APOLLO

FBISE Chemistry Class 11
Topical workbook - Volume 2 of 4

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

APOLLO

States and phases of matter

Domain B: Physical Chemistry

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

State three differences between crystalline and amorphous solids.	1x3

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

Identify intermolecular forces among the following molecules. Also write in descending order of their strength. C_6H_6, HF, H_2O, HBr	2+1

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

Surface tension of water is about three times more than CCl_4. Why?	03	OR	Calculate the pH of a buffer solution in which $0.11\,M\ CH_3COONa$ and $0.09\,M\ CH_3COOH$	03

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

Write three points of differences between amorphous and crystalline solids.	1+1+1

Identify types of intermolecular forces among the following molecules. Also write the ascending order of their strength. HCl, NH_3, O_2, HF	2+1

(xiii) What is meant by vapour pressure? Following is a table of the vapour pressure of water, ethanol and pentane. (1+2)

Liquid	Vapour Pressure
Water (H_2O)	2.44
Ethanol (C_2H_5OH)	5.83
Pentane (C_5H_{10})	59.9

Explain these variations in vapour pressure.

8.	London Dispersion forces are only forces present among which of the following?	Polar molecules of water	Molecules of HF	Molecules of solid iodine	Molecules of ammonium chloride

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

Ice has high heat of fusion. Give its two importance in real life.	03
Illustrate the conductivity of a metallic crystal by	

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

Differentiate between amorphous and crystalline solids.	03
By applying HESS'S law calculate enthalpy of	

03	OR	Give reasons for: **a)** H_2O is a liquid but H_2S is gas at room temperature. **b)** Heat of sublimation is greater than heat of vaporization.	03

First Annual 2025 | Section C Q6 OR | 7 marks

a) Simple dry cell b) Alkaline dry cell	
Explain the term vapour pressure. Write two factors affecting the vapour pressure of liquid. Compare the vapour pressure of Diethyl ether, water and ethanol.	2+2 +3

Second Annual 2025 | Section A Q6 | 1 mark

6.	According to Kinetic Molecular Theory, gas pressure is due to:	Repulsion between molecules	Attraction between molecules	Collisions of molecules with container walls	Movement of electrons

Second Annual 2025 | Section A Q7 | 1 mark

7.	Which type of intermolecular force is strongest?	London dispersion	Dipole-dipole	Hydrogen bonding	Van der Waals

Second Annual 2025 | Section A Q9 | 1 mark

9.	Which of the following is an amorphous solid?	NaCl	Diamond	Graphite	Glass

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

	molecular geometry regarding dipole moment.	
(vi)	Differentiate liquid crystals from pure liquids or crystalline solids at least in two ways.	03
(vii)	Justify the following statements:	

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

	crystalline solids at least in two ways.			one application in real life.	
(vii)	Justify the following statements: a. Evaporation causes cooling b. Petrol is more volatile than water	03	OR	Differentiate between amorphous and crystalline solids with reference to melting point, water of crystallization and geometrical shape.	1x3
(viii)	Write three differences between molecular and				

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

	one application in real life.
OR	Differentiate between amorphous and crystalline solids with reference to melting point, water of crystallization and geometrical shape.
	Briefly explain what is meant by the terms

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

	b. Petrol is more volatile than water	
(viii)	Write three differences between molecular and metallic solids.	1x3
(ix)	Consider the following reaction	

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

	and heterogeneous catalysis.	+1.5
(xi)	Why a solution has a lower vapor pressure than the pure solvent? Describe on particle basis.	03

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

		+1.5
OR	Classify the following processes as Exothermic or Endothermic: **a.** Formation of clouds **b.** Formation of ice **c.** Sublimation of dry ice (CO_2)	03

(xiv)	Justify the following statements: **a.** Water has low vapour pressure than petrol **b.** Ethanol is more viscous than dimethyl ether	1.5 +1.5	OR	Jus a. b.

Second Annual 2025 | Section C Q6 OR | 6 marks

OR	Justify the following statements: **a.** Boiling point of Halogens increases down the group. **b.** Methane is gas while Hexane is liquid.

(OLD)

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

	forces?				
(v)	Describe the following properties of crystalline solids: **a.** Melting point **b.** Cleavage plane **c.** Habit of a crystal	1x3	OR	What type of reactions occur on hydrolysis of the following salts? Answer along with the reactions involved: **a.** $NaCl$ **b.** NH_4Cl	1.5 + 1.5

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

(viii)	What in meant by evaporation? On what factors does the evaporation rate depend?	03

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

(xi)	Why molar heat of vaporization of water is greater than its molar heat of fusion?	03

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

(xii)	How the following factors affect the strength of London dispersion forces: a. Atomic or molecular size b. Polarizability	1.5 + 1.5

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

(xiii)	Briefly explain the factors that can affect the rate of evaporation. (Any three)	1x3

OR	Briefly explain hydrogen bonding. Explain following Properties of water due to hydrogen bonding: **a.** Surface tension **b.** Boiling point **c.** Heat of vaporization	1+ 2x3

APOLLO

Energetics

Domain B: Physical Chemistry

FBISE model paper | Section A Q21 | 0.5 marks

21.	In a reaction pathway diagram, activation energy is best described as:	Energy difference between reactants and products	Energy required to break bonds of products	Energy barrier between reactants and transition state	Total enthalpy change of reaction

FBISE model paper | Section A Q23 | 0.5 marks

23.	Which of the following defines lattice energy?	Energy released when gaseous ions form a solid ionic compound	Energy required to melt a solid	Energy of electron gain by atoms	Energy released in combustion

FBISE model paper | Section A Q24 | 0.5 marks

24.	Which factor increases electron affinity (makes it more negative)?	Larger atomic size	Higher nuclear charge	Increased shielding only	Lower electronegativity

FBISE model paper | Section A Q25 | 0.5 marks

25.	Which process results in a positive entropy change?	Freezing of water	Melting of ice	Condensation of steam	Formation of NaCl(s) from ions in solution

FBISE model paper | Section A Q26 | 0.5 marks

26.	Given: $S°(H_2O)$ = 213 J K^{-1} mol^{-1}, $S°(O_2)$ = 205 J K^{-1} mol^{-1}, $S°(H_2)$ = 424 J K^{-1} mol^{-1}. Calculate $\Delta S°$ for: $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$.	-416 J K^{-1} mol^{-1}	+416 J K^{-1} mol^{-1}	+627 J K^{-1} mol^{-1}	-627 J K^{-1} mol^{-1}

FBISE model paper | Section A Q37 | 0.5 marks

37.	The standard enthalpy change for the reaction is ΔH^o = +1668 kJ $2NF_3(g) \rightarrow 2N(g) + 6F(g)$ What is the bond energy of the N–F bond?	–556 kJ mol^{-1}	–278 kJ mol^{-1}	+278 kJ mol–1	+556 kJ mol^{-1}

FBISE model paper | Section A Q56 | 0.5 marks

56.	Which reaction has an enthalpy change equal to the standard enthalpy change of formation of propane?	$3C(g) + 4H_2(g) \rightarrow C_3H_{8(g)}$	$3C(g) + 8H(g) \rightarrow C_3H_8(g)$	$3C(s) + 4H_2(g) \rightarrow C_3H_8(g)$	$3C(s) + 4H_2(g) \rightarrow C_3H_8(l)$

Q7	Define the first electron affinity (EA) and Lattice Energy. Why is the electron affinity of chlorine more negative than that of fluorine, despite fluorine being more electronegative?

3+3	**OR**	For the formation of potassium fluoride, the following data are given: • Enthalpy of atomization of K = +89 kJ mol^{-1} • Enthalpy of atomization of F_2 = +79 kJ mol^{-1} • Ionization energy of K = +419 kJ mol^{-1} • Electron affinity of F = −328 kJ mol^{-1} • Enthalpy of formation of KF = −567 kJ mol^{-1} (a) Draw a Born–Haber cycle for KF formation. (b) Calculate the lattice energy of KF. (c) Explain how ionic size affects lattice energy in KF.

	~~am~~ of HF gas at STP is:								
5.	What will be the enthalpy of solution of *NaCl* if ΔH (reverse lattice) is *+786 kj/mol* and ΔH (hyd) is *-783 kj/mol*?	*+3 kj/mol*	*–3 kj/mol*	*+1569 kj/mol*	*–1569 kj/mol*	○	○	○	○
	The following equilibrium will **NOT** be shifted								

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

	ionic crystalline solids.	
(vi)	Why Enthalpy of solution for NH_4NO_3 is +25.7 kj/mol (endothermic process) whereas that of $CaCl_2$ is -83.0 kj/mol (exothermic process)? Explain briefly.	**1.5 + 1.5**
(vii)	Write down any three measures that ensure the preservation of water resources.	**03**

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

	a suitable example.				
(xiii)	Calculate K_c for the following reaction at equilibrium at 100°C. $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ $[SO_2]$=0.59 M $[O_2]$ =0.05 M $[SO_3]$=0.259 M	**03**	**OR**	Calculate total entropy change when $NaCl$ dissolves in water under standard conditions: $NaCl_{(s)} \longrightarrow Na^+_{(aq)} + Cl^-_{(aq)}$ $S°(NaCl)=72.1\ j/mol/K$, $S°(Na^+)=321\ j/mol/K$ $S°(Cl^-)=56.5\ j/mol/K$	**03**
(xiv)	Draw Born-Haber cycle for the formation of KCl. (Calculation is **NOT** required)			For the reaction $N_2O_4 \longrightarrow 2NO_2$, the concentration	

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

Draw Born-Haber cycle for the formation of KCl. (Calculation is **NOT** required)	**03**	**OR**

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

OR	Briefly explain the terms with examples: **a)** Enthalpy of atomization, **b)** Lattice energy, **c)** Electron affinity.	**03**

First Annual 2025 | Section C Q6 OR | 7 marks

	(iii) reaction with $K_2Cr_2O_7/H_2SO_4$	
OR	State Hess's law with an example. Apply Hess's law to calculate enthalpy of formation of CH_3COOH. The standard enthalpies of combustion of carbon, hydrogen and acetic acid are -393.5 *kj/mol*, -285.8 *kj/mol* and -875 *kj/mol* respectively.	**2+5**

Second Annual 2025 | Section A Q5 | 1 mark

	hydrogen bonding?	point	tension	pressure	
5.	The enthalpy change when 1 mole of a substance is completely burned in oxygen is called:	Heat of formation	Heat of combustion	Heat of atomization	Heat of neutralization
	Which substance has zero value for their				

Second Annual 2025 | Section A Q6 | 1 mark

	called.				
6.	Which substance has zero value for their standard enthalpy of formation?	H_2O	CO_2	Fe_2O_3	O_3
	Increasing			Changing	Low

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

(ix)	Draw Energy cycle according to Hess's law for the given reaction: $C + O_2 \rightarrow CO_2 \quad \Delta H^o = -393.5kJ/mol$ If this reaction occurs in two steps: $C + \frac{1}{2}O_2 \rightarrow CO \ \Delta H_1^o = -110.52kJ/mol$ $CO + \frac{1}{2}O_2 \rightarrow CO_2 \ \Delta H_2^o = -282.98kJ/mol$	

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

	solids with examples.	
(viii)	Differentiate between Exothermic and Endothermic reactions with suitable example in each case.	1.5 + 1.5
(ix)	Draw Energy cycle according to Hess's law for the	

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

Calculate $\Delta H°$ of the reaction from the following data: $S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$

$$S_{(s)} + \frac{3}{2}O_{2_{(g)}} \rightarrow SO_{3_{(g)}} \quad \Delta H° = -395.2kJ$$

$$2SO_{2_{(g)}} + O_{2_{(g)}} \rightarrow 2SO_{3_{(g)}} \quad \Delta H° = -198.2kJ$$

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

Briefly explain the term enthalpy change of atomization with one example.	1+2

First Annual 2026 | Section A Q2 | 1 mark

Increase in temperature causes molecules to:	Lose energy	Stay same	Gain kinetic energy	Stop moving

First Annual 2026 | Section A Q5 | 1 mark

Combustion is a/an _____ process.	Exothermic	Neutral	Endothermic	Reversible

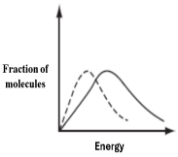
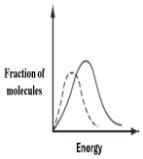
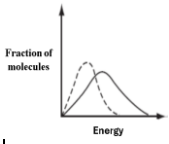
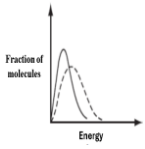
First Annual 2026 | Section B Q2(iv) | 3 marks

Calculate Bond energy of HCl , when: Bond dissociation energy of $H_2 = 436kJ/mol$ Bond dissociation energy of $Cl_2 = 243kJ/mol$	03

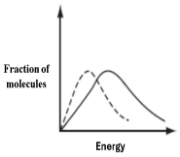
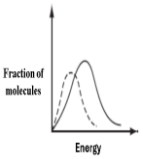
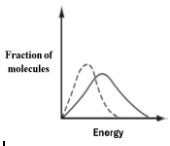
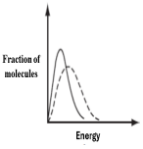
First Annual 2026 | Section B Q2(xi) OR | 3 marks

Briefly explain standard enthalpy of electron affinity and standard enthalpy of Lattice (ΔH_{Lattce}) with examples.	1.5 + 1.5

Q1. **Fill the relevant bubble against each question according to curriculum. Each part carries one mark.**

	Question	A	B	C	D	A	B
i.	0.1 mole of NaCl contains 6.02×10^{22}	molecules	formula units	ions	atoms	○	○
ii.	Which solid-line curve most accurately represents the distribution of molecular energy in a gas at 500 K if the dotted-line curve represents the corresponding distribution for the same gas at 300 K?					○	○
iii.	For the rate law , **Rate = $k[A]^{\frac{1}{2}}$[B],** predict order with respect to A, the order with respect to B and the total order.	$\frac{1}{2}$; 0; $\frac{1}{2}$	$\frac{1}{2}$; 1; 1	$\frac{1}{2}$; 1; $\frac{3}{2}$	$\frac{1}{2}$; 1; 2	○	○
iv.	1^{st} Electron affinity of oxygen atom is greater than nitrogen because of,	greater nuclear charge of Nitrogen	more Screening effect of oxygen	less nuclear force of attraction of Nitrogen	greater nuclear force of attraction of oxygen	○	○

Q1. **Fill the relevant bubble against each question according to curriculum. Each part carries one mark.**

	Question	A	B	C	D	A	B	
i.	0.1 mole of NaCl contains $6.02x10^{22}$	molecules	formula units	ions	atoms	○	○	○
ii.	Which solid-line curve most accurately represents the distribution of molecular energy in a gas at 500 K if the dotted-line curve represents the corresponding distribution for the same gas at 300 K?					○	○	○
iii.	For the rate law , **Rate = $k[A]^{\frac{1}{2}}$[B],** predict order with respect to A, the order with respect to B and the total order.	$\frac{1}{2}$; 0; $\frac{1}{2}$	$\frac{1}{2}$; 1; 1	$\frac{1}{2}$; 1; $\frac{3}{2}$	$\frac{1}{2}$; 1; 2	○	○	○
iv.	1^{st} Electron affinity of oxygen atom is greater than nitrogen because of,	greater nuclear charge of Nitrogen	more Screening effect of oxygen	less nuclear force of attraction of Nitrogen	greater nuclear force of attraction of oxygen	○	○	○
v.	If the total energy of the product is greater than the reactants, identify the reaction.	Exothermic	Endothermic	Reduction	oxidation	○	○	○

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

(iv)	Calculate the enthalpy (ΔH) change of reaction by using the following data $C_2H_2 + \frac{5}{2} O_2 \rightarrow 2CO_2 + H_2O$ ΔH_f of $CO_2 = -393.5$ KJ mol^{-1} ΔH_f of $H_2O = -285.5$ KJ mol^{-1} ΔH_f of $C_2H_2 = 227.3$ KJmol^{-1}	03

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

Define the following with at least one equation in each case. a. Standard enthalpy of atomization (ΔH_{atm}). b. Standard enthalpy of Lattice	1.5+ 1.5

First Annual 2025 | Section A Q15 | 1 mark

	depends upon this.	solute	particles	solvent	particles
15.	Enthalpy change for the reaction $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$ is called enthalpy of:	Formation (ΔH_f^o)	Neutralization (ΔH_n^o)	Combustion (ΔH_c^o)	Atomization (ΔH_{at}^o)
	Change in heat energy of a chemical				Internal

First Annual 2025 | Section A Q16 | 1 mark

	enthalpy of.				
16.	Change in heat energy of a chemical reaction at constant temperature and pressure is:	Enthalpy change	Bond energy	Heat of sublimation	Internal energy change
	Reduction potential of copper electrode is				

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

Human body burns glucose for energy. Burning 1.8g of glucose produces 20.36kJ heat. Calculate molar heat of combustion of glucose. ($C_6H_{12}O_6$)	2+1

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

a) CH_2O b) SO_3 c) CH_4	
Describe the relationship between the enthalpy change and the heat of reaction.	03
The standard reduction potential for the following	

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

solids.	
By applying HESS'S law calculate enthalpy of formation of methane from given data: $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O \quad \Delta H^\circ = -890.4\,kJ/mol$ $H_2 + \frac{1}{2}O_2 \longrightarrow H_2O \quad \Delta H^\circ = -285.5\,kJ/mol$ $C + O_2 \longrightarrow CO_2 \quad \Delta H^\circ = -393.5\,kJ/mol$ $C + 2H_2 \longrightarrow CH_4 \quad \Delta H^\circ = ?$ Describe the effect of change in pressure on the	03

Second Annual 2025 | Section A Q15 | 1 mark

15. The SI unit of enthalpy is:	Joule	Calorie	eV	atm

Second Annual 2025 | Section A Q16 | 1 mark

16.	Which law is used to calculate enthalpy change of a reaction through energy cycles?	Avogadro's law	Hess's law	Boyle's law	Graham's law

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

	Theory:	Pt.3
OR	Derive the relationship between temperature and kinetic energy. $T \propto K.E$	03

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

(xii)	Write thermochemical equation for the combustion of Ethanol C_2H_5OH and Hexane C_6H_{14}.	03

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

	of Mg is −2.38v and Sn is −0.14v.	
OR	Construct energy cycle for the given reaction according to Hess's law $C+O_2 \rightarrow CO_2 \quad \Delta H° = -393.5\ kJ$ this reaction may take place in two steps: $C+\frac{1}{2}O_2 \rightarrow CO \quad \Delta H_1^\circ = -110.5kJ$ $CO+\frac{1}{2}O_2 \rightarrow CO_2 \quad \Delta H_2^\circ = -282.98kJ$	03

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

Briefly explain the following terms with one example of each: • Enthalpy of atomization • First electron affinity • Lattice energy	1x3

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

(x)	Construct an energy cycle to calculate $\Delta H_{(solution)}$ for $NaCl$ and calculate its enthalpy of solution when: $\Delta H(lattice) = -786\,kJ/mol$ $\Delta H(hydration) = -783\,kJ/mol$	03

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

(xii)	Compare exothermic and endothermic reactions and write one reaction for each.	1.5 + 1.5	OR	Briefly explain homogeneous equilibria and heterogeneous equilibria. Write one reaction for each.	1.5 + 1.5

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

Differentiate between exothermic and endothermic reactions.	03

OR	What is meant by lattice energy? Give example.	2+1

APOLLO

Chemical Kinetics

Domain B: Physical Chemistry

FBISE model paper | Section A Q18 | 0.5 marks

In a series of experiments, the initial rate of a reaction was measured at different concentrations of reactant **A** (with all other conditions constant): Experiment | [A] / mol dm⁻³ | Initial Rate / mol dm⁻³ s⁻¹ 1 | 0.10 | 0.020 2 | 0.20 | 0.080 3 | 0.40 | 0.320 Based on the experimental data, what is the correct rate equation for the reaction with respect to reactant A?	Rate = k[A]	Rate = k[A]²	Rate = k[A]³	Rate = k

FBISE model paper | Section A Q20 | 0.5 marks

20.	At higher temperature, the Boltzmann distribution curve becomes:	Narrower and taller	Broader and flatter	Unchanged	Discontinuous

FBISE model paper | Section A Q27 | 0.5 marks

27.	A student studies the decomposition of a substance A. The reaction is found to be first order, with a half-life of 10 minutes at a fixed temperature. The value of the rate constant (k) is:	0.0693 min^{-1}	0.693 min^{-1}	14.43 min^{-1}	1.443 min^{-1}

FBISE model paper | Section B Q3 | 4 marks

Q3	Using the Boltzmann distribution curve of molecular energies, explain briefly why a higher temperature increases the rate of reaction. Explain how the use of a catalyst increases the rate of a reaction.	**2+2**	**OR**	Use the rules of systematic nomenclature (IUPAC) to write the name of the following structures. $CH_2=C(CH_3)–CH_2–CH(CH_3)–CH_3$ $(CH_3)_2CH–CH(CH_3)–CH_2–OH$ $CH_3–C(O)–CH(CH_3)–CH_2–CH_3$

First Annual 2025 | Section A Q16 | 1 mark

			2–Propanol		bromide				
16.	Identify correct relationship for determination of half-life of a first order reaction:	$t_{1/2} = 0.693/k$	$t_{1/2} = [A°]/2k$	$t_{1/2} = 1/k[A°]$	$t_{1/2} = 0.0231[A°]/k$	◯	◯	◯	◯

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

	$S^\circ(Cl_2) = 50.5\ J/mol/K$	
OR	For the reaction $N_2O_4 \longrightarrow 2NO_2$, the concentration of N_2O_4 is reduced from 0.1M to 0.05M in 60 sec. If reaction is 1st order, calculate rate constant for this reaction.	**03**

Q (Marks 26)

First Annual 2025 | Section C Q6 OR | 7 marks

What is solubility product? Derive an expression for the solubility product of CaF_2. How can the concept of solubility product be applied to predict the precipitation of CaF_2 on mixing aqueous solutions of Ca^{+2} and F^{-1} ions?	1+2 +4	OR	Explain the occurrence of a chemical reaction with reference to molecular collisions, activation energy, formation of activated complex and enthalpy changes in the reaction.

1HA-I-25005-(P)

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

	reaction.	
OR	How does a catalyst affect the rate of a chemical reaction? Explain by drawing a reaction pathway diagram.	03
	How can Iodoform test be applied for identification	

Second Annual 2025 | Section A Q7 | 1 mark

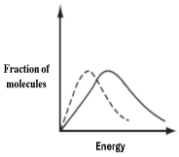
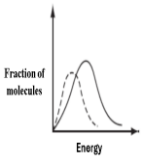
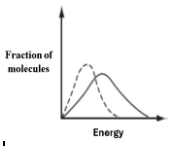
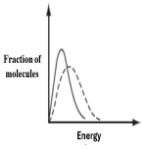
	standard enthalpy of formation?				
7.	A catalyst increases the rate of reaction by:	Increasing activation energy	Decreasing temperature	Changing equilibrium constant	Lowering activation energy
	If an element "X" has 1st ionization energy				

Second Annual 2025 | Section C Q5 | 6 marks

Q.5	Use the Maxwell–Boltzmann distribution curve to explain the effect of temperature on the rate of a reaction with the help of General graphical representation.	**3+3**
Q.6	What is meant by Nucleophilic addition reactions?	

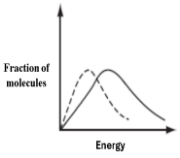
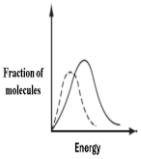
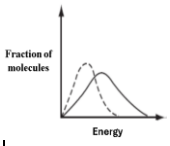
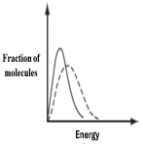
FBISE model paper | Section A Q1(ii) | 1 mark

Q1. **Fill the relevant bubble against each question according to curriculum. Each part carries one mark.**

	Question	A	B	C	D	A	B
i.	0.1 mole of NaCl contains $6.02x10^{22}$	molecules	formula units	ions	atoms	○	○
ii.	Which solid-line curve most accurately represents the distribution of molecular energy in a gas at 500 K if the dotted-line curve represents the corresponding distribution for the same gas at 300 K?					○	○

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

Q1. **Fill the relevant bubble against each question according to curriculum. Each part carries one mark.**

	Question	A	B	C	D	A	B
i.	0.1 mole of NaCl contains $6.02x10^{22}$	molecules	formula units	ions	atoms	○	○
ii.	Which solid-line curve most accurately represents the distribution of molecular energy in a gas at 500 K if the dotted-line curve represents the corresponding distribution for the same gas at 300 K?					○	○
iii.	For the rate law , **Rate = $k[A]^{\frac{1}{2}}$[B],** predict order with respect to A, the order with respect to B and the total order.	$\frac{1}{2}$; 0; $\frac{1}{2}$	$\frac{1}{2}$; 1; 1	$\frac{1}{2}$; 1; $\frac{3}{2}$	$\frac{1}{2}$; 1; 2	○	○

First Annual 2025 | Section A Q13 | 1 mark

	solution with a pH greater than 7?				
13.	When a reaction proceeds in a sequence of steps, the overall rate is determined by:	Fastest step	Slowest step	Order of reaction	Molecularity of all steps
			Number of		Number of

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

	were dissolved in solution.	
(ii)	What is the effect of catalyst on the following: a) Rate of reaction b) The energy of activation c) The equilibrium position	03

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

	maximum BO_2Cl_2	
(xii)	The rate law for the following reaction $2H_2 + 2NO \longrightarrow N_2 + 2H_2O$ $Rate = K[H_2][NO_2]^2$ Propose mechanism. Identify rate determining step in the mechanism.	03
(xiii)	How the anomalous behaviour of water will be	

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

(xiv)	How the **nature of reactant** and **surface area** affect the rate of reaction?	03

Second Annual 2025 | Section A Q13 | 1 mark

13.	Which factor does **NOT** affect the rate of reaction?	Temperature	Concentration	Catalyst	Color of reactants
14.	Colligative properties depend on:	Nature of solute	Number of solute	Molar mass of solvent	Volume of solvent

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

	crystallization and geometrical shape.	
OR	Briefly explain what is meant by the terms activation energy and activated complex.	1.5 +1.5

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

	b. Concentration of SO_3 is increased	
(x)	Differentiate between homogeneous catalysis and heterogeneous catalysis.	1.5 +1.5
(xi)	Why a solution has a lower vapor pressure than	

First Annual 2026 | Section C Q3 OR | 6 marks

Attempt the following questions:

Q.3	20 g of H_2SO_4 on dissolving water completely ionizes. Calculate: a. No. of H_2SO_4 molecules	2x3	OR	What is order of reaction? Give one example each of first order, zero order, second order, third order and pseudo first order reactions.	1x6

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

OR	What is meant by order of reaction? Write rate equation for following reaction. $NH_4NO_2 \rightarrow N_2 + 2H_2O$	

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

OR	Differentiate between homogeneous and heterogeneous catalysis.	03

APOLLO

Chemical Equilibriu m

Domain B: Physical Chemistry

FBISE model paper | Section A Q28 | 0.5 marks

28.	According to Le Chatelier's Principle, increasing pressure favors the side with:	More moles of gas	Fewer moles of gas	Equal moles of gas	No gaseous molecules

FBISE model paper | Section A Q38 | 0.5 marks

38.	Which observation indicates that a system has reached equilibrium?	Concentrations of reactants and products keep changing	Concentrations of reactants and products become constant	Concentrations of reactants and products are the same	The forward and backward reactions stop completely

FBISE model paper | Section A Q63 | 0.5 marks

Scenario for MCQ 61 to 64	**A student in a chemistry laboratory prepared different aqueous solutions including HCl, NH_4Cl and CH_3COOH. During the experiment, the student measured pH values and studied acid-base behavior of different substances.**

63.	The aqueous solution of NH_4Cl is acidic because:	NH_4^+ undergoes hydrolysis producing H_3O^+	Cl^-produces OH^-	NH_4Cl is insoluble	Water acts as Lewis acid

FBISE model paper | Section A Q73 | 0.5 marks

Scenario for MCQ 73 to 76	**A chemical engineer investigates the Haber process:** $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) +$ **heat** **The goal is to maximize ammonia production by adjusting reaction conditions.**

73.	To increase ammonia yield, the engineer should use:	Low pressure	High pressure	Low concentration of reactants	Open container

FBISE model paper | Section A Q74 | 0.5 marks

Scenario for MCQ 73 to 76	**A chemical engineer investigates the Haber process:** $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) +$ **heat** **The goal is to maximize ammonia production by adjusting reaction conditions.**

74.	Since the forward reaction is exothermic, lowering the temperature will:	Favor ammonia formation	Favor reactants	Stop equilibrium completely	Reduce the effect of pressure

FBISE model paper | Section A Q75 | 0.5 marks

Scenario for MCQ 73 to 76		**A chemical engineer investigates the Haber process:** $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \textbf{heat}$ **The goal is to maximize ammonia production by adjusting reaction conditions.**			
75.	The equilibrium constant (K_c) for the Haber process depends only on:	Concentration of nitrogen	Pressure applied	Temperature	Amount of catalyst

FBISE model paper | Section A Q76 | 0.5 marks

Scenario for MCQ 73 to 76		**A chemical engineer investigates the Haber process:** $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \textbf{heat}$ **The goal is to maximize ammonia production by adjusting reaction conditions.**			
76.	The addition of a catalyst in the Haber process will:	Permanently increase ammonia yield	Shift equilibrium to the right	Decrease the reverse reaction rate	Allow equilibrium to be reached faster

FBISE model paper | Section B Q1 OR | 4 marks

2+2	**OR**	A chemist tests three different fertilizer salt solutions and records their pH values: **Ammonium chloride (**NH_4Cl**):** pH = 5 (Acidic) **Sodium carbonate (**Na_2CO_3**):** pH = 11 (Basic) **Sodium chloride (**NaCl**):** pH = 7 (Neutral) Using the concept of salt hydrolysis, answer the following: why each salt solution shows acidic, basic, or neutral behaviour. Identify the ions responsible for hydrolysis in each case. Name the parent acid and parent base for each salt, and explain how their strengths determine the final pH of the solution.	**2+2**

1+3	**OR**	Describe dynamic equilibrium in terms of reversible physical changes. Why no apparent change is observed even though changes continue at the molecular level.	**2+2**

FBISE model paper | Section C Q8 | 6 marks

Q8	Using Le Chatelier's principle, explain how operating conditions are used to increase the yield in (a) The Haber process for the manufacture of ammonia. (b) The Contact process for the oxidation of sulfur dioxide to sulfur trioxide.

First Annual 2025 | Section A Q6 | 1 mark

The following equilibrium will **NOT** be shifted in the forward direction by: $(N_2 + 3H_2 \rightleftharpoons 2NH_3 + \Delta)$	Increasing temperature	Increasing pressure	Adding H_2 gas	Removing NH_3	○	○	○	○

	a suitable example.		
(xiii)	Calculate K_c for the following reaction at equilibrium at 100°C. $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ $[SO_2]$=0.59 M $[O_2]$ =0.05 M $[SO_3]$=0.259 M	**03**	**OR**
(xiv)	Draw Born-Haber cycle for the formation of KCl. (Calculation is **NOT** required)		

	calculated from data obtained?			orbital theory is superior to valence bond theory.	
Q.4	Describe by giving balanced chemical equations and necessary conditions that how a Carboxylic acid can be prepared from: **a)** CH_3-CH_2-Cl **b)** $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-OH$ **c)** C_6H_5-CHO	**2x3**	**OR**	Discuss the effect of following changes on the given reactions at equilibrium: **i** Increasing pressure: $C_3H_8+5O_2 \rightleftharpoons 3CO_2+4H_2O$ **ii** Removing SO_3: $2SO_2+O_2 \rightleftharpoons 2SO_3$ **iii** Decreasing temperature: $CO_2+\Delta \rightleftharpoons CO+\frac{1}{2}O_2$	**2x3**
Q.5	How can one identify the functional groups in the			Why is Ethene more reactive than Ethane? Write	

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

OR	What is dynamic equilibrium? How does it exist between two physical states of a substance? Describe by giving an example.	1+2
	How are the elements arranged in different blocks	

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

1.5 + 1.5	OR	Why is the ionization of HF decreased when aqueous solution of its salt is added to it? Briefly explain by applying Le-Chatlier's principle.	03

2N... C (Marks 36)

Q.4	Explain one physical and one chemical method to recognize a system at equilibrium.	3+3	OR	Write down a chemical reaction between CH_3COOH and CH_3OH with necessary conditions. Also write the mechanism of this reaction.	2+4

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

Calculate K_p if the following concentrations are found at Equilibrium in given reaction:

$2SO_2 + O_2 \rightleftharpoons 2SO_3$

$[SO_2] = 0.59M \quad [O_2] = 0.05M \quad Temprature = 450°C$

$[SO_3] = 0.259M$

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

(x)	$N_2 + 3H_2 \rightleftharpoons 2NH_3$ This reaction is at equilibrium. What will happen if: **a.** Ammonia is removed from the mixture **b.** More nitrogen is added in the mixture	**1.5 + 1.5**	**OR**	Write chemical equation for the preparation of alkyl halides: **a.** From Alkenes **b.** From Alkanes	**1.5 + 1.5**

(x)	$N_2 + 3H_2 \rightleftharpoons 2NH_3$ This reaction is at equilibrium. What will happen if: **a.** Ammonia is removed from the mixture **b.** More nitrogen is added in the mixture.	**1.5 + 1.5**	**OR**	Write chemical equation for the preparation of alkyl halides: **a.** From Alkenes **b.** From Alkanes	**1.5 + 1.5**

Second Annual 2025 | Section C Q6 OR | 6 marks

c. Ethanol into Ethene	
State Le-Chatlier's Principal. How it helps to obtain maximum product in: **a.** Exothermic reactions **b.** Endothermic reactions	**2+2 +2**

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

State the necessary conditions for equilibrium.	**03**

Q.4	How can ethanoic acid be prepared from the following? Write all reagents and conditions with chemical equation: **a.** Ethanol **b.** Ethane nitrile **c.** Ethyl acetate	**2x3**	**OR**	Formation of methanol is an important industrial reaction in the processing of new fuels. $CO + 2H_2 \rightleftharpoons CH_3OH \qquad \Delta H = -90.7 kJ\, mol^{-1}$ Explain three factors that can increase the yield of methanol in this reaction.	**2x3**

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

Give two possible ways to recognize equilibrium.	03

First Annual 2026 | Section C Q4 OR | 3 marks

2x3	OR	Manufacturing of ammonia by Haber's process is represented by the following equation. $N_2 + 3H_2 \rightleftharpoons 2NH_3 \quad \Delta H° = -92.46\ kJmol^{-1}$ Explain three factors that can increase the yield of

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

Give two possible ways to recognize an equilibrium.	1.5+ 1.5

First Annual 2025 | Section A Q10 | 1 mark

		atoms	atoms	atoms	
10.	Formation of NH_3 is a reversible, exothermic process, what will happen on cooling?	More reactant will be formed	More H_2 will be formed	More N_2 will be formed	More NH_3 will be formed
	The pK_a of CH_3COOH is +4.76. pK_b of the				

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

	using the example of phenol water system.	
(xi)	Consider the reaction: $SO_2 + Cl_2 \rightleftharpoons SO_2Cl_2 + heat$ Propose three changes that will produce the maximum SO_2Cl_2	03
	The equilibrium law for the following reaction	

First Annual 2025 | Section C Q4 OR | 6 marks

	non-volatile solute can be determined? Derive.	
OR	By using Le-Chatellier's principle, describe best three conditions to get the maximum yield of Ammonia by Haber's process. $N_2 + 3H_2 \rightleftharpoons 2NH_3 + \Delta H$	2x3
	While construction working along chemical	

Second Annual 2025 | Section A Q10 | 1 mark

10. Le Chatelier's Principle explains:	Shifts in equilibrium	Rate of reaction	Limiting reagent	Electrolysis

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

	metallic solids.	
(ix)	Consider the following reaction at equilibrium $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ what will happen if: **a.** Pressure is increased **b.** Concentration of SO_3 is increased	03
(x)	Differentiate between homogeneous catalysis	

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

1.5 + 1.5	OR	Briefly explain homogeneous equilibria and heterogeneous equilibria. Write one reaction for each.	1.5 + 1.5
		Write down the following	

	c.	Mass of individual ions
Q.4		K_c for the following reaction is 1×10^{-3} at $230°C$. $2ICl_{(g)} \rightleftharpoons Cl_{2(g)} + I_{2(g)}$ 1.6 moles of ICl, 0.05 moles of each I_2 and Cl_2 are present in equilibrium mixture of volume $2dm^3$. After removal of one mole of ICl. Determine the equilibrium concentrations of I_2, Cl_2 and ICl, when the equilibrium is restored
Q.5	a.	Explain any two methods for the preparation of

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

OR	Write equilibrium constant expression for: $PCl_5 \rightleftharpoons PCl_3 + Cl_2$	**03**

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

OR	Pressure is one of the factors which disturbs the equilibrium. How change in pressure will affect the following reaction: $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$	**03**

(xiv)	Prove that common ion effect is one of the application of Le-Chartier's principle.	**03**

APOLLO

Acids, Bases and Salts

Domain B: Physical Chemistry

FBISE model paper | Section A Q40 | 0.5 marks

40.	The correct K_{sp}expression for AgCl is:	$[AgCl]$	$[Ag^+][Cl^-]$	$[Ag^+]$ $+ [Cl^-]$	$[Ag^+]^2[Cl^-]$

FBISE model paper | Section A Q41 | 0.5 marks

41.	A buffer solution is prepared by mixing $0.1\,M\,CH_3COOH$ and $0.1\ M\ CH_3COONa$. If Ka of acetic acid is 1.8×10^{-5}, the pH of the buffer will be approximately:	3.7	4.7	6.7	5

FBISE model paper | Section A Q54 | 0.5 marks

54.	The solubility of AgCl decreases in NaCl solution because of:	Neutralization	Hydrolysis	Common ion effect	Buffer action

FBISE model paper | Section A Q62 | 0.5 marks

Scenario for MCQ 61 to 64		**A student in a chemistry laboratory prepared different aqueous solutions including HCl, NH_4Cl and CH_3COOH. During the experiment, the student measured pH values and studied acid-base behavior of different substances.**			
62.	A $0.001\ mol\ dm^{-3}$ HCl solution has pH equal to:	1	3	11	7

FBISE model paper | Section A Q64 | 0.5 marks

Scenario for MCQ 61 to 64		**A student in a chemistry laboratory prepared different aqueous solutions including HCl, NH_4Cl and CH_3COOH. During the experiment, the student measured pH values and studied acid-base behavior of different substances.**			
64.	Which species acts as a Lewis base in the formation of coordinate bond with H^+?	BF_3	$AlCl_3$	NH_3	H^+

Q9 Silver chromate (Ag_2CrO_4) is a sparingly soluble salt.

(a) Construct the expression for the solubility product constant, K_{sp}, of Ag_2CrO_4 and calculate its value if the solubility is 1.3×10^{-4} mol dm^{-3}.

(b) A solution of Ag_2CrO_4 is prepared in 0.10 mol dm^{-3} $AgNO_3$. Calculate the new solubility of Ag_2CrO_4 in this solution and explain briefly the reason for the decrease in solubility.

$(N_2 + 3H_2 \longrightarrow 2NH_3 + \Delta)$								
Aqueous solution of which of the following salts will have pH less than 7?	Na_2SO_4	KNO_3	$CuSO_4$	Na_2CO_3	○	○	○	○
Position of an element in periodic table with	In Group 1	In Group 2	In Group 13	In Group 14				

(viii)	Why aqueous solution of Na_2CO_3 is basic whereas that of NH_4Cl is acidic? Justify by giving chemical equations.	**1.5 + 1.5**
(ix)	Determine the principal energy level and number of valence electrons in the different sub-shells and	

Q.6	What is solubility product? Derive an expression for the solubility product of CaF_2. How can the concept of solubility product be applied to predict the precipitation of CaF_2 on mixing aqueous solutions of Ca^{+2} and F^{-1} ions?	**1+2 +4**	**OR**	Explain the occurrence of a chemical reaction with reference to molecular collisions, activation energy, formation of activated complex and enthalpy changes in the reaction.	**07**

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

	configuration of Mn $(Z=25)$.			diagram.	
(xiii)	Calculate concentration of H^+ ion in $1.0\ M$ solution of Formic acid *(HCOOH)* which ionizes as: $HCOOH \rightleftharpoons H^+ + HCOO^-$, $K_a = 1.8\times10^{-4}$	**03**	**OR**	How can Iodoform test be applied for identification of aldehydes and ketones? Describe by giving chemical equations.	**1.5 + 1.5**

Second Annual 2025 | Section A Q9 | 1 mark

	valence electrons.				
9.	A conjugate acid–base pair differs by:	One neutron	One electron	One proton	One molecule
	The number of valence electrons in an atom			Group	Isotopic

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

Write K_{sp} expression for the following molecules: **a.** CaF_2 **b.** $MgSO_4$	**1.5 +**

Write K_{sp} expression for the following molecules: **a.** CaF_2 **b.** $MgSO_4$	**1.5 + 1.5**