KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

Chemistry Department

CHEM 201: Organic Chemistry I (Term 151)

Major Exam # 1

Sunday, October 11, 2015

Duration: 120 minutes

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Dr. Ahsanul Haq Qureshi (Sec. 2)
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Dr. Othman Al Hamouz (Sec. 5)

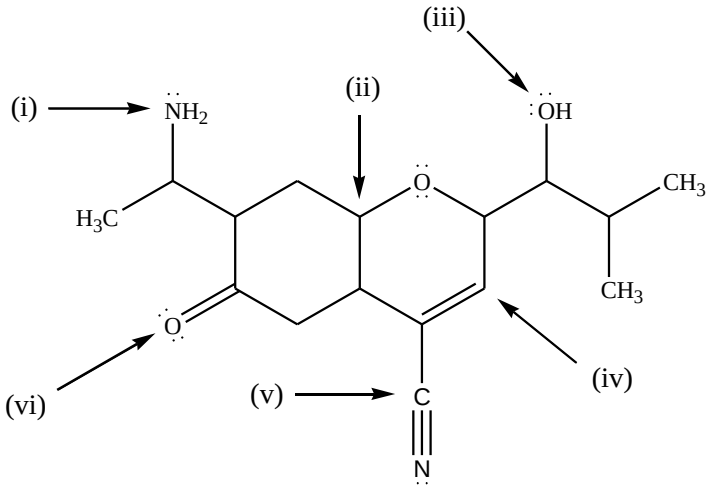
NAME_____ **ID**_____ **SEC.**_____

Question	Value	Score
1 - 5	35	
6 - 10	40	
11 - 15	25	
Total	100	

^{1}H							^{2}He
^{3}Li	^{4}Be	^{5}B	^{6}C	^{7}N	^{8}O	^{9}F	^{10}Ne
^{11}Na	^{12}Mg	^{13}Al	^{14}Si	^{15}P	^{16}S	^{17}Cl	^{18}Ar
						^{35}Br	
						^{53}I	

(8 Points)

Q1. Consider the following structure and answer the questions below.



(a) Identify the ***hybridization*** of the indicated atoms:

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Hybridization						

(b) Specify the approximate ***bond angles*** around the indicated atoms:

Bond angle (approximate)	(ii)	(iv)	(v)

(c) The total number of **π** bonds in the molecule is _____.

(2 + 2 points)

Q2.

(A) Draw a line-bond structure (*skeletal structure*) for **C_2H_3Cl**, the starting materials from which PVC [poly(vinyl chloride)] plastic is made.

(B) Draw an electron-dot structure (*Lewis structure*) for the following molecule.

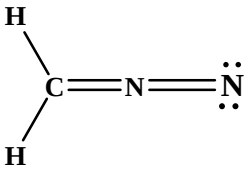
C_3H_3N

(3 + 3 + 4 points)

Q3.

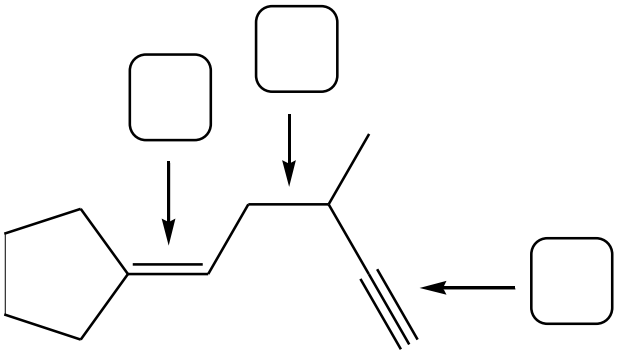
(A) Calculate **formal charges** for the nitrogen (N) and oxygen (O) atoms in the following molecules.

(i)



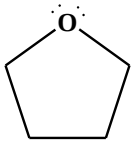
(ii) $CH_3CH_2\ddot{O}:$

(B) Number the indicated **C-C** bonds in order of **increasing** bond length (*1 is the shortest bond*).

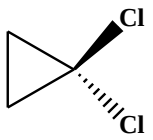


(C) Indicate which of the following compounds is/are **polar** and **non-polar**. Use the boxes to show the direction of polarity of each compound.

(i)



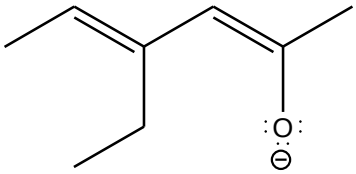
(ii)



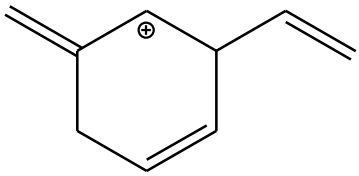
(6 points)

Q4. Draw all important **resonance** forms for each of the following structures. *Use curved arrows to indicate the electron movement.*

(a)



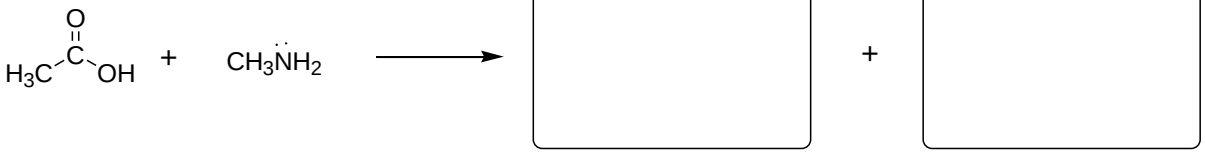
(b)



(3 + 4 points)

Q5.

(A) Complete the following acid-base reaction and identify the conjugated acid and the conjugated base in the reaction. (pK_a of CH_3COOH = 4.75, pK_a of CH_3NH_2 = 10.64).

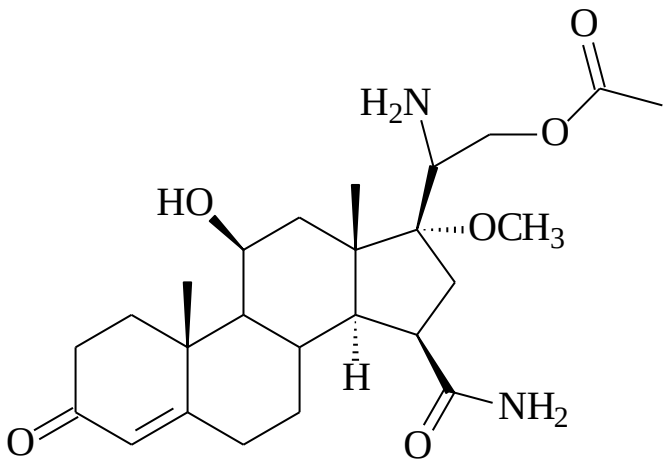


Conjugated acid **Conjugated base**

(B) Identify the **Lewis acid (LA)** and the **Lewis base (LB)** in the following series of compounds.

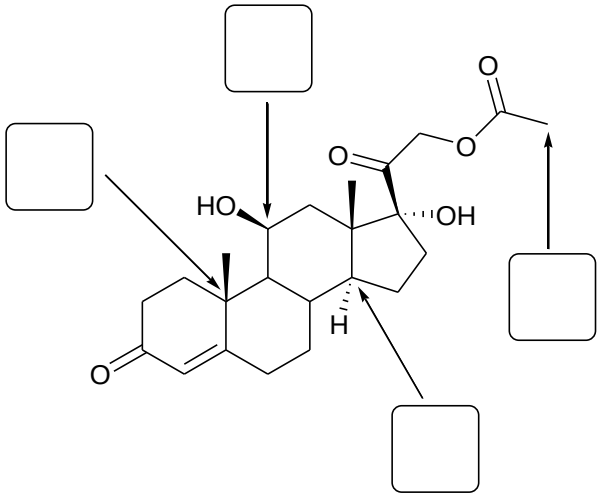
(7 points)

Q6. **Circle** and **write** the **name** of each functional group in the following structure.



(4 points)

Q7. The structure of Cortisone acetate (active ingredient in steroid skin creams) is shown below. Label the indicated carbon atoms as **primary (1^0), secondary (2^0), tertiary (3^0) and quaternary carbon (4^0).**

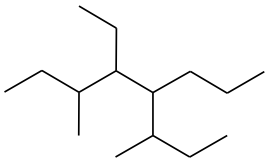


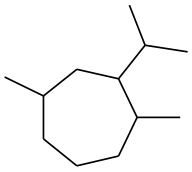
(7 points)

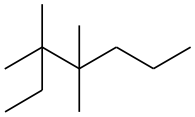
Q8. Draw **seven (7)** constitutional (structural) isomers of **cycloalkanes** with molecular formula **C_6H_{12}**.

(6 + 6 points)
Q9.

(A) Give the **IUPAC** names for the following organic structures.

(a) 

(b) 

(c) 

(B) Draw the **correct** structure for each of the following names.

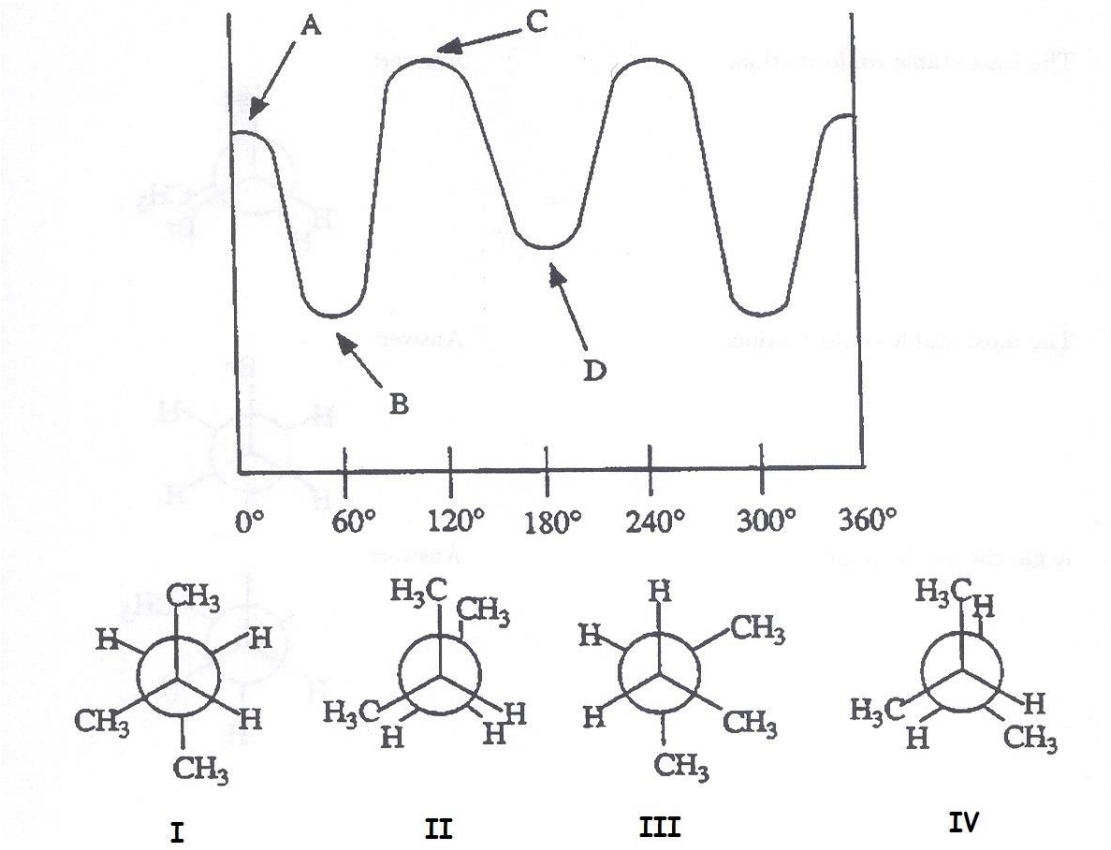
(a) 2-Bromo-3-chloro-5-isobutylnonane.

(b) 1,2-Diethyl-3,4-dimethyl-5-cyclopropylcyclohexane.

(c) *cis*-1-Ethyl-3-methylcyclopentane.

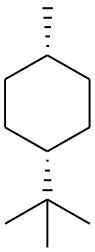
(4 + 3 + 3 points)
Q10.

(A) Consider the following potential energy diagram and match the **indicated** energy levels with the appropriate Newman projections.

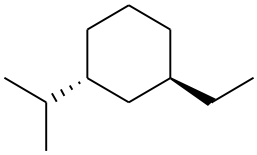


Energy level	Newman projection
A	
B	
C	
D	

(B) Draw the **most stable** chair conformation for the following compound.

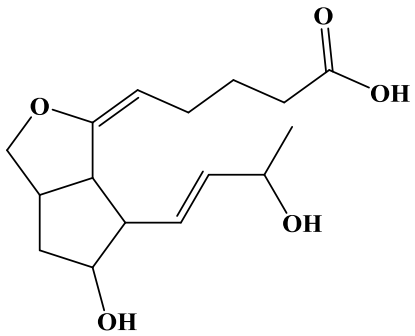


(C) Draw the **least stable** chair conformation for the following compound.



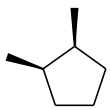
(**5 points**)

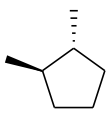
Q11. Identify all the chirality centers in the following molecule by inserting an **asterisk (*)** on each chiral carbon.

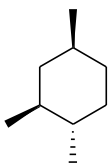


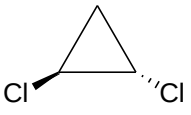
(**4 points**)

Q12. Identify the following compounds as **Chiral** or **Achiral**.



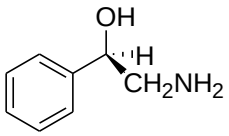


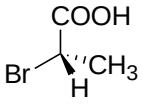


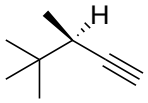


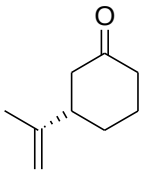
(**8 points**)

Q13. Assign (***R***) or (***S***) configurations to the chirality centers in the following molecules:





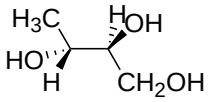


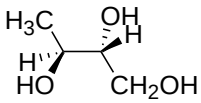


(**6 points**)

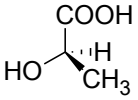
Q14. Identify each of the following pairs as **enantiomers**, **diastereomers** or **identical** compounds (if any).

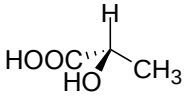
(a)



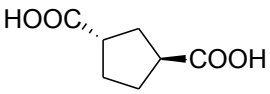


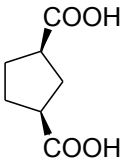
(b)





(c)





(**2 points**)

Q15. Draw a **meso** structure of a **cyclic** compound with molecular formula $\mathbf{C_6H_{12}}$.
(Show tetrahedral representation of all the chirality centers).