KATHMANDU UNIVERSITY
End Semester Examination [C]
May/June, 2019

Marks Scored:

Level: B.E./B.Tech./B.Pharm.
Year : II

Course : CHEM 201
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date 09 JUN 2019

SECTION "A"

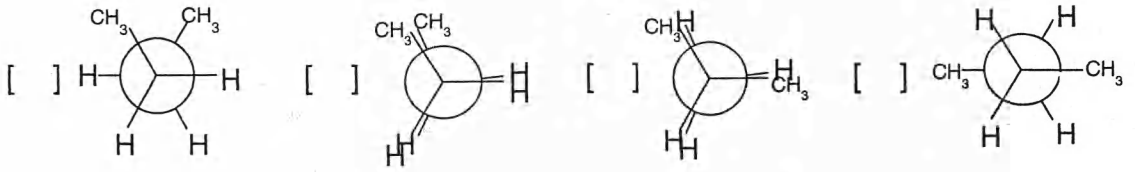
[20 Q. × 1 = 20 marks]

I. Choose and mark [X] *at the most appropriate answer.*

1. (R)-2-chloro-(S)-3-bromobutane and (S)-2-chloro-(S)-3-bromobutane are
   [ ] Enantiomers [ ] Diastereomers
   [ ] Structural isomers [ ] Meso-compounds

2. A sample of 2-methyl-1-butanol has a specific rotation of +1. 151. What is the approximate % of (-)-isomer in the sample? Given specific rotation of optically pure (R)-(+)-isomer is +5.756.
   [ ] 20% [ ] 40% [ ] 60% [ ] 80%

3. Which of the following conformation has lowest potential energy?



4. Which conformation of cyclohexane has no angle strain but does have torsional strain?
   [ ] Chair [ ] Half-chair [ ] Twist boat [ ] Boat

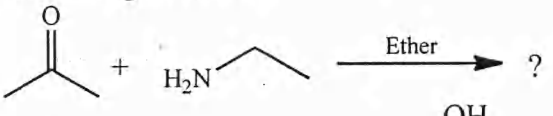
5. Which electrophilic addition reactions form carbocation intermediate?
   [ ] Hydrogenation [ ] Halogenation
   [ ] Hydration [ ] Halohydrin formation

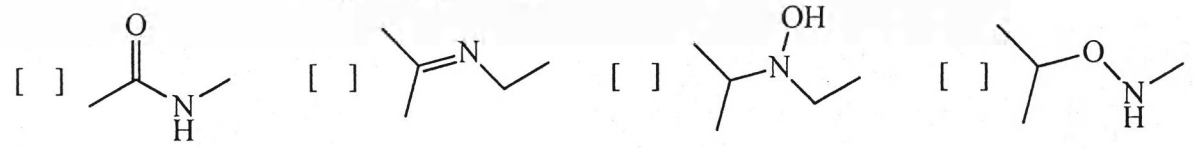
6. In a protic solvent, which of the following halogens would be the best nucleophile?
   [ ] I^- [ ] Br^- [ ] Cl^- [ ] F^-

7. Rank the following in order of decreasing leaving group ability (better leaving group > poor leaving group): H_2O, OH^-, Br^-, H^-.
   [ ] $H_2O > OH^- > Br^- > H^-$ [ ] $H_2O > Br^- > OH^- > H^-$
   [ ] $H_2O > H^- > OH^- > Br^-$ [ ] $H_2O > Br^- > H^- > OH^-$

8. Which of the following compounds would be the most reactive toward a nucleophile?
   [ ] Pentanal [ ] 3-Pentanone [ ] Pentane [ ] 2-Nonanone

9. What is the product of the following reaction?

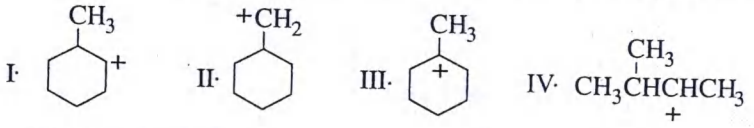




10. Which of the following compounds may be classed as an aprotic solvent?
[ ] N, N-Dimethylformamide [ ] N-Methylformamide
[ ] Ethyl alcohol [ ] Acetic acid

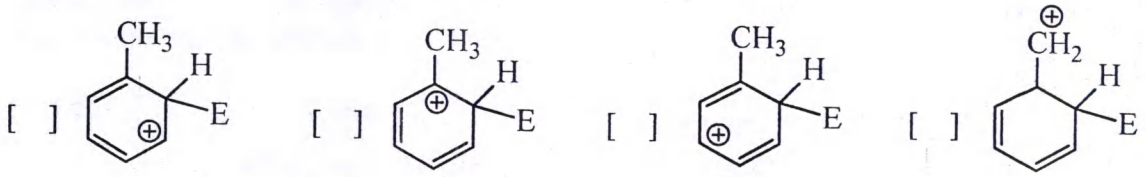
11. For a chiral substrate, which of the following reaction mechanism is accompanied by formation of racemic mixture?
[ ] S_N1 [ ] S_N2 [ ] E1 [ ] E2

12. Which of the following carbocations would you expect to rearrange?

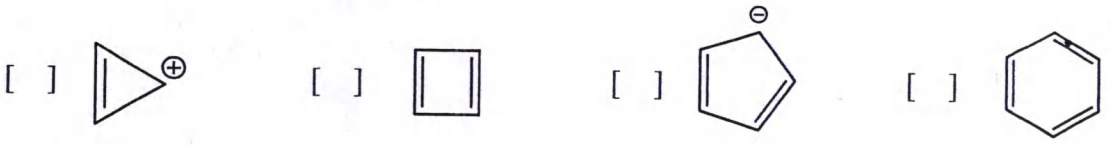


[ ] I, II and III only [ ] II and III only
[ ] I, II and IV only [ ] IV only

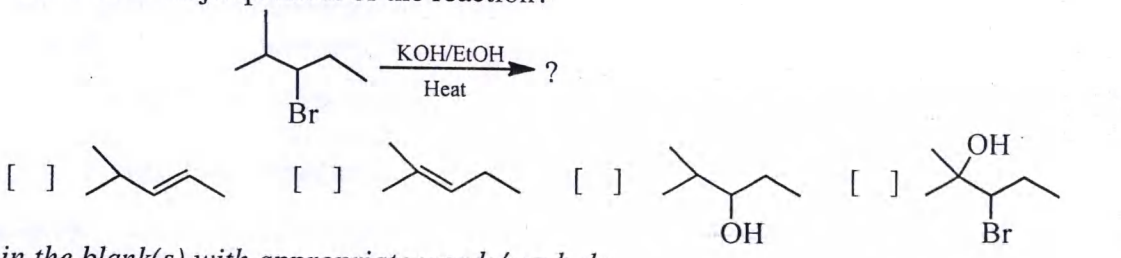
13. Which is the most stable structure?



14. Which is **not** an aromatic structure?



15. What is the major product of the reaction?



II. Fill in the blank(s) with appropriate words/symbols.

16. A _____ is always a Lewis base, and it may be negatively charged or neutral.

17. Electron withdrawing substituent at ortho and para position ***increases*** reactivity of the benzene ring toward _____ substitution.

18. Oxidation of alkene by permanganate is the basis of a very useful analytical test known as _____.

19. A/An _____ has an uninterrupted cyclic cloud of π electrons that contains an odd number of pairs of π electrons.

20. The treatment of 2-methyl-2-butene with acidified water yields (IUPAC name) _____ as a major product.

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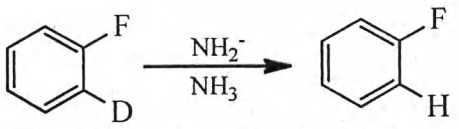
SECTION "B"

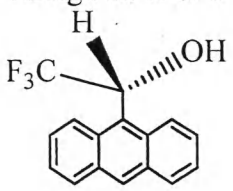
Attempt *ALL* questions.

1.

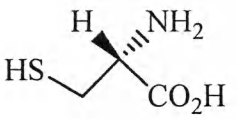
a) Write the mechanism for the reaction when chlorobenzene reacts with NH_2^-/NH_3 . What evidence does the following reaction provide for this mechanism? [2+2]



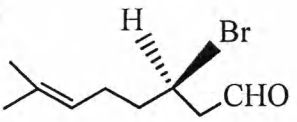
b) Assign an R or S configuration of each chiral center in the molecules given below. [3]



I



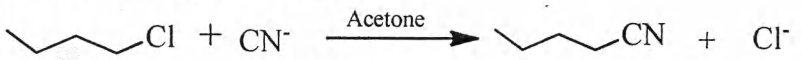
II



III

2.

a) *Consider the following S_N2 reaction.*



i. Draw an energy diagram, label the axes, the reactants, products, E_a. *Assume that the reaction is exothermic.* [2]

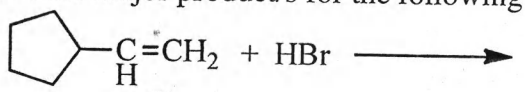
ii. What happens to the reaction rate in each of the following case? [2]
   a. The leaving group is changed from Cl^- to I^-.
   b. The solvent is changed from acetone to ethanol.
   c. The alkyl halide is changed from chlorobutane to 2-chlorobutane.
   d. The concentration of cyanide ion is increased by a factor of five.

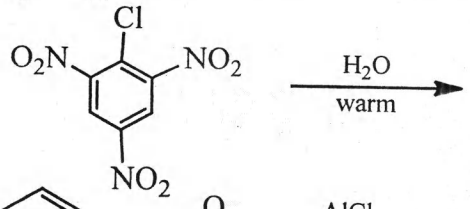
b) What are the two criteria for a molecule to be aromatic? Give reason why benzene undergoes substitution reaction more easily than addition. [1+2 = 3]

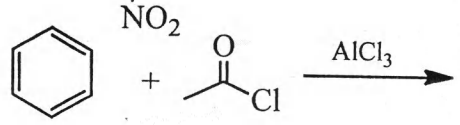
3. How would you carry out the following conversions? [4×1.5 = 6]
   a) Benzene to *m*-propylbromobenzene
   b) 2-Butanone to 2-methyl-2-butenoic acid
   c) Toluene to *m*-nitrobenzoic acid
   d) 2-Methylpropene to 2,2,4-trimethylpentane (isooctane)

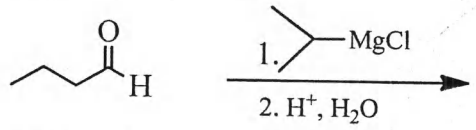
4. Give the appropriate reasons for the following statements (*ANY FIVE*). [5×2 = 10]
   a) Incomplete racemization is often found in S_N1 reactions. An excess of inversion is generally found.
   b) An aprotic solvent dissolves ionic compounds mainly due to solvaion of cations
   c) Chair conformation of cyclohexane is most stable conformation.
   d) Hexane is not a common solvent for either S_N1 or S_N2 reactions.
   e) Cyclopentadiene is much more acidic than cycloheptatriene.
   f) Nitrobenzene undergoes electrophilic substitution slower than toulene

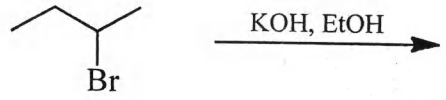
5. Give the major product/s for the following reactions. [6 × 1 = 6]

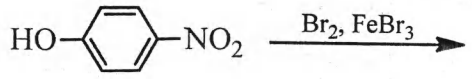
i. 

ii. 

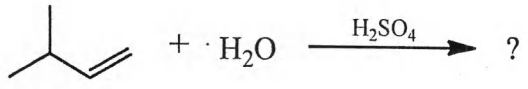
iii. 

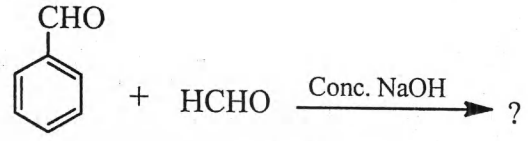
iv. 

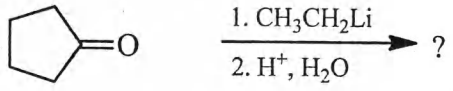
v. 

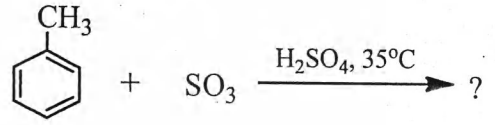
vi. 

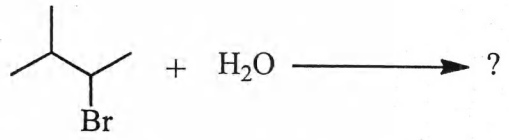
6. Complete the equations and propose the mechanism for the following reactions *(ANY FOUR)*. [4 × 2.5 = 10]

i. 

ii. 

iii. 

iv. 

v. 

7. Write short notes on *(ANY THREE)*: [3×3 = 9]
   a) Rearrangement of carbocation
   b) Phase transfer catalysis
   c) Resolution of racemic modification
   d) Conformational analysis of n-butane