B. Sc. Chemistry Examination, 2023

(3rd Semester, CBCS)

CHEMISTRY (CORE)

Paper: Core / Chem / Th / 05

Time : Two Hours Full Marks : 40

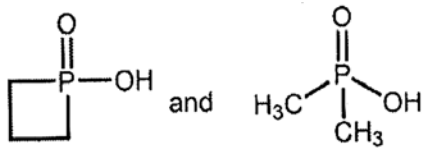
(20 marks for each unit)

Use a separate answer script for each unit.

UNIT - 3051 - I

1. Answer any ***five*** questions : 5×2

(a) Which one of the following is more acidic ? Explain.



(b) Write down Drago-Wayland equation and explain each of the parameter of the equation. How is it changed when charge transfer is considered ?

(c) Explain how a buffer solution of NH_4OH/NH_4Cl resists the change in pH on addition of strong acid and base.

(d) Why is NH_4Cl added with NH_4OH to get a precipitate of Group IIIA cations in Group analysis?

(e) How can you separate Cu^{2+} and Cd^{2+} from their mixture? Discuss with appropriate reactions.

(f) Calculate pH of the solution of a 25 mL of 0.1M acetic acid when 25 mL of 0.1 M KOH is added to it. What is the pH of acid solution before the addition of alkali ?
(Given : K_a of acetic acid is 1.75×10^{-5})

(g) Derive the expression for calculating pH of a very dilute solution of a strong acid ? What is the pH of 10^{-7} M HCl.

2. (a) The E° value of the Cu^{2+}/Cu^{+} half-cell (0.15 V) is less than that of the $I_2/2I^-$ half-cell (0.54 V); yet Cu^{2+} is found to oxidize iodide ion to molecular iodine. Explain, in details, the reason behind this observation. 3

(b) What is a redox indicator ? How will you choose an indicator for the titration of Fe^{2+} solution with Ce^{4+} solution ? Describe the expected color change of the chosen indicator. 1+2+1

(c) The Latimer diagram for manganese is given below.

$$MnO_4^- \xrightarrow{+0.56V} MnO_4^{2-} \xrightarrow{+2.27V} MnO_2 \xrightarrow{+0.95V}$$

$$Mn^{3+} \xrightarrow{+1.50V} Mn^{2+} \xrightarrow{-1.18V} Mn$$

(i) Calculate the potential for going from MnO_4^- to Mn^{2+}.

(ii) Identify the species which will undergo disproportionation in solution, and indicate why ? $1\frac{1}{2} + 1\frac{1}{2}$

UNIT - 3052 - I

3. Answer any ***five*** questions. 5×2

(a) What are crown ethers and cryptands ? What are the basic differences between them ?

(b) What are alkalides ? Mention the preparation of alkalides and one of their applications.

(c) Is it likely that a compound $N_2^+PtF_6^-$ would be formed as in case of $O_2^+PtF_6^-$? Justify.

(d) How would you prepare XeO_2F_2 ? As per VSEPR model draw the structure of XeO_2F_2.

(e) Write down the structure of $[Mg_8H_{10}]^{6+}$ and describe the importance of such compounds.

(f) Describe the synthesis and structure of one zero-valent Be compound.

(g) Explain the structure of $BeMe_2$.

(h) Give the product(s) of the following reactions :
$Li + N_2 \rightarrow ?$ $Mg + N_2 \rightarrow ?$ $Li + O_2 \rightarrow$, $Na + O_2 \rightarrow ?$

4. (a) Comment on the density of water in solid and liquid state. 2

(b) Among CO and CN^- which one is better σ-donor and π-acceptor and why ? 2

(c) With the help of M.O. diagram show that H_2O molecule has angular geometry. 2

(d) Reaction between N_2 and O_2 occurs around 3000^0C – comment. 2

(e) Stability order $I_3^- > Br_3^- > Cl_3^-$ – comment. 2