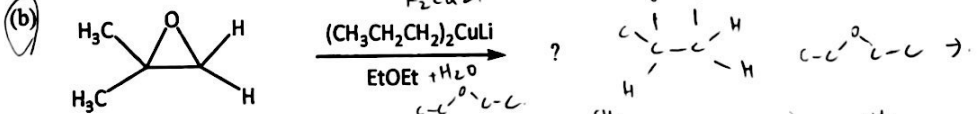
Chem 2210-01 Organic Chemistry

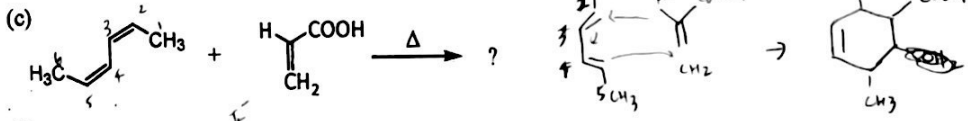
Final Exam

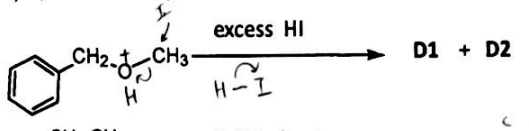
January 12, 2021

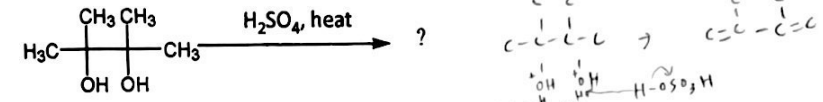
1. Predict the major product, if any, or provide appropriate starting materials, or reagent(s) for the following reactions. (36%)

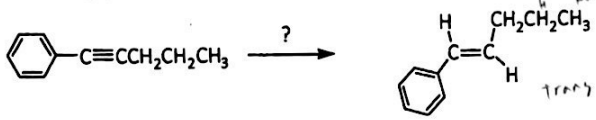
(a) 

(b) 

(c) 

(d) 

(e) 

(f) 

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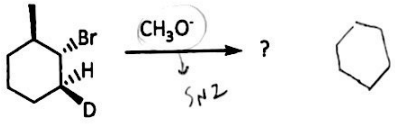
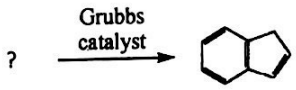
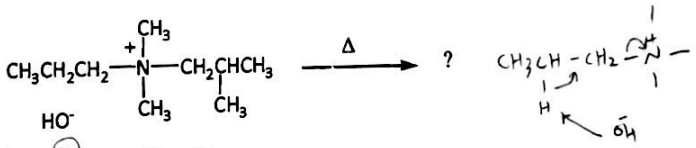
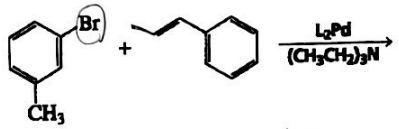
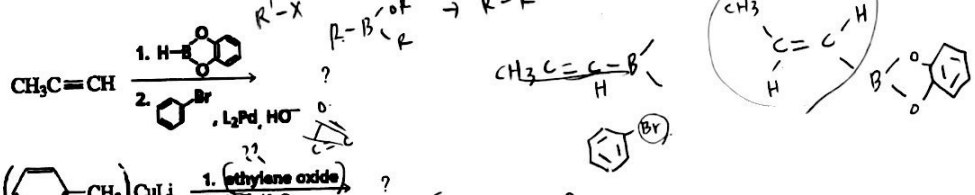
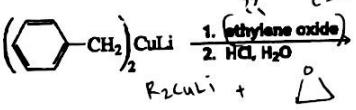
(h) 

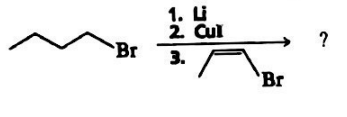
(i) 

(j) 

(k) 

(l) 

(m) 

(n) 

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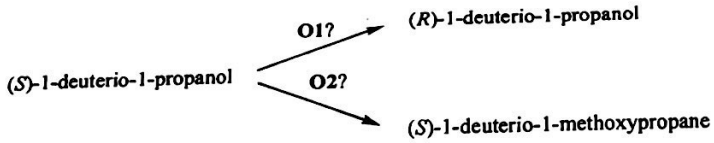

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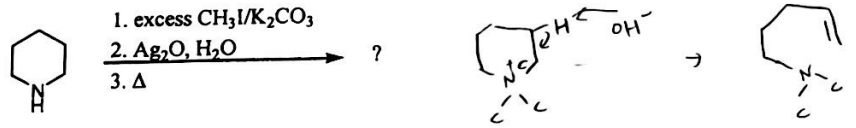

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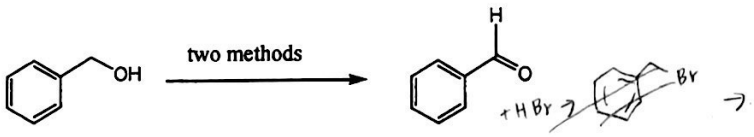
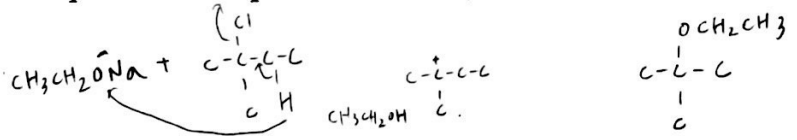
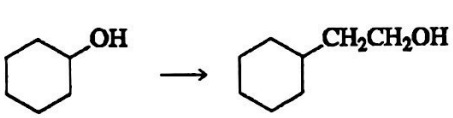


2. One student wanted to synthesize the anesthetic 2-ethoxy-2-methylpropane. He used sodium ethoxide and 2-chloro-2-methylpropane for his synthesis and ended up with very little ether. What was the predominant product of his synthesis? What reagents should he have used? (6%)



3. Show how you would synthesize the following compound, starting with the provided starting material. (48%)

(a)



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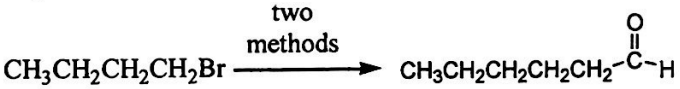
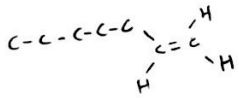
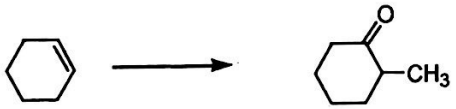




(c)

(d)



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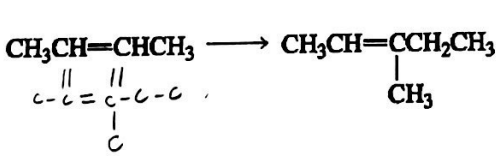
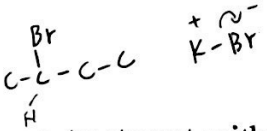


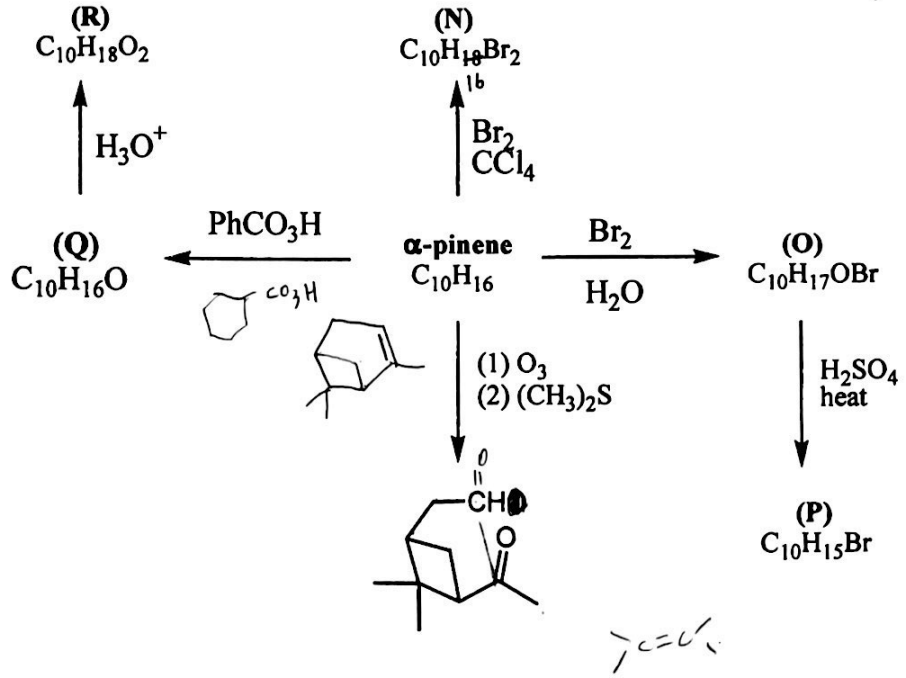


4. (a) Optically active 2-bromobutane undergoes racemization on treatment with a solution of KBr. Give a mechanism for this racemization. (3%)

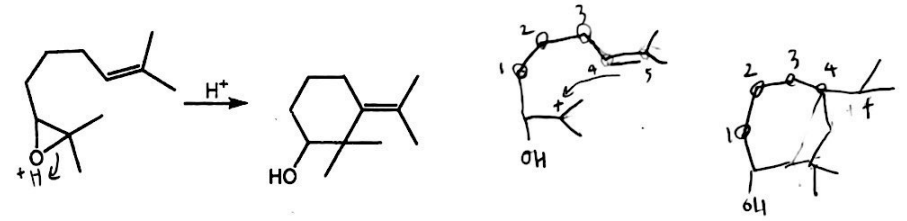
(b) In contrast, optically active 2-butanol does not racemize on treatment with a solution of KOH. Explain why a reaction like that in (a) does not occur. (3%)

(c) Optically active 2-butanol does racemize in dilute acid. Propose a mechanism for this racemization. (3%)

5. One of the constituents of turpentine is α-pinene, formula $C_{10}H_{16}$. The following scheme gives some reactions of α-pinene. Determine the structure of α-pinene and of the reaction products (**N**) through (**R**). (12%)



6. Propose a reaction mechanism for each of the following reactions. (5%)



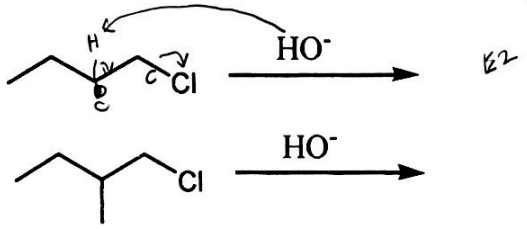
7. Which reaction in each of the following pairs will take place more rapidly? Why? (15%)

(a) H_2O or H_2S when reacts with methyl iodide in methanol?

(b) $BrCH_2CH_2CH_2NH_2$ or $BrCH_2CH_2CH_2CH_2NH_2$ in S_N2 condition

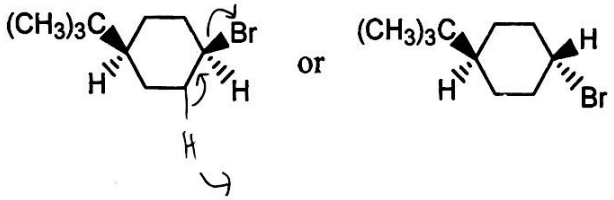
(c) ^-OCN or ^-SCN when reacts with isopropyl bromide?

(d)



	SN1	SN2	E1	E2
1°	X	V	X	V
2°	X	V	X	V
3°	V	X	V	V

(e)



in E2 reaction?

Have a Nice Winter Break and Happy Lunar New Year!

國立清華大學試卷

記					分
1	22	2	4		
3	25	4	0		
5	10	6	1		
7	6	8			
9		10			
11		12			
13		14			
15		16			
17		18			
19		20			
總 分	68				

所 系 化學23

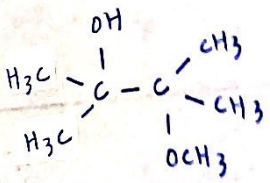
科 目 有機

學 號 108023025

姓 名 張小萱

日 期 110,01,12

1. (a)



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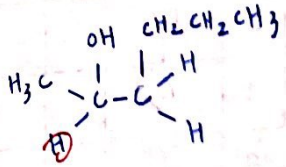

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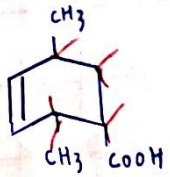

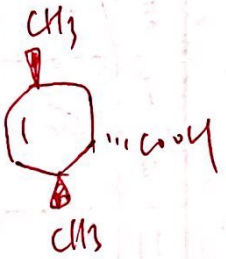

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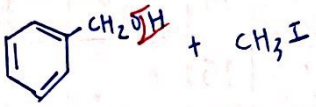

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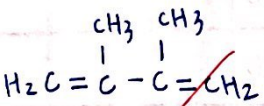

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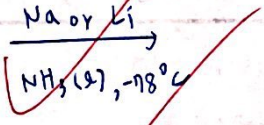

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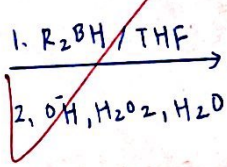

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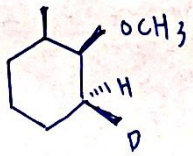

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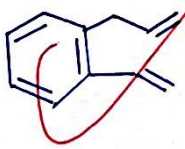

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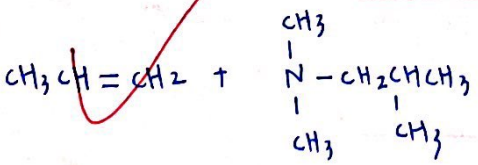

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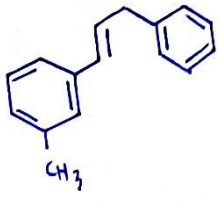
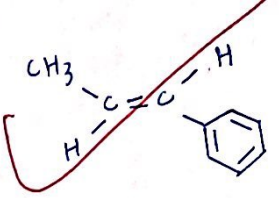
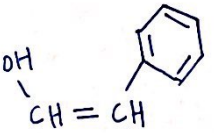


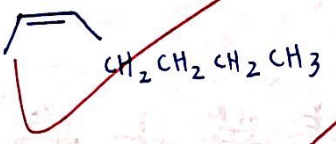
(l)



(m)



(n)

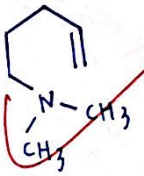


(o)

o1: 1. $TsCl$ / pyridine
2. HO^-

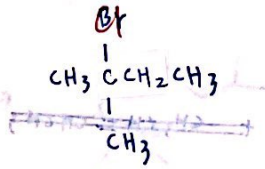
o2: 1. PBr_3 / pyridine
2. CH_3O^-

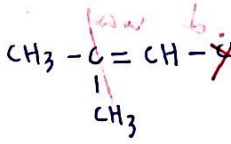
(p)



(q) method I: PCC, CH_2Cl_2

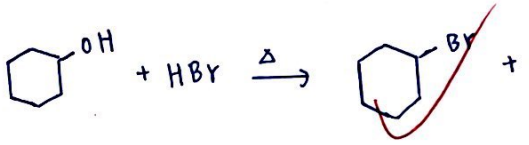
method II: NaClO, CH_3COOH, 0°C

2. CH_3CH_2OH +  → reagent

 → predominant product

+4

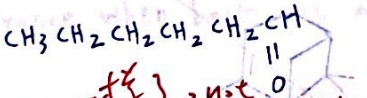
3. (a)



+1

(b) method I:

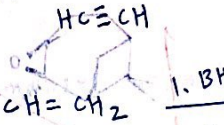
$CH_3CH_2CH_2CH_2Br \xrightarrow[HC\equiv CH]{NaNH_2} CH_3CH_2CH_2CH_2C\equiv CH \xrightarrow[2,\ OH^-,\ H_2O_2,\ H_2O]{1.\ R_2BH/THF}$

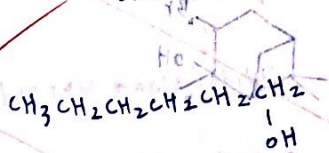
$CH_3CH_2CH_2CH_2CH=CH \xrightarrow{K,E,T_1}$ 

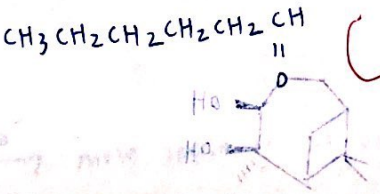
+8

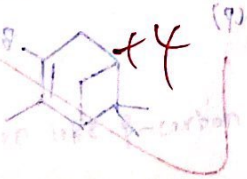
method II:

$CH_3CH_2CH_2CH_2Br \xrightarrow[HC\equiv CH]{NaNH_2} CH_3CH_2CH_2CH_2C\equiv CH \xrightarrow[Lindlar\ cat.]{H_2}$



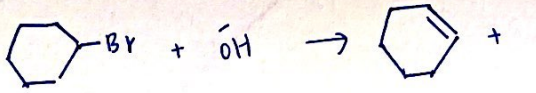
$\xrightarrow[2,\ OH^-,\ H_2O_2,\ H_2O]{1.\ BH_3/THF}$  $\xrightarrow[DCM]{PCC}$

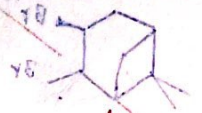




+4

(c)





+1

(d)

+8

3, (a)

$CH_3CH=CHCH_3$ + $CH_3CH_2C(CH_3)=CCH_2CH_3$ → $CH_3CH=C(CH_3)CH_2CH_3$ + ~~$CH_3CH=CHCH_3$~~

~~Rubbor~~ cat.

↑ Grubb

forget his name...

+2

4, +10

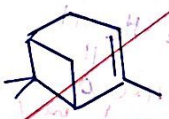
(a)

(b)

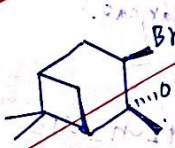
(c)

+10

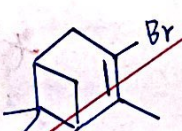
5, α-pinene



(b)

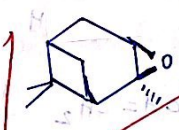


(c)



(d)

(e)



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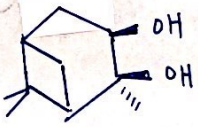

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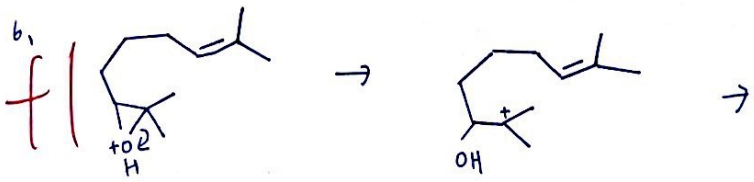


fb

7. (a) HS^- smaller electrondensity ⇒ stable ⇒ better nucleophile in protic solvent

⇒ H_2S more rapid

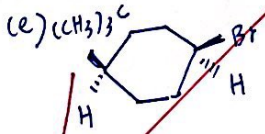
(b) $BrCH_2CH_2CH_2CH_2NH_2$ more rapid ∵ smaller hindrance when back side approach

∵ NH_2 withdraw e^-, make $Br-\overset{\delta-}{CH_2}\overset{\delta+}{(CH_2)_2NH_2}$

↑ more positive ⇒ unstable

(c) ^-OCN more rapidly, ^-OCN smaller nucleophilosity ⇒ better nucleophile in aprotic solvent

(d)  $\xrightarrow{HO^-}$ more rapid ∵ Cl^- poor leaving group, carbanion like β-carbon during E2, ∄ 3° carbanion more unstable than 2° carbanion

(e)  more rapid ∵ base enter from bottom (opposite side of leaving group Br^-), when less steric hindrance by $(CH_3)_3C$