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FBISE Chemistry Class 12
Topical workbook - Volume 1 of 3

140 questions arranged by official framework topic.
National Curriculum 2022-23; supported examinations from 2027.

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Ethics and Values in Chemistry

Domain A: Nature of Science in Chemistry

First Annual 2025 | Section B Q2(vii) OR | 3 marks

with one example in each case.	
Describe two sources of oxides of Nitrogen and Sulphur with one environmental impact associated with each of these pollutants.	03
Differentiate between addition and condensation	

First Annual 2025 | Section B Q2(xii) OR | 3 marks

What are the alternatives to ChloroFlouro carbons (CFCs)? How do they compare in terms of environmental impact and effectiveness?	03
Briefly describe why ethanol exhibits three signals in	

Second Annual 2025 | Section B Q2(ix) OR | 3 marks

Describe the role of CFCs in destroying ozone in the stratosphere.	

Second Annual 2025 | Section C Q4 OR | 7 marks

Explain green house effect and global warming as resulting in climate change.	4+3

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Electrochemistry

Domain B: Physical Chemistry

FBISE model paper | Section A Q1(xvii) | 1 mark

xvii.	According to the activity series of metals, which of the following metals can displace zinc from a zinc sulphate solution in a displacement reaction?	Magnesium	Gold	Silver	Copper	○ ○ ○ ○

FBISE model paper | Section B Q2(xii) OR | 3 marks

OR	Balance the following redox equation by oxidation number method. $HNO_3 + Zn \rightarrow Zn(NO_3)_2 + N_2O + H_2O$	03

FBISE model paper | Section B Q2(xiii) OR | 3 marks

OR	During the electrolysis of copper (II) sulphate ($CuSO_4$) solution using inert electrodes. Name the products formed at the anode and cathode. Explain your reasoning.	2+1

First Annual 2025 | Section B Q2(xiii) | 3 marks

(xiii)	A stream of water has the following BOD levels 5mg/L, 1mg/L and 3mg/L. Describe the condition of water (Clean, very clean etc) corresponding to each BOD level.	03

First Annual 2025 | Section C Q3 | 7 marks

Q.3	Arrange the halide ions in order of their reducing strength and explain the trend using chemical equations with sulphuric acid.	2+5

First Annual 2026 | Section B Q2(i) | 3 marks

(i)	Given the reaction: $Fe + Pb^{2+} \rightarrow Fe^{2+} + Pb$. Determine whether this reaction is feasible. Reduction potential values for Fe and Pb are –0.44V and –0.13V respectively.
(ii)	State whether oxidation or reduction has occurred in

First Annual 2026 | Section B Q2(ii) | 3 marks

(ii)	State whether oxidation or reduction has occurred in the conversion $NH_3 \rightarrow NO_2$.(H=+1, O = -2)

(iii)	Predict the products formed at the anode and cathode, with chemical equations, when molten NaCl is electrolyzed.
(iv)	State the type of ions formed by Group II elements

First Annual 2026 | Section C Q3 | 7 marks

A current of 3.0 A is passed through a solution of $CuSO_4$ for 45 minutes.
(a) Write chemical equation occurs at cathode.
(b) Calculate the total charge passed.
(c) Calculate the mass of copper deposited.
(Molar mass of Cu = 63.5 g mol^{-1}, z = 2)

First Annual 2026 | Section A Q3 | 1 mark

3. $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$ What is being oxidized in given reaction?	Cu	Zn^{2+}	Cu^{2+}	Zn

First Annual 2026 | Section B Q2(i) | 3 marks

(i)	Given the following half-cell reactions: $Fe^{3+} + e^- \rightarrow Fe^{2+}$ ($E° = +0.77$ V) $Zn^{2+} + 2e^- \rightarrow Zn$ ($E° = -0.76$ V) identify the oxidation and reduction reactions and calculate E° of cell.	1+1 +1

First Annual 2026 | Section B Q2(ii) | 3 marks

	calculate E° of cell.	
(ii)	What is Standard Hydrogen Electrode? Write its working with the help of chemical reactions.	1+2

Q.3	Balance the given redox equation according to oxidation number method a. $P + HNO_3 + H_2O \rightarrow H_3PO_4 + NO$ b. $HNO_3 + HI \rightarrow NO + I_2 + H_2O$

Q.3	Balance the given redox equation according to oxidation number method a. $P + HNO_3 + H_2O \rightarrow H_3PO_4 + NO$ b. $HNO_3 + HI \rightarrow NO + I_2 + H_2O$

FBISE model paper | Section B Q2(vii) | 3 marks

(vii)	Use the following data to construct redox equations, and calculate the standard cell potentials, for the reactions between acidified H_2O_2 (aq) and KI (aq). $I_2 + 2\bar{e} \rightarrow 2I^{1-}$ $\quad E^\circ = 0.54V$ $O_2 + 2H^+ + 2\bar{e} \rightarrow H_2O_2$ $\quad E^\circ = 0.68\ V$	03

FBISE model paper | Section B Q2(xiii) OR | 3 marks

OR	Balance the following redox equation by oxidation number method. $HNO_3 + Zn \rightarrow Zn(NO_3)_2 + N_2O + H_2O$	03

First Annual 2026 | Section B Q2(i) OR | 3 marks

1.5 + 1.5	OR	Write the chemical equation for the reaction of $K_2Cr_2O_7$ a). with Mohr's salt and b). with oxalic acid in acidic medium.	1.5 + 1.5
1.5		Write IUPAC name for the coordination compounds	1.5

First Annual 2026 | Section C Q6 | 6 marks

Q.6	How halide ions (I^-,Br^-) act as reducing agents? Support your answer by furnishing their chemical reactions with sulphuric acid.	1.5x4

SUPPLEMENTARY TABLE —— 2HA-I 260

FBISE model paper | Section B Q2(vi) OR | 3 marks

OR

Write the chemical reaction of $K_2Cr_2O_7/H_2SO_4$ with the $FeSO_4$ and identify the oxidizing agent. (2+1)

FBISE model paper | Section B Q2(vii) | 3 marks

vii. The order as reducing agent of Halide ions is $F^- < Cl^- < Br^- < I^-$. Justify the order. (1+1+1)

What are dancers? How does not Glue work? (1+2)

OR

What is redox reaction? Write down a redox reaction of Potassium dichromate with oxalic acid. (1+2)

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Chemical Equilibrium

Domain B: Physical Chemistry

FBISE model paper | Section A Q1(ii) | 1 mark

ii.	The base dissociation constants (Kb) for four bases are given below: W: 1.2×10^{-4} X: 3.5×10^{-2} Y: 6.8×10^{-6} Z: 2.1×10^{-3} Which base is the strongest?	W	Y	Z	X	○ ○ ○ ○

FBISE model paper | Section B Q2(xii) | 3 marks

(xii)	When 100 cm^3 of an aqueous solution containing 0.50 g of an organic compound **A** was shaken with 20 cm^3 of hexane, it was found that 0.40 g of **A** was extracted into the hexane. Calculate the partition coefficient of **A** between hexane and water.	3

Q.4	(a) What is meant by buffer solution? (b) Write suitable equations to show how a mixture of ethanoic acid, CH_3CO_2H, and sodium ethanoate acts as a buffer solution to control the pH when either an acid or an alkali is added. (c) Briefly describe how the pH of blood is controlled.	**01** **03** **02**

First Annual 2026 | Section B Q2(i) OR | 3 marks

The partition coefficient of a solute between two solvents is 2.5. If concentration in aqueous layer is 0.4 mol dm^{-3}, calculate concentration in organic layer.

Draw the titration curve for HCl titrated with NH_3

First Annual 2026 | Section B Q2(ii) OR | 3 marks

layer.

Draw the titration curve for HCl titrated with NH_3. Label: initial pH, equivalence point, and final pH. (NH_3 in burette)

Calculate the pH of an acetic acid / sodium acetate

First Annual 2026 | Section B Q2(iii) OR | 3 marks

(NH3 in burette)
Calculate the pH of an acetic acid / sodium acetate buffer containing 1mol of each component. Ka for acetic acid = $1.8x10^{-5}$
Predict the shape, approximate bond angles and

First Annual 2026 | Section A Q4 | 1 mark

What is being oxidized in given reaction?				
Which of the following statements is correct?	Strong bases have high degree of ionization	Weak bases completely ionize	Strong bases have low degree of ionization	Weak bases have high K_b
		First		

First Annual 2026 | Section B Q2(i) OR | 3 marks

OR	A solute distributes between water and ether at equilibrium, its concentration in ether is 4 g/L and in water is 2 g/L. Find the partition coefficient (K_{pc}).	**03**

First Annual 2026 | Section B Q2(iii) | 3 marks

(iii)	Two bases A and B have K_b values of 1.8×10^{-5} and 1.0×10^{-2} respectively. Identify the stronger base. Justify your answer based on extent of ionization.	**1+2**
(iv)	Compare the ionization energies of Group 1 and	

FBISE model paper | Section A Q1(ii) | 1 mark

- A characteristic peak pattern with a 1:1 intensity ratio at m/z = 122 and 124

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

S. No	Question	A	B	C	D	A	B	C	D
i.	In which of the following reactions is there the greatest change in oxidation number of nitrogen?	$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$	$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$	$2NO + O_2 \rightarrow 2NO_2$	$4NH_3 + 6NO \rightarrow 5N_2 + 6H_2O$	O	O	O	O
ii.	The base dissociation constants (Kb) for four bases are given below: W: 1.2×10^{-4} X: 3.5×10^{-2} Y: 6.8×10^{-6} Z: 2.1×10^{-3} Which base is the strongest?	W	Y	Z	X	O	O	O	O

(xiii)	When 100 cm^3 of an aqueous solution containing 0.50 g of an organic compound **A** was shaken with 20 cm^3 of hexane, it was found that 0.40 g of **A** was extracted into the hexane. Calculate the partition coefficient of **A** between hexane and water.	3

Q.4	(a) What is meant by buffer solution? (b) Write suitable equations to show how a mixture of ethanoic acid, CH_3CO_2H, and sodium ethanoate acts as a buffer solution to control the pH when either an acid or an alkali is added. (c) Briefly describe how the pH of blood is controlled.	**01** **03** **02**

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Group2

Domain C: Inorganic Chemistry

FBISE model paper | Section A Q1(iv) | 1 mark

iv.	Which of the following group 2 compounds is commonly used to diagnose disorders of the intestine and stomach.	Magnesium sulfate	Calcium carbonate	Barium sulfate	Strontium nitrate	○ ○ ○ ○

FBISE model paper | Section B Q2(xi) | 3 marks

(xi)	Describe and explain the trend in the solubilities of the sulphates of the Group II elements.	1+2	**OR**	The three Chloro compounds acyl chloride, aryl chloride and alkyl chloride vary in their ease of hydrolysis. Suggest an explanation for these

FBISE model paper | Section B Q2(xiii) | 3 marks

(xiii)	How is calcium hydroxide (slaked lime) used in agriculture, and why is it important for soil treatment?	03

First Annual 2025 | Section B Q2(iv) | 3 marks

(iv)	Beryllium (Be) differs from other alkaline earth metals in terms of its reactions with hydrogen and alkalis. Describe these differences and provide the relevant chemical equations.	03

First Annual 2025 | Section B Q2(v) | 3 marks

(v)	Sodium and Magnesium belong to same period but why is Sodium Carbonate more stable than Magnesium Carbonate?	03

First Annual 2025 | Section B Q2(xiv) OR | 3 marks

	Write two chemical equations to show the amphoteric nature of BeO.	03

First Annual 2025 | Section C Q5 | 6 marks

Q.5	Write chemical equations to illustrate the basic nature of Group-I normal oxides, per-oxides and super oxides using Na_2O, Na_2O_2 and NaO_2 as examples.	**2x3**

First Annual 2025 | Section B Q2(iv) | 3 marks

(iv)	How is Beryllium Carbide (Be_2C) different from carbides of other alkaline earth metals? Justify your answer by furnishing chemical reactions.	

First Annual 2025 | Section B Q2(v) | 3 marks

(v)	Na_2CO_3 is thermally more stable than $MgCO_3$. Discuss the underlying reasons for this difference in stability.	03

Second Annual 2025 | Section A Q4 | 1 mark

Beryllium hydroxide is classified as:	Neutral	Acidic	Basic	Amphoteric

Second Annual 2025 | Section B Q2(i) | 3 marks

(i)	Usually Ionization energy increases along the period from left to right. Why is ionization energy of Mg higher than Al in 3rd period?

Second Annual 2025 | Section B Q2(iii) | 3 marks

(iii)	Briefly explain the amphoteric nature of aluminum oxide with chemical reactions. (Give reaction with acid and base)

Second Annual 2025 | Section B Q2(iv) | 3 marks

(iv)	Differentiate between Na_2O and P_4O_{10} on the basis of acid-base character with reference to chemical reaction with water.

Second Annual 2025 | Section B Q2(v) | 3 marks

(v)	Why is $BeCl_2$ covalent while other Group 2 chlorides are ionic?

Second Annual 2025 | Section B Q2(vi) | 3 marks

	are ionic?	
(vi)	Compare the stability of Group-I and Group-II carbonates. What is the trend of thermal stability in Group-II carbonates down the Group?	2+1
(vii)	Write names of given coordinating	

Second Annual 2025 | Section C Q3 | 7 marks

Q.3	Describe how Berylium is different from its other group members in terms of its oxide, carbides and its reactions with water and alkalis.	1+2 + 2+2
Q.4	What is meant by	

First Annual 2026 | Section B Q2(iv) | 3 marks

	is electrolyzed.
(iv)	State the type of ions formed by Group II elements. Mention their charge, and compare their reactivity with that of Group I elements.
(v)	Compare with the help of chemical equations the

First Annual 2026 | Section B Q2(v) | 3 marks

	with that of Group I elements.
(v)	Compare with the help of chemical equations the reactivity of Li and Be with oxygen.
(vi)	Determine whether the following compound is

First Annual 2026 | Section C Q5 OR | 6 marks

Phenylamine > Ammonia > Ethylamine.
Explain the trend in thermal stability of Group II carbonates and nitrates, giving reasons. Also, write the order of stability for each.
Justify the given order of ease of hydrolysis: Acyl

First Annual 2026 | Section A Q5 | 1 mark

	Ionization		Ionization	
The reactivity of Group 2 elements ____ down the group:	Remains constant	First increases then decreases	Decreases	Increases
	d-orbitals are			

First Annual 2026 | Section B Q2(iv) | 3 marks

	justify your answer based on extent of ionization.	
(iv)	Compare the ionization energies of Group 1 and Group 2 elements. Explain the reason for the difference.	1+2
(v)	Write any three uses of group-II elements in	

First Annual 2026 | Section B Q2(v) | 3 marks

	difference.	
(v)	Write any three uses of group-II elements in industry, agriculture or medicines.	1x3
(vi)	Draw the Cis and Trans isomers of 2-butene and	

FBISE model paper | Section A Q1(iv) | 1 mark

- A characteristic peak pattern with a 1:1 intensity ratio at m/z = 122 and 124

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

S. No	Question	A	B	C	D	A	B	C	D
i.	In which of the following reactions is there the greatest change in oxidation number of nitrogen?	$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$	$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$	$2NO + O_2 \rightarrow 2NO_2$	$4NH_3 + 6NO \rightarrow 5N_2 + 6H_2O$	○	○	○	○
ii.	The base dissociation constants (Kb) for four bases are given below: W: 1.2×10^{-4} X: 3.5×10^{-2} Y: 6.8×10^{-6} Z: 2.1×10^{-3} Which base is the strongest?	W	Y	Z	X	○	○	○	○
iii.	How many ions are produced from $[Co(NH_3)_6]Cl_3$ in the solution?	3	4	5	6	○	○	○	○
iv.	Which of the following group 2 compounds is commonly used to diagnose disorders of the intestine and stomach.	Magnesium sulfate	Calcium carbonate	Barium sulfate	Strontium nitrate	○	○	○	○

FBISE model paper | Section B Q2(xi) | 3 marks

(xi)	Describe and explain how the thermal stabilities of the Group II nitrates vary down the group.	1+2	**OR**	Write a balanced chemical equation for the reaction of acid rain (containing sulphuric acid) with calcium carbonate in the soil. Explain how

First Annual 2026 | Section A Q2 | 1 mark

Which of the following nitrates decomposes at the lowest temperature?	$Ba(NO_3)_2$	$Sr(NO_3)_2$	$Mg(NO_3)_2$	$Ca(NO_3)_2$

First Annual 2026 | Section B Q2(i) | 1.5 marks

Q. 2 Answer the following parts briefly.

(i)	How does the solubility of $MgSO_4$ compare with $BaSO_4$?	1.5 + 1.5

First Annual 2026 | Section B Q2(iii) | 2 marks

(iii)	Compare the melting and boiling points of beryllium with magnesium. Explain the reason for the difference.	1+1 +1

First Annual 2026 | Section B Q2(v) OR | 3 marks

	two reasons.	
OR	Write two balanced chemical equations for the amphoteric behaviour of BeO.	1.5 + 1.5

FBISE model paper | Section B Q2(i) | 3 marks

Attempt all parts from the following. All parts carry equal marks. (1 × 3 = 12)

i. The thermal stability of carbonates of alkaline earth metals increases down the group. Justify this behavior. (3)

OR

FBISE model paper | Section C Q3 | 7 marks

Q.3 Describe the peculiar behavior of 1st member of the alkaline earth metals. Give five main differences from its group elements. (2+5)

OR

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Transition Metals

Domain C: Inorganic Chemistry

FBISE model paper | Section A Q1(iii) | 1 mark

iii.	How many ions are produced from $[Co(NH_3)_6]Cl_3$ in the solution?	3	4	5	6	○ ○ ○ ○

FBISE model paper | Section A Q1(vi) | 1 mark

vi.	A transition metal ion with a $3d^8$ electronic configuration commonly forms a four coordinate complex. Which geometry is most likely observed for such a complex?	Linear	Tetrahedral	Square Planar	Octahedral	○ ○ ○ ○

FBISE model paper | Section A Q1(xii) | 1 mark

xii.	Which one of the following is not a bidentate ligand?	Ethanedioate ion	Oxalate ion	Thiocyanate ion	1,2-Diaminoethane	○ ○ ○ ○

FBISE model paper | Section B Q2(iii) OR | 3 marks

OR	Copper and silver both are transition metals. Copper (I) and silver (I) compounds are colourless. Suggest your answer.	03

Note: Attempt all questions. Marks of each question

Q.3	Consider a following reaction where stable complex is formed. $[Cd(H_2O)_6]^{2+} + EDTA^{4-} \rightleftharpoons [Cd(EDTA)]^{2-} + 6H_2O$	
	(a) Write an expression of K_{stab} for this reaction and state its unit.	**02**
	(b) At equilibrium at 298K, concentration of $[Cd(H_2O)_6]^{2+}$ and $EDTA^{4-}$ was found to be $3x10^{-8}$ $moldm^{-3}$ and $4x10^{-10}$ $moldm^{-3}$. Calculate concentration of $[Cd(EDTA)]^{2-}$ in this solution. K_{stab} of $[Cd(EDTA)]^{2-}$ is $6.3x10^{19}$.	**04**

are given.

OR	Use the following E^o values to predict whether a reaction will occur when the following pairs of aqueous solutions are mixed. If a reaction occurs, write a balanced equation and calculate the E^o cell. $Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$ $E^o = 0.77$ V $Cl_2 + 2e^- \rightleftharpoons 2Cl^-$ $E^o = 1.36$ V $Br_2 + 2e^- \rightleftharpoons 2Br^-$ $E^o = 1.07$ V $I_2 + 2e^- \rightleftharpoons 2I^-$ $E^o = 0.54$ V $Co^{3+} + e^- \rightleftharpoons Co^{2+}$ $E^o = 1.82$ V $Cr^{3+} + e^- \rightleftharpoons Cr^{2+}$ $E^o = -0.41$ V **(i)** $Fe^{3+}(aq)$ and $Cl^-(aq)$ **(ii)** $Co^{3+}(aq)$ and $Br^-(aq)$ **(iii)** $Cr^{2+}(aq)$ and $I_2(aq)$	**02** **02** **02**

First Annual 2025 | Section B Q2(i) OR | 3 marks

How Fe^{+2} act as a catalyst in given reaction? Write its two steps mechanism. $S_2O_8^{-2} + 2I^{-1} \xrightarrow{Fe} 2SO_4^{-2} + I_2$	1x3

First Annual 2025 | Section B Q2(ii) OR | 3 marks

Why group II-B and III-B are considered as non-typical transition elements?	03

First Annual 2025 | Section B Q2(iv) OR | 3 marks

			b. Synthesis of vegetable Ghee from oil.	
Beryllium (Be) differs from other alkaline earth metals in terms of its reactions with hydrogen and alkalis. Describe these differences and provide the relevant chemical equations.	**03**	**OR**	Write chemical reactions of $KMnO_4$ in acidic medium with: **a.** $FeSO_4$ **b.** Mohr's Salt (Balancing is not necessary)	**03**
Sodium and Magnesium belong to same period but			Identify the type of isomerism in given pairs	

First Annual 2025 | Section B Q2(i) OR | 3 marks

Justify the given statements: **a.** 2nd electron affinity is endothermic. **b.** Electron affinity of chlorine is higher than fluorine	**03**	**OR**	Why Group-II-B and III–B elements are called Non-typical transition elements?	**03**

First Annual 2025 | Section B Q2(ii) OR | 3 marks

OR	Write chemical reactions of $K_2Cr_2O_7$ in acidic medium with: **a.** Oxalic acid **b.** Mohr's salt (Balancing is not necessary) Identify the major products in the given reactions	03

Second Annual 2025 | Section A Q5 | 1 mark

Which transition metal is used as a catalyst in Haber's process?	Cu	Ni	Pt	Fe

Second Annual 2025 | Section B Q2(i) OR | 3 marks

Predict the shape of given coordination compounds based on coordination number. i = $[Ag(NH_3)_2]^{+2}$ ii = $[Ni(CN)_6]^{-2}$	1.5 + 1.5

Second Annual 2025 | Section B Q2(vii) | 3 marks

	Group II carbonates down the Group?				
(vii)	Write names of given coordination compounds $a = K_4\left[Fe(CN)_6\right]$ $b = \left[Cr(NO_2)_3\right]SO_4$	**1.5 + 1.5**	**OR**	How can acetic acid be prepared by Grignard reagent?	**03**

Second Annual 2025 | Section B Q2(viii) | 3 marks

(viii)	Write chemical reaction of $KMnO_4$ with Iron (II) sulphate and oxalic acid in the presence of H_2SO_4.

First Annual 2026 | Section B Q2(iv) OR | 3 marks

acetic acid = 1.8x10

Predict the shape, approximate bond angles and coordination number of $[Ag(NH_3)_2]^+$

First Annual 2026 | Section B Q2(v) OR | 3 marks

Why transition elements with d^{10} configuration are usually colourless?

Compare the enthalpy of hydrogenation of benzene

First Annual 2026 | Section C Q4 | 7 marks

What are transition elements? Write trend of melting point and atomic radii from Ti to Cu in 3d series.

First Annual 2026 | Section A Q6 | 1 mark

Ethanoic acid > Phenol > Ethanol

When phenol is treated with bromine water, a white precipitate is formed.

		decreases		
Zinc is not considered as a transition element because:	d-orbitals are completely filled	It is a non-metal	It has no d-orbitals	It is highly reactive
				Rotates

First Annual 2026 | Section B Q2(v) OR | 3 marks

a. $[Pt(NH_3)_4BrCl]SO_4$ **b.** $K_4[Fe(CN)_6]$	
Write any three physical properties of transition elements.	**1x3**
Write the mechanism of nitration of benzene.	

First Annual 2026 | Section C Q4 | 7 marks

	b. $HNO_3 + H_2O \rightarrow NO_2 + H_2O$	
Q.4	Compare the arrangement of d-orbitals in octahedral and tetrahedral complexes. (Support your answer by drawing their diagrams of d-d splitting pattern).	**3.5 + 3.5**

- A characteristic peak pattern with a 1:1 intensity ratio at m/z = 122 and 124

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

S. No	Question	A	B	C	D	A	B	C	D
i.	In which of the following reactions is there the greatest change in oxidation number of nitrogen?	$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$	$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$	$2NO + O_2 \rightarrow 2NO_2$	$4NH_3 + 6NO \rightarrow 5N_2 + 6H_2O$	○	○	○	○
ii.	The base dissociation constants (Kb) for four bases are given below: W: 1.2×10^{-4} X: 3.5×10^{-2} Y: 6.8×10^{-6} Z: 2.1×10^{-3} Which base is the strongest?	W	Y	Z	X	○	○	○	○
iii.	How many ions are produced from $[Co(NH_3)_6]Cl_3$ in the solution?	3	4	5	6	○	○	○	○

- A characteristic peak pattern with a 1:1 intensity ratio at m/z = 122 and 124

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

S. No	Question	A	B	C	D	A	B	C	D
i.	In which of the following reactions is there the greatest change in oxidation number of nitrogen?	$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$	$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$	$2NO + O_2 \rightarrow 2NO_2$	$4NH_3 + 6NO \rightarrow 5N_2 + 6H_2O$	○	○	○	○
ii.	The base dissociation constants (Kb) for four bases are given below: W: 1.2×10^{-4} X: 3.5×10^{-2} Y: 6.8×10^{-6} Z: 2.1×10^{-3} Which base is the strongest?	W	Y	Z	X	○	○	○	○
iii.	How many ions are produced from $[Co(NH_3)_6]Cl_3$ in the solution?	3	4	5	6	○	○	○	○
iv.	Which of the following group 2 compounds is commonly used to diagnose disorders of the intestine and stomach.	Magnesium sulfate	Calcium carbonate	Barium sulfate	Strontium nitrate	○	○	○	○
v.	When benzene is nitrated, conc. Nitric and sulphuric acid react to form an intermediate which attack the benzene ring, which one of the following represents this intermediate?	NO^+	NO_2	NO_2^-	NO_2^+	○	○	○	○
vi.	A transition metal ion with a $3d^8$ electronic configuration commonly forms a four coordinate complex. Which geometry is most likely observed for such a complex?	Linear	Tetrahedral	Square Planar	Octahedral	○	○	○	○

Q. 2 Attempt the following questions

(i) What is meant by coordination number? Complete the table for the following two complexes. 03

Central Metal ion	Ligand	Coordination number	Formula of complex ion
Fe^{3+}	CN^-		$K_3[Fe(CN)_6]$
Pt^{4+}	$NH_2CH_2CH_2NH_2$		$[Pt(NH_2CH_2CH_2NH_2)_2]^{4+}$

(ii) How can nylon-6,6 be prepared from 02

Note: Attempt all questions. Marks of each question

Q.3	Consider a following reaction where stable complex is formed. $[Cd(H_2O)_6]^{2+} + EDTA^{4-} \rightleftharpoons [Cd(EDTA)]^{2-} + 6H_2O$	
	(a) Write an expression of K_{stab} for this reaction and state its unit.	**02**
	(b) At equilibrium at 298K, concentration of $[Cd(H_2O)_6]^{2+}$ and $EDTA^{4-}$ was found to be $3x10^{-8}$ $moldm^{-3}$ and $4x10^{-10}$ $moldm^{-3}$. Calculate concentration of $[Cd(EDTA)]^{2-}$ in this solution. K_{stab} of $[Cd(EDTA)]^{2-}$ is $6.3x10^{19}$.	**04**

...

Use the following E^o values to predict whether a reaction will occur when the following pairs of aqueous solutions are mixed. If a reaction occurs, write a balanced equation and calculate the E^o cell. $Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$ $E^o = 0.77$ V $Cl_2 + 2e^- \rightleftharpoons 2Cl^-$ $E^o = 1.36$ V $Br_2 + 2e^- \rightleftharpoons 2Br^-$ $E^o = 1.07$ V $I_2 + 2e^- \rightleftharpoons 2I^-$ $E^o = 0.54$ V $Co^{3+} + e^- \rightleftharpoons Co^{2+}$ $E^o = 1.82$ V $Cr^{3+} + e^- \rightleftharpoons Cr^{2+}$ $E^o = -0.41$ V	
(i) $Fe^{3+}(aq)$ and $Cl^-(aq)$	**02**
(ii) $Co^{3+}(aq)$ and $Br^-(aq)$	**02**

...

Use the following E^o values to predict whether a reaction will occur when the following pairs of aqueous solutions are mixed. If a reaction occurs, write a balanced equation and calculate the E^o cell. $Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$ $E^o = 0.77$ V $Cl_2 + 2e^- \rightleftharpoons 2Cl^-$ $E^o = 1.36$ V $Br_2 + 2e^- \rightleftharpoons 2Br^-$ $E^o = 1.07$ V $I_2 + 2e^- \rightleftharpoons 2I^-$ $E^o = 0.54$ V $Co^{3+} + e^- \rightleftharpoons Co^{2+}$ $E^o = 1.82$ V $Cr^{3+} + e^- \rightleftharpoons Cr^{2+}$ $E^o = -0.41$ V	
(i) $Fe^{3+}(aq)$ and $Cl^-(aq)$	**02**
(ii) $Co^{3+}(aq)$ and $Br^-(aq)$	**02**

FBISE model paper | Section C Q3(iii) OR | 2 marks

...

Use the following E^o values to predict whether a reaction will occur when the following pairs of aqueous solutions are mixed. If a reaction occurs, write a balanced equation and calculate the E^o cell. $Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$ $E^o = 0.77$ V $Cl_2 + 2e^- \rightleftharpoons 2Cl^-$ $E^o = 1.36$ V $Br_2 + 2e^- \rightleftharpoons 2Br^-$ $E^o = 1.07$ V $I_2 + 2e^- \rightleftharpoons 2I^-$ $E^o = 0.54$ V $Co^{3+} + e^- \rightleftharpoons Co^{2+}$ $E^o = 1.82$ V $Cr^{3+} + e^- \rightleftharpoons Cr^{2+}$ $E^o = -0.41$ V	
(ii) Co^{3+}(aq) and Br^-(aq)	**02**
(iii) Cr^{2+}(aq) and I_2(aq)	**02**

First Annual 2026 | Section A Q4 | 1 mark

4.	In the compound $[Co(NH_3)_6]Cl_3$, the coordination number of cobalt is:	3	4	6	9

First Annual 2026 | Section A Q5 | 1 mark

The electronic configuration of Fe^{2+} ion is:	[Ar] $3d^6$	[Ar] $3d^5 4s^1$	[Ar] $3d^4 4s^2$	[Ar] $3d^7$

FBISE model paper | Section B Q2(ii) | 3 marks

ii. Ammonia acts as a ligand and a base. Justify this statement by the reactions with copper ion. (1.5+1.5)

FBISE model paper | Section B Q2(ii) OR | 3 marks

What are ligands? Give example of tridentate and hexadentate ligand. (1+1+1)

FBISE model paper | Section B Q2(vi) | 3 marks

vi. What is the oxidation number and coordination number of the metals in the following complexes? (1.5+1.5)

(a) $[Cr(H_2O)_4(OH)_2]NO_3$ (b) $K_4[Fe(CN)_6]$

FBISE model paper | Section C Q4 OR | 6 marks

OR

Demonstrate the chemical reactions of $[Fe(H_2O)_6]^{+3}$. With the following (2+2+2)

i. Sodium hydroxide ii. Sodium Carbonates iii. Ammonia

FBISE PBA model | Section B Q2(i) | 1 mark

Question 2: Give answers to following questions.

i. . Draw structure of Nickel dimethyl glyoxime. **[01]**

APOLLO

Organic Chemistry

Domain E: Organic Chemistry

FBISE model paper | Section A Q1(vii) | 1 mark

vii.	What is the least number of carbon atoms in a non-cyclic alkane molecule that has a chiral centre?	7	8	9	10	○ ○ ○ ○

FBISE model paper | Section B Q2(ix) | 3 marks

(ix)	Hex-2-ene shows one of the type of isomerism. Draw displayed formulae of its two isomers.	03

FBISE model paper | Section B Q2(x) | 3 marks

(x)	Explain what is meant by the term chiral center. Draw displayed formulae for the isomers of $CH_3CH(OH)CO_2H$.	03

First Annual 2025 | Section B Q2(v) OR | 3 marks

Identify the type of isomerism in given pairs. **a.** 1-Chloro propane and 2-Chloro propane **b.** Butanone and Butanal **c.** Diethyl Ether and Methyl Propyl Ether	**03**

First Annual 2026 | Section A Q7 | 1 mark

7. An optically active compound is one that:	Has double bonds	Is colored	Has fruity smell	Rotates plane-polarized light

First Annual 2026 | Section B Q2(vii) | 3 marks

(vii)	Separate the chiral and Achiral molecules in the following. a. $CF_3CH_2CCl_3$ b. $CF_2HCHFCCl_3$ c. $CH_2ClCH(OH)CH_3$	**1x3**

First Annual 2026 | Section B Q2(viii) | 3 marks

(viii)	Draw a pair of enantiomers for 2-butanol and show the chiral center.	**2+1**

FBISE model paper | Section B Q2(ix) | 3 marks

(ix)	Hex-2-ene shows one of the type of isomerism. Draw displayed formulae of its two isomers.	03

FBISE model paper | Section B Q2(x) | 3 marks

(x)	Explain what is meant by the term chiral center. Draw displayed formulae for the isomers of $CH_3CH(OH)CO_2H$.	03

First Annual 2026 | Section A Q10 | 1 mark

an example of:	reaction	reaction		
b. The compound $CH_3–CH(OH)–CH_3$:	Has one chiral center	Has two chiral centers	Exhibits optical isomerism	Has no chiral center

FBISE model paper | Section B Q2(ix) | 3 marks

ix. Summarize the concept of optical Isomerism by drawing different isomeric structures of tartaric acid showing their optical behavior. (1.5+1.5)

APOLLO

Hydrocarbon

Domain E: Organic Chemistry

FBISE model paper | Section A Q1(v) | 1 mark

v.	When benzene is nitrated, conc. Nitric and sulphuric acid react to form an intermediate which attack the benzene ring, which one of the following represents this intermediate?	NO^+	NO_2	NO_2^-	NO_2^+	O O O O

FBISE model paper | Section A Q1(viii) | 1 mark

viii.	Which of the following substituents is an electron-withdrawing, meta-directing group?	–OH	$–CH_3$	$–NO_2$	$–NH_2$	O O O O

FBISE model paper | Section B Q2(vi) | 3 marks

(vi)	Explain the molecular orbital structure of benzene and how delocalized π-electrons contribute to its relative stability.	03

FBISE model paper | Section B Q2(vi) OR | 3 marks

OR	Benzene can be converted into acetophenone by Friedel Craft acylation. Write down the steps involved in the mechanism of the formation of Acetophenone from benzene.	03

First Annual 2025 | Section B Q2(ix) OR | 3 marks

Provide the chemical equation to illustrate how ozonolysis of same alkyne can be used to prepare two molecules of acetic acid.	03

First Annual 2025 | Section B Q2(vi) | 3 marks

Briefly explain the 'Coal' and 'Petroleum' as the source of organic compounds.	03
Briefly describe any three types of adhesives	

First Annual 2025 | Section C Q4 OR | 6 marks

Explain the mechanism of Nitration and Friedel craft Acylation of Benzene highlighting key steps and intermediates.	3+3

First Annual 2025 | Section B Q2(v) OR | 3 marks

OR	Provide the chemical equation to illustrate how can ozonolysis of same alkyne be used to prepare formic acid and acetic acid.	03

First Annual 2025 | Section B Q2(viii) OR | 3 marks

OR	Identify the more stable alkene in each of the given pairs and explain reason for stability. **a.** 1,3-pentadiene and 1, 4-pentadiene **b.** 2, 3 Dimethyl -2-butene and 2-methyl -2-butene	03

Second Annual 2025 | Section A Q6 | 1 mark

The allotrope of carbon known as 'Bucky ball' has how many carbon atoms in its simplest molecule?	70	40	50	60

Second Annual 2025 | Section A Q7 | 1 mark

Which reaction mechanism is involved in chlorination of methane in the presence of sunlight?	Free radical substitution	SN1	SN2	Electrophilic substitution

Second Annual 2025 | Section A Q8 | 1 mark

8.	The delocalized π-electrons in benzene are responsible for:	Oxidation	Aromatic stability	Instability	Addition reactions

Second Annual 2025 | Section B Q2(iii) OR | 3 marks

Draw the structure of given:

a. 1, 2-Dimethyl cyclo butane

b. 1, 3-Diethyl cyclo pentane

Write mechanism of reaction when (

Second Annual 2025 | Section C Q3 OR | 7 marks

Write mechanism of Nitration and Sulphonation of Benzene.	3+4

First Annual 2026 | Section B Q2(vi) OR | 3 marks

usually colourless?
Compare the enthalpy of hydrogenation of benzene and 1,3,5-cyclohexatriene and explain the significance of the difference.
Predict the product when phenol is treated with

First Annual 2026 | Section C Q5 | 6 marks

Explain the mechanism showing the role of the Lewis acid of Friedel-Crafts alkylation of benzene with CH_3Cl using $AlCl_3$ as a catalyst.
Justify the following order of acidic strength by

First Annual 2026 | Section A Q8 | 1 mark

				polarized ligh
The correct relative reactivity order is:	Alkene > Benzene > Alkane	Alkene > Alkane > Benzene	Benzene > Alkene > Alkane	Alkane > Benzene > Alkene
The product formed when chloroethane				

First Annual 2026 | Section B Q2(vi) | 3 marks

(vi)	Draw the Cis and Trans isomers of 2-butene and identify the stable isomer between them.	2+1

First Annual 2026 | Section B Q2(vi) OR | 3 marks

Write the mechanism of nitration of benzene.	03

- A characteristic peak pattern with a 1:1 intensity ratio at m/z = 122 and 124

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

S. No	Question	A	B	C	D	A	B	C	D
i.	In which of the following reactions is there the greatest change in oxidation number of nitrogen?	$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$	$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$	$2NO + O_2 \rightarrow 2NO_2$	$4NH_3 + 6NO \rightarrow 5N_2 + 6H_2O$	O	O	O	O
ii.	The base dissociation constants (Kb) for four bases are given below: W: 1.2×10^{-4} X: 3.5×10^{-2} Y: 6.8×10^{-6} Z: 2.1×10^{-3} Which base is the strongest?	W	Y	Z	X	O	O	O	O
iii.	How many ions are produced from $[Co(NH_3)_6]Cl_3$ in the solution?	3	4	5	6	O	O	O	O
iv.	Which of the following group 2 compounds is commonly used to diagnose disorders of the intestine and stomach.	Magnesium sulfate	Calcium carbonate	Barium sulfate	Strontium nitrate	O	O	O	O
v.	When benzene is nitrated, conc. Nitric and sulphuric acid react to form an intermediate which attack the benzene ring, which one of the following represents this intermediate?	NO^+	NO_2	NO_2^-	NO_2^+	O	O	O	O

OR	Benzene can be converted into acetophenone by Friedel Craft acylation. Write down the steps involved in the mechanism of the formation of Acetophenone from benzene.	03

First Annual 2026 | Section A Q8 | 1 mark

Hydrocarbons containing a benzene ring are called:	Alkanes	Aliphatic	Cycloalkanes	Aromatic
				Elimination

First Annual 2026 | Section B Q2(iv) OR | 3 marks

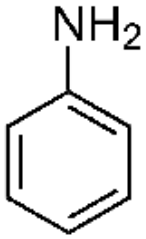
	significance of the difference.	
OR	Why alkanes are less reactive than other hydrocarbons? Support your answer by furnishing two reasons.	1.5 + 1.5
	Write two balanced chemical equations for the	1.5

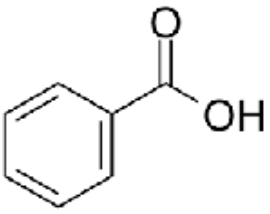
First Annual 2026 | Section C Q3 OR | 7 marks

OR	Write Mechanism of the electrophilic substitution reaction for nitration and sulphonation of benzene.	3+4
	How automobiles contribute to environmental	

OR

The following mono substituted benzene are subjected to nitration reaction.
Prioritize the positions of different products formed. (1.5+1.5)

a) 

b) 

APOLLO

Halogenoalkanes

Domain E: Organic Chemistry

FBISE model paper | Section A Q1(ix) | 1 mark

ix.	Which of the following halogenoalkanes is most likely to undergo an SN1 reaction?	Methyl chloride	Ethyl bromide	Isopropyl chloride	Tert-butyl bromide	○ ○ ○ ○

FBISE model paper | Section C Q4 OR | 6 marks

OR	Describe the SN_1 and SN_2 mechanisms of nucleophilic substitution in halogenoalkanes. Explain the step-by-step mechanism of each reaction with suitable examples.	**06**

	2-Methyl-2-Propanol and 2-Propanol.	
(xii)	Write any three differences between E_2 and E_1 reactions of alkyl halides.	**03**