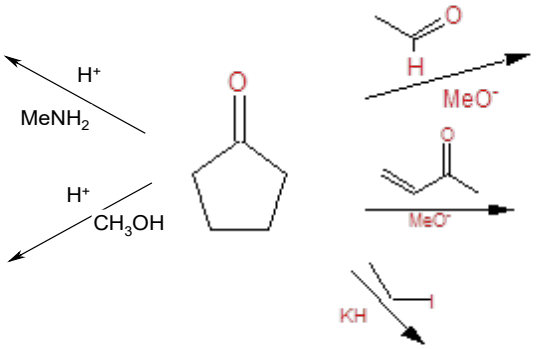
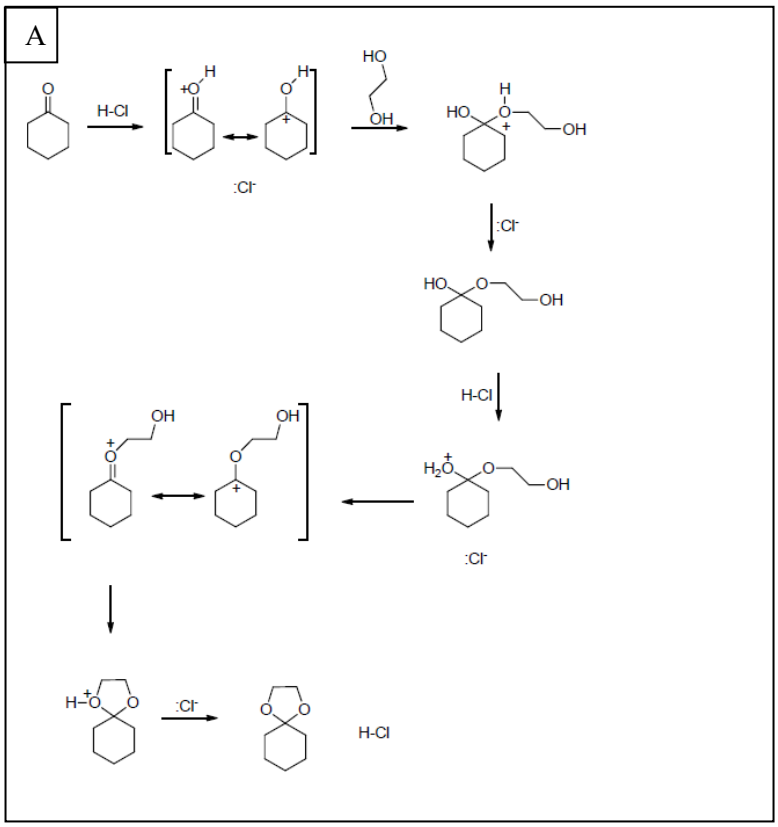
Chem 3325 Name :_____ Exam # 3 2022

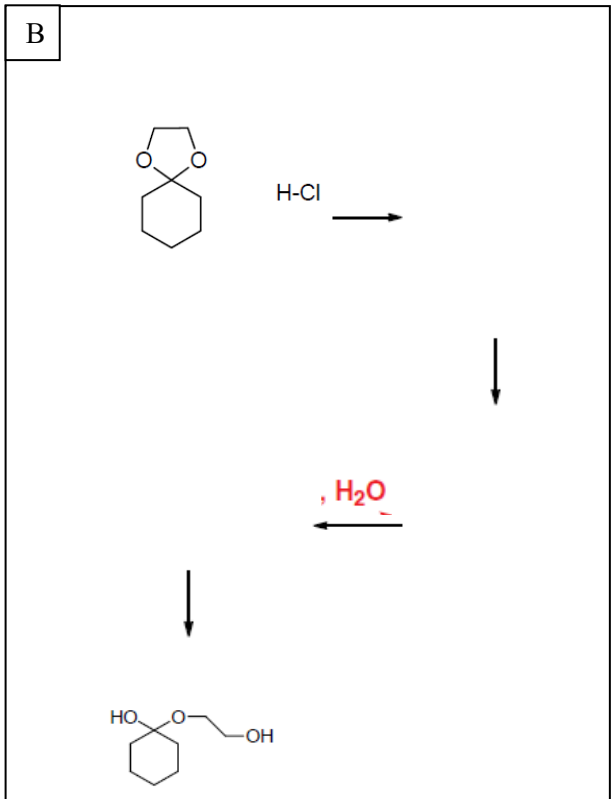
Answer **any seven of** questions 1-8 (15 points each) for a total of 105 points.

1. Provide products for the following reactions:



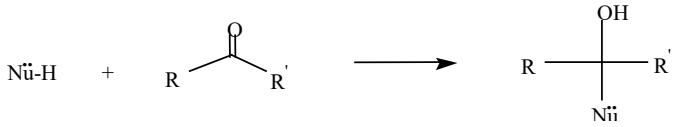
2. Provide mechanisms for each of the steps in scheme A, and structures and mechanisms for B:



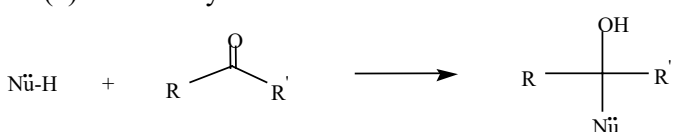


3. (i) For the general nucleophilic addition reaction on the right give the mechanisms for:

(a) base-catalysis of the forward reaction :

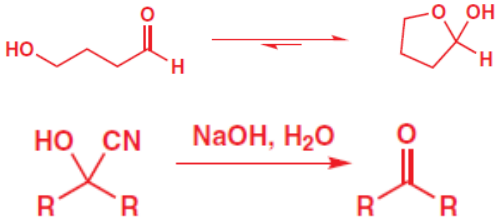


(b) acid-catalysis of the reverse reaction :

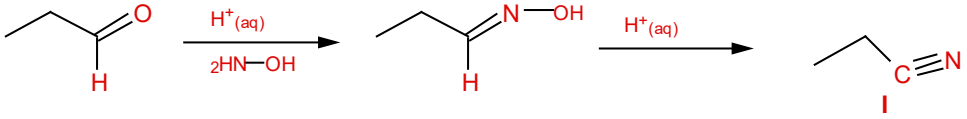


(ii) Provide a mechansim for :

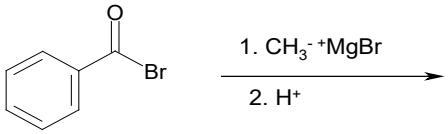
4. (i) Provide mechanisms for the following reactions:



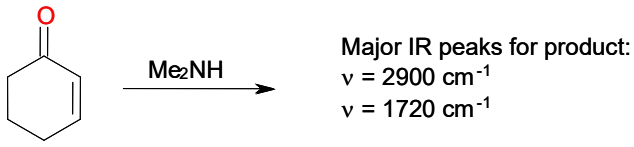
(Ii) Propose a mechanism for <u>both</u> of the following reactions:



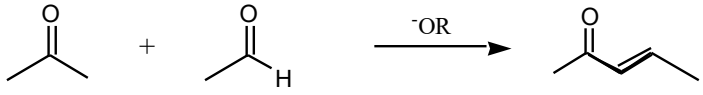
5. (i) Give a product, and a mechanism for its formation, for the following reaction <u>given</u> that the IR for the product has a broad peak around 3350 cm^{-1} :



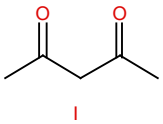
(ii) Give a structure for the product in the following reaction <u>and</u> a mechanism for its formation:



6. (i) Explain in terms of mechanism any possible difficulties with the *Aldol* condensation reaction shown:

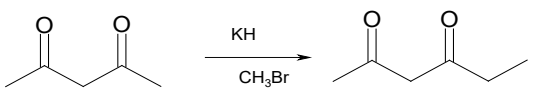


(ii) Account for the fact that the diketone, **I** below, has two types of acidic protons, one with a pKa of 20 and the other with a pKa of 9 :

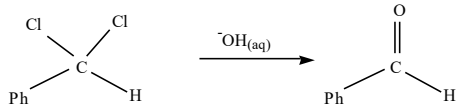


I

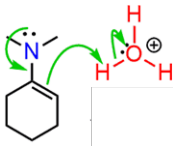
(iii) The reaction on the right will NOT take place as written. Explain in terms of mechanism:



7. (i) Provide a mechansim for the following :

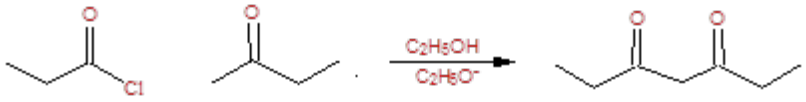


(ii) The enamine shown below reacts in aqueous acid to yield two products **I** and **II** . Continue the mechanism shown and identify the products, given the IR peak observed for **I:**

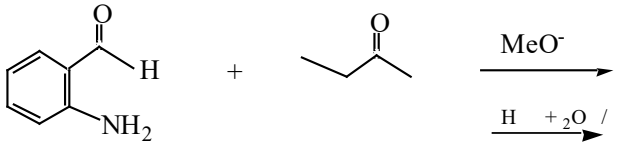


I and II
(IRυ = 1720 cm-1)

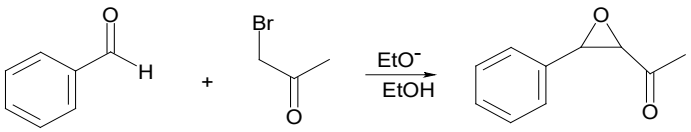
(iii) Provide a mechanism for the following *condensation* reaction and identify any other products possible:



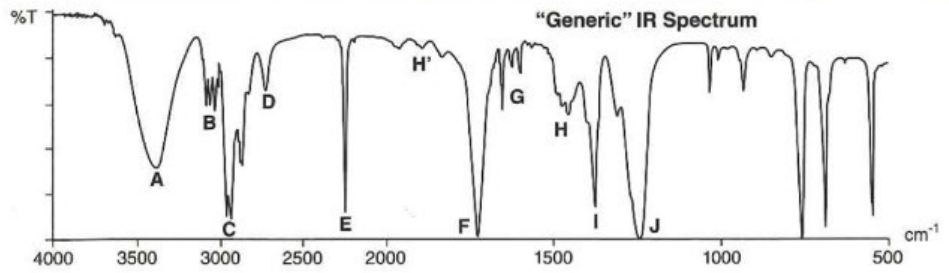
8. (i) Explain in terms of mechanism how the following reaction can give two different products depending on the conditions



(ii) Provide a mechanism for the following reaction :



IR Interpretation Guide



O-H N-H stretch	A	R–O–H	3600–3200	Phenols 3500
		–N–H	3500–3290 1° 3400–3340 2°	1°→2 peaks 2°→1 peak med. to weak
		–C(=O)–O–H	3550–2500	Broad & often "monstrous"
C-H stretch	B	R–C≡C–H	3300	
		=C–H	3300–3000	No peaks in this area means no aromatic!
		C–H	3300–3100	
		R,R C=C H,R	3300–3000	No peaks in this area means no alkene!
	C	–C–C–H	2960–2850	In "all" IR spectra
	D	R–C(=O)–H	2820 & 2720	2720 is key peak

C≡C, C≡N	E	R–C≡C–R'	2260–2190	Weak to none if symmetrical
		R–C≡N	2250 aliph. 2230 arom.	
		R–C≡C–H	2140–2100	
C=O	F	C(=O) ring	1785 4-ring 1750 5-ring 1715 6-ring	Depends on size of ring
		R–C(=O)–O–R	1735 aliph. 1720 arom.	
		R–C(=O)–H	1730–1705	1730 aliphatic 1703 conjugated
		R–C(=O)–R	~1715 cm-1	1685 conjugated
		R–C(=O)–O–H	~1710	1680 conjugated
		R–C(=O)–N(R)R	1690 1° 1680 2° 1650 3°	Aromatic amides 1675 1°
		C=C–C(=O)–R	1685	Aromatic 1690

C=C	G	R,H C=C H,R	1675	
		R,R C=C H,H	1658	Tri- & tetra-substituted ~1670
		R,H C=C R,H	~1653	
		R,H C=C H,H	~1645	
	H H'	benzene ring	1600, 1580, 1500, 1450	Move and vary in intensity; H' = overtones 2000–1650
nitro	H I	–N(=O)=O	1550–1490 1355–1315	Aromatic nitro Both strong
C–C & C–H bend	I	R,R C H,H	1490–1440	Scissor bend
		H,R C H,H	1470–1430 & 1380–1370	Umbrella bend
		CH3,CH3 C	1390–1375 & 1370–1360	t-butyl ~1365
C–O	J	C–O ethers esters	1150–1060 alkyl ethers and esters	1270–1200 aryl & vinyl ethers 1285 acids
		C–O alcohols	1150 3° 1100 2° 1050 1°	Tertiary Secondary Primary