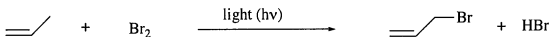
Problem 5: 16

Problem 6: 9

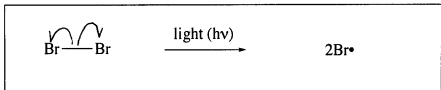
Problem 7: 15

Total: 100

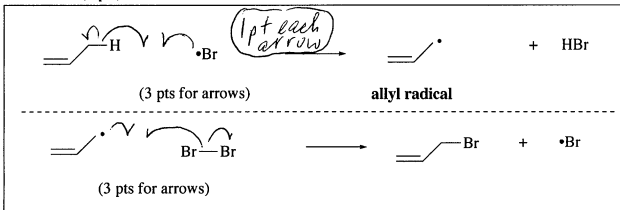
1. (10) Using provided boxes, answer the questions on **mechanism** of the following reaction:



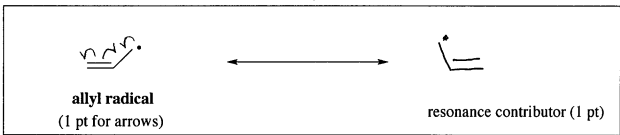
Using the "fishhook" arrows write the **initiation step** in the reaction mechanism (2 pts):



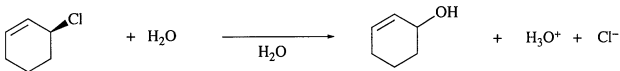
Using the "fishhook" arrows, write the two **chain propagation steps** in the reaction mechanism (6 pts):



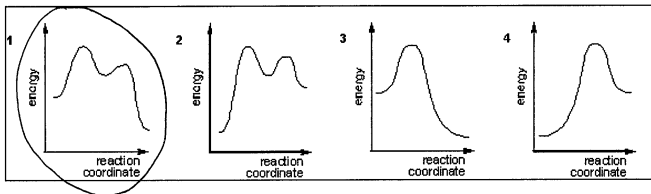
Using "fishhook" arrows and showing the structure of the second **resonance contributor**, show **resonance stabilization** for the allyl radical (2 pts):



2. (10) Answer the questions on mechanism of the following reaction:



a) Which of the following energy diagrams best represents the course of this reaction (circle the correct answer, 3 pts)?



b) Circle the correct **rate equation** for this reaction (3 pts):

Rate =  $k \times [\text{RX}]$

Rate =  $k \times [\text{RX}] \times [\text{H}_2\text{O}]$

Rate =  $k \times [\text{RX}] \times [\text{Cl}^-]$

Rate =  $k \times [\text{H}_2\text{O}] \times [\text{Cl}^-]$

c) Circle the **nucleophile** in this reaction (2 pts):

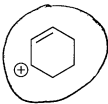
HCl

H<sub>2</sub>O

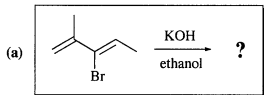
H<sub>3</sub>O<sup>+</sup>

Cl<sup>-</sup>

d) Circle the carbocation **intermediate** in this reaction (2 pts):



3. (20, 4 pts each) Circle the structure of the **major product** in each of the following reactions:



2-methyl-1-pentene

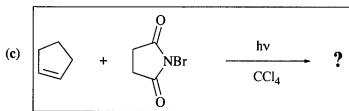
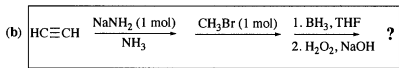
2-methyl-1-penten-4-yne

5-methyl-2-pentyne

2-methyl-1,3-pentadiene

**2-methyl-1-penten-3-yne**

5-methyl-2-pentyne

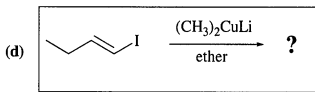


4-bromocyclopentene

1-bromocyclopentene

**3-bromocyclopentene**

bromocyclopentane

*trans*-1,2-dibromocyclopentane

(Z)-2-pentene

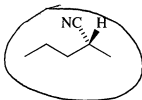
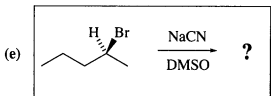
**(E)-2-pentene**

2-methylbutane

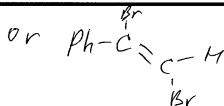
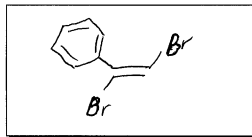
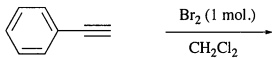
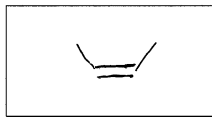
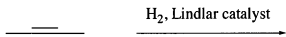
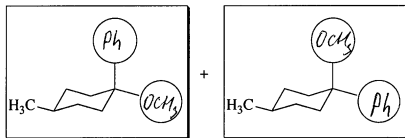
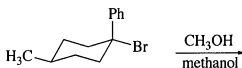
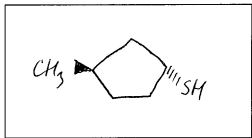
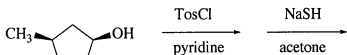
2-methyl-1-butene

2-methyl-2-pentene

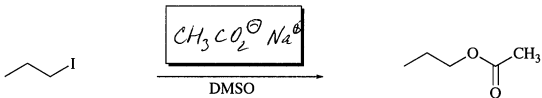
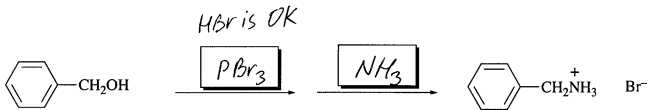
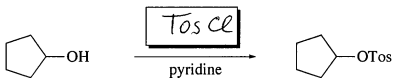
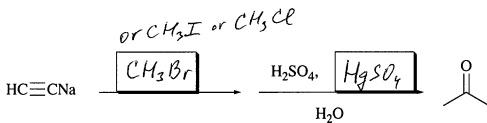
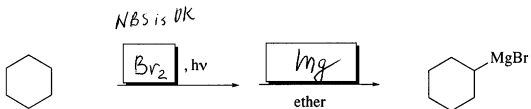
1-pentyne



4. (20; 5 pts each) Draw the structure of the main product for each the following **stereoselective** reactions. Draw structures in the provided boxes; make sure to show the correct **stereochemistry** for the substituents (-2 pts for wrong stereochemistry).

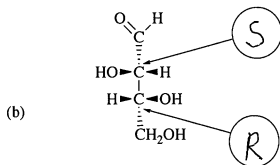
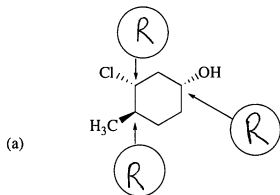


5. (16, 2 pts each) Place in each box the molecule of a reagent that is required to perform each of the following reactions:

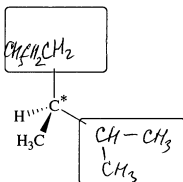


*CH<sub>3</sub>C(=O)O<sup>-</sup> is OK*  
*CH<sub>3</sub>CO<sub>2</sub><sup>-</sup> or AcO<sup>-</sup>*

6. (9 pts) (a) Assign the **R,S** configuration to each **stereocenter** in the following compounds (1 pts each stereocenter; use the provided circles for your answers):



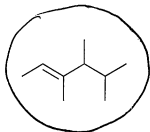
(b) Using provided stereocenter, finish the **drawing** of (**S**)-2,3-dimethylhexane by placing appropriate substituents in the boxes on the bonds:  
(2 pts each substituent):



2 pts each

7. (15, 5 pts each) For each of the following questions (a)-(c) **circle** the item that is the correct answer.

(a) Which one of the following molecules is **chiral**?



(b) Which of the following alkyl bromides reacts the slowest with sodium cyanide, NaCN, in dimethylsulfoxide?

1-bromo-2-methylbutane

2-bromo-3-methylbutane

1-bromobutane

1-bromo-2,3-dimethylbutane

bromomethane

bromoethane

(c) Which one of the following compounds has the **best leaving group**?

cyclohexanol

3-methylcyclohexanol

1-methylcyclohexanol

iodocyclohexane

methylamine

chloromethane

fluorocyclohexane

2-bromohexane

ethanol