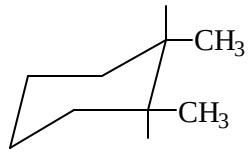
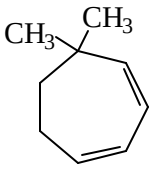
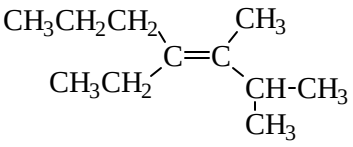
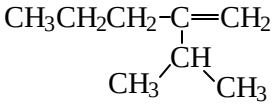
CHEMISTRY 2401
Exam # 2, October 21, 1998

(12) I. Provide appropriate names for each of the following. Include stereochemical designations (cis/trans, E/Z) where possible.

A. 

B. 

C. 

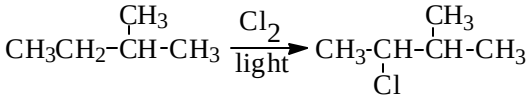
D. 

(18) II. Draw structural formulas for each of the following:

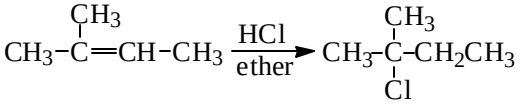
A. A Newman projection formula for a gauche conformation of n-pentane.

B. The lowest energy chair conformation for cis-1-tert-butyl-4-methylcyclohexane.

C. The alkyl radical intermediate for reaction below:



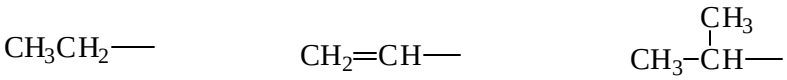
D. The carbocation intermediate for the the reaction below:



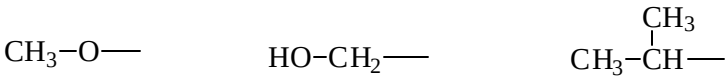
E. E-3-ethyl-3-octene F. 1,3-dichlorocyclopentene

(15) III. Rank each of the following as directed in each case:

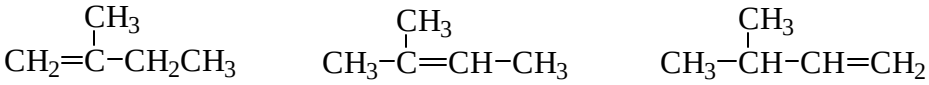
A. Circle the group with the highest Cahn-Ingold-Prelog priority and underline the group with the lowest priority.



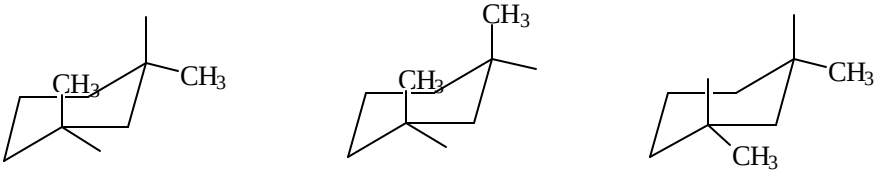
B. Circle the group with the highest Cahn-Ingold-Prelog priority and underline the group with the lowest priority.



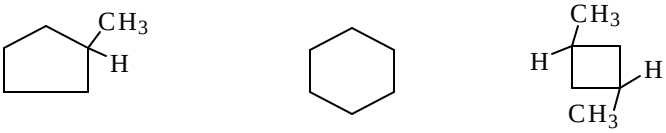
C. Circle the alkene with the highest heat of hydrogenation and underline the alkene with the lowest heat of hydrogenation.



D. Circle the structure below that is thermodynamically most stable and underline the one that is thermodynamically least stable.



E. Circle the compound below with the largest heat of combustion and underline the one that has the lowest heat of combustion.



(8) IV. Three different reactions have the following parameters?

Reaction 1: ΔG^o = + 2.5 Kj/mol, ΔH^o = + 4.5 Kj/mol, E_a = 5 Kj/mol

Reaction 2: ΔG^o = - 2.5 Kj/mol, ΔH^o = - 4.5 Kj/mol, E_a = 10 Kj/mol

Reaction 3: ΔG^o = - 4.5 Kj/mol, ΔH^o = + 2.5 Kj/mol, E_a = 15 Kj/mol

_____ Which of these reactions has the largest K_{eq} ?
_____ Which of these reactions occurs fastest?
_____ Which of these reactions is exothermic?
_____ For which of these reactions is ΔS^o negative?

(18) V, Multiple choice: Circle the letter corresponding to the correct response.

1) Mixing 2-methylbutane with Cl_2 / light would produce

A. 1-chloro-2-methylbutane
B. 2-chloro-2-methylbutane
C. 1.-chloro-3-methylbutane
D. 2-chloro-3-methylbutane
E. All of these would be produced

2) Mixing 2-methyl-2-butene with HCl would produce

A. 1-chloro-2-methylbutane
B. 2-chloro-2-methylbutane
C. 1.-chloro-3-methylbutane
D. 2-chloro-3-methylbutane
E. All of these would be produced

3) When we chlorinated 1-chlorobutane in lab the product that was formed in largest amount was

A. 1,1-dichlorobutane
B. 1,2-dichlorobutane
C. 1,3-dichlorobutane
D. 1,4-dichlorobutane

4) The reason that the compound in question 3 was formed in largest amount was because it

A. is most stable. B. is formed fastest. C. has the highest boiling point.
D. is less filling.

5. The number of degrees of unsaturation (rings & double bonds) in a compound that has a molecular formula of $C_{12}H_{18}O$ is

A. 1 B. 2 C. 3 D. 4 E. 5 F. 6

6. The number of degrees of unsaturation (rings & double bonds) in a compound that has a molecular formula of C_8H_9N is

A. 1 B. 2 C. 3 D. 4 E. 5 F. 6

(12) VI. Discuss briefly each of the following.

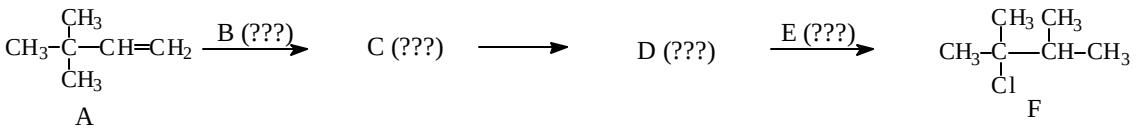
A. A housewife bought bottles of 1-pentene and 2-pentene from Walmart. Being a careful person she decided to check the purity of the chemicals she had bought using gas chromatography. She was pleased that the 1-pentene produced only one GC peak. However,

the 2-pentene produced two GC peaks. She returned the apparently impure 2-pentene to Walmart and requested a refund of her money. Walmart insisted that there was nothing wrong with the 2-pentene and refused to grant her refund. Explain.

B. Isobutyl cations rapidly undergo rearrangement to yield tert-butyl cations; however, isobutyl free radicals do not rearrange to tert-butyl radicals.

C. *Cis*-1,3-dimethylcyclohexane has a lower heat of combustion than does *trans*-1,3-dimethylcyclohexane. For the 1,4-dimethylcyclohexane isomers the situation is reversed. That is, the *trans* isomer has the lower heat of combustion. What do *cis*-1,3-dimethyl cyclohexane and *trans*-1,4-dimethylcyclohexane have in common that causes them to be thermodynamically more stable than their stereoisomers.

(16) VII. Complete the reaction mechanism for the reaction below:



B _____ C _____ D _____ E _____

Now sketch an energy coordinate diagram for the reaction showing clearly the locations of the two intermediates (C and D) and their relative energy contents.

Finally, give the structures of two other alkenes that would yield product F when treated with HCl.

??? ???