Multiple Choice Questions. 100 points

1. Choose the monomer that could be used to prepare the following chain growth polymer called Delrin.

\[ \text{Delrin} \]

(a) ![Structure A](#)  
(b) ![Structure B](#)  
(c) H₂C=C=O  
(d) HO—COOH  
(e) ![Structure C](#)

2. Choose the monomers that could be used to prepare the following step growth polymer.

\[ \text{Polymer} \]

(a) ![Structure A](#)  
(b) ![Structure B](#)  
(c) ![Structure C](#)  
(d) ![Structure D](#)  
(e) ![Structure E](#)

3. Choose the correct name of the C2 epimer of D-glucose.

(a) D-allose  
(b) D-altrose  
(c) D-mannose  
(d) D-gulose  
(e) D-galactose

4. Choose the major product formed when glucose is treated with methanol in the presence of acid.

\[ \text{Glucose} \xrightarrow{\text{H}^+} \text{Methanol} \]

(a) ![Product A](#)  
(b) ![Product B](#)  
(c) ![Product C](#)  
(d) ![Product D](#)  
(e) ![Product E](#)
5. Choose the order that has the following compounds correctly arranged with respect to increasing melting point. (highest on right)

(a) A < B < C  (c) A < C < B  (e) B < A < C
(b) B < C < A  (d) C < A < B

6. Choose the compound that would most readily form micelles when dissolved in water.

7. Many plasma proteins found in an aqueous environment are globular in shape. Choose the order that the following amino acid components arrange correctly with respect to their probability of being found on the surface of a protein in an aqueous environment. Most probable to be on the protein surface is on the right.

(a) A < B < C  (c) A < C < B  (e) B < A < C
(b) B < C < A  (d) C < B < A

8. Choose the pH that would cause the following amino acid to most rapidly migrate to the negative electrode on electrophoresis.

pK_{a1} = 2.10  pK_{a2} = 4.07  pK_{a3} = 9.47
9. Choose the major product of the following reaction.

\[
\text{HO} \quad \overset{\text{heat}}{\longrightarrow} \quad \text{(a) } \quad \text{H} \quad \text{(b) } \quad \text{H} \quad \text{(c) } \quad \text{H} \quad \text{(d) } \quad \text{H} \quad \text{(e) } \quad \text{H}
\]

10. Choose the reactants that would give the following product.

\[
\begin{align*}
? & \quad \overset{\text{Diels}}{\text{Alder}} \\
& \quad \text{CH}_3 \\
& \quad \text{CH}_3 \\
& \quad \text{CO}_2\text{CH}_3
\end{align*}
\]

\[
\begin{align*}
(a) & \quad \text{CH}_3 + \quad \text{C}_2\text{H}_4 + \quad \text{CO}_2\text{CH}_3 \\
(b) & \quad \text{CH}_3 + \quad \text{C}_2\text{H}_4 + \quad \text{CO}_2\text{CH}_3 \\
(c) & \quad \text{CH}_3 + \quad \text{C}_2\text{H}_4 + \quad \text{CO}_2\text{CH}_3 \\
(d) & \quad \text{CH}_3 + \quad \text{C}_2\text{H}_4 + \quad \text{CO}_2\text{CH}_3 \\
(e) & \quad \text{CH}_3 + \quad \text{C}_2\text{H}_4 + \quad \text{CO}_2\text{CH}_3
\end{align*}
\]

11. Choose the best method for preparing benzyl amine (PhCH$_2$NH$_2$).

\[
\begin{align*}
(d) & \quad \text{O} \quad \text{NH}_2 \\
& \quad \overset{1. \text{LiAlH}_4}{\longrightarrow} \quad \overset{2. \text{H}_2\text{O}}{\longrightarrow} \\
(b) & \quad \text{CH}_3 \quad \overset{\text{Br}}{\longrightarrow} \quad \overset{\text{NH}_3}{\longrightarrow} \\
(c) & \quad \text{O} \quad \text{H} \quad \overset{\text{NH}_3}{\longrightarrow}
\end{align*}
\]

\[
\begin{align*}
(d) & \quad \text{N} \quad \text{H} \\
& \quad \overset{\text{NaOH}}{\longrightarrow} \\
(e) & \quad \text{N} \quad \text{H} \quad \overset{\text{HBr}}{\longrightarrow}
\end{align*}
\]

12. Choose the order that has the following compounds correctly arranged with respect to increasing reactivity towards nitration (HNO$_3$/H$_2$SO$_4$)

\[
\begin{align*}
\text{(a) } & \quad A < B < C \\
\text{(b) } & \quad C < A < B \\
\text{(c) } & \quad A < C < B \\
\text{(d) } & \quad C < B < A \\
\text{(e) } & \quad B < A < C
\end{align*}
\]
13. Choose the reactants that would give the following product.

\[ \text{?} \xrightarrow{\text{OH}} \text{Ph-CH-CH}_2-\text{C-CH}_3 \]

(a) \[ \text{Ph-\(\text{C-H}\)} + \text{CH}_3-\text{C-CH}_3 \]

(b) \[ \text{Ph-\(\text{C-C-CH}_3\)} + \text{HO-\(\text{C-C-CH}_3\)} \]

(c) \[ \text{Ph-\(\text{C-H}\)} + \text{H-\(\text{C-C-CH}_3\)} \]

(d) \[ \text{Ph-\(\text{C-C-CH}_3\)} + \text{CH}_3-\text{C-CH}_3 \]

(e) \[ \text{Ph-\(\text{C-C-CH}_3\)} + \text{CH}_3-\text{C-CH}_3 \]

14. Choose the compounds predicted to be stabilized by the cyclic delocalization of electrons (aromatic).

(a) A and C  
(b) A and E  
(c) A, B, D and E  
(d) A, D and E  
(e) B and C

15. Choose the true statement about A, B and C.

(a) A = benzoic acid, B = benzyl alcohol and C = sodium chloride.

(b) A = benzoic acid, B = sodium chloride and C = benzyl alcohol.

(c) A = benzyl alcohol, B = benzoic acid and C = sodium chloride.

(d) A = benzyl alcohol, B = sodium chloride and C = benzoic acid.

(e) A = sodium chloride, B = benzyl alcohol and C = benzoic acid.
16. Choose the best reaction scheme for preparation of the following compound.

(a)\[ \text{ } \]
1. \( \text{Cl} / \text{AlCl}_3 \)
2. \( \text{Br}_2, \text{FeBr}_3 \)

(b)\[ \text{ } \]
1. \( \text{Cl} / \text{AlCl}_3 \)
2. \( \text{Br}_2, \text{FeBr}_3 \)
3. \( \text{NH}_2\text{NH}_2 \)
4. \( \text{KOH} \)

(c)\[ \text{ } \]
1. \( \text{Br}_2, \text{FeBr}_3 \)
2. \( \text{Cl} / \text{AlCl}_3 \)

(d)\[ \text{ } \]
1. \( \text{O} / \text{AlCl}_3 \)
2. \( \text{NH}_2\text{NH}_2 \)
3. \( \text{KOH} \)
4. \( \text{Br}_2, \text{FeBr}_3 \)

(e)\[ \text{ } \]
1. \( \text{Br}_2, \text{FeBr}_3 \)
2. \( \text{O} / \text{AlCl}_3 \)
3. \( \text{KOH} \)
4. \( \text{Br}_2, \text{FeBr}_3 \)

17. Choose the best reagent for performing the following reaction.

(a)\[ \text{ } \]
1. \( \text{CH}_3\text{MgBr} \)
2. \( \text{H}_2\text{O} / \text{heat} \)

(b)\[ \text{ } \]
1. \( \text{CH}_3\text{Li} \)
2. \( \text{H}_2\text{O} / \text{heat} \)

(c)\[ \text{ } \]
1. \( \text{H}_2\text{C=Ru} \)
2. \( \text{H}_2\text{O} / \text{heat} \)

(d)\[ \text{ } \]
1. \( \text{CH}_3\text{Li} / \text{Zn(Cu)} \)
2. \( \text{H}_2\text{O} / \text{heat} \)

(e)\[ \text{ } \]
1. \( \text{H}_2\text{C=PPh}_3 \)

18. Choose the major product of the following reaction.

(a)\[ \text{ } \]
(b)\[ \text{ } \]
(c)\[ \text{ } \]
(d)\[ \text{ } \]
(e)\[ \text{ } \]

19. Choose the major product of the following reaction.

(a)\[ \text{ } \]
(b)\[ \text{ } \]
(c)\[ \text{ } \]
(d)\[ \text{ } \]
(e)\[ \text{ } \]
20. Choose the major product of the following reaction.

\[ \text{CH}_3\text{MgBr} \rightarrow ? \]

(a) \[ \text{HO} \text{CH}_3 \]
(b) \[ \text{H}_3\text{C} \text{CH}_3 \text{OH} \]
(c) \[ \text{H}_3\text{C} \text{CH}_3 \text{O} \]
(d) \[ \text{H}_3\text{C} \text{CH}_3 \text{OH} \]
(e) \[ \text{H}_3\text{C} \text{CH}_3 \text{OH} \]

21. By putting parentheses around the repeat unit give the structure of the polymer resulting from the following reaction. 5 pts

\[ \text{CH}_3\text{CH} = \text{CH}_2 \rightarrow \text{HOCH}_2\text{OH} \]

22. Give structures for compounds A and B in the following reaction scheme. 10 pts

\[ \text{H}_3\text{N} \quad \text{H}_2\text{N} \]
\[ \text{H}_3\text{N} \quad \text{H}_2\text{N} \]

A \[ \rightarrow \text{RN} = \text{C} = \text{NR} \]

\[ \text{H}_3\text{N} \quad \text{H}_2\text{N} \]
\[ \text{H}_3\text{N} \quad \text{H}_2\text{N} \]
23. Using the curved arrow formalism show the bond making and bond breaking that occurs in the conversion of nerol to \(\alpha\)-terpineol. 10 pts

\[
\text{nerol} \xrightarrow{H^+ \text{ added}} \ \text{nerol} \xrightarrow{H_2O} \ \alpha\text{-terpineol}
\]

24. Propose a synthesis of the following compound from benzene and any necessary reagents. 10 pts

\[
\text{C}_6\text{H}_6 + \text{Br} + \text{HNO}_3 + \text{H}_2\text{SO}_4 \xrightarrow{\text{CuBr}} \ \text{D} \xrightarrow{\text{HNO}_2, \text{HBr}, 0-5^\circ} \ \text{E}
\]

25. The synthesis of haloperidol, an important drug for the treatment of schizophrenia, was discussed in the section on medicinal chemistry. A key intermediate was prepared by a reaction scheme analogous to that shown below. Propose structures for compounds C, D, and E in this reaction scheme. 10 pts

\[
\text{EtO} \xrightarrow{\text{excess}} \text{EtO} \xrightarrow{\text{H}_2\text{C}-\text{NH}_2} \text{C} \xrightarrow{\text{EtO}} \text{D} \xrightarrow{\text{EtO}} \text{E}
\]

\[
\text{C}_6\text{H}_{11}\text{NO} \xrightarrow{1. \text{HO}} \text{E} \xrightarrow{2. \text{H}} \text{E} \xrightarrow{3. \text{heat}} \text{E}
\]
26. Propose reactants and reagents to complete the following reactions. 10 pts

(a) [Diagram showing a cyclohexane ring undergoing reaction to form a cyclopentane ring]

(b) [Diagram showing a cyclohexane ring undergoing reaction to form a cyclohexene ring]

27. Propose a synthesis of the following compound from methoxybenzene and other reactants containing four carbon atoms or less. 10 pts

28. Cyclopentadiene reacts with methyl acrylate to give an endo/exo mixture of cycloadducts. Answer the following questions using the diagram shown below. 10 pts

(a) On the answer sheet circle the cycloadduct formed faster (kinetic). endo
(b) On the answer sheet circle the more stable cycloadduct (thermodynamic). **exo**

(c) Give the letter representing the energy difference that could be used to calculate the rate of formation of the **exo** cycloadduct.  **B**

(d) Give the letter representing the energy difference that could be used to calculate the equilibrium constant of the reactants and the **endo** cycloadduct.  **C**

(e) On the answer sheet circle the correct stereochemical relationship (entiomeric or diastereomeric) between the **endo** and **exo** cycloadducts.  **diastereomeric**

29. Using the curved arrow formalism show the bond making and bond breaking that occurs in the following reaction.  (hint: see problem 28)  5 pts

![Chemical reaction diagram]