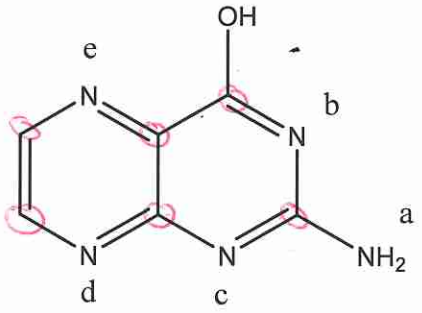
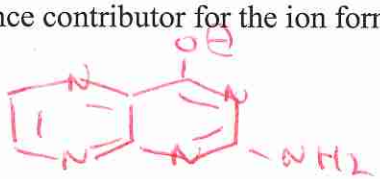
Organic 211 Test # 1 (A2, B2) September 8, 2020

Name:_____

1) Given below is the molecule Pterin. Answer the following questions about Pterin. The phenol's pKa is 10 while amine a's conjugate acid's pKa is 4.6 and any other amine's conjugate acid's pKa is 5.25. (4 pts. each)



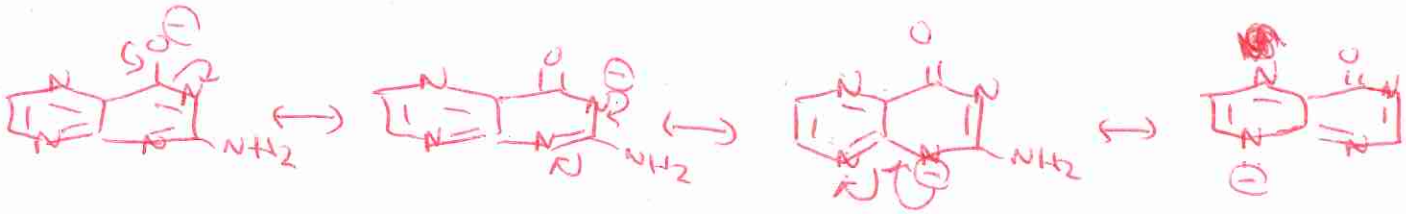
a) Give the resonance contributor for the ion formed at a pH of 12.0 with the oxygen bearing the charge.



b) Which of the other nitrogens can the charge be shared?

b, c, d

c) Show the resonance structures for ALL of the ions that you answered in part b.



d) Circle the sp^2 carbons in Pterin

See above

e) How many degrees of unsaturation does Pterin have?

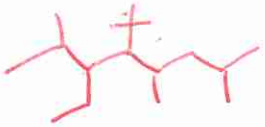
C_6H_{14}

7°

$C_6H_5N_5O \equiv C_6H_6$

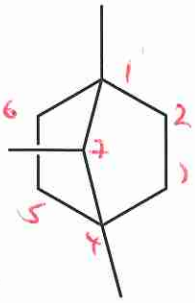
$14/2 = 7°$

2) Give the name if given the structure or the structure if given the name for the following molecles. (4 pts. each)



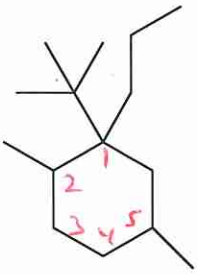
a) 4-(*tert*-butyl)-3-ethyl-2,5,7-trimethyloctane

b)



1,4,7-trmethyl bicyclo(2.2.1) heptane

c)



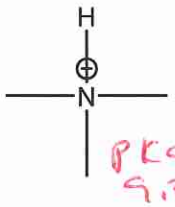
1-tert-butyl-2,5-dimethyl-1-propyl cyclohexane

3) Work the following three reactions. If the equilibrium lies toward the reactants, draw the products and write Keq <1. If the equilibrium lies toward the products, draw the products and write Keq > 1. If no reaction is possible, indicate this fact. (4 pts. each)

a) 

pKa 15.7

+ $^{-}NH_2$ ⇌ $^{\ominus}O$ + NH_3 pKa 35 Keq > 1

b) 

pKa 9.5

+ ^{-}Cl ⇌ $-\ddot{N}-$ + HCl more acidic than 9.5 so Keq < 1

c) 

+ NH_3 ⇌ $-\equiv-H$ + $NH_2^{\ominus}$

pKa 35 pKa 24 Keq < 1

4) Alkynes have a stronger bond between carbon and hydrogen than an alkene's carbon hydrogen bond. However, the alkyne is more acidic than an alkene. Explain. (4 pts.)

more s Character for sp means more stable conjugate base. this means alkyne is more acidic

$-\equiv-H \rightarrow -\equiv C:^{\ominus}$ 50% s sp

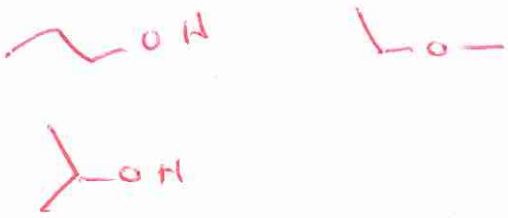
$=-H \rightarrow =:^{\ominus}$ 33% s sp^2

5) How do valence bond theory and molecular orbital theory differ?
(4 pts.) Valence bond theory involves overlap of electrons from two orbitals.
Molecular orbital theory puts electrons into molecular orbitals that cover the whole molecule and not just a single bond.

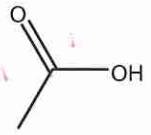
6) Write structural formula for all of the constitutional isomers that have the molecular formula C_3H_8O. (4 pts.)

$C_3H_8O \cong C_3H_8$

0° of unsaturation = 0/2



7) Rank the following molecules due to acidity. (most acidic = 1) (5 pts.)



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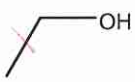
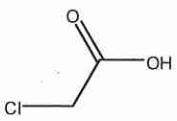


5



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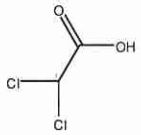


1

4

8) You need 450. mLs of a 7.50 M solution of pterin (a solid) in water. How much pterin would you add? How much water? SHOW YOUR WORK. (5 pts.)

$C_6H_5N_5O$

C 6 x 12 = 72
H 5 x 1 = 5
N 5 x 14 = 70
O 1 x 16 = 16

163 g/mole

$\frac{7.50 \text{ moles}}{1 \text{ liter}} \times 0.450 \text{ L} = 3.375 \text{ moles}$

$3.375 \text{ moles} \times \frac{163 \text{ g}}{\text{mole}} = 550 \text{ g of pterin}$

and

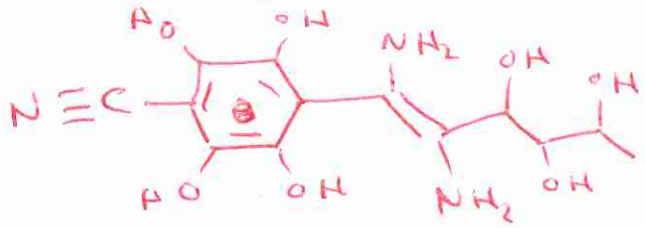
450 ml of H_2O

9) a) How many degrees of unsaturation does a molecule with a molecular formula $C_{13}H_{15}N_3O_7$ contain? SHOW YOUR WORK. (4 pts.)

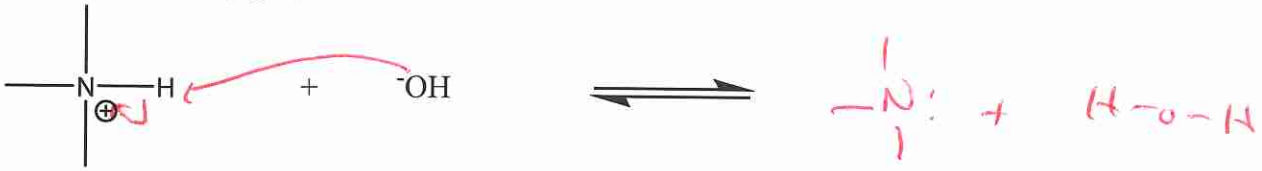
$C_{13}H_{15}N_3O_7 = C_{13}H_{28}$ / $C_{13}H_{12}$

$16/2 = 8°$

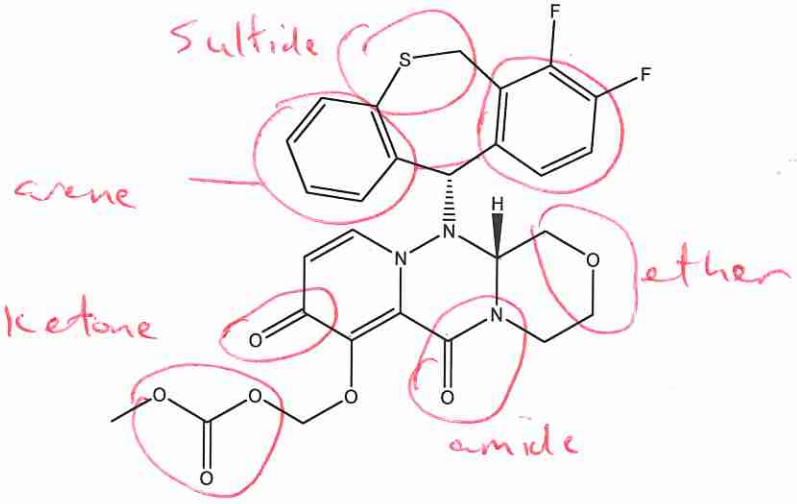
b) Give a molecule that contains the molecular formula $C_{13}H_{15}N_3O_7$ and has an sp carbon, an sp^2 carbon and a sp^3 carbon. (4 pts.) lots of possibilities.



10) Push the arrows for the following reaction to indicate how the conjugate base and conjugate acid are formed. (4 pts.)

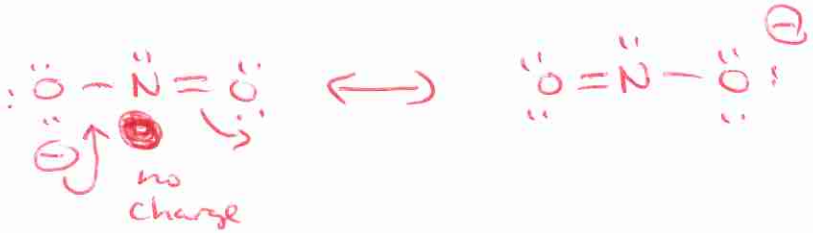


11) Given below is Xofluza. Identity at least four different functional groups. (4 pts.)



-1 1
N 1 x 5 = 5
O 2 x 6 = 12
18 e⁻

12) Draw two Lewis Dot structure for the nitrite ion. It has the connectivity of ONO and a negative charge. Show your work. (5 pts.)



13) Put the following molecules in order of boiling point. (lowest boiling point = 1) (3 pts.)

(57°C) 1 (81°C) 2 (161°C) 4 3 (151°C)

perflurohexane cyclohexane cyclohexanol n -nonane

2 3 4 1

14) Give something that you studied that was not asked on this test. (10 pts.)