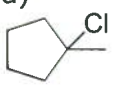
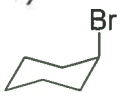
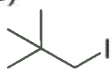
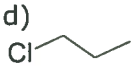
8A. Identify halides and carbocations as being 1°, 2°, or 3°

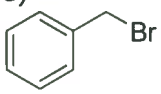
8A.1 Classify the following halides and carbocations as 1°, 2°, or 3°.

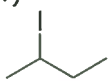
a)  3°

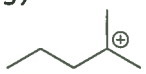
b)  2°

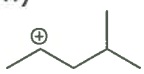
c)  1°

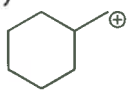
d)  1°

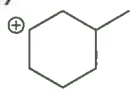
e)  1°

f)  2°

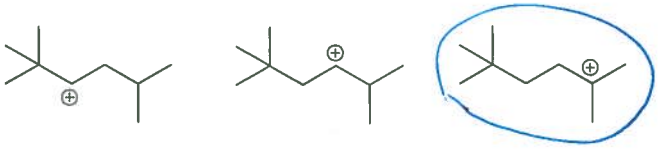
g)  3°

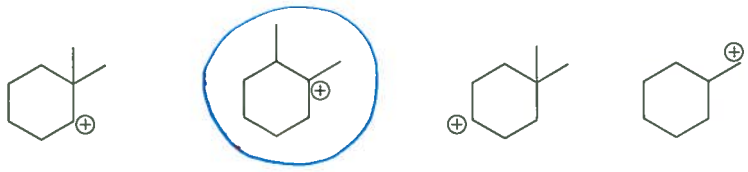
h)  2°

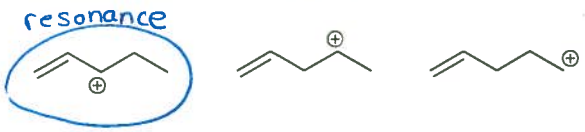
i)  1°

j)  2°

8A.2 Circle the most stable cation in each set.

a) 

b) 

c) 

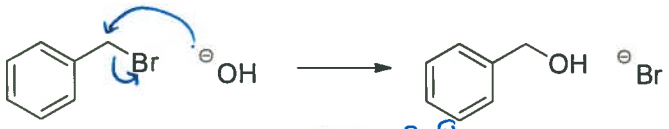
8A.3 Why does stability of carbocations increase with substitution?

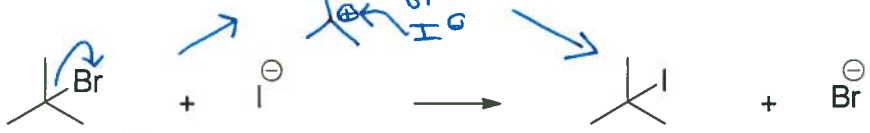
Alkyl groups are e⁻ donating (sp^2 lower in energy than sp^3) which stabilizes cation

or Hyperconjugation - bonds on alkyl groups can donate to empty p orbital on cation stabilizing it.

8B. Draw the mechanism of an S_N2 and S_N1 reactions including stereochemistry

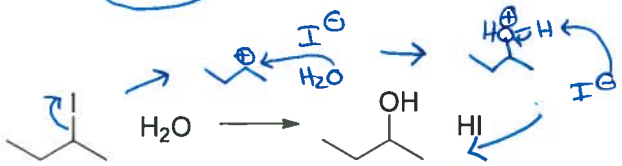
8B.1 Draw a mechanism for the following reactions.

a) 

b) 

c)

d)

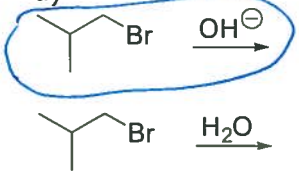


8C. Predict how reaction conditions (substrate, nucleophile, leaving group, solvent) effect the rate of S_N1 and S_N2 reactions.

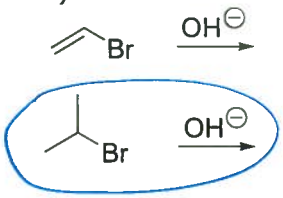
OCSL: 9.1 – 9.35

8C.1 Circle the faster substitution reaction among the following pairs. If the rate is not affected, circle both.

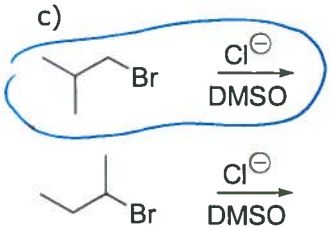
a)



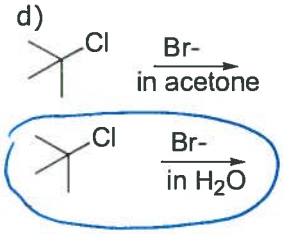
b)



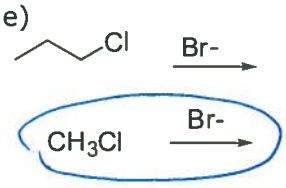
c)



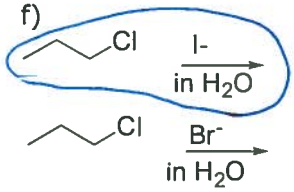
d)



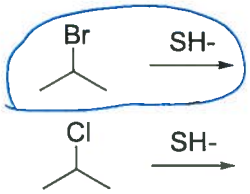
e)



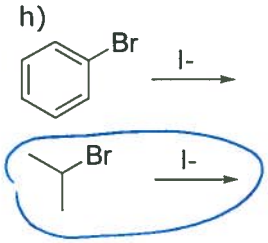
f)



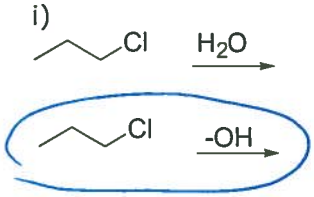
g)



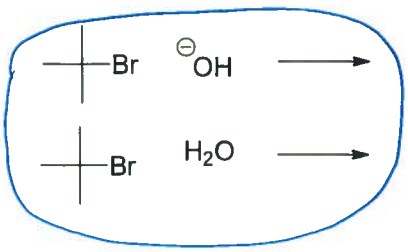
h)



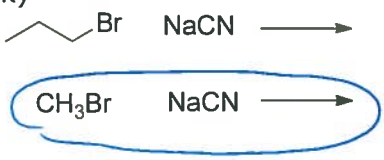
i)



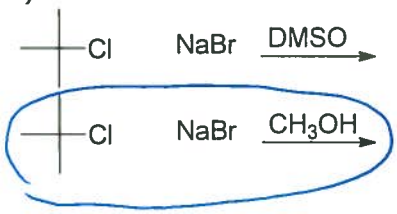
j)



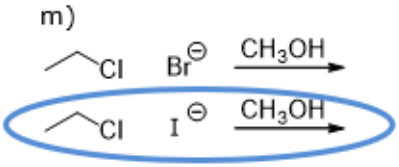
k)



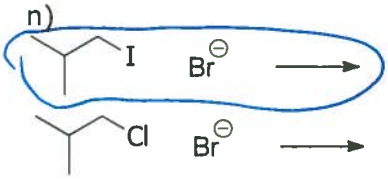
l)



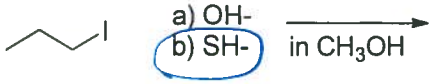
m)



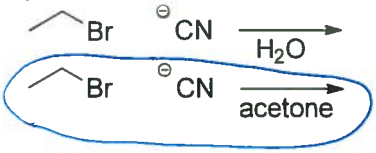
n)



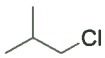
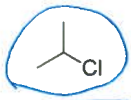
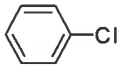
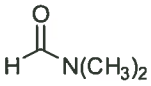
o)



p)



8C.2 Circle the best choice for each statement.

Best Substrate for S_N1			
Best nucleophile in DMSO	$CH_3CO_2^-$	$CH_3CH_2O^-$	CH_3CH_2OH
Best solvent for S_N2	CH_3CN	CH_3OH	$CH_3(CH_2)_3CH_3$
Best leaving group	I-	F-	OH-
Best Nucleophile in CH_3CN	I-	F-	OH-
Best nucleophile in H_2O	I-	Cl-	F-
Best substrate for S_N2			CH_3Cl
Best solvent for S_N1	CH_3OH		 CH_3CN

8C.3 What would happen to the rate of the reaction below under the following conditions? (increase, decrease, same)

a) Increasing the concentration of water same

b) decreasing the concentration of halide decrease

c) changing the leaving group to bromine decrease

d) starting with 2-iodo propane decrease

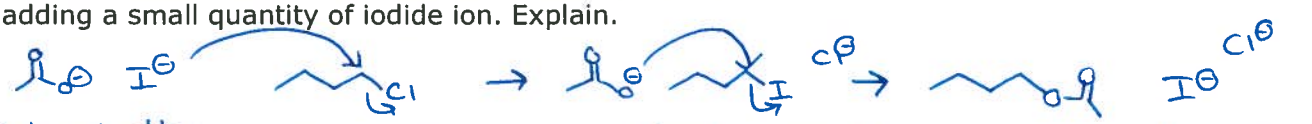
8C.4 What would happen to the rate of the reaction below under the following conditions? (increase, decrease, same)

a) the solvent is changed from CH_3OH to DMSO increase

b) the leaving group is changed from bromine to chlorine decrease

c) the nucleophile is changed to H_2O decrease

8C.5 The reaction of 1-chlorobutane with $CH_3CO_2^-$ in CH_3CO_2H to give butyl acetate is greatly accelerated by adding a small quantity of iodide ion. Explain.



8D. Determine if a set of conditions is likely to be S_N1 or S_N2 and predict the products including stereochemistry.

8D.1 Determine if the following would be associated with an S_N1 or S_N2 reaction.

a) One step SN2

b) Favors strong nucleophiles SN2

c) racemizes stereochemistry SN1

d) 2nd order kinetics SN2

e) Has a carbocation intermediate SN1

f) Best in protic solvents SN1

g) Two steps SN1

h) Inverts stereochemistry SN2

i) 1st order kinetics SN1

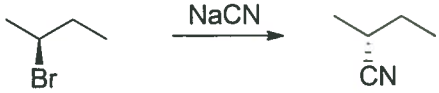
j) Best in aprotic solvents SN2

8D.2 Indicate if the following is likely to go through a S_N1 or S_N2 mechanism.

a)

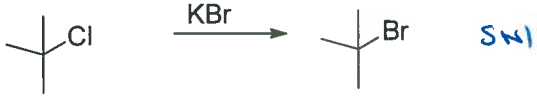
SN2

b)



SN2

c)

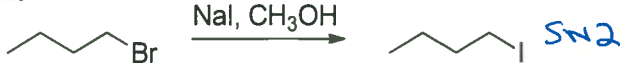


SN1

d)

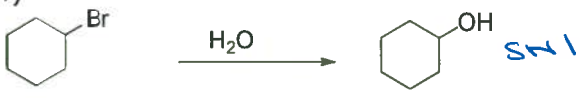
SN2

e)



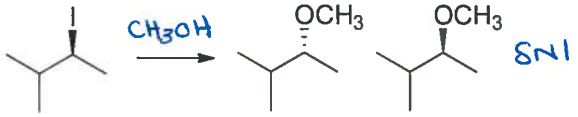
SN2

f)



SN1

g)



SN1

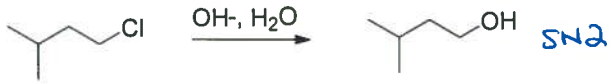
h)

SN1

i)

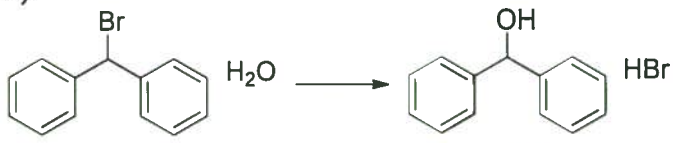
SN2

j)



SN2

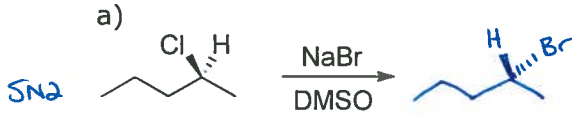
k)



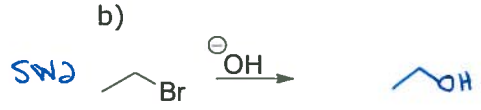
SN1

8D.3 Indicate if the following reactions proceed through an S_N1 or S_N2 mechanism. Draw the substitution product(s); show stereochemistry if relevant.

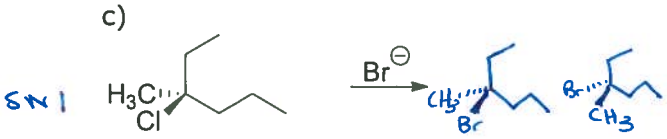
a)



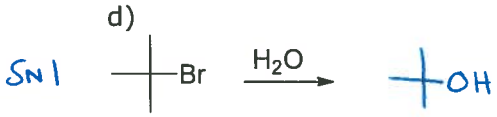
b)



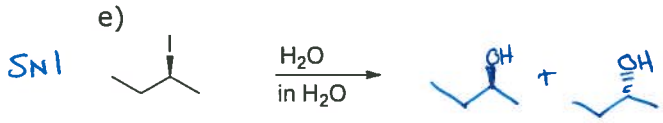
c)



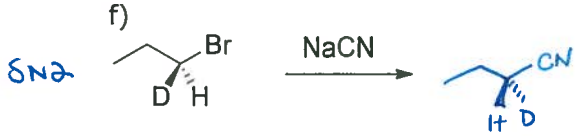
d)



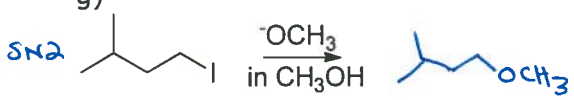
e)



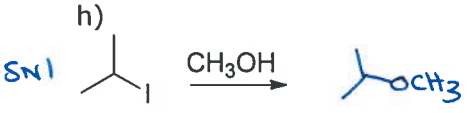
f)



g)

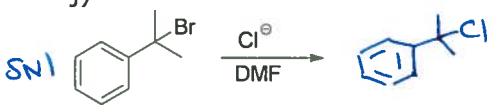


h)

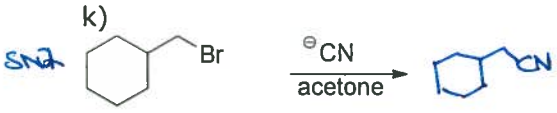


i)

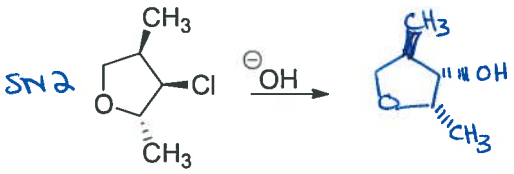
j)



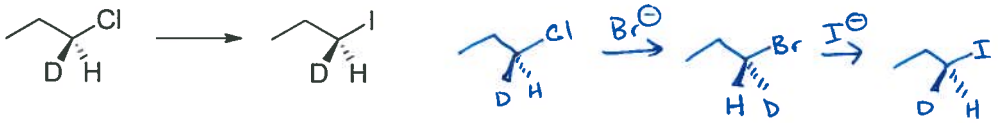
k)



l)



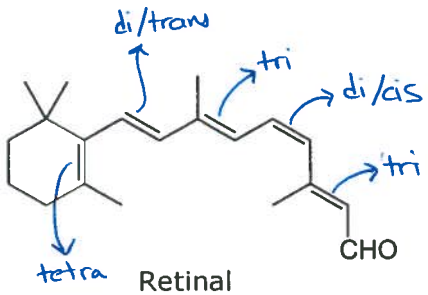
8D.4 Propose a way to make the following product. (note stereochemistry)



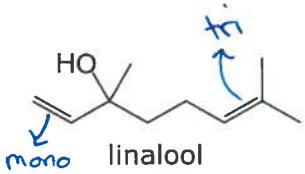
8E. Identify alkenes as being mono, di, tri or tetra substituted, cis or trans, and predict the trend in stability

OCSL: 10.1 – 10.11

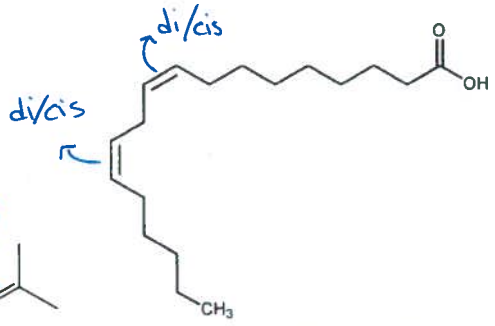
8E.1 Identify the alkenes in the following natural products as being mono, di, tri or tetra substituted. Identify di-substiuted as cis or trans.



Retinal



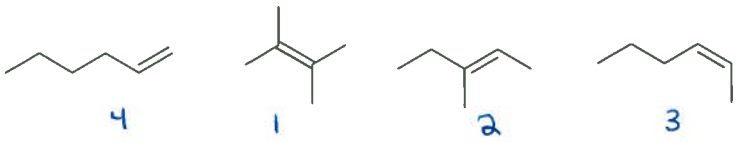
linalool



linoleic acid

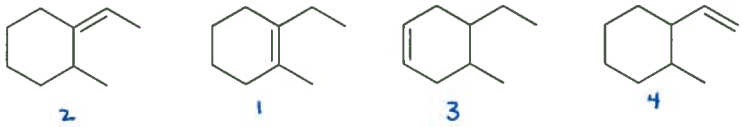
8E.2 Rank the following groups of alkenes from least stable (4) to most stable (1).

a)



b)

c)

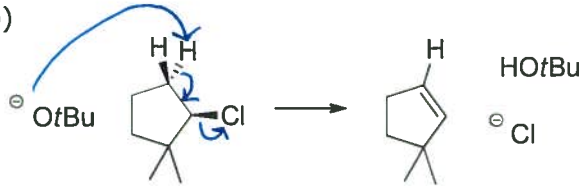


8F. Draw the mechanism of the E2 & E1 reactions.

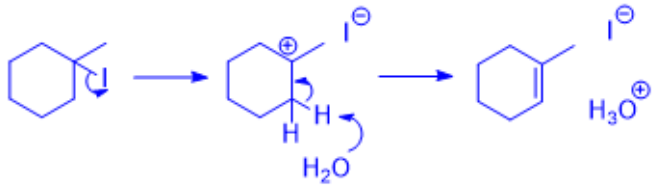
8F.1 Draw the mechanism of the following reactions.

a)

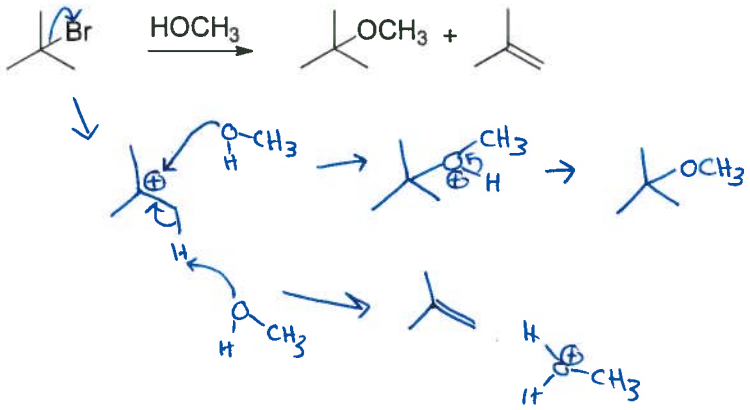
b)



c)

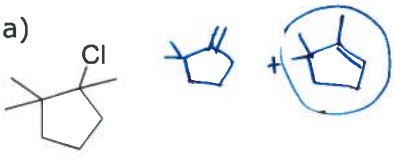


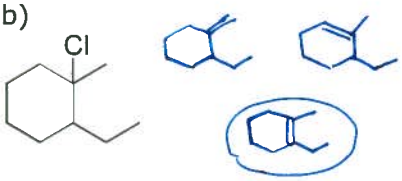
8F.2 The molecule below reacts through an SN1/E1 pathway in methanol. Draw the mechanism for each pathway.

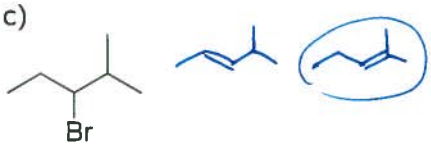


8G. Predict all possible elimination products of an alkyl halide and identify the major product

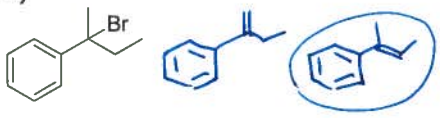
8G.1 Draw all possible elimination products for the following molecules and circle the major product.

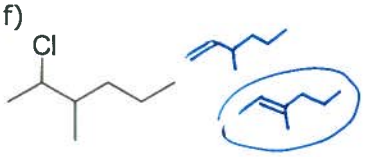
a) 

b) 

c) 

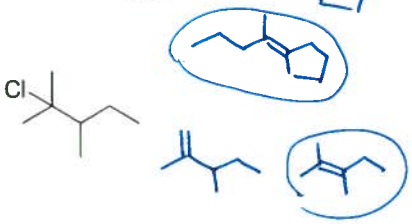
d) 

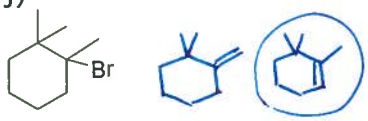
e) 

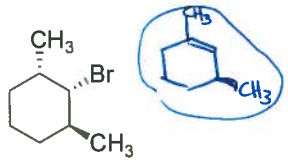
f) 

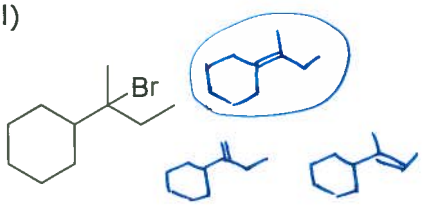
g) 

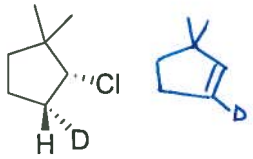
h) 

i) 

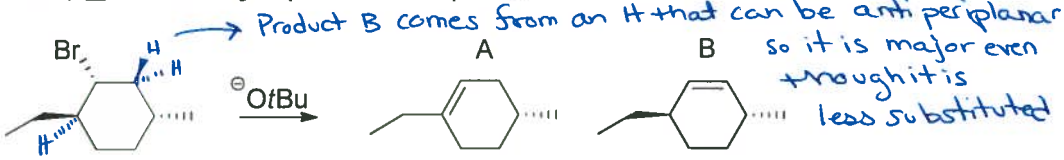
j) 

k) (assume E2) 

l) 

m) (assume E2) 

8G.2 In the reaction below, **B** is the major product. Explain.



Product B comes from an H that can be anti periplanar so it is major even though it is less substituted

8G.3 What alkyl halides would you start with to get each of the following as the major elimination product?

a) 

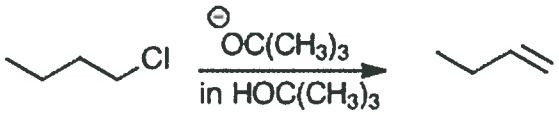
b) 

c) 

d) 

8H. Predict how reaction conditions (substrate, base, leaving group, solvent) effect the rate of E2

8H.1 For the following E2 reaction, what happens to the rate with each of the following changes? (increase, decrease, same)



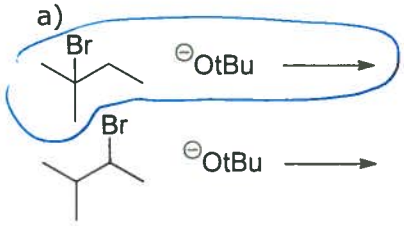
a) the solvent is changed to DMF increase

b) the concentration of $^{-}OC(CH_3)_3$ is decreased decrease

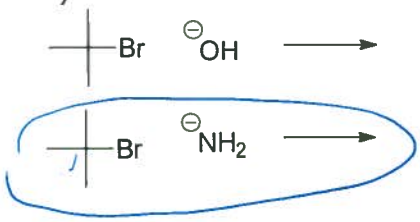
c) The halide is changed to 2-bromobutane increase

8H.2 Circle the faster elimination reaction. If the rate is not affected by the change, circle both.

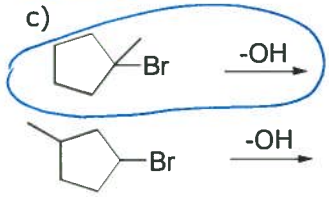
a)



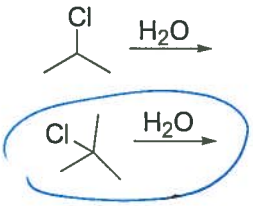
b)



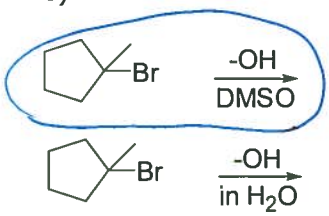
c)



d)



e)



8H.3 Circle **ALL** that apply to the given statement.

a) Works best with bulky bases: S_N1 S_N2 E1 E2

b) Requires antiperiplanar geometry: S_N1 S_N2 E1 E2

c) The mechanism involves a carbocation intermediate: S_N1 S_N2 E1 E2

d) The mechanism has two steps: S_N1 S_N2 E1 E2

e) Rate increases with better leaving groups: S_N1 S_N2 E1 E2

f) Stereochemistry in inverted : S_N1 S_N2 E1 E2

g) Zaitsev product is formed S_N1 S_N2 E1 E2

h) Rate increases with concentration of the substrate: S_N1 S_N2 E1 E2

i) Rate increases in aprotic solvents S_N1 S_N2 E1 E2

8H.4. Briefly explain why is $^-$OtBu sometimes favored over hydroxide as an elimination reagent.

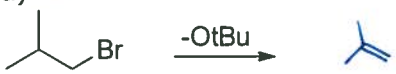
$^-$OtBu is preferred when $^-$OH will give substitution products

8I. Determine if a set of conditions will be S_N2, E2 or S_N1/E1 and predict the products.

OCSL: 10.12 – 10.39

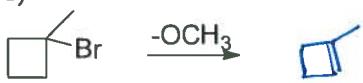
8I.1 Label the reaction most likely to take place (E1,SN1, E2, SN2 or a combination of these) under the following conditions. Draw the major product(s), include stereochemistry when relevant.

a) E2

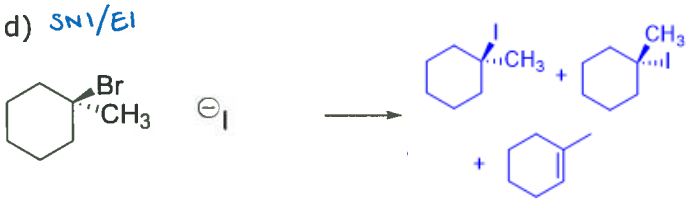


b) SN1/E1

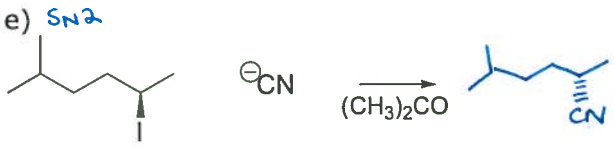
c) E2



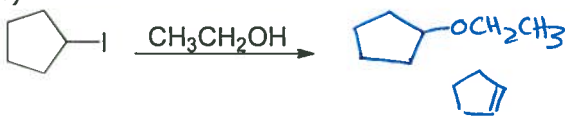
d) SN1/E1



e) SN2

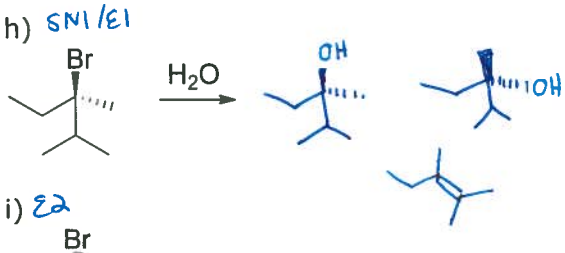


f) SN1/E1

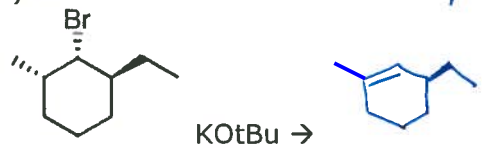


g) SN2

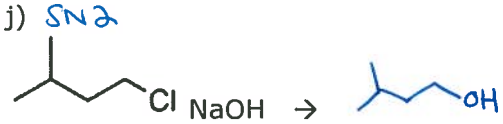
h) SN1/E1



i) E2

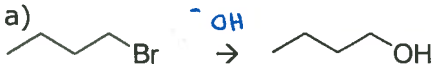


j) SN2



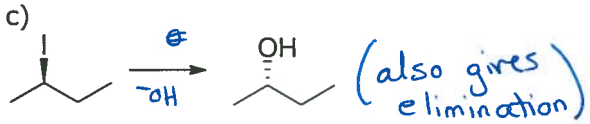
8I.2 Fill in the reagents in the following reactions.

a)



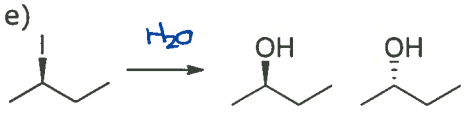
b)

c)



d)

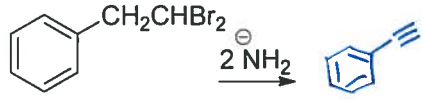
e)



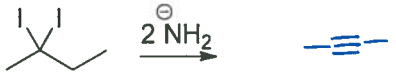
8J. Predict the elimination products of dihalides

8J.1 Predict the major product of the following reaction.

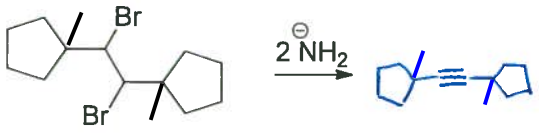
a)



b)



c)



d)