Spring 2023 **Chemistry 2500 Midterm #1** ____/58 marks

Confidentiality Agreement:
I agree not to discuss (or in any other way divulge) the contents of this exam until after 5:00pm Mountain Time on Friday, February 3rd, 2023. I understand that breaking this agreement would constitute academic misconduct. The minimum penalty would be a mark of 0/58 on this exam.

Signature: _____ Date: _____

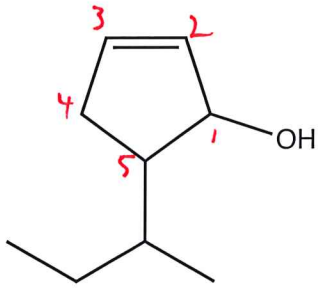
KEY

1) Please read the test carefully before starting. It has 10 pages of questions including a this cover page and two blank pages.
2) The exam is worth a total of 58 marks. Most of these marks are for explanation/showing your work rather than for reaching the correct answer. Explain all your answers fully using diagrams where appropriate (a picture really is worth a thousand words!).
3) You may use a molecular model kit and ruler. You may not have written materials in your model kit.
4) No calculators allowed.
5) **DO NOT WRITE ON ANY QR CODE!!!** Work on pages without a QR code will not be graded.
6) If your work is not legible, it will be given a mark of zero. For full credit, explanations must be complete. In many cases, complete explanations include drawing relevant structures.
7) Marks will be deducted for incorrect information added to an otherwise correct answer.
8) You have 2 hours to complete this test.

Question Breakdown

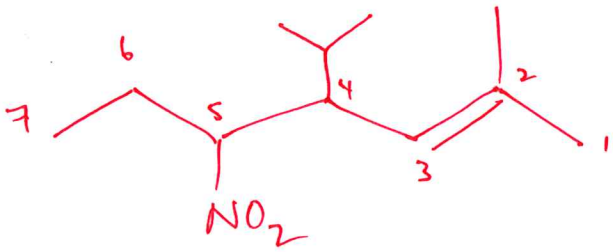
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11		Total			
/ 2	/ 2	/ 10	/ 5	/ 4	/ 3	/ 6	/ 7	/ 4	/ 4	/ 11		/ 58			

1. Name the following molecule according to IUPAC rules. **[2 marks]**



5-sec-butylcyclopent-2-enol.

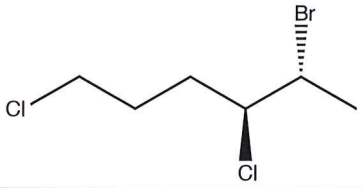
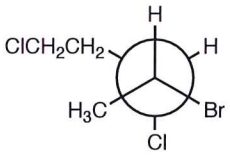
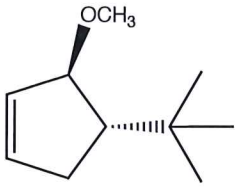
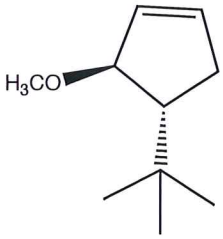
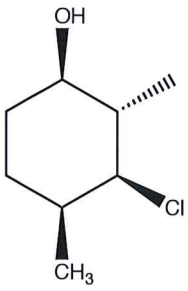
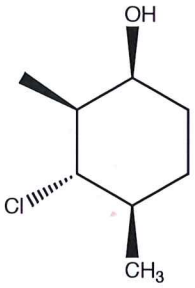
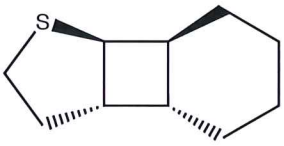
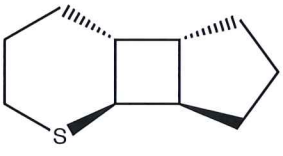
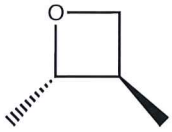
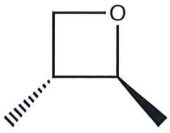
2. Using line structures, draw the structure of **4-isopropyl-2-methyl-5-nitrohept-2-ene** **[2 marks]**



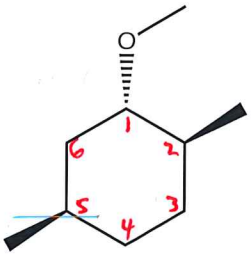
3. Using the appropriate letter or letters, indicate the relationship(s) between the following pairs of molecules. If there is more than one relationship, provide all the letters that apply. *No explanation is necessary.*

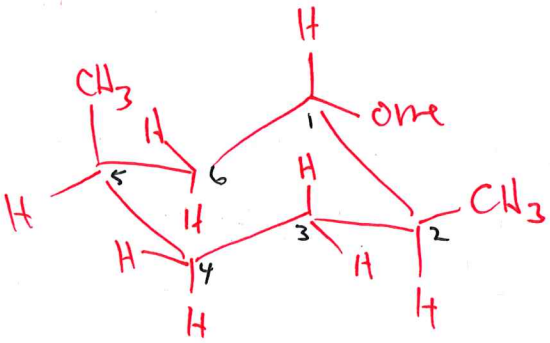
[10 marks]

A = stereoisomers
B = constitutional isomers
C = conformers
D = diastereomers
E = enantiomers
F = identical molecules
G = none of the above

	relationship(s)
 and 	G.
 and 	A, E
 and 	A, D
 and 	B
 and 	F

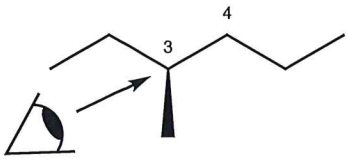
4. Draw the most stable chair conformer for the following molecule. **All** axial and equatorial bonds must be drawn and will be graded for proper placement. **[5 marks]**

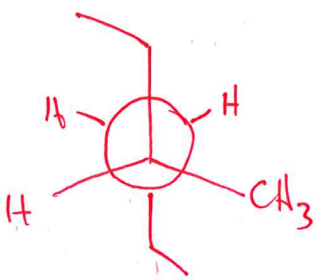




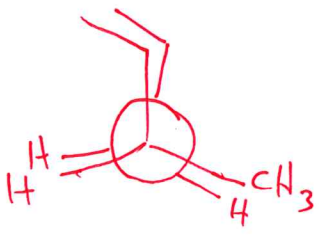
most stable conformer b/c more substituents are equatorial (2 eq, 1 ax)

5. For the following molecule, draw and label Newman projections of both the highest energy and lowest energy conformers looking down the C3-C4 bond. **[4 marks]**





lowest energy



highest energy.

6. Which of the following molecules (A, B, or C) would you expect to be the most soluble in the given solvent? Briefly explain your answer. **[3 marks]**

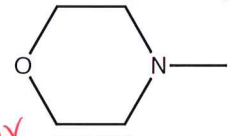
IMF : H-bonding.



V. polar

solvent

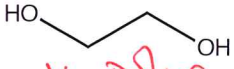
IMF : dipole-dipole



polar

A

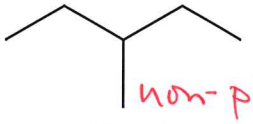
H-bonding



V. polar

B

London forces



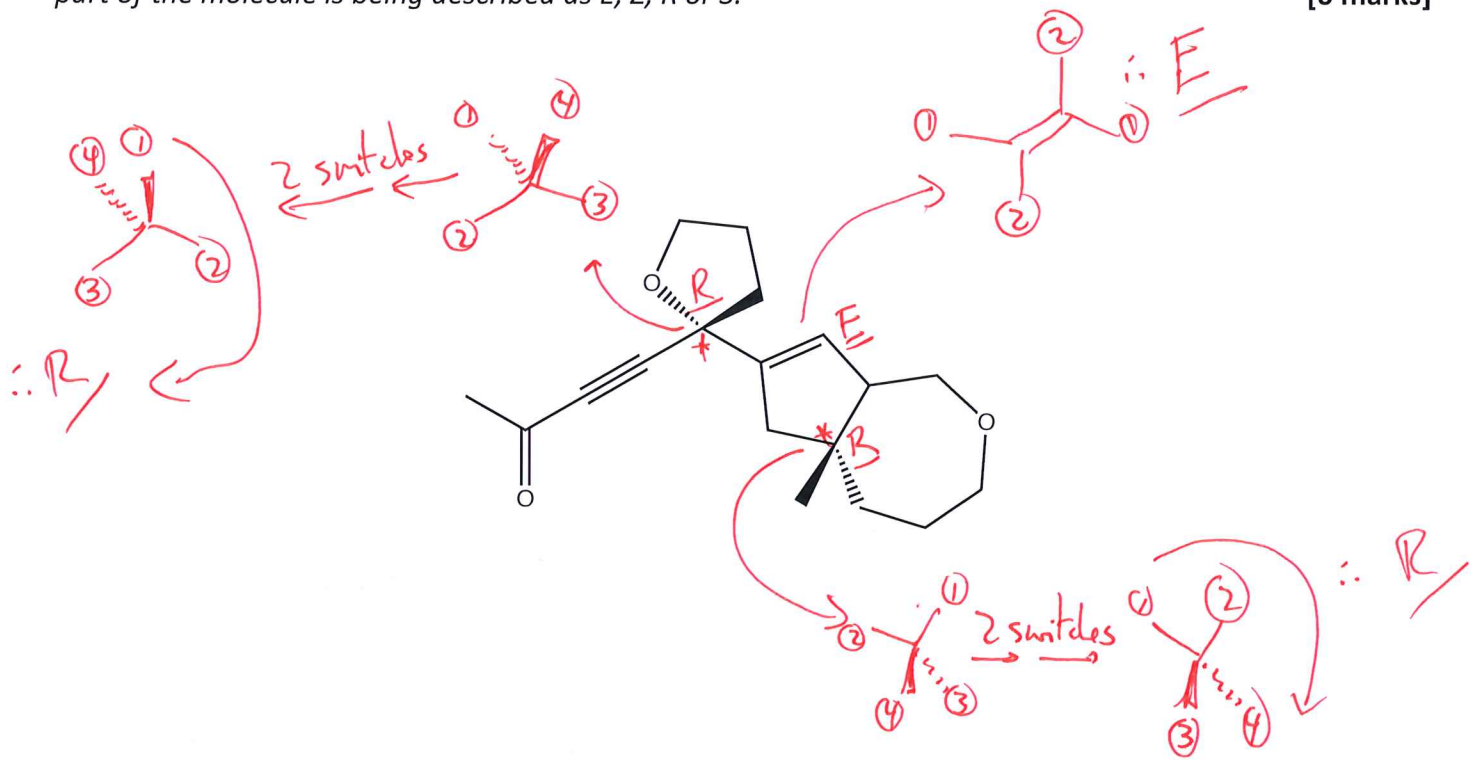
non-polar.

C

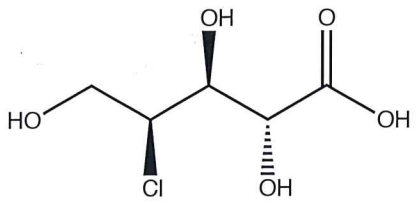
B The solvent is a polar molecule which can H-bond. Likes dissolve likes so any polar molecule which can participate in H-bonding would be the most soluble.

* B is the most polar & can H-bond.
A - somewhat polar - dipole-dipole interactions.
C - non-polar - London dispersion forces.

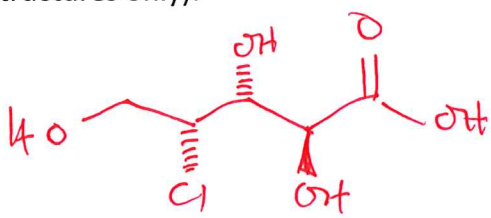
7. For the molecule below, where appropriate, assign the stereochemical configuration(s) as *E*, *Z*, *R* or *S*. *For full marks, you must show the priority numbers you used to assign each configuration and it must be clear what part of the molecule is being described as E, Z, R or S.* **[6 marks]**



8. For the following molecule: **[7 marks]**

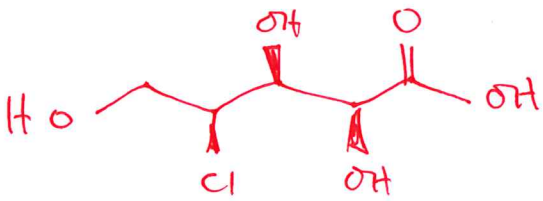


(a) Draw its **enantiomer** (line structures only):



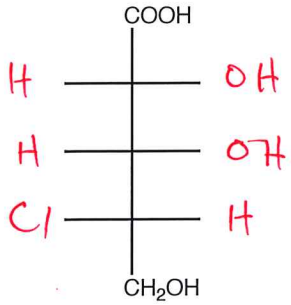
NOTE: this is one possible way to draw the enantiomer.

(b) Draw a **diastereomer** (line structures only):

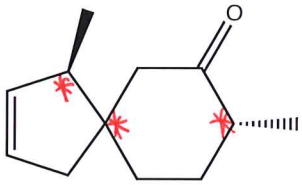


NOTE: this is one possible answer.

(c) Complete the following Fischer projection:



9. Consider the structure of molecule X: **[4 marks]**



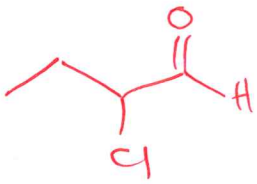
Molecule X

(a) What is the molecular formula for molecule X? $C_{12}H_{18}O$

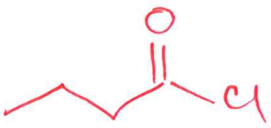
(b) Draw a * at each chirality center in molecule X.

10. Using only the molecular formula C_4H_7OCl, draw (line structures only) an example for each of the following: **[4 marks]**

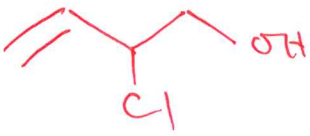
(a) an aldehyde



(b) an acid chloride



(c) an alcohol



(d) a cyclic ether



These represent one possible answer.

11. Draw all the **CYCLIC** (molecules with rings) *constitutional* isomers for the molecular formula C_4H_8O. All molecules are neutral, and every atom has a formal charge of zero. **Only line structures will be graded (NO expanded or condensed structures).** **[11 marks]**

