Name: KEY

Chem 109B Apr. 26, 2017 4:00pm

1-15. (45) Manki Xiong

16-17. (20) Hongyi Chen

18. (25) Zhikun Wang

20 (20) Joanna Chen

1 of (110)

Circle the best answer here: (3 pts each) (45 pts mult choice) **(no penalty for guessing)**

1.	(A)	B)	C)	D)	E)	9.	A)	B)	C)	D)	(E)
2.	A)	(B)	C)	D)	E)	10.	A)	(B)	C)	D)	E)
3.	A)	(B)	C)	D)	E)	11.	A)	B)	C)	(D)	E)
4.	A)	(B)	C)	D)	E)	12.	A)	(B)	C)	D)	E)
5.	A)	B)	C)	(D)	E)	13.	A)	B)	(C)	D)	E)
6.	A)	B)	C)	(D)	E)	14.	A)	B)	(C)	D)	E)
7.	A)	(B)	C)	D)	E)	15.	A)	B)	C)	D)	(E)
8.	(A)	B)	C)	D)	E)						

16. (14 pts.) Complete the following acid base equilibrium equation. (1) Label the pKa's of the acids in this reaction (2) show with an **arrow** the direction in which the equilibrium lies. (d) Give the equilibrium constant, K. (e) Give ΔG° for the reaction at 25°C. Some pK_a's that might be needed are: H_3O^+(-2), H_4N^+(9), HCCH (25), CH_3CO_2H(5), H_2O(16), NH_3(35).

sign -1 (3 pts.) $K = 10^{+9}$ (2 pts.) $\Delta G^\circ = -13$ (kcal/mole) ±1 sign -1

$H_2O + H\text{-}C\equiv C^- = H\text{-}C\equiv C\text{-}H + {}^{\ominus}:\ddot{O}\text{-}H$ (2 pt. each)

pKa ≈ 16 (1 pt.) pKa = 25 (1 pt.)

(2 pt.)

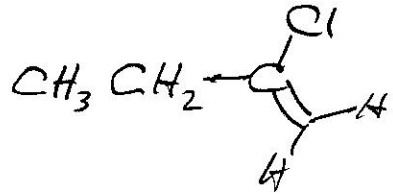
17. (6 pts) In terms of basic principles that you can, explain why acetylene is a stronger acid than methane.

The negative charge and lone-pair electrons 1 pt.
in $H\text{-}C\equiv C:^{\ominus}$ are more stable than in $H\text{-}\underset{H}{\overset{H}{C}}:^{\ominus}$ 4 pt.
because the sp hybrid orbital is 50% s-character (lower E) 1 pt.
and held closer to the C nucleus than in the 25% s 1 pt.
sp^3 orbital on $:CH_3$. 1 pt.

$H\text{-}C\equiv C:^{\ominus}$ sp $\quad H\text{-}\ddot{C}\text{-}H$ sp^3) 1 pt.

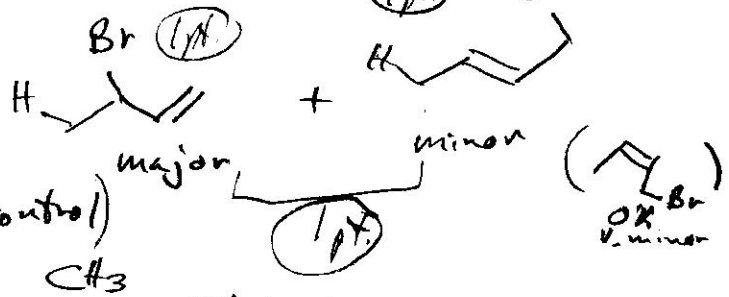
code words are:
element effect due to hybridization

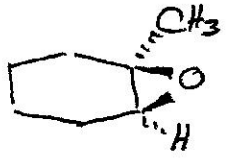
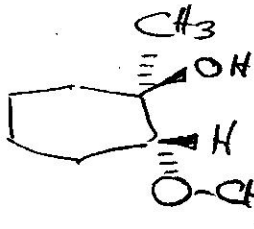
18. (25 pts) Write the main product(s), or missing reagents, for the following reactions, showing appropriate major/minor and stereochemistry where needed.

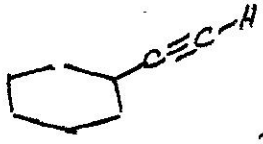
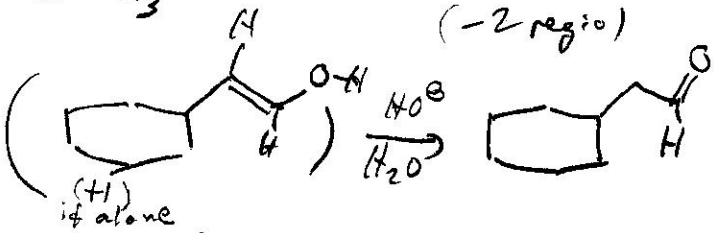
(a) $CH_3CH_2-C\equiv C-H \xrightarrow{1\ equiv.\ HCl}$  3 pts.

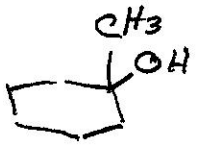
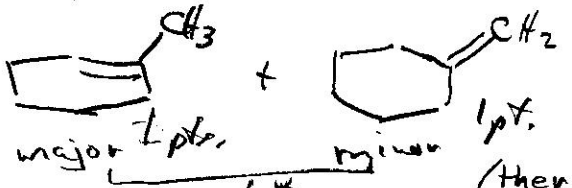
(b) $CH_3CH_2C\equiv C-H \xrightarrow[NH_3]{NaNH_2} CH_3CH_2-C\equiv C:^{\ominus} \xrightarrow{CH_3-Br} CH_3CH_2C\equiv C-CH_3$ 4 pts. 2 pts. 2 pts.

3 pts (c) $CH_3CH_2OH \xrightarrow[(pyridine)]{PBr_3} CH_3CH_2Br$

3 pts. (d)  $\xrightarrow[-80^\circ C]{HBr}$ (low temp kinetic control) 

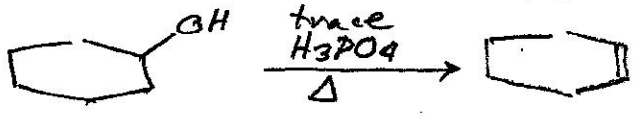
4 pts. (e)  $\xrightarrow[CH_3OH]{CH_3O^{\ominus}}$  2 pt struct. 1 pt. stereochem (O's trans) 1 pt regiochem (OCH_3 on less hindered C)

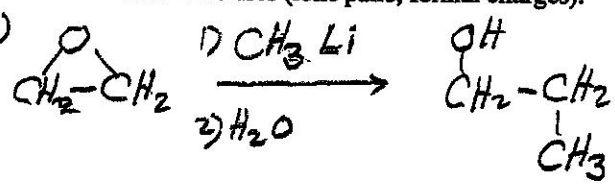
3 pts. (f)  $\xrightarrow[2)\ H_2O_2, H_2O, OH^{\ominus}]{1)\ R_2BH,\ THF}$  (-2 regio)

3 pts. (g)  $\xrightarrow[\Delta]{\text{trace conc. } H_2SO_4}$  1 pt. 1 pt. 1 pt. (thermodynamic control)

2 pts. (h) $CH_3CH_2Br \xrightarrow[(ether)]{Mg} CH_3-CH_2-Mg-Br$

20. (20 pts, includes 10 extra credit) On the back of this page or on another piece of paper, write the mechanism for the reactions shown below showing all steps, **balanced equations**, and proper arrows and Kekule-Lewis structures (lone pairs, formal charges).

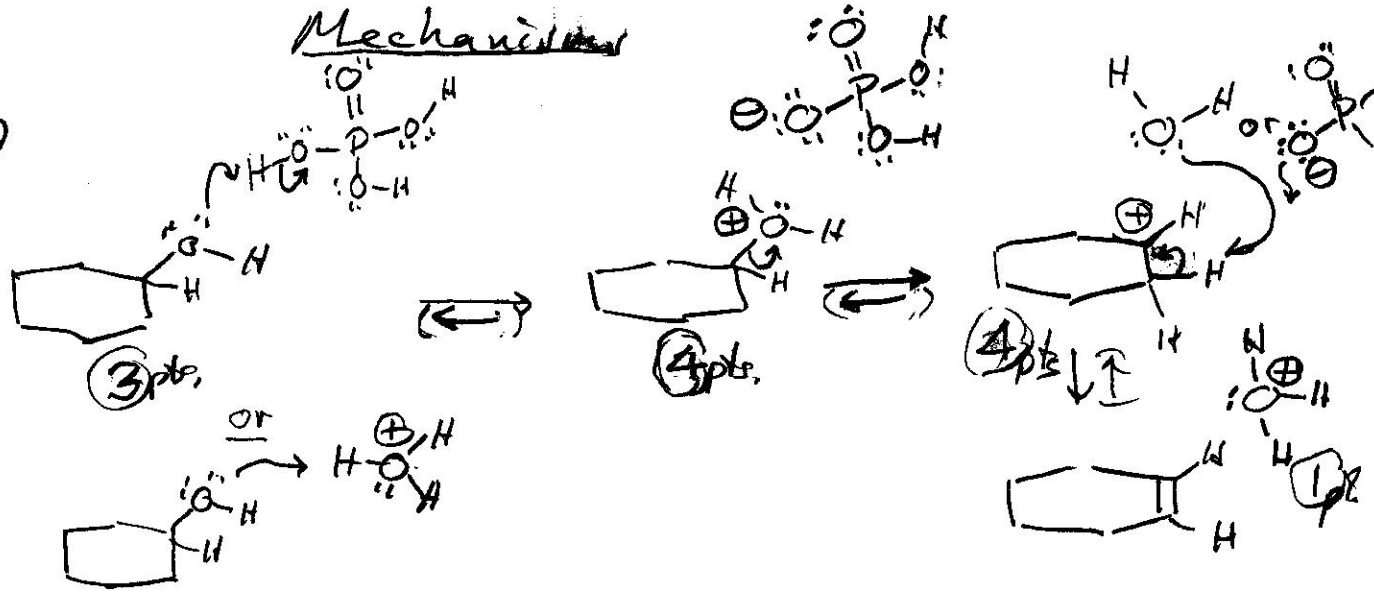
(a) 

(b) 

Mechanisms

20 (a)

12 pts



20 (b)

8 pts