

CHEMISTRY - II
(CHEM 2201)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) The oxidation number of cobalt in $K[Co(CO)_4]$ is
(a) +1 (b) +3 (c) +3 (d) -1.
- (ii) Consider two ideal gases A and B with molar mass M_A and $4 M_A$ respectively. The rms speed of B is 400 ms^{-1} at 27°C . The rms speed of A will be
(a) 50 ms^{-1} (b) 100 ms^{-1} (c) 400 ms^{-1} (d) 800 ms^{-1}
- (iii) The most strong field ligand in the spectrochemical series is
(a) Cl^- (b) F^- (c) NO_2^- (d) CN^-
- (iv) In which of the following reaction, amide is reduced to amine which has one carbon less than the starting material?
(a) Lossen rearrangement (b) Beckmann rearrangement
(c) Hofmann rearrangement (d) Fries rearrangement.
- (v) The spin magnetic moment of cobalt in the complex $Hg[Co(SCN)_4]$ is
(a) $\sqrt{3} \text{ BM}$ (b) $\sqrt{8} \text{ BM}$ (c) $\sqrt{5} \text{ BM}$ (d) $\sqrt{24} \text{ BM}$.
- (vi) The coagulating power of the effective ions for coagulation of a negatively charged colloidal particles will follow the order
(a) $Al^{3+} > Mg^{2+} > SO_4^{2-} > Cl^-$ (b) $Mg^{2+} > Al^{3+} > SO_4^{2-} > Cl^-$
(c) $SO_4^{2-} > Mg^{2+} > Al^{3+} > Cl^-$ (d) $Cl^- > Al^{3+} > Mg^{2+} > SO_4^{2-}$
- (vii) The high temperature limiting value of molar heat capacity of CO_2
(a) $6RT$ (b) $6.5R$ (c) $5/2 R$ (d) $13/2 RT$
- (viii) The order of stability of different conformation of cyclohexane is
(a) Chair form > boat form > twist boat form
(b) Chair form > twist boat form > boat form
(c) Twist boat form > chair form > boat form
(d) Boat form > chair form > twist boat form.

- (ix) The average speed of N₂ gas at 27°C is 400 ms⁻¹. The speed will be 800 ms⁻¹ at
(a) 54°C (b) 108°C (c) 927°C (d) 13.5°C.
- (x) Hypothyroidism is caused due to deficiency of
(a) K (b) Fe (c) I (d) F.

Group – B

2. (a) Write without derivation the expression for Maxwell's distribution of molecular speed and explain the general feature of the distribution curve. Using this expression, obtain the expression for most probable speed.
(b) Discuss the origin of charge on colloidal particles. Explain what is electrophoresis?
(2 + 2 + 4) + (2 + 2) = 12
3. (a) With the help of the appropriate postulate, obtain the Schrodinger wave equation.
(b) Describe two methods of preparation of colloidal particles. What is meant by Zeta potential?
6 + (4 + 2) = 12

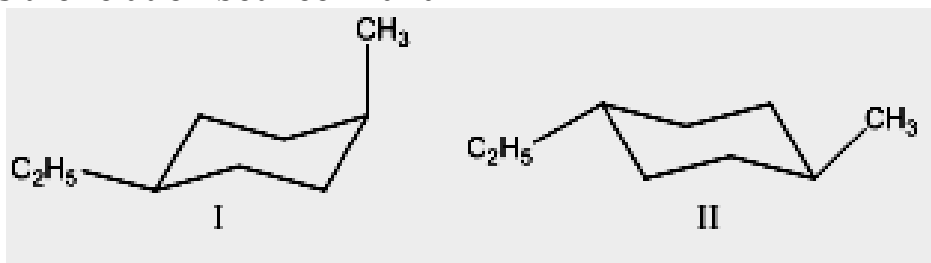
Group – C

4. (a) Write using IUPAC rules, the formulae of the following complex compounds:
tetraamminecobalt(III)-μ-imido-μ-nitrotetraamminecobalt(III) ion,
tetrapyridineplatinum(II) tetrachloroplatinate(II)
(b) What is 18 electron rule? [Mn(CO)₅] do not exist as stable molecule, however its anion [Mn(CO)₅]⁻ exist as stable species-justify.
(c) Draw a figure to show splitting of degenerate d-orbitals in a tetrahedral crystal field. Calculate the CFSE of the anionic tetrahedral complex [CuCl₄]²⁻.
(d) Draw and name the possible isomers of the neutral complex [Co(NH₃)₃Cl₃].
(1 + 1) + (2 + 2) + 2 + (2 + 2) = 12
5. (a) Calculate CFSE of the octahedral complexes [Co(CN)₆]³⁻ and [CoF₆]³⁻, from then compare their stability.
(b) Carbon monoxide is a σ-donor and π-accepter ligand- explain using diagram showing orbital overlap.
(c) Draw the possible optical isomers of [CoCl₂(en)₂]⁺ ion.
(d) Differentiate between coordination isomerism and coordination position isomerism.
(2 + 2 + 1) + 3 + 2 + 2 = 12

Group – D

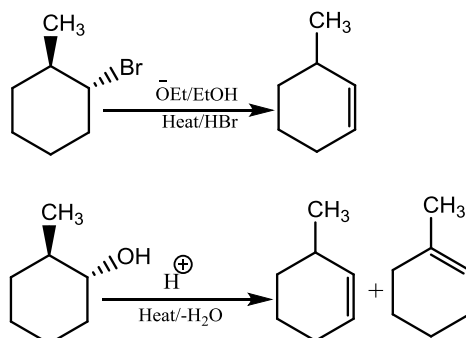
6. (a) Explain why only the trans-isomer of 2-bromocyclohexanol reacts with NaOH to give epoxide?

- (b) Draw energy profile diagram of n-butane. Which conformation is most stable?
- (c) Draw the structure of cis-1,4-di-tert-butyl cyclohexane in its most stable conformation. Discuss about it.
- (d) Write short note on transannular interaction.
- (e) What is the relation between I and II?



$$3 + (2 + 1) + 2 + 2 + 2 = 12$$

7. (a) What do you mean by the term 'crown ether'? Write the structure of 18-crown-6 and its role in the reaction of $(\text{CH}_3\text{CH}_2)_6\text{CH}_2\text{Br}$ with KF in warm benzene.
- (b) Draw the conformational isomers of 1,2 Dihydroxyethane in Newman projection formula. Identify the most stable conformation.
- (c) Suggest mechanisms to explain the different results obtained in following two reactions.

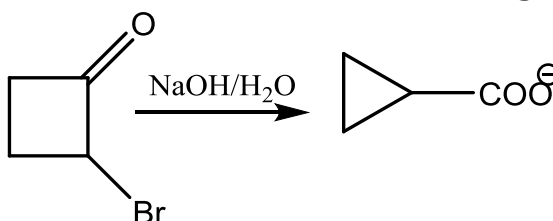


- (d) Draw the most stable conformation of trans 1,2 dimethyl cyclohexane. Compare its stability with the corresponding cis isomer.

$$(1 + 1 + 2) + (2 + 1) + 2 + 3 = 12$$

Group - E

8. (a) Show using a schematic diagram the anticancer activity of cis-platin by blocking the DNA codons of tumour cells.
- (b) How lead poisoning can be removed using metal chelate as a drug?
- (c) Suggest the reasonable mechanism for the following reaction.



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- (d) Write Gibbs adsorption equation and discuss how the equation can explain the lowering the surface tension of the solution by the surfactants.

$$3 + 2 + 3 + (2 + 2) = 12$$

9. (a) Draw the structure of unithiol and mention its utility.
- (b) What is the cause of pernicious anemia?
- (c) What happened when ethanoic acid is treated with hydrazoic acid in concentrated sulphuric acid? Write down the mechanism of this reaction.
- (d) Define the surface pressure and obtain the two dimensional analogue of three dimensional ideal gas equation.

$$(1 + 1) + 1 + (2 + 2) + 5 = 12$$

Department & Section	Submission Link
CHE	https://classroom.google.com/c/MjM1NDMzMzI3NzE3/a/Mzc0NDIyMTg0NjMy/details
BACKLOG	https://classroom.google.com/c/Mzc0NDU3NDU4MjE4?cjc=6qzfw5n