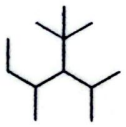
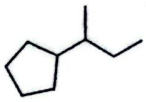
CHEM 205 **Worksheet (WS3) (58 points total)**

Key Topics: *Nomenclature, Conformational Stability, Newman Projections, Chair Structures*

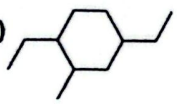
1. Using IUPAC rules (*see Chapter 2.14-2.18 and Table 2.4 and 2.5 in text*) provide a name to each structure below. Use common names for branched substituents were applicable. **(6pts)**

(a) 

3-tert-butyl-2,4-dimethylhexane

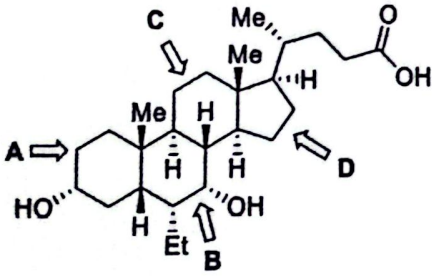
(b) 

2-cyclopentylbutane

(c) 

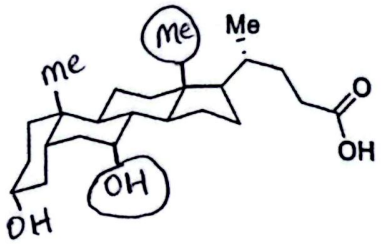
1,4-Diethyl-2-methylcyclohexane

2. (a) Convert the semi-synthetic animal steroid shown below in bond-line form to its proper chair form by drawing in the missing non-hydrogen groups in their proper orientation and circle the groups that are axial. The skeleton is made up of the tetracyclic ring core. These 4 rings have been labeled A thru D for clarity. **(7pts)**



Bond-Line Form

≡



Chair Form

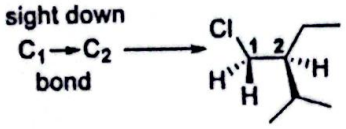
b) 2 rings represent in-fused deadline system = A and B

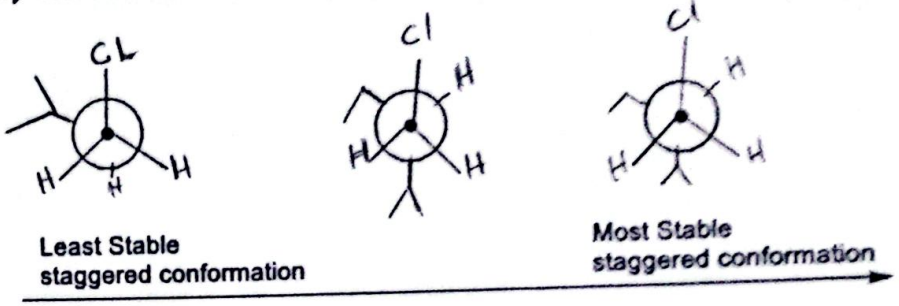
c) 2 rings represent trans-fused deadline system = B and C

(b) Identify the two fused rings that represent a trans-decalin system **(1pt)** A, B

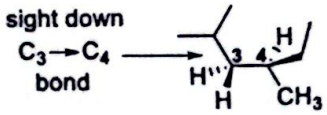
(c) Identify the two fused rings that do not represent a decalin skeleton. **(1pt)** B, C

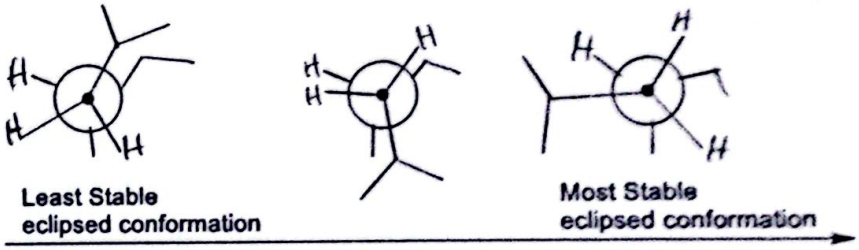
3. **(a)** Sighting down the C1 → C2 bond, consider the bond-line structure shown below. Using the Newman projection templates provided, draw all three **staggered conformations** in Newman projection form in order of increasing stability about the C1 → C2 bond. **(6pts)** You may assume that iPr > Et > Cl in terms of size.



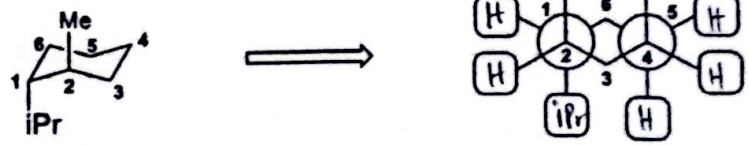


(b) Sighting down the C3 → C4 bond, consider the bond-line structure shown below. Using the Newman projection templates provided, draw all three **eclipsed conformations** in Newman projection form in order of increasing stability about the C3 → C4 bond. **(6pts)**



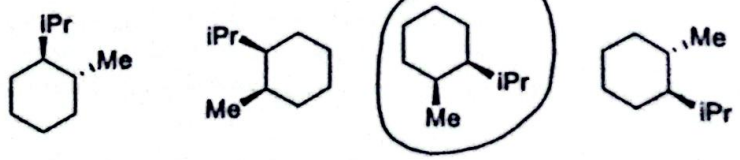


(c) (i) Convert the chair structure below into its proper Newman projection using the template provided. You need to fill in the empty boxes with the correct substituents (hydrogen and non-hydrogen groups). Use the numbering scheme provided. **(4pts)**



Chair Newman

(ii) Circle the bond-line structure below that best represents the same structure provided above in part c(i) **(2pts).**

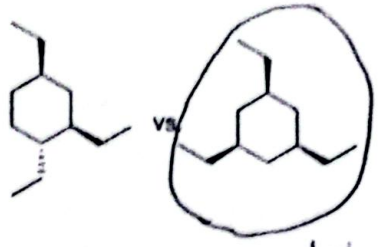


(iii) (1pt) Is the iPr group at C-1 in the chair axial or equatorial? axial

(iv) (1pt) Is the CH_3 group at C-2 in the chair axial or equatorial? equatorial

4. For (a) circle the most relative stable structure. Show work by drawing relevant chair structures and/or Newman projections (as needed) to clearly illustrate why. Explain your choice with a few words (no more than one sentence). It is best practice here that only the most stable conformations for each compound are being compared. For (b), provide a brief explanation for why chair 1 is more stable than chair 2. **(10pts)**

(a)



There is no repulsion in structure 2, so, it is the most stable structure

(b)

Briefly explain why chair 1 is more stable (and more favorable) than chair 2.

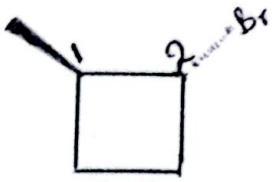
In chair 1 there is less energy involved that means more stability

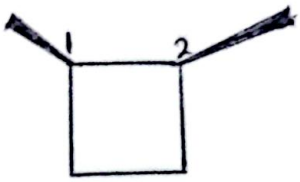
5. (a) (3pts) Provide a systematic (IUPAC) name for the structure below. You may ignore stereochemistry.

The IUPAC name of the given structure is 7-methylbicyclo[4.2.1]nonane

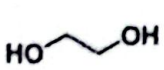
(b) Draw the structure of each compound below. Be sure to clearly show the relative stereochemistry. Then, circle the compound that will have the highest heat of combustion. **(4pts)**

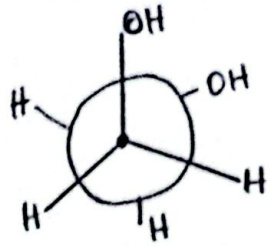
trans-1,2-dibromocyclobutane vs *cis*-1,2-dibromocyclobutane



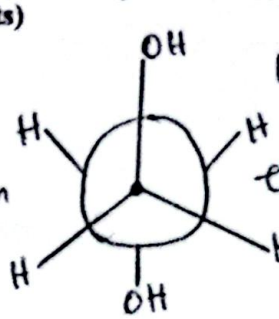


6. Draw and compare the Newman projections of when the OH groups are anti to each other versus when they are gauche to each other. Then, explain in a few words why the compound is more stable in the conformation where the OH groups are gauche to each other. **(6pts)**





Gauche form is more stable conformation due to formation of hydrogen bonding



Anti form Here both hydroxyl H group is anti each other and the dihedral angle is 180°