PRINTED FIRST NAME

PRINTED LAST NAME

ASU ID or Posting ID

C-NR₂

Person on your LEFT (or Aisle) Person on your RIGHT (or Aisle) <u>/</u>18 PRINT YOUR NAME ON EACH PAGE! /32..... · READ THE DIRECTIONS CAREFULLY! _/40..... · USE BLANK PAGES AS SCRATCH PAPER /20..... work on blank pages will not be graded ... /40 WRITE CLEARLY! /25..... · MOLECULAR MODELS ARE ALLOWED · DO NOT USE RED INK · DON'T CHEAT, USE COMMON SENSE! Total (incl Extra)_ /5 /175+5 Extra Credit Н Нe Interaction Energies, kcal/mol Li Be F Ne Eclipsing Gauche Na Mg Cl Ar Me/Me ~0.9 Sc Ti V Cr Mn Fe Co Ni Cu Zn H/Me Et/Me ~0.95 Ga Ge As Se Br Kr Me/Me ~2.6 i-Pr/Me ~1.1 Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Хe Me/Et t-Bu/Me ~2.7 ~2.9 Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn Approximate Coupling Infrared Correlation Chart C≣N small range Constants, J (Hz), for mange of values ¹H NMR Spectra broad peak 1600-1660 Q 2720-2820 C = N3000-3100 2200 broad with spikes ~3300 -с≡сн O-H \triangle 0 2200 broad ~3300 broad ~3000 1650 (cm⁻¹) 1500 2000 3500 3000 2500 amine R-NH₂ variable and condition NMR Correlation Charts -OCH₂--CH₃ alcohol R-OH dependent, ca. 2 - 6 δ $-H_2C-X$ Aromatic Ar — H -H₂C-NR₂ mainly 8 - 6.5 Alkyl C=CH₂ R C-OH 10 (δ, ppm) ²⁰ O ²⁰ R-C-OH 220 200 180 140 120 100 80 60 40 0 R-C≡Ņ -OCH₂ Ö $R_2C = CR_2$ RC≡CR C-X

Aromatic

Question 1 (18 pts). Rank the following reactions in order of increasing rate. Give a BRIEF explanation that includes discussions of Lewis acidity/basicity, nucleophilicity/ electrophilicity, substitution, addition, elimination or rearrangement as appropriate.

- 2 -

A
$$O_2N$$

NH₂
 CI_2

AICI₃
 O_2N

NH₂
 CI_2

AICI₃
 O_2N

NH₂
 O_2N

Slowest

 O_2N
 O

Extra credit question (5 pts). β -carotene is synthesized using which reaction?

Clemmenson

Grignard

Wittig

Aldol

Question 2 (32 pts.) Provide the missing major organic products, you can IGNORE stereochemistry EXCEPT WHERE EXPLICITELY INCLUDED IN THE STARTING STRUCTURE, and you do **NOT** need to state what kinds of reactions these are or whether a solution of the product would be optically active.

b)
$$\frac{N_2H_4}{\text{KOH/heat}}$$

Question 3 (40 pts.) In each case, synthesize the (target) molecules on the right from the starting molecules the left. this can not be done in one reaction. Give reagents and conditions and the intermediate molecules at each step. Do not show any mechanisms or transient intermediates.

- 4 -

Question 4 (20 pts.) Synthesize the (target) molecule on the right from the starting molecule the left. this can not be done in one reaction. Give reagents and conditions and the intermediate molecules at each step. Do not show any mechanisms or transient intermediates.

Question 5 (40 pts.) Give a complete arrow-pushing mechanisms for the following reactions. Indicate the lewis acid/base for each INTERmolecular step (LB or LA) and whether they are also Brønsted bases/acids (LB/BB or LA/BA)

- 6 -

a) DRAW ALL RELEVANT RESONANCE CONTRIBUTORS OF THE INTERMEDIATES

b) DO NOT draw resonance contributors for the intermediates

Question 6 (25pts) Provided are spectra for a compound with molecular formula $C_6H_{14}O$





