ISC · CLASS 12 · CHEMISTRY

ISC Class 12 Chemistry Guess Paper 2027

Time: 3 hours · Maximum marks: 70 · 34 questions

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Section A

Compulsory. Question 1 is made up of fourteen subparts of 1 mark each: (A) four fill-in-the-blank questions, (B) seven multiple-choice questions (including assertion-reason), and (C) three passage/case-based short questions.

Q1. Crystal field splitting energy (CFSE) for high spin d^4 octahedral complex is: 1 mark
(a) -1.6 $Delta_o$
(b) -1.2 $Delta_o$
(c) -0.8 $Delta_o$
(d) -0.6 $Delta_o$

Q2. Data for hypothetical reaction 2A + B -> 2AB: Exp 1: [A]=0.5, [B]=0.5, rate=$1.8x10^{-4}$; Exp 2: [A]=1.0, [B]=0.5, rate=$3.6x10^{-4}$; Exp 3: [A]=1.0, [B]=1.0, rate=$3.6x10^{-4}$ (mol L^{-1} sec^{-1}). The rate law expression is: 1 mark
(a) rate=$k[A]^1[B]^1$
(b) rate=$k[A]^1[B]^0$
(c) rate=$k[A]^2[B]^1$
(d) rate=$k[A]^0[B]^1$

Q3. The correct order of freezing point of 0.5 M solution of urea, $AlCl_3$, KCl and $MgCl_2$ is: 1 mark
(a) $AlCl_3$ > $MgCl_2$ > KCl > urea
(b) Urea > KCl > $MgCl_2$ > $AlCl_3$
(c) $MgCl_2$ > KCl > $AlCl_3$ > urea
(d) KCl > $MgCl_2$ > $AlCl_3$ > urea

Q4. The sum of coordination number and oxidation number of metal 'M' in the complex $[M(en)_2Cl_2]$ is: 1 mark
(a) 6
(b) 8
(c) 9
(d) 10

Q5. Which of the following reactions will NOT give primary amine? 1 mark
(a) C_2H_5NC --$LiAlH_4$-->
(b) C_2H_5CN --$LiAlH_4$-->
(c) $C_2H_5CONH_2$ --Br_2/KOH-->
(d) CH_3CONH_2 --Br_2/KOH-->

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Q6. Cobalt (III) chloride forms several octahedral complexes with ammonia. Which will NOT give a test for chloride ions with silver nitrate solution at 25 degC? 1 mark
(a) $CoCl_3.6NH_3$
(b) $CoCl_3.5NH_3$
(c) $CoCl_3.4NH_3$
(d) $CoCl_3.3NH_3$

Q7. [context: The boiling points of alcohols are higher than those of corresponding ethers due to intermolecular hydrogen bonding and increase with molecular mass; for isomeric alcohols the order is 1 deg > 2 deg > 3 deg: Propan-1-ol 370 K, Butan-1-ol 391 K, Butan-2-ol 371 K, 2-methyl-propan-2-ol 356 K. Aliphatic alcohols are weak acids, weaker than water and phenol. Phenols are used both as a disinfectant and an antiseptic at different concentrations.] Although alcohols are weaker acids than water, phenol is more acidic than alcohols. Justify. 1 mark

Q8. [context: Vishal measured the resistance of aqueous KCl solutions at 298 K using a conductivity cell connected to a Wheatstone bridge and recorded: 1.00 M: kappa = 111.3×10^{-3} S cm^{-1}, $Lambda_m$ = 111.3 S cm^2 mol^{-1}; 0.10 M: kappa = 12.9×10^{-3}, $Lambda_m$ = 129.0; 0.01 M: kappa = 1.41×10^{-3}, $Lambda_m$ = 141.0] Why did the molar conductivity increase though the conductivity decreased with dilution? 1 mark

Q9. Fill in the blanks by choosing the appropriate word(s) from those given in the brackets: 1 mark
[methyl alcohol, ethyl alcohol, paired, one, Cannizzaro, d-d, salicylaldehyde, Perkin's, unpaired, f-f, salicylic acid, Kolbe's, two, 193000, 96500, Reimer-Tiemann]
Formaldehyde reacts with conc. alkali to give sodium formate and _____ due to the absence of alpha-hydrogen atom. The reaction is known as _____ reaction.

Q10. [context: Living beings maintain a balance of radioactive C-14 in their tissues (formed in the upper atmosphere: $_7N^{14} + _0n^1 \rightarrow _6C^{14} + _1H^1$; ratio C-14 : C-12 = $1 : 10^{12}$). After death C-14 decays ($_6C^{14} \rightarrow _7N^{14} + _{-1}e^0$ + gamma rays) and is not replaced. The half-life of C-14 is 5770 years, so the age of a fossil can be determined.] The half-life period ($t_{1/2}$) for a first order reaction is 30 minutes. Calculate the time taken to complete 87.5% of the reaction. 1 mark

Q11. Fill in the blanks by choosing the appropriate word(s) from those given in the brackets: 1 mark
[first, alc. AgCN, primary, decrease, third, increase, zero, Lucas, alc. KCN, KOH, no change, two, Tollen's, AgOH, tertiary]
Methyl chloride on treatment with _____ forms methyl cyanide, whereas on treatment with _____ it forms methyl isocyanide.

Q12. [context: Kohlrausch observed that different pairs of strong electrolytes having a common cation or anion had almost the same difference of $Lambda^{inf}_m$, and postulated the Law of Independent Migration of ions. Molar conductivities at infinite dilution $lambda^{inf}_m$ (S cm^2 mol^{-1}): Ba^{2+} 127.2, Cl^- 76.3, Ca^{2+} 119.0, SO_4^{2-} 160.0] Calculate the molar conductance at infinite dilution $Lambda^{inf}_m$ for $BaCl_2$. 1 mark

Q13. [context: During an unexpected heavy snowfall in Kashmir, thousands of visitors were stranded because it was dangerous to travel on snowy roads and vehicles could not move as water froze in the car radiators. Officials decided to sprinkle rock salt or $CaCl_2$ on the roads.] How many grams of ethylene glycol (mol. wt. = 62 g mol^{-1}) should be added to 10 kg of water so that the solution freezes at -10 degC? (K_f for water = 1.86 K kg mol^{-1}) — 1 mark

Q14. Fill in the blanks by choosing the appropriate word(s) from those given in the brackets: — 1 mark
[methyl alcohol, ethyl alcohol, paired, one, Cannizzaro, d-d, salicylaldehyde, Perkin's, unpaired, f-f, salicylic acid, Kolbe's, two, 193000, 96500, Reimer-Tiemann]
The colour of transition metal ions is due to _____ electron(s) in d-subshell and _____ transition.

Section B
Ten short-answer questions of 2 marks each. Internal choice is provided in two of the questions.

Q15. (i) Why is the first ionisation enthalpy of chromium less than that of zinc? (Atomic Number Cr=24, Zn=30) (ii) Why does pink colour of aqueous $KMnO_4$ solution disappear when warmed with oxalic acid solution in acidic medium? — 2 marks

Q16. Answer the following with respect to the coordination complex ion $[Cr(NH_3)_6]^{3+}$: (a) What is the hybridisation state of the central metal atom? (b) Comment on the magnetic nature of the complex ion. — 2 marks

Q17. An organic compound [A] with molecular formula C_3H_7NO forms compound [B] on heating with Br_2 and KOH. Compound [B] on heating with $CHCl_3$ and alcoholic KOH produces a pungent smelling compound [C]. Compound [B] on reacting with $C_6H_5SO_2Cl$ forms compound [D] which is soluble in alkali. Write the structures of compounds [A], [B], [C] and [D]. — 2 marks

Q18. An organic compound 'X' with molecular formula $C_4H_{10}O$ is soluble in conc. H_2SO_4 and does not react with sodium metal or $KMnO_4$. Compound 'X' when heated with excess of HI gives a single alkyl halide. Deduce the structure of 'X'. Explain all the reactions involved. — 2 marks

Q19. Write chemical equations to convert each of the following: (i) Methyl magnesium bromide to propan-2-ol (ii) Phenol to benzene — 2 marks

Q20. Calculate the value of E^o_{cell}, E_{cell} and DeltaG that can be obtained from the following cell at 298 K. Al / Al^{3+}(0.01M) // Sn^{2+}(0.015M) / Sn. Given $E^o_{Al^{3+}/Al}$ = -1.66 V, $E^o_{Sn^{2+}/Sn}$ = -0.14 V. — 2 marks

Q21. Account for each of the following: (i) Zirconium (Zr) and Hafnium (Hf) are difficult to separate. (ii) Salts of Cupric (Cu^{2+}) ion are coloured whereas salts of Cuprous (Cu^+) ion are colourless. — 2 marks

Q22. In general, the rate of a reaction becomes double with every 10 degC rise in temperature. If this generalisation holds true, calculate the value of activation energy when temperature changes from 295 K to 305 K. — 2 marks

Q23. Write the Nernst equation and calculate the emf of the following cell at 298 K: $Mg(s) / Mg^{2+}(1x10^{-3}M) // Cu^{2+}(1x10^{-4}M) / Cu(s)$. Given $E^{o}_{Mg^{2+}/Mg} = -2.373$ V, $E^{o}_{Cu^{2+}/Cu} = +0.337$ V. — 2 marks

Q24. When 2 g of benzoic acid (C_6H_5COOH) is dissolved in 25 g of benzene, it shows a depression in freezing point equal to 1.62 K. Molal depression constant for benzene is 4.7 K kg mol^{-1}. What is the percentage association of acid if it forms dimer in solution? — 2 marks

Section C

Seven questions of 3 marks each, typically split into sub-parts (short derivations, conversions, numericals and reasoning). Internal choice is provided in two of the questions.

Q25. (i) Identify the non-reducing sugar which on hydrolysis gives two reducing monosaccharides. (ii) Which structure of protein is normally unaffected during denaturation of protein? (iii) Name the vitamins whose deficiency cause the following diseases: (a) Rickets (b) Night blindness — 3 marks

Q26. Write the chemical equations for the following conversions: (i) Nitrobenzene to benzene (ii) Aniline to bromobenzene (iii) Methyl cyanide to ethylamine — 3 marks

Q27. Write chemical equations to illustrate the following name reactions: (i) Rosenmund's reaction (ii) Benzoin condensation (iii) Perkin's reaction — 3 marks

Q28. (i) The unit of rate constant of a reaction is same as that of its rate of reaction. Find the order of this reaction. (ii) Give one example of pseudo first order reaction. (iii) How will the rate of reaction be affected when the surface area of the reactant is reduced? — 3 marks

Q29. How will the following be obtained? (Give chemical equation) (a) Picric acid from Phenol (b) Ethyl acetate from ethanol (c) Anisole from sodium phenoxide — 3 marks

Q30. Give a chemical test to distinguish between the following pairs of compounds: (a) Ethanol and methanol (b) Ethanol and Ethanal (c) Propan-2-ol and 2-methyl propan-2-ol — 3 marks

Q31. (a) The molar conductivity at infinite dilution for $lambda^{inf}_{H\hat{}+}$ = 348.65 S cm^2 mol^{-1} and $lambda^{inf}_{CH_3COO\hat{}-}$ = 41.4 S cm^2 mol^{-1}. Calculate the degree of dissociation (alpha) of acetic acid if its molar conductivity ($Lambda^{c}_{m}$) is 40.65 S cm^2 mol^{-1}. (b) Compounds [A] and [B] are two electrolytes. Upon dilution, the molar conductivity of [A] increases 3 times while that of [B] increases 30 times. Which one is a weak electrolyte? Why? (c) Can copper sulphate solution be stored in a zinc pot? Give a reason ($E^{0}_{Zn^{2+}/Zn}$=-0.76 V, $E^{0}_{Cu^{2+}/Cu}$=+0.34 V). — 3 marks

Section D

Three long-answer questions of 5 marks each, made up of multi-part identification, mechanism, numerical and reasoning sub-parts. Internal choice is provided in two of the questions.

Q32. (i) The resistance of a conductivity cell with 0.1 M KCl solution is 200 ohm. When the same cell is filled with 0.02 M NaCl solution, the resistance is 1100 ohm. If the conductivity of 0.1 M KCl solution is 0.0129 $ohm^{-1}cm^{-1}$, calculate the cell constant and molar conductivity of 0.02 M NaCl solution. (ii) The emf (E^0_{cell}) of the following reaction is 0.89 V: $3Sn^{4+} + 2Cr \rightarrow 3Sn^{2+} + 2Cr^{3+}$. Calculate the value of $DeltaG^0$ for the reaction. Predict whether the above reaction will be spontaneous or not. 5 marks

Q33. (i) The compound $[PtCl_2(NH_3)_2]$ known as cis-platin is used in chemotherapy. (a) Write its IUPAC name and the type of isomerism it exhibits. (b) What is the geometry of the compound? (ii) What type of structural isomers are $[Pt(NH_3)_3Br]NO_3$ and $[Pt(NH_3)_3(NO_3)]Br$? How can they be distinguished by a chemical test? (iii) A coordination compound $CoCl_3.4H_2O$ precipitates silver chloride when treated with silver nitrate. The molar conductance of its solution corresponds to a total of two ions. Write the structural formula of the compound and name it. 5 marks

Q34. An organic compound [A] ($C_2Cl_3O_2H$) is obtained when compound [B] reacts with red phosphorous and Cl_2. [B] can be obtained on reaction of methyl magnesium bromide with carbon dioxide followed by acid hydrolysis. Upon partial reduction, [B] forms [C] (C_2H_4O) which gives yellow precipitate of iodoform on heating with iodine and sodium hydroxide. [C] also reacts with dilute NaOH to form [D]. (a) Identify [A], [B], [C] and [D]. (b) Write the reaction for formation of [A] from [B]. What is the reaction called? (c) Write the chemical test to distinguish between [C] and acetone. (d) Which will be more acidic, [A] or [B]? Why? 5 marks

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