Quiz 4 Chem 109a  [10%] of grade.
NOTE: C-D bonds are stronger than C-H bonds,...ie. harder to break. This is a very useful fact to know in some of the following questions.

1. Which of the following would you expect to react fastest with the nucleophile I⁻ (iodide)?
   A) CH₃CH₂CH₂Br
   B) CH₃CH₂CH₂Cl
   C) (CH₃)₂CHCH₂Br
   D) (CH₃)₂CHCH₂Cl
   E) (CH₃)₃CCH₂Br

2. Predict the MAJOR product IF the following reaction went by the S_N1 pathway:

   ![Chemical structure](image)

   A)
   B)
   C)
   D)
   E)

3. Indicate the expected MAJOR product of the following reaction:

   ![Chemical structure](image)
4. The **MAJOR** product of the following reaction conditions will result from:

A) $S_N^2$
B) $S_N^1$
C) E2
D) E1
E) there is no way to know

5. If the concentration of NaOH is doubled in the following reaction, what will happen to the reaction rate?
6. What would be the **major** organic product of the following reaction?

7. What would be the **major** organic product of the following reaction?
8. 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

9. What major product would result for the following reaction?
10. Which of the haloalkanes below would you expect to most rapidly undergo the reaction shown?

A) \( \text{CH}_3\text{CH}_2\text{Br} \)
B) \( \text{CH}_3\text{Br} \)

A) \( \text{CH}_3\text{CH}_2\text{Br} \)
B) \( \text{CH}_3\text{Br} \)
11. Which of the bases below would be best to accomplish the following reaction?

\[
\begin{align*}
\text{A)} & \quad \text{CH}_3\text{O}^- \text{ Na}^+ \\
\text{B)} & \quad \text{CH}_3\text{CH}_2\text{O}^- \text{ Na}^+ \\
\text{C)} & \quad (\text{CH}_3)_2\text{CHO}^- \text{ Na}^+ \\
\text{D)} & \quad (\text{CH}_3)_3\text{CO}^- \text{ Na}^+ \\
\text{E)} & \quad \text{Na}^+ \cdot \text{OH}
\end{align*}
\]

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

\[
\begin{align*}
\text{A)} & \\
\text{B)} & \\
\text{C)} & \\
\text{D)} & \\
\text{E)} &
\end{align*}
\]

13. Which of the following molecules \textbf{WILL} readily undergo an elimination reaction when treated with NaOCH\textsubscript{3}?
14. Which mechanism proceeds with inversion of configuration?
A) bimolecular elimination (E2)
B) unimolecular elimination (E1)
C) unimolecular substitution (S_N1)
D) bimolecular substitution (S_N2)
E) free-radical halogenation

15. Which of the cyclohexyl bromides would you expect to react the **fastest** in the following reaction?

A) 

B) 

E) None of these would undergo elimination.
16. Predict the MAJOR product of the following $S_N1$ reaction:

17. Which one of the following would undergo E2 elimination most rapidly?
18. Which of the nucleophiles shown below would NOT cause an E2 elimination as the predominant reaction?

A) H2O
B) CH3OH
C) CO2
D) OH
E) CH3O

19. How many alkene products are possible in the following reaction?

A) None; cannot eliminate
B) One
C) Two  
D) Three  
E) Four

20. Predict the product of reaction of the following deuterated compound.

21. To which side (if any) would the following equilibrium lie?
22. What is the major product of the following reaction:

\[ \text{1-pentanol} + \text{CH}_3\text{Li} \rightarrow ? \]

A) \[
\begin{align*}
&\text{CH}_3
&\text{Li}
\end{align*}
\]

B) 

C) 

D) 

E) 

23. Rank the following alcohols in order of decreasing acidity in solution.

<table>
<thead>
<tr>
<th>Alcohol</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH(_3)OH</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH(_3)(\text{CH}_2)OH</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CH(_3))(_2)CHOH</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CH(_3))(_3)COH</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A) 1 > 2 > 3 > 4
B) 2 > 1 > 3 > 4
C) 4 > 3 > 2 > 1
D) 4 > 3 > 1 > 2
E) 1 > 3 > 2 > 4

24. Which of the following reactions would be the best for the preparation of anisole
25. Saytzev's Rule has to do with the following:
   A) Free-radical substitutions
   B) Hydration of double bonds
   C) Bromination of double bonds
   D) Products of elimination reactions
   E) Hydrogenation of double bonds

26. Which of the following can be used to synthesize (R)-2-cyanopentane from (R)-2-bromopentane?
   A) NaBr
   B) NaCN
   C) NaI followed by KCN
   D) NaCN followed by HI
   E) This reaction cannot occur

27. S_N2 substitution at secondary halides and sulfonates is often complicated by competing E2 elimination. Which of the nucleophiles below would you choose to obtain the highest yield in an S_N2 reaction with menthyl bromide?
28. What is the correct stereochemistry of the product of the following reaction:

A) 3R,4S  
B) 2S,3R  
C) 2R,3S  
D) 2R,3R  
E) 3R,4R

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

A)  
B)  
C)  
D)  
E)  

30. Which of the following reagents would best accomplish a typical S_N2 reaction?
31. Predict the major product of the following reaction:

\[ \text{Br} \xrightarrow{\text{NaN}_3} \]

A) ![N_3]
B) ![ benzene]
C) ![ benzene]
D) ![ benzene]
E) no reaction occurs

32. Several alkyl halides, including iodomethane, are known carcinogens or cancer-suspect materials. To destroy these materials by conversion to non-electrophilic species, you can react them with nucleophiles. Which of the following would be the best for rapidly destroying methyl iodide (iodomethane)?

A) CH_3OH
B) NH_3
C) H_2O
D) NaI
E) CH_3CO_2H

33. Which of the following is **not** normally a good leaving group on carbon?

A) Br
B) OCH_3
C) Cl
D) OSO_2R
34. To which side (if any) would the following equilibrium lie?

\[
\text{CH}_3\text{CH}_2\text{S}^-\text{K}^+ + \text{HOH} \rightleftharpoons \text{CH}_3\text{CH}_2\text{SH} + \text{KOH}
\]

A) to the left
B) to the right
C) equally to the right and left
D) there is no way to tell
E) only S_N2, S_N1 and E2 reactions are possible

35. Predict the major product of the following reaction:

A)  

B)  

C)  

D)  

E) no reaction occurs

36. Which of the following haloalkanes would not undergo the reaction below?

\[
\text{R-X} + \text{CH}_3\text{S}^- \rightarrow \text{CH}_3\text{SR} + \text{X}
\]

A) (CH_3)_2CHI
B) CH_3Cl
C) (CH_3)_3CBr
D) CH_3CH_2Br
E) CH_3CH_2CH_2I
Answer Key - Ferret:Exam:Quiz4.qf.ef

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