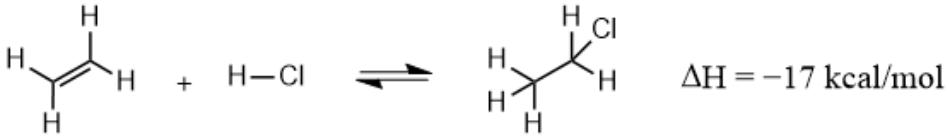
Library of Organic Chemistry Active Learning Resources LOCAL

Substitution & Elimination Reactions Exam Review

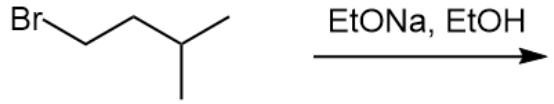
1 Do you expect the forward reaction to be spontaneous? Explain briefly.

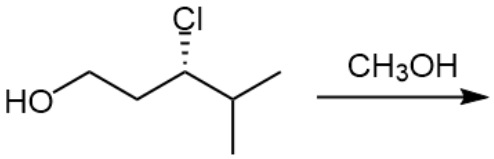


$\Delta H = -17$ kcal/mol

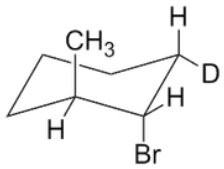
Predict the major and minor products, and provide mechanisms for all products.

2





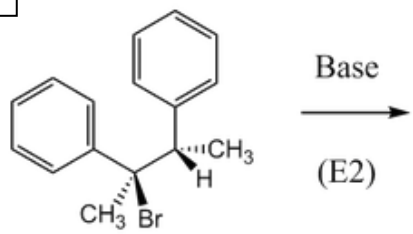
3



What is the major product of an E2 reaction of the compound shown above?

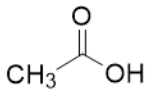
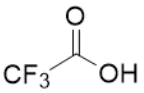
Predict the major product.

4



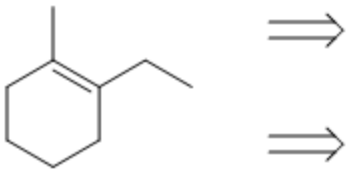
5

In which of the following are the solvents NOT listed in order of increasing polarity?

	less polar		more polar
A)		<	
B)	CH_3OH	<	CH_3CH_2OH
C)		<	CH_3OH
D)	CH_3OH	<	H_2O
E)	aprotic	<	protic

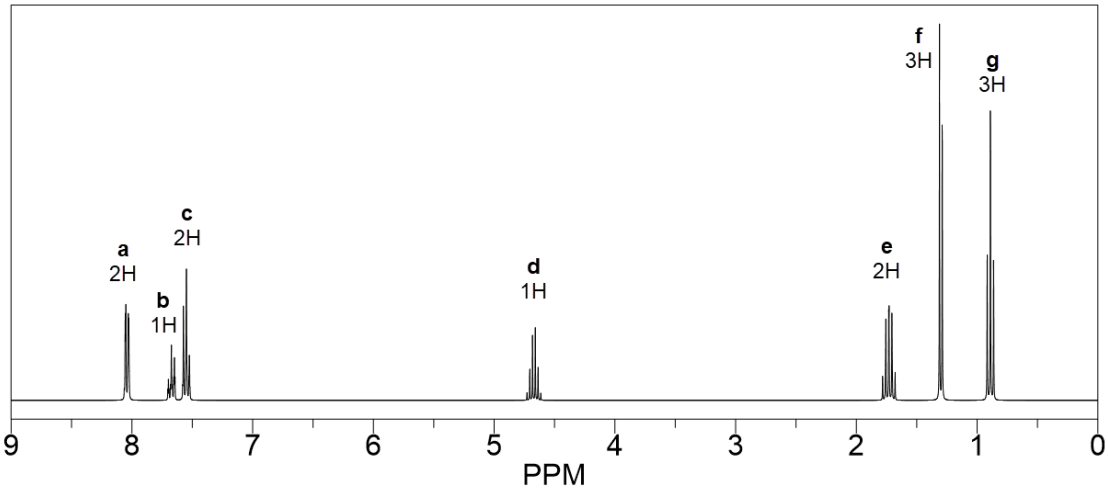
6

Provide TWO possible synthetic routes to the given alkene target molecule. Begin with two different retrosyntheses (what starting material and reagent?).



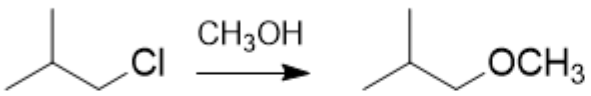
7

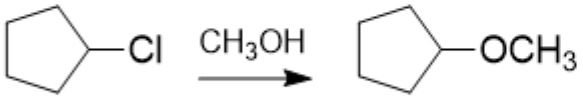
Provide a structure with the formula $C_{11}H_{14}O_2$ that is consistent with the following NMR spectrum.



VIII. (20 pts) For each of the following pairs of reactions, name the mechanism, indicate which reaction will be faster and briefly explain why. If you expect no significant difference in the reaction rates, say so. (Note: an explanation such as, "secondary is faster" is NOT sufficient - *why* is it faster? Why isn't it slower?)

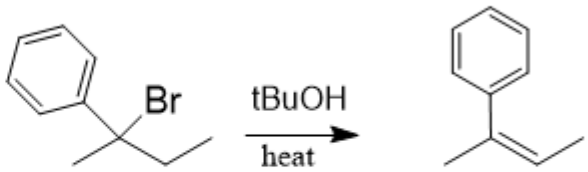
8

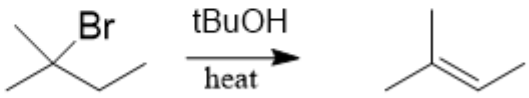
I. 

II. 

mechanism name?
which is faster? Explain.

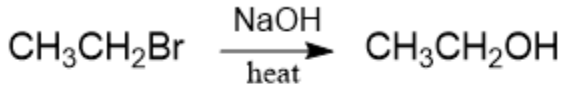
9

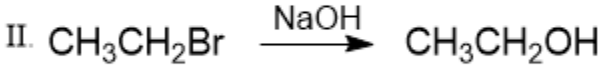
I. 

II. 

mechanism name?
which is faster? Explain.

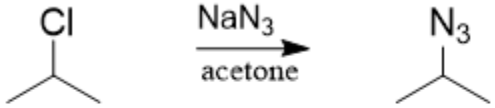
10

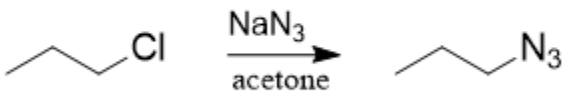
I. 

II. 

mechanism name?
which is faster? Explain.

11

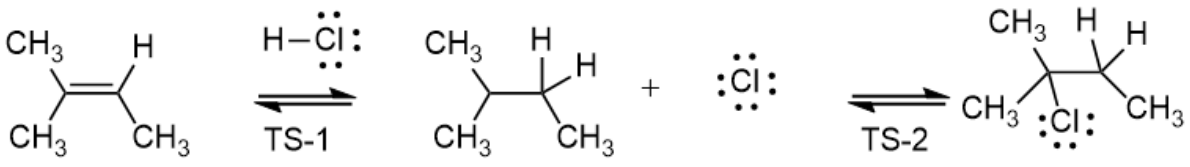
I. 

II. 

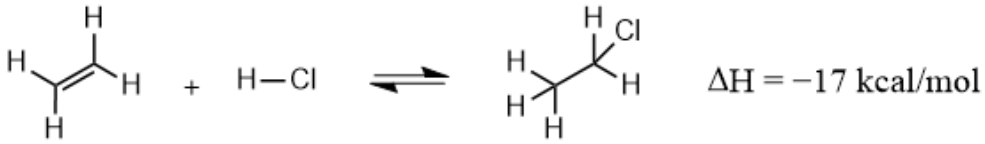
mechanism name?
which is faster? Explain.

12

Add in any **missing formal charges**. **Draw curved arrows** for each step of the mechanism.
Draw the **structures of the transition states TS-1 and TS-2** for the two-step mechanism.



1 Do you expect the forward reaction to be spontaneous? Explain briefly.



A) The forward reaction will be spontaneous at all temperatures because it is exothermic and there is an increase in entropy.

B) The forward reaction will be spontaneous at low temperatures because it is exothermic and there is an increase in entropy.

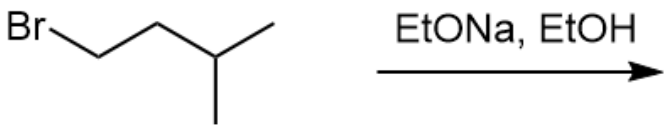
C) The forward reaction will be spontaneous at high temperatures because it is exothermic and there is an increase in entropy.

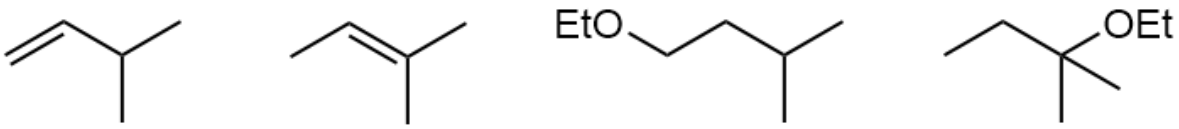
D) The forward reaction will be spontaneous at low temperatures because it is exothermic and there is a decrease in entropy.

E) The forward reaction will be spontaneous at high temperatures because it is exothermic and there is a decrease in entropy.

Predict the major product(s) and minor product(s).

2a





I II III IV

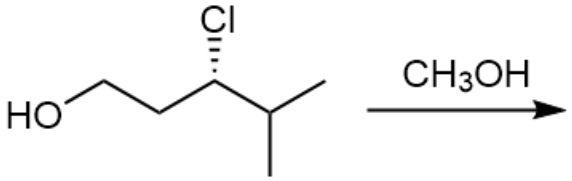
Major product(s)?

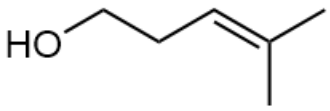
A) I only
B) II only
C) III only
D) I and III
E) II and IV

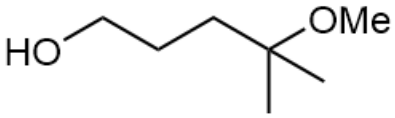
Minor product(s)?

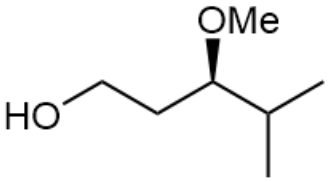
A) I only
B) II only
C) III only
D) I and III
E) II and IV

2b Of the following, which is NOT expected to be a likely product?

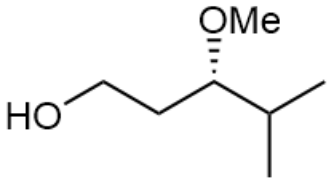


A) 

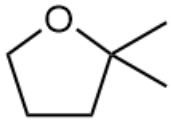
B) 

C) 

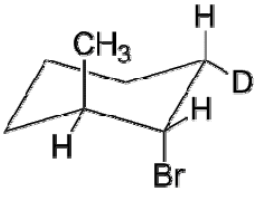
(only enantiomer)

D) 

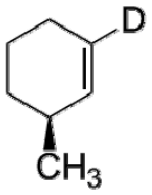
(racemic)

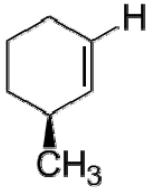
E) 

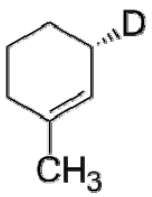
3

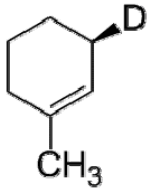


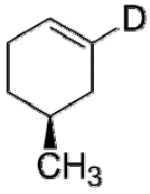
What is the major product of an E2 reaction of the compound shown above?

A) 

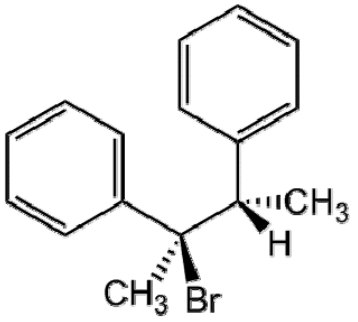
B) 

C) 

D) 

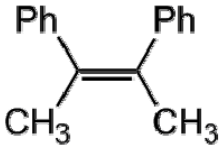
E) 

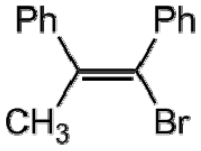
4 Predict the major product.

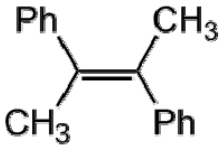


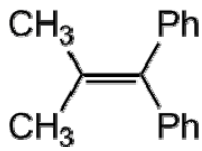
Base

(E2)

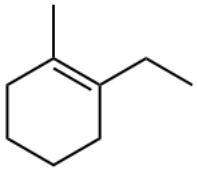
A) 

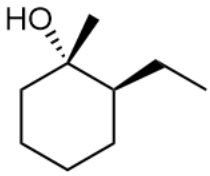
B) 

C) 

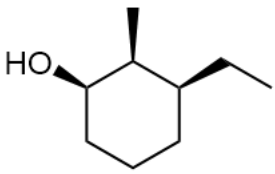
D) 

Which of the following does NOT represent an efficient synthesis of the desired target molecule?

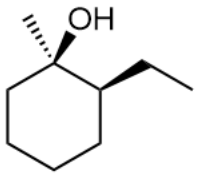
6  ⟹ ?

A) 

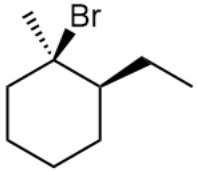
+ conc. H_2SO_4

B) 

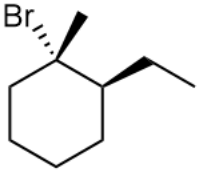
+ conc. H_2SO_4

C) 

+ conc. H_2SO_4

D) 

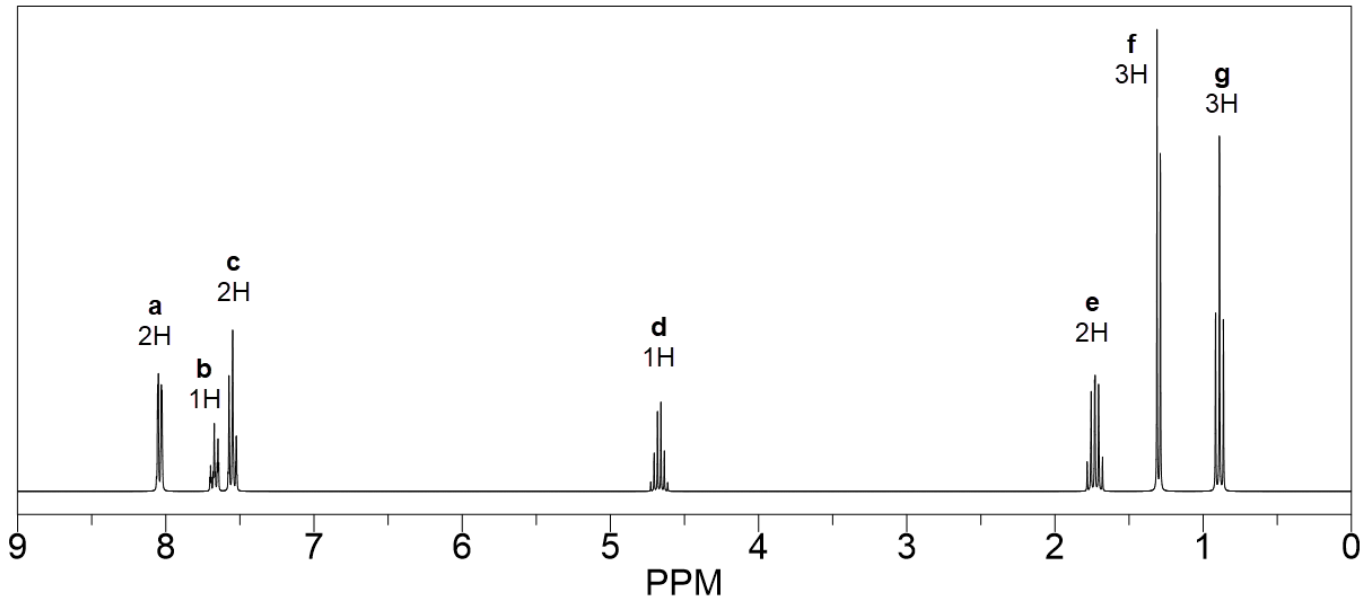
+ NaOH

E) 

+ NaOH

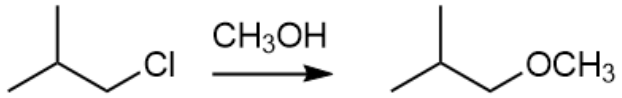
7

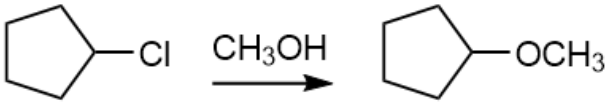
Provide a structure with the formula $C_{11}H_{14}O_2$ that is consistent with the following NMR spectrum.

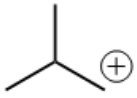


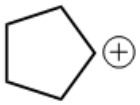
8

Which of the following is the FASTER reaction? Explain briefly.

I 

II 

A) I is faster because this is less stable: 

B) II is faster because this is more stable: 

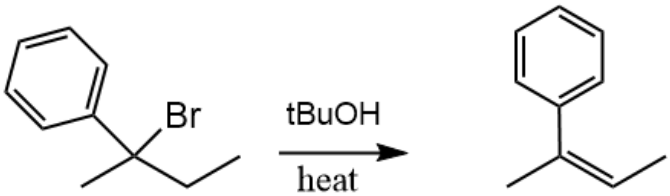
C) I is faster because LG has less sterics

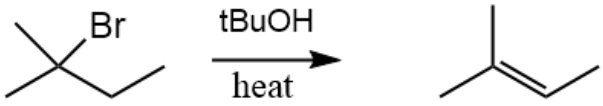
D) II is faster because LG is allylic

E) neither reaction should be faster

9

Which of the following is the FASTER reaction? Explain briefly.

I 

II 

A) I is faster because the LG has less sterics.

B) II is faster because the LG has less sterics.

C) I is faster because it has a more stable product.

D) II is faster because it has a tertiary carbocation.

E) I is faster because intermediate has a resonance.

10 Which of the following is the FASTER reaction? Explain briefly.

I $CH_3CH_2Br \xrightarrow[heat]{NaOH} CH_3CH_2OH$

II $CH_3CH_2Br \xrightarrow{NaOH} CH_3CH_2OH$

A) I is faster because it has a lower E_a.

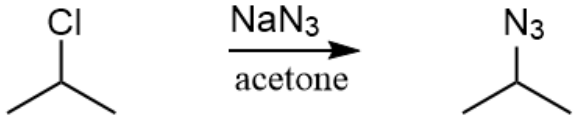
B) II is faster because it has a lower E_a.

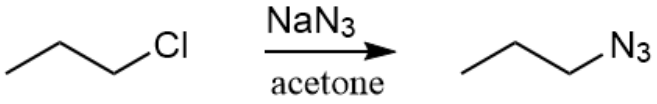
C) I is faster because more kinetic energy results in more high-energy collisions.

D) II is faster because it is an exothermic reaction.

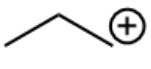
E) I is faster because heat lowers the energy of the carbocation intermediate.

11 Which of the following is the FASTER reaction? Explain briefly.

I 

II 

A) I is faster because this is more stable: 

B) II is faster because this is less stable: 

C) I is faster because LG has less sterics

D) II is faster because LG has less sterics