MIT MUZAFFARPUR

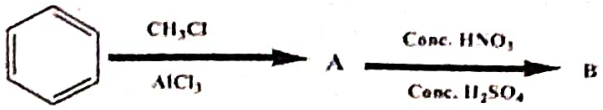
Roll no.

Mid Semester Examination, November 2024 **Branch: Information Technology (2023-24)**

Course Name: Chemistry (100203) **Semester: II** **Max Marks: 20** **Time: 02 hrs**

1) Mention Roll no. at the top of the question paper.
2) Attempt all the parts of a question at one place only.
3) All questions are compulsory.
4) Some questions have an internal choice, attempt accordingly.

Q. No.	SECTION -A (5 marks) short answer questions	Marks	CO
Q 1	(i) Write down an example of isomerization isomers of a coordination compounds. (ii) Write down the various types of constituents responsible for alkalinity in water. (iii) Provide the shapes of hybrid orbitals formed through sp^2 and dsp^2 hybridization. (iv) Find out the pressure of ideal gas (0.46 moles) confined in a container having a volume of 9.5 liter, at 306 K. (R=0.0821 L atm mol^{-1} K^{-1}). (v) Draw the fully eclipsed and fully staggered projection structure of ethane	1 *5 = 5	CO 1 CO 3 CO 4 CO 4 CO 5
	SECTION -B (15 marks) long answer questions		
Q 2	Draw the molecular orbital diagram of N_2^+, N_2^- molecules and predict their magnetic properties. **OR** Outline the crystal field splitting of d^7 configuration of a transition metal ions in octahedral geometry, in high as well as low spin complex. Also discuss their magnetic properties.	3	CO 1
Q 3	Find out the values of all four quantum numbers (n, l, m, s) for third (3) and sixth (6) electrons of oxygen atom, with proper justification of the same.	3	CO 1
Q 4	Discuss **at least two** applications of **any one** of below mentioned spectroscopic technologies **in detail**, in the field of chemical/medical sciences (i) UV-Vis spectroscopy (ii) Fluorescence spectroscopy (iii) Magnetic resonance imaging	3	CO 2
Q 5	A standard sample of calcium carbonate was produced by dissolving 0.53 grams of $CaCO_3$ in a total volume of 530 ml of aqueous solution. For the titration of 25.0 ml of this solution against EDTA, the volume of EDTA required to reach the equivalence point was determined to be 24.0 ml. In a separate analysis, another 50.0 ml sample from the hostel mess of the institute, was titrated with the previously mentioned EDTA solution, resulting in a consumption of 15.0 ml of EDTA solution at the end point. Based on the aforementioned data, find out the following calculations- (i) Number of moles of $CaCO_3$ and the concentration of the resultant solution. (ii) Number of moles of EDTA present in 24.0 ml of the EDTA solution. (iii) Hardness of the hostel mess water quantified in terms of parts per million. **OR** Write down the half-cell reaction, Nernst equation and find out the E°_{Cell}, E_{Cell} of the following cell at 298 K. **$Mg(s) \setminus Mg^{(+2)}$ (0.001M) $\| Cu^{(2+)}$ (0.0001 M)$\setminus Cu(s)$** Given that- E^0 (Cu/Cu^{+2}) =0.33 V & E^0 (Mg^{+2}/Mg)=-2.34 V.	3	CO 3

Q 6	From the below mentioned electrophilic substitution reaction, find out the structure of A & B. Discuss the nature of splitting patterns and type of multiplicity of various types of hydrogens of A and B, in their ^1H NMR spectra with a neat diagram and detailed explanation.  **OR** Nuclear magnetic resonance spectroscopic analysis constitutes a highly effective methodology for the identification and differentiation of structural isomers. A chemist has synthesized a variety of isomers of a compound characterized by the molecular formula C_4H_8. Determine the numbers of possible structural isomers as well as their respective structures. Analyze their splitting patterns and types of multiplicity in the ^1H NMR spectra, accompanied by a clear and precise diagram for these compounds.	3	CO 5