

Chemistry 2521
Fall Semester 2001; Final Exam

December 19, Thursday, 4:00 to 5:55 pm

This exam has 6 problems (200 pts) on 7 pages. Make sure your copy is complete and correct.

Printed Name (Last, First) _____

Your final grades will be posted Thursday afternoon.

Good Luck!

2
Chemistry 2521
Fall 2001; Final Exam

This exam has 6 problems on 7 pages. Make sure your copy is complete and correct.

Printed Name (Last, First) _____

Scores:

1. _____

2. _____

3. _____

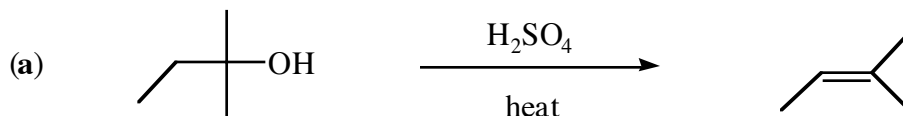
4. _____

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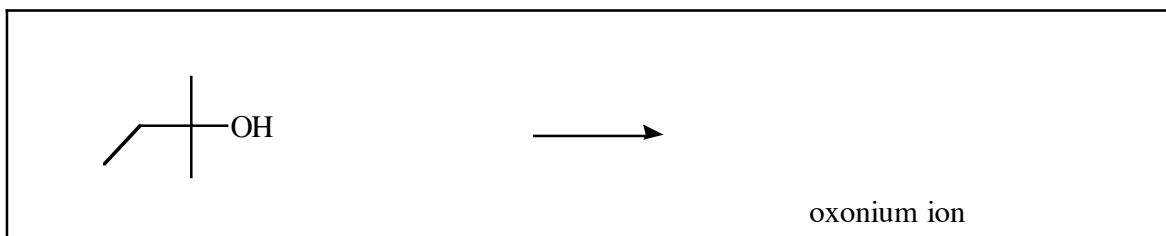
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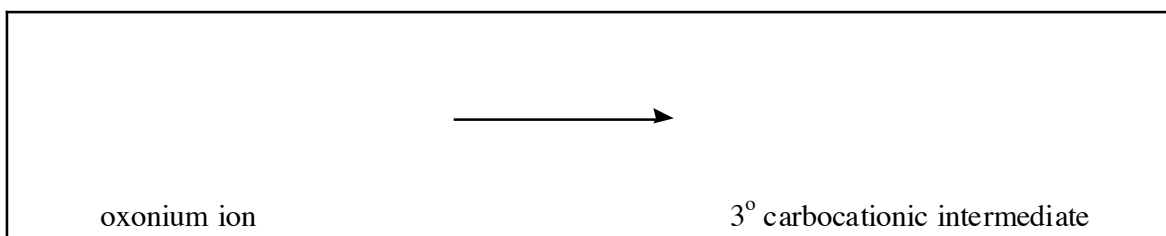
1. (30) Using provided boxes, answer the questions on **mechanisms** of the following reactions (15 pts each):



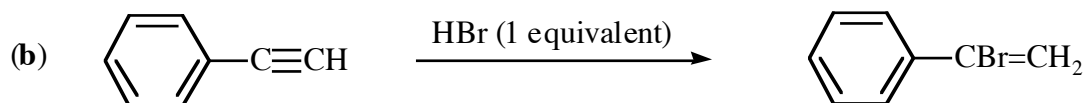
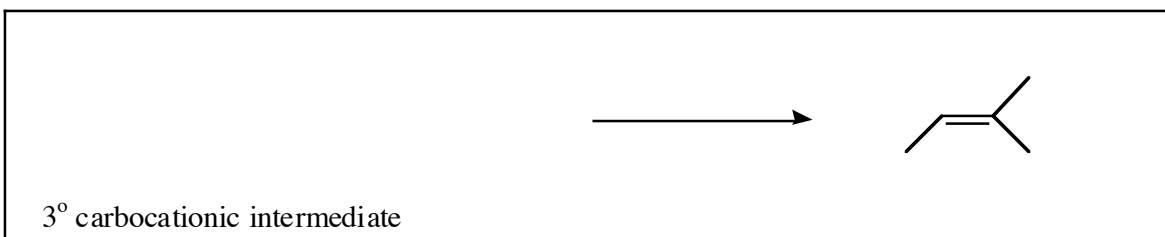
Using curved arrows and showing the structure of the **oxonium** intermediate, write the **first step (protonation)** in the reaction mechanism (5 pts):



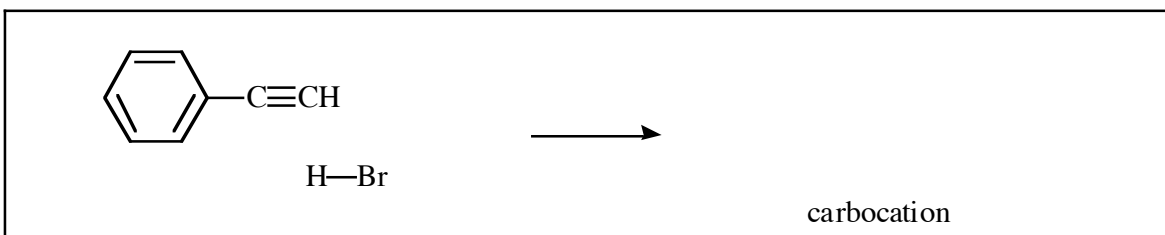
Using curved arrow and showing the structure of the **carbocationic** intermediate, write the **second step** in the reaction mechanism (5 pts):



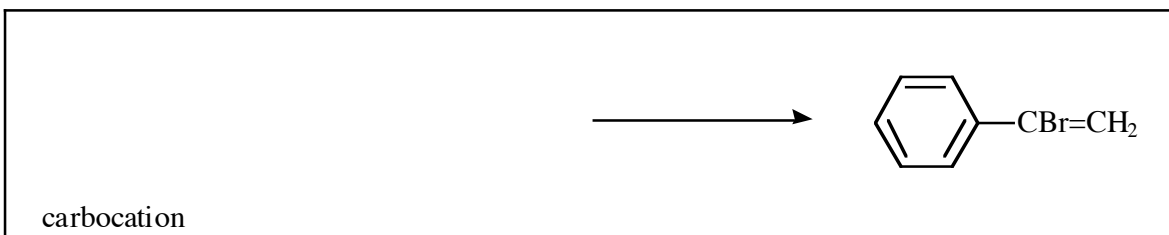
Using curved arrows and other essential species (H_2O), write the **elimination step (E1)** in the reaction mechanism (5 pts):



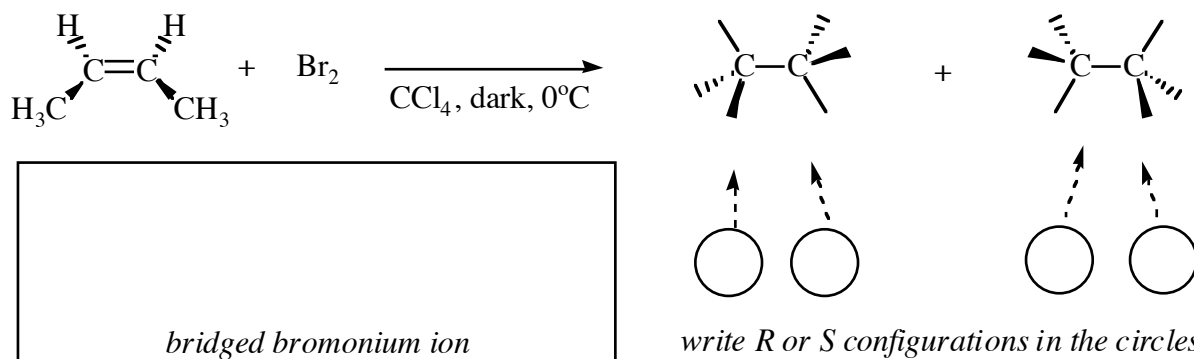
Using curved arrows and showing the structure of the **carbocationic** intermediate, write the **first step** in the reaction mechanism (10 pts):



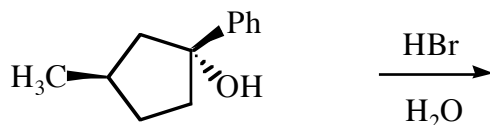
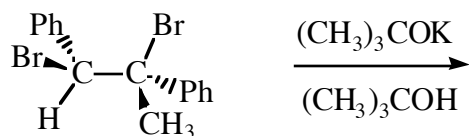
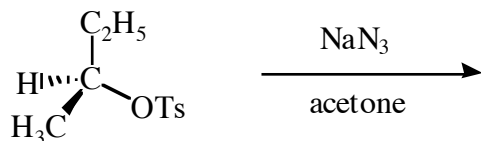
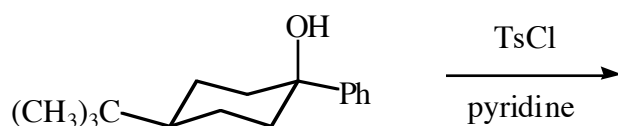
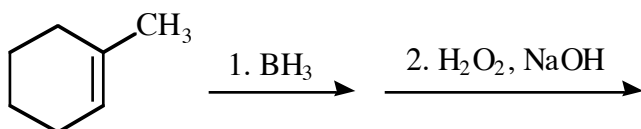
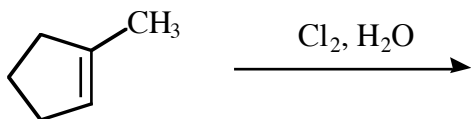
Using curved arrow and other essential species, write the **final step** in the reaction mechanism (5 pts):



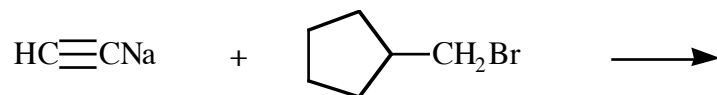
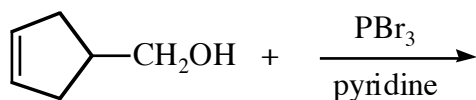
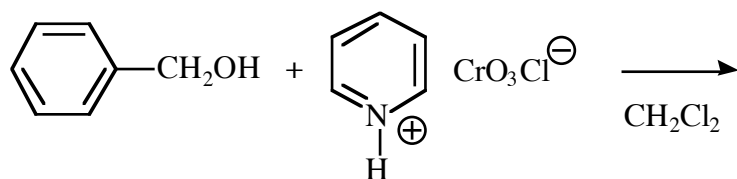
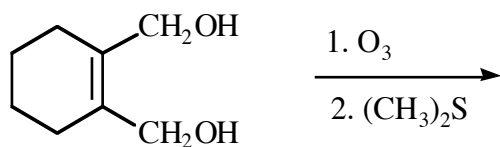
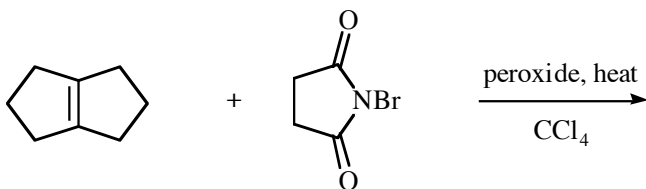
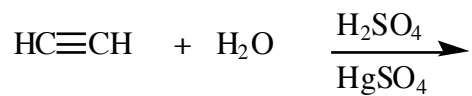
2. (29) Finish drawings of the **three-dimensional structures** of products in the following reaction [your drawings must be in agreement with the *stereochemistry* of this reaction!] (10 pts). In the provided circles, write **R,S configurations** for all **stereocenters** in each of the products (8 pts). In the provided box, draw the structure of the **bridged bromonium ion** intermediate for this reaction (11 pts).



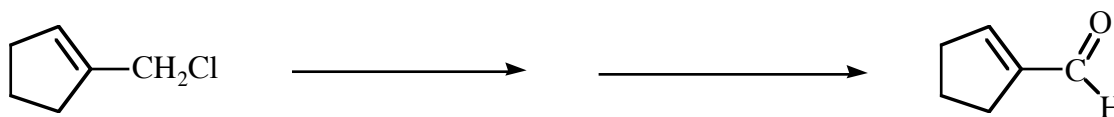
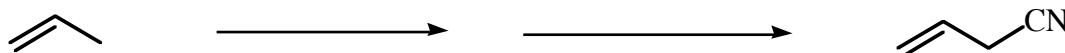
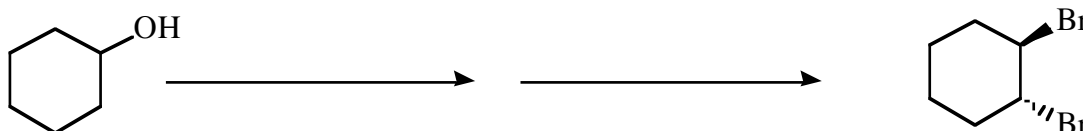
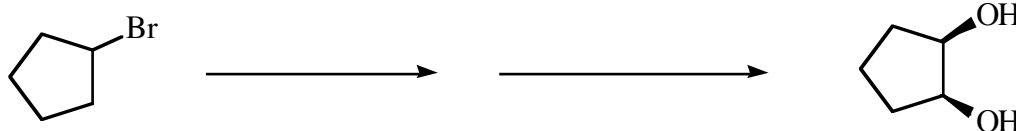
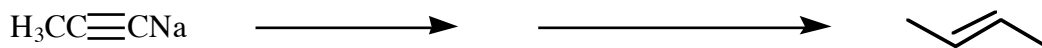
3. (36) Complete the following equations by drawing **three-dimensional structures** with the **correct stereochemistry** of the major organic products expected in each case (6 pts each).



4. (35) Complete the following equations by drawing structures of the **major** product(s) expected in each reaction (5 pts each).



5. (30) Give the **reagents on the arrow** that can be used to convert the reactant to the indicated product in high yield (5 pts each).



6. (40, 5 pts each) For each of the following questions (a)-(h) **circle** the item that is the correct answer.

(a) Which of the following compounds is the **most reactive in $\text{S}_{\text{N}}1$** reactions?

- 1-chlorohexane 1-iodo-2-methylhexane 1-iodo-1-methylcyclohexane 1-iodohexane
 2-hexyl tosylate 1-fluoro-4-methylhexane 1-hexyl tosylate 1-iodo-4-methylcyclohexane
 methane ethane *tert*-butylcyclohexane methanol ethanol vinyl chloride

(b) Which of the following compounds is the **most reactive in $\text{S}_{\text{N}}2$** reactions?

1-bromohexane 1-bromo-2-phenylhexane 3-bromocyclohexene iodomethane
 2-iodohexane 3-bromocyclohexanol 4-bromo-1-phenylcyclohexene 1-bromo-2-phenylcyclohexane

(c) Which of the following compounds is the **most reactive in radical** reactions with **NBS**?

cyclohexane 1,1-dimethylcyclohexane ethylene chloromethane fluoromethane
 methane ethane phenylcyclohexane 3-methylcyclohexanol dichloromethane butane

(d) Which one of the following compounds has the **most acidic hydrogens**?

methane ammonia 1-fluoropropane 2-butyne cyclohexanol 1-iodopropane
 2-methylcyclohexene 3-methylcyclohexene tetrafluoromethane 1-chloropropane

(e) Which one of the following compounds has **two** stereoisomers (including enantiomers and diastereomers)?

2-iodo-3-chlorobutane methylcyclopentane 1-iodo-1-methylcyclopentane 1,1-dimethylcyclobutane
 3-bromocyclohexanol 4-methylcyclohexanol 1,2-dibromocyclohexane 3,4-dichlorohexane

(f) Which one of the following compounds will have the **highest** boiling point?

propane acetic acid 2-chloropropane 1,2-dimethylcyclopropane
 1-fluoropropane dimethyl ether 1-propanethiol propene propyne

(g) Which of the following compounds is the **strongest base**?

CH_3OCH_3 LiCl CH_3OH LiI H_2O LiF NaNH_2
 CH_3OLi NH_3 CH_3NH_2 *t*-BuOH *t*-BuOK HCl

(h) Which of the following alkenes will be the **major** product in the **acid-catalyzed dehydration** of **3-methyl-2-butanol**?

3-methyl-1-butene (*E*)-2-pentene (*Z*)-2-pentene 2-methyl-2-butene 2-methylbutane
 (*E*)-2-butene (*Z*)-2-butene 1-butene 1-pentene dimethylacetylene 1-pentyne