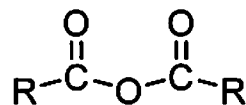
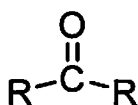
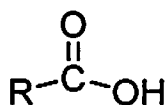


Name: _____

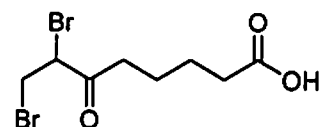
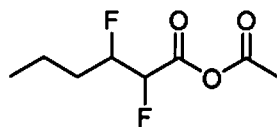
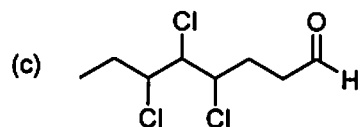
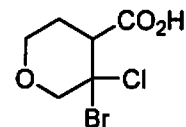
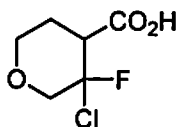
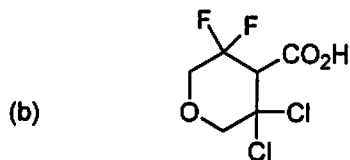
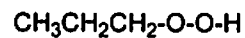
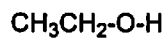
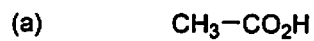
If you do not want your graded exam placed in the box outside my office, then check here
1-10) are True or False (10pts)

- 1) Carboxylic acid derivatives are compounds that can be hydrolyzed to produce carboxylic acids.
- 2) (*Paying very close attention to detail*) $\text{CH}_3\text{CH}_2\text{CN}$ is correctly IUPAC named as PROPANNITRILE.
- 3) Exothermic reactions have late transition states (according to Hammond).
- 4) KMnO_4 will convert acid chlorides to aldehydes.
- 5) Esters are more reactive than anhydrides in nucleophilic acyl substitution reactions.
- 6) Carboxylic acids can be reduced all the way to primary amides by using an excess of LiAlH_4 followed by H_3O^+ .
- 7) Nucleophilic acyl substitution reactions proceed through a one-step (concerted) mechanism.
- 8) Oxidative cleavage of hex-3-yne produces ethanoic acid.
- 9) Lactones are cyclic amides.
- 10) Ester hydrates have the same number of oxygen atoms as anhydrides.

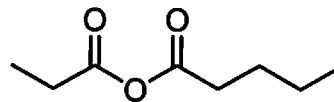
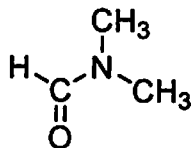
11-13) Name the general classes (*functional groups*) of these organic compounds. (3pts)



14) Circle the *strongest* acid in the following threesomes. (3pts)



15) Name the following molecules in IUPAC acceptable terms. (3+3=6pts)

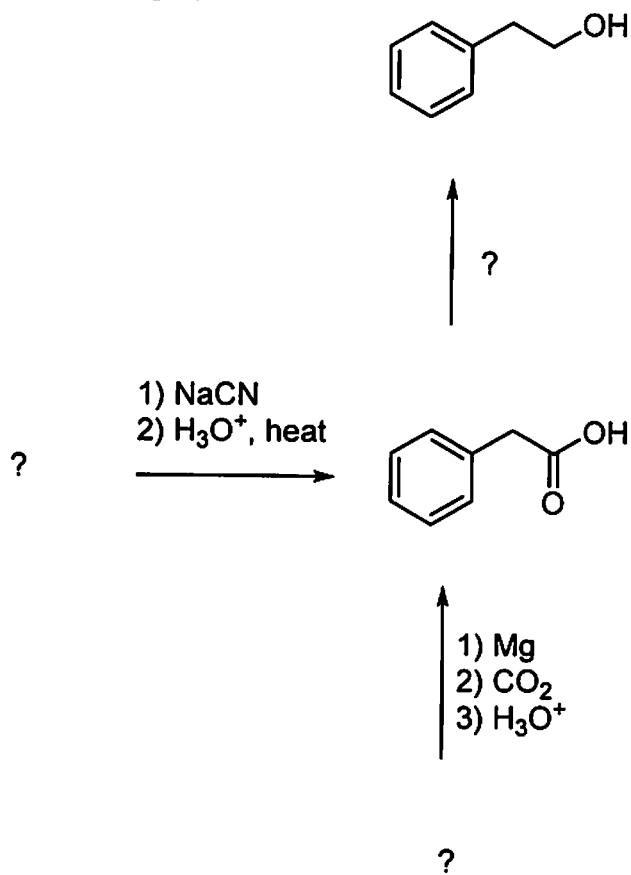


16) Draw the following molecules in line angle (*stick figure*) form.
(3+3=6pts)

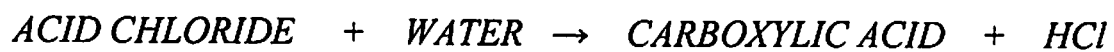
Ethylbutanoate

2-Methylpropanoylfluoride

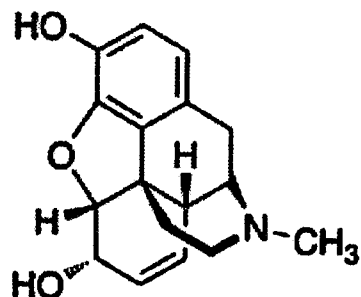
17) Fill in the missing starting materials, and reagents, for these three transformations. (2+2+2=6pts)



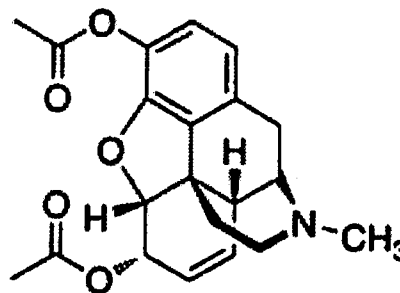
18) (4pts) Write the mechanism (*i.e. curly arrows*) for the reaction of:



19) (1+1+2+2=6pts) The following two molecules are “opioids”, meaning they bind to the opioid receptors in the brain. They can provide significant pain relief (and also a variety of other desirable / undesirable side effects). Heroin is estimated to be about three times more potent than morphine.



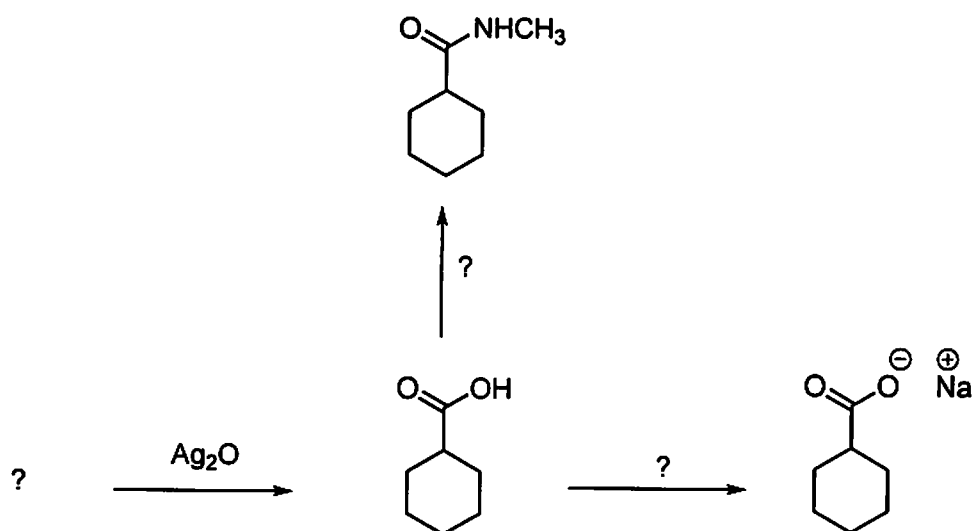
morphine



heroin

- Which molecule contains ester functional groups?
- For *morphine*, indicate which Hydrogen atom is most acidic.
- Provide reagents to convert *morphine* \rightarrow *heroin*.
- Provide reagents to convert *heroin* \rightarrow *morphine*.

20) Fill in the missing starting material, and reagents, for these three transformations. (2+2+2=6pts)



****BONUS QUESTION (1+1=2 points)****

Provide one practical **advantage** of using reagents such as Thionyl Chloride (or Oxalyl Chloride) to make acid chlorides.

Provide one practical **disadvantage** of using a reagent such as Diazomethane to make methyl esters.

hydrogen 1 H 1.0079	beryllium 4 Be 9.0122	lithium 3 Li 6.941	sodium 11 Na 22.990	potassium 19 K 39.098	calcium 20 Ca 40.078	strontium 38 Sr 87.62	barium 56 Ba 137.33	cesium 55 Cs 132.91	francium 87 Fr [223]	scandium 21 Sc 44.956	titanium 22 Ti 47.887	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krrypton 36 Kr 83.80	rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29	barium 56 Ba 137.33	lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04	cesium 55 Cs 132.91	barium 56 Ba 137.33	lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	wolfram 74 W 183.84	reynoldium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]	actinium 87 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]	bohrium 103 Bh [264]	hassium 104 Hs [265]	meitnerium 105 Mt [268]	darmstadtium 106 Ds [271]	roentgenium 107 Rg [272]	copernicium 108 Cn [285]	nihonium 109 Nh [286]	flerovium 110 Fl [289]	tennessine 111 Ts [294]	oganesson 112 Og [294]	unbinidium 113 Uub [287]	ununbium 114 Uub [288]	ununtrium 115 Uut [288]	ununquadium 116 Uuq [289]	ununpentium 117 Uup [289]	ununhexium 118 Uuh [289]	ununseptium 119 Uus [289]	ununoctium 120 Uuo [289]
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* Lanthanide series

** Actinide series

lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]

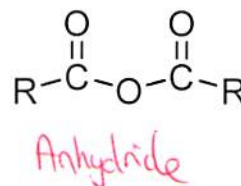
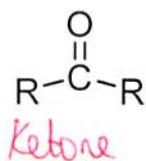
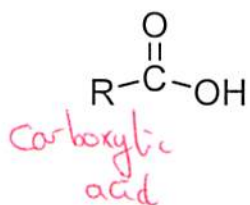
Name: Seamus Halways

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1-10) are True or False (10pts)

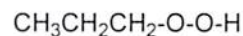
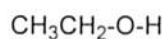
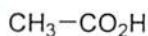
- 1) Carboxylic acid derivatives are compounds that can be hydrolyzed to produce carboxylic acids. True
- 2) (*Paying very close attention to detail*) $\text{CH}_3\text{CH}_2\text{CN}$ is correctly IUPAC named as PROPANNITRILE. F
- 3) Exothermic reactions have late transition states (according to Hammond). F
- 4) KMnO_4 will convert acid chlorides to aldehydes. F
- 5) Esters are more reactive than anhydrides in nucleophilic acyl substitution reactions. F
- 6) Carboxylic acids can be reduced all the way to primary amides by using an excess of LiAlH_4 followed by H_3O^+ . F
- 7) Nucleophilic acyl substitution reactions proceed through a one-step (concerted) mechanism. F
- 8) Oxidative cleavage of hex-3-yne produces ethanoic acid. F
- 9) Lactones are cyclic amides. F
- 10) Ester hydrates have the same number of oxygen atoms as anhydrides. True

11-13) Name the general classes (*functional groups*) of these organic compounds. (3pts)

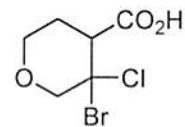
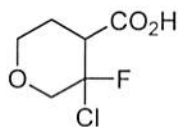
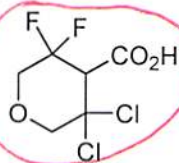


14) Circle the *strongest* acid in the following threesomes. (3pts)

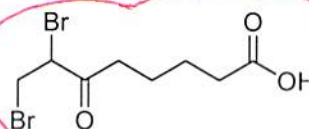
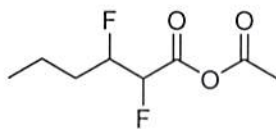
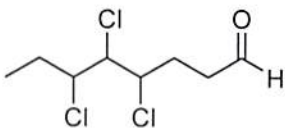
(a)



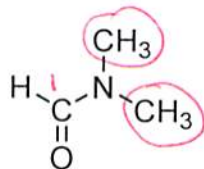
(b)



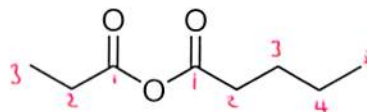
(c)



15) Name the following molecules in IUPAC acceptable terms. (3+3=6pts)



N,N-dimethylmethanamide

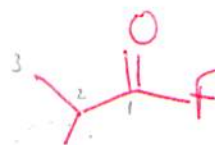


Pentanoic Propanoic Anhydride

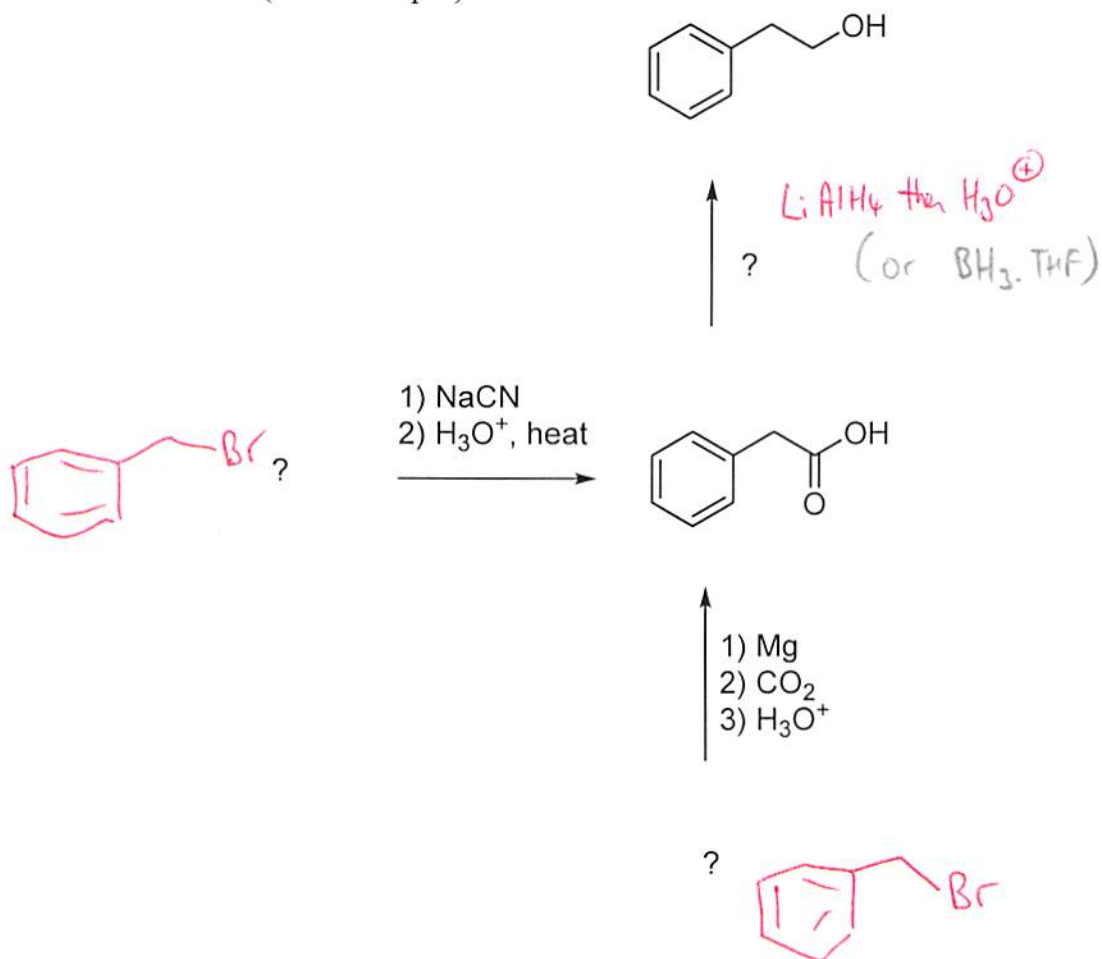
16) Draw the following molecules in line angle (*stick figure*) form. (3+3=6pts)

Ethylbutanoate

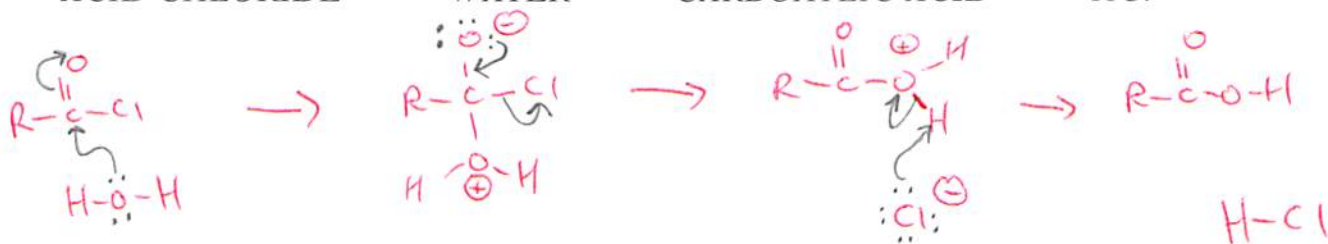
2-Methylpropanoyl fluoride



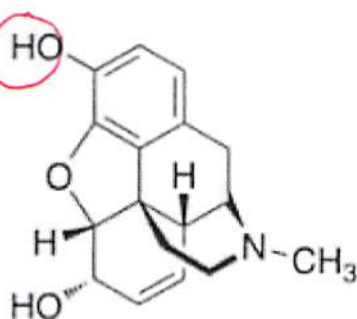
17) Fill in the missing starting materials, and reagents, for these three transformations. (2+2+2=6pts)



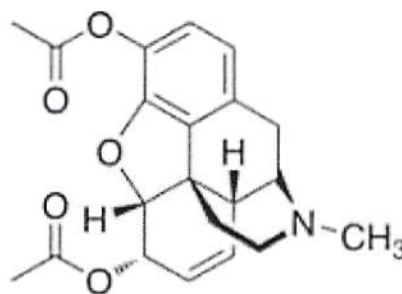
18) (4pts) Write the mechanism (*i.e.* curly arrows) for the reaction of:



19) (1+1+2+2=6pts) The following two molecules are “opioids”, meaning they bind to the opioid receptors in the brain. They can provide significant pain relief (and also a variety of other desirable / undesirable side effects). Heroin is estimated to be about three times more potent than morphine.



morphine



heroin

a) Which molecule contains ester functional groups?

b) For *morphine*, indicate which Hydrogen atom is most acidic.

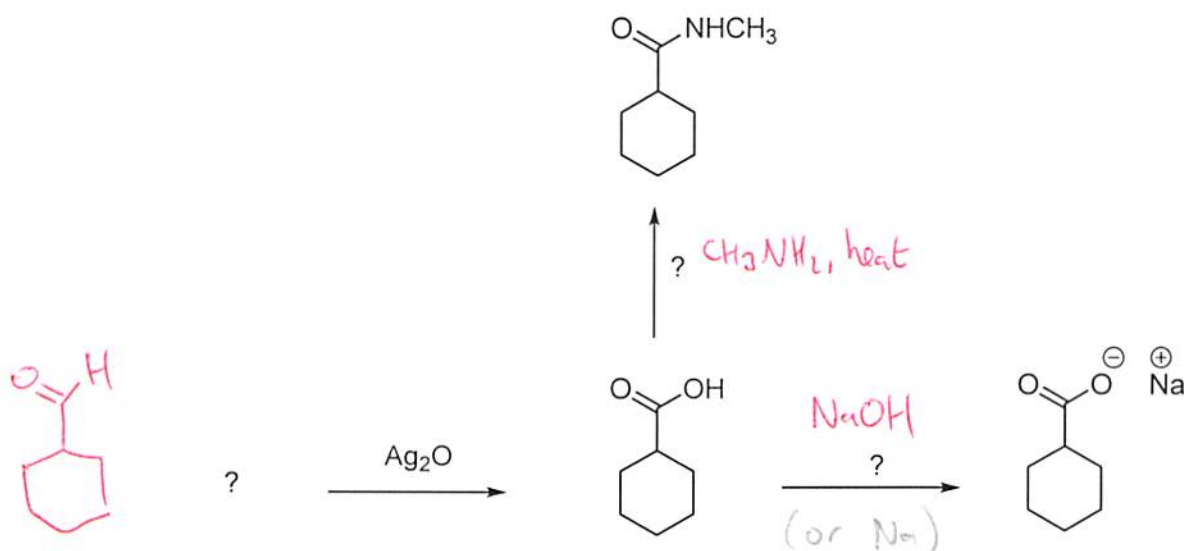
c) Provide reagents to convert *morphine* → *heroin*.

Alcohol → Ester so 2 equiv CH_3COCl (or 2 $\text{CH}_3\text{COOH}, \text{H}^+$)
(or 2 $\text{CH}_3\text{CO}_2\text{R}$)

d) Provide reagents to convert *heroin* → *morphine*.

Ester → Alcohol so 2 equiv H_2O (H^+ or OH^-)
(or 2 ROH, H^+)
or 2 LiAlH_4 , then H_2O
or 2 any good nucleophile, H^+)

20) Fill in the missing starting material, and reagents, for these three transformations. (2+2+2=6pts)



****BONUS QUESTION (1+1=2 points)****

Provide one practical **advantage** of using reagents such as Thionyl Chloride (or Oxalyl Chloride) to make acid chlorides.

The by-products from the reaction are SO_2 & HCl , which are both gases, and so will bubble away from your desired product. This means minimal further purification of your product is needed.

Provide one practical **disadvantage** of using a reagent such as Diazomethane to make methyl esters.

CH_2N_2 is a toxic, highly reactive (explosive!) reagent that is very shock sensitive, and needs special equipment and careful handling for safe use.