Fall 18: Organic 1 Exam 2 Ch 5-8 50 points

Name _____

If you do NOT want your graded exam placed in the box outside my office, then please check here____

1-10 Are True/False (10pts)

1) S_N1 and E1 reactions are both types of *substitution* reaction.

2) π bonds are weaker than σ bonds, and so it is the π bond of a double bond that reacts as the nucleophile.

3) A typical C=C bond length is around 1.3 Angstroms.

4) I^- is a stronger nucleophile than F^-.

5) A *stereospecific* reaction is where a certain stereoisomer reacts to generate one specific stereoisomer as product.

6) Hex-2-ene and cyclohexane are diastereomers.

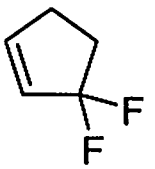
7) A Lewis base that donates its two electrons to a (protic) Hydrogen is acting as a base.

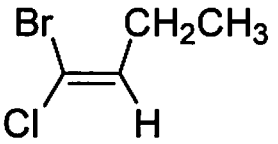
8) An epoxide is a 3 membered ring.

9) S_N1 and E1 reactions both proceed through carbocation intermediates.

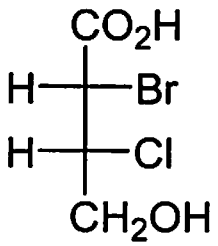
10) Increasing the steric hindrance around the reaction center will increase the rate of S_N2 reactions.

11) Provide the correct full IUPAC names for the following molecules. (3+3=6pts)

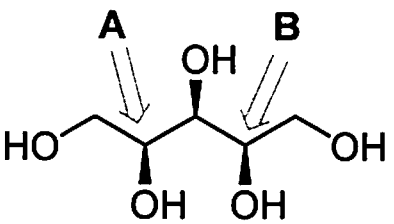
(a) 

(b) 

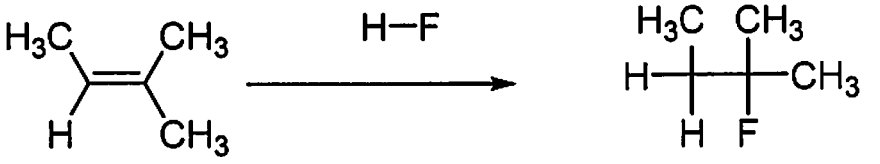
12) i) Assign R or S to each chiral center in this Fischer projection. (4pts)



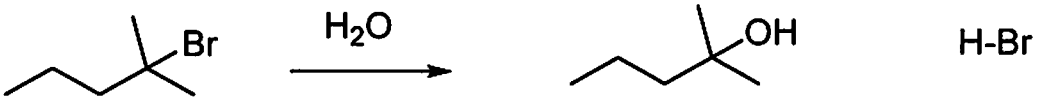
ii) Assign R or S to chiral centers A and B in this stick figure (line angle) diagram. (4pts)



13) Write the mechanism (*i.e. curly arrows*) for the below electrophilic addition. (3pts)

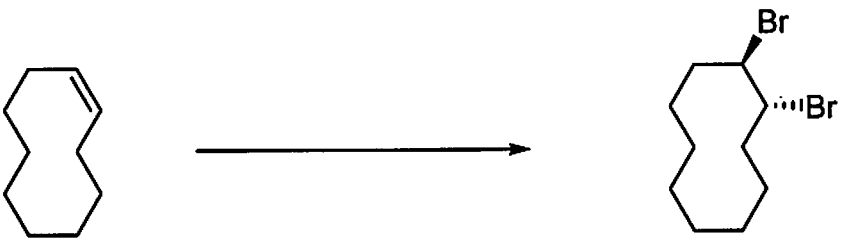


14) (4pts) The following alkyl bromide will undergo **S_N1** reaction with water, as shown below.

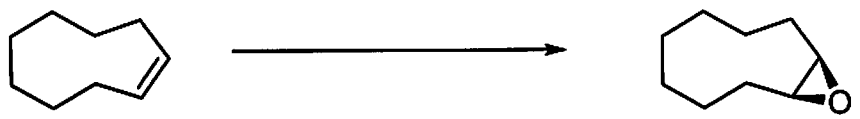


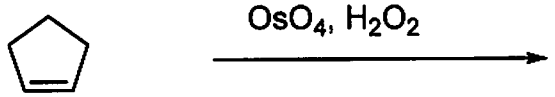
Write the mechanism (*i.e. curly arrows*) for this **S_N1** process.

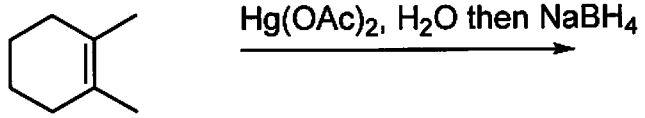
15) Provide the **reagents** for the first three, and **products** for the last three transformations. (12pts)

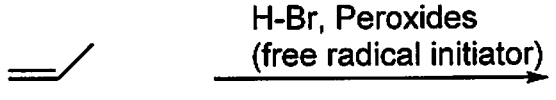
(a) 

(b) 

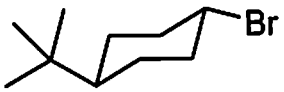
(c) 

(d) 

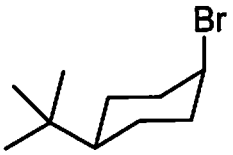
(e) 

(f) 

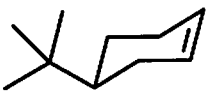
16) (7pts) For the molecules below:



A



B



C

a) Are A and B isomers?

b) Indicate whether A or B is more stable.

c) How many π bonds are in C?

d) For the transformation of A (and/or B) into C, what two atoms are removed?

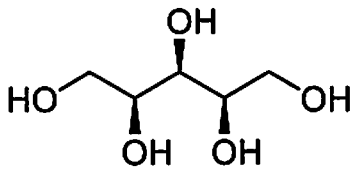
e) What is the preferred geometric relationship between proton and leaving group for an E2 elimination?

f) Under E2 elimination conditions, the production of C from either A or B differs in speed (reaction rate) by a factor of about 500 times.
Which is faster, A $\rightarrow$ C or B $\rightarrow$ C?

g) Briefly explain your answer to part (f).

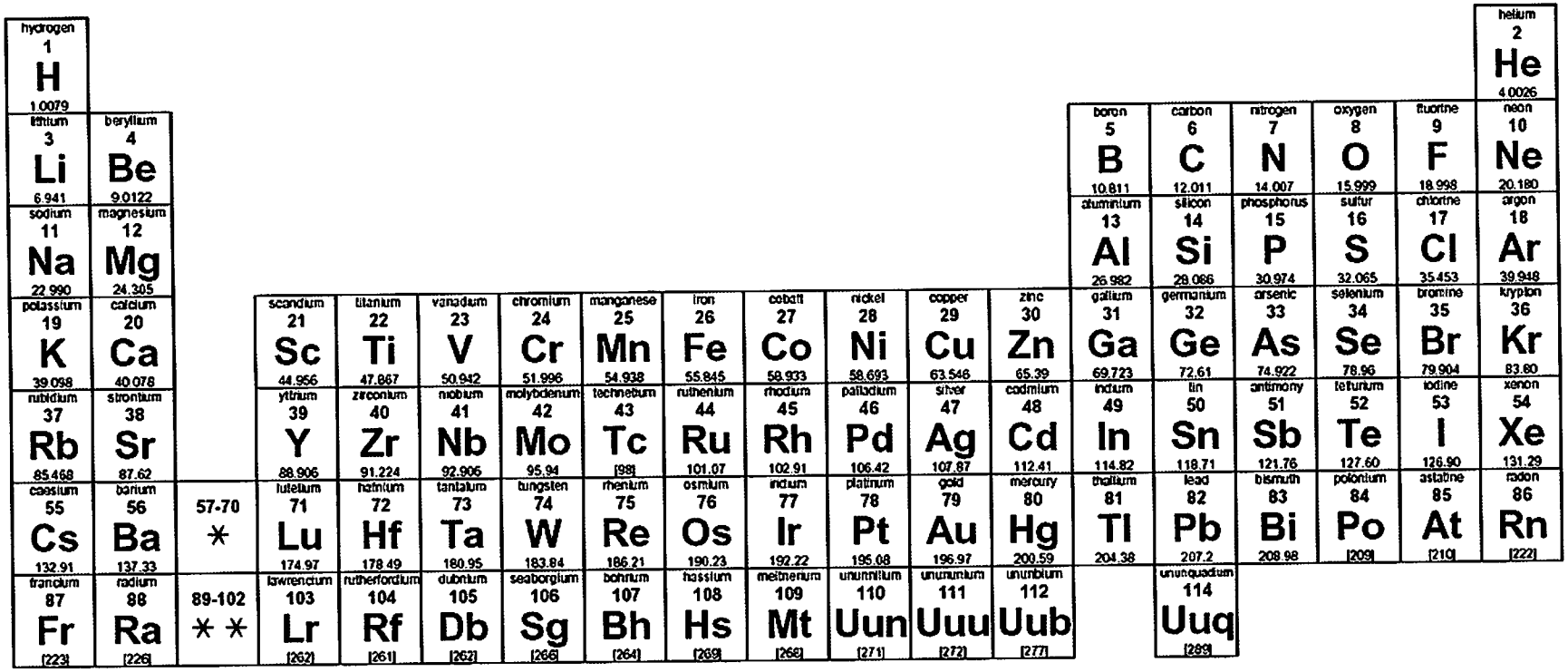
up to 2 BONUS POINTS

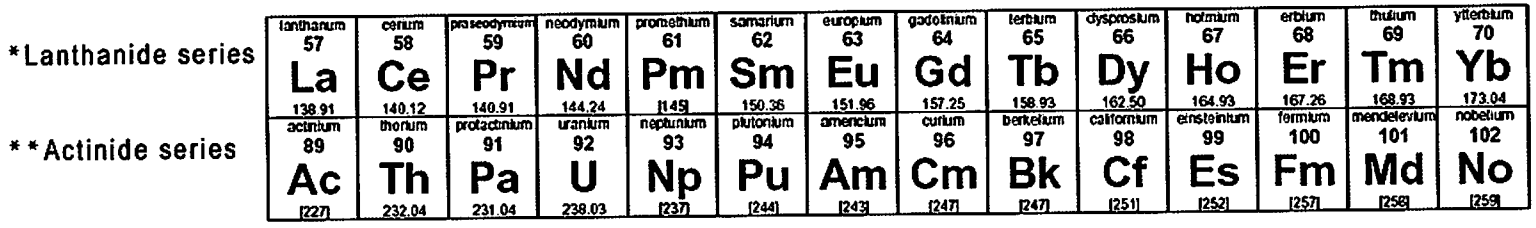
The compound in question (12) part ii is "Xylitol", which is used as an artificial sweetener for drugs, toothpaste, confections and chewing gum.



Is Xylitol correctly described as a *meso* compound?

Based on your knowledge of the relationship between chirality and optical activity (rotation of plane polarized light), guess the optical rotation value (including + or - sign, and numerical value) for a 0.1M solution of Xylitol at room temperature.


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]


*Lanthanide series
**Actinide series
lanthanum 57 La 138.91
cerium 58 Ce 140.12
praseodymium 59 Pr 140.91
neodymium 60 Nd 144.24
promethium 61 Pm [145]
samarium 62 Sm 150.36
europium 63 Eu 151.96
gadolinium 64 Gd 157.25
terbium 65 Tb 158.93
dysprosium 66 Dy 162.50
holmium 67 Ho 164.93
erbium 68 Er 167.26
thulium 69 Tm 168.93
ytterbium 70 Yb 173.04
actinium 89 Ac [227]
thorium 90 Th 232.04
protactinium 91 Pa 231.04
uranium 92 U 238.03
neptunium 93 Np [237]
plutonium 94 Pu [244]
americium 95 Am [243]
curium 96 Cm [247]
berkelium 97 Bk [247]
californium 98 Cf [251]
einsteinium 99 Es [252]
fermium 100 Fm [257]
mendelevium 101 Md [258]
nobelium 102 No [259]

Fall 18: Organic 1 Exam 2 **Ch 5-8** **50 points**

Name REX YOSCORE

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1-10 Are True/False (10pts)

1) S_N1 and E1 reactions are both types of *substitution* reaction. false

2) π bonds are weaker than σ bonds, and so it is the π bond of a double bond that reacts as the nucleophile. T

3) A typical C=C bond length is around 1.3 Angstroms. T

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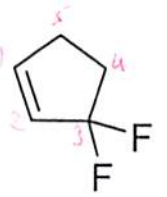
8) An epoxide is a 3 membered ring. T

9) S_N1 and E1 reactions both proceed through carbocation intermediates. T

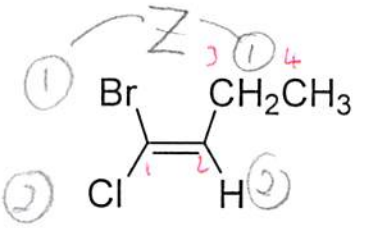
10) Increasing the steric hindrance around the reaction center will increase the rate of S_N2 reactions. False

11) Provide the correct full IUPAC names for the following molecules. (3+3=6pts)

(a) 

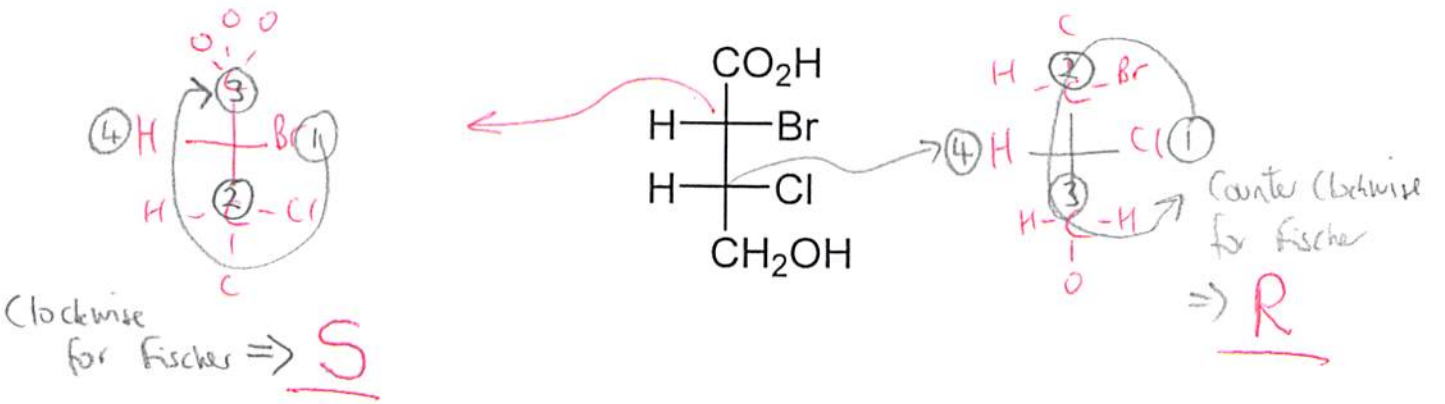
3,3-Difluorocyclopentene

(3,3-Difluorocyclopent-1-ene is acceptable).

(b) 

(Z)-1-Bromo-1-chlorobut-1-ene

12) i) Assign R or S to each chiral center in this Fischer projection. (4pts)



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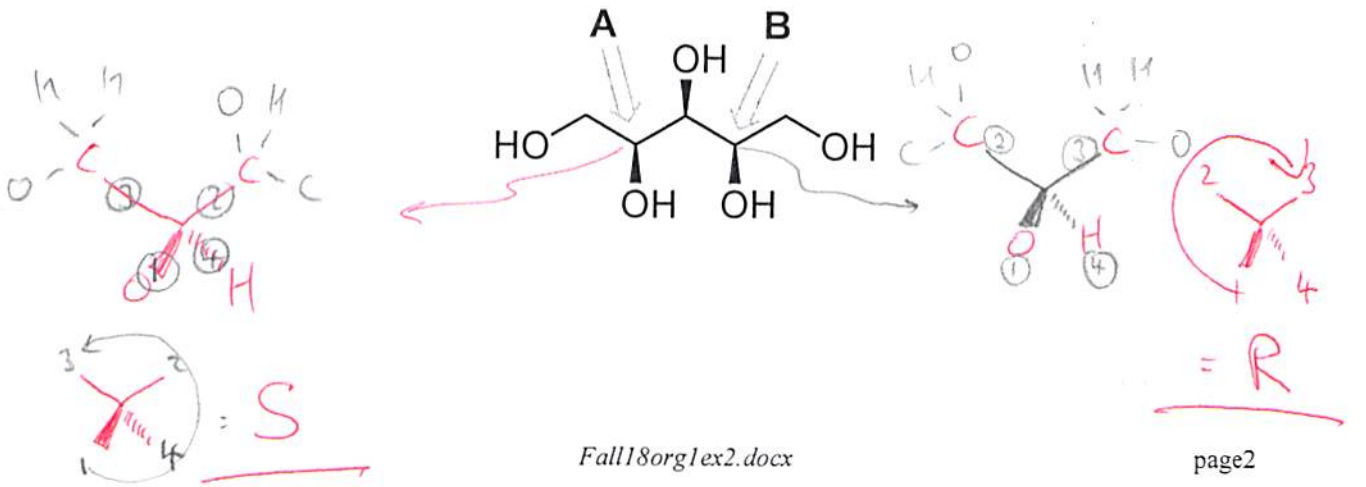
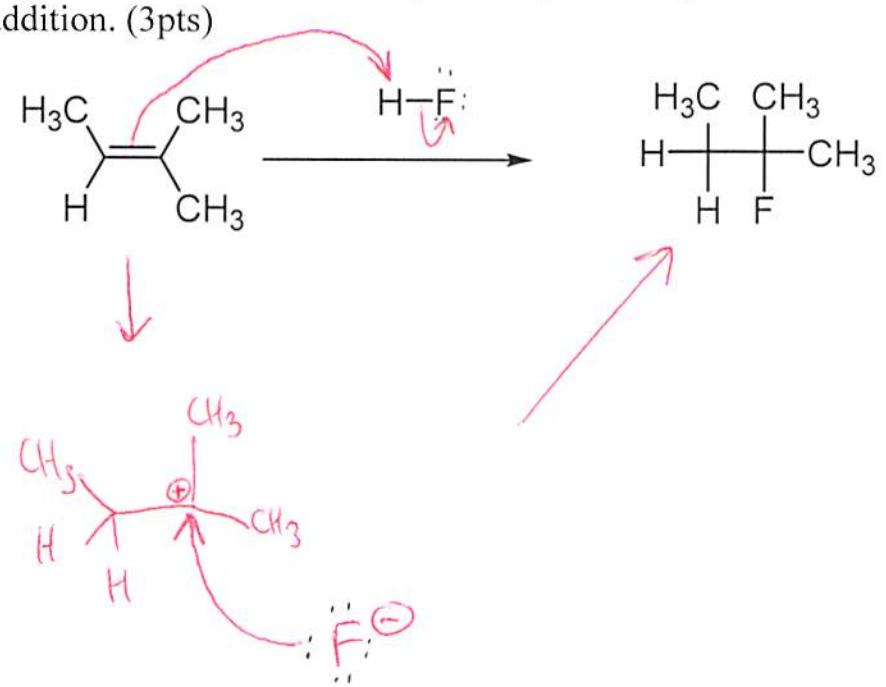
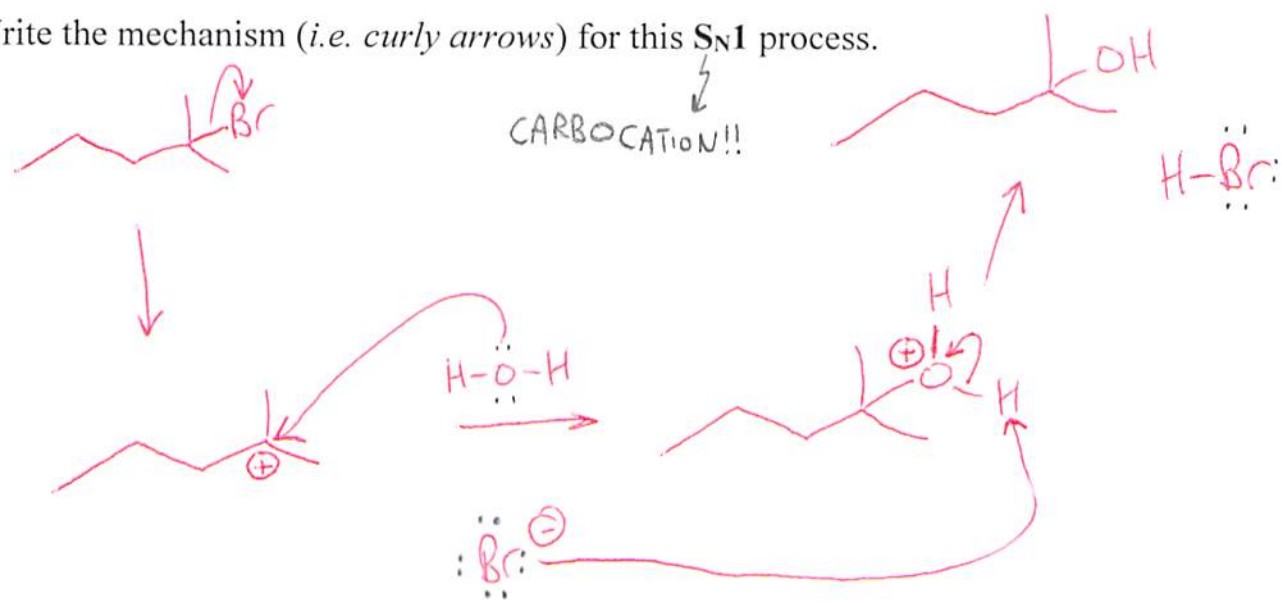


13) Write the mechanism (*i.e. curly arrows*) for the below electrophilic addition. (3pts)

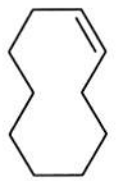
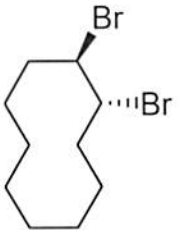


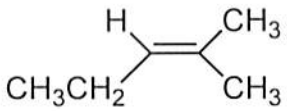
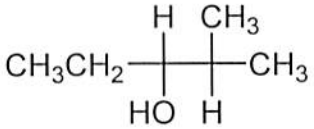
14) (4pts) The following alkyl bromide will undergo **SN1** reaction with water, as shown below.

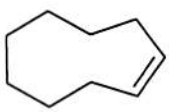
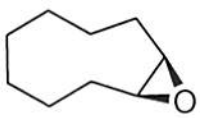
Write the mechanism (*i.e. curly arrows*) for this **SN1** process.



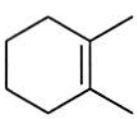
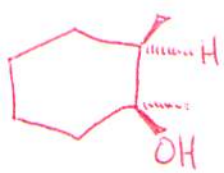
15) Provide the **reagents** for the first three, and **products** for the last three transformations. (12pts)

(a)  Br_2 → 

(b)  $BH_3, H_2O_2, NaOH$ →  AM addn H OH

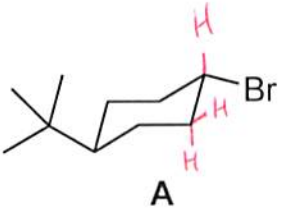
(c)  mCPBA (Comy Peroxy acid) → 

(d)  OsO_4, H_2O_2 →  SYN Addn OH OH

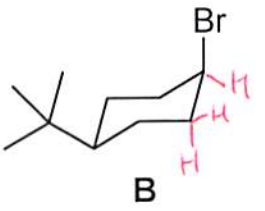
(e)  $Hg(OAc)_2, H_2O$ then $NaBH_4$ →  ANTI Addition H OH

(f)  H-Br, Peroxides (free radical initiator) →  AM Addn H Br

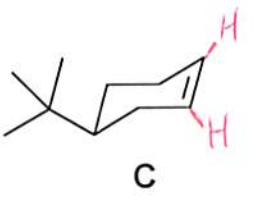
16) (7pts) For the molecules below:



A



B



C

a) Are A and B isomers? Yes

b) Indicate whether A or B is more stable. A

c) How many π bonds are in C? 1

d) For the transformation of A (and/or B) into C, what two atoms are removed?

H & Br

e) What is the preferred geometric relationship between proton and leaving group for an E2 elimination?

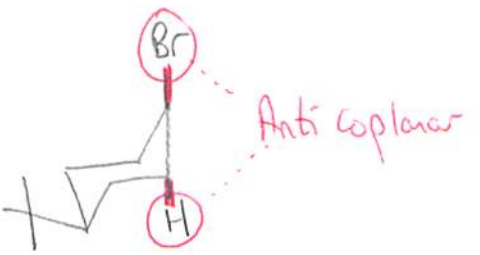
ANTI COPLANAR

f) Under E2 elimination conditions, the production of C from either A or B differs in speed (reaction rate) by a factor of about 500 times.
Which is faster, A → C or B → C?

g) Briefly explain your answer to part (f).

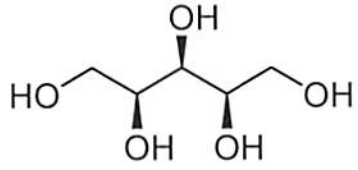
In B, the H and Br removed are arranged anticoplanar (the required geometry).

In A they are not anticoplanar.



up to 2 BONUS POINTS

The compound in question (12) part ii is "Xylitol", which is used as an artificial sweetener for drugs, toothpaste, confections and chewing gum.



Is Xylitol correctly described as a *meso* compound?

Yes (Achiral, but has Chiral centers).

Based on your knowledge of the relationship between chirality and optical activity (rotation of plane polarized light), guess the optical rotation value (including + or - sign, and numerical value) for a 0.1M solution of Xylitol at room temperature.

0 (Zero, optically INACTIVE since it is NOT CHIRAL).