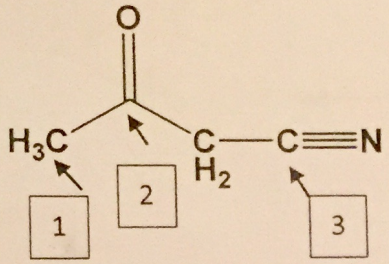
14

1. Answer the following questions: Write your answers in the boxes provided:

a) The formal charges on oxygen in the following structure are, respectively

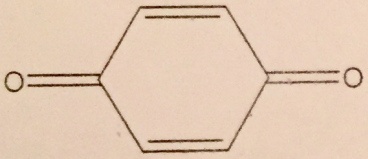
$(CH_3)_3\ddot{O}$ | 6-3-2=+1 | $CH_3CH_2\ddot{O}:$ | 6-1-6=-1

b) What is the hybridization of the indicated carbon (by arrow) in the following compounds:



1	2	3
sp^3	sp^2	sp

c) How many ***sigma*** (σ) and how many ***pi*** (π) bonds are present in the following structure?



(σ)	(π)
12	4

12

2. Consider the following acid base reaction:

$$CH_3CH_2NH_2 + OH^- \rightleftharpoons CH_3CH_2NH^- + H_2O$$

a) Give the products of the reaction and identify the acid, base, conjugate acid and comjugate base

$CH_3CH_2NH_2$ + OH^- ⇌ $CH_3CH_2NH^-$ + H_2O

Acid | Base | conjugate base | conjugate acid

b) Label the stronger and weaker acids and bases in the above reaction

Stronger acid: H_2O

~~Weaker acid~~:

Weaker acid: $CH_3CH_2NH_2$

~~Weaker~~ Stronger Base: $CH_3CH_2NH^-$

Weaker base: OH^-

c) Is the value of the equilibrium constant K greater or less than 1?

if equilibrium favors reactants $K>1$

" " favors Products $K<1$

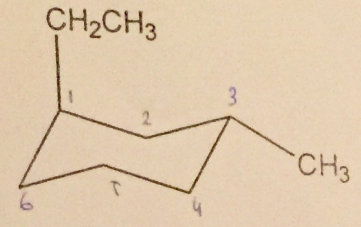
$\therefore$ ~~K>1~~

d) Which is a stronger base $CH_3CH_2CH_2O^-$ or $CH_3CH_2\overset{O}{\overset{\|}{C}}O^-$? Explain briefly

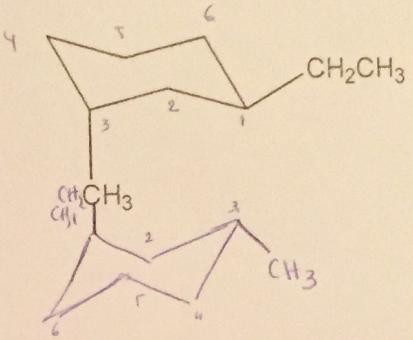
$CH_3CH_2CH_2O^-$ is a stronger base because it has less resonance structures (more stable)

* less electron delocalization.

d)



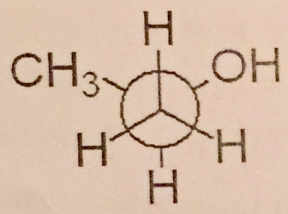
and

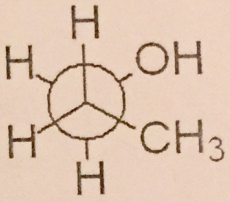


* upon flipping the second structure, we obtain the 1st structure

Answer: ~~Identical~~ different conformations of the same compound

e)



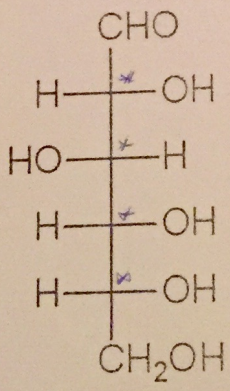


different connectivity

Answer: ~~Constitutional~~ isomers

Bonus question (5pts)

How many compounds are **enantiomers** of (+)-Glucose that has the Fischer projection shown below? How many are diastereomers?



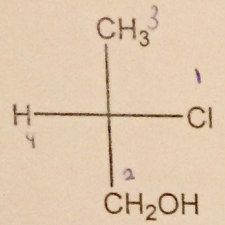
1

Enantiomers ~~2~~ 1 Diastereomers ~~13~~ 14.

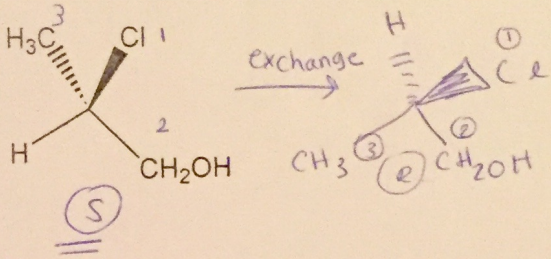
(+)-glucose not included!

6. Identify the relationship in each of the following pairs. Do the drawings represent: constitutional isomers, different conformations of the same compound, stereoisomers, or they are just different ways of drawing the same compound (identical). If they are stereoisomers are they enantiomers or diastereomers? Show your work, NO credit for guessing!

a)



and



R, but since H is on vertical axis ⇒ (S)

Answer: S and S → Identical

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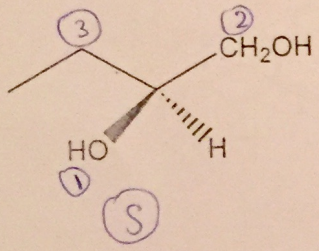
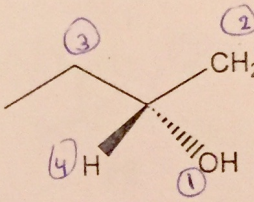
b)



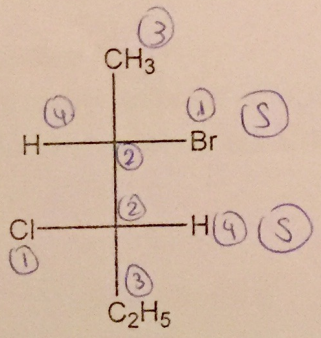
and



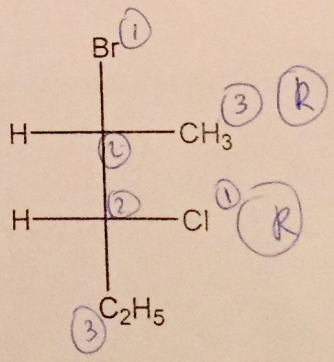
S, but since H is on the wedge ⇒ (R)

Answer: enantiomers

c)

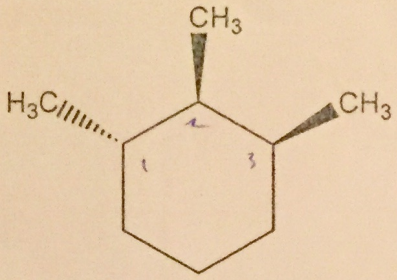


and

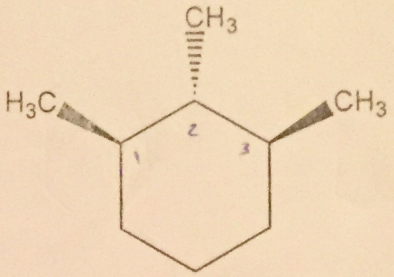


Answer: Enantiomers

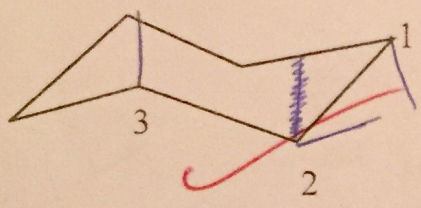
5. **a)** Draw chair conformations of the following pair of stereoisomers and identify the **more stable** stereoisomer in the following pairs. Give the reason for your choice

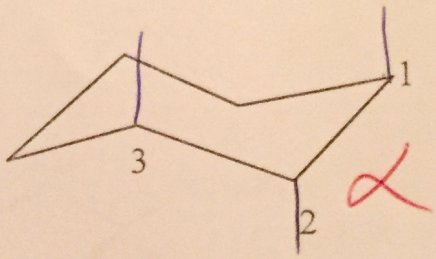


A



B

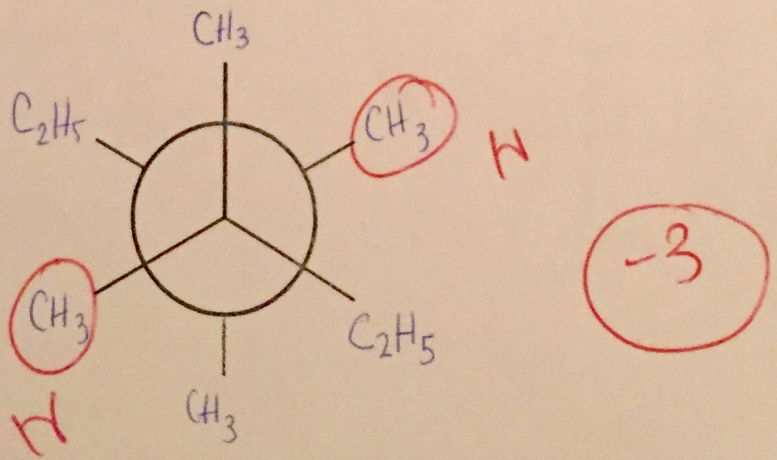




A is more stable because there are more substituents (Methyl groups) in the equatorial α position.

-4

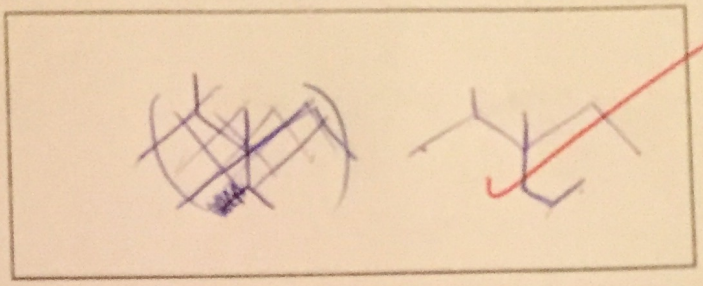
b) Draw the **most stable** Newman conformation of 3,4-Dimethyl hexane as viewed down the C3-C4 bond



-3

4. a) Draw the bond-line representation and give the correct IUPAC name of the following compound:2,3-Dimethyl-3-propylpentane

Bond-line

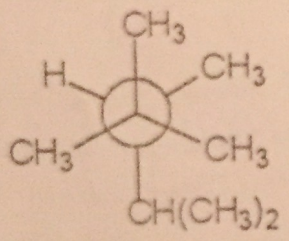


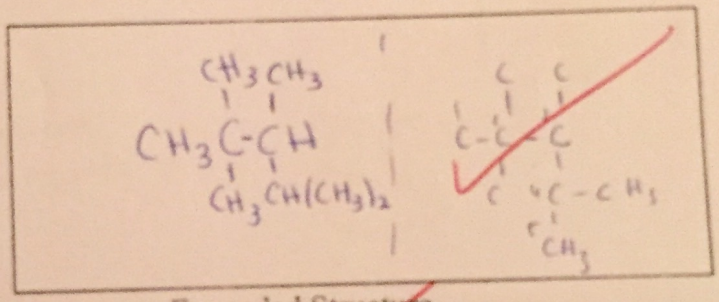
-2

Correct IUPAC name: ~~3-isopropyl-3-methylheptane~~ 3-isopropyl-2-methylhexane

b

b) Draw the expanded structure and give IUPAC name of the following compound

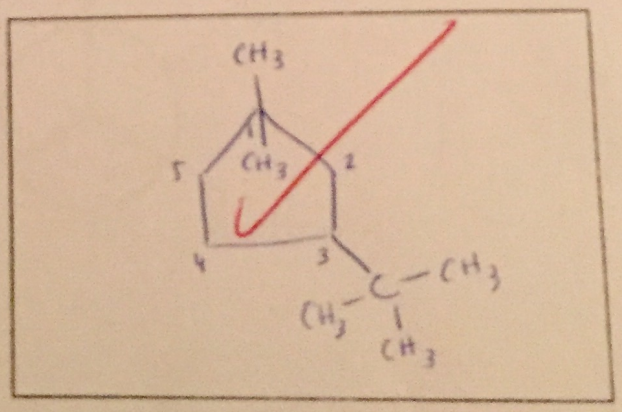




Expanded Structure

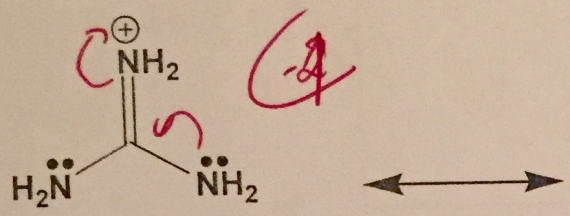
IUPAC name 2,2,3,4-tetramethylpentane

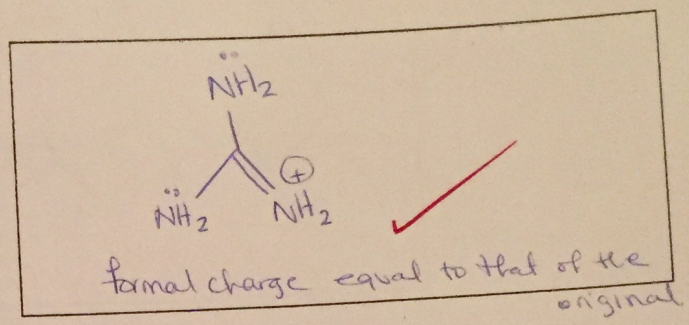
c) Draw the structure of 3-*tert*-Butyl-1,1-dimethylcyclopentane



3. Using **curved arrows** show how each of the following could be generated and give the structure of the product in the box provided.
Specify formal charges if any. Justify your answers

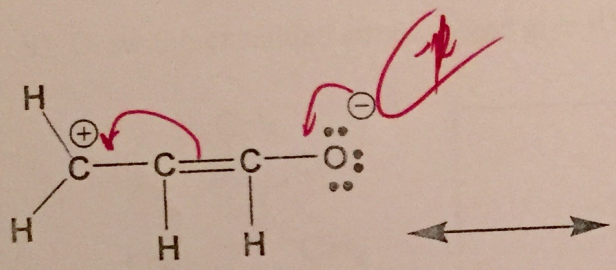
a) An equally stable resonance structure of:

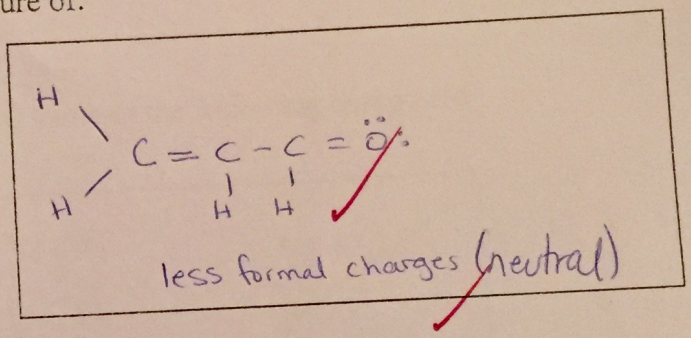




Answer:

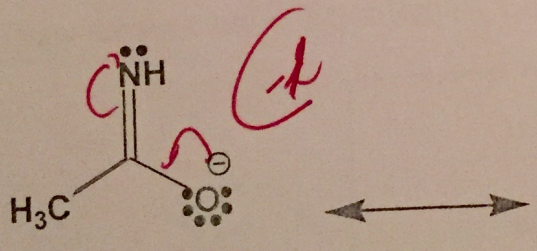
b) The most stable resonance contributing structure of:

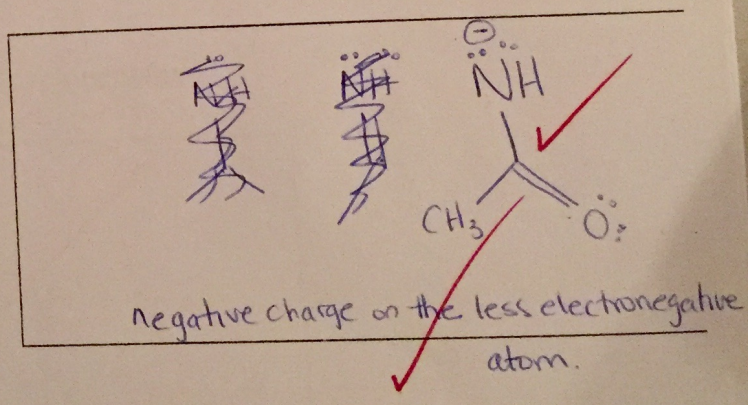




Answer:

c) A less stable resonance contributing structure of:





Answer: