Concordia University CHEM 221
Dr. C. Rogers, Section 02 Fall 2003

Name:_____

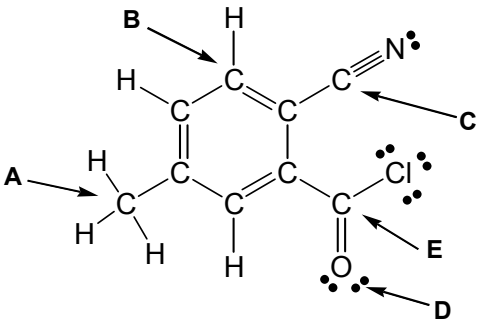
ID #:_____

ORGANIC CHEMISTRY I -- W2005 section02
Sample MIDTERM TEST (questions mostly from F2003 MT#1&2)

INSTRUCTIONS: This test paper includes 7 pages, 12 questions and a periodic table; check that your paper is complete. Answer all questions inside the boxes provided (except questions 11b & 12); information written elsewhere will not be marked. Model kits are allowed. **GOOD LUCK!**

#1. **(2 Marks)** What is the expected hybridization for each of the indicated atoms in this molecule?

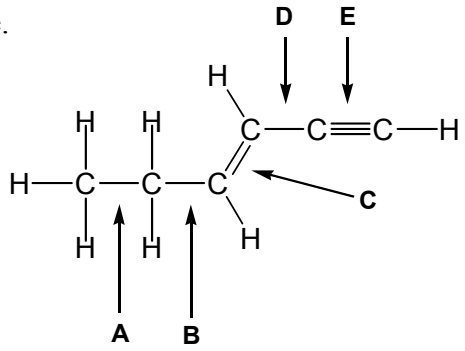
ANSWERS
A:
B:
C:
D:
E:



 # 2. **(2 Marks)** Rank the bonds in terms of length for this molecule.

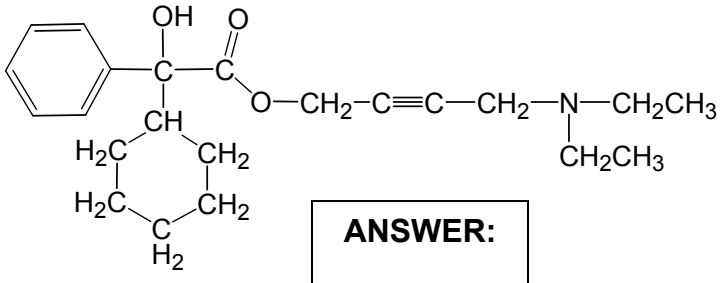
a) longest **D** > **B** > **A** > **C** > **E** shortest
b) longest **E** > **C** > **A** > **B** > **D** shortest
c) longest **A** > **B** > **D** > **C** > **E** shortest
d) longest **E** > **C** > **D** > **B** > **A** shortest
e) longest **A** > **D** > **B** > **E** > **C** shortest

ANSWER:



 # 3. **(2 Marks)** The molecule shown here is oxybutynin, an anticholinergic compound. Which choice represents the list of functional group classes in oxybutynin?

a) 2 phenyl rings, an amine, an ester, an alkyne, a nitrile
b) a nitrile, a ketone, an alcohol, a phenyl ring, an amine
c) an alkyne, an ester, a phenyl ring, an amine, an alcohol
d) an acid, an alcohol, a nitrile, an alkyne, 2 phenyl rings
e) a phenyl ring, an amine, an alkyne, a ketone, an ether



ANSWER:

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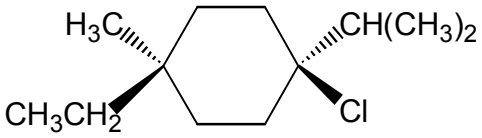
 # 4. **(2 Marks)** How many secondary (2°) carbons are present in this structure?

ANSWER:



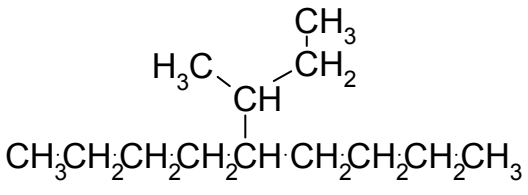
 # 5. **(4 Marks)** Draw line structures for the following compounds:

a) *N*-methyl-1,3-dichloro-6-ethyl-2-octamine

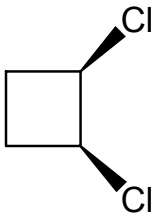
b) *trans*-1-bromo-3-(1-methylethyl)cyclohexane

 # 6. **(4 Marks)** Provide systematic IUPAC names for the following compounds:

a)



b)



 # 7. (6 Marks) There are many constitutional (structural) isomers with the molecular formula $C_3H_6O_2$.

a) In each box, draw one isomer that meets the criteria listed in that box (there are a number of correct possibilities). All atoms should be closed shell (full valence) and uncharged.

ISOMER A: one 3-atom ring; **both** oxygen atoms are part of the ring of atoms	**ISOMER B**: one 3-atom ring; a **single** oxygen atom is part of the ring of atoms	**ISOMER C**: one 3-atom ring; oxygen atoms are **not** part of the ring of atoms

b) Based on the structures of the molecules, you should be able to confidently predict one of these isomers as being either the most or the least soluble in water. Choose which one you are going to identify, then explain your reasoning.

I will identify the: (circle one)

most soluble in water least soluble in water

Circle which isomer it is: A B C

Explanation (include sketches of relevant intermolecular interactions):

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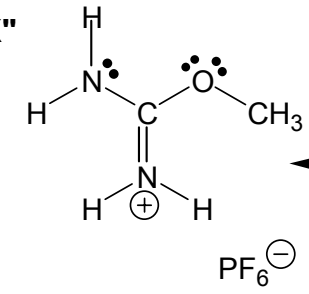
 # 8. a) (3 Marks) There are three other significant resonance contributors for molecule **"X"** shown below. Draw them in the boxes provided. You do not need to draw the PF_6^- anion.

"X"



X_a **X_b** **X_c**

b) (3 Marks) Rank the four structures **X**, **X_a**, **X_b**, and **X_c** according to how much they contribute to the real structure of the molecule. Give a reason why the most important contributor is so stable, and why the least important contributor is so unstable.

Most important **Least important**

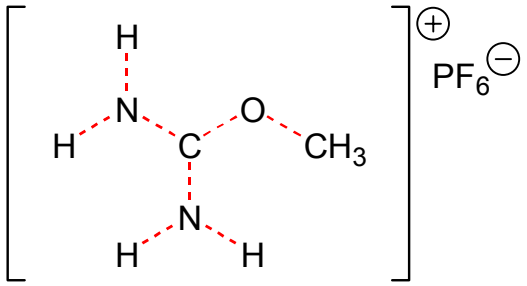
_____ > _____ > _____ > _____

Why so stable?

Why so unstable?

c) (2 Marks) Considering these resonance contributors, how do you think the molecule "really" looks? In the box on the left, the connectivity in molecule "**X**" is indicated by dotted lines. **Your task is to represent the 3-dimensional (3-D) representation of structure of "X" by writing over the dotted-lines: use lines, dashes and wedges to indicate spatial orientation with respect to the page**. Describe this 3-D structure by filling in the blanks in the other box (you can number the atoms in the structure for clarity).

How I think "X" looks in 3-D:



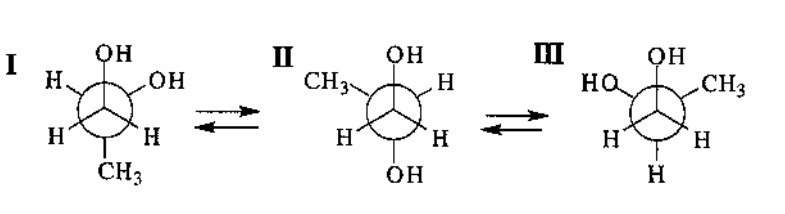
These bond will NOT rotate freely:

These atoms will be in the same plane:

The reason for this is:

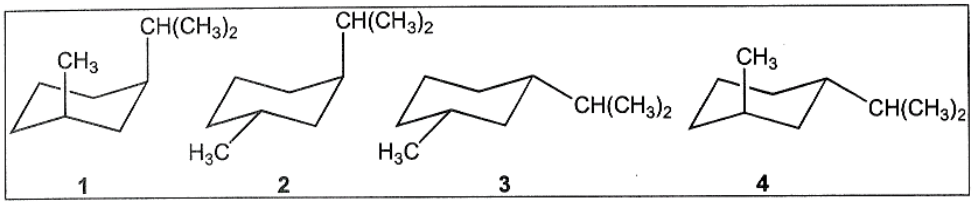
 # 9. (___/ 4 Marks) CIRCLE YOUR CHOICE. The three staggered forms of 1,2-propanediol are represented here as Newman projections. Taking into account **both** steric and electrostatic interactions between substituents, rank the conformers according to their relative stability.

a) most stable **III < II < I** least stable
b) most stable **III < I < II** least stable
c) most stable **II < III < I** least stable
d) most stable **I < III < II** least stable
e) most stable **I < II < III** least stable

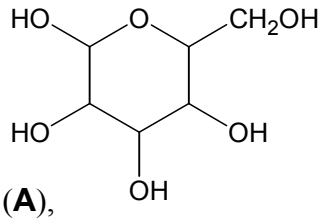


 # 10. (___/ 3 Marks) CIRCLE YOUR CHOICE. Which structure represents the <u>most stable</u> chair conformation of *trans*-1-isopropyl-3-methylcyclohexane?

a) **1**
b) **2**
c) **3**
d) **4**



 # 11. (___/ 5 Marks) The structure of glucose includes a six-membered ring. The relative orientations of the ring's substituents has not been shown in the drawing here, but the information in part (a) will allow you to figure it out.



a) In the most stable conformation of glucose, the molecule adopts a chair conformation where all the substituents are equatorial. Draw this conformation (**A**), and show what the molecule would look like in the "flipped" chair conformation (**B**).

MORE STABLE CHAIR: **A**	⇌	LESS STABLE CHAIR: **B**

b) Draw a planar representation of glucose (like that shown at the top of the question) that shows the dashes and wedges needed to illustrate the relative orientation of the substituents.

 # 12. (___/ 8 Marks) You are asked to prepare 2-bromo-2-methylpropane, starting with an alkane precursor.

a) What reagents and reaction conditions (*e.g.,* hot/cold, light/dark, relative amounts of reagents; we'll learn about solvents later) would you choose? Write a reaction equation that describes your choices.

b) Would a significant amount of undesired products also form? Explain, and identify any undesired products you are talking about and how they would form.

c) Would your answer to (b) be the same if you were talking about preparing 2-methyl-2-chloropropane instead? Explain.

----------THE END----------

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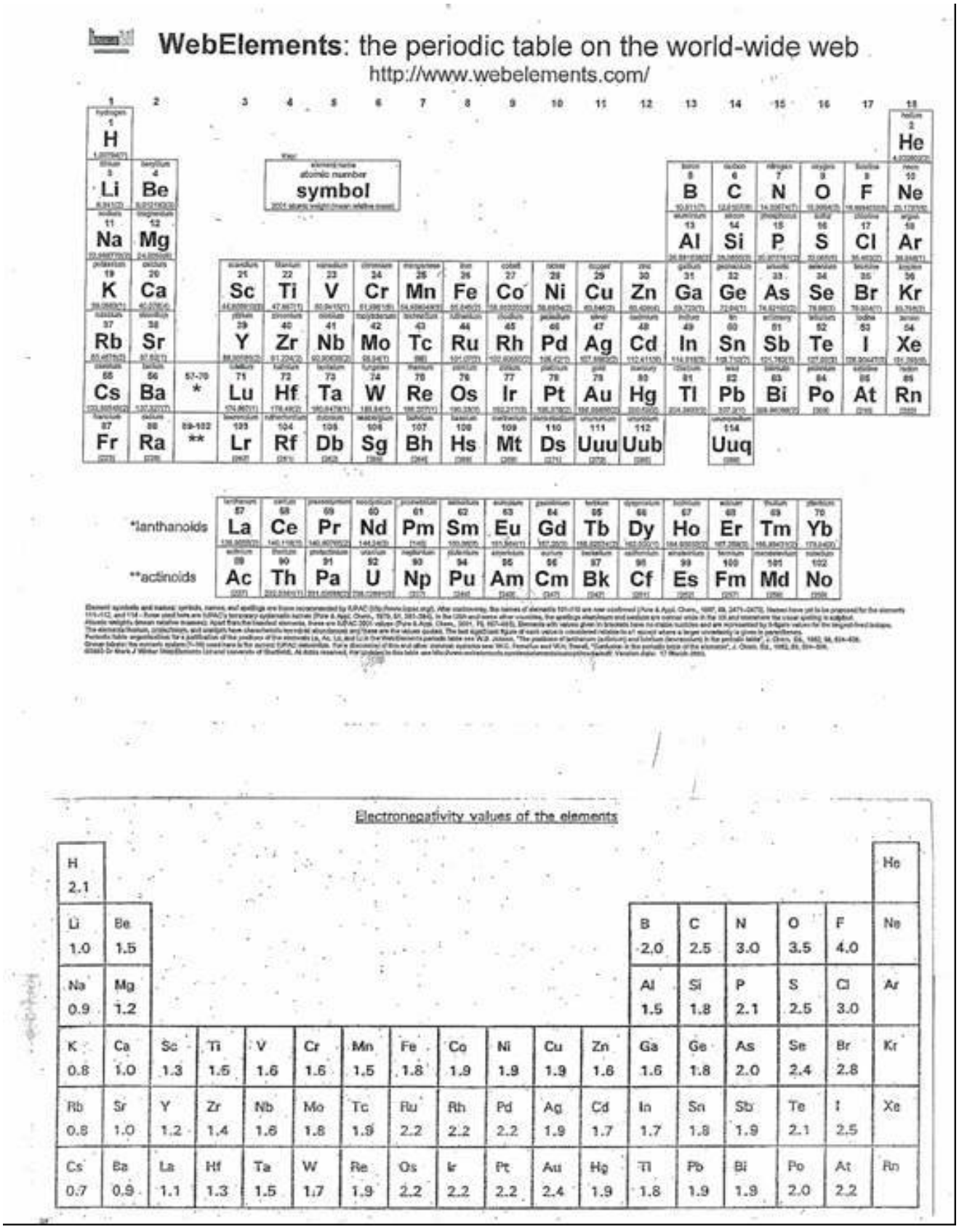

WebElements: the periodic table on the world-wide web

http://www.webelements.com/

1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
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	57-70 *	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	89-102 **	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Uuu	Uub		Uuq				

*lanthanoids	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	
**actinoids	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	

Electronegativity values of the elements

H 2.1																	He
Li 1.0	Be 1.5											B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	Ne
Na 0.9	Mg 1.2											Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0	Ar
K 0.8	Ca 1.0	Sc 1.3	Ti 1.5	V 1.6	Cr 1.6	Mn 1.5	Fe 1.8	Co 1.9	Ni 1.9	Cu 1.9	Zn 1.6	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8	Kr
Rb 0.8	Sr 1.0	Y 1.2	Zr 1.4	Nb 1.6	Mo 1.8	Tc 1.9	Ru 2.2	Rh 2.2	Pd 2.2	Ag 1.9	Cd 1.7	In 1.7	Sn 1.8	Sb 1.9	Te 2.1	I 2.5	Xe
Cs 0.7	Ba 0.9	La 1.1	Hf 1.3	Ta 1.5	W 1.7	Re 1.9	Os 2.2	Ir 2.2	Pt 2.2	Au 2.4	Hg 1.9	Tl 1.8	Pb 1.9	Bi 1.9	Po 2.0	At 2.2	Rn