

**CHM 2120B
Midterm #1
October 7, 2015**

First Name: _____ Last Name: _____

Student Number: _____ Seat number: _____

Approximate total number of marks: 73

The marks are given as a guide and are subject to change.

You have eighty (80) minutes to complete this exam.

You may write in pen or in pencil, but regrade requests not possible if in pencil.

The use of molecular models is permitted but they cannot be shared.

The use of calculators or other electronic devices is not permitted.

	1a	2a	3b	4b	5b	6b	7b		8		1b	2b	3a	4a	5a	6a	7a	0	
1	H																		2
3	Li	4	Be										5	6	7	8	9	10	
													B	C	N	O	F	Ne	
11	12												13	14	15	16	17	18	
	Na	Mg											Al	Si	P	S	Cl	Ar	
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54		
	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86		
	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
87	88	89	104	105	106														
	Fr	Ra	Ac	Rf	Ha	106													

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

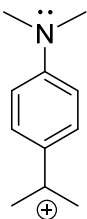
By signing below, you acknowledge that you have ensured that you are complying with the above statement.

Signature: _____

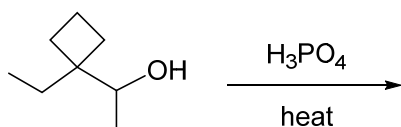
1. Draw the structure of 2,4,5-trichlorobenzoic acid.

(1 point)

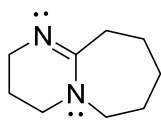
2. Draw at least four more resonance structures of the following compound, using curved arrows to show electron movement. All lone pairs and/or charges must be clearly shown. (6 points)



3. Draw the major product of the following reaction and provide a mechanism. (5 points)

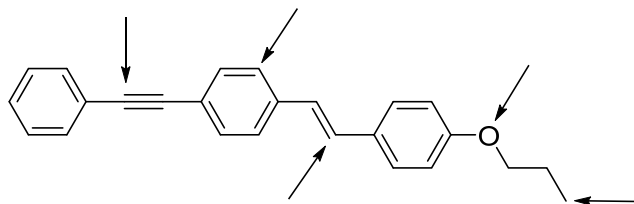


4. (a) Which N atom is more basic? Circle the more basic N and explain your choice using appropriate structures to support your answer. **(5 points)**

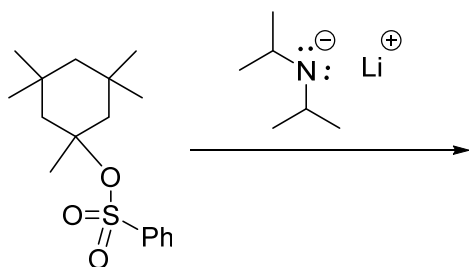


(b) The above compound is commonly known by which acronym? **(1 point)**

5. Identify the hybridization state of each of the atoms indicated with an arrow. **(5 points)**

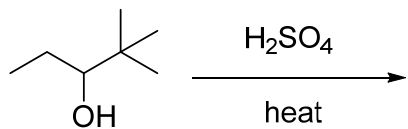


6. (a) Predict the major product, (b) explain your product choice, and (c) draw a mechanism to account for its formation. **(4 points)**

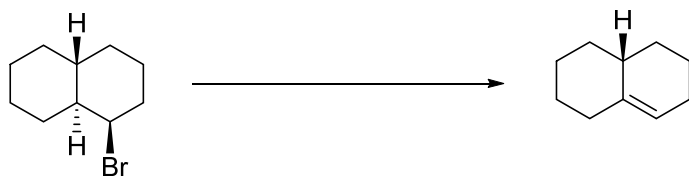


7. Predict the major product, and draw a mechanism for its formation:

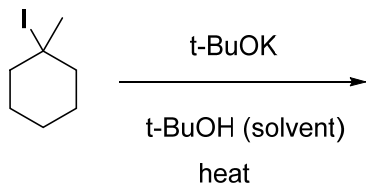
(5 points)



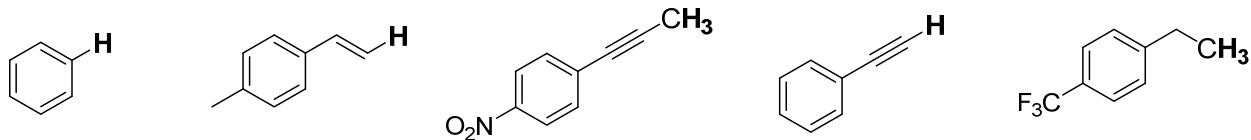
8. (a) Propose reagent(s), solvent(s), and reaction conditions for the following transformation:
(3 points)



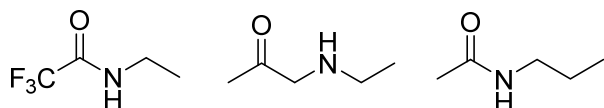
(b) Draw the major product(s) of the following reaction and explain your answer. **(3 points)**



9. Circle the most acidic proton in the following set and briefly explain your choice. (2 points)



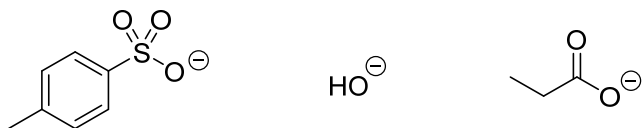
10. Circle the most basic nitrogen in the following set and briefly explain your choice. (2 points)



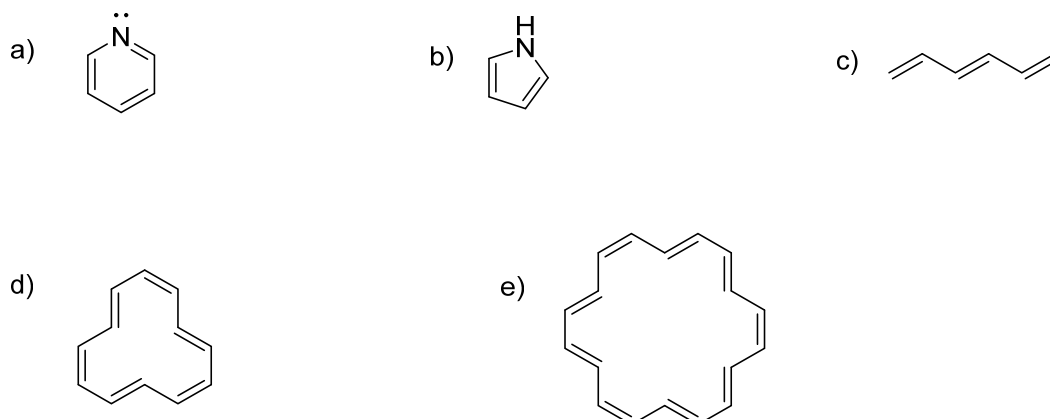
11. Circle the more acidic proton and briefly explain your choice. (2 points)



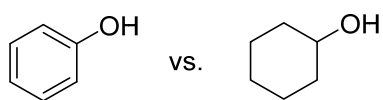
12. Circle the best leaving group: (1 point)



13. Decide whether each of the following is aromatic, anti-aromatic, or non-aromatic. (5 points)

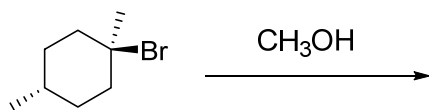


14. a) Circle the more acidic compound. **(1 point)**

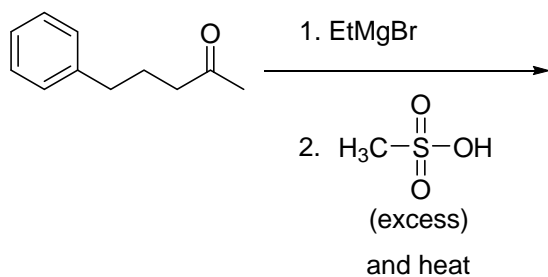


b) Explain your choice above with the aid of appropriate structures. **(6 points)**

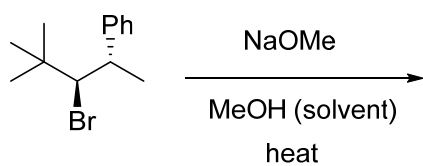
15. a) Predict the S_N1 product(s) and write the mechanism of the following reaction. **(4 points)**



b) Provide the major organic product of the following and draw the entire mechanism for its formation. (7 points)

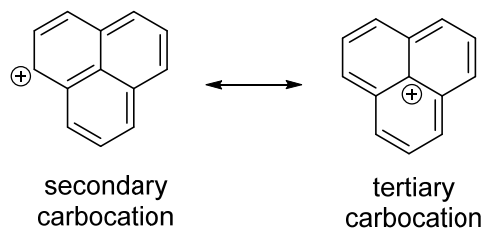


c) Provide a mechanism and the major organic product for the reaction below. Please include the Newman projections of: (i) the starting material as drawn below, and (ii) the reactive conformation. Briefly explain the significance of your reactive conformation. (5 points)



Bonus! (3 points - all or nothing!)

Tertiary carbocations are in general more stable than secondary ones. This is not the case for the example below, however. Explain why.



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===== End of exam =====
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pK_a Table

Acid	pK _a value (H ₂ O solvent)	Acid	pK _a value (H ₂ O solvent)
HI	-10		9
HBr	-9		9.9
HCl	-8		10.6
	-6.2		15.7
	-3.8		17
H ₂ SO ₄	-3		20
	-2.6		24
CH ₃ OH ₂ ⁺	-2.2		36
H ₃ O ⁺	-1.7		38
HNO ₃	-1.3		50
HF	3.17		51
	4.76		

