CHE 1502 JUNE 2016 EXAM PACK

1. (2)- ionic bonding between the Na^+ and OH^-; covalent bonding between O and H
2. (2)- C can only form a maximum of four bonds
3. (1)- Formal charge= valence electrons- [lone electrons+ ½(bonding electrons0]= 5-(0+1/2(8)= +1
4. (2)- has the lowest boiling point because it has more branching, and it forms spherical molecules with fewer points of contact between the molecules.
5. (2)- constitutional isomers are isomers that differ in their bonding sequence
6. (2)- One is totally eclipsed, and the other is eclipsed at 120^0 respectively.
7. (1)- the anti-conformation is the most stable because the Iodine atoms are opposed, and hence there is less steric hindrance
8. (1)- it is an S_N2 reaction where the alkyl halide is converted to a thiol
9. (1)- an alcohol is a weak electrophile because the hydroxyl is a poor leaving group. The hydroxyl group becomes a good leaving group when it is protonated (H_2O). HI reacts with the alcohol by an S_N2 attack of iodide on the protonated alcohol. The C-O bond is broken in this way.
10. (3)
11. (1)- the O atom is sp^3 hybridized giving a nearly tetrahedral bond angle
12. (2)- an E2 reaction mechanism where a base abstracts a proton neighbouring the leaving group, forcing the electrons to make a double bond, and in so doing forcing off the leaving group.
13. (4)- in the mechanism, of the E2 reaction, a strong base abstracts a proton on a carbon atom adjacent to the one with the leaving group. As the base abstracts a proton, a double bond is formed
14. (2)

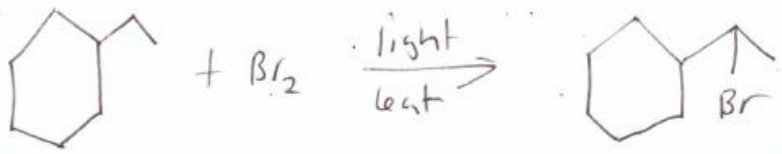
15. (2)-using the Cahn Ingold Prelog rules which state that: (1) assign priorities to each group bonded to the carbon atom; (2) in case of ties, use the next atoms along the chain of each group as tiebreakers; (3) treat double bonds and triple bonds as if each bond were a bond to a separate atom, (4) using a three dimensional drawing, put the fourth priority group in back, and view the molecule along the bond from the asymmetric carbon to the fourth priority group.
16. (4)- a tertiary amine is bonded to three R groups
17. (3)- geometric isomers
18. (1)- the two first priority atoms are one the same side of the double bond, so it's a Z isomer, (zusammen)
19. (2) the more stable cation formed is the one where the carbon atom is bonded to more methyl groups. The methyl groups have a positive inductive effect
20. (4) according to Markonikov rule the halogen atom attaches on the carbon atom with less H atoms
21. (2)- in the presence of peroxides, anti-Markonikov orientation is obtained where the Br atom attaches to the carbon atom with less R groups, or more hydrogen atoms.
22.
23. (2)- ethyl comes first before fluoro, the first carbon atom is the one closest to the –OH group
24. (2) the stable product formed is where the alkyl groups are farther apart, that is in the trans configuration
25. (1)

26. (3)- the reaction takes place using Markonikov orientation whereby the O atom attaches to the C atom bonded to fewer H atoms. The final product is a ketone which is stable
27. (1) the negatively polarized oxygen acts as a nucleophile and a Lewis base
28. (2)- Electron withdrawing groups increases the acidity of carboxylic acids. Electron donating groups such as alkyl reduce the acidity by making the O-H bond stronger, and making it less likely for a proton to be lost.
29. (3)- the compound should be an ester
30. (3)

SECTION B

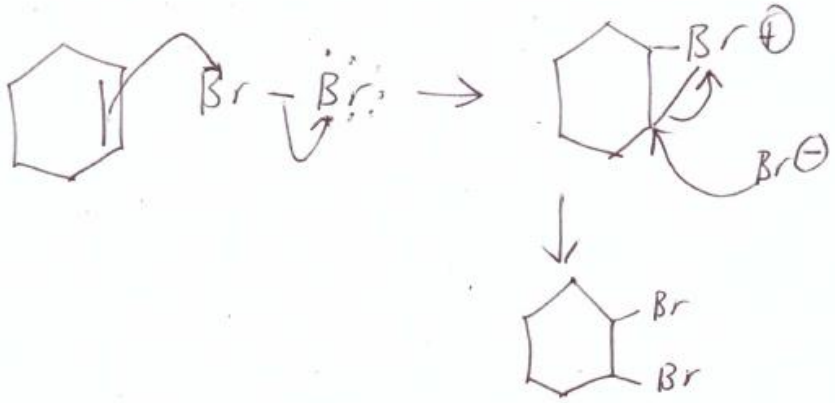
JUNE 2016

1(a)

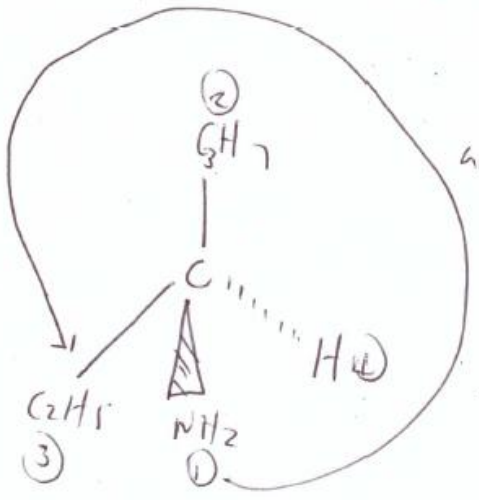


(b)

(c)

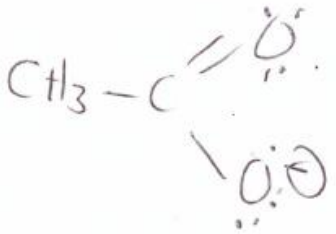


(d)

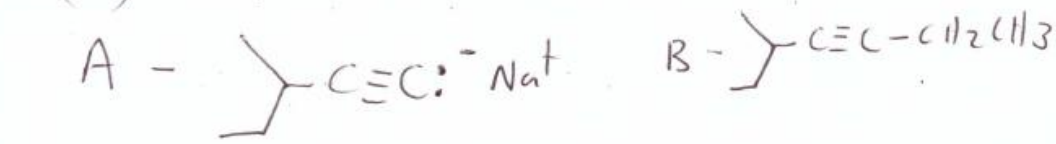


S-3-aminohexane

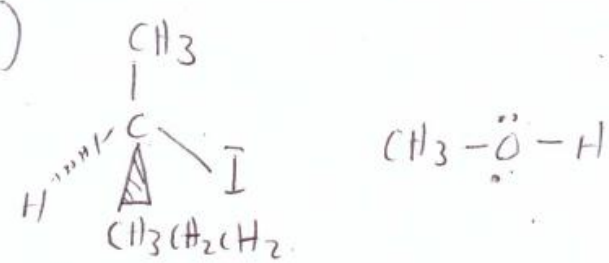
(e)



2(a)

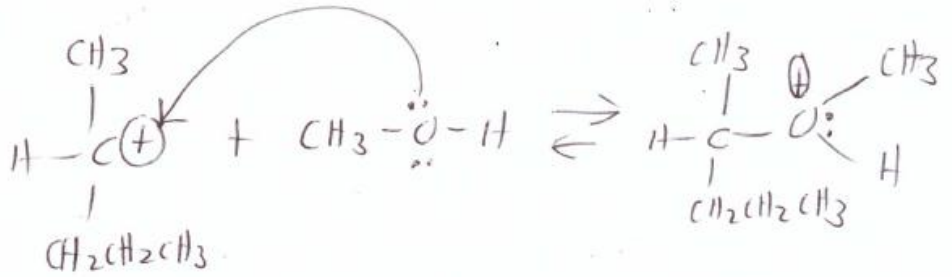


(b)

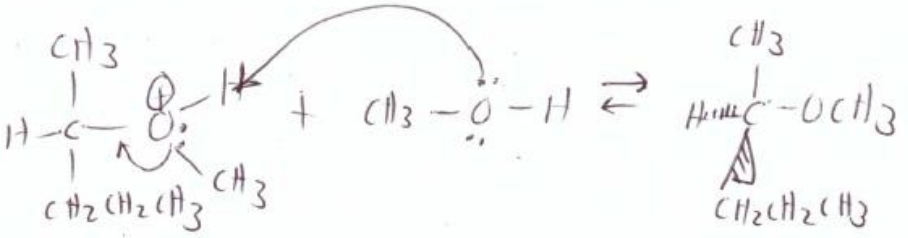


STEP 1: FORMATION of CARBOCATION.

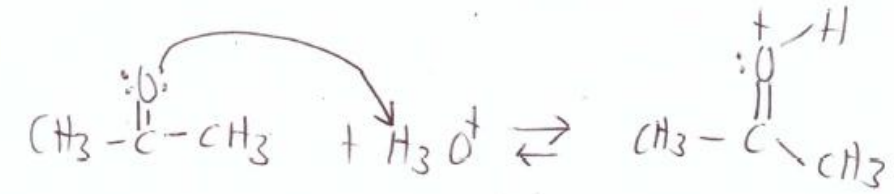
STEP II : NUCLEOPHILIC ATTACK BY SOLVENT.

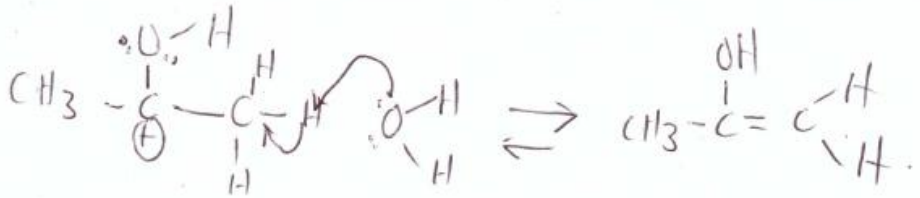


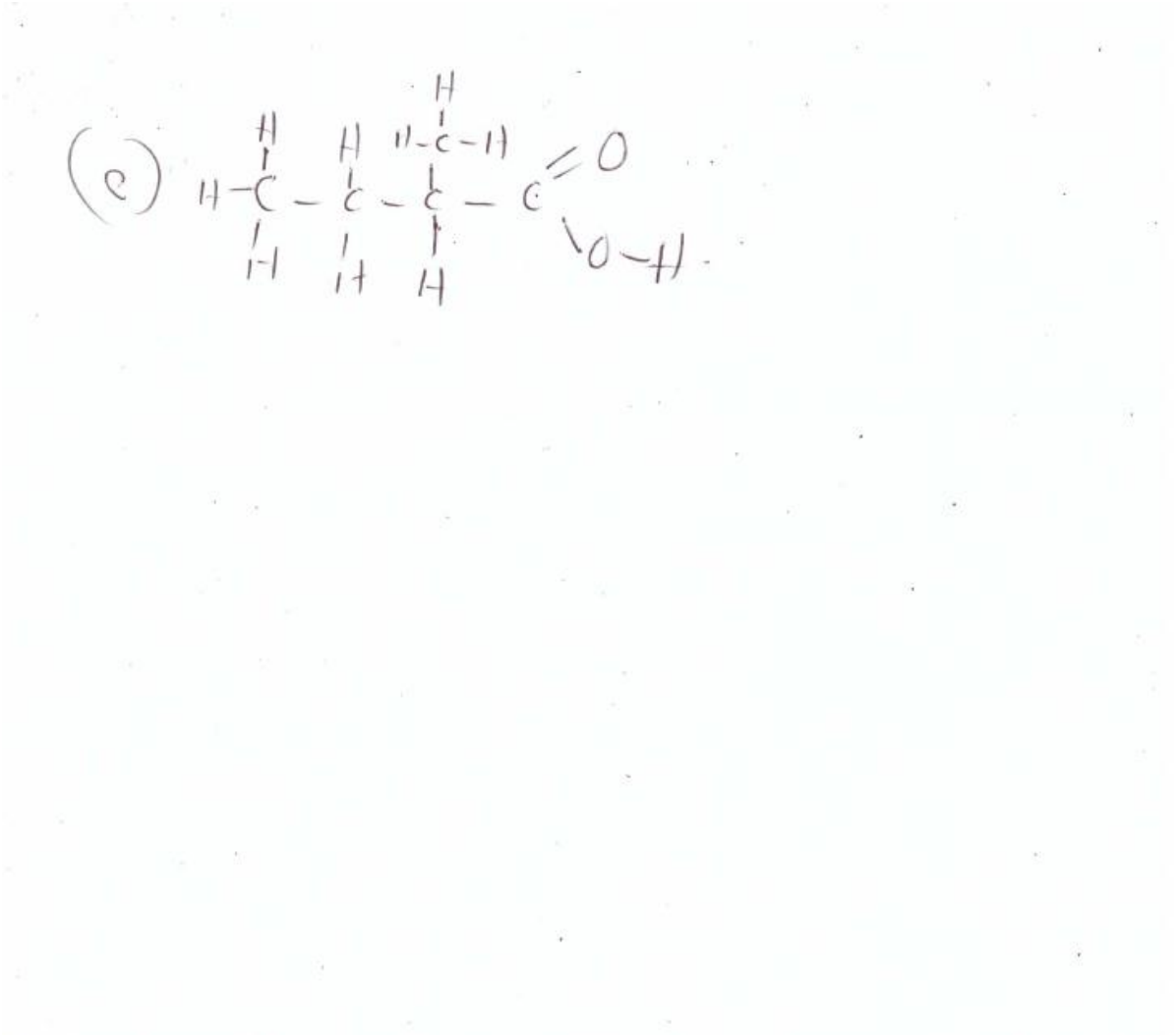
STEP III : DEPROTONATION FORMING PRODUCT.



d)







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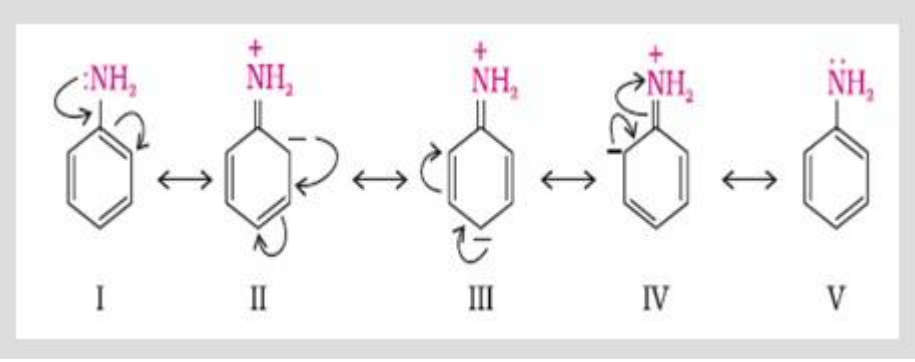
1. (3) the C atom is sp^3 hybridized. Sp^2 hybridization only takes place for C when double bonds are involved.
2. (2) a Lewis base is a species with a non-bonding pair of electrons that it can donate to form new bonds
3. (3)
4. (1) F.C= 5- ½(8)= +1 for N' F.C= 4-[2+1/2(6)]=-1 for C
5. (2)
6. (4)- the secondary radical formed at the secondary position is more stable, and so is the transition state leading to it

7. (4)- both of them have non-bonding pairs of electrons hence they act as Lewis bases
8. (1)- the carbocation is formed in the rate-limiting step when the I atom leaves
9. (2)- an ether is formed because the reaction takes place with the solvent acting as the nucleophile.
10. (1)- a secondary halide in the presence of a strong base undergoes S_N2
11. (4)- the synthesis involves use of a less hindered alkyl group as the S_N2 substrate and the alkoxide of the more hindered alkyl group
12. (3)Zaistev rule predicts that the more substituted alkene will be formed
13. (4)- it contains hydrogen bonds that give it a higher boiling point than other compounds that have VDW forces.
14. (4)- Zaistev rule applies, if two or more alkenes might be formed by deprotonation of the carbocation, the most highly substituted alkene usually predominates
15. (4)
16. (1)
17. (3)
18. (2)



19. (2)
20. (4)- the two priority groups are on the same side

21. (2)- according to Markonikov's rule, the major product is formed on the C atom with less H atoms
22. (3)-
23. (4)- With peroxides the anti-Markonikov's rule is followed
24. (2)- in the presence of H_2 and Pd catalyst, the alkynes are converted to alkanes
25. (1)- the major product is still an alkyne. Sodium amide is used as a base to form acetylide salts. The acetylide salts are strong nucleophiles that are involved in formation of the triple bond by double hydrohalogenation of a dihalide.
26. (3)
27. (1)
28. (4)- the Cl atoms are electron withdrawing groups that increase the acidity of the carboxylic acids. The more they are the greater
29. (2)-
30. (3)

SECTION B

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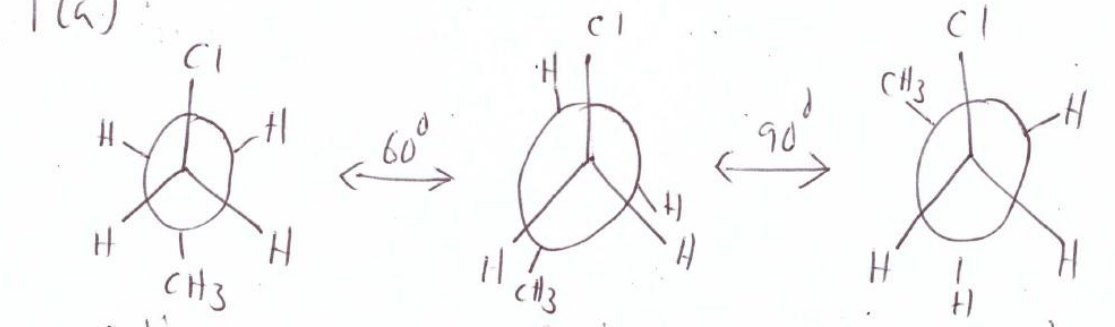
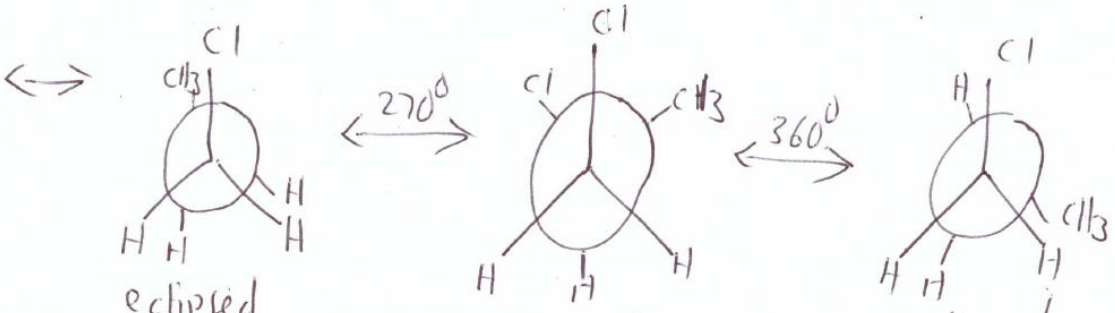
1(a)

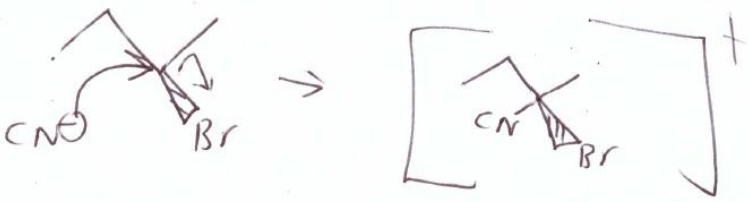


anti-staggered | eclipsed | n-gauche

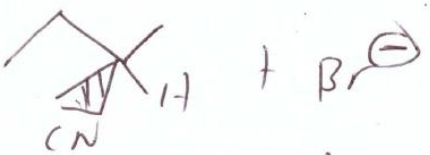


eclipsed | p gauche | eclipsed

b)

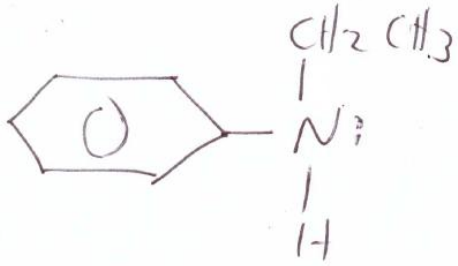


transition state



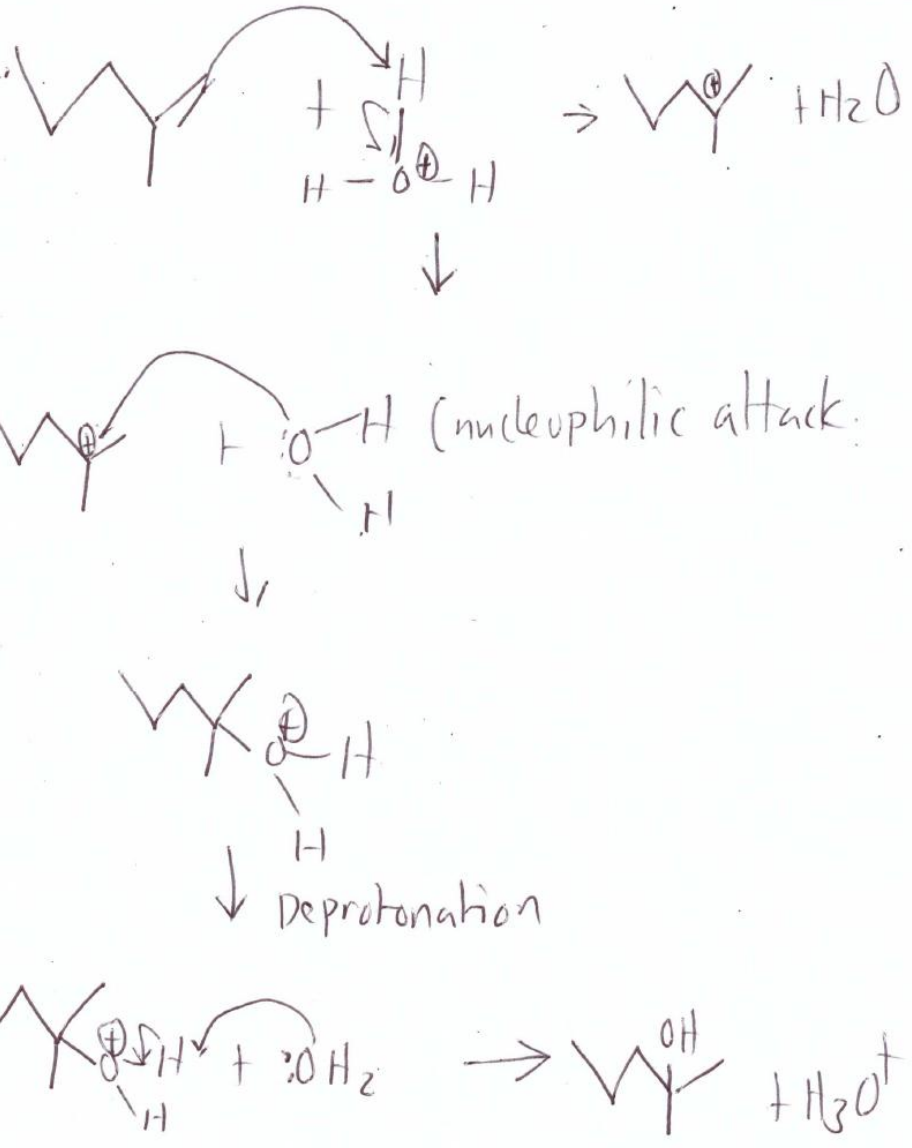
S-2-methylbutanenitrile

(c)

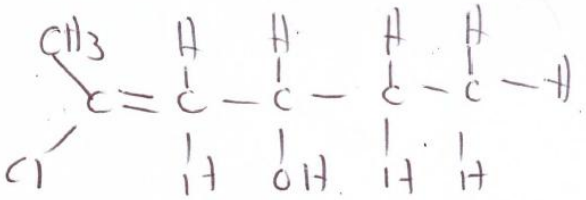


N-ethylaniline.

2(a)



(b)



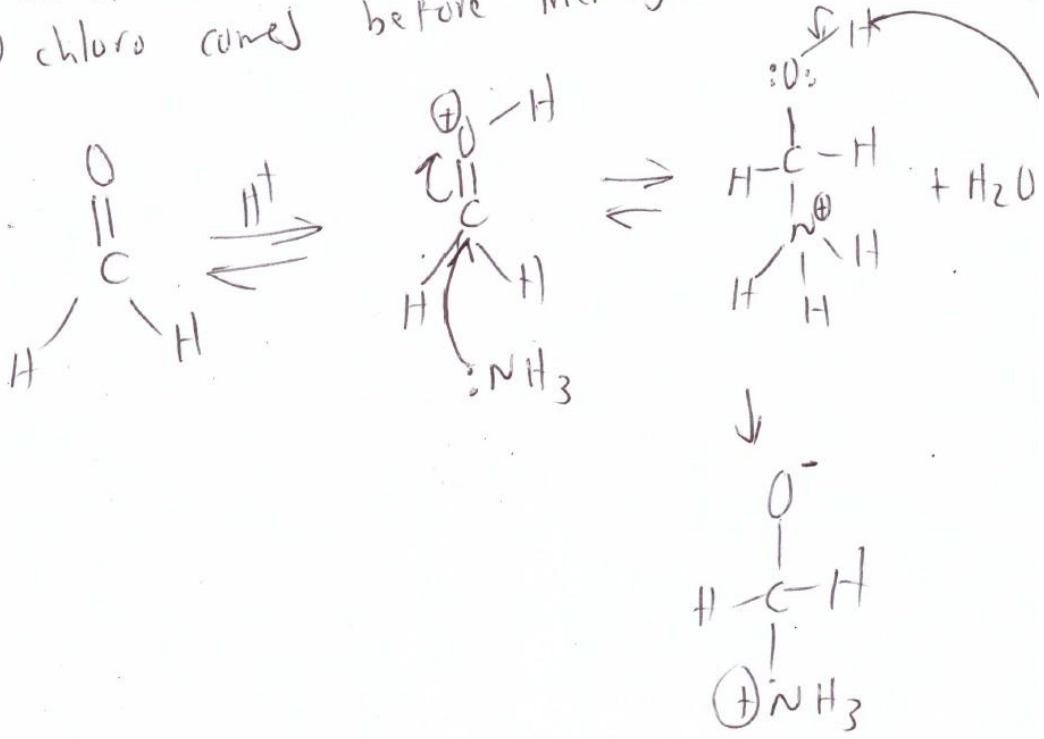
(ii) The structure violates the IUPAC rules in that:

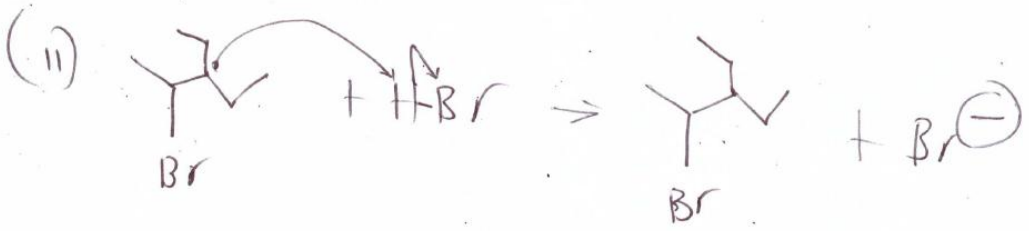
(1) the longest chain is not five carbon atoms long

(2) The methyl group is on carbon number one so it is not considered a side group

(3) chloro comes before methyl when naming

(c)



(ii) 

(d) Heterolytic fission takes place.

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1. (2)- its sp hybridization for the C atom, and sp^2 hybridization for the O atoms
2. (1)
3. (1)- the molecule is symmetrical. As for methoxymethane, the C-O bonds are polar, and it is angular. Meaning that the molecule has an overall dipole
4. (2)
5. (2)
6. (2)- HBr is the electrophile. The H atom in the molecule is attracted to negative charge
7. (3)

8. (1)- homolysis takes place when a bond breaks in such a way that both atoms gain an electron
9. (1)
10. (1)
11. (4)- it is branched and it has the lower molecular weight of the two branched compounds
12. (2)- the reaction goes rapidly with methyl halides, slower with secondary halides, and non-reactive with tertiary halides.
13. (4)- in S_N2 reaction, back-side attack occurs, literally turning the tetrahedron of the carbon atom inside out. In the product, the nucleophile assumes a stereo chemical position opposite the position of the leaving group originally occupied. This is called inversion of configuration at the carbon atom
14. (2)- with a strong base, S_N2 is most likely.
15. (1)
16. (4)- C has the lowest boling point because it is the most branched, and it forms a nearly spherical shape
17. (1)- the more substituted product is formed
18. (3)
19. (3)
20. (2)- it is a primary amine, and forms more hydrogen bonds
21. (1)
22. (3)- using the Anti Markonikov rule
23. (4)
24. (2)
25. (1)

26. (4)

27. (1)

28. (2)

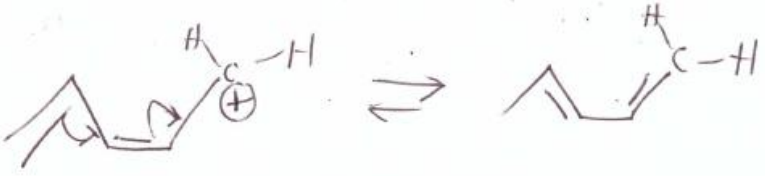
29. (3)- the most number of electron withdrawing groups

30. (3)

SECTION B

JUNE 2017 SECTION B

1(a)

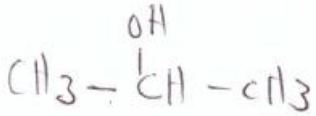


(b)

(anti conformation)
most stable

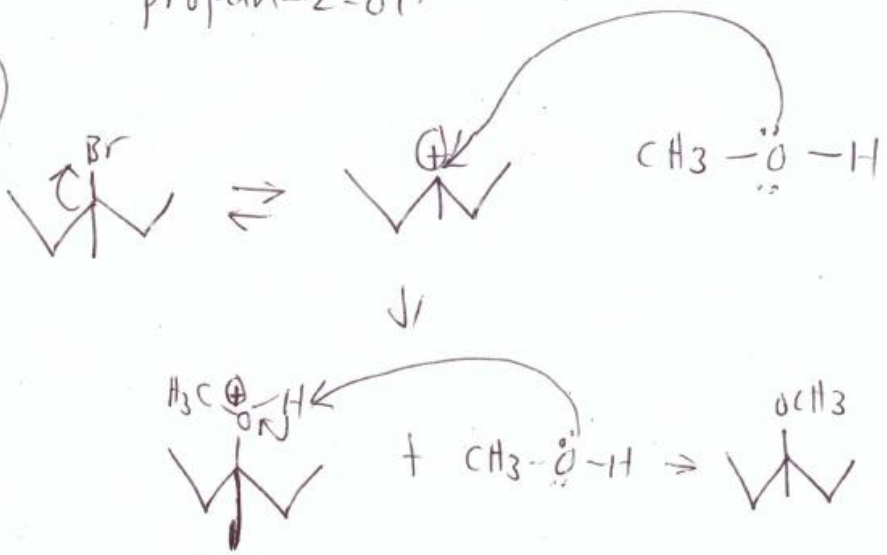
totally eclipsed
(least stable)

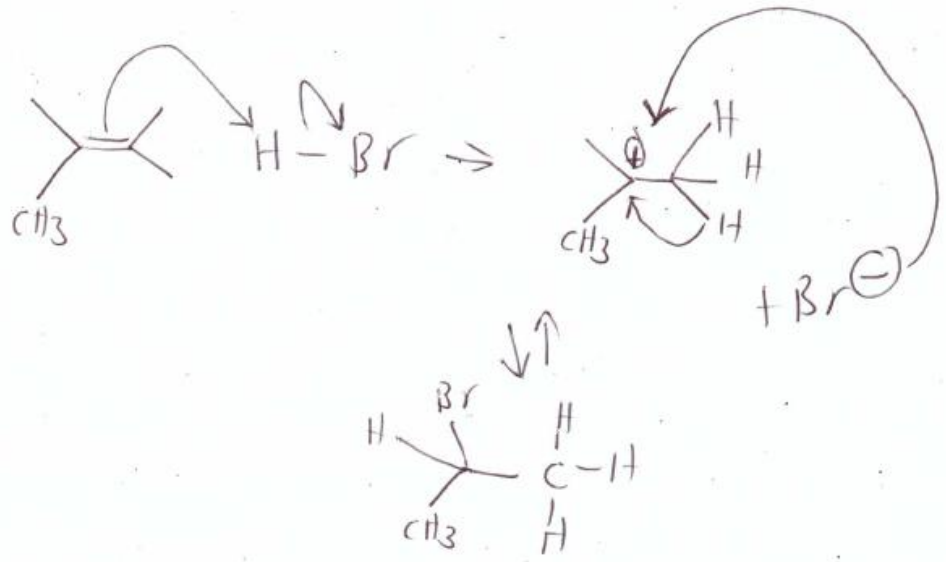
(c)



propan-2-ol.

(d)

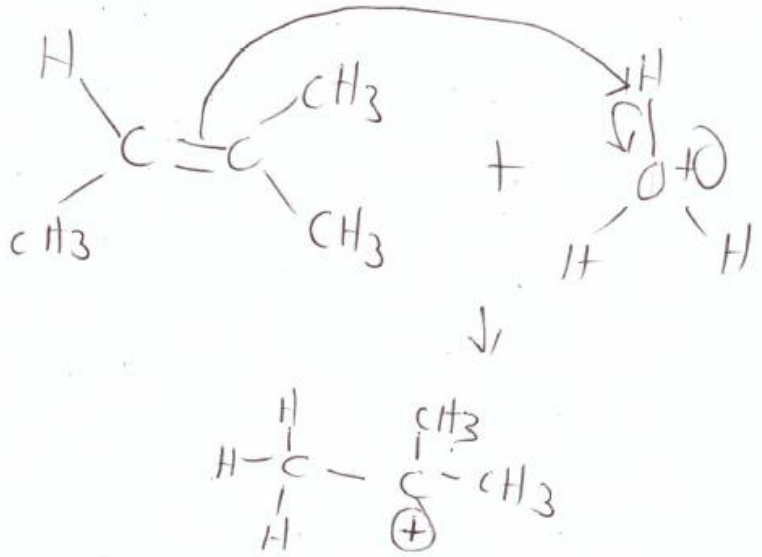




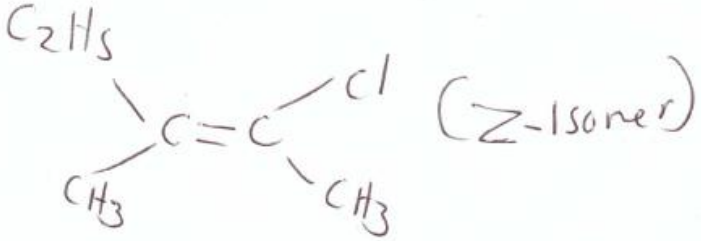
(e) 4,5 - dimethy hexan-3-one.

2(a)

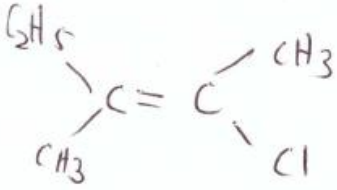
(b)



c)



(Z-Isomer)



(E-Isomer.

1. (2)
2. (1)- That is sp^3 hybridization
3. (3)
4. (3)
5. (1) it contains lone electrons
6. (4)
7. (2)- heterocyclic breaking of a covalent bond involves breaking of the bond with one atom gaining both electrons
8. (2)- the longest chain has seven carbon atoms
9. (2)- it has more than four carbon atoms
10. (4)- the two largest groups are far from each other, and therefore it has the lowest energy, and is considered the most stable
11. (4)
12. (1)- the most stable radical is one in which the three alkyl groups that have an electron donating effect increase the positive charge on the carbocation
13. (4)- the tertiary radical is formed preferentially, and so is the transition state
14. (2)
15. (4)- there is steric hindrance from the large groups
16. (4)
17. (3)- it proceeds via E2 reaction mechanism
18. (1)
19. (3)
20. (2)- by applying Mrkonikov's rule
21. (2)
22. (2)

23. (1)

24. (1)- phenyl ethers react with HBr, and HI to give phenols

25. (2)

26. (4)- the trans product is the major one

27. (3)- the carboxylic acid without the electron withdrawing groups is the weakest

28. (1)

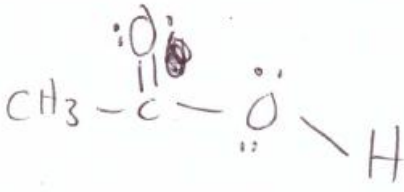
29. (1)

30. (2)

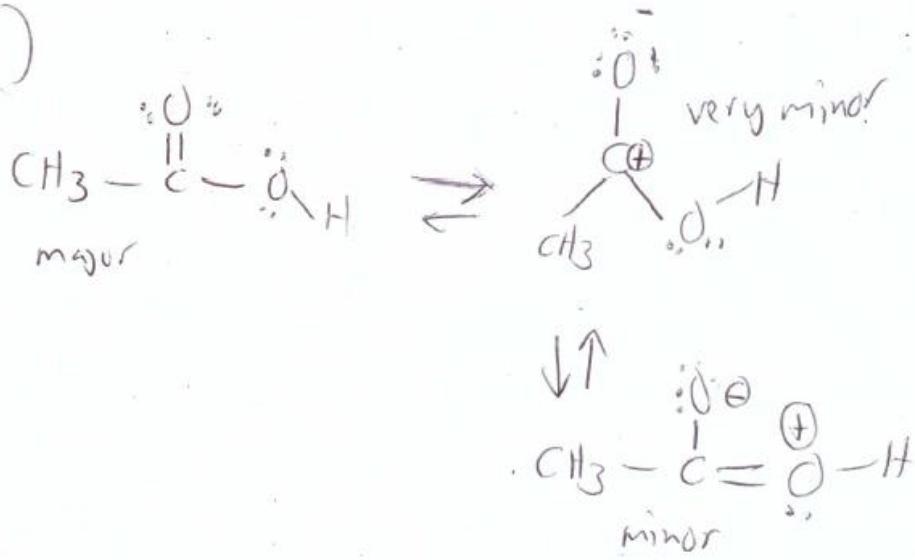
31. SECTION B

SECTION B

1 (a)



(b)



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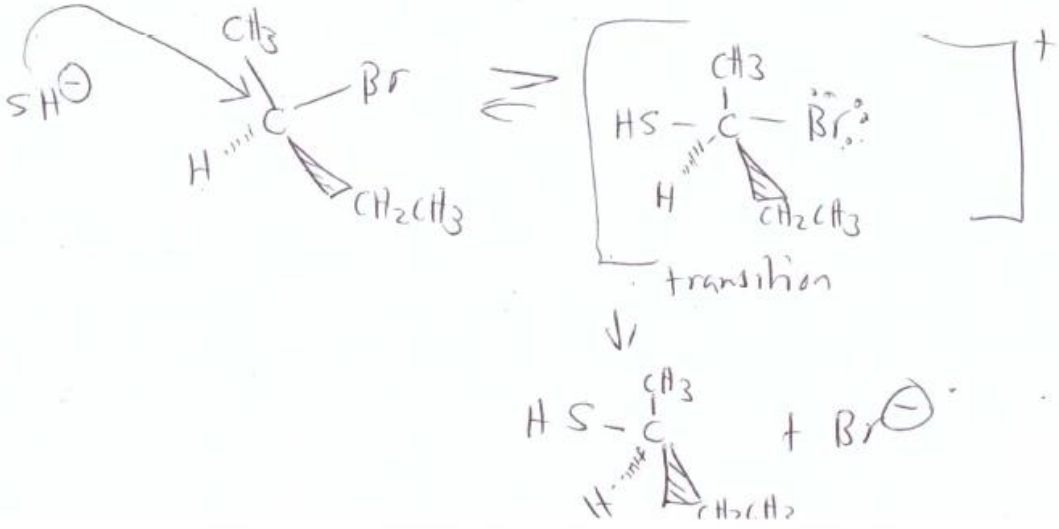
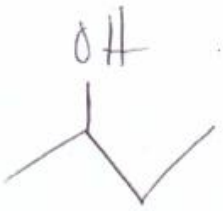
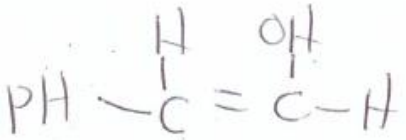


(d)

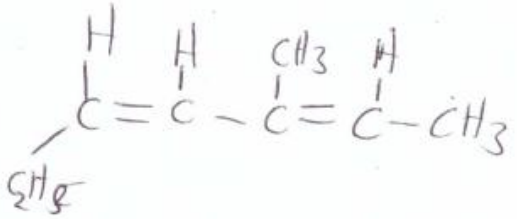


The molecule has a chiral centre and is bonded to four different groups

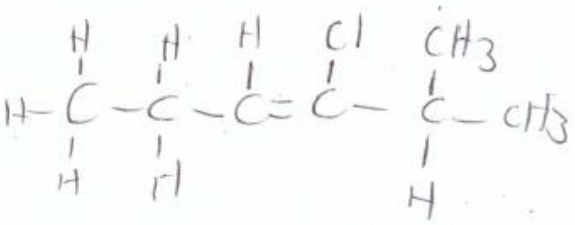
(e)



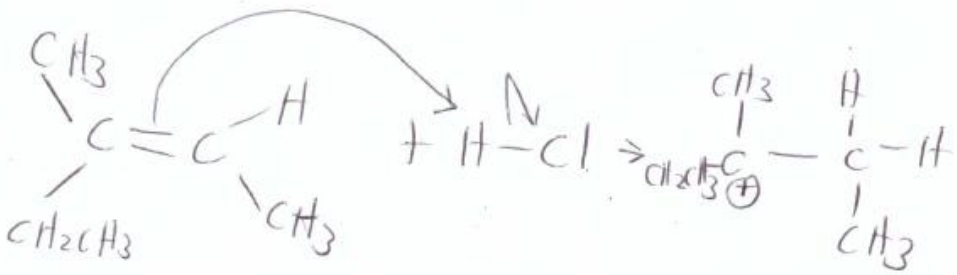
2 (a)



(b)



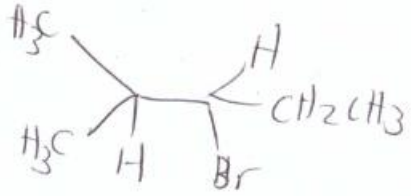
(c)



b.(ii) The name is wrong because the longest chain is seven carbon atoms long and the methyl group is not on carbon number one. The correct name should be

4 chloro - 5 methyl hept - 3 - ene

(d)



(Anti-Markonikov rule)

(e) $CH_3C\equiv C-H + NaNH_2$

$\downarrow$

$CH_3C\equiv C:^{\ominus}\ Na^{\oplus} + NH_3$

$+ CH_3Br$

$\downarrow$

$CH_3C\equiv C-CH_3$

(f) ethyl-2-fluoro-3-methyl-butanoate: