Name: Answer Key
Last First MI

Chemistry 234
Exam 2 (Blue)

Summer 2018 Dr. J. Osbourn

Instructions: The first 14 questions of this exam should be answered on the provided Scantron. You must use a pencil for filling in the Scantron sheet. Ensure all erasures are complete. Any questions left blank will be marked incorrect. Answer the remaining questions on the exam itself. Show all work and provide complete explanations.

Please write your name on:

- **The first page (Exam Cover Page)**
- **The second page (Grading Page)**
- **The Scantron Sheet** – Circle your Last Name

Please bubble in your WVU Student ID Number on your Scantron sheet.

The Periodic Table

1 IA												13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1 H 1.01	2 IIA																2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.1	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.6	53 I 126.9	54 Xe 131.29
55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac^ (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (264)	108 Hs (265)	109 Mt (268)	110 Ds (271)	111 Rg (272)							

	58	59	60	61	62	63	64	65	66	67	68	69	70	71
*	Ce 140.1	Pr 140.9	Nd 144.2	Pm (145)	Sm 150.4	Eu 152.0	Gd 157.3	Tb 158.9	Dy 162.5	Ho 164.9	Er 167.3	Tm 168.9	Yb 173.0	Lu 175.0
^	90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

Diazonium Ion Displacement Reactions

$Ar-N\equiv N^{\oplus}\ Cl^{\ominus}$ +

H_2O	$\longrightarrow$ $Ar-OH$	$CuCN$	$\longrightarrow$ $Ar-CN$
$CuNO_2$	$\longrightarrow$ $Ar-NO_2$	H_3PO_2	$\longrightarrow$ $Ar-H$
$CuBr$	$\longrightarrow$ $Ar-Br$	$CuCl$	$\longrightarrow$ $Ar-Cl$
KI	$\longrightarrow$ $Ar-I$	HBF_4	$\longrightarrow$ $Ar-F$

Please do not rip off this cover sheet

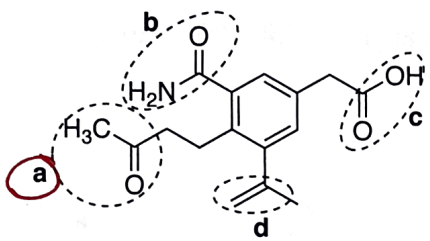
Multiple-Choice

Choose the best answer for each of the following questions. Record each answer on your Scantron sheet. Additionally, circle/write each answer on your exam. *(2 points each)*

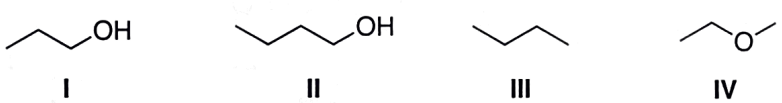
1. Which of the following reagents can successfully carry out the transformation shown below. *Bubble in the letters for all that apply.*

a	b	c	d
$Na_2Cr_2O_7$ H_2SO_4	1. DIBAL-H -78 °C 2. H_2O	1. $NaBH_4$ CH_3OH 2. H_2CrO_4	1. LAH 2. H_2O 3. PCC

2. If the following molecule is subjected to a sodium borohydride reduction, which functional group would get reduced?



3. Which of the following correctly has the molecules ranked from lowest boiling point to highest boiling point?

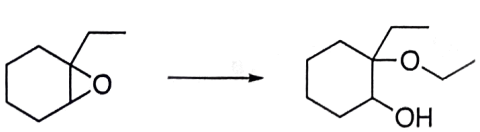


I II III IV

a. III < II < I < IV
b. II < III < IV < I
c. III < II < IV < I
d. III < IV < I < II
e. None of the above

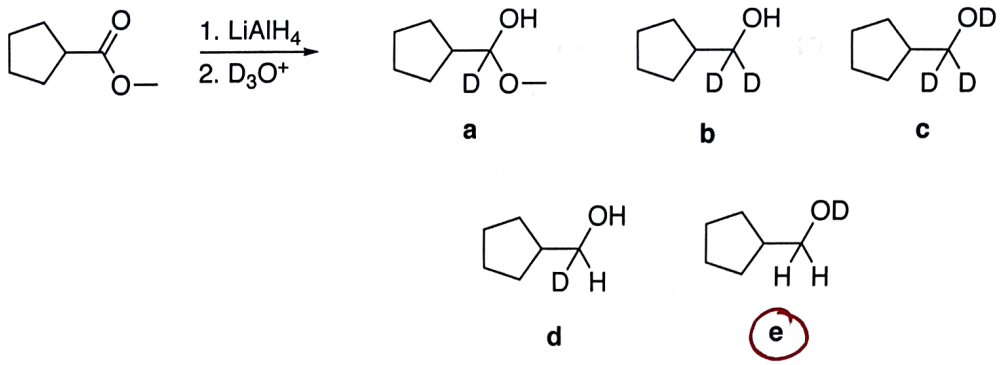
III < IV < I < II

4. Select the appropriate reagent to accomplish the following transformation.

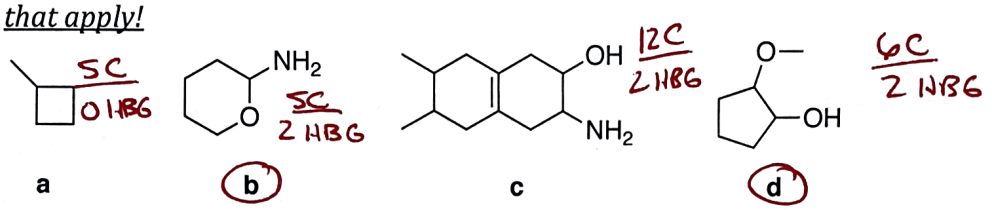


a	b	c	d
1. $NaOCH_2CH_3$ 2. H_3O^+	1. NaOH 2. H_3O^+	H_2SO_4 $HOCH_2CH_3$	H^+ H_2O

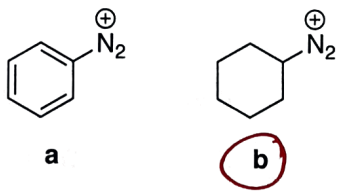
5. What is the major product of the following reaction?



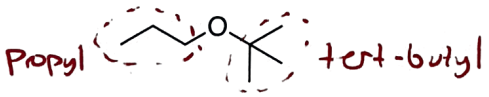
6. Which of the following molecules do you expect to be water soluble? *Bubble in the letters for all that apply!*



7. Which one of the following is the least stable?

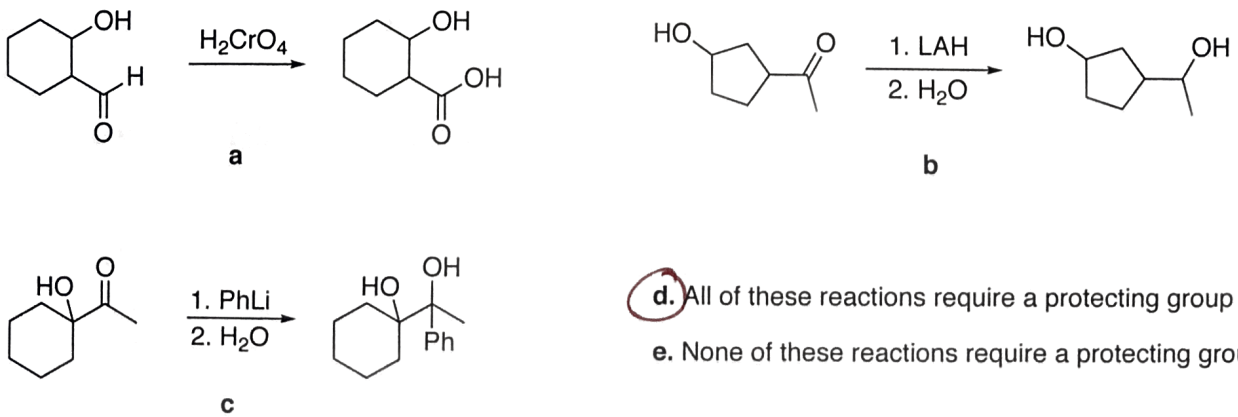


8. What is the common name for the molecule shown below?



a. tert-butyl ether
b. tert-butyl propyl ether
c. ethyl tert-butyl ether
d. ethyl isopropyl ether
e. none of the above

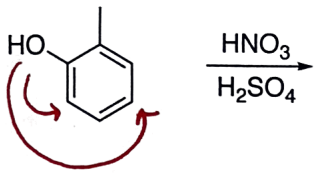
9. Which reaction below would require the use of a protecting group to be carried out successfully?

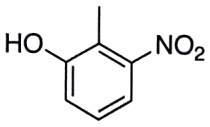


d. All of these reactions require a protecting group

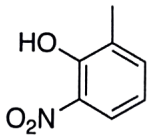
e. None of these reactions require a protecting group

10. What is/are the major product(s) for the following reaction. *Bubble in the letters for all that apply.*

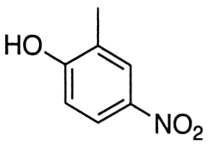




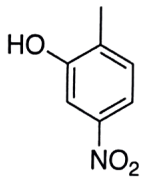
a



b

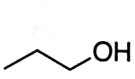


c

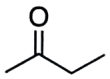


d

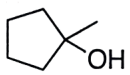
11. Which of the following compounds can be further oxidized by H_2CrO_4? *Bubble in the letters for all that apply.*



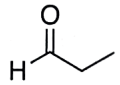
a



b

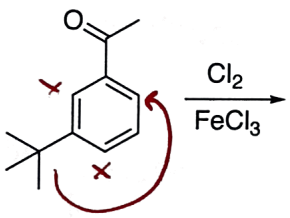


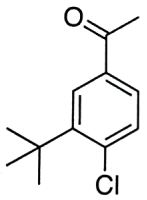
c



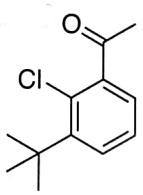
d

12. What is/are the major product(s) for the following reaction. *Bubble in the letters for all that apply.*

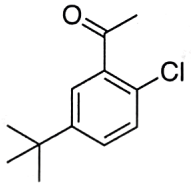




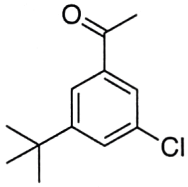
a



b

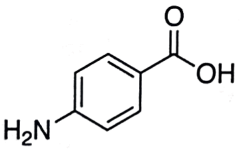


c

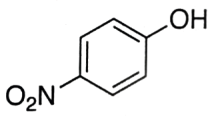


d

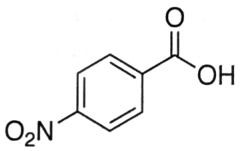
13. Which one of the following compounds is the most acidic?



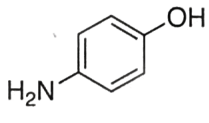
a



b

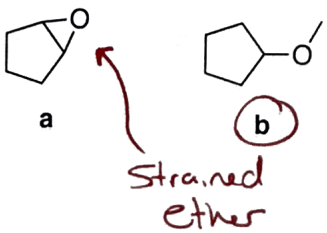


c



d

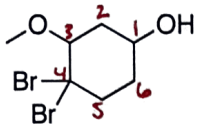
14. Which one of the following is the least reactive?



BLUE

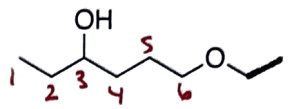
Completion Section: Answer the remaining questions on the exam itself. Read the questions carefully and provide complete explanations.

15. Provide the IUPAC name for each compound shown below. *(3 points each)*

a) 

-1 wrong #
-1 wrong abc order
-1 spelling

4,4-dibromo-3-methoxycyclohexanol
+1 +1 +1

b) 

6-ethoxy-3-hexanol
or
hexan-3-ol

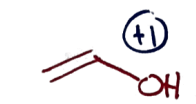
+1 Correct #
+1 Correct parent
+1 Correct substituents

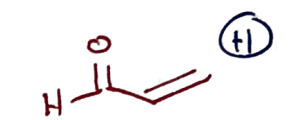
okay to have 1-ol

16. Draw a representative structure for each of the following. *(1 point each)*

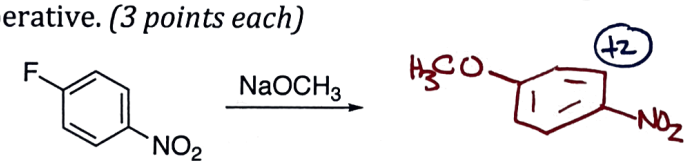

benzyne


furan

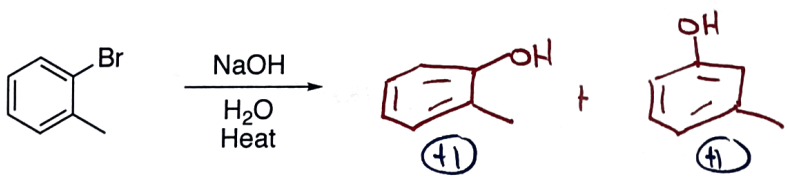

vinyl alcohol


α,β-unsaturated aldehyde

17. Predict the product(s) for each of the following reactions. Then, indicate the mechanism that is operative. *(3 points each)*

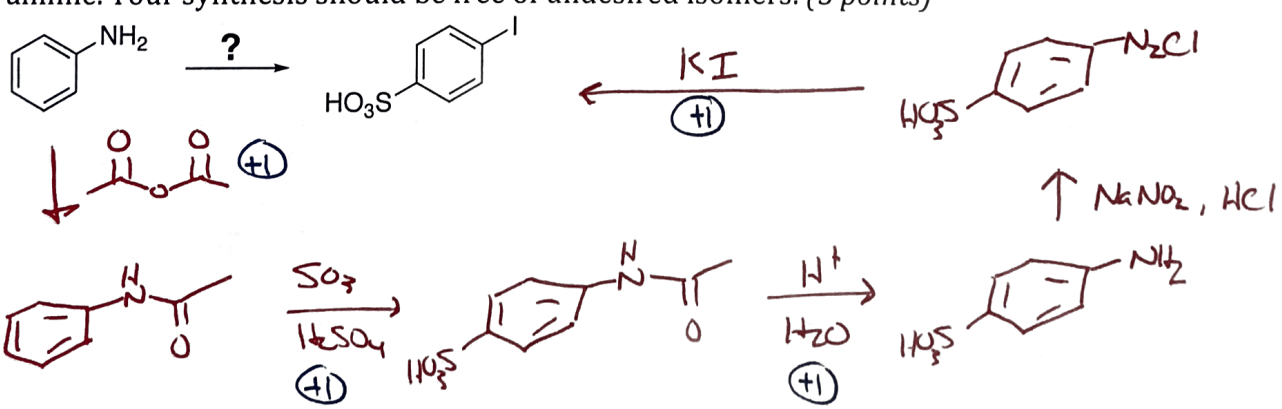
a) 

+1
a. EAS
b. Addition-Elimination
c. Benzyne

b) 

a. EAS
b. Addition-Elimination
c. Benzyne
+1

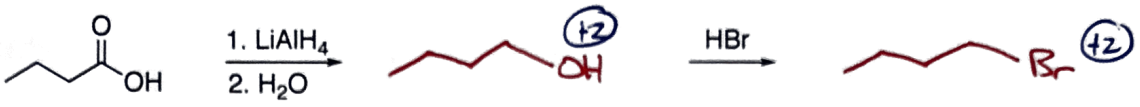
18. Design a reasonable synthesis for the para-disubstituted benzene shown below starting with aniline. Your synthesis should be free of undesired isomers. *(5 points)*

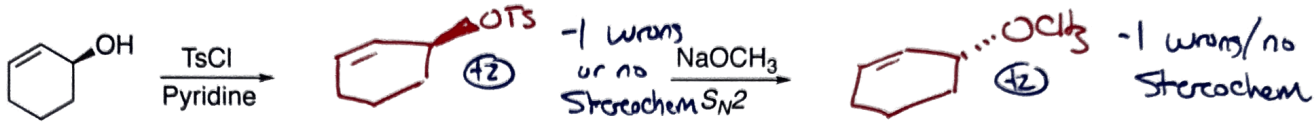


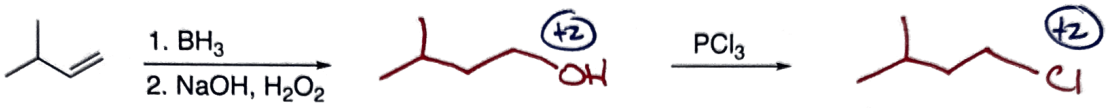
-2 if reagents are correct, but order is messed up.

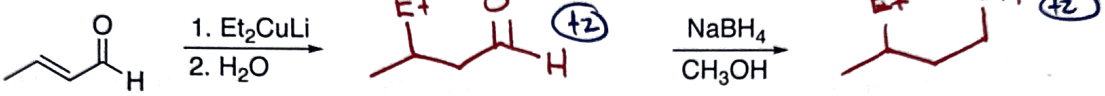
BLUE

19. Predict the major organic product(s) for each reaction below. *Show stereochemistry in reaction b.* *(2 points each)*

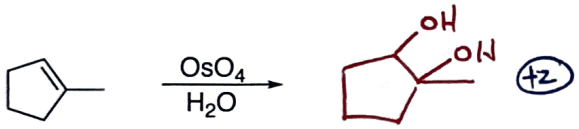
a. 

b. 

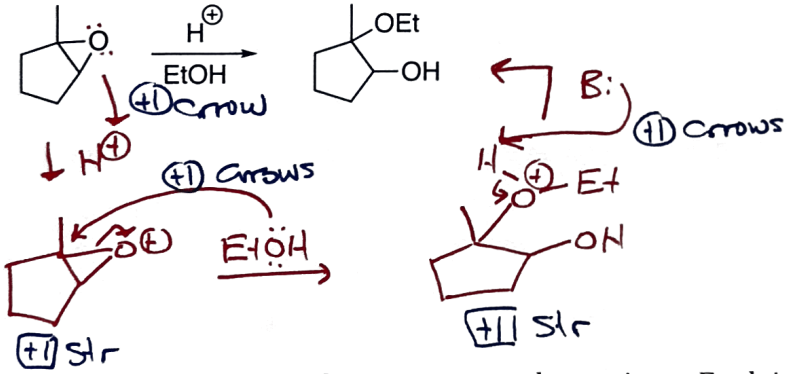
c. 

d. 

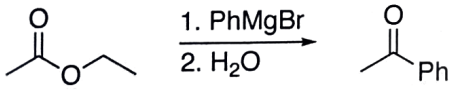
e. 

f. 

20. Show the complete electron pushing mechanism for the following reaction. *(5 points)*

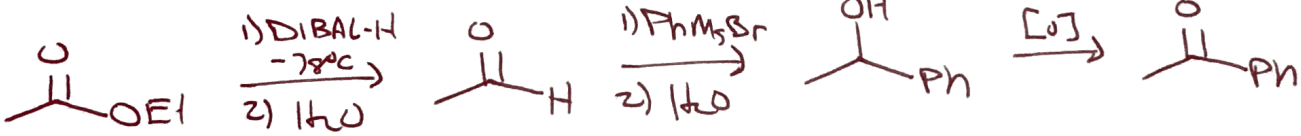


21. The following reaction does not proceed as written. Explain the problem and provide a suitable synthetic alternative to prepare the desired product from the given starting material. *(4 points)*



The Grignard reagent will add 2x to the ester to give a 3° alcohol. +2

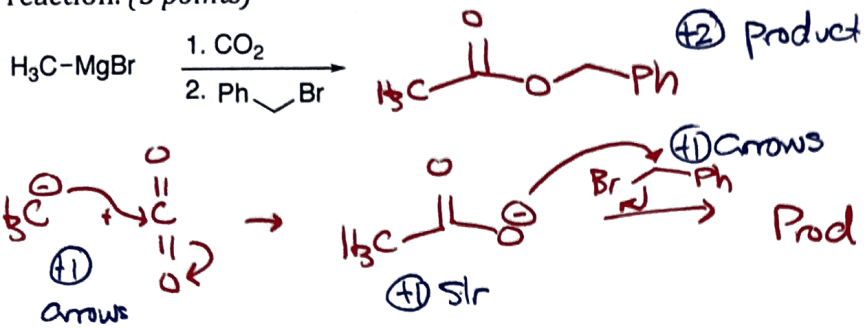
Alternative Route:



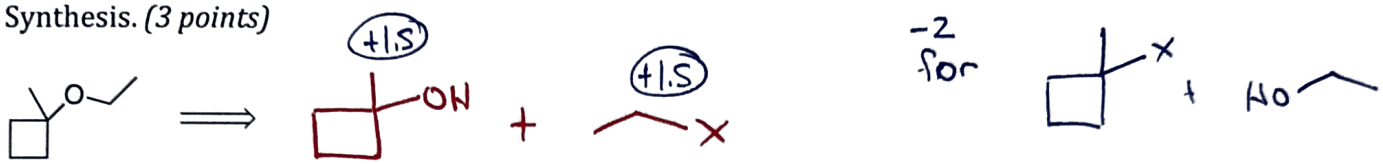
+2 valid alternative route

BLUE

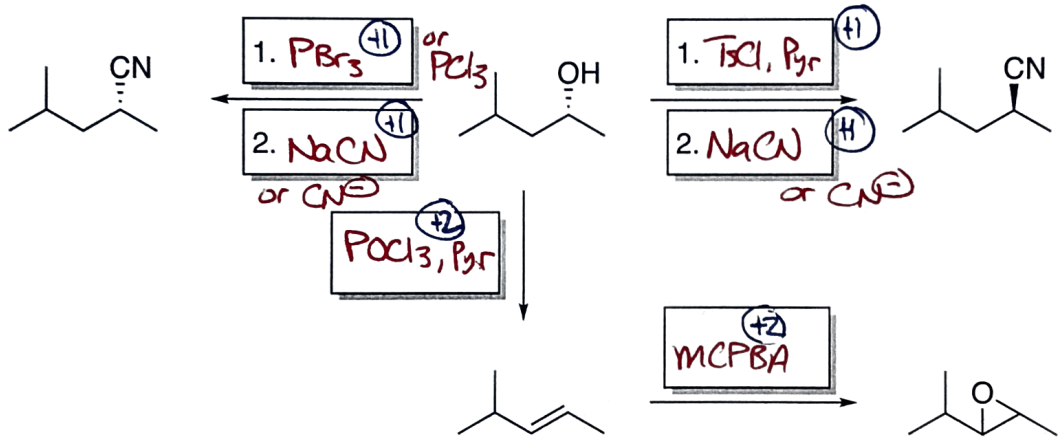
22. Predict the product and provide the complete electron pushing mechanism for the following reaction. *(5 points)*



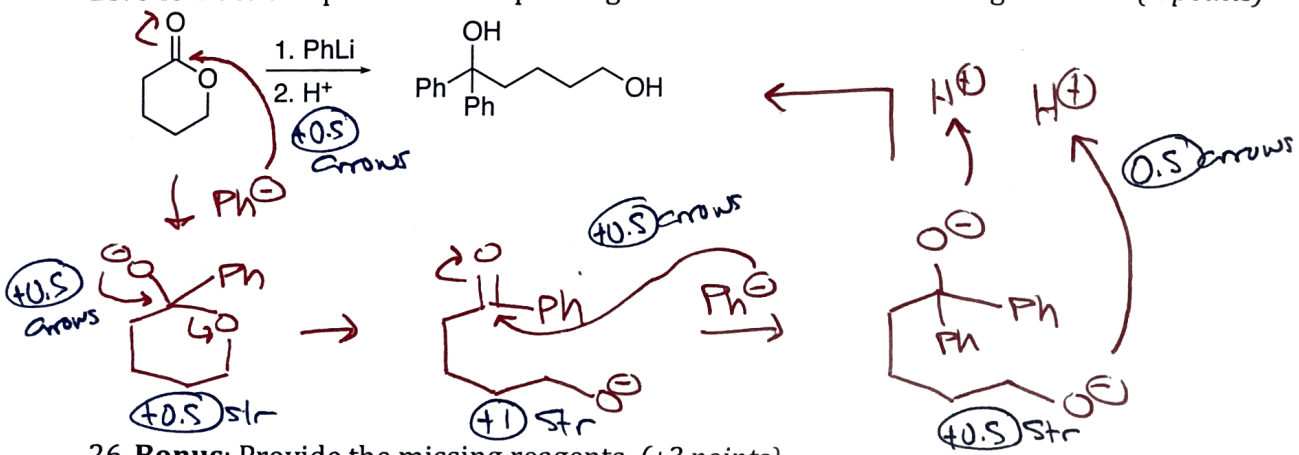
23. Provide the best set of starting materials to prepare the following ether via the Williamson Ether Synthesis. *(3 points)*



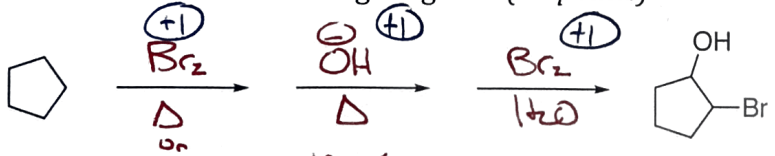
24. Provide the missing reagents for each transformation shown below. *(8 points)*



25. Show the complete electron pushing mechanism for the following reaction. *(4 points)*



26. **Bonus**: Provide the missing reagents. *(+3 points)*



accept any base
don't have to have Δ