

Example Term Test 1a, 59-230/2

Oct. 6, 2015

Last Name:

First Name:

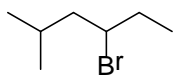
ID:

Q1	Q2	Q3	Q4	Q5	Q6	MC	Total
/18	/23	/12	/11	/8	/10	/60	/142

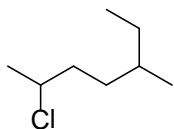
Short Answer Questions (82/142)

1) Name the following molecules according to IUPAC rules.
(3 marks for each molecule; -0.5 for each mistake)

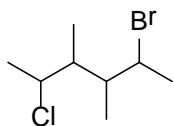
a.



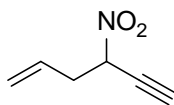
b.



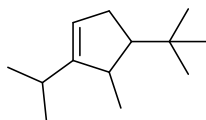
c.



d.



e.

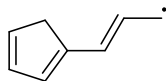


f. (include cis/trans relation)

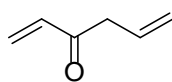


2) Draw all valid (as defined on the lecture slides) resonance structures (conjugated forms) of each of the molecules given below. Use curved arrows to indicate the movement of electrons and the appropriate arrow between each resonance structure (include all lone pairs!). (-0.5 for each mistake)

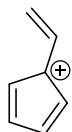
a. (6 marks); dot is a radical



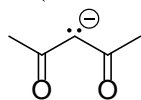
b. (4 marks)



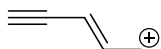
c. (5 marks)



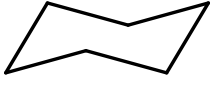
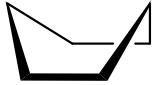
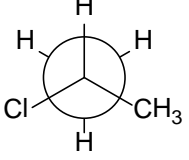
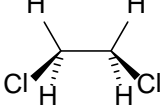
d. (4 marks)



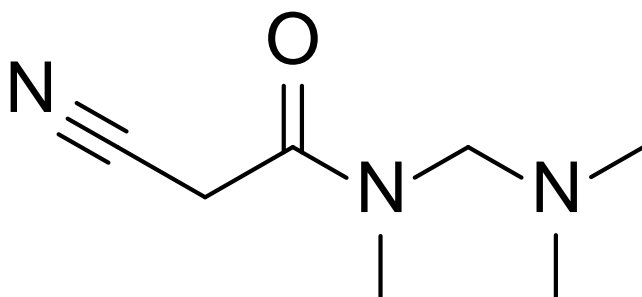
e. (4 marks)




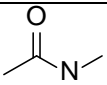
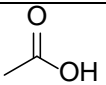
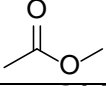
3) Indicate in the table the type(s) of strain energies of the molecules in the given conformations (cross each box that applies) (12 marks)

molecule	Torsional Strain	Steric Strain	Bond Angle Strain
			
			
			
			

4) State the hybridization of each atom of the molecule shown below (e.g. sp or sp³). (11 marks)

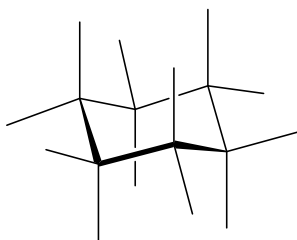
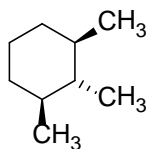


5) Name the following functional groups (8 marks)

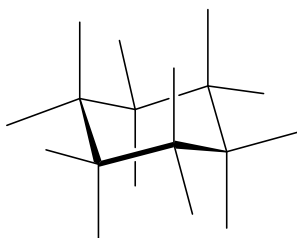
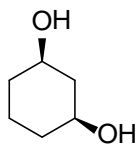
-NH			
			
-OH			
-O-		-SH	

6) Draw the more stable chair conformation for each of the shown planarized cyclohexane molecules. Use one template for each structure and add substituents to the appropriate bonds. All other axial and equatorial bonds are considered as C-H.

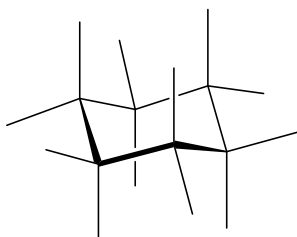
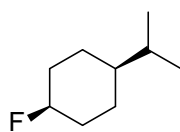
a. (3 marks)



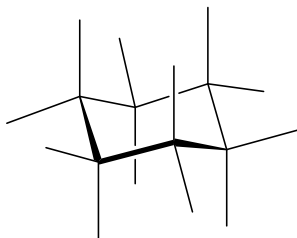
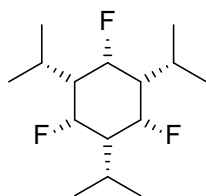
b. (2 marks)



c. (2 marks)



d. (3 marks)



Twenty Multiple Choice Questions (each 3 points = 60)

1) Which electron configuration is correct for the carbon of a carbocation?

- | | | | |
|----|------------------|----|----------------------------|
| a. | $1s^2 2s^2 2p^1$ | d. | $1s^2 2s^2 2p^6 3s^2 3p^5$ |
| b. | $1s^2 2s^2 2p^3$ | e. | $1s^2 2s^2 2p^4$ |
| c. | $1s^2 2s^2 2p^5$ | | |

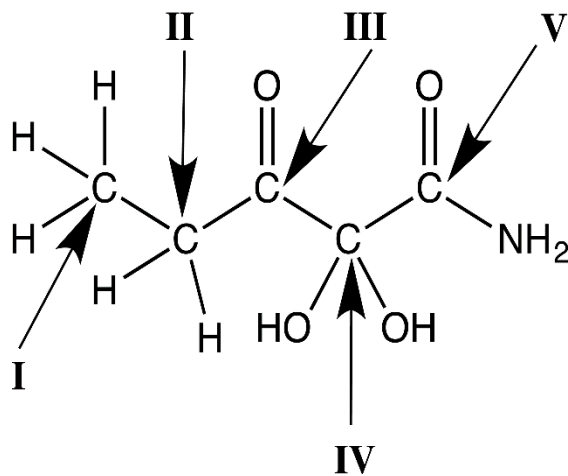
2) How many total valence electrons are used in the structure of Methanol, HOCH_3 ?

- | | | | |
|----|----|----|----|
| a. | 13 | d. | 16 |
| b. | 14 | e. | 28 |
| c. | 15 | | |

3) How many valence electrons are assigned to both oxygen atoms when determining formal charge in the ionic compound sodium acetate, NaOOCCH_3 ?

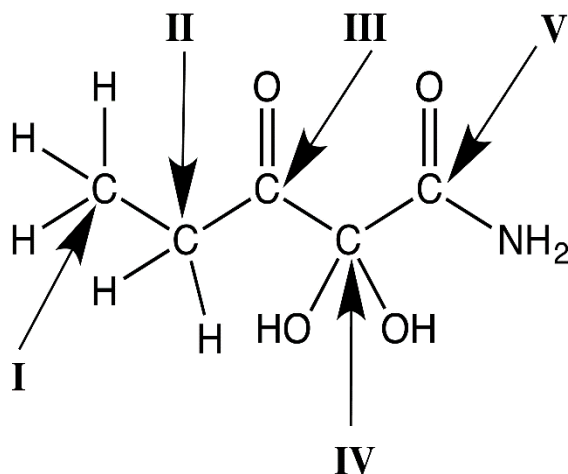
- | | | | |
|----|----|----|----|
| a. | 7 | d. | 13 |
| b. | 9 | e. | 14 |
| c. | 11 | | |

4) Which carbon atom has an oxidation state of +3?



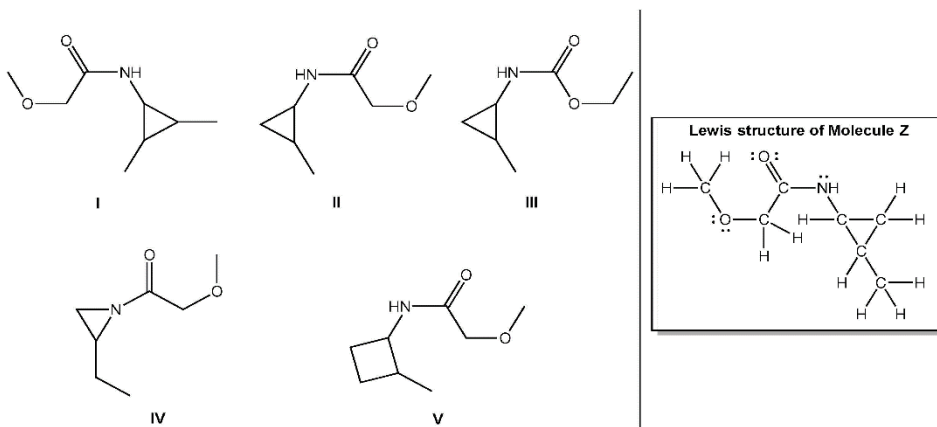
- | | | | |
|----|-----|----|----|
| a. | I | d. | IV |
| b. | II | e. | V |
| c. | III | | |

5) Which carbon atom has an oxidation state of -3?



- | | | | |
|----|-----|----|----|
| a. | I | d. | IV |
| b. | II | e. | V |
| c. | III | | |

6) Which line structure is correct for Molecule Z?



- | | | | |
|----|-----|----|----|
| a. | I | d. | IV |
| b. | II | e. | V |
| c. | III | | |

7) Which condensed formula contains a ketone?

- | | | | |
|----|--|----|-----------------------------------|
| a. | CH_3COCH_3 | d. | $\text{CH}_3\text{CH}_2\text{OH}$ |
| b. | $\text{CH}_3\text{CO}_2\text{CH}_2\text{CH}_3$ | e. | CH_3COH |
| c. | $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ | | |

8) An atom's electrons have a high probability of being found within a region of three-dimensional space defined by quantum mechanics. What term identifies this region?

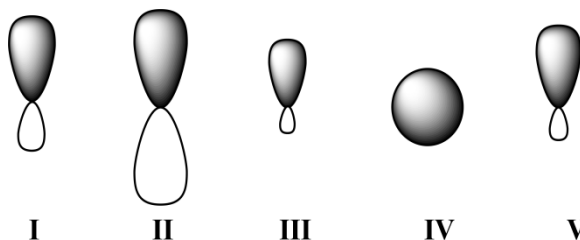
- | | | | |
|----|------------------------|----|---------------|
| a. | Electron configuration | d. | Nucleus |
| b. | Atomic orbital | e. | Valence shell |
| c. | Central core | | |

- 9) Which of the following functional groups has a lone pair residing in an sp -hybridized orbital?
- | | |
|-----------|------------|
| a. Amide | d. Nitrile |
| b. Alkyne | e. Ester |
| c. Amine | |

- 10) Which two atomic orbitals overlap to form the MOs of σ symmetry that correspond to the C—C bond in ethylene?
- | | |
|----------------------|----------------------|
| a. $2s$ and $2p$ | d. sp^3 and sp^3 |
| b. $2p$ and sp^2 | e. $2p$ and $2p$ |
| c. sp^2 and sp^2 | |

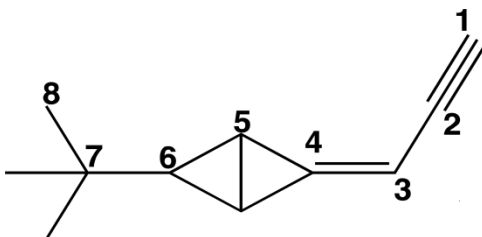
- 11) Recall that ethyne is $\text{HC}\equiv\text{CH}$. Which two orbitals share electrons in one of ethyne's covalent C—H bonds?
- | | |
|--|--|
| a. H_{2s} and C_{2p} | d. H_{1s} and C_{sp^2} |
| b. H_{1s} and C_{2p} | e. H_{1s} and C_{sp} |
| c. H_{1s} and C_{sp^2} | |

- 12) Given below are $2s$, $2p$, sp , sp^2 , and sp^3 orbitals, all drawn to scale and in no particular order. Which of these orbitals would carbon use for a C—O π bond?



- | | |
|--------|-------|
| a. I | d. IV |
| b. II | e. V |
| c. III | |

- 13) The carbon atoms in the molecule below are labeled 1–8. Which C—C—C bond angle in the molecule would be approximately 180° ?



- | | |
|---------------------------------------|---------------------------------------|
| a. $\text{C}_1\text{-C}_2\text{-C}_3$ | d. $\text{C}_5\text{-C}_6\text{-C}_7$ |
| b. $\text{C}_2\text{-C}_3\text{-C}_4$ | e. $\text{C}_6\text{-C}_7\text{-C}_8$ |
| c. $\text{C}_4\text{-C}_5\text{-C}_6$ | |

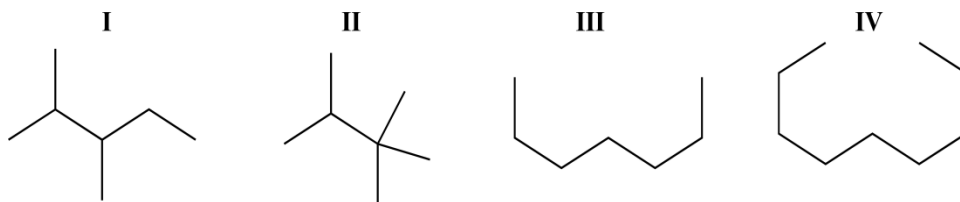
14) Which functional group will engage in dipole–dipole interactions, but will *not* serve as a hydrogen-bond acceptor?

- | | |
|------------------|--------------------|
| a. Nitrile | d. Carboxylic acid |
| b. Ketone | e. Amine |
| c. Alkyl bromide | |

15) Identify the weakest intermolecular force.

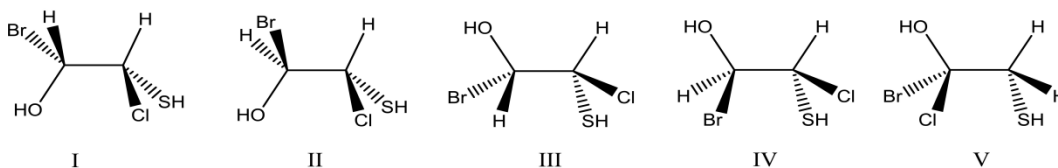
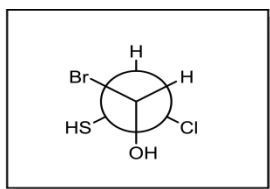
- | | |
|------------------|----------------------------------|
| a. Hydrogen bond | d. Dipole–induced dipole |
| b. Ion–dipole | e. Induced dipole–induced dipole |
| c. Ion–ion | |

16) Rank the following molecules based on *decreasing* boiling point.



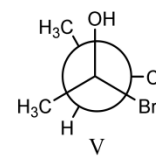
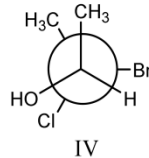
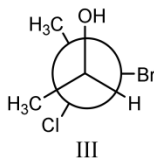
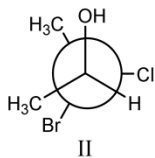
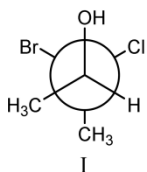
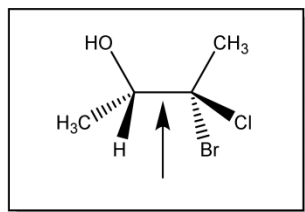
- | | |
|----------------------|----------------------|
| a. I > II > III > IV | d. IV > III > I > II |
| b. II > I > III > IV | e. IV > III > II > I |
| c. I > III > IV > II | |

17) Which of the following dash–wedge structures (viewed from the left) best represents the Newman projection below?



- | | |
|--------|-------|
| a. I | d. IV |
| b. II | e. V |
| c. III | |

- 18) The Newman projection looking down the indicated bond in the species below is best represented by which of the following (I, II, III, IV, or V; II to V are eclipsed structures)?



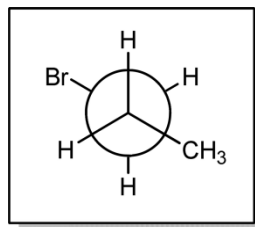
- a. I
b. II
c. III

- d. IV
e. V

- 19) Which of the following pairs do *not* have the same connectivity?

- a. Two stereoisomers
b. Two conformational isomers
c. Cyclohexane chair conformations before and after a chair flip
d. Two constitutional isomers
e. Two Newman projection rotamers

- 20) How many degrees does the front carbon have to be rotated clockwise to result in a gauche conformer?



- a. 60°
b. 90°
c. 109.5°

- d. 120°
e. 300°