1. Draw structures for the following: (15%)  
(a) 2-Methylheptane  
(b) 4-Methyl-2,2-dimethylhexane  
(c) 4-Ethyl-3,4-dimethylpentane  
(d) 2,4,4-Trimethylheptane  
(e) 3,3-Diethyl-2,5-dimethylnonane  
(f) 4-Isopropyl-3-methylheptane

2. Predict the products of the following reactions (the aromatic ring is unreactive in all cases). Indicate regiochemistry when relevant. (12.5%) 

3. Which of the following pairs of Fischer projections represent the same enantiomer, and which represent different enantiomers? (10%)  
(a)  
(b)  
(c)  
(d)  
(e)  

4. Predict the product(s) of the following reactions: (22.5%)  
(a)  
(b)  
(c)  
(d)  
(e)  
(f)  
(g)  

CH₃CH₂CH₂CH₂Br → A + B?
5. Which reaction in each of the following pairs would you except to be faster? (10%) 
(a) The S_n2 displacement by I⁻ on CH₃Cl or on CH₃OTos 
(b) The S_n2 displacement by CH₃CO₂⁻ on bromoetane or on bromocyclohexane 
(c) The S_n2 displacement on 2-bromopropane by CH₃CH₂O⁻ or by CN⁻ 
(d) The S_n2 displacement by H⁻⁻C⁻⁻ on bromomethane in benzene or in hexamethylphosphoramide 

6. Identify the reagents a-f in the following scheme: (15%) 

![Chemical Reaction Diagram]

7. The infrared spectra are shown. One is the spectrum of cyclohexane, and the other is the spectrum of cyclohexene. Identify them, and explain your answer. (7.5%)
8. Propose structures for the two compounds whose $^1$H-NMR spectra are shown. (7.5%)

(a) C$_3$H$_4$Br

![NMR spectrum of C$_3$H$_4$Br]

(b) C$_3$H$_4$Cl$_2$

![NMR spectrum of C$_3$H$_4$Cl$_2$]