CHM 3140 Organic Chem. I, Dr. Starkey, Cal Poly Pomona
Final Exam Review – Practice Problems

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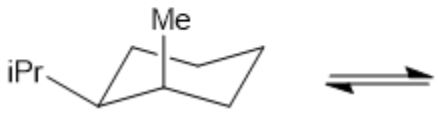
https://pollev.com/lauriestarke263
LAURIESTARKE263 to 37607

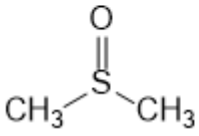
Draw the other chair conformation for the given compound. Identify each drawing as *cis* or *trans*.

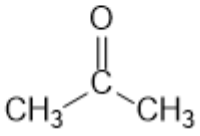
Select the equation that describes the equilibrium and explain: $K_{eq} > 1$ or $K_{eq} = 1$ or $K_{eq} < 1$

1

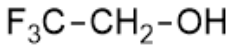


2 One of the following compounds is planar at the central atom and the other is pyramidal. Identify the correct geometry of each compund and briefly explain the geometry of each.

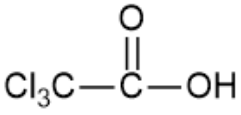




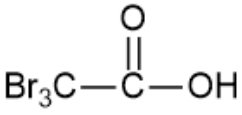
3 Identify the strongest acid and the weakest acid. Explain briefly.



X



Y

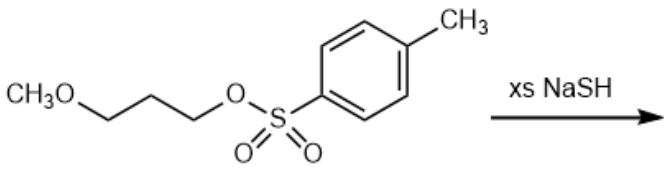


Z

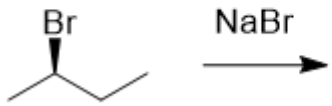
Is hydroxide a strong enough base to deprotonate propyne?
Predict the products of the proton-transfer reaction, and determine the direction of the equilibrium.

4

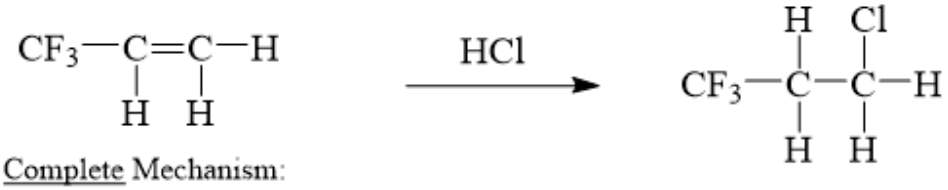
5 Predict the major product.



6 Explain why racemization of the given compound is observed during the S_N2 reaction shown.



7 Provide a complete mechanism for the following reaction. Pay close attention to details, including lone pairs, formal charges and the use of curved arrows.

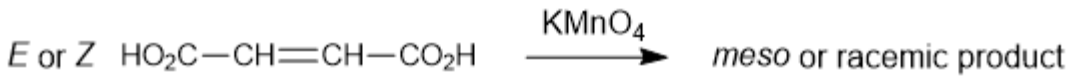


Complete Mechanism:

The product shown is the only one formed. Briefly explain the observed regiochemistry.

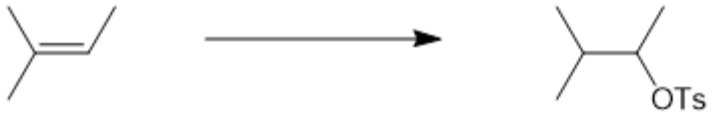
When the alkene shown is treated with potassium permanganate, the resulting product is either a *meso* compound or a racemic mixture. Determine which isomer (*E* or *Z*) gives which product.

8



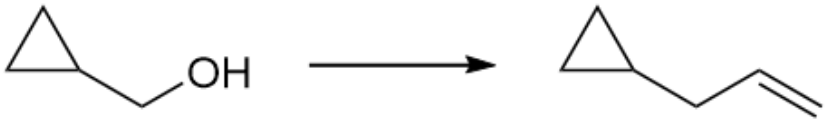
Provide the reagents necessary to transform the given starting material into the desired product.
If more than one synthetic step is needed, you must show the intermediate products formed.
It may help to begin with a retrosynthesis, but you are not required to do so.

9

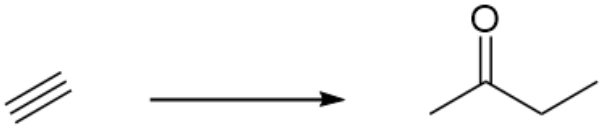


10

11



12



Provide the reagents necessary to transform the given starting material into the desired product.
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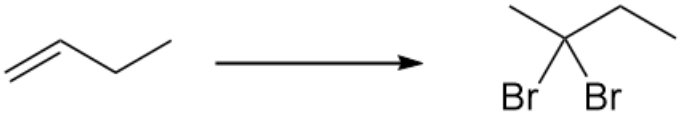
13

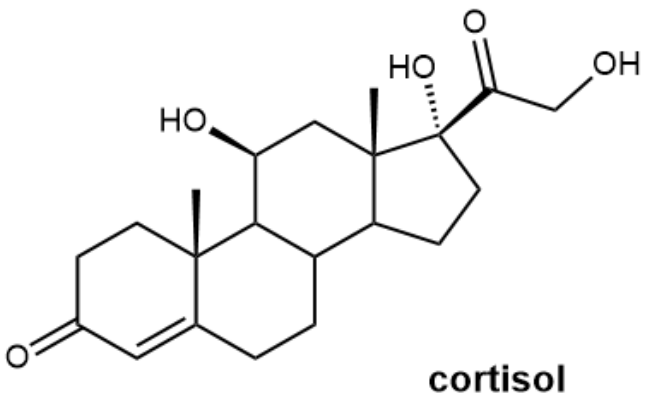
14



15

Cortisol is a hormone that the body releases in response to stress. HIgh levels of cortisol cause problems with memory, concentration and sleeping, and can lead to headaches, weight gain, anxiety and depression. **Relaxation** helps rid the body of cortisol, so adopting daily habits of **meditation** or **focused breathing** is good for your health and might lead to higher grades!

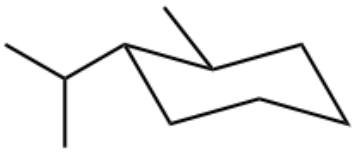
- Identify all of the chiral centers in cortisol. Use * to mark each.
- Cortisol has how many possible stereoisomers? (Nature makes only one!)
- Using the given drawing, determine the number of degrees of unsaturation (DU or HDI).
- Cortisol has 21 carbon atoms. What is its molecular formula? (CALCULATE the # of H atoms)

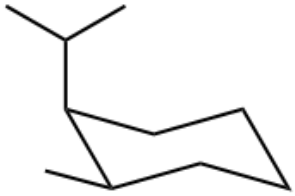


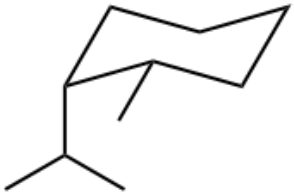
cortisol

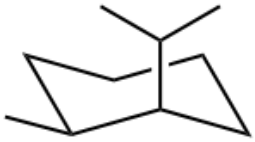
1a Shown below is a chair conformation of a substituted cyclohexane (**X**). Identify the other chair conformation (**Y**).

X **Y**

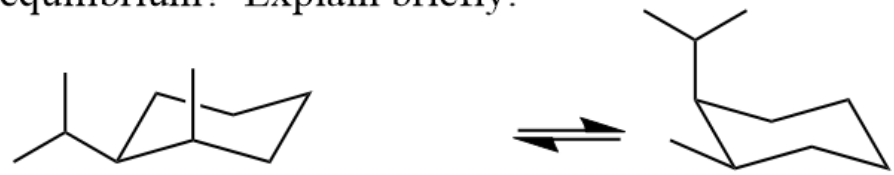
A) 

B) 

C) 

D) 

1b Which chair conformation (**X** or **Y** or neither) predominates at equilibrium? Explain briefly.



X **Y**

A) **Y** is favored, because the substituents are farther apart.

B) **Y** is favored, because the larger group is axial.

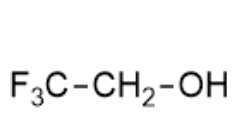
C) Neither is favored, because both have one eq. and one ax. group.

D) **X** is favored, because the larger group is equatorial.

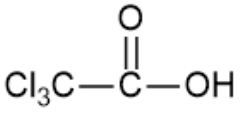
E) **X** is favored, because it has greater 1,3-diaxial interactions.

Identify the strongest acid and the weakest acid. Explain briefly.

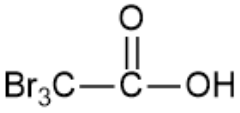
3



X



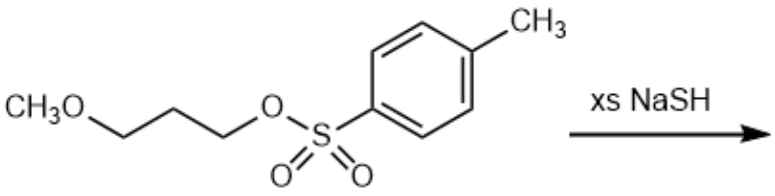
Y



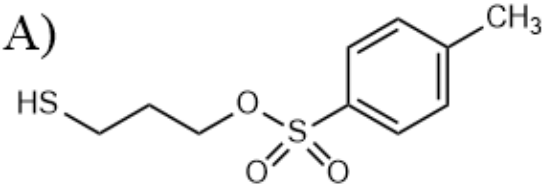
Z

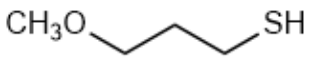
	strongest acid	**weakest acid**
A)	**X** (F is electronegative)	**Z** (Br is the largest)
B)	**Y** (resonance, and Cl is electronegative)	**X** (no resonance)
C)	**Z** (resonance, and Br is the largest)	**Y** (Cl is smaller)
D)	**Z** (resonance, and Br is the largest)	**X** (no resonance)

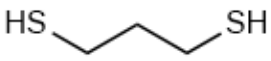
5 Predict the major product.

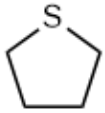


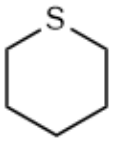
A)



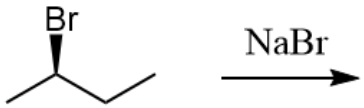
B) 

C) 

D) 

E) 

6 Explain why *racemization* of the given compound is observed during the S_N2 reaction shown.



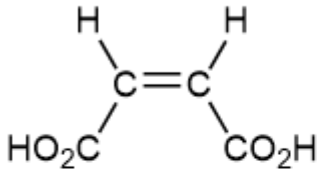
A) Backside attack on the given compound leads to an achiral product.

B) The carbocation intermediate is planar, leading to a racemic mixture.

C) A racemic mixture is formed because the product is the enantiomer of the starting material.

D) S_N2 always results in racemization due to inversion of configuration.

8 Describe the product(s) formed when the alkene shown is treated with $KMnO_4$.



A) This is the *Z* isomer, and it gives a meso diol.

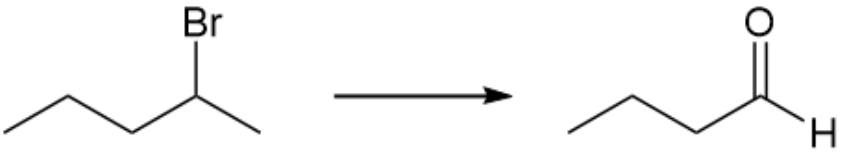
B) This is the *E* isomer, and it gives a meso diol.

C) This is the *Z* isomer, and it gives a racemic mixture.

D) This is the *E* isomer, and it gives a racemic mixture.

10

Which reagents would be best to achieve the following synthesis?



A) 1) xs $NaNH_2$
2) H_2O
3) BH_3-THF
4) H_2O_2, NaOH

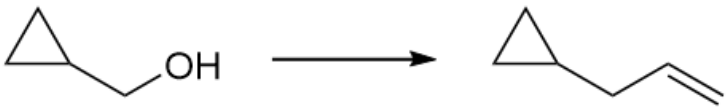
B) 1) xs $NaNH_2$
2) H_2O
3) $Hg(OAc)_2$, H_2O
4) $NaBH_4$

C) 1) EtONa
2) O_3
3) DMS

D) 1) *t*-BuOK
2) O_3
3) DMS

11

Which reagents would be best to achieve the following synthesis?



A) 1) H_2SO_4
2) $H_2C{=}CHNa$

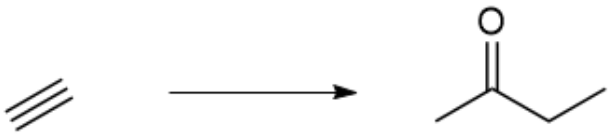
B) 1) TsCl, pyridine
2) $H_2C{=}CHNa$

C) 1) H_2SO_4
2) $HC{\equiv}CNa$
3) H_2, Lindlar's

D) 1) TsCl, pyridine
2) $HC{\equiv}CNa$
3) H_2, Lindlar's

Which reagents would be best to achieve the following synthesis?

12



A) 1) $NaNH_2$
2) EtBr
3) H_2, Lindlar's
4) O_3
5) Zn, H_2O

B) 1) $NaNH_2$
2) EtBr
3) H_2SO_4, H_2O, $HgSO_4$

C) 1) $NaNH_2$
2) EtBr
3) H_2, Lindlar's
4) mCPBA

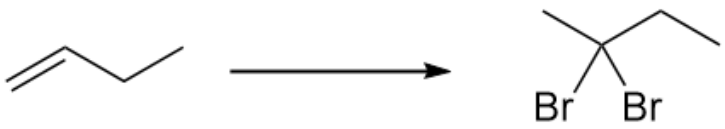
D) 1) $NaNH_2$
2) EtBr
3) BH_3-THF
4) H_2O_2, NaOH

13 Which reagent(s) are best to achieve the following synthesis?

I. HCN
II. HCN, ROOR
III. 1) HBr; 2) NaCN
IV. 1) HBr, ROOR; 2) NaCN

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

14 Which reagents would be best to achieve the following synthesis?



A) 1) Br_2
2) xs $NaNH_2$
(H_2O workup)
3) HBr (xs)

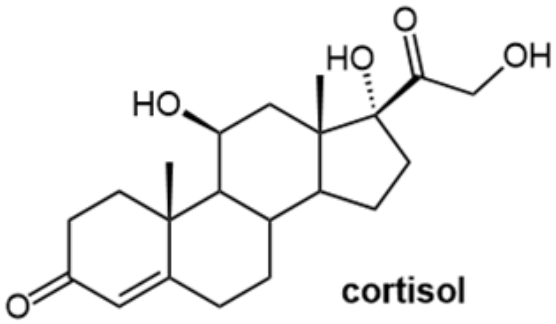
B) 1) HBr
2) xs $NaNH_2$
(H_2O workup)
3) HBr (xs)

C) 1) Br_2
2) xs $NaNH_2$
(H_2O workup)
3) Br_2

D) 1) HBr
2) xs $NaNH_2$
(H_2O workup)
3) Br_2

15a

- Identify all of the chiral centers in cortisol. Use * to mark each.
- Cortisol has how many possible stereoisomers? (Nature makes only one!)

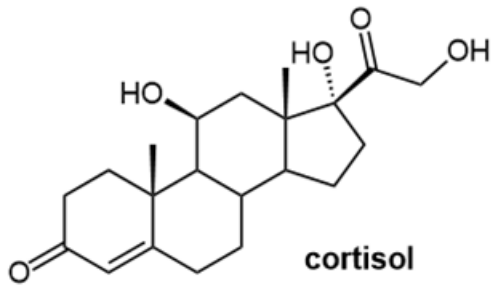


cortisol

A) 16
B) $2^7 = 128$
C) $7^2 = 49$
D) $2^8 = 256$
E) $8^2 = 64$

15b

- Using the given drawing, determine the number of degrees of unsaturation (DU or HDI).
- Cortisol has 21 carbon atoms. What is its molecular formula? (CALCULATE the # of H atoms)



cortisol

A) 4 rings + 2 pi bonds = 6 DU
B) 4 rings - 2 pi bonds = 2 DU
C) (4 rings + 2 pi) ÷ 2 = 3 DU
D) 4 rings + 3 pi bonds = 7 DU
E) 4 rings - 3 pi bonds = 1 DU

A) $C_{21}H_{28}O_5$
B) $C_{21}H_{20}O_5$
C) $C_{21}H_{34}O_5$
D) $C_{21}H_{32}O_5$
E) $C_{21}H_{30}O_5$