CHM 2120C - MIDTERM #1

Date: 11 Feb. 2016 Duration: 90 minutes
Professeur : Claudia El Nachef

First name: _____ Last name :_____

Student #: _____

- **Total number of points : 68**
- Molecular models are allowed.
- You can write with pen or pencil but regrading won't be possible if written in pencil.
- You should submit all scratch papers with the exam copy.
- A simplified pKa table is provided on the last page.

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	104 Rf	105 Ha	106 106												

58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

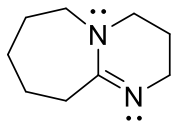
Cellular phones, unauthorized electronic devices or course notes (unless an open-book exam) are not allowed during this exam. Phones and devices must be turned off and put away in your bag. Do not keep them in your possession, such as in your pockets. If caught with such a device or document, the following may occur: you will be asked to leave immediately the exam and academic fraud allegations will be filed which may result in you obtaining a 0 (zero) for the exam.

By signing below, you acknowledge that you have ensured that you are complying with the above statement.

_____

GOOD LUCK!

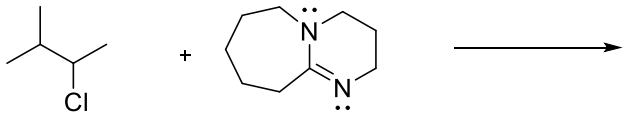
1. a) Determine the hybridization state of both nitrogen atoms in this molecule and indicate in which orbitals do their lone pairs reside. Explain your answer using appropriate structure. (**5 points**)



b) Circle the most basic nitrogen atom and explain briefly your choice. (**2 points**)

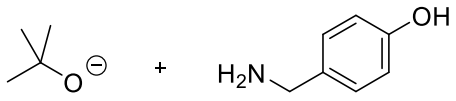
c) By which acronym is the above compound commonly known? (**1 point**)

d) For the following reaction:
- Determine the type of reaction that will take place. (**1 point**)
- Draw a mechanism of all products and indicate the major one. (*Draw in all lone pairs and formal charges*) (**4 points**)

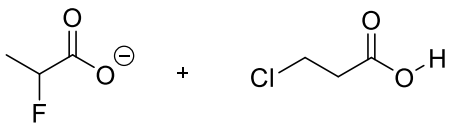


2. Complete each of the following reversible reactions. Use curved arrows to show the mechanism. Once products are established, show by using uneven equilibrium arrows, in each of the following cases, what side does the equilibrium favor, the starting materials or the products? justify your answer. (**10 points en total**)

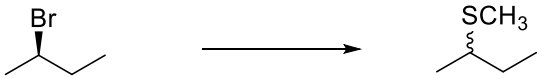
a)



b)

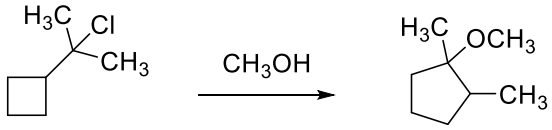


3. Consider this following substitution reaction:



Suggest two experimental methods that would be helpful to conclude whether this reaction proceeded through an S_N1 or an S_N2. Explain briefly the difference in results in each suggested experimental method. (**4 points**)

4. Suggest a mechanism for this following reaction: (**6 points**)

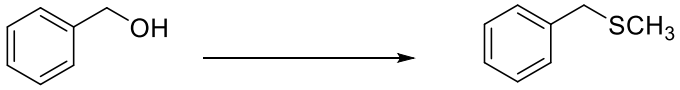


5. When (3*S*,4*R*)-3-bromo-4-methylhexane is treated with sodium methoxide, alkenes are generated as well as a nucleophilic substituted product.
   a- Determine all the products from this reaction and indicate the one that is major. (**4 points**)

b- What is the IUPAC name of the product resulting from the substitution reaction? (**2 points**)

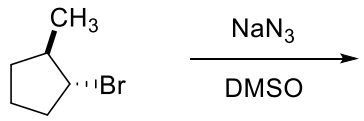
c- Draw the mechanism leading to the major product of this reaction. To support your answer, make sure to include the Newman projection of: (i) the starting material, (ii) the reactive conformation and the (iii) product. (**6 points**)

6. Propose reagent(s) and solvent(s) for the following transformation and draw the mechanism for the formation of the intermediate and the final product. (**8 points**)

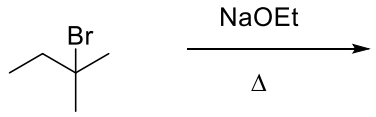


7. Draw the major product (s) of the following reactions and indicate what type of reaction mechanism took place. (**11 points**)

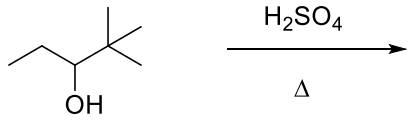
a)



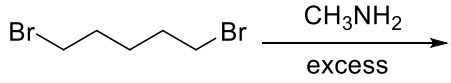
b)



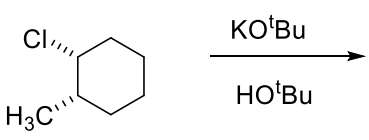
c)



d)

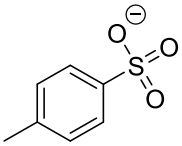


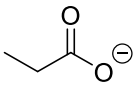
e)



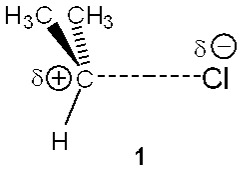
Show the reactive chair conformation

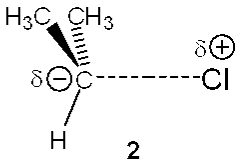
8. Circle the best leaving group: (**2 points**)

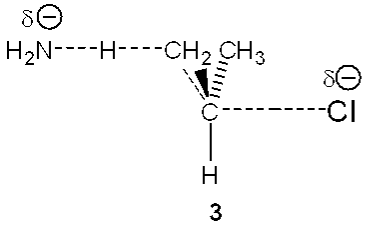


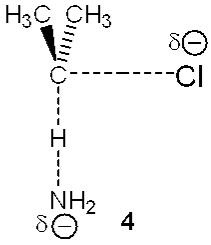


9. Circle the transition state of the rate determining step of the elimination reaction of 2-chloropropane and sodium amide. (**2 points**)

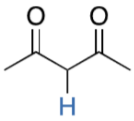
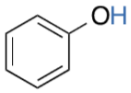
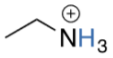
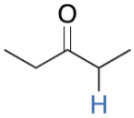

1


2


3


4

pK_a Table

Acid	pK_a value (H_2O solvent)	Acid	pK_a value (H_2O solvent)
HI	-10		9
HBr	-9		
HCl	-8		9.9
	-6.2		10.6
	-3.8	H_2O	15.7
H_2SO_4	-3		17
	-2.6		20
$CH_3OH_2^+$	-2.2		
H_3O^+	-1.7		24
HNO_3	-1.3	H_2	36
HF	3.17	NH_3	38
	4.76		50
			51