

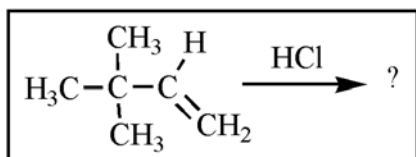
Exam 2 Chem 109a Fall 2004

Please put your name and perm number on both the exam and the scantron sheet.

Next, answer the following 34 multiple-choice questions on the scantron sheet.

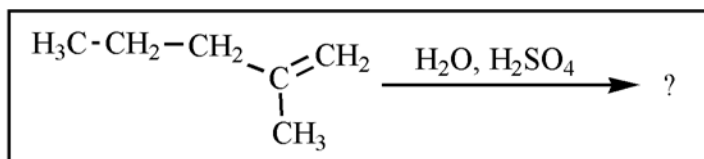
Then choose **one A-type** mechanism question and **one B-type** mechanism and give your two mechanism on the space provided below the question. We will only grade one of each.

1. What would be the major organic product of the following reaction?



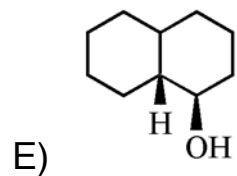
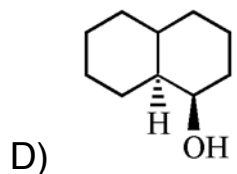
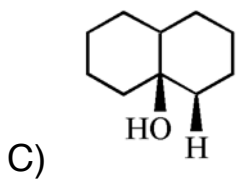
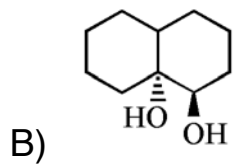
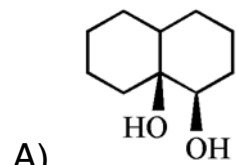
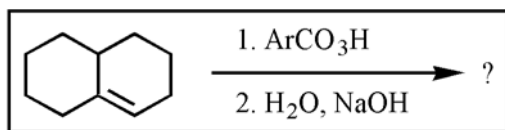
- A)
$$\begin{array}{c} \text{H}_3\text{C} \quad \text{H} \\ | \quad | \\ \text{H}_3\text{C}-\text{C}-\text{C}-\text{CH}_2\text{Cl} \\ | \quad | \\ \text{H}_3\text{C} \quad \text{H} \end{array}$$
- B)
$$\begin{array}{c} \text{H}_3\text{C} \quad \text{Cl} \\ | \quad | \\ \text{H}_3\text{C}-\text{C}-\text{C}-\text{CH}_3 \\ | \quad | \\ \text{H}_3\text{C} \quad \text{H} \end{array}$$
- C)
$$\begin{array}{c} \text{Cl} \quad \text{H} \\ | \quad | \\ \text{H}_3\text{C}-\text{C}-\text{C}-\text{CH}_3 \\ | \quad | \\ \text{H}_3\text{C} \quad \text{CH}_3 \end{array}$$
- D)
$$\begin{array}{c} \text{Cl} \\ | \\ \text{H}_2\text{C} \quad \text{H} \\ | \quad | \\ \text{H}_3\text{C}-\text{C}-\text{C}-\text{CH}_3 \\ | \quad | \\ \text{H}_3\text{C} \quad \text{H} \end{array}$$
- E)
$$\begin{array}{c} \text{H}_3\text{C} \quad \text{Cl} \quad \text{Cl} \\ | \quad | \quad | \\ \text{H}_3\text{C}-\text{C}-\text{C}-\text{CH}_2 \\ | \quad | \\ \text{H}_3\text{C} \quad \text{H} \end{array}$$

2. What would be the major organic product of the following reaction?

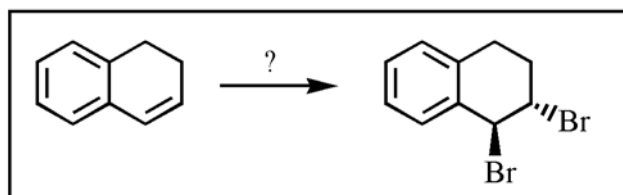


- A) $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\underset{\text{CH}_3}{\text{C}}(\text{H})-\text{CH}_2-\text{OH}$
- B) $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\underset{\text{CH}_3}{\text{C}}(\text{OH})(\text{CH}_3)$
- C) $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\underset{\text{CH}_3}{\text{C}}(\text{H})-\text{CH}_2-\text{OOH}$
- D) $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\underset{\text{CH}_3}{\text{C}}(\text{OOH})(\text{CH}_3)$
- E) $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\underset{\text{CH}_3}{\text{C}}(\text{H})-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$

3. What would be the expected product of the following reaction?

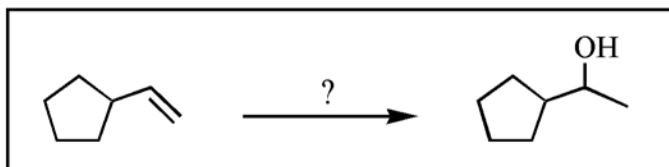


4. What reagent(s) would accomplish the following reaction?



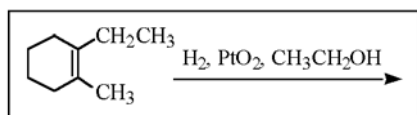
- A) Br_2
- B) NBS
- C) $\text{Br}_2 + \text{light}$
- D) $\text{Br}_2 + \text{FeBr}_3$
- E) HBr

5. Which reagents would you expect to accomplish the following transformation?



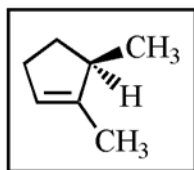
- A) BH_3 then $\text{H}_2\text{O}_2, ^-\text{OH}$
- B) $\text{Hg}(\text{O}_2\text{CCH}_3)_2, \text{H}_2\text{O}$ then NaBH_4
- C) $\text{H}_2\text{O}, \text{H}^+$
- D) $\text{KMnO}_4, \text{H}_2\text{O}, \text{cold}$
- E) cat. $\text{OsO}_4, \text{H}_2\text{O}_2$

6. Predict the product of the following reaction:



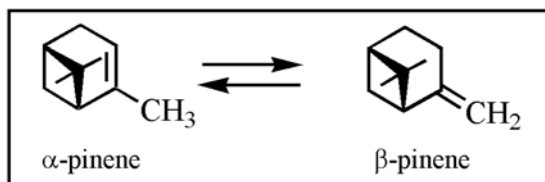
- A)
- B)
- C)
- D)
- E) Equal amounts of A and B

7. What would be the name of the following compound?



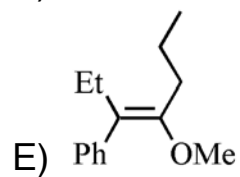
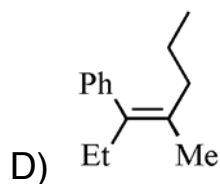
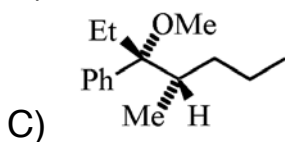
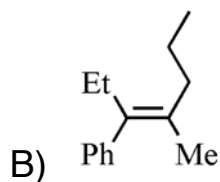
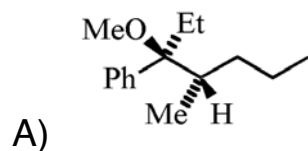
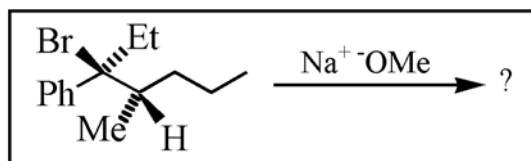
- A) 2,3-dimethylcyclopentene
- B) 1,5-dimethylcyclopentene
- C) *cis*-2,3-dimethylcyclopentene
- D) *cis*-1,5-dimethylcyclopentene
- E) *trans*-2,3-dimethylcyclopentene

8. Under special reaction conditions, α -pinene and β -pinene can be in equilibrium (caused to interconvert reversibly). Using your knowledge of alkene stability, which of the following would be true at equilibrium?

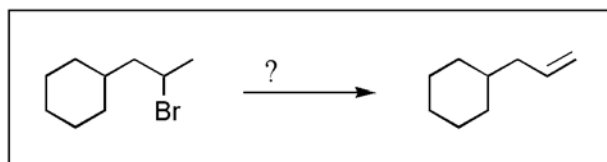


- A) The α -isomer will predominate.
- B) The β -isomer will predominate.
- C) The isomers would be equally favored.
- D) A third isomer would predominate.
- E) None of these is true.

9. Predict the product of the following reaction:

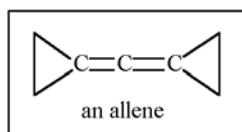


10. What reagent would give the highest yield of the product shown below?

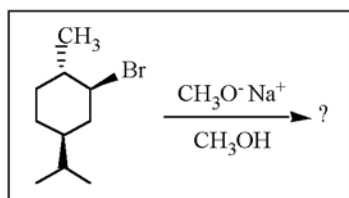


- A) $\text{K}^+ \text{OtBu}^-$
- B) NaCN
- C) $\text{CH}_3\text{S}^- \text{Na}^+$
- D) NaOH
- E) $\text{CH}_3\text{O}^- \text{Na}^+$

11. Based on what you know about carbon-carbon double bonds, which of the following would be true of the allene shown?

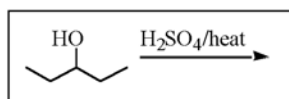


- A) The two rings would be in the same plane.
 B) The two rings would be in perpendicular planes.
 C) There is no way to tell what geometric relationship the rings would have.
 D) The three carbons shown would not be co-linear.
 E) Allenes cannot exist.
12. What product would you expect from the reaction shown below?



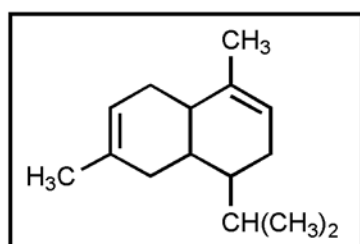
- A)
- B)
- C)
- D)
- E)

13. What would be the MAJOR organic product of the following reaction?



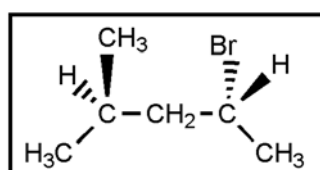
- A)
- B)
- C)
- D)
- E)

14. How many chiral centers are present in β -cadinene?



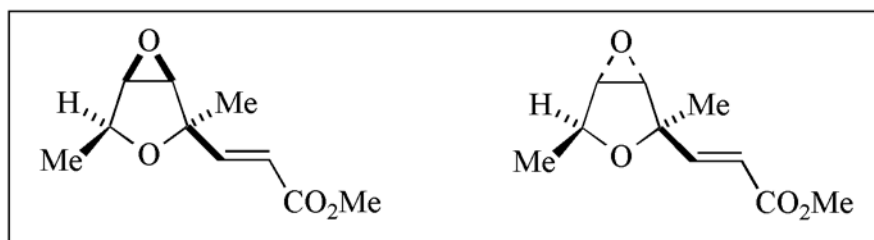
- A) none
- B) 1
- C) 2
- D) 3
- E) 4

15. What would be the complete name of the following?

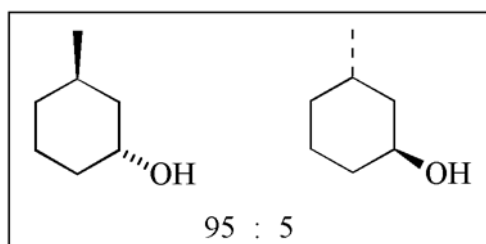


- A) A. (2*R*,4*S*)-2-bromopentane
- B) (*R*)-2-bromo-4-methylpentane
- C) (*S*)-4-bromo-2-methylpentane
- D) (2*R*,4*R*)-2-bromo-4-methylpentane
- E) (*S*)-2-bromo-4-methylpentane

16. Which of the following statements is **not** true?
- A) Enantiomers have identical properties except in chiral environments or with plane-polarized light.
- B) Reactions involving only achiral or racemic materials must produce achiral or racemic products.
- C) Diastereomers have identical properties in all environments.
- D) Enantiomers exhibit equal and opposite optical rotations.
- E) All of the above are true.
17. The relationship between the following two compounds is:



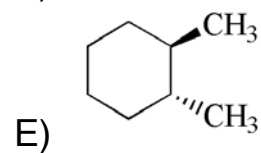
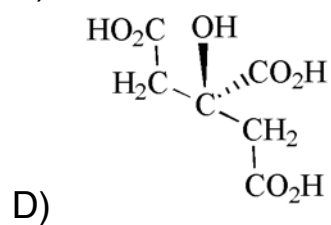
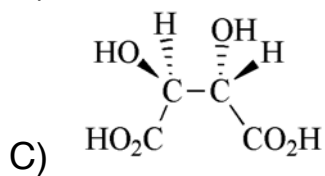
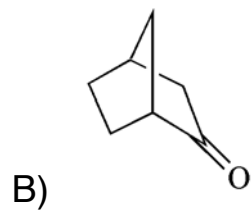
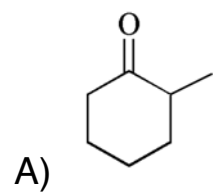
- A) same molecule
- B) enantiomers
- C) diastereomers
- D) mesos
- E) conformers
18. A particular reaction produces the following two alcohols in a ratio of 95 : 5.



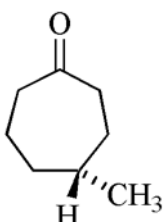
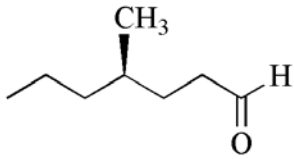
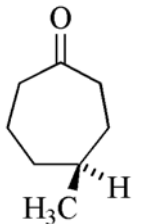
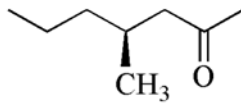
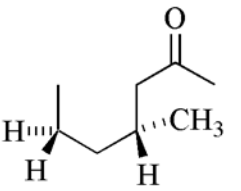
The enantiomeric excess (% ee) is:

- A) 100
- B) 95
- C) 90
- D) 85
- E) none of these

19. Which of the following molecules is **not** chiral?



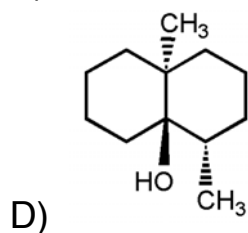
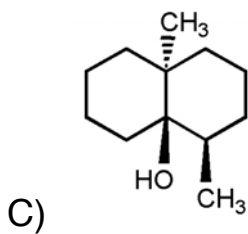
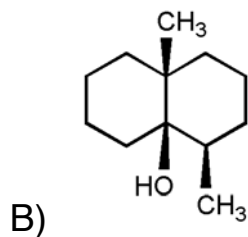
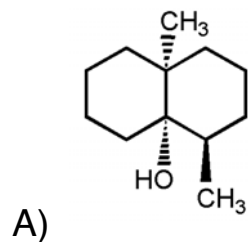
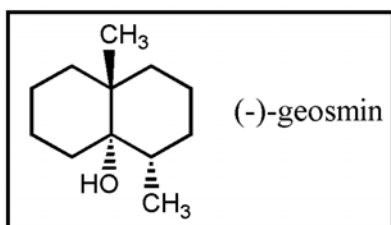
20. What is the correct structure for (*R*)- 4-methyl-2-heptanone?

- A) 
- B) 
- C) 
- D) 
- E) 

21. Which of the following is NOT TRUE for a meso compound:

- A) It is achiral
- B) It will rotate plane polarized light
- C) It may be cyclic or acyclic
- D) It is a stereoisomer
- E) It has a mirror plane

22. The structure of (-)-geosmin is shown below. Which structure would be that of its enantiomer, (+)-geosmin?

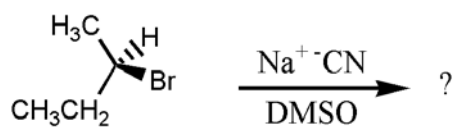


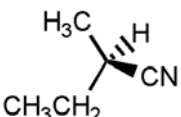
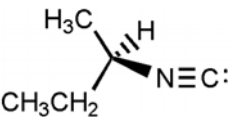
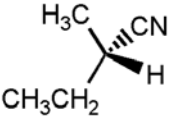
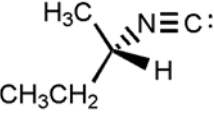
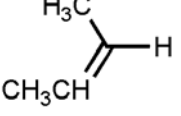
E) None of these.

23. What technique(s) can be used to obtain non-racemic compounds from racemic material?

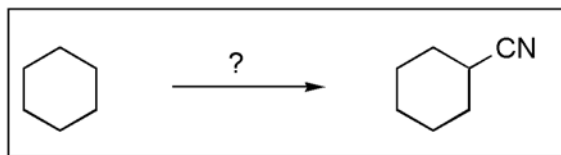
- A) Resolution
- B) Distillation
- C) Extraction
- D) Column chromatography
- E) Both B and C

24. What would be the major product of the following reaction?



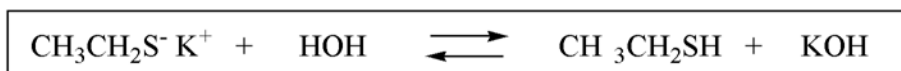
- A)  CC(C)C(C#N)C
- B)  CC(C)C(C#N)C
- C)  CC(C)C(C)C#N
- D)  CC(C)C(C)C#N
- E)  CC(C)=CC

25. What reactants are required to achieve the following transformation?



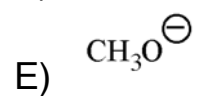
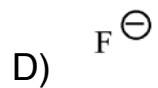
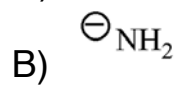
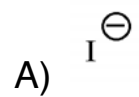
- A) $\xrightarrow{1. \text{PBr}_3}$
2. NaCN
- B) $\xrightarrow{1. \text{NaCN}}$
2. H_2SO_4
- C) $\xrightarrow{1. \text{Br}_2, h\nu}$
2. HCN
- D) $\xrightarrow{1. \text{SOCl}_2}$
2. KCN
- E) $\xrightarrow{1. \text{Br}_2, h\nu}$
2. KCN

26. To which side (if any) would the following equilibrium lie?

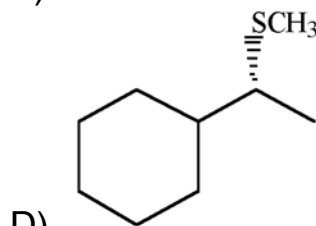
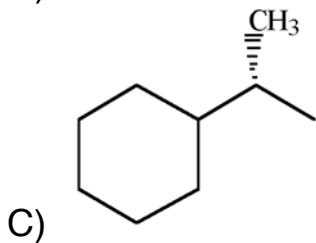
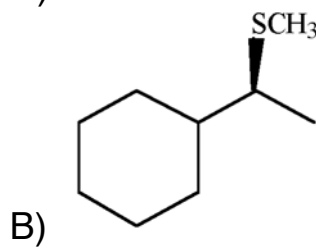
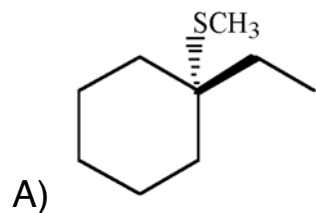
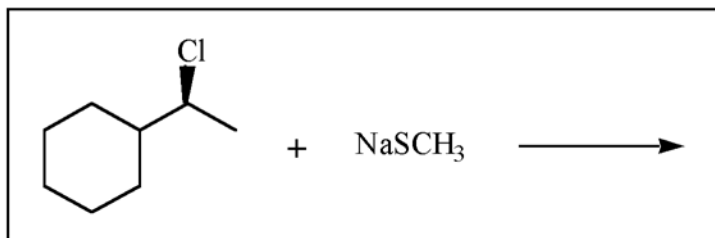


- A) to the left
- B) to the right
- C) equally to the right and left
- D) there is no way to tell
- E) only $\text{S}_{\text{N}}2$, $\text{S}_{\text{N}}1$ and E2 reactions are possible
27. Which of the following reagents would best accomplish a typical $\text{S}_{\text{N}}2$ reaction?
- A) CH_3OH
- B) H_2O
- C) HCN
- D) KCN
- E) KO^tBu

28. Which of the following is the best leaving group?

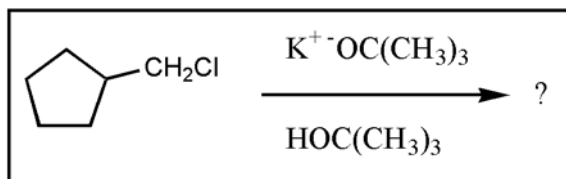


29. Predict the major product of the following reaction:



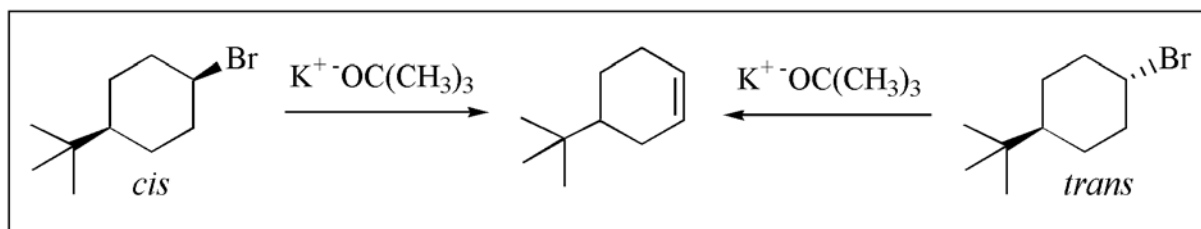
E) No reaction will occur.

30. What would be the **major** organic product of the following reaction?



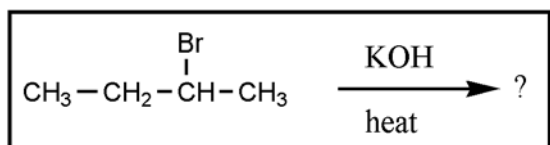
- A) COC(C)(C)CC1CCCC1
- B) CC1(C)OC(C)(C)C1
- C) CC1=CCCC1
- D) C=C1CCCC1
- E) OCC1CCCC1

31. Which would be true of the following reactions?



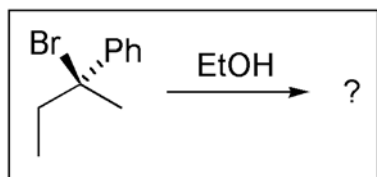
- A) *cis* would react faster
- B) *trans* would react faster
- C) *cis* and *trans* would react at the same rates
- D) no reaction is expected under these conditions
- E) the product shown would not be formed

32. What would be the major product of the following reaction?



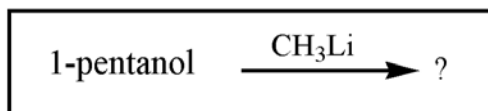
- A) $\begin{array}{c} \text{H}_3\text{C} \quad \text{H} \\ \diagdown \quad / \\ \text{C}=\text{C} \\ / \quad \diagdown \\ \text{H} \quad \text{CH}_3 \end{array}$
- B) $\text{CH}_3-\text{CH}_2-\overset{\text{OH}}{\underset{|}{\text{CH}}}-\text{CH}_3$
- C) $\begin{array}{c} \text{H} \quad \text{H} \\ \diagdown \quad / \\ \text{C}=\text{C} \\ / \quad \diagdown \\ \text{H}_3\text{C} \quad \text{CH}_3 \end{array}$
- D) $\text{CH}_3-\text{CH}_2-\text{CH}=\text{CH}_2$
- E) $\text{CH}_3-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$

33. Predict the MAJOR product of the following S_N1 reaction:



- A)
- B)
- C)
- D)
- E)

34. What is the major product of the following reaction:



- A)
- B)
- C)
- D)
- E)

Answer Key -

**Ferret:Users:thomaspe:Documents:classes:chem109a:Test2.
ef**

1. C
2. B
3. B
4. A
5. B
6. E
7. A
8. A
9. D
10. A
11. B
12. C
13. B
14. D
15. B
16. C
17. C
18. C
19. D
20. E
21. B
22. C
23. A
24. C
25. E
26. A
27. D
28. A
29. D
30. D
31. A
32. A
33. E
34. E