

Chem 226 / Practice Questions for Exam 2; **Note:** This is an incomplete collection; content & emphasis will vary.

**Exam 2 Fall 2002:** Questions were developed from Worksheets, In-class interrogatories, Homework & On-line Exercises/Exams. Questions & distribution of points: [5 ques.: multiple choice, T/F or ranking, 2 short answer, ...many structural drawings.] GENERAL TOPICS: resonance, hydrocarbon stability, alkenes, unsaturation, nomenclature, functionality (~20%); STEREOCHEMISTRY: all topics (~40%); MECHANISMS: Free Radical, Sn1, Sn2, E1, E2 (~40%)

1. Circle the protic solvent(s).

A) diethyl ether      B) n-hexane      C) acetone

D) ethanol      E) nitromethane

2. Which of the following is not a nucleophile?

A) H<sub>2</sub>O      B) CH<sub>3</sub>OH      C) H<sub>2</sub>      D) <sup>-</sup>CN      E) NH<sub>3</sub>

3. Which compound would you expect to react most rapidly with ethanolic silver nitrate?

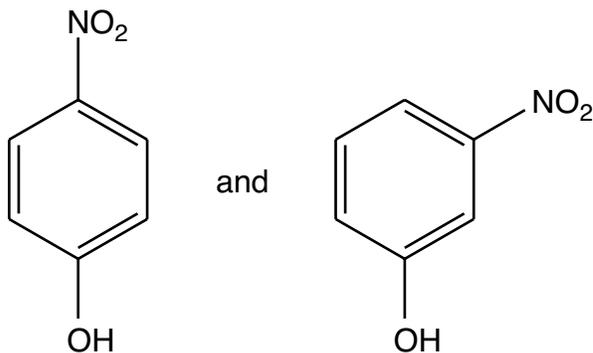
A) ethyl chloride      B) isopropyl chloride      C) t-butyl chloride

D) vinyl chloride      E) chlorobenzene

4. Which compound is classed as a protic solvent.?

A) diethyl ether    B) n-hexane    C) acetone    D) ethanol    E) nitromethane

5. Compare each pair of compounds shown below, circle the better nucleophile of the two, and give a reason for your choice.

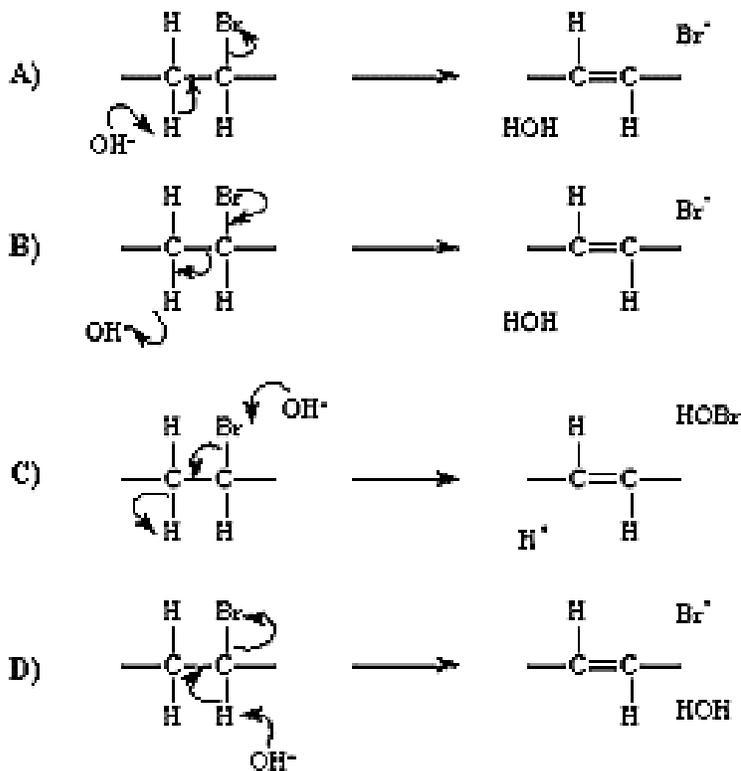


Reason:



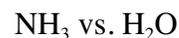
Reason:

6. Which of the following best represents the mechanism for  $\text{E}_2$  elimination of  $\text{HBr}$  from a secondary bromo compound (dehydrobromination) by hydroxide ion?



7. A reaction mixture consisted of 0.5M methyl iodide and 1.0 M sodium hydroxide. The measured rate of reaction at room temperature was 0.05 mol/L per second. What would be the rate for a reaction mixture of 0.1M methyl iodide and 2.0 M sodium hydroxide?

8. Circle the stronger nucleophile in each pair:



9. Rank the following substrates in decreasing order of reactivity under  $S_N1$  reaction conditions:

- A) methyl chloride    B) t-butyl iodide  
C) 2-bromo propane    D) ethyl chloride

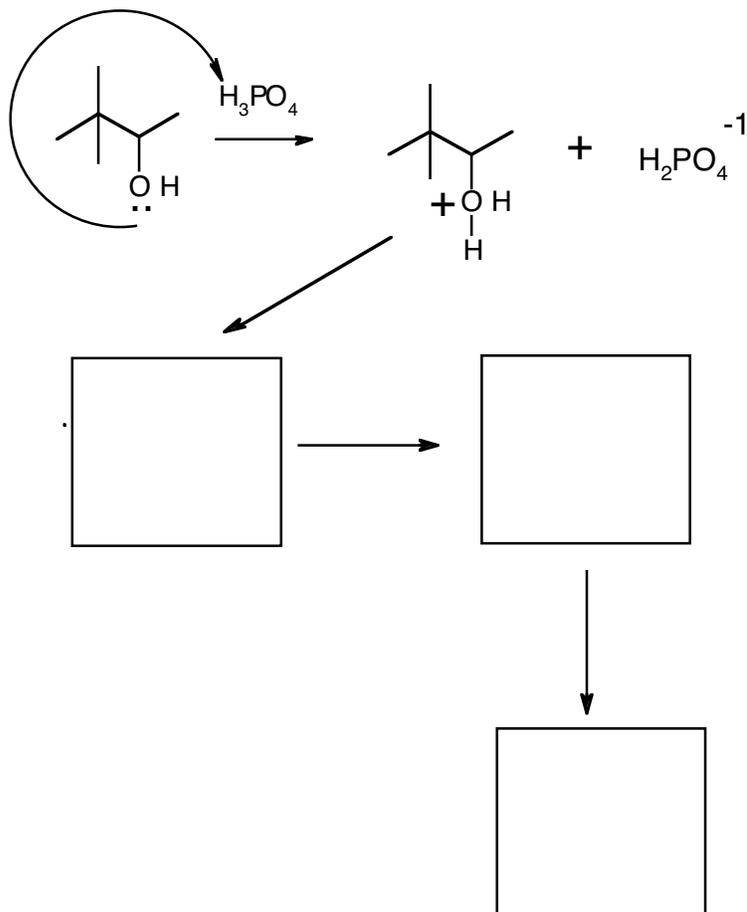
\_\_\_\_\_ > \_\_\_\_\_ > \_\_\_\_\_ > \_\_\_\_\_

10. Rank the following substrates in decreasing order of reactivity under  $S_N2$  reaction conditions:

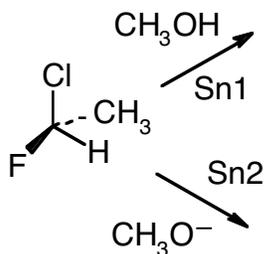
- A) methyl chloride    B) t-butyl iodide  
C) 2-bromo propane    D) ethyl chloride

\_\_\_\_\_ > \_\_\_\_\_ > \_\_\_\_\_ > \_\_\_\_\_

11. The following dehydration reaction with phosphoric acid produces 2,3-dimethylbut-2-ene. Show the complete reaction mechanism with arrows to indicate electron movement.

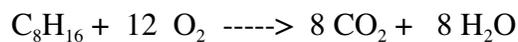


12. Optically active (R)-1-chloro-1-fluoroethane can produce a product with the same molecular formula of  $C_3H_7FO$  by either an  $S_N1$  or  $S_N2$  reaction. However, an optical rotation is observed in one case and not the other. Show the stereochemistry of the products and briefly explain this observation.



Explanation:

13. For the reaction:



The following thermodynamic data was measured:

Compound	Heat of Combustion (kJ/mol)
<b>A)</b> 1,1-dimethylcyclohexane	-5215
<b>B)</b> 1,1-dimethyl-2-propyl-cyclopropane	-5318
<b>C)</b> 1-ethyl-1-methylcyclopentane	-5240

Draw an energy diagram illustrating the data.

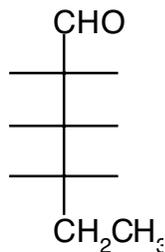
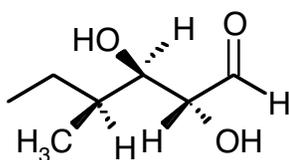


Rank the compounds in order of increasing stability:

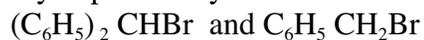


It is claimed that more substituted alkanes are energetically more stable. For example, isobutane is 9 KJ/mole more stable than butane. Briefly explain the relationship of this statement to your diagram and the order of stability.

14. Complete the Fischer projection to correspond to the structure on the left.

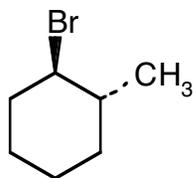


15. Circle the compound in each pair that would react faster by an  $S_N1$  mechanism. Briefly explain why.

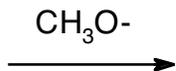
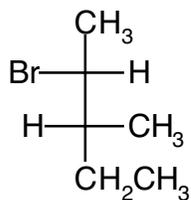


Reason:

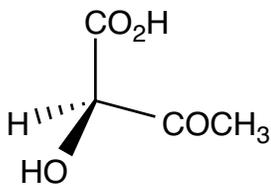
16. Provide structure(s) for the elimination product(s) in the following reaction. Indicate stereochemistry as appropriate:



+ sodium ethoxide  $\longrightarrow$

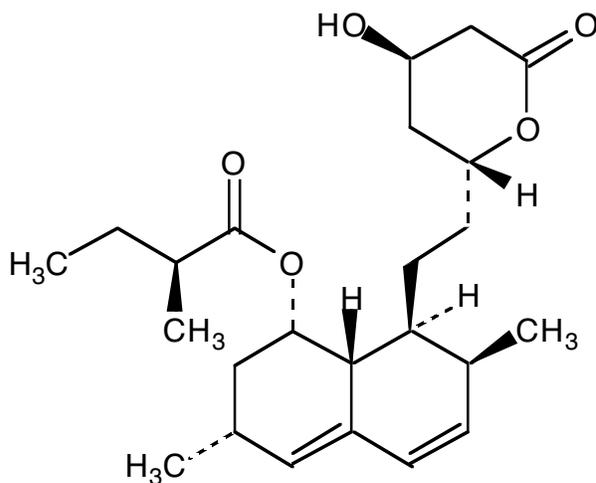


17. Assign the (R) or (S) configuration to the following structure; label the groups 1-4 with priorities  $1 > 2 > 3 > 4$ .



Circle one: R or S

18. Circle all of the chiral carbon atoms in lovastatin, a fungal metabolite which is an antihypercholesterolemic. Its optical rotation is  $[\alpha]^{25} = +323^\circ$ .



How many stereoisomers are possible? \_\_\_\_\_

How many elements (degrees) of unsaturation are present? \_\_\_\_\_

Identify two different types of functions in the molecule both of which contain oxygen.

\_\_\_\_\_

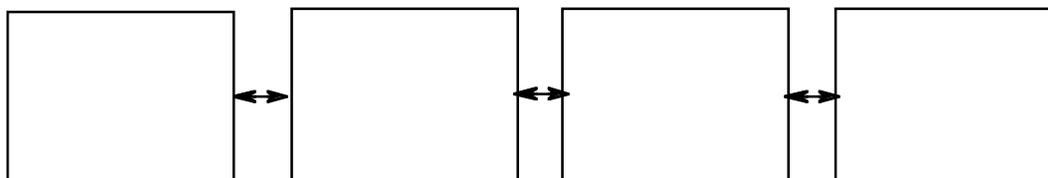
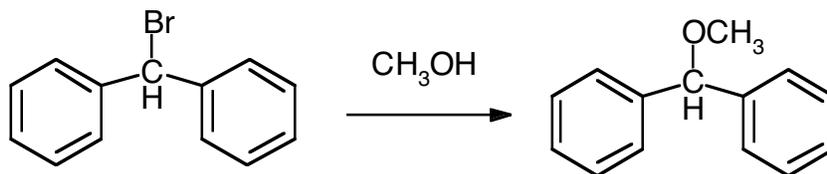
\_\_\_\_\_

A synthetic sample had an optical rotation of  $[\alpha]^{25} = -16.25^\circ$ .

What is the optical purity (enantiomeric excess) of the sample? \_\_\_\_\_

Which isomer is in excess? (circle one): d- or l-

19. Draw the carbocation for the following solvolysis reaction and 3 different resonance structures showing the electron movement in each with arrows.



20. Circle the compound(s) which has (have) a Z- configuration.

