

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) Key

Scores:

1. 30

2. 29

3. 36

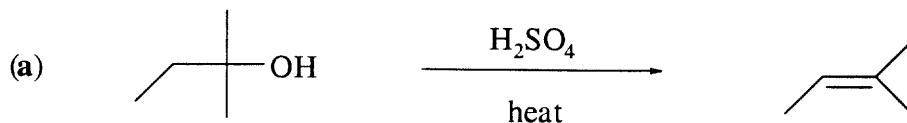
4. 35

5. 30

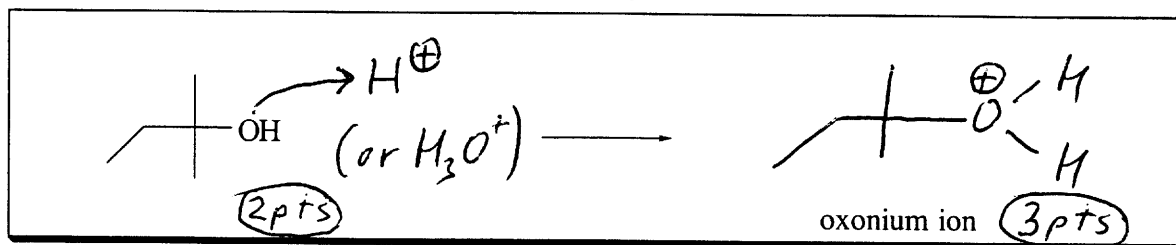
6. 40

Total: 200

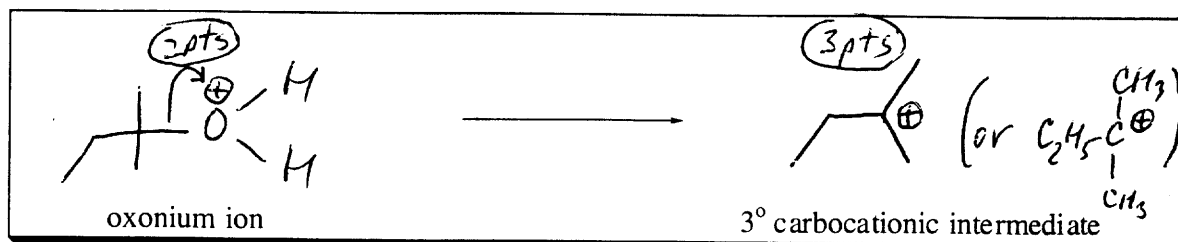
1. (30) Using provided boxes, answer the questions on **mechanisms** of the following reactions (15 each):



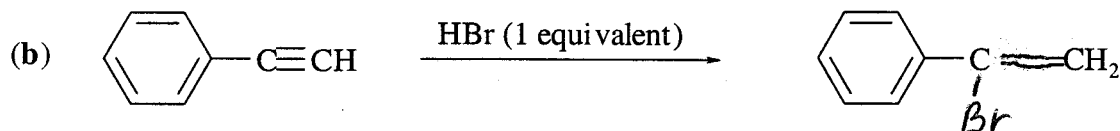
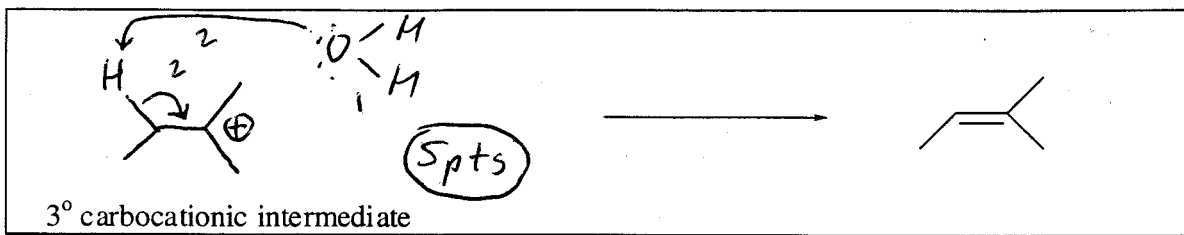
Using curved arrows and showing the structure of the **oxonium** intermediate, write the **first step (protonation)** in the reaction mechanism (5 pts):



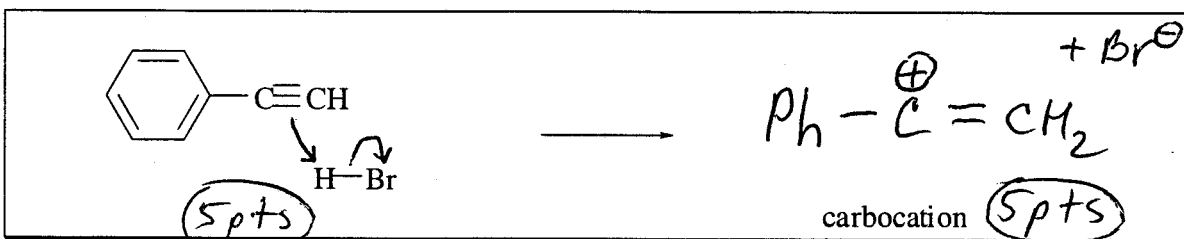
Using curved arrow and showing the structure of the **carbocationic** intermediate, write the **second step** in the reaction mechanism (5 pts):



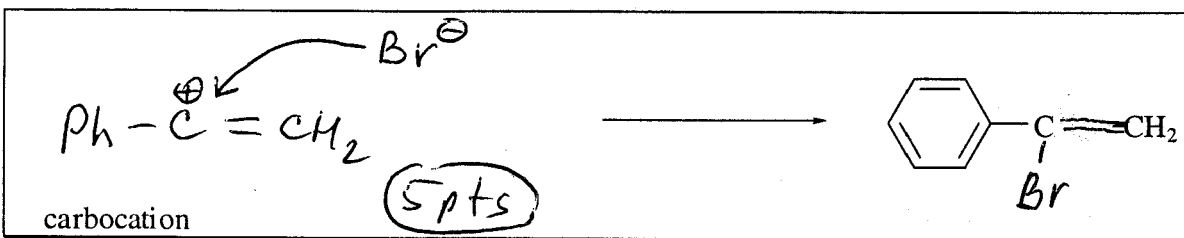
Using curved arrows and other essential species ( $\text{H}_2\text{O}$ ), write the **elimination step (E1)** in the reaction mechanism (5 pts):



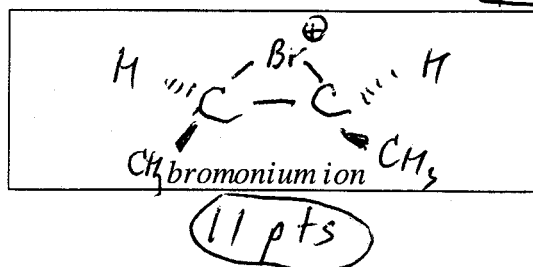
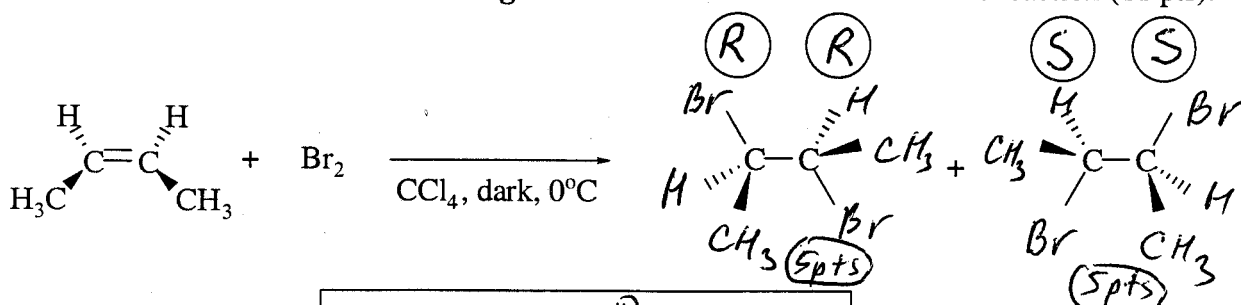
Using curved arrows and showing the structure of the **carbocationic** intermediate, write the **first step** in the reaction mechanism (10 pts):



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

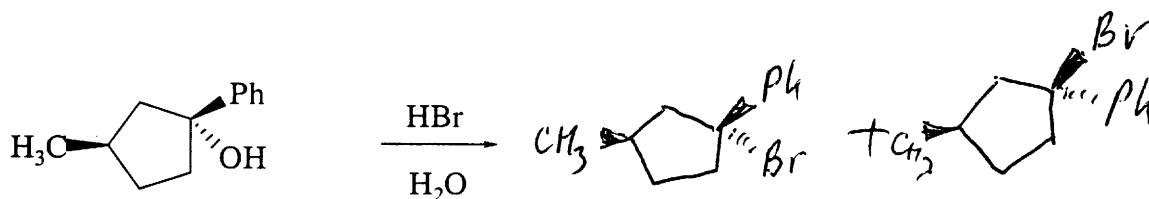
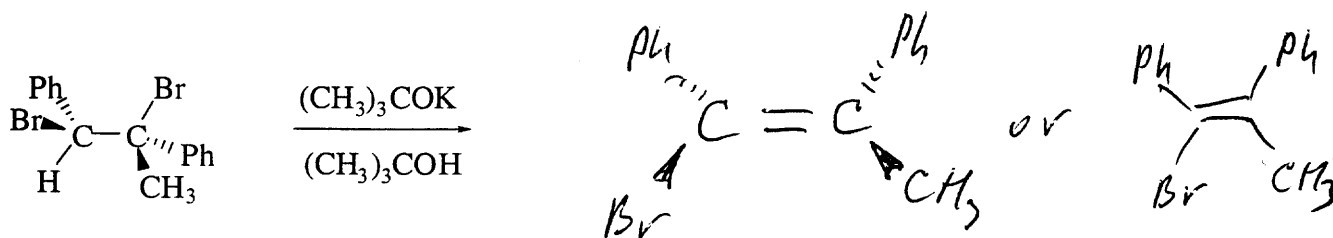
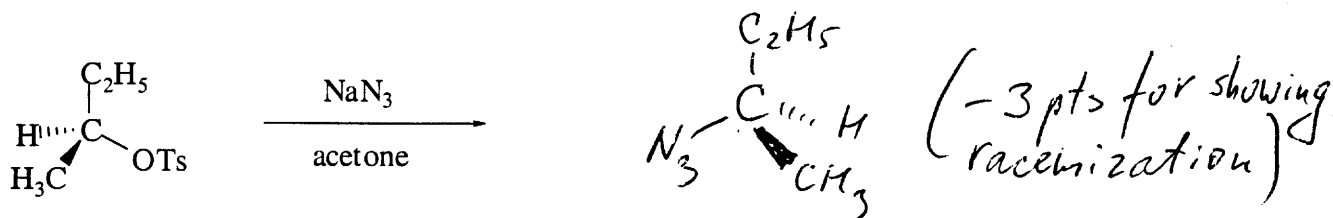
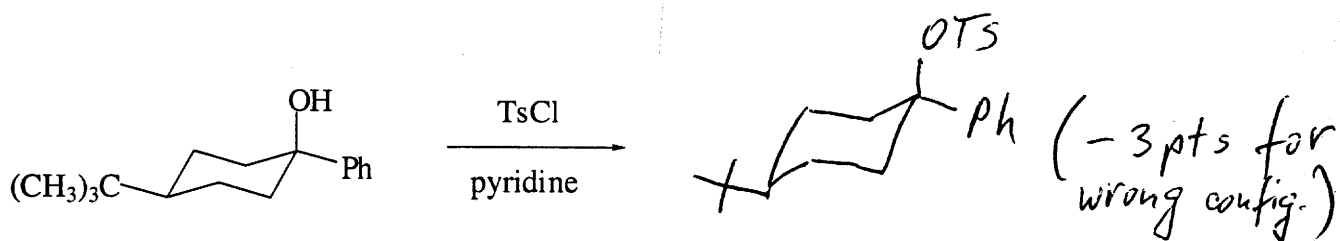
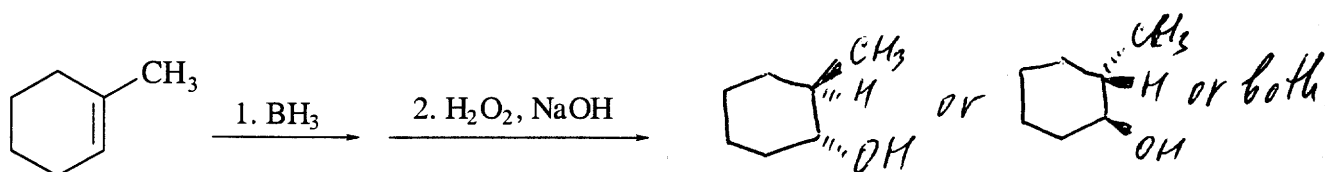
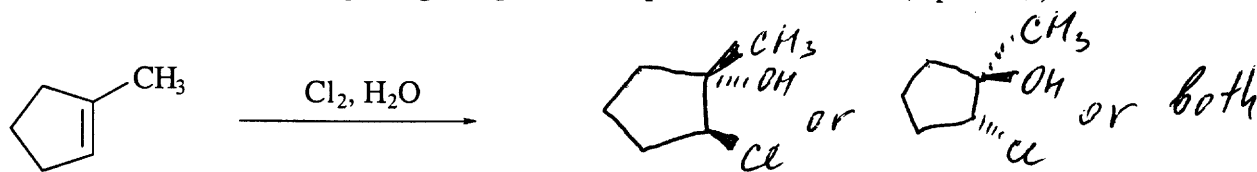


2. (29) Finish drawings of the **three-dimensional structures** of major organic products in the following reaction [your drawings must be in agreement with the *stereochemistry* of this reaction!] (10 pts). In the provided circles, write **R,S configurations** for all **stereocenters** in each of the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

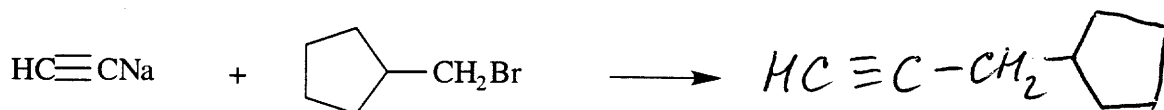
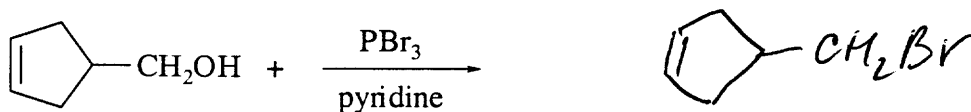
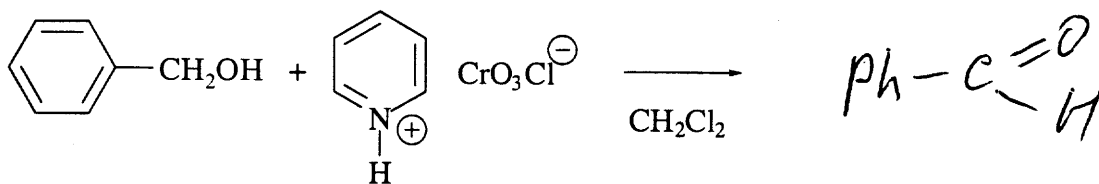
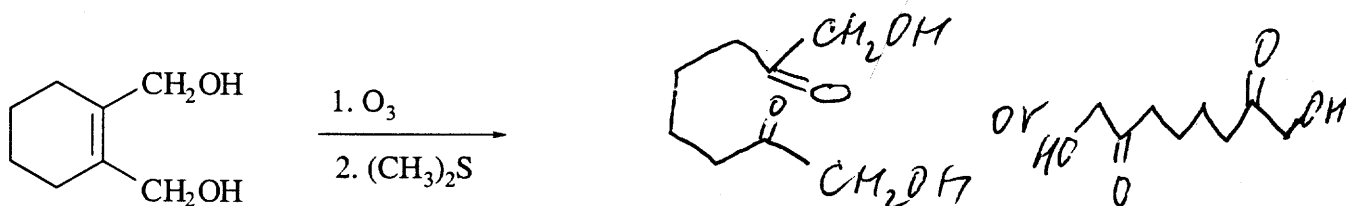
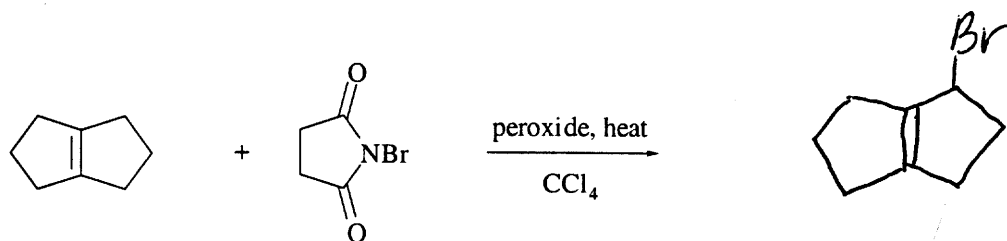
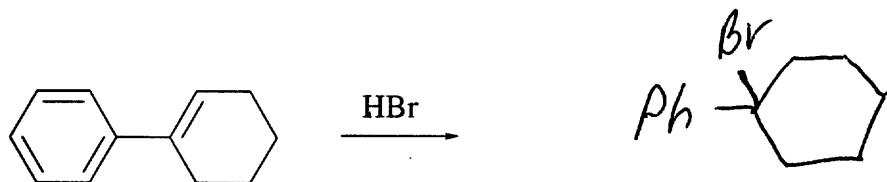
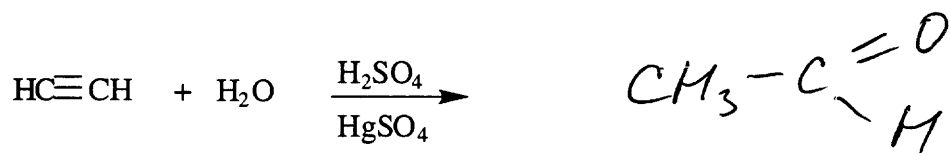


2pts each  
stereocenter  
total 8pts

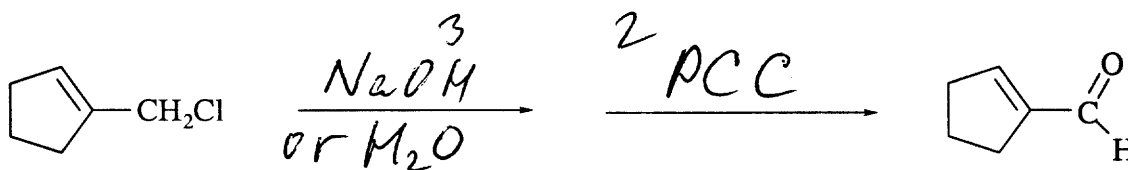
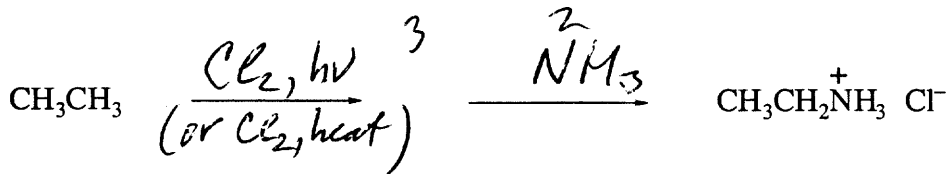
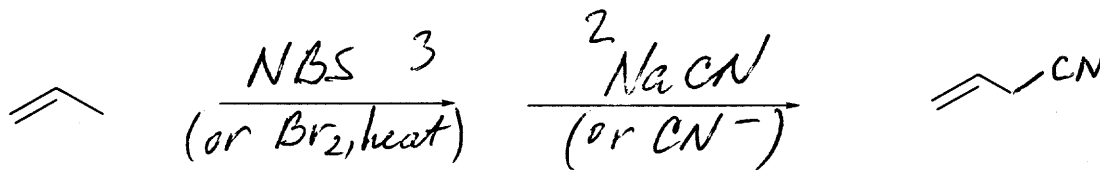
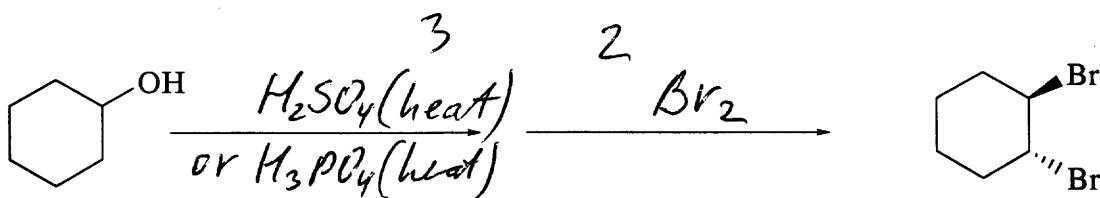
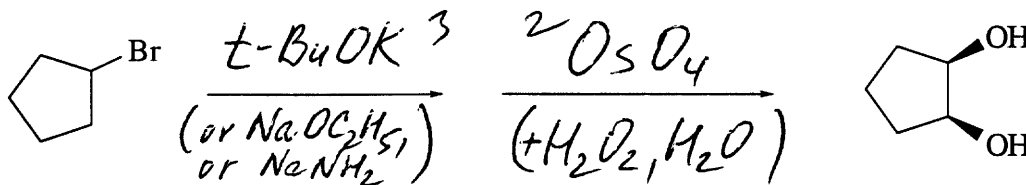
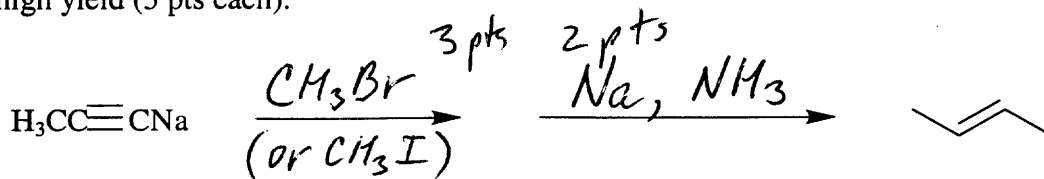
3. (36) Complete the following equations by drawing **three-dimensional structures** with the **correct stereochemistry** of the major organic products expected in each case (6 pts each).



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 S<sub>N</sub>1** reactions?

- |                  |                         |                                   |                            |
|------------------|-------------------------|-----------------------------------|----------------------------|
| 1-chlorohexane   | 1-iodo-2-methylhexane   | <u>1-iodo-1-methylcyclohexane</u> | 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 S<sub>N</sub>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?

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<sub>3</sub>OCH<sub>3</sub>    LiCl    CH<sub>3</sub>OH    LiI    H<sub>2</sub>O    LiF    **NaNH<sub>2</sub>**  
 CH<sub>3</sub>OLi    NH<sub>3</sub>    CH<sub>3</sub>NH<sub>2</sub>    *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