Chemistry 130, Midterm Exam 1

Instructor: Bergdahl

Spring 2019

Name:_____

Be prepared to show ID upon request.

****Any use of any electronic devices is prohibited during the test** ****

Be prepared to show ID upon request.

My student I.D. (red I.D.) number is:

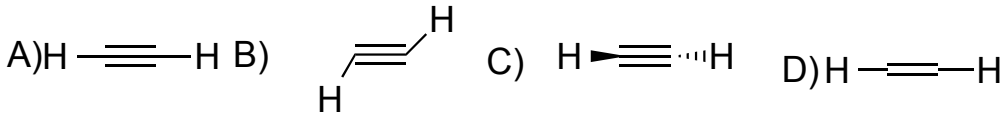
Good Luck!!

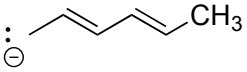
Part A. 1-25 Questions. Each correct answer is 3 points. (Part 1 max 75 points)

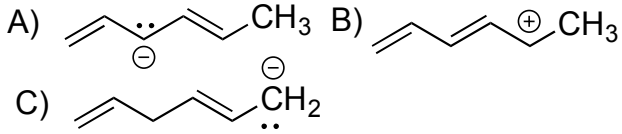
1) What is the electron configuration of negatively charged carbon atom?
A) $1s^2 2s^2 2p^2$
B) $1s^2 2s^2 2p^3$
C) $1s^2 2s^2 2p^4$
D) $1s^2 2s^2 2p^5$

2) Which of the following bonds is ionic?
A) C—F
B) Li—F
C) H—H
D) C—H

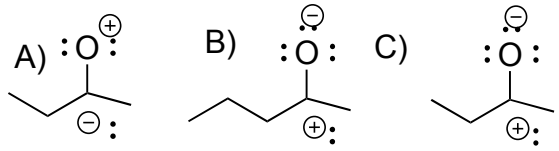
3) Which representation of ethyne (HCCH) is correct.



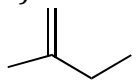
4) Which of the following structures is a valid resonance structure of 



5) Which of the following contributing resonance structures of butanone is more stable

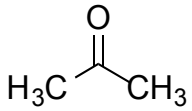


6) The double bond in butane is formed from the overlap of what orbitals



A) C sp^2 orbital overlapping with a C sp^2 orbital; and a C P orbital overlapping with an C P orbital.
B) C sp^2 orbital overlapping with a C sp^2 orbital
C) a C p orbital overlapping with an C p orbital.
D) a C s orbital overlapping with an C s orbital.

7) The Carbon-Hydrogen bonds in acetone are made up of



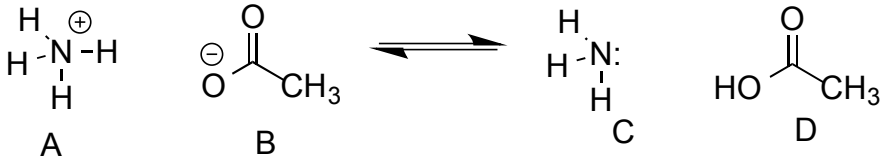
A) C sp^2 orbital overlapping with a O sp^2 orbital; and a C P orbital overlapping with an O P orbital.
B) C sp^3 orbital overlapping with a H s orbital
C) a C p orbital overlapping with an H p orbital.
D) a C s orbital overlapping with an C s orbital.

8) Which of the following is the weakest Acid
A) CH_4 B) H_2O C) NaH D) HI

9) Which of the following is the strongest base
A) NaOH B) $-CH_3$ C) Cl- D) HCl

10) The higher the pKa the _____ the Acid
A) Weaker B) Stronger C) Lower pH D) higher pH

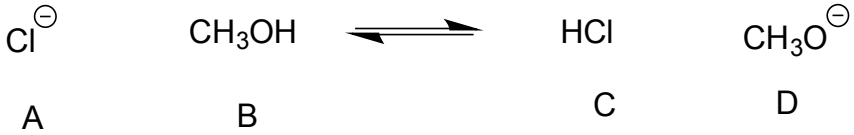
11) Identify the conjugate acid in the following acid Base reaction



A B C D

12) The reaction in question 11 will have a k_{eq} of
A) 1
B) Greater than 1
C) Less than 1

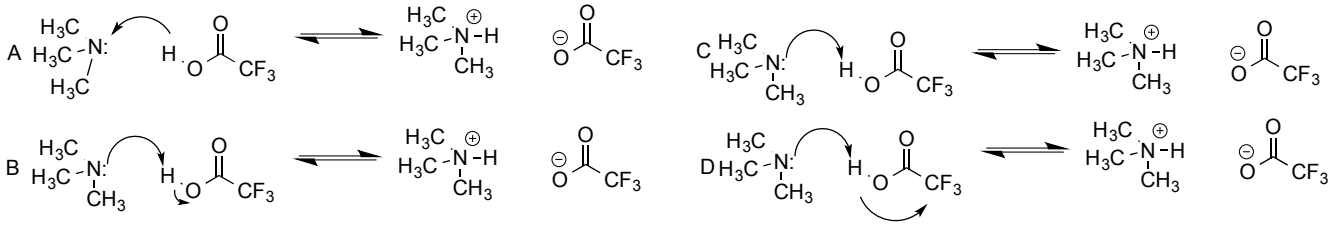
13) Identify the conjugate base in the following acid/base reaction



A B C D

14) The reaction in question 20 will have a k_{eq} of
A) 1
B) Greater than 1
C) Less than 1

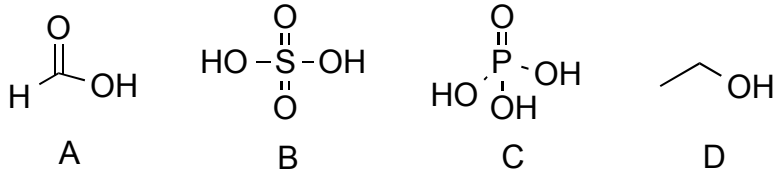
15) Only one of the mechanisms of the below acid base reaction has the correct arrow pushing. Identify it



16) Why does HI have a pKa of -9 while HCl as a pKa of -7.
A) More resonance
B) I is more electronegative
C) The inductive effect
D) I has a larger atomic radius than Cl.

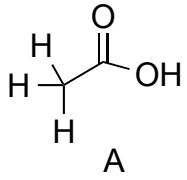
17) How many times more acidic is HI?
A) 2 fold
B) 10 fold
C) 100 fold
D) 1000 fold

18) Which of the following is least acidic.

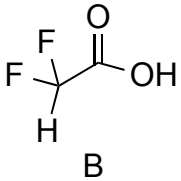


19) Your answer is least acidic because
A) The conjugate base has no resonance stabilization
B) The conjugate base is destabilized by the inductive effect
C) The conjugate base is destabilized because the negative charge is on a more electronegative atom.
D) The conjugate base is destabilized because there are more possible resonance structures, with one that contributes much more than the others to the hybrid.

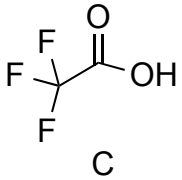
20) Which of the following is most acidic.



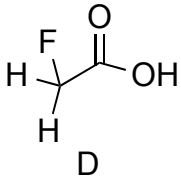
A



B



C



D

21) Your answer is more acidic because
A) The conjugate base is stabilized because there are more resonance structures that contribute substantially. Thus the negative charge is spread out more
B) The conjugate base is most stabilized by the inductive effect
C) The conjugate base is stabilized because the negative charge is on a more electronegative atom.
D) A&B

22) Which of the following is more acidic.
A) CH_4 B) CH_3F C) CF_3OH D) CH_3OH

23) Your answer is more acidic because
A) The conjugate base is stabilized because there are more resonance structures that contribute substantially. Thus the negative charge is spread out more
B) The conjugate base is stabilized by the inductive effect
C) The conjugate base is stabilized because the negative charge is on a more electronegative atom.
D) B&C

24) A Linear alkane with 5 carbons is
A) Hexane
B) Pentane
C) Propane
D) Heptane

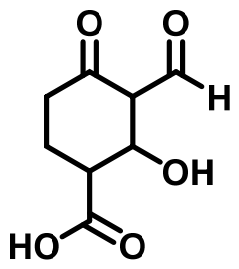
25) Constitutional isomers are
A) Molecules with the same molecular formula and the same connectivity but a different spatial arrangement of atoms in three-dimensional space
B) Molecules with the same connectivity but a different molecular formula
C) Molecules with the same molecular formula but different connectivity of the atoms
D) Molecules that have identical chemical properties

Part B. Short answer questions, 26-32, each problem is worth 5-10 points (total 61 points)

Problem 26. Draw the Lewis structure for Li_2CO_3. Which bonds are ionic or covalent? (10p)

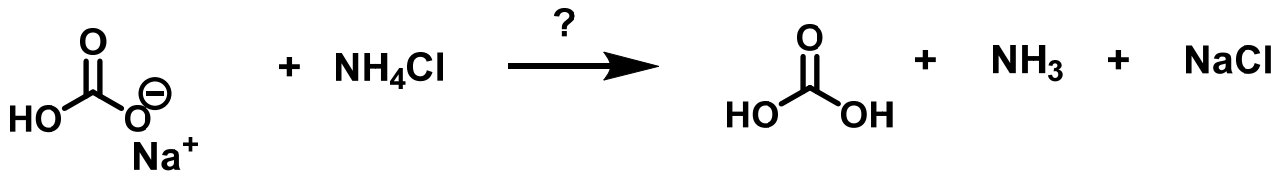
Problem 27. Draw the Lewis structure for TWO compounds with the molecular formula $C_7H_{17}N$, one tertiary amine and one primary amine. (10p)

Problem 28. Identify the functional groups in the following molecule: (8p)



Problem 29. Draw the relevant resonance structures for carbonmonoxide, CO. (8p)

Problem 30. Predict if the following acid-base reaction favorable or unfavorable as indicated. Justification is (One sentence max) (10p)

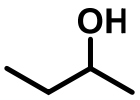


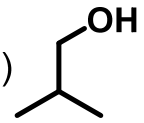
Problem 31. Draw a line-angle structure for the following condensed structural formula. (5p)

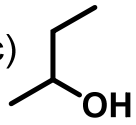
$CH_3(CH_2)_3CH(CH_2CH_3)(CH_2)_6CH(CH_3)_2$

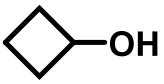
Problem 32. Which of the structural formulas below represent,

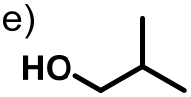
A) The same compound
B) Different compounds that are constitutional isomers
C) Different compounds that are NOT constitutional isomers

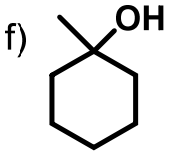
a) 

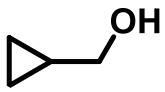
b) 

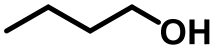
c) 

d) 

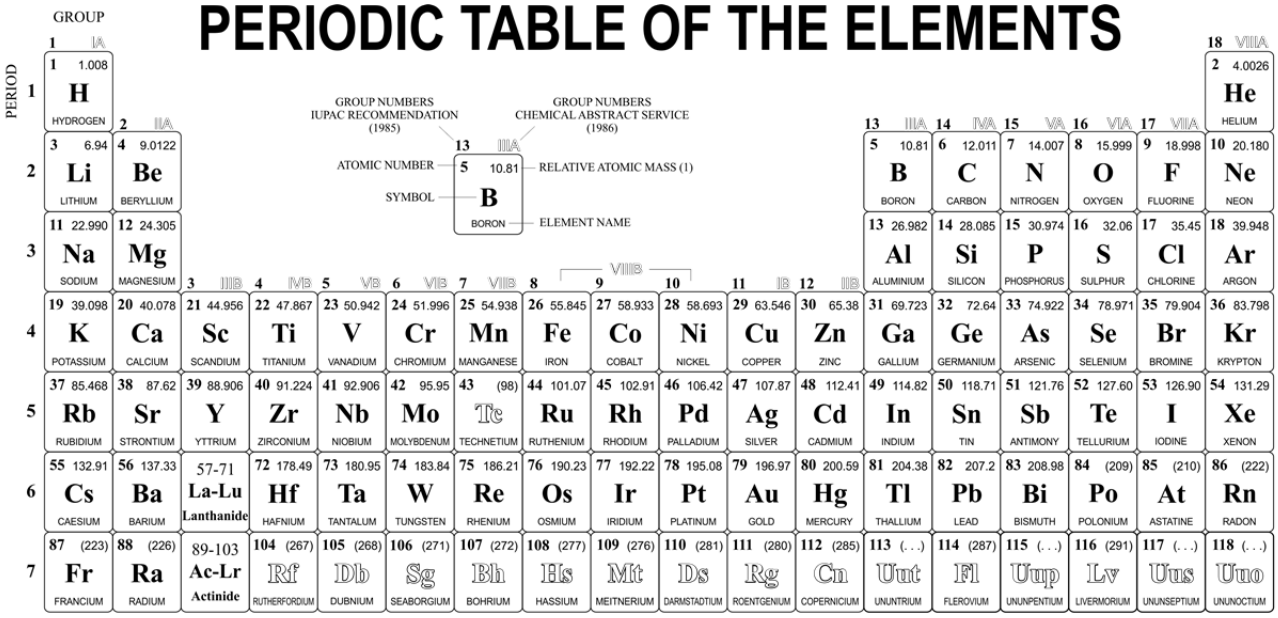
e) 

f) 

g) 

h) 

PERIODIC TABLE OF THE ELEMENTS



LANTHANIDE

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
138.91	140.12	140.91	144.24	(145)	150.36	151.96	157.25	158.93	162.50	164.93	167.26	168.93	173.05	174.97
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
LANTHANUM	CERIUM	PRASEODYMIUM	NEODYMIUM	PROMETHIUM	SAMARIUM	EUROPIUM	GADOLINIUM	TERBIUM	DYSPROSIUM	HOLMIUM	ERBIUM	THULIUM	YTTERBIUM	LUTETIUM

ACTINIDE

89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
(227)	232.04	231.04	238.03	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(262)
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
ACTINIUM	THORIUM	PROTACTINIUM	URANIUM	NEPTUNIUM	PLUTONIUM	AMERICIUM	CURIUM	BERKELIUM	CALIFORNIUM	EINSTEINIUM	FERMIUM	MENDELEVIUM	NOBELIUM	LAWRENCIUM

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(1) Pure Appl. Chem., **88**, 265-291 (2016)

TABLE 1.4 Electronegativity Values and Trends for Some Atoms (Pauling Scale)

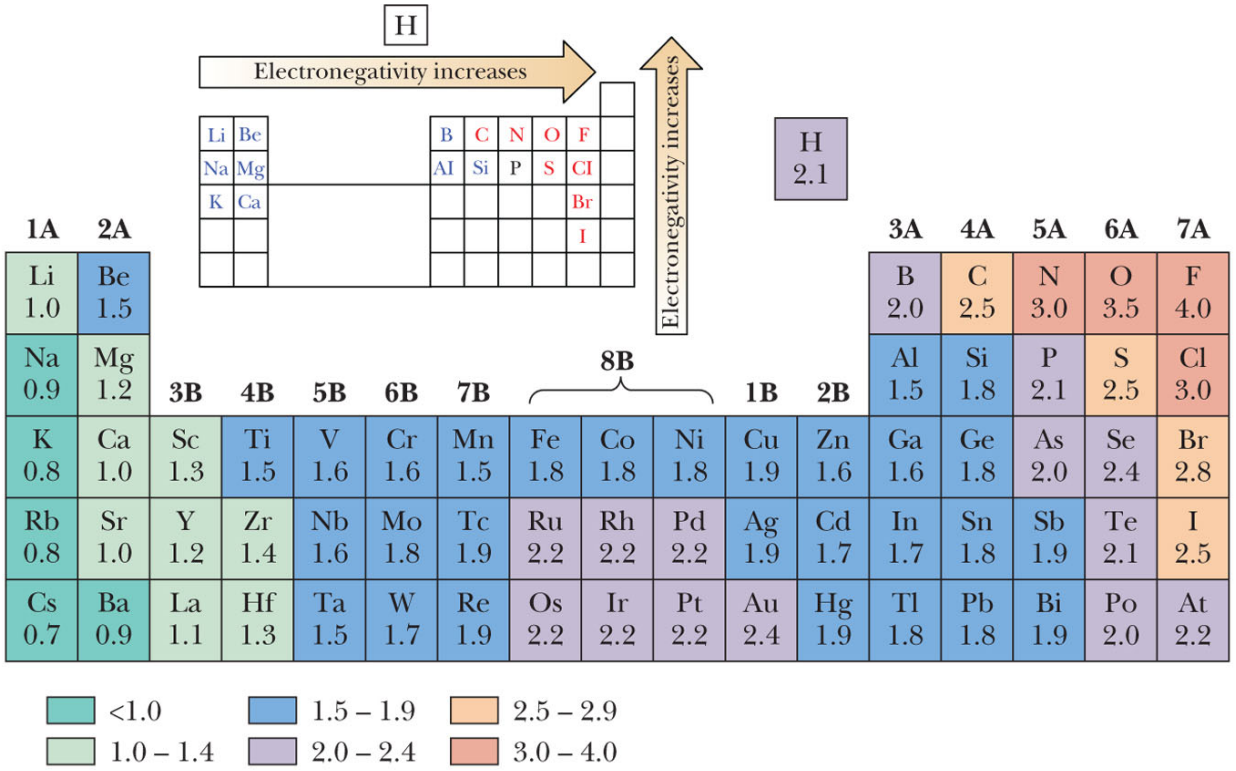

TABLE 2.2 pK_a Values for Some Organic and Inorganic Acids

the weaker the acid, the stronger is its conjugate base

the stronger the acid, the weaker is its conjugate base

	Acid	Formula	pK_a	Conjugate Base	
Weaker acid	ethane	CH_3CH_3	51	$CH_3CH_2^-$	Stronger base
	ammonia	NH_3	38	NH_2^-	
	ethanol	CH_3CH_2OH	15.9	$CH_3CH_2O^-$	
	water	H_2O	15.7	HO^-	
	methylammonium ion	$CH_3NH_3^+$	10.64	CH_3NH_2	
	bicarbonate ion	HCO_3^-	10.33	CO_3^{2-}	
	phenol	C_6H_5OH	9.95	$C_6H_5O^-$	
	ammonium ion	NH_4^+	9.24	NH_3	
	hydrogen cyanide	HCN	9.21	CN^-	
	carbonic acid	H_2CO_3	6.36	HCO_3^-	
	acetic acid	CH_3COOH	4.76	CH_3COO^-	
	benzoic acid	C_6H_5COOH	4.19	$C_6H_5COO^-$	
	phosphoric acid	H_3PO_4	2.1	$H_2PO_4^-$	
	hydronium ion	H_3O^+	−1.74	H_2O	
	sulfuric acid	H_2SO_4	−5.2	HSO_4^-	
Stronger acid	hydrogen chloride	HCl	−7	Cl^-	Weaker base
	hydrogen bromide	HBr	−8	Br^-	
	hydrogen iodide	HI	−9	I^-	

Grading: **Part A _____/75 points**

Part B_____/61 points

Total_____/136 points

Adjusted_____/150 points