KATHMANDU UNIVERSITY
End Semester Examination
September 2024

Marks Scored:

Level : B.Sc./B.Tech. | Course : CHEM 103
Year : I | Semester : II
Exam Roll No. : | Time: 30 mins. | F. M. : 20
Registration No.: | Date : 17 SEP 2024

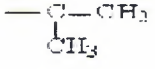
SECTION "A"
[20Q. × 1 = 20 marks]

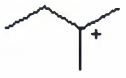
Choose and mark [X] in the most appropriate answer. Symbols have their usual meanings.

1. Which of the following molecules exists as a pair of enantiomers?
[ ] 2-Bromopropane [ ] 1-Bromo-3-methylbutane
[ ] 2-Cyclohexen-1-ol [ ] cis-1,2-Dichlorocyclobutane

2. A solution containing 0.2 g/mL of a pure R enantiomer in a 1 dm polarimeter rotates plane polarized light by +3°. What is the specific rotation of the R isomer?
[ ] +0.06° [ ] +15° [ ]+670° [ ] +150°

3. A pure sample of the R-enantiomer of a compound has a specific rotation, [α], of -15°. A solution containing 0.6 g/mL of a mixture of enantiomers rotates plane polarized light by -3° in a 1 dm polarimeter. What is the enantiomeric excess (%ee) of the mixture?
[ ] 33% R [ ]33% S [ ]50% R [ ]75% R

4. Which of the following groups has the highest priority in the (R,S) system?
[ ] —C≡CH [ ]  [ ] –CH=CH$_2$ [ ]–CH$_2$–CH$_3$

5. Which is the MOST stable cation?
[ ]  [ ]  [ ]  [ ] 

6. Which of the following statements is **TRUE** for an E1 reaction?
[ ] The E1 reaction requires a strong base to take place
[ ] Primary and secondary alkyl halides are a good substrate for the E1 reaction.
[ ] The E1 reaction occurs during the solvolysis of tertiary alkyl halides
[ ] The rate of the E1 depends on the concentration of nucleophile.

7. Identify the name of the mechanism for the following reaction.


[ ] E1 [ ] E2 [ ]S_N1 [ ]S_N2

8. The number of moles of ions gives on complete ionization of one mole of $[Co(NH_3)_6]Cl_3$ is/are
[ ] 4 [ ] 3 [ ] 2 [ ] 1

9. Predict the major product of the following reaction:
2-methylbutane + Br_2/light energy →
[ ] 1-bromo-2-methylbutane [ ] 2-bromo-2-methylbutane
[ ] 2-bromo-3-methylbutane [ ] 1-bromo-3-methylbutane

10. A complex compound in which the oxidation number of a metal is zero,is
[ ] $K_4[Fe(CN)_6]$ [ ] $K_3[Fe(CN)_6]$ [ ] $[Ni(CO)_4]$ [ ] $[Pt(NH_3)_4]Cl_2$.

11. Among the ligands NH_3,en,CN- and CO the correct order of their increasing field strength, is
[ ] CO< NH3 <en < CN– [ ] NH3< en< CN–< CO
[ ] CN–< NH3< CO< en [ ] en< CN– <NH3 < CO

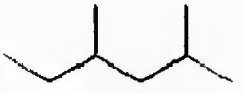
12. The IUPAC name of $[Ni(NH_3)_4]$ $[NiCl_4]$ is
[ ] Tetrachlorido nickel (II) - Tetrraammine nickel (II)
[ ] Tetrraammine nickel (II) - Tetrachlorido nickel (II)
[ ] Tetrraammine nickel (II) - Tetrachlorido nickelate (II)
[ ] Tetrachlorido nickel (II) - Tetrraammine nickelate (II)

13. $[Co(NH_3)_5\ NO_2]Cl_2$ and $[Co(NH_3)_5\ (ONO)]Cl_2$ are releted to each other as ?
[ ] Geometrical isomer [ ] Optical isomer
[ ] Linkage isomer [ ] Co-ordination isomer

14. Which of the following cannot be explained by crystal field theory?
[ ] The order of spectrochemical series
[ ] Stability of metal complexes
[ ] Magnetic properties of transition metal complexes
[ ] Colour of metal complexes

Fill in the blank

15. ⟶For the SN1reaction $(CH_3)_3C\text{-}Cl + I^-$ $(CH_3)_3C\text{-}I + Cl^-$
If the concentration of iodide ion is doubled, the rate of forming tert-butyl iodide will be_____

16. The number of stereoisomers for the following structure are 
_____

17. The formula of the complex, Sodium pentacyanonitrosylferrate (II) is_____

18. The dehydration of alcohols follow the order as_____

19. Free radical addition on asymmetrical alkenes follow_____ orientation.

20. The cation/s and anion/s present in aqueous solution of $Fe_4\ [Fe(CN)_6]_3$ is/are _____

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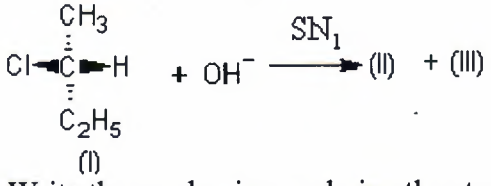
SECTION "B"

Attempt *ALL* questions.

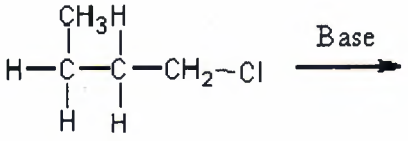
1.

a. Consider the following reaction



a. Write the mechanism and give the structure for (II) and (III). [2+1=3]
b. Discus the role of solvent in the above reaction. [2]
c. What is the stereochemistry of the reaction? Explain. [2]

b. i. Give the E1mechanism. [2]



ii. What will the effect of change in nature (strong and weak) of bases? Explain. [2]

2. Write notes on. [5×3=15]
a. Conformations of cycloalhexane
b. Sequence rule.
c. Effective Atomic Number (EAN rule)
d. Tetragonal distortion of octahedral complexes
e. Factors Affecting the Magnitude of Cystal field stabilization energy (Δ_o)

3. Give the appropriate reasons for the following facts. [4×3=12]
a. Dehydration of alchol is acid catalized where as dehydrohalogenation required base.
b. Free radical addition of HBr to asymmetrical alkene fallows anti –Markovnikov orientation.
c. The coordination compounds are coloured.
d. Equatorial methylcyclohexane is more stable than axial methylcyclohexane.

4. Differentiate between [3×3=9]
a. t_{2g} orbitals and e_g orbitals
b. Tetrahedral complexes and square plannar complexes
c. Pai-acceptor and pai-donor ligands

5. Define the followings with examples [4×2=8]
a. Polymerization Isomerism in coordination compounds
b. Meso compounds
c. Baeyer's strain theory
d. Aprotic solvent