CHEMISTRY 2323: Fundamentals of Organic Chemistry I Second Midterm Exam

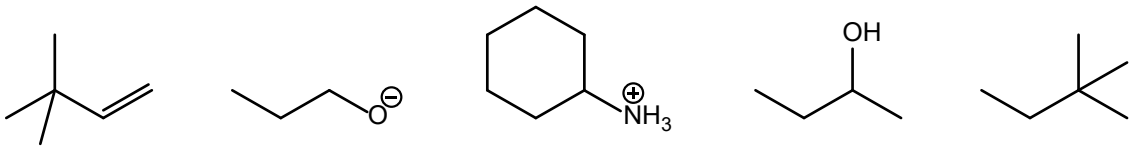
Prof. Ognjen Š. Miljanić October 17, 2025

Name: _____ Student ID Number: _____

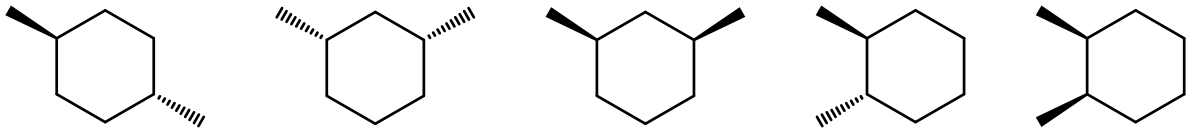
(print legibly) Last First

Read all directions very carefully. Write your answer legibly in the designated spaces and think carefully about what you are doing. The total number of points is 300. This exam is supposed to have six pages, with the last page intentionally left blank.

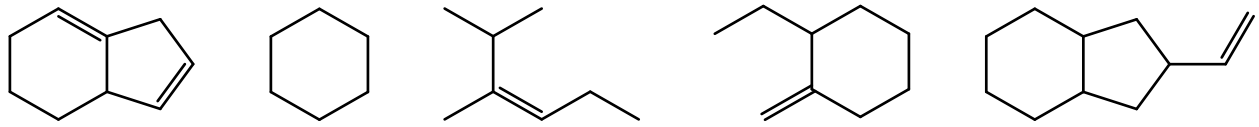
1. This question has several parts. In each part, **circle only one entry**.
   Circle the most nucleophilic compound: *5×8 = 40 points*



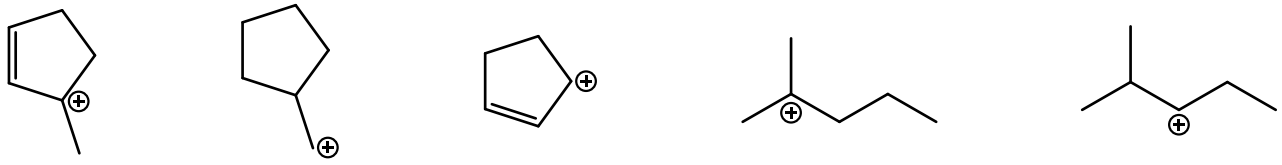
Circle the least stable isomer of dimethylcyclohexane:



Circle the only compound which does not react with HBr:



Circle the most stable catiom (think about hyperconjugation and resonance):



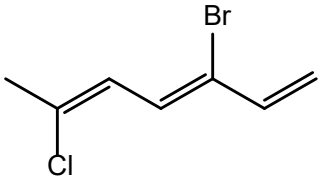
The degree of unsaturation of atorvastation (Lipitor), which has molecular formula $C_{33}H_{35}FN_2O_5$, is:

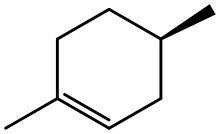
1 4 12 17 21

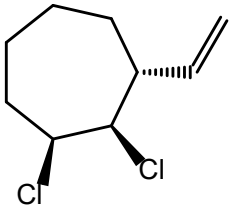
DO NOT WRITE IN THIS SPACE

FINAL SCORE

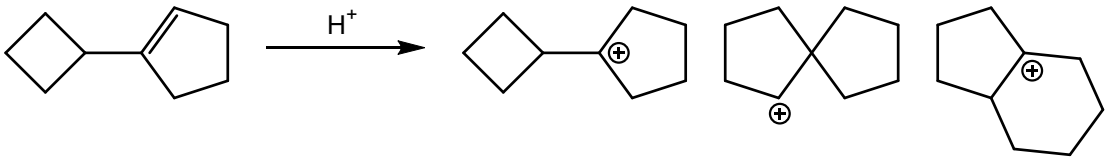
2. For each of the following structures, write their <u>complete systematic IUPAC name</u>. Be sure to indicate stereochemistry where this is pertinent. *3×10 = 30 points*



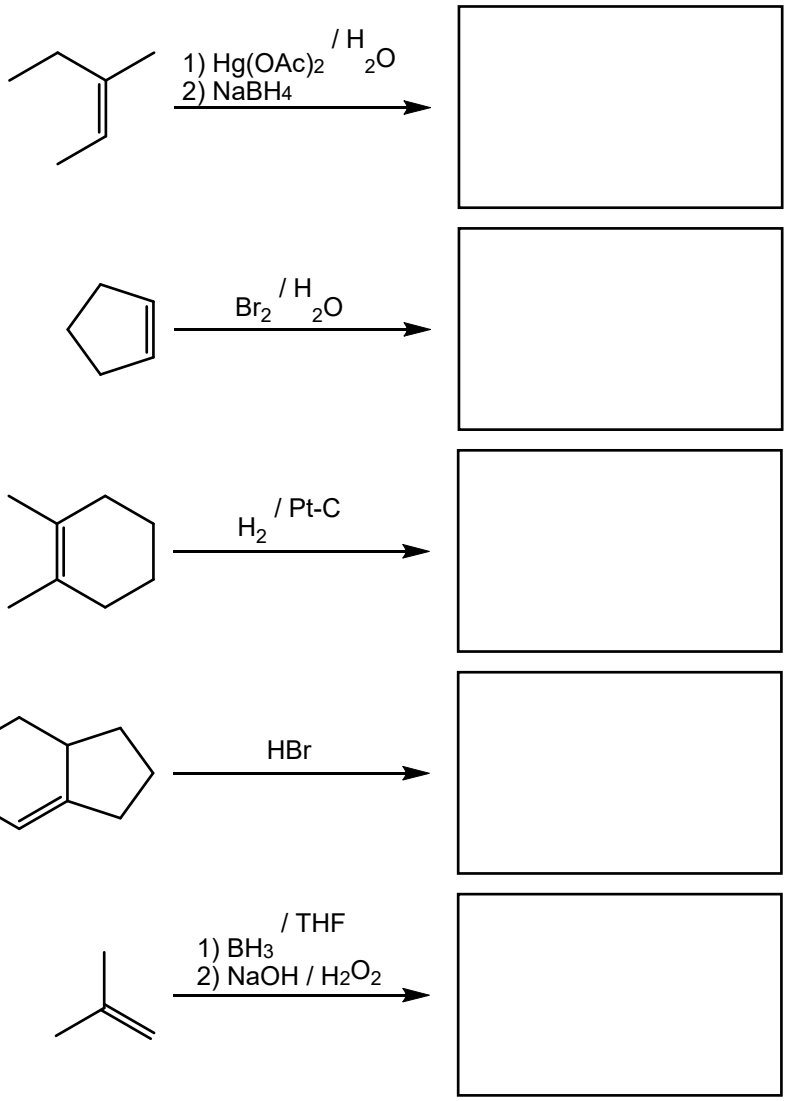




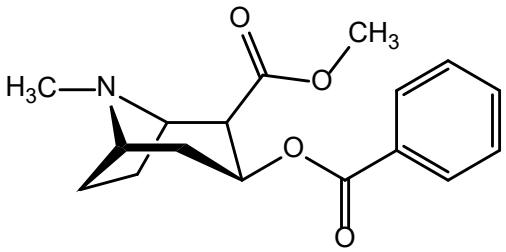
3. Propose a mechanism to account for the formation of the three cations shown on the right from the alkene starting material on the left. More products are formed, but you only need to account for the ones shown here. *50 points*



4. For each of the reactions or series of reactions below, draw the structure of the missing major organic product(s) in the box(es) provided. Make sure to include all the pertinent information about stereochemistry and charges. *5×12 = 60 points*

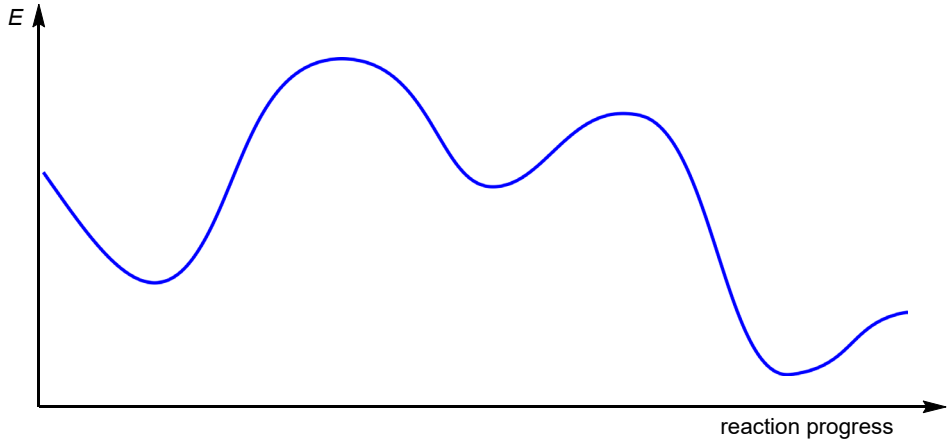


5. Shown below is the chemical structure of cocaine—a central nervous system stimulant and a common illegal drug. Circle all the stereocenters in cocaine. *20 points*



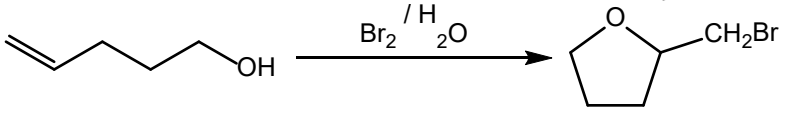
BONUS: Pick any two stereocenters in cocaine and determine whether they have (*R*) or (*S*) configuration. Be clear on which stereocenters you are referring to. *10 points*

6. On the energy diagram shown below, clearly label (*a*) the activation energies for both steps, (*b*) the positions of the starting material, intermediate(s), transition states(s), and the product, and (*c*) the overall ΔG of the reaction. *40 points*



7. Treatment of 4-penten-1-ol with aqueous Br_2 yields a cyclic bromo ether rather than the expected bromohydrin. Suggest a mechanism, using curved arrows to show electron movement. *40 points*

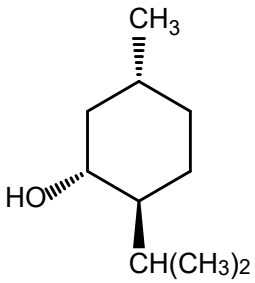
Textbook problem 8-38 (McMurry, 10th edition)



4-penten-1-ol 2-(bromomethyl)tetrahydrofuran

8. Draw the two chair conformations of menthol, and tell which is more stable. *20 points*

Textbook problem 4-45 (McMurry, 10th edition)



menthol

hydrogen 1 H 1.0079																	helium 2 He 4.0026
lithium 3 Li 6.941	beryllium 4 Be 9.0122											boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305											aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078		scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80
rubidium 37 Rb 85.468	strontium 38 Sr 87.62		yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29
caesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 ✶	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
francium 87 Fr [223]	radium 88 Ra [226]	89-102 ✶ ✶	lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	ununnilium 110 Uun [271]	unununium 111 Uuu [272]	ununbium 112 Uub [277]		ununquadium 114 Uuq [289]				