

Student ID _____ Name _____

TA Name _____

page _____ points: _____

2 _____ (17)

3 _____ (35)

4 _____ (18)

5 _____ (20)

6 _____ (10)

Total _____ (100)

Periodic Table

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Ha	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac															

Please sit with an empty seat between you and your neighbors.**Unless specifically asked, you do not have to draw mechanisms for reactions.****Feel free to ask questions about the questions, but please don't ask questions about your answers, it distracts your neighbors.**

1. Draw the best Lewis structure for each species shown below. Lone pairs and formal charges must be included. Show hybridization on each non-hydrogen atom. (12 pts).

a) Methyl azide CH_3N_3

b) *tert*-butyl thioisocyanate ${}^t\text{BuNCS}$

c) carbene CH_2

d) ozone O_3

2. Provide the corresponding pKa values for the following species. (5 pts)

pKa

HF

CH_3COOH

H_3O^+

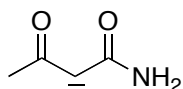
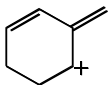
HNO_3

NH_4^+

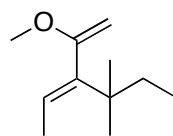
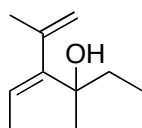
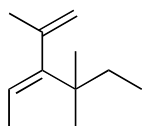
3. Provide all constitutional isomers for C_5H_{10} using bond-line formulas and their corresponding IUPAC names. (17 pts)

4. Draw the energy diagram as the dihedral angle of the central carbon-carbon bond of butane varies from 0° to 360° . Draw appropriate Newman projections for conformations whose dihedral angles are 0° , 120° , 180° , and 300° . (18 pts)

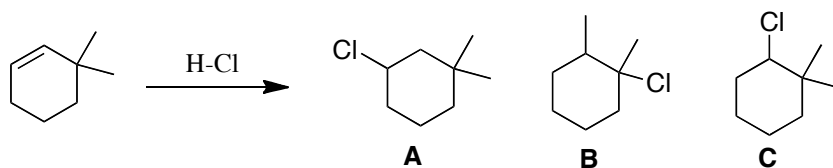
5. Using the curved arrow notation, draw all other possible resonance structures for the following species. Compare the stability for each series of resonance structures. Be sure to show ALL lone pairs and formal charges in your structures. (12 pts)



6. Provide the olefin geometry of the following species (Z or E). (6 pts)



7. The reaction shown below provides three products A-C. Draw the mechanism for the formation of these products. Be sure to include all arrows and all charges. (20 pts)



Which of the three products would you expect to be formed in the smallest amount, A, B, or C?

8. Write a mechanism for the following reaction. (10 pts)

