

CEM 251, Summer 2020
Midterm Exam
Wednesday, June 3, 2020, 6:00 PM
Online (TopHat)



**Happy
Summer**



There's no subject compared to chemistry
how it works is a total mystery
homework is for my own mastery
says my professor
but all I see is my own misery

Anonymous

A question that sometimes drives me hazy:
Am I or are the others crazy?

Albert Einstein

1-10. (40 pts.) _____

11. (20 pts.) _____

12. (20 pts.) _____

13. (20 pts.) _____

14. (5 pts. E.C) ____

TOTAL (100 pts.) _____

Score

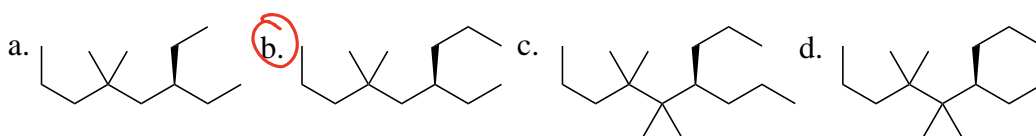
Note: You have 1.5 h to complete this exam.

(40 pts.) Multiple choice questions (4 pts. each); choose your answer and make sure to click on the submit button for each question.

1. (4 pts.) What is the chemical formula of 3-bromo-3-methylbutanol? (Hint: Draw it first, then work out the formula).

- a. $C_5H_{11}BrO$ b. C_4H_9BrO c. C_5H_9Br d. C_5H_9BrO

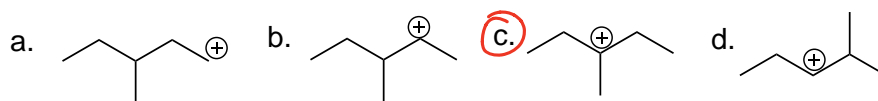
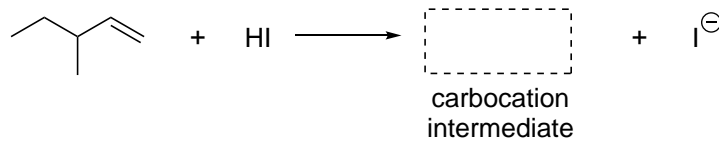
2. (4 pts.) Which of the structures below is (*R*)-6-ethyl-4,4-dimethylnonane?



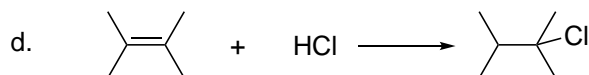
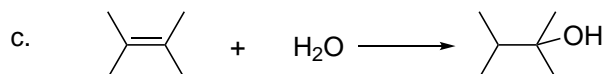
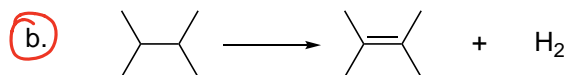
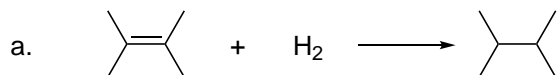
3. (4 pts.) Which of the following compounds is the weakest acid?

- a. $Cl_2CH_3CH_2OH$ b. $ClCH_2CH_2OH$ c. CH_3CH_2OH d. CH_3COOH

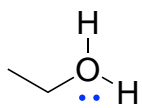
4. (4 pts.) What is the carbocation intermediate for the reaction below?



5. (4 pts.) Which of the following reaction is an oxidation reaction?



6. (4 pts.) What is the formal charge of the oxygen in the protonated ethanol below?



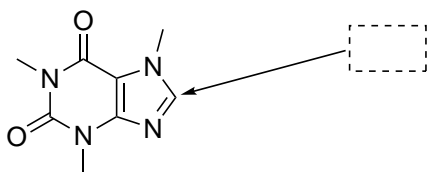
a. -2

b. -1

c. 0

d. +1

7. (4 pts.) what is the hybridization of the carbon indicated in the compound (caffeine) below?



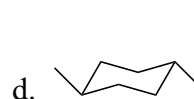
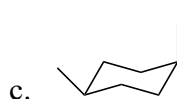
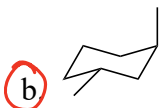
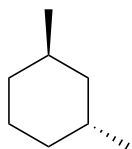
a. sp^3

b. sp^2

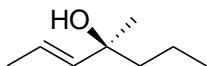
c. sp

d. sd^2

8. (4 pts.) Convert the structure below to the appropriate chair conformer?



9. (4 pts.) What is the configuration of the chiral center in of the compound below?



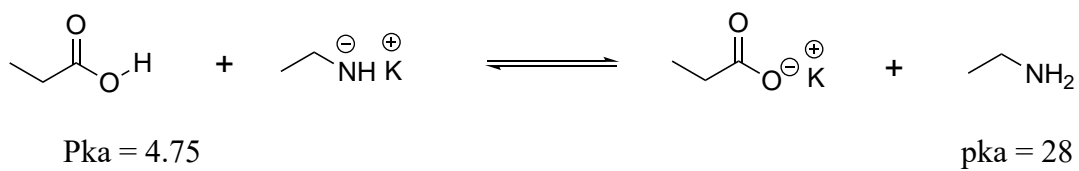
a. R

b. S

c. E

d. Z

10. (4 pts.) Which side of the equilibrium reaction is favored? (think about the pka's)

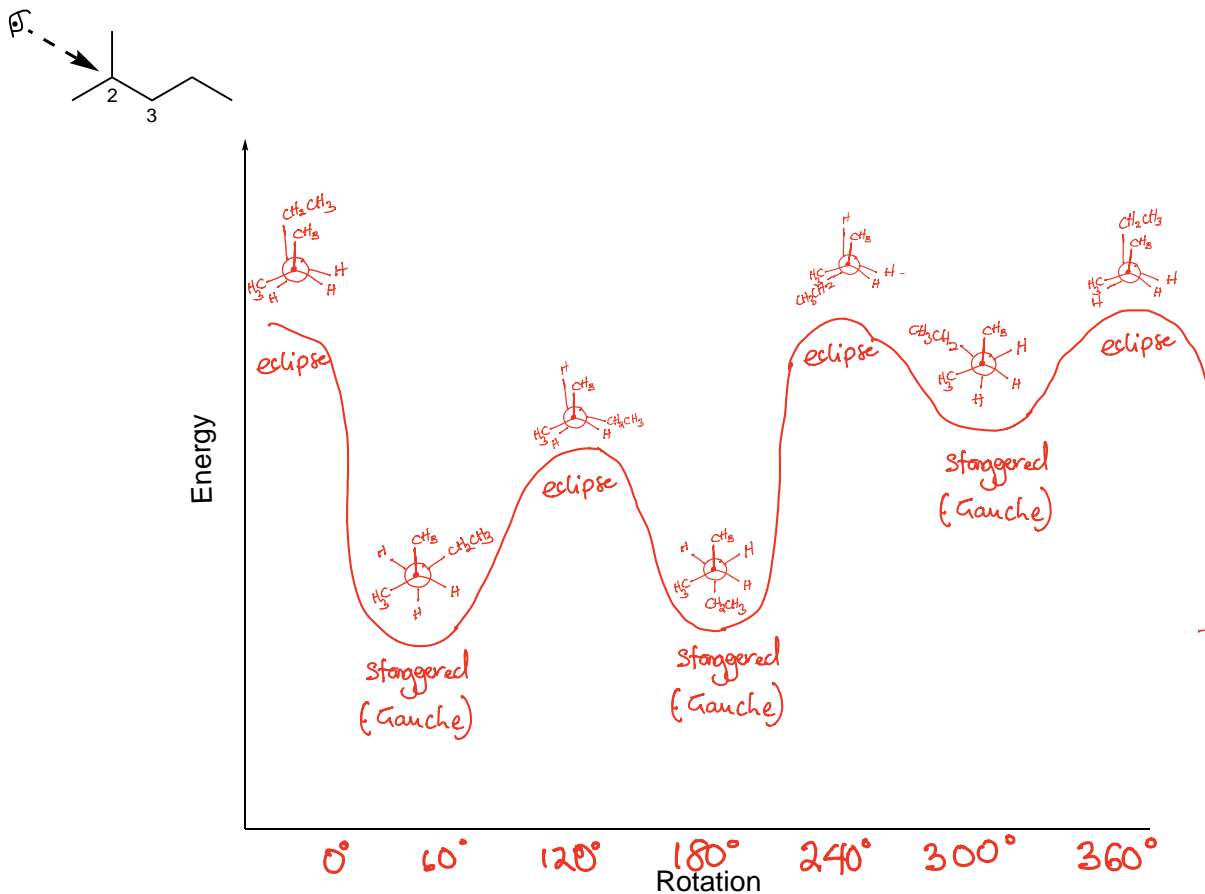


- a. Left b. Middle c. Right d. No equilibrium

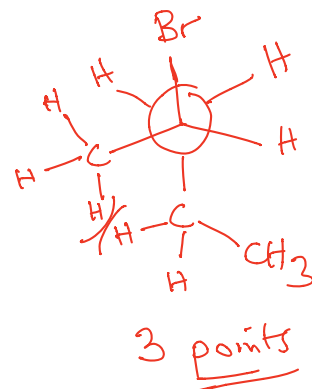
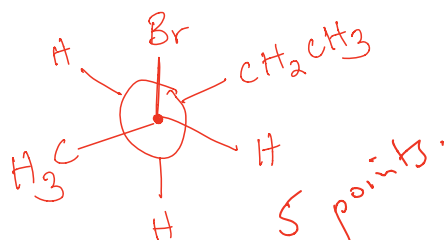
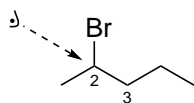
(60 pts.) There are 3 question (20 pts. each). Answer each question on a single sheet of paper and upload the image of the answer sheet directly on TopHat.

11. (20 pts.)

a) (15 pts.) Draw the bond rotation energy diagram for 2-methylpentane (looking down the C2-C3 bond) with the Newman projections for each point (0°– 360°). (eclipse, staggered, gauche etc.)

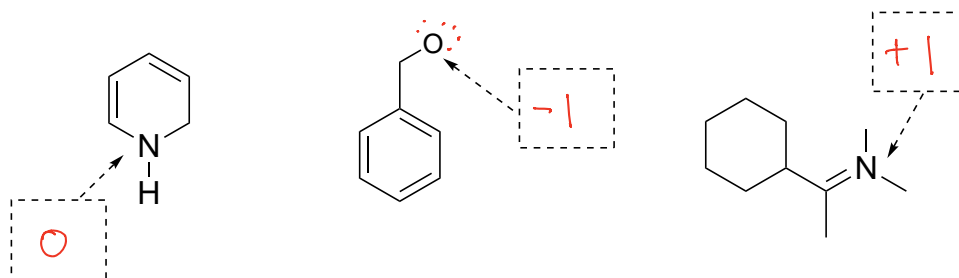


b) (5 pts.) Draw the most stable Newman projection conformer of 2-bromopentane (looking down on C2-C3)

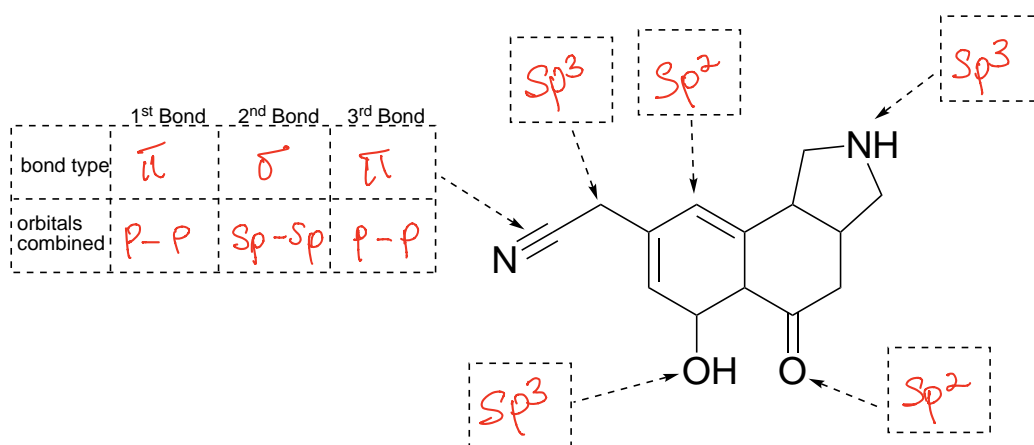


12. **20 pts.**

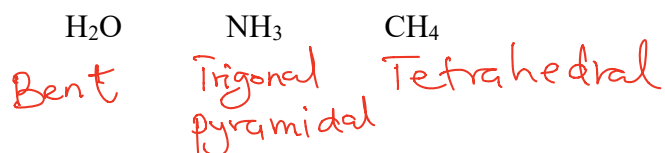
- a) (6 pts.) Calculate the **formal charge** for each of the atoms indicated below. (Hint: Make sure to add lone pairs when appropriate and be considered in your calculations).



- b) (11 pts.) Indicate the hybridization of the atoms indicated in the compound below. In $C\equiv N$ triple bond attached indicate bond types and orbitals present in each of the bond makeup.

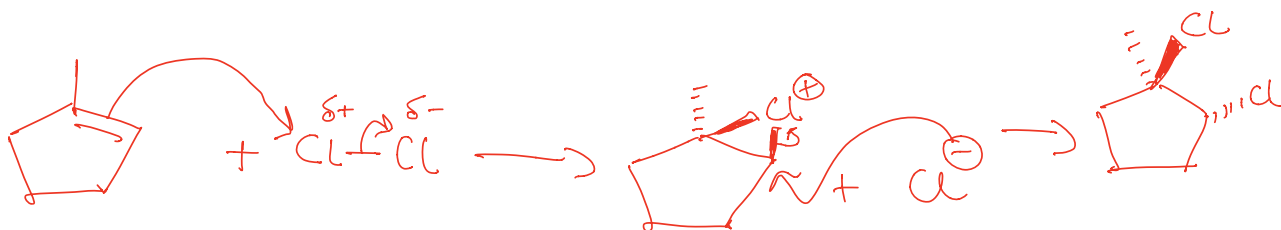
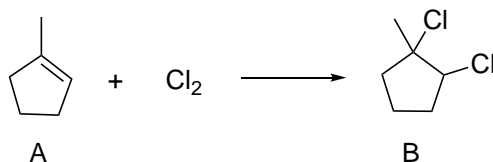


- c) (3 pts.) What are the shapes of the molecules below? (eg. Linear etc.)



13. (20 pts.)

- a) (10 pts.) Provide a plausible arrow pushing mechanism for the reaction below? Be sure to account for the intermediate(s) and the stereochemistry in the final product.



- b) (4 pts.) What is the IUPAC name of the compound labelled A above? Be sure to account for the E/Z configuration.

(E)-1-methylcyclopentene

- c) (2 pts.) Is the compound labelled A a nucleophile or an electrophile?

Nucleophile

- d) (4 pts.) What is the IUPAC name of the compound labelled B above? Don't worry about the stereochemistry.

1-methyl-1,2-dichlorocyclopentane

14. (5 pts. extra credit)

- Write a poem (rhyme) about something chemical that we've learned in this class. The poem must have not less than 5 lines.