

PERIODIC CHART OF THE ELEMENTS

IA	IIA	IIIB	IVB	VB	VIB	VII B	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	INERT GASES		
1 H 1.00797														1 H 1.00797	2 He 4.0026		
3 Li 6.939	4 Be 9.0122										5 B 10.811	6 C 12.0112	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.183	
11 Na 22.9898	12 Mg 24.312										13 Al 26.9815	14 Si 28.086	15 P 30.9738	16 S 32.064	17 Cl 35.453	18 Ar 39.948	
19 K 39.102	20 Ca 40.00	21 Sc 44.956	22 Ti 47.90	23 V 50.942	24 Cr 51.996	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.905	40 Zr 91.22	41 Nb 92.906	42 Mo 95.94	43 Tc (99)	44 Ru 101.07	45 Rh 102.905	46 Pd 106.4	47 Ag 107.870	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.904	54 Xe 131.30
55 Cs 132.905	56 Ba 137.34	*57 La 138.91	72 Hf 178.49	73 Ta 180.948	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 196.967	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.980	84 Po (210)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	†89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 ? (271)	111 ? (272)	112 ? (277)						

Numbers in parenthesis are mass numbers of most stable or most common isotope.

Atomic weights corrected to conform to the 1963 values of the Commission on Atomic Weights.

The group designations used here are the former Chemical Abstract Service numbers.

* Lanthanide Series

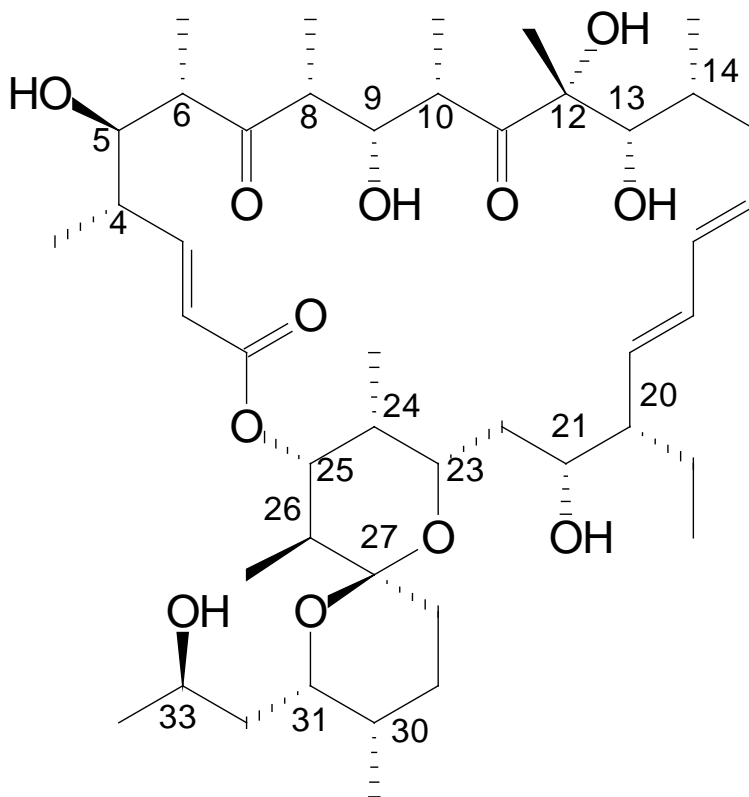
58 Ce 140.12	59 Pr 140.907	60 Nd 144.24	61 Pm (147)	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.924	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.97
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† Actinide Series

90 Th 232.038	91 Pa (231)	92 U 238.03	93 Np (237)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (249)	99 Es (254)	100 Fm (253)	101 Md (256)	102 No (256)	103 Lr (257)
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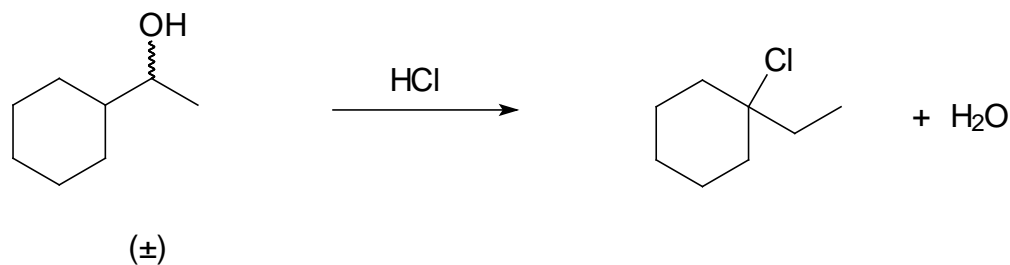
1. (10 pts). Assign the absolute stereochemistry [(*R*) or (*S*)] of any 5 chiral centers (**your choice**) in 21-hydroxyoligomycin A. **Choose only 5 chiral centers**, or you will have points deducted for incorrect answers.

J. Nat. Prod. **2007**, *70*, 367-371.

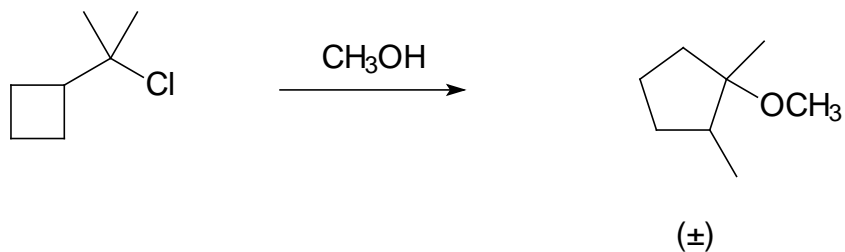


4.	5.	6.	8.	9.
10.	12.	13.	14.	20.
21.	23.	24.	25.	26.
27.	30.	31.	33.	

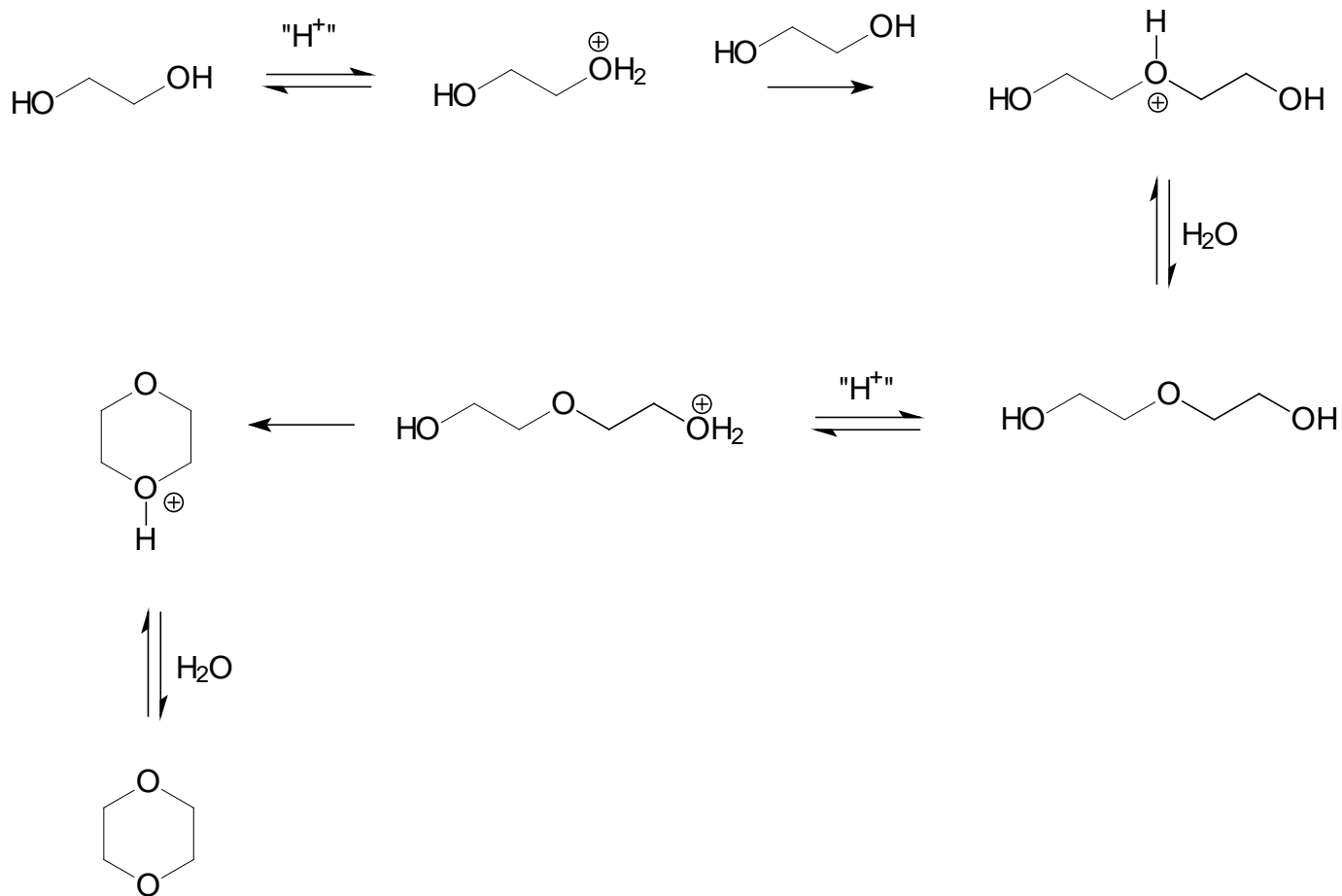
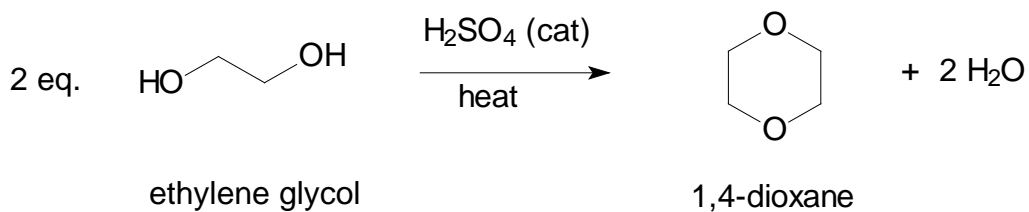
2. (10 pts). Provide a complete, step by step mechanism for the following transformation. Draw the structures of all intermediates formed in the mechanism. Use arrows to show "pushing" of electrons.



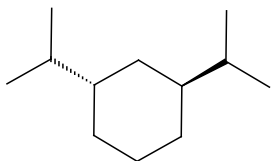
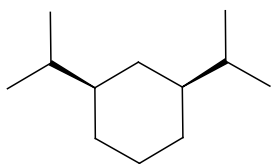
3. (10 pts). Provide a complete, step by step mechanism for the following transformation. Draw the structures of all intermediates formed in the mechanism. Use arrows to show "pushing" of electrons.



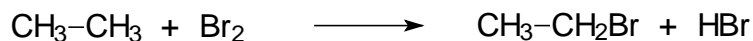
4. (10 pts.) Given the reaction of ethylene glycol with a catalytic amount of sulfuric acid to form 1,4-dioxane: **provide the Missing Arrows in the reaction mechanism below:**



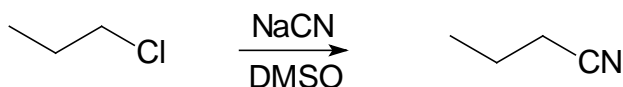
5. (10 pts) Draw both chair forms of each of the following. Indicate which of the four chair forms is the MOST STABLE.



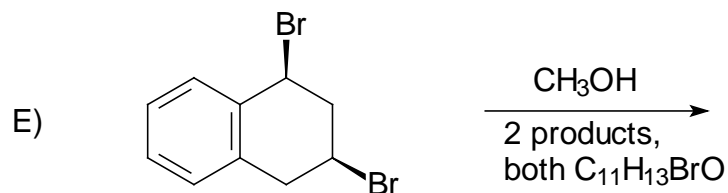
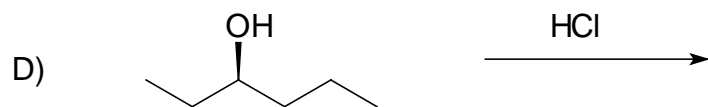
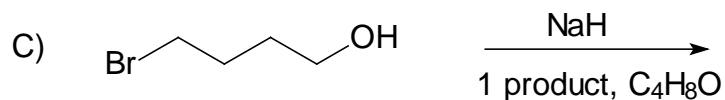
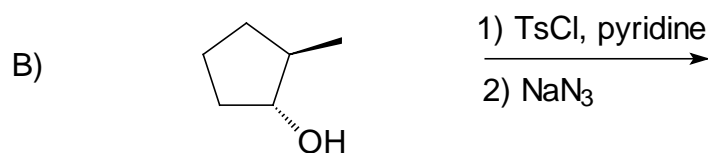
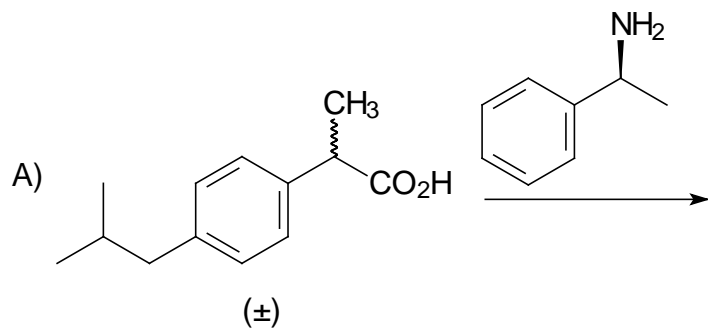
6. (5 pts.) Calculate the Heat of Reaction (ΔH°) for the formation of bromoethane from reaction of ethane with bromine. Bond energies: H-CH₂CH₃ (98 kcal/mole), Br-Br (46 kcal/mole), CH₃CH₂-Br (81 kcal/mole), H-Br (88 kcal/mole).



7. (5 pts) Draw the structure of the Transition State (the high energy intermediate) that would occur during the reaction of 1-chloropropane with sodium cyanide in DMSO.



8. (20 pts) Draw the structure(s) of the **MAJOR** organic product(s) formed after each step in the following reactions. *Draw the correct product stereochemistry where applicable.* You may indicate racemic mixtures by using the (\pm) symbol.



9 (15 pts) Provide a complete, step by step mechanism for the following transformation. Draw the structures of all intermediates (*including resonance structures*) formed in the mechanism. Use arrows to show "pushing" of electrons.



10 (5 pts.) Rank the 5 compounds below in order of reactivity (1 = Fastest, 5 = Slowest) in the S_N2 reaction pathway.

