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>10 PRINT YOUR NAME ON EACH PAGE! /17..... · READ THE DIRECTIONS CAREFULLY! _/32..... · USE BLANK PAGES AS SCRATCH PAPER /38..... work on blank pages will not be graded ... /18 WRITE CLEARLY! /40..... · MOLECULAR MODELS ARE ALLOWED /20..... · DO NOT USE RED INK · DON'T CHEAT, USE COMMON SENSE! Total (incl Extra) **Extra Credit** /5 /175+5н Нe Interaction Energies, kcal/mol Li Be F Ne Gauche **Eclipsing** Na Mg Ar Me/Me ~0.9 H/Me Et/Me ~0.95 Sc Ti V Cr Mn Fe Co Ni Cu Zn 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 ~2.9 t-Bu/Me ~2.7 Cs Ba Lu Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn Infrared Correlation Chart Approximate Coupling small range usually Constants, J (Hz), for range of values ¹H NMR Spectra broad peak 1600-1660 C = N3000-3100 Δ 2200 broad with spikes ~3300 C = CH2850-2960 -O-H \triangle 0 2200 broad ~3300 С-О-Н broad ~3000 1650 (cm⁻¹) 1500 3500 3000 2500 2000 -C-CH3 amine R-NH₂ variable and condition NMR Correlation Charts -OCH₂alcohol R-OH dependent, ca. 2 - 6 δ -H₂C-X Aromatic Ar — H mainly 8 - 6.5 Alkyl C=CH₂ R-C-OH 11 10 (δ, ppm) 220 200 0 180 160 120 100 60 R-C≡N -OCH₂ R-C-OH O Alkyl $3^{Y} > 2^{Y} > 1^{Y}$ $R_2C = CR_2$ RC≡CR

Aromatic

Question 1 (10 pts.) Give the IUPAC name for the following compound. Be sure to use cis/trans, E/Z or R/S where appropriate.

Question 2 (17 pts.) Rank the following in order of increasing Bronsted acidity. Provide drawings of the conjugate bases in each case, *include ALL resonance contributors as appropriate*, and support your assignment of the acidity order with a **BRIEF explanation**, that MUST include the phrase "*energy of the electrons*".

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

Clemmenson

Grignard

Wittig

Aldol

Question 3 (32 pts.) Provide the missing major organic products or reagents/conditions, you can IGNORE stereochemistry in these problems

d)
$$\begin{array}{c} H \downarrow O \\ \hline \\ H_2NMe \\ \hline \\ H^+ \text{ cat.} \end{array}$$

Question 4 (38 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 5 (18 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 6 (40 pts.) For the following TWO reactions a) and b):

- 1) Give a complete arrow-pushing mechanisms
- 2) 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)
- 3) Show wehere every proton comes from and goes to (i.e., no +H⁺ or -H⁺)
- 4) DRAW ALL RELEVANT RESONANCE CONTRIBUTORS FOR THE INTERMEDIATES

Give the number of transition states in your mechanism for reaction a) _____

b)
$$H_2O$$
 OH OH

Give the number of transition states in your mechanism for reaction b)

Question 7 (20 pts.) Give a complete arrow-pushing mechanisms for the following reaction.

- 1) You can use the abbreviated +H⁺ and -H⁺ to indicated protonation and deprotonation
- 2) DRAW ALL RELEVANT RESONANCE CONTRIBUTORS FOR THE INTERMEDIATES

