

CHEMISTRY (CODE - 043)
SAMPLE QUESTION PAPER*
CLASS XII (2026-27)

Time: 3 hours

Max. Marks: 70

GENERAL INSTRUCTIONS:

Read the following instructions carefully.

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 very 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.
8. In addition to this, a separate question has been provided for visually impaired candidates in lieu of questions having visual inputs.
9. Use of log tables and calculators is not allowed.

Section-A														
Question 1 to 16 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.														
1	The boiling points and K_b values of isomeric amines are given in table 1. <table><tr><th>Amine</th><th>Boiling point/K</th><th>pK_b (approx)</th></tr><tr><td>P</td><td>329.3</td><td>3.00</td></tr><tr><td>Q</td><td>310.5</td><td>9.83</td></tr><tr><td>R</td><td>350.8</td><td>3.22</td></tr></table> Table 1 Which one of the following statement is correct? A. Amine P is more volatile than amine R, but less basic B. Amine R will give white precipitate with Hinsberg reagent, which is soluble in NaOH C. Amine Q is more soluble in water as compared to R. D. Amine P and Q can be prepared by Gabriel Phthalimide process.	Amine	Boiling point/K	pK_b (approx)	P	329.3	3.00	Q	310.5	9.83	R	350.8	3.22	1
Amine	Boiling point/K	pK_b (approx)												
P	329.3	3.00												
Q	310.5	9.83												
R	350.8	3.22												
2	Which of the following complex is tetrahedral in shape? A. $[\text{Ni}(\text{CN})_4]^{2-}$ B. $[\text{Cu}(\text{NH}_3)_4]^{2+}$ C. $[\text{NiCl}_4]^{2-}$ D. $[\text{Co}(\text{en})_3]^{3+}$	1												

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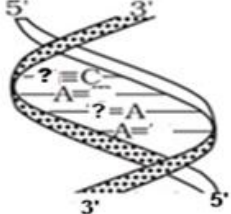
3	The quantity of charge required to obtain one mole of metal “M” from M_2O_3 is: A. 1F B. 6F C. 3F D. 2F	1
4	An organic compound “X” on reaction with chloroform and alcoholic KOH gives foul smelling product. In which of the following case compound X would be produced: A. Chloromethane is treated with AgCN. B. Nitrobenzene is reduced. C. Benzene diazonium chloride is treated with Cu/KCN D. Aniline reacts with Acetyl chloride.	1
5	Consider a system in a state of dynamic equilibrium, as shown in Fig. 1(a). The lower part is solution and the upper part is gaseous system at pressure p and temperature T. If the pressure is increased over the solution phase by compressing the gas to a smaller volume as shown in Fig 1(b). Figure 1 Which of the following statements is true about figure 1(b) A. solubility of gas will increase until dynamic equilibrium is reached B. solubility of gas will decrease until dynamic equilibrium is reached C. solubility of gas will increase until static equilibrium is reached D. solubility of gas will decrease until static equilibrium is reached (For Visually Challenged Learners) According to Henry’s law partial pressure P of a gas above the liquid at constant temperature is directly proportional to A. volume of the gas B. mole fraction of the gas in the solution C. atmospheric pressure D. vapour pressure of the solution	1
6	Aavya carries out hydrolysis of acetyl chloride. The reaction is represented by the following equation: $CH_3COCl + H_2O \longrightarrow CH_3COOH + HCl$ She carries out the reaction with (i) equimolar amounts of acetyl chloride and water (ii) excess of water. The rate law obeyed in the two cases will be: A. (i) First order (ii) Second Order B. (i) First order (ii) First order C. (i) Second order (ii) Second order D. (i) Second order (ii) First order	1

7	The amino acid $\text{HOOC-CH}_2\text{-CH}_2\text{-CH(NH}_2\text{) COOH}$, can be synthesised within our body. Which of the following is true about this amino acid? $\text{HOOC-CH}_2\text{-CH}_2\text{-CH(NH}_2\text{) COOH}$ is: A. an acidic and non-essential amino acid. B. a neutral and non- essential amino acid. C. an acidic and essential amino acid D. a neutral and essential amino acid	1
8	Identify the Grignard reagent and carbonyl compound which on reaction followed by hydrolysis will give 3-methyl pentan-3-ol. (i) $\text{C}_2\text{H}_5\text{COC}_2\text{H}_5 + \text{CH}_3\text{MgCl}$ (ii) $\text{C}_2\text{H}_5\text{COCH}_3 + \text{C}_2\text{H}_5\text{MgCl}$ (iii) $\text{CH}_3\text{CHO} + \text{C}_2\text{H}_5 - \underset{\text{MgCl}}{\text{C}} \text{H} - \text{C}_2\text{H}_5$ (iv) $\text{C}_2\text{H}_5\text{CHO} + \text{CH}_3 - \underset{\text{MgCl}}{\text{C}} \text{H} - \text{C}_2\text{H}_5$ A. (i) and (iii) B. (ii) and (iv) C. (iii) and (iv) D. (i) and (ii)	1
9	Which one of the following element will be strong oxidising agent in their +3 oxidation state? (Atomic no. Cr=24, Mn=25, Ti=22, Fe=26) A. Cr B. Mn C. Ti D. Fe	1
10	When (–)-2-bromohexane reacts with sodium hydroxide, (+)-hexan-2-ol is formed. Which one of the following observation would be correct? A. The reaction follows S_N^2 mechanism and is accompanied by inversion of configuration. B. The reaction follows S_N^1 mechanism and is accompanied by inversion of configuration. C. The reaction follows S_N^2 mechanism and is accompanied by retention of configuration. D. The reaction follows S_N^1 mechanism and is accompanied by retention of configuration.	1
11	If half-life of a first order reaction is 16 minutes, how much time does it take to complete 75% of the reaction? A. 16 min B. 32 min C. 48 min D. 64 min	1
12	Which solution has the highest conductivity? A. 0.1 M HCl B. 0.1 M CH_3COOH C. 0.1 M glucose D. 0.1 M NH_4OH	1

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13	Assertion (A): Nitration of aniline gives significant amount of meta derivative. Reason (R): -NH₂ is ortho and para directing and highly activating group. Select the most appropriate answer from the options given below: A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true.	1
14	Assertion (A): Permanganate and manganate ions have tetrahedral structure Reason (R): In permanganate and manganate ions, pi bonding takes place which is due to overlap of p orbitals of oxygen with p orbitals of manganese. Select the most appropriate answer from the options given below: A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true.	1
15	Assertion (A): Miscibility of ethers with water resembles those of alcohols of the same molecular mass. Reason (R): The oxygen of ether can also form hydrogen bonds with water. Select the most appropriate answer from the options given below: A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true	1
16	Assertion (A): [Co(NH₃)₆]³⁺ is diamagnetic. Reason (R): NH₃ is a strong field ligand and causes pairing of electrons. Select the most appropriate answer from the options given below: A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true	1
Section-B Question No. 17 to 21 are very short answer questions carrying 2 marks each.		
17(A)	Attempt either A or B (I) Complete and balance the following reaction $\text{SO}_3^{2-} + \text{MnO}_4^- + \text{H}^+ \rightarrow$ (II) Why does titanium melt at a lower temperature than chromium? OR	1 1

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17(B)	(I) Why do titanium and scandium forms complex compounds, whereas potassium and calcium do not, although they belong to same period? (II) Complete and balance the following reaction $\text{Fe}^{2+} + \text{Cr}_2\text{O}_7^{2-} + \text{H}^+ \rightarrow$	1 1
18	“The rate of reaction remains constant during the course of reaction.” Is this statement always true or is true under certain conditions? Reflect on the statement.	2
19	(I) Complete the sequence of nitrogenous bases in the given DNA strand (Figure 2) (II) Milk contains a protein called casein. How does the structure of casein change on addition of a few drops of lemon juice to milk? (For Visually Challenged Learners) (I) Name the nitrogenous bases in DNA (II) Milk contains a protein called casein. How does the structure of casein change on addition of a few drops of lemon juice to milk?	 Figure 2 1 1 1 1
20	Chlorobenzene can be converted into phenol by heating in aqueous sodium hydroxide solution at a temperature of 623K and 300 atm, however presence of a substituent group effects its activity towards this nucleophilic substitution reaction. Which substituent (i) nitro or (ii) methoxy will increase the reactivity of chlorobenzene and why?	2
21	Account for the following: (I) Underground iron pipelines are often protected by connecting them to a more reactive metal like magnesium. (II) Write the reactions occurring at cathode and anode during the electrolysis of molten magnesium chloride.	2x1
Section-C Question No. 22 to 28 are short answer questions, carrying 3 marks each.		
22	(I) Which of the following has the highest magnetic moment? Justify your answer. Ti^{2+}, Co^{2+}, Fe^{2+} [Atomic No. Ti = 22 Co = 27 , Fe = 26] (II) Which characteristic of iron make it suitable to: a) act as catalyst in Haber's process. b) form interstitial compound with oxygen.	1 2

23

The values of log k and 1/T for a reaction are given-

3

S.No.	Log k	1/T (/K)
1.	-4.46	0.00333
2.	-3.91	0.00323
3.	-3.37	0.00313
4.	-2.82	0.00303
5.	-2.31	0.00294

The plot of log k vs 1/T obtained for the above data is as shown in Figure 3.

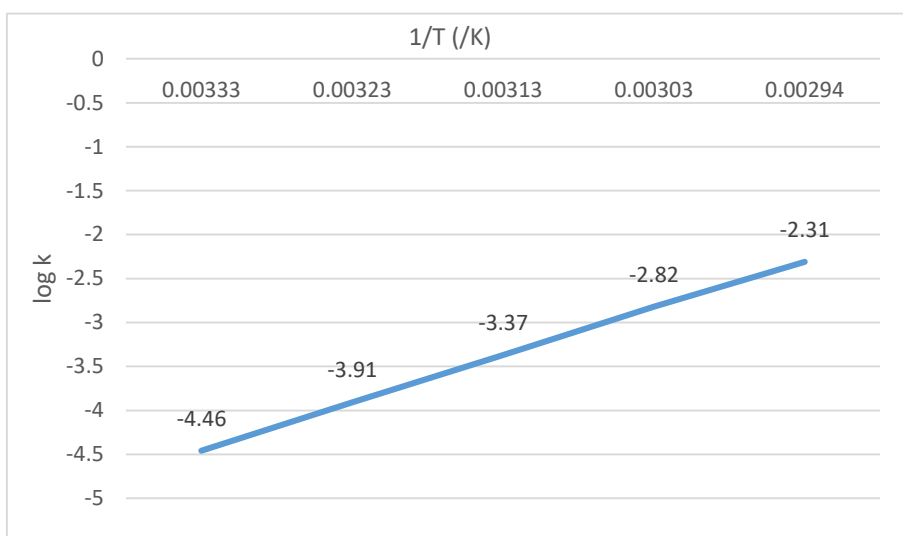


Figure 3

Here k is the rate constant and T is the absolute temperature.

Calculate E_a for the reaction. (Given $R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$)

(For Visually Challenged Learners)

Rate constant k of a reaction varies with temperature 'T' according to the equation

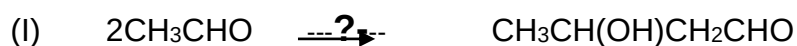
$$\log k = \log A - \frac{E_a}{2.303RT}$$

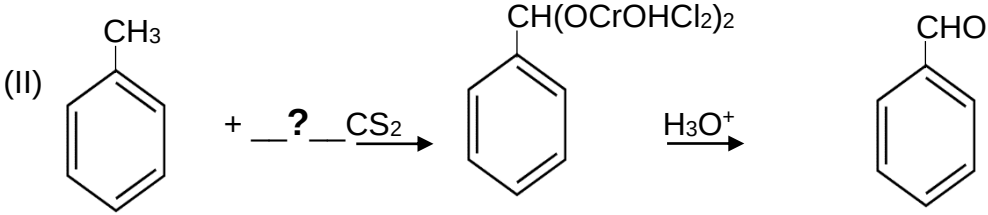
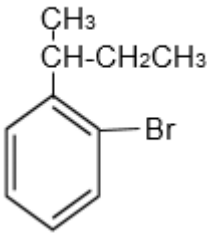
where E_a is the activation energy. When a graph is plotted for log k vs 1/T, a straight line with a slope of -4250 K is obtained. Calculate E_a for the reaction. (Given $R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$).

24

Identify each name reaction and complete the missing reactant/ product in the given reaction sequence.

3x1

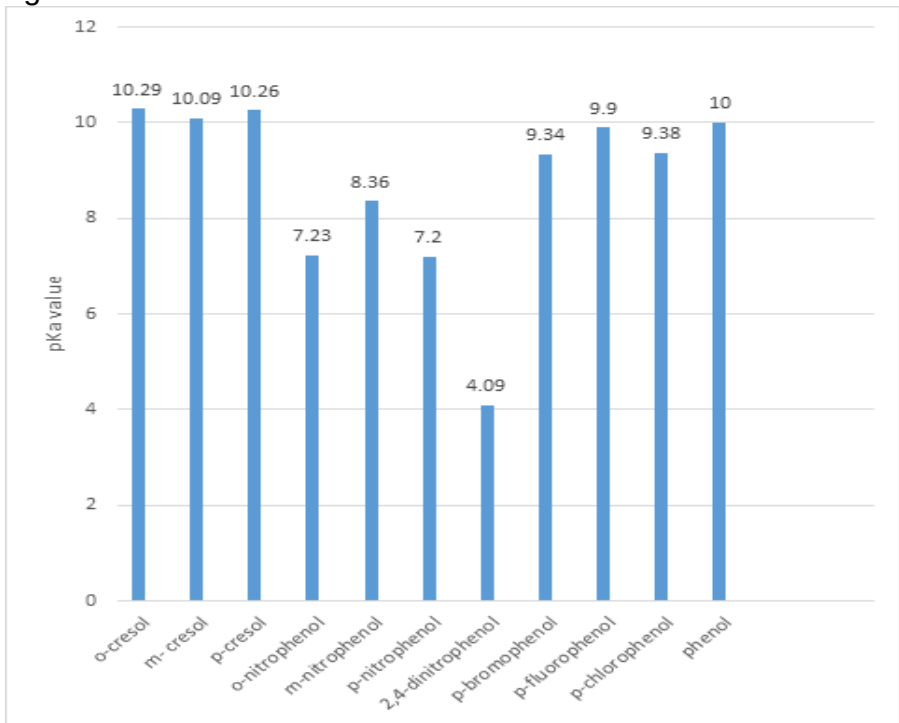


	(II)  (III) $>C=O \xrightarrow[-H_2O]{NH_2NH_2} \text{---?---} \xrightarrow[\text{Heat}]{KOH/\text{ethylene glycol}} >CH_2 + N_2$	
25	(I) Aman prepared a solution by dissolving 10 ml of Acetone and 10 ml of Carbon disulphide. The net volume of resulting solution was not found to be 20 mL. a) What would be the observation in this case? Comment. b) In case carbon disulphide is replaced by chloroform in the above case, what would be the expected changes in volume of the resulting solution? Support your answer with appropriate reason. (II) Calculate the concentration of oxygen (in ppm) present in 1 litre of sea water. Given that a litre of sea water weighs 1030 g and contains about 6×10^{-3} g of dissolved oxygen.	1+1 1
26	(I) Convert the following; a) Nitrobenzene to flourobenzene b) Benzoic acid to benzylamine (II) Aniline undergoes electrophilic substitution reactions readily. However, acetylation of aniline is required to obtain monosubstituted products. Give reason for your answer	2 1
27(A)	Attempt either A or B (I) Write the IUPAC name of the following compound  (II) When $CH_3CH_2CH_2Cl$ reacts with $AgCN$ and KCN, Compound "X" and "Y" respectively are formed. Identify "X" and "Y". Support your answer with appropriate reason. OR	1 2
27(B)	(I) What is the IUPAC nomenclature of the compound: $(CH_3)_3C-C(CH_3)Br-CH_2CH_3$	1

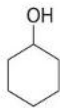
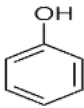
	(II) Which of the following will be hydrolysed more readily? $\text{CH}_2=\text{CH}-\text{CH}_2\text{Cl}$ or $(\text{CH}_3)_2\text{CHCl}$ Support your answer with reason.	2
28	(I) On adding 100 g of non-volatile solute A in 1000 g of water, the vapour gets reduced by 50 percent. Calculate the molar mass of solute A.	2
	(II) It has been observed that nitric acid solution containing 32% of water by mass, cannot be separated into its components through fractional distillation. Why?	1

Section D

Question No. 29 & 30 are case-based/data -based questions carrying 4 marks each.

29	Acidity of substituted phenols Phenol and substituted phenols are relatively more acidic than aliphatic alcohols. The pKa value is a quantitative measure of the acidic strength. The effect of substituents on acidity of phenols (pKa values) is given in Figure 4.  Figure 4 Study the graph and answer the following questions (I) The pKa value of 2,4,6- trinitrophenol will be: A. more than 8.36 B. between 7.2 and 8.3 C. between 4.09 and 2.3 D. less than 4.09 (II) The order of acidity of p-halophenols is : A. p-bromophenol > p-chlorophenol > p-fluorophenol > phenol B. phenol > p-fluorophenol > p-chlorophenol > p-bromophenol C. p-chlorophenol > p-bromophenol > p-fluorophenol > phenol	1 1
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	D. phenol > p-flourophenol > p-bromophenol > p-chlorophenol Attempt either (IIIA) or (IIIB). (IIIA) Predict which one of the following two compounds will have lower value of pKa .  OR  Give reason in support of your reason. OR (IIIB) Predict whether 4 chloro-2, 6- dinitrophenol is more or less acidic than 2,4,6-trinitrophenol? Use the values in the graph to support your answer. (For Visually Challenged Learners) Read the passage and answer the questions that follow The presence of electron withdrawing groups such as nitro group, enhances the acidic strength of phenol. It is due to the effective delocalisation of negative charge in phenoxide ion. On the other hand, electron releasing groups, such as alkyl groups, in general, do not favour the formation of phenoxide ion resulting in decrease in acid strength. Cresols, for example, are less acidic than phenol. The pKa value is a quantitative measure of the acidic strength. Higher the pKa value lower is the acidic strength. (I) Which of the following will form least stable phenoxide ion? - phenol - o-cresol - o-nitrophenol - o-chlorophenol (II) Which group causes the maximum increase in pKa value of phenol: – CH₃ – OCH₃ – NO₂ – Cl Attempt either (IIIA) or (IIIB) (IIIA). Which of the following will be more acidic? Nitrophenol or 2,4-Dinitrophenol. Support your answer with appropriate reason? OR (IIIB). Predict whether pka value of p-cresol or p-nitrophenol will be higher or lower than phenol. Give reason to support your answer.	2 2 1 1 2 2
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30	Identification of carbohydrate Students of class 12 are given a sample of carbohydrate obtained from a plant extract. They conducted the following tests to identify the carbohydrate. The students find that the given carbohydrate is soluble in water. They take about 1-2 mL of aqueous solution of the carbohydrate in a test tube and add 2 mL of Benedict's reagent. The test tube is heated in water bath for 3-5 minutes. A brick red precipitate is obtained. The sample of the given carbohydrate on hydrolysis with dilute acid, gives only one type of monosaccharide. Read the passage and answer the following questions: (I) The sample gives a positive Benedict's test. We can conclude that the given carbohydrate is a - monosaccharide - reducing sugar - non-reducing sugar - polysaccharide (II) Which of the following is plant based carbohydrate? (i) sucrose (ii) lactose (iii) starch (iv) glycogen (i) and (ii) (i) and (iii) (iii) and (iv) (i) and (iv) Attempt either (IIIA) or (IIIB) (IIIA) Considering all observations reported in the passage the sample is most likely (i) glucose (ii) fructose (iii) sucrose (iv) lactose (v) maltose. Justify your answer. OR (IIIB) Ravi reports that the given sample is starch. What could be his justification, based on the observations in the passage? Do you agree with Ravi? Why or why not?	1 1 2 2
Section-E Question No. 31 to 33 are long answer type questions carrying 5 marks each.		
31(A)	Attempt either A or B (I) Account for the following - The pH should be around 3.5 during the addition of ammonia derivative compounds to aldehyde/ ketone. - Alcohols are added to carbonyl compounds in the presence of dry HCl gas. - The reaction of aldehydes with sodium hydrogen sulphite is commonly used for the separation and purification of aldehydes. (II) A student has three colourless samples: methanol, acetaldehyde, and acetic acid. They have only NaHCO_3, and 2,4-DNP reagent	3x1 2

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31(B)	Devise a flowchart to identify each compound using only these two reagents. OR (I) Arrange the following according to the property indicated a) CH_3CHO, HCHO, $\text{C}_6\text{H}_5\text{CHO}$ (decreasing order of the ease of oxidation) b) CH_3COCl, CH_3COOH, CH_3CONH_2, $\text{CH}_3\text{COOCH}_3$ (increasing order of nucleophilic acyl substitution) c) CH_3CHO, CH_3COCH_3, CF_3CHO (increasing order of electrophilicity of carbonyl carbon) (II) Write any two possible isomers of the compound having molecular formula $\text{C}_3\text{H}_6\text{O}$. Identify which of these isomer/s will give a positive Tollen's test and explain the reason.	3x1 2
32(A)	Attempt either A or B Answer the following questions: (I) Two test tubes, X and Y, contain solutions of the complexes $[\text{Cr}(\text{H}_2\text{O})_3\text{Cl}_3]$ and $[\text{Cr}(\text{en})_3]^{3+}$ respectively. If plane-polarized light is passed through these solutions, which solution will rotate the plane of polarization and why? (II) $[\text{Ni}(\text{CO})_4]$ and $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ are two complexes of Ni. Which complex will have higher crystal field splitting energy, and which factor determines this difference? (III) A solution of the coordination compound $\text{PdCl}_2 \cdot 4\text{NH}_3$ is treated with AgNO_3, and 2 mole of AgCl precipitate form. Determine the primary valency and secondary valency of Pd in the compound. (IV) The complex $[\text{Fe}(\text{CN})_6]^{4-}$ exhibits d^2sp^3 hybridisation. Based on this, comment on the strength of the ligand CN^- and its effect on the geometry of the complex. (V) Why is anhydrous CuSO_4 white, but $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ blue in colour?	5x1
32(B)	OR Answer the following questions: (I) Three coordination compounds of cobalt(III) are given: Compound A: $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ Compound B: $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ Compound C: $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$ Which of the three compounds will show maximum electrolytic conductivity and why? (II) On the basis of crystal field theory, write the electronic configuration for d^5 ion if $\Delta_0 > P$. (III) Using IUPAC norms, write the formulae of Diaquadiammine (oxalato) chromium(III) chloride. (IV) Compare the optical activity of $[\text{Co}(\text{NH}_3)_2\text{Cl}_2(\text{en})]\text{Cl}$ and $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$. Which one is optically active and why? (V) Explain why $[\text{Cu}(\text{NH}_3)_4]^{2+}$ shows a blue colour while $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$ shows a greenish colour. Which factor influences the colour difference?	5x1

33(A)	Attempt either A or B			1+2																							
	(I)	A student investigates the effect of concentration on the cell potential of a Zn–Cu galvanic cell at 298 K. The cell is: $\text{Zn(s)} \mid \text{Zn}^{2+}(\text{aq}) \parallel \text{Cu}^{2+}(\text{aq}) \mid \text{Cu(s)}$ standard electrode potentials: $E^0(\text{Zn}^{2+}/\text{Zn}) = -0.76 \text{ V}$, $E^0\text{Cu}^{2+}/\text{Cu} = +0.34 \text{ V}$, $E^0_{\text{cell}} = 1.10 \text{ V}$ The following experimental data were collected:																									
		<table><tr><th>Experiment</th><th>$[\text{Zn}^{2+}] \text{ (M)}$</th><th>$[\text{Cu}^{2+}] \text{ (M)}$</th><th>Measured EMF (V)</th></tr><tr><td>1</td><td>1.00</td><td>1.00</td><td>1.10</td></tr><tr><td>2</td><td>0.1</td><td>1.00</td><td>1.16</td></tr><tr><td>3</td><td>1.00</td><td>0.10</td><td>1.04</td></tr><tr><td>4</td><td>0.01</td><td>1.00</td><td>1.22</td></tr><tr><td>5</td><td>1.00</td><td>0.01</td><td>0.98</td></tr></table>	Experiment		$[\text{Zn}^{2+}] \text{ (M)}$	$[\text{Cu}^{2+}] \text{ (M)}$	Measured EMF (V)	1	1.00	1.00	1.10	2	0.1	1.00	1.16	3	1.00	0.10	1.04	4	0.01	1.00	1.22	5	1.00	0.01	0.98
	Experiment	$[\text{Zn}^{2+}] \text{ (M)}$	$[\text{Cu}^{2+}] \text{ (M)}$		Measured EMF (V)																						
	1	1.00	1.00		1.10																						
	2	0.1	1.00		1.16																						
	3	1.00	0.10		1.04																						
	4	0.01	1.00		1.22																						
	5	1.00	0.01		0.98																						
	a)	Why does experiment 4 show the maximum EMF?																									
b)	For experiment 3, calculate the theoretical EMF using the Nernst equation. Suggest one possible reason why the measured EMF differs slightly from the calculated value.																										
(II)	If k is expressed in Sm^{-1} and the concentration, c in mol m^{-3} then the units of molar conductivity are in $\text{Sm}^2\text{mol}^{-1}$. However, if we use Scm^{-1} as the units for k and molcm^{-3} , the units of concentration, then the units of molar conductivity are in $\text{Scm}^2\text{mol}^{-1}$. Show how $1 \text{ Sm}^2\text{mol}^{-1}$ is related to $1 \text{ S cm}^2\text{mol}^{-1}$																										
(III)	What happens to the specific gravity of electrolyte in lead storage battery during charging and discharging of battery?																										
OR																											
33(B)	I. For aqueous NaCl at 25°C the molar conductivities at two concentrations are measured as: $\Lambda_m(0.010 \text{ M}) = 123.9 \text{ S cm}^2 \text{ mol}^{-1}$ $\Lambda_m(0.040 \text{ M}) = 120.7 \text{ S cm}^2 \text{ mol}^{-1}$ Molar conductivity for strong electrolytes can be represented as $\Lambda_m = \Lambda^\circ_m - A\sqrt{c}$. Determine Λ° (molar conductivity at infinite dilution) and the constant A for NaCl solution.																										
	II. Write the electrode reactions that occur in a hydrogen–oxygen fuel cell. Also, state two advantages of fuel cells compared to conventional batteries.																										