

CHEMISTRY 302
EXAM 2
11:15 AM / SECTION 4
30 MARCH 2012

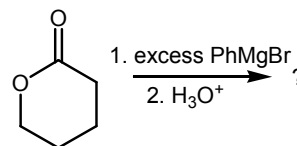
Note: Your exam should consist of 5 pages including the cover page and grade tabulation sheet. Skim the entire exam, and solve the easiest problems first. Exams not returned when time is called will not be graded.

1 1A																	18 8A																												
1 H Hydrogen 1.01																	2 He Helium 4.00																												
3 Li Lithium 6.94	4 Be Beryllium 9.01															13 B Boron 10.81	14 C Carbon 12.01	15 N Nitrogen 14.01	16 O Oxygen 16.00	17 F Fluorine 19.00	18 Ne Neon 20.18																								
11 Na Sodium 22.99	12 Mg Magnesium 24.31	3 B Boron 10.81	4 Be Beryllium 9.01															13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95																						
19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.39	31 Ga Gallium 69.72	32 Ge Germanium 72.61	33 As Arsenic 74.92	34 Se Selenium 78.96	35 Br Bromine 79.90	36 Kr Krypton 83.80																												
37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.60	53 I Iodine 126.90	54 Xe Xenon 131.29																												
55 Cs Cesium 132.91	56 Ba Barium 137.33	57 La Lanthanum 138.91	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.84	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)																												
87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (269)	109 Mt Meitnerium (268)																																					
<p>* If this number is in parentheses, then it refers to the atomic mass of the most stable isotope.</p>																																													
<table><tr><td>58 Ce Cerium 140.12</td><td>59 Pr Praseodymium 140.91</td><td>60 Nd Neodymium 144.24</td><td>61 Pm Promethium (145)</td><td>62 Sm Samarium 150.36</td><td>63 Eu Europium 151.96</td><td>64 Gd Gadolinium 157.25</td><td>65 Tb Terbium 158.93</td><td>66 Dy Dysprosium 162.50</td><td>67 Ho Holmium 164.93</td><td>68 Er Erbium 167.26</td><td>69 Tm Thulium 168.93</td><td>70 Yb Ytterbium 173.04</td><td>71 Lu Lutetium 174.97</td></tr><tr><td>90 Th Thorium 232.04</td><td>91 Pa Protactinium 231.04</td><td>92 U Uranium 238.03</td><td>93 Np Neptunium (237)</td><td>94 Pu Plutonium (244)</td><td>95 Am Americium (243)</td><td>96 Cm Curium (247)</td><td>97 Bk Berkelium (247)</td><td>98 Cf Californium (251)</td><td>99 Es Einsteinium (252)</td><td>100 Fm Fermium (257)</td><td>101 Md Mendelevium (258)</td><td>102 No Nobelium (259)</td><td>103 Lr Lawrencium (262)</td></tr></table>																		58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.97	90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)
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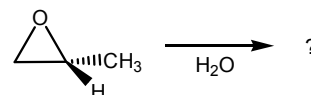
PLEASE DO NOT OPEN THIS EXAM UNTIL YOU ARE INSTRUCTED TO DO SO.

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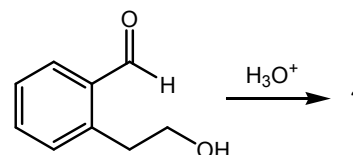
1. (12 pts) Using curved arrow notation, write a complete mechanism for the reaction at right and predict the structure of the product. If an intermediate is resonance stabilized, it is not necessary to draw all its resonance structures.



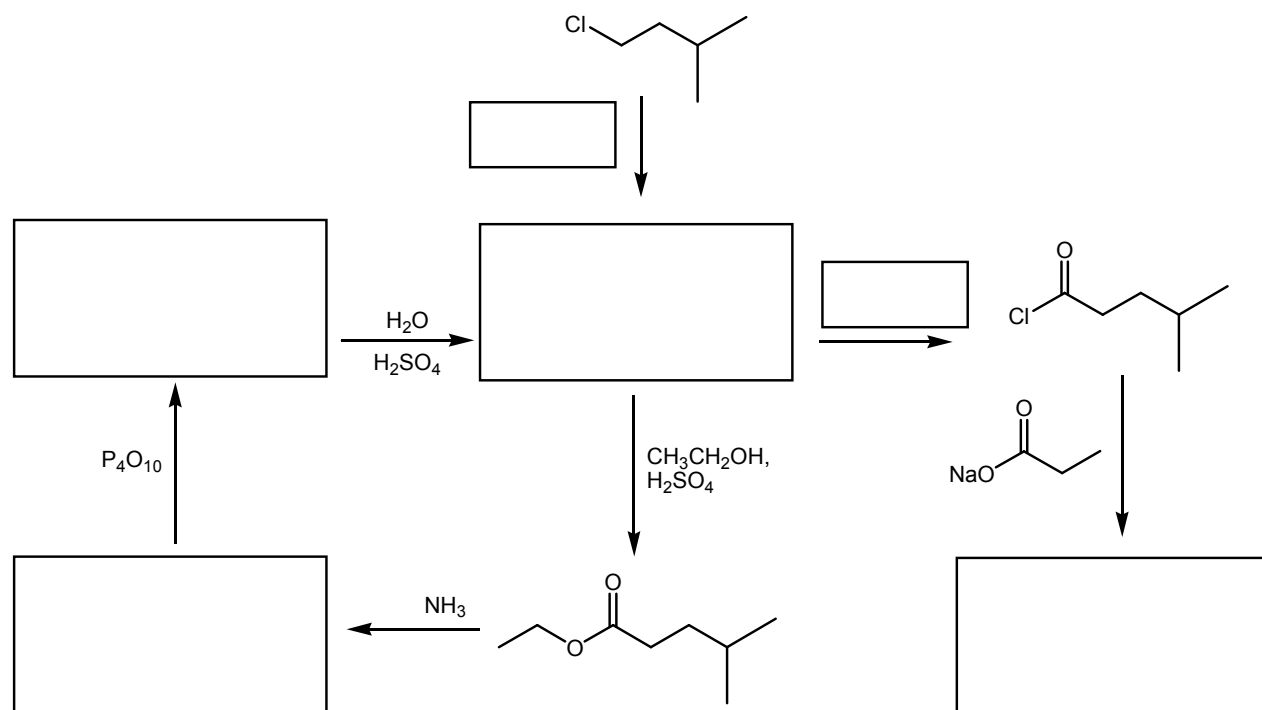
2. (12 pts) Hydrolysis of (*R*)-propylene oxide (at right) produces a chiral molecule. Write a complete mechanism for the H₃O⁺ catalyzed reaction. Write a complete mechanism for the HO⁻ catalyzed reaction. In each case, clearly draw the product in 3D.



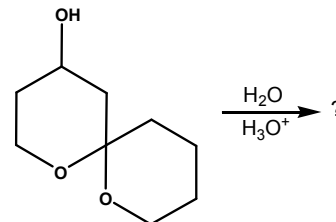
3. (8 pts) Intramolecular hemiacetal formation can be catalyzed by H₃O⁺. Using curved arrow notation, write a complete mechanism for the reaction at right and predict the structure of the product. If an intermediate is resonance stabilized, it is not necessary to draw all its resonance structures.



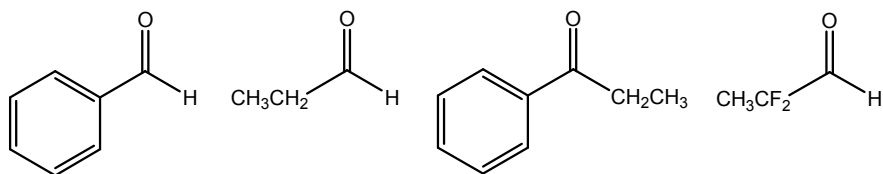
4. (18 pts) Fill in the missing reagents/reactants/products in the scheme below.



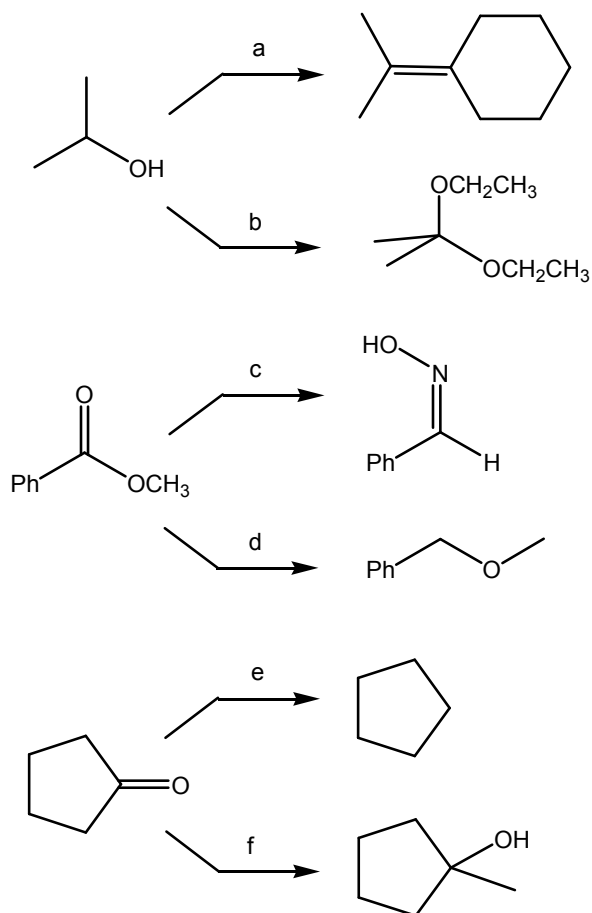
5. (12 pts) Recently researchers have synthesized (4*S*,6*S*)-4-hydroxy-1,7-dioxaspiro-[5.5]undecane, a pheromone of the olive fly. Show a curved arrow mechanism for the complete acid-catalyzed hydrolysis of this molecule.



6. (10 pts) Arrange the following compounds in order of increasing reactivity with a nucleophile (1 = least reactive). Clearly explain the order.



7. (28 pts) Indicate what reagents you would use to complete the following syntheses, assuming all necessary reagents are available.



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Page	Points	Score
2	32	
3	30	
4	38	
Total	100	