ANSWERS.

CHM 2120
SAMPLE Midterm #1
September, 2013

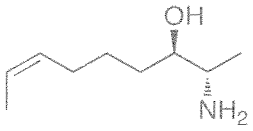
First Name: _____ Last Name: _____

Student Number: _____ Seat number: _____

Approximate total number of marks: 82
The marks are given as a guide and are subject to change.
You can write in pen or 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.

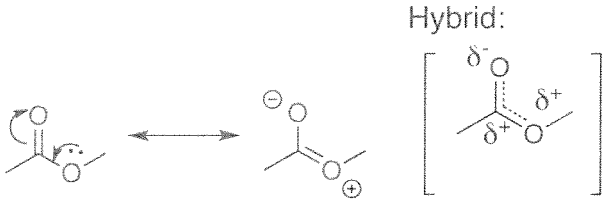
1a	2a	3b	4b	5b	6b	7b		8		1b	2b	3a	4a	5a	6a	7a	0
1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 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												

1. Draw the structure of (2*S*,3*R*,*Z*)-2-aminonon-7-en-3-ol. **(3 points)**



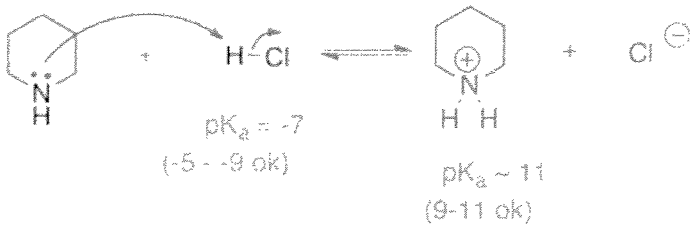
2.

a. Draw all of the resonance structures of the following compound using arrows to show the movement of electrons. **(4 points)**
b. Draw the resonance hybrid structure. **(2 points)**



3.

a. Draw the mechanism and products for the following reaction. **(5 points)**
b. Will the reaction favour the starting materials or the products? **(1 point)**
c. Justify your choice in part b. **(3 points)**



The equilibrium favours the side with the weakest acid,
i.e. the side with the protonated amine on the right (products),

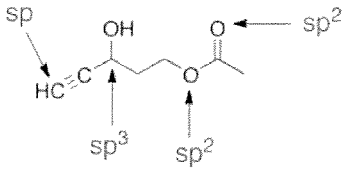
4. Circle the most basic nitrogen atom in the following compound and justify your choice. Draw structures to support your answer. **(3 points)**

1 point: the circled N

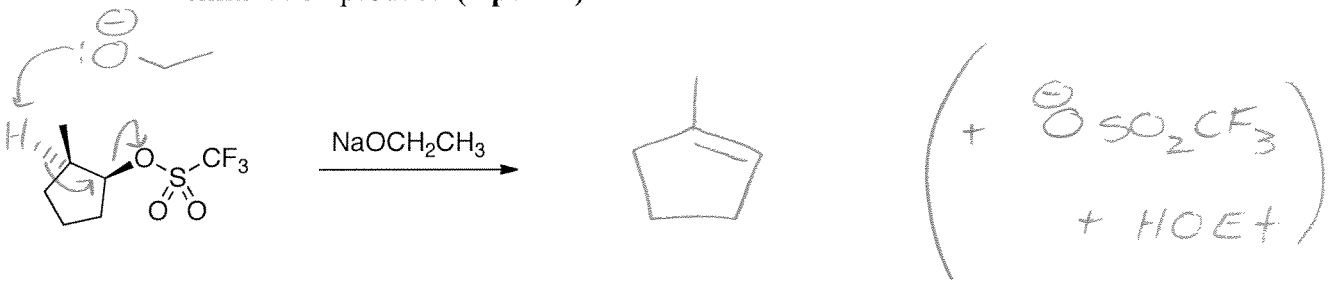
1 point: the electrons in the right hand nitrogen are involved in resonance, they are more stabilized (they are delocalized). Aromaticity would be destroyed if this N was protonated (this would be destabilizing)

1 point: the electrons in the left hand nitrogen are not involved in resonance (they are in an sp^2 orbital). Aromaticity is not destroyed if these electrons are protonated.

5. Identify the hybridization state for each of the atoms indicated with an arrow. **(4 points)**

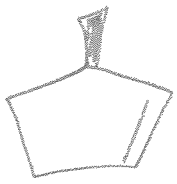


6. For the following reaction:
   a. Draw the mechanism to show the formation of the **major** organic elimination product: **(4 points)**

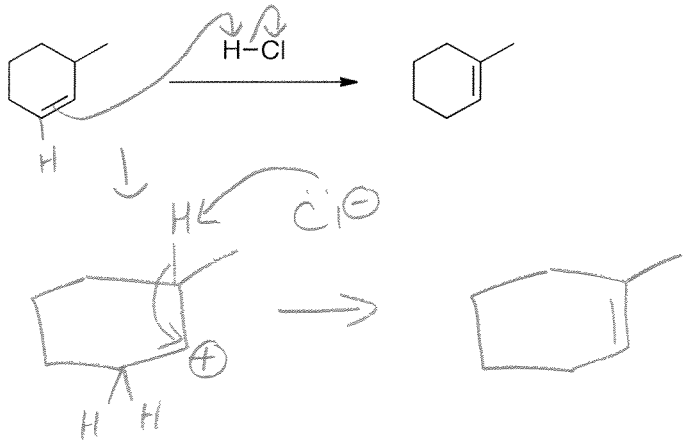


2

   b. Draw the minor organic product. **(4 points)**

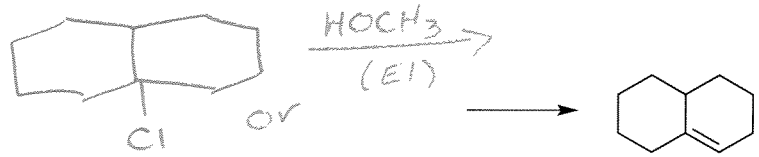


7. Draw a mechanism to explain the formation of the product shown. **(4 points)**

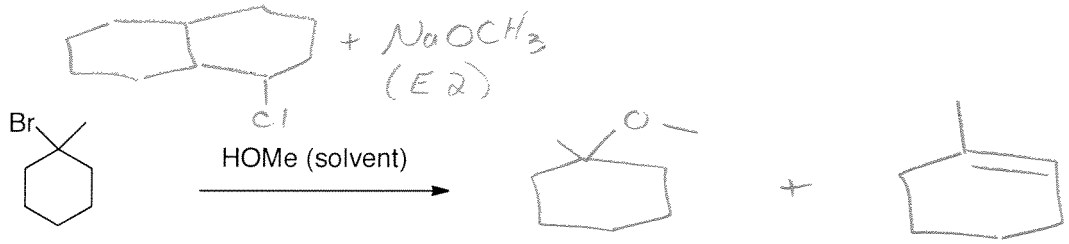


8. Draw the starting material(s) **OR** the major organic product(s) for each of the following reactions: **(3 points each, total = 6 pts)**

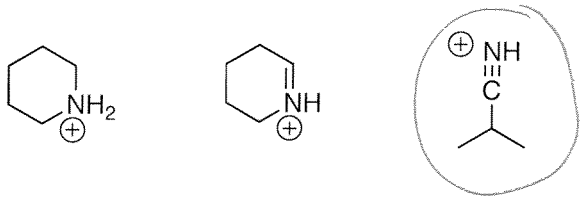
a.



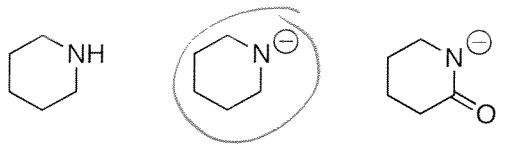
b.



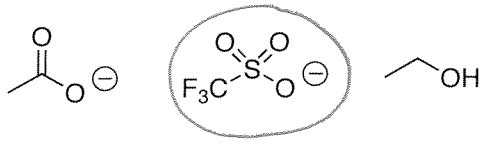
9. Circle the strongest acid in the following set: **(1 point)**



10. Circle the strongest base in the following set: **(1 point)**



11. Circle the best leaving group in the following set: **(1 point)**

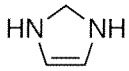


12. Decide whether each of the following compounds is aromatic, anti-aromatic, or non-aromatic. **(3 points)**

a.

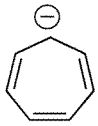
Aromatic

b.



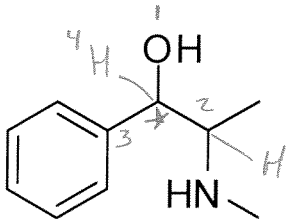
Non aromatic

c.

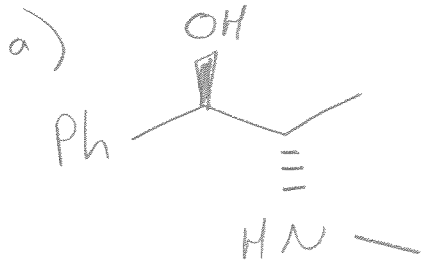


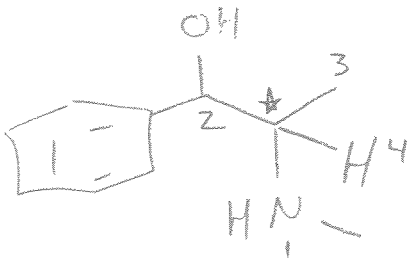
Anti- aromatic

13. Ephedrine has the structure shown below but with the (1*R*, 2*S*) configuration.
    a. Draw its structure with the correct configurations at the stereocentres. The priorities given to each group to determine the correct structure must be indicated (redrawing the structure for each chiral centre helps). **(4 points)**
    b. Draw a diastereomer of ephedrine. **(2 points)**

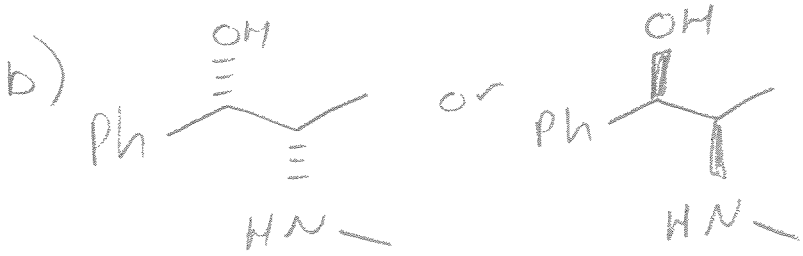


a)



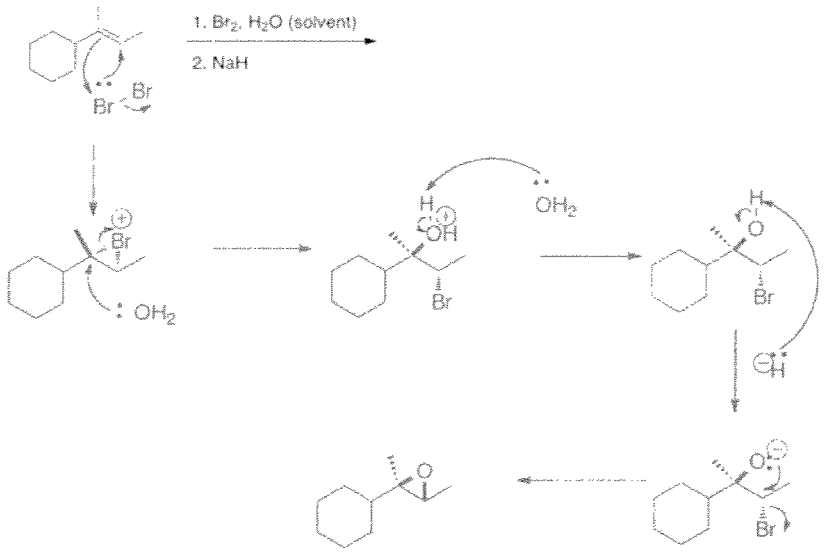


b)

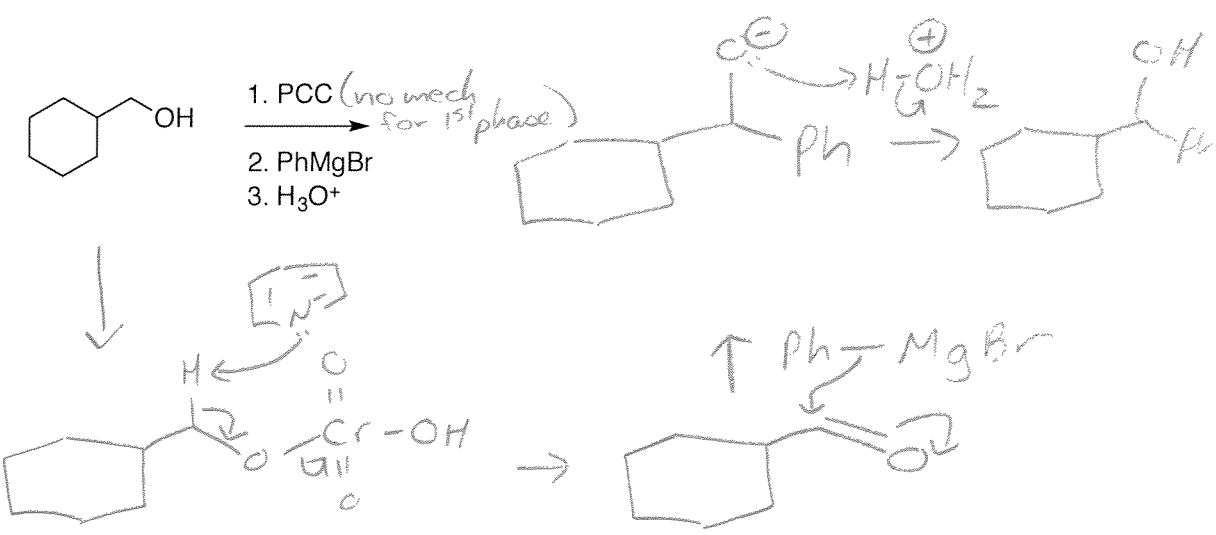


14. Provide a mechanism and the major organic product of each of the following reactions. **(6 points each = 18 points)**

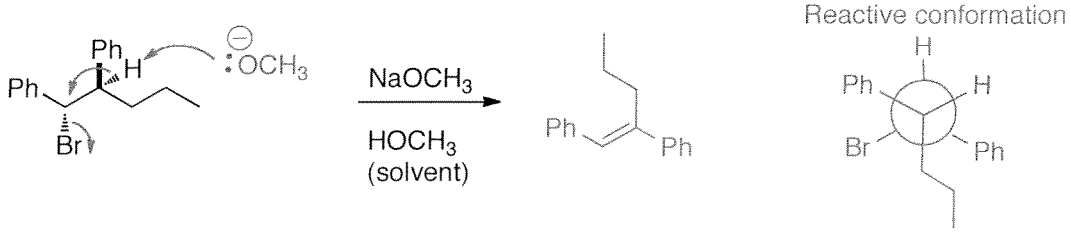
a.



b.



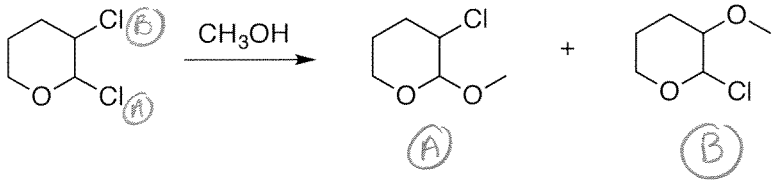
c. Please include a Newman projection of the reactive conformation.

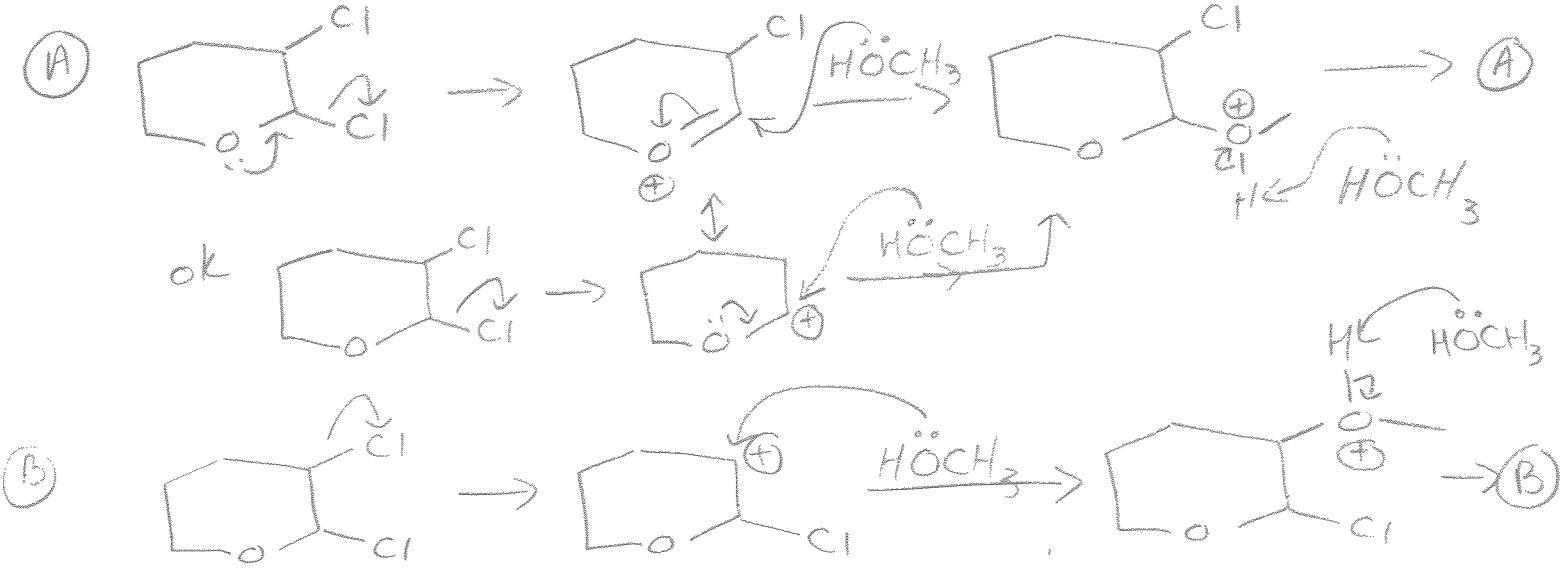


Note that resonance structures should be drawn when resonance is used in an explanation.

15.

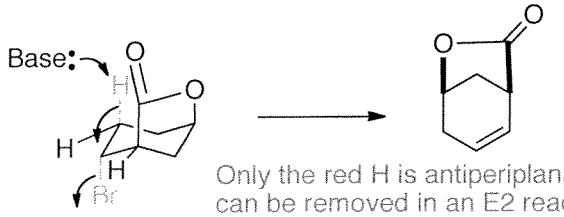
a. Draw a mechanism showing the formation of the each product of the following reaction. **(6 points)**
b. Circle the major product. **(1 point)**
c. Justify your answer in part b. **(2 points)**



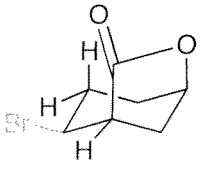


Route A forms a resonance stabilized carbocation which forms faster than the carbocation in B, leading to A as the major product

Bonus! **(3 points)**
Explain the following results. Please draw a mechanism in 3D as part of your answer.



Only the red H is antiperiplanar to the Br and can be removed in an E2 reaction



No proton is A.P.P. to the leaving group and chair flip (change in conformation to the other chair) is impossible because of the ester group