

NAME: _____ Section: _____ Student Number: _____

Spring 2020

Chemistry 2500 Midterm #2A

____/ 60 marks

- INSTRUCTIONS:
- 1) Please read over the test carefully before beginning. You should have 8 pages of questions and a data/periodic table sheet.
 - 2) Unless otherwise stated in the question, explain all of your answers fully. Use diagrams where appropriate. When invoking any argument based on resonance, you must draw all relevant resonance structures.
 - 3) ALL structures must be drawn showing lone pairs, non-zero formal charges and reasonable bond angles – regardless of whether they are expanded, condensed or line-bond. Marks will be deducted for poorly drawn structures.
 - 4) Marks will be deducted for incorrect information added to an otherwise correct answer.
 - 5) If your work is not legible, it will be given a mark of zero.
 - 6) Calculators are not allowed. You are not permitted to have any electronic devices with you during the exam unless authorized by the instructor.
 - 7) You may use a molecular model kit.
 - 8) You have 2 hours to complete this test.

Confidentiality Agreement:

I agree not to discuss (or in any other way divulge) the contents of this exam with (or in the presence of) any student who has not written it until after 5:00 pm Mountain Time on Monday, March 16th, 2020 (the Monday after the official date of the test). I understand that breaking this agreement would constitute academic misconduct, a serious offense with serious consequences. The minimum punishment would be a mark of 0/60 on this exam and removal of the “overwrite midterm mark with final exam mark” option for my grade in this course; the maximum punishment would include expulsion from this university.

Signature: _____

Date: _____

Course: CHEM 2500 (Organic Chemistry I)

Semester: Spring 2020

The University of Lethbridge

Question Breakdown

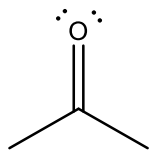
Q1	/ 4
Q2	/ 4
Q3	/ 4
Q4	/ 4
Q5	/ 5
Q6	/ 10
Q7	/ 10
Q8	/ 8
Q9	/ 6
Q10	/ 5

Total	/ 60
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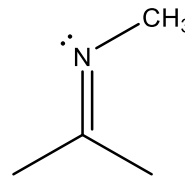
NAME: _____ Section: _____ Student Number: _____

1. For each of the pairs of molecules below, circle the better electrophile and briefly explain your choice. Your explanations must make it clear that you know what the term electrophile means. **[4 marks]**

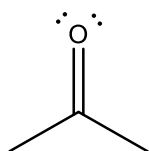
(a)



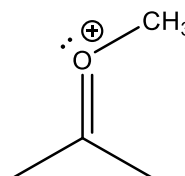
vs.



(b)

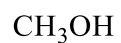


vs.

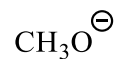


2. For each of the pairs of molecules below, circle the better nucleophile and briefly explain your choice. Your explanations must make it clear that you know what the term nucleophile means. **[4 marks]**

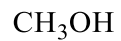
(a)



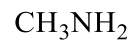
vs.



(b)



vs.



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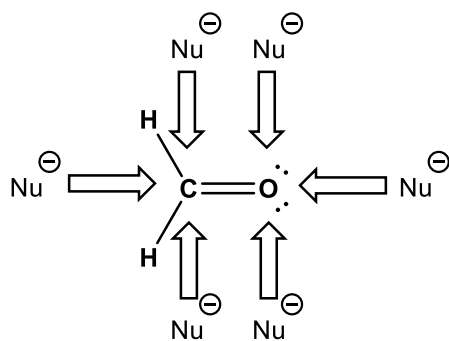
3.

[4 marks]

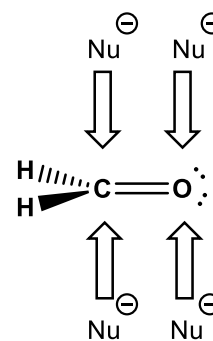
- (a) The drawings below show nucleophiles moving toward an aldehyde from different directions. Assuming each nucleophile continues along its current path, circle all of the nucleophiles that would be able to react with the aldehyde when they hit it. [2 marks]

Please make the simplifying assumption that the aldehyde is not moving.

Marks will be deducted for incorrect circles.



top view of aldehyde

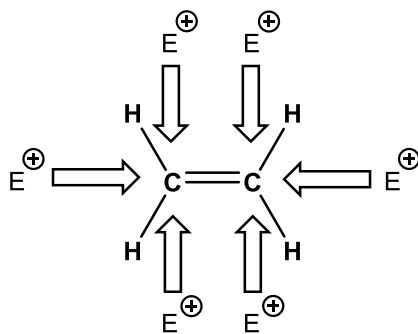


side view of aldehyde

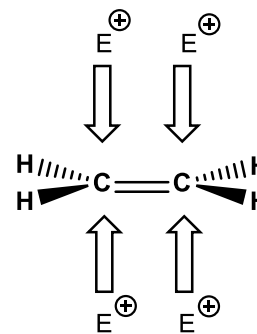
- (b) The drawings below show electrophiles moving toward an alkene from different directions. Assuming each electrophile continues along its current path, circle all of the electrophiles that would be able to react with the alkene when they hit it. [2 marks]

Please make the simplifying assumption that the alkene is not moving.

Marks will be deducted for incorrect circles.



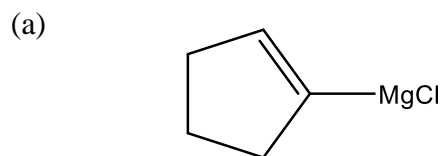
top view of alkene



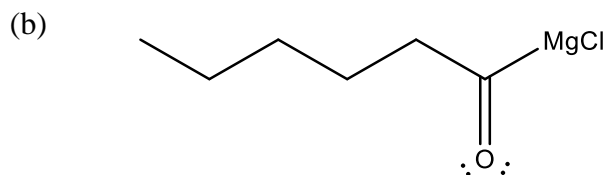
side view of alkene

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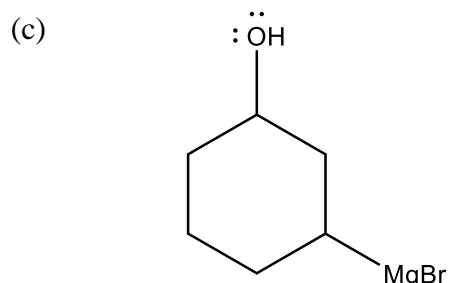
4. Under each potential Grignard reagent, circle "yes" or "no" to indicate whether or not it could be prepared. [4 marks]



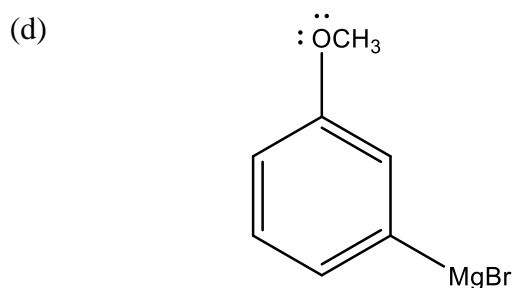
yes / no



yes / no

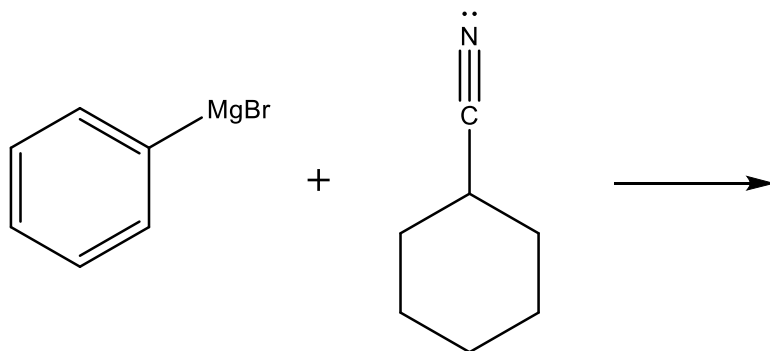


yes / no



yes / no

5. Consider the reaction below: [5 marks]



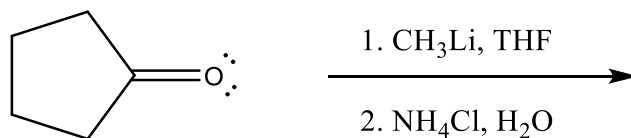
(a) Briefly describe how you would prepare the Grignard reagent shown above. Your answer should be a reaction equation including all essential information. [3 marks]

(b) Complete the diagram for this reaction by adding curved arrows to show electron movement and drawing the product. Do **NOT** assume any work-up steps that are not shown. [2 marks]
Answer directly on the diagram above.

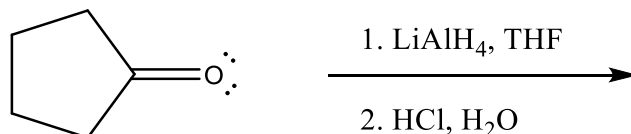
NAME: _____ Section: _____ Student Number: _____

6. Draw the major organic product of each of the following reactions. Clearly show any relevant stereochemistry. If a mixture of enantiomers is formed, write “racemic” next to the product. [10 marks]

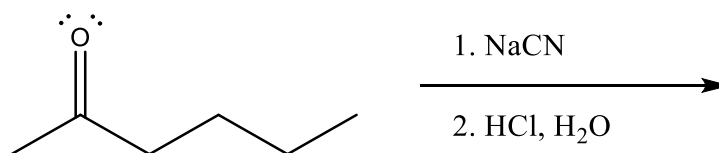
(a)



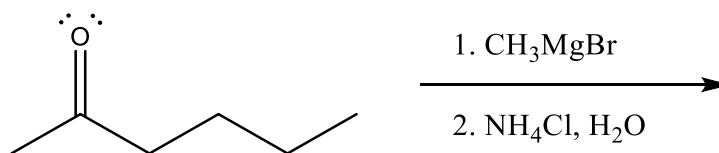
(b)



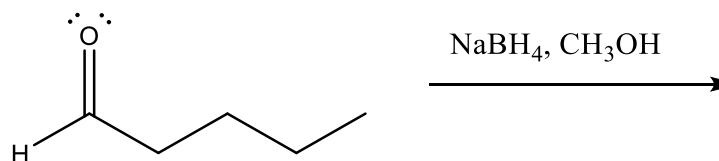
(c)



(d)



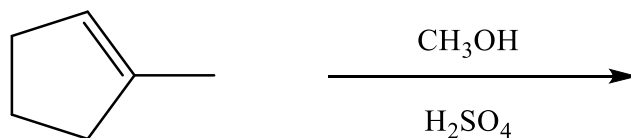
(e)



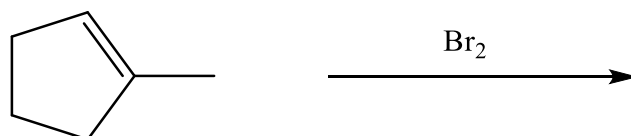
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7. Draw the major organic product of each of the following reactions. Clearly show any relevant stereochemistry. If a mixture of enantiomers is formed, write "racemic" next to the product. **[10 marks]**

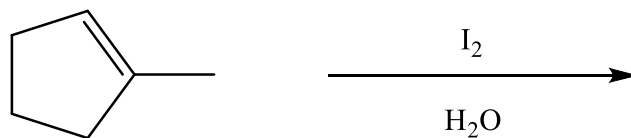
(a)



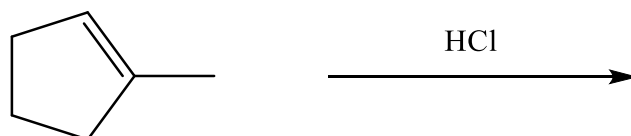
(b)



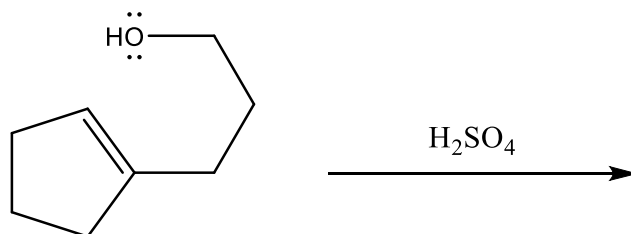
(c)



(d)



(e)



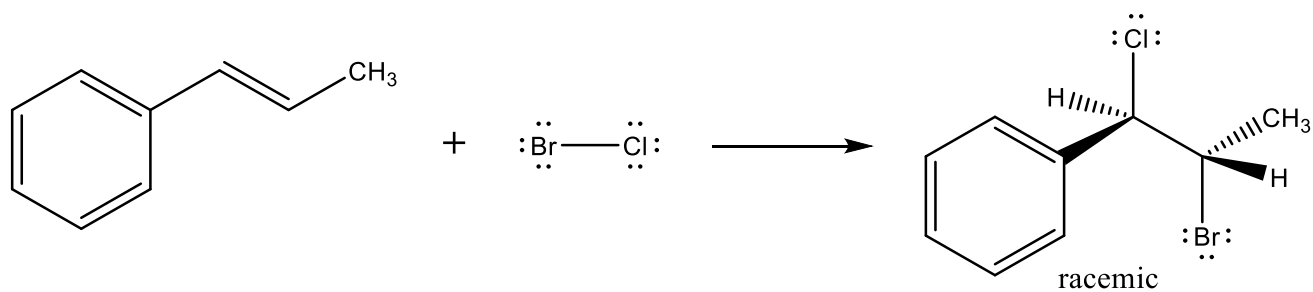
NAME: _____

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Student Number: _____

8. Consider the reaction below:

[8 marks]



(a) Draw a mechanism for this reaction.

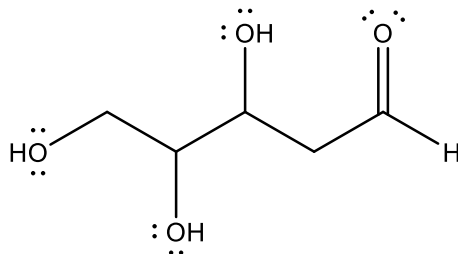
[3 marks]

(b) Explain the regioselectivity of this reaction. In other words, why does each halogen atom wind up attached to the particular carbon atom shown? [3 marks]

(c) Explain the stereospecificity of this reaction. In other words, why is only one diastereomer of product formed? [2 marks]

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9. The linear form of deoxyribose is shown below. **[6 marks]**



Deoxyribose exists primarily in the furanose form (hemiacetal with 5-atom ring).

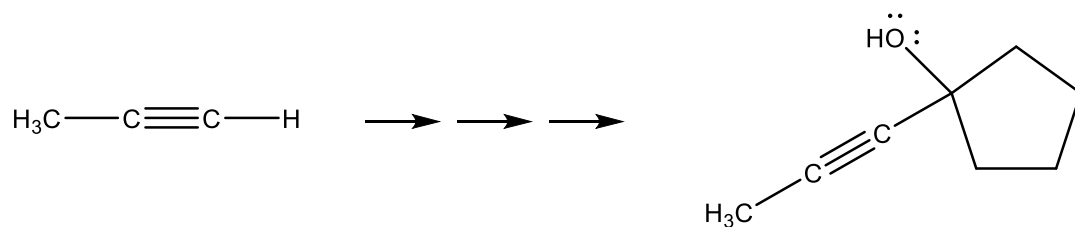
Draw a mechanism showing the acid-catalyzed reaction in which linear deoxyribose is converted to the furanose form.

You may assume the presence of as much H_3O^+ and H_2O as your mechanism requires.

You do NOT need to show stereochemistry.

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10. Show how the alcohol below can be prepared starting with propyne (also shown below).
Your answer should be a series of reaction equations. Please show the product of each step.
*You do **not** need to include mechanisms; however, there will be no penalty for adding them if they help you think.* **[5 marks]**



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Some Useful Data**Principal Functional Group Priority List**

Carboxylic acid

Sulfonic acid

Ester

Acid chloride

Amide

Nitrile

Aldehyde

Ketone

Alcohol

Thiol

Amine

1 **Chem 1000 Standard Periodic Table** **18**

1.0079 H 1																	4.0026 He 2	
6.941 Li 3	9.0122 Be 4												10.811 B 5	12.011 C 6	14.0067 N 7	15.9994 O 8	18.9984 F 9	20.1797 Ne 10
22.9898 Na 11	24.3050 Mg 12	3	4	5	6	7	8	9	10	11	12	26.9815 Al 13	28.0855 Si 14	30.9738 P 15	32.066 S 16	35.4527 Cl 17	39.948 Ar 18	
39.0983 K 19	40.078 Ca 20	44.9559 Sc 21	47.88 Ti 22	50.9415 V 23	51.9961 Cr 24	54.9380 Mn 25	55.847 Fe 26	58.9332 Co 27	58.693 Ni 28	63.546 Cu 29	65.39 Zn 30	69.723 Ga 31	72.61 Ge 32	74.9216 As 33	78.96 Se 34	79.904 Br 35	83.80 Kr 36	
85.4678 Rb 37	87.62 Sr 38	88.9059 Y 39	91.224 Zr 40	92.9064 Nb 41	95.94 Mo 42	(98) Tc 43	101.07 Ru 44	102.906 Rh 45	106.42 Pd 46	107.868 Ag 47	112.411 Cd 48	114.82 In 49	118.710 Sn 50	121.757 Sb 51	127.60 Te 52	126.905 I 53	131.29 Xe 54	
132.905 Cs 55	137.327 Ba 56	La-Lu	178.49 Hf 72	180.948 Ta 73	183.85 W 74	186.207 Re 75	190.2 Os 76	192.22 Ir 77	195.08 Pt 78	196.967 Au 79	200.59 Hg 80	204.383 Tl 81	207.19 Pb 82	208.980 Bi 83	(210) Po 84	(210) At 85	(222) Rn 86	
(223) Fr 87	226.025 Ra 88	Ac-Lr	(265) Rf 104	(268) Db 105	(271) Sg 106	(270) Bh 107	(277) Hs 108	(276) Mt 109	(281) Ds 110	(280) Rg 111	(285) Cn 112	(284) Nh 113	(289) Fl 114	(288) Mc 115	(293) Lv 116	(294) Ts 117	(294) Og 118	
138.906 La 57	140.115 Ce 58	140.908 Pr 59	144.24 Nd 60	(145) Pm 61	150.36 Sm 62	151.965 Eu 63	157.25 Gd 64	158.925 Tb 65	162.50 Dy 66	164.930 Ho 67	167.26 Er 68	168.934 Tm 69	173.04 Yb 70	174.967 Lu 71				
227.028 Ac 89	232.038 Th 90	231.036 Pa 91	238.029 U 92	237.048 Np 93	(240) Pu 94	(243) Am 95	(247) Cm 96	(247) Bk 97	(251) Cf 98	(252) Es 99	(257) Fm 100	(258) Md 101	(259) No 102	(262) Lr 103				

Developed by Prof. R. T. Boeré (updated 2016)