श्री Venkateshwar International School

Sector-18, Dwarka, New Delhi – 110075

MID-TERM EXAMINATION (2025-26)
CHEMISTRY (043)
CLASS– XII

Max. Marks: 70

Time:3 Hours

General Instructions:
1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case - based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.

SECTION - A (10)

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

Q1. If the rate of a reaction $2A + 3B \rightarrow C + 2D$ is $k[A]^0[B]$. By what factor will the rate of reaction increase if the concentration of A increases by a factor of 2 and that of B by a factor of 3? **(1)**

A. 5
B. 6
C. 3
D. 2

Q2. Low concentration of oxygen in blood and tissues in the human at high altitude is due to: **(1)**

A. Low atmospheric pressure
B. Low temperature
C. High atmospheric pressure
D. Both high temperature & high atmospheric pressure

Q3. The colour of $KMnO_4$ is due to **(1)**

A. $L \rightarrow M$ charge transfer transition.
B. $\sigma \rightarrow \sigma^*$ transition.
C. $M \rightarrow L$ charge transfer transition.
D. $d \rightarrow d$ transition.

Q4. The magnetic moment of $[NiCl_4]^{2-}$ [atomic no.of Ni = 28] **(1)**

A. 1.82 BM
B. 2.82 BM
C. 4.42 BM
D. 5.46 BM

Q5. Henry's Law is applicable in the conditions: **(1)**

A. The gas undergoes association or dissociation in the given solution.
B. The pressure of the gas is not too high and temperature not too low.
C. The gas undergoes any chemical change.
D. All the above.

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A. 5,790 yea
C. 13,300
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Q6. Correct increasing order for the wavelength of absorption in the visible region for the (1)
complexes of Co^{3+} is

A. $[Co(en)_3]^{3+}, [Co(NH_3)_6]^{3+}, [Co(H_2O)_6]^{3+}$

B. $[Co(H_2O)_6]^{3+}, [Co(en)_3]^{3+}, [Co(NH_3)_6]^{3+}$

C. $[Co(H_2O)_6]^{3+}, [Co(NH_3)_6]^{3+}, [Co(en)_3]^{3+}$

D. $[Co(NH_3)_6]^{3+}, [Co(en)_3]^{3+}, [Co(H_2O)_6]^{3+}$

Q7. $KMnO_4$ is not acidified by HCl instead of H_2SO_4 because (1)

A. H_2SO_4 is a stronger acid than HCl.

B. HCl is oxidized to Cl_2 by $KMnO_4$.

C. H_2SO_4 is dibasic acid.

D. rate is faster in presence of H_2SO_4.

Q8. What will happen during the electrolysis of aqueous solution of $CuSO_4$ by using platinum (1)
electrodes?

A. Copper will deposit at cathode.

B. Copper will deposit at anode.

C. Oxygen will be released at anode.

D. Copper will dissolve at anode.

Q9. Using the data given below find out the strongest reducing agent (1)

$$E^{\ominus}_{Cr_2O_7^{2-}/Cr^{3+}} = 1.33V \qquad E^{\ominus}_{Cl_2/Cl^-} = 1.36V$$

$$E^{\ominus}_{MnO_4^-/Mn^{2+}} = 1.51V \qquad E^{\ominus}_{Cr^{3+}/Cr} = -0.74V$$

A. Cl^-

B. Cr

C. Cr^{3+}

D. Mn^{2+}

Q10. Which of the following compounds has the highest boiling point? (1)

A. $CH_3CH_2CH_2Cl$

B. $CH_3CH_2CH_2CH_2Cl$

C. $CH_3CH(CH_3)CH_2Cl$

D. $(CH_3)_3CCl$

Q11. According to Arrhenius equation rate constant k is equal to $A\,e^{-E_a/RT}$. Which of the following
options represents the graph of ln k vs 1/T? (1)

A. (ln k vs 1/T, decreasing line)

B. (ln k vs 1/T, increasing line)

C. (ln k vs 1/T, increasing line)

D. (ln k vs 1/T, increasing line)

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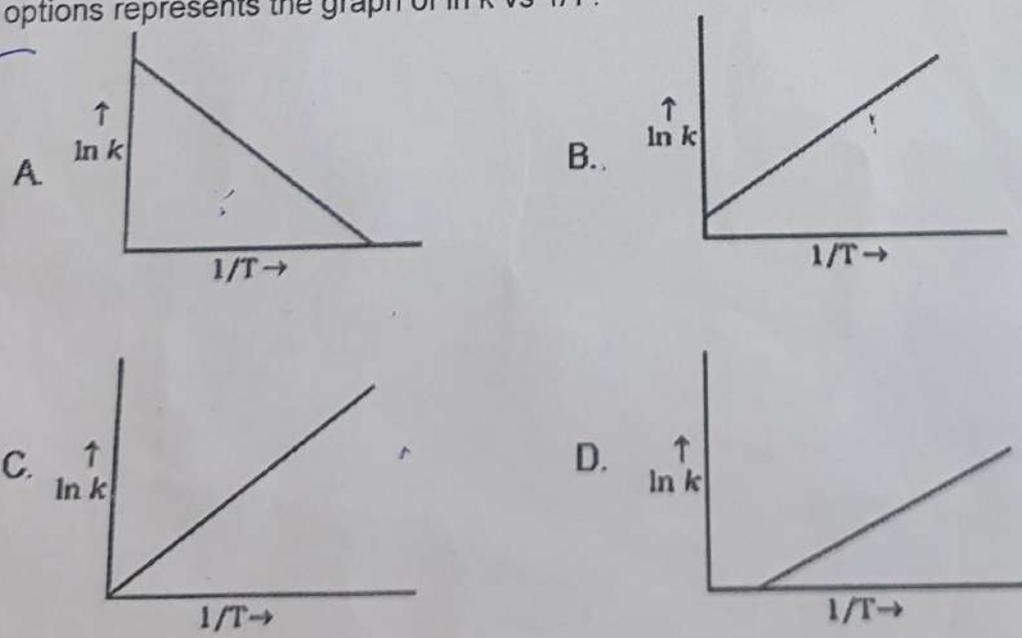
2. An archeologist found that the percentage of carbon-14 in a wooden artifact was 20% of what carbon-14 would have been in the wood when it was cut from the tree. What would be the approximate age of this wooden artifact? (1)
(Given the half-life of carbon-14= 5730 years)
A. 5,790 years
B. 12,060 years
C. 13,300 years
D. 38,000 years

For Questions 13 to 16, two statements are given, one labelled as Assertion (A) and the other labelled as Reason (R).
Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
A. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
B. Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
C. Assertion (A) is true, but Reason (R) is false.
D. Assertion (A) is false, but Reason (R) is true.

Q13. Assertion (A) : Alkyliodides can be prepared by reaction of alcohol with iodine in the presence of an oxidising agent. (1)

Reason (R) : Oxidising agent oxidises I_2 into HI.

Q14. Assertion (A) : Cu^{2+} iodide is not known. (1)
Reason (R) : Cu^{2+} oxidizes I^- to iodine.

Q15. Assertion (A) : When NaCl is added to water, an elevation in boiling point is observed.
Reason (R) : Lowering of vapour pressure of solution causes elevation in boiling point. (1)

Q16. Assertion (A) : The resistivity for a substance is its resistance when it is one meter long and its area of cross section is one square meter. (1)

Reason (R) : The SI unit of resistivity is ohm meter.
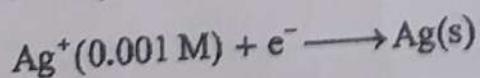
SECTION - B ⑥

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

Q17. Write the IUPAC name of the following compounds: (2)
(a) $[Pt(NH_3)_4Cl_2]^{2+}$
(b) $K_3[Fe(CN)_5NO]$

Q18. The half-cell reactions of an electrochemical cell are given below: (2)

$$Mn^{3+}(0.1\ M) + e^- \longrightarrow Mn^{2+}(0.01M) \qquad E° = 1.50V$$
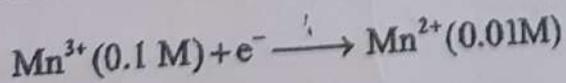
$$Ag^+(0.001\ M) + e^- \longrightarrow Ag(s) \qquad E° = 0.80V$$

(a) Formulate a galvanic cell using the above data.
(b) Calculate the emf of the cell at 25°C.

3

Q19 Elimination reactions are as common as the nucleophilic substitution in case of alkyl halides. (2)

(a) Specify the reagents used in both cases.

(b) Also give reason to support your answer.

Q20. A 5% solution of cane sugar (molar mass = 342) is isotonic with 1% solution of a substance X. Calculate the molar mass of X. (2)

OR

Calculate the mass of a non-volatile solute (molar mass 40 g mol⁻¹) which should be dissolved in 114 g octane to reduce its vapour pressure to 80%.

Q21. (a) Write the cell reactions which occur in lead storage battery when the battery is in use or when the battery is on charging.

(b) Based on your understanding of electrochemistry explain why after prolonged use, the lead storage battery stops functioning. (2)

SECTION - C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

Q22. Give reasons for the following observations: (3)

(a) p-dichorobenzene has higher melting point than those of o- and m- isomers.

(b) Chloroform is stored in closed dark bottles.

(c) Arylhalides can not be prepared by the reaction of phenol with HCl in the presence of ZnCl₂.

Q23. Answer the following questions: (3)

(a) Umang took two glasses of water from a water filter. She cools one glass in a fridge and warms the other glass on a stove. Which glass of water will hold more dissolved oxygen? Explain using Henry's law.

(b) The depression in freezing point of water observed for the same amount of acetic acid, trichloroacetic acid and trifluoroacetic acid increases in the order given above. Explain briefly.

(c) What is meant by positive deviations from Raoult's law and how is the sign of $\Delta_{mix}H$ related to positive deviations from Raoult's law?

Q24. In the given reaction $A + 3B \rightarrow 2C$, the rate of formation of C is 2.5×10^{-4} mol L⁻¹ s⁻¹. Calculate the

(a) rate of reaction

(b) rate of disappearance of B (3)

Q25. Ajay arranged two setups P and Q as shown below: (3)

Cu wire

Setup P

Electrodes

NaCl solution

Setup Q

4
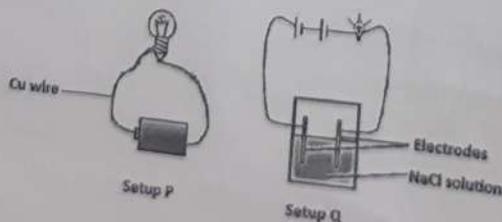
Both experiments are carried out at 25°C.
(a) Name the current carriers in setup P and Q.
(b) What is the effect of an increase in temperature on the conductivity of NaCl solution and Cu wire?
(c) What happens to the chemical composition of NaCl and Cu wire when current is passed through both setups for a prolonged period of time?

Q26. Primary alkyl halide C_4H_9Br (A) reacted with alcoholic KOH to give compound (B). Compound (B) is reacted with HBr to give (C) which is an isomer of (A). Give the structural formula of (A),(B) and (C). Also write the equations for all reactions.   (3)

                                                                                        (3)
Q27. Give reason for the following:
(a) The complex formed by Ca^{2+} with EDTA is more stable than the complex formed by Ca^{2+} with ethylenediamine.
(b) In d^4 complexes, ligands for which $\Delta_0 < P$ form high spin complexes.
(c) On removal of water from $[Ti(H_2O)_6]Cl_3$ on heating, it becomes colourless.

Q28. A purple colour compound A which is a strong oxidizing agent and used for bleaching of wool, cotton, silk and other textile fibres was added to each of the three test tube, along with H_2SO_4. It was followed by strong heating. In which of the test tubes A, B and C :

A   Oxalic acid   B   PbS   C   KI
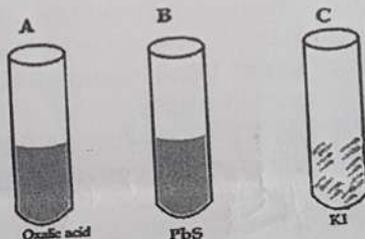
(a) Voilet vapours will be formed.
(b) The bubbles of the gas evolved will extinguish a burning match stick.
(c) Write an equation for each of the above observations.   (3x1)

OR

Answer the following:

(a) Why is Mn_2O_7 acidic whereas MnO is basic?
(b) Why do actinoids show wide range of oxidation states?
(c) Au lies below Ag in the same group but still they have same atomic size. Why?

SECTION - D (5)

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks. Read the passage carefully and answer the questions that follow:

Q29. Duracell pioneered the alkaline-manganese dioxide electrochemical system nearly 40 years ago. In the 1960-1970 decade, this battery system rapidly became the popular choice of designers in the ever-widening field of consumer electronics. The zinc/potassium hydroxide/manganese dioxide cells, commonly called alkaline or alkaline-manganese dioxide

cells, have a higher energy output than zinc-carbon (Leclanche) cells. Other significant advantages are longer shelf life, better leakage resistance, and superior low temperature performance. In comparison to the zinc-carbon cell, the alkaline cell delivers up to ten times the ampere-hour capacity at high and continuous drain conditions, with its performance at low temperatures also being superior to other conventional aqueous electrolyte primary cells. Its more effective, secure seal provides excellent resistance to leakage and corrosion. The use of an alkaline electrolyte, electrolytically prepared manganese dioxide, and a more reactive zinc powder contribute to a higher initial cost than zinc-carbon cells. However, due to the longer service life, the alkaline cell is actually more cost-effective based upon cost-per-hour usage, particularly with high drains and continuous discharge.

(a) What do you mean by a primary cell?

(b) Give any two examples of primary cell.

(c) Given that the electrode potential for $Zn^{2+}/Zn = -0.76$ V and $Mn^{4+}/Mn^{3+}_{(aq.)} = +0.74V$.

(i) Write down the half-cell reactions for this cell at each electrode.

(ii) Calculate the overall cell potential.

OR

(iii) Which of the two will be the positive electrode? Justify your answer. (1+1+2)

Q30. Coordination compounds are molecules that contain one or more metal centers bound to ligands. Ligands can be atoms, ions, or molecules that transfer electrons to the metal. These compounds can be charged or neutral. When charged, neighboring counter-ions help stabilize the complex. The metal ion is located at the center of a complex ion, surrounded by other molecules or ions known as ligands. Ligands can be thought of as covalently bonded to the core ion through coordination. Understanding coordination theory in chemistry provides insight into the geometric shape of complexes and the structure of coordination compounds, which consist of a central atom or molecule connected to surrounding atoms or compounds. Inorganic coordination compounds exhibit different properties and are used in synthesizing organic molecules. The coordination of chemicals is vital for the survival of living organisms. Metal complexes are also essential for various biological processes, with many enzymes, known as metalloenzymes, being composed of metal complexes. These metal complexes occur naturally.

REFERENCE: Odling W. (1864). On the proportional numbers of the elements. Quarterly Journal of Science. 1: 642–648. Meyer J.L. (1864). Die modernenTheorien der Chemie.

(a) The compounds $PtCl_2.2HCl$ gives no precipitate with excess of $AgNO_3$ solution. What are the primary and secondary valencies of the metal in the compound?

(b) Draw cis and trans isomers of $[CoCl_2(NH_3)_4]^+$ ion.

(c) (i) Define chelate effect.How does it affect the stability of complex?

OR

(ii) What will be the colour of the precipitate obtained when ionization isomer of compound $[Co(NH_3)_5Br]SO_4$ reacts with $AgNO_3$? (1+1+2)

SECTION - E ⑧

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

31.I. (a) Write the complete equation for:

(i) Oxidation of Sn^{2+} by $Cr_2O_7^{2-}$ in acid medium.

(ii) Oxidation of NO_2^- by MnO_4^- in acidic aqueous medium.

(b) Out of $CuCl_2$ and $CuCl$ which is more stable in aqueous solution and why?
(c) Predict which of the following will be coloured in aqueous solution. Give reason for your answer.

    Sc^{3+}, Fe^{2+} and Zn^{2+}

(d) Give two similarities in the properties of Sn and Zn.

                                                        (2+1+1+1)

<center>OR</center>

II. (a) How would you account for the following?

    (i) The second ionization enthalpy of Mn is lower than Cr.

    (ii) The highest oxidation state of a metal exhibited in oxide or fluoride only.

(b) Write general configuration of Lanthanoids.

(c) What are alloys? Name an important alloy which contains some of the lanthanoid metals.   (2+1+2)

Q32. I. (a) The rate constant for a first order reaction is 60 s^{-1}. How much time will it take to reduce the initial concentration of the reactant to its 1/16 th value?

(b) Write two factors that affect the rate of a chemical reaction.

(c) Write two conditions for the collisions to be effective collisions.   (3+1+1)

<center>OR</center>

II. (a) Consider the following reaction:

    1. $H_2O_2 + I^- \rightarrow H_2O + IO^-$

    2. $H_2O_2 + IO^- \rightarrow H_2O + I^- + O_2$
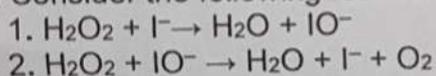
    In the above reaction, the rate of formation of the intermediate is slow.

    (i) Write the rate law.

    (ii) How will the rate of the reaction be affected if the concentration of peroxide is doubled?

(b) With the help of an example explain what is meant by pseudo first order reaction.

(c) Why in the redox titration of $KMnO_4$ vs oxalic acid, we heat oxalic acid solution before starting the titration?   (2+2+1)

Q33. I. (a) How will you bring the following conversions?

    (i) Ethanol to ethyl fluoride   (ii) Benzene to biphenyl

(b) How will you distinguish between ethylbromide and ethyliodide.

(c) Write main product formed when:

    (i) Methylchloride is treated with $AgNO_2$.

    (ii) Chlorobenzene is treated with $Cl_2/FeCl_3$.   (2+1+2)

<center>OR</center>

II. (a) Name the possible alkenes which will yield 1-chloro-1-methylcyclohexane on their reaction with HCl. Write the reaction involved.

(b) Give reaction for the following name reactions:

    (i) Swartz reaction

    (ii) Wurtz Fittig reaction

(c) Write the structural formula of 1-chloro-4-ethylcyclohexane.   (2+2+1)

<center>7</center>