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FBISE Chemistry Class 11
Topical workbook - Volume 1 of 4

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

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Atomic Structure

Domain B: Physical Chemistry

FBISE model paper | Section A Q2 | 0.5 marks

2.	The carbonate ion, CO_3^{2-}, has a total of 30 protons. How many neutrons and electrons are there in this ion?	neutrons: 30, electrons: 30	neutrons: 32, electrons: 32	neutrons: 30, electrons: 32	neutrons: 32, electrons: 28

FBISE model paper | Section A Q3 | 0.5 marks

3.	A sample of Magnesium contains the following isotopes. Isotope Percentage abundance ^{24}Mg 81.21% ^{25}Mg 14.10% ^{26}Mg 4.69% What is the relative atomic mass of magnesium, to one decimal place, in this sample?	24.10	24.23	25.09	25.83

FBISE model paper | Section A Q5 | 0.5 marks

5.	The first six ionisation energies of an element, in $kJ\ mol^{-1}$, are shown. 578 1817 2745 11578 14831 18378 Which group of the Periodic Table includes this element?	Group 2	Group 3	Group 4	Group 5

FBISE model paper | Section A Q11 | 0.5 marks

11.	How many orbitals are there in total in the first four quantum shells of an atom?	7	10	16	30

FBISE model paper | Section A Q12 | 0.5 marks

12.	Which element is in the p-block and has two unpaired electrons in the ground state?	sodium	silicon	chlorine	aluminium

FBISE model paper | Section A Q16 | 0.5 marks

16.	What is the electron arrangement of the nitrogen ion in magnesium nitride?	$1s^2\ 2s^2$	$1s^2\ 2s^2\ 2p^3$	$1s^2\ 2s^2\ 2p^4$	$1s^2\ 2s^2\ 2p^6$

FBISE model paper | Section A Q35 | 0.5 marks

35.	Which of these ions has the greatest ionic radius?	N^{3-}	F^{1-}	Na^{+}	Al^{3+}

First Annual 2025 | Section A Q1 | 1 mark

1.	The third ionization potential value of an element is **significantly high** as compared to its 1st and 2nd ionization potentials. The element belongs to:	Group–1 (I-A)	Group–2 (II-A)	Group–17 (VII-A)	Group–18 (VIII-A)

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

Q. 2 Answers the following parts briefly. **(14 x 3 = 42)**

(i)	Write down electronic configuration of : $_{29}Cu^{+2}$, $_{33}As$, $_{35}Br^{-1}$	**03**	**OR**	What is meant by Catenation? What is its importance in organic chemistry?	**1+2**

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

	$KOH_{(aq)}$, NH_3 and $AgNO_3$.	
OR	Briefly describe the terms 'shell', 'sub–shell' and 'orbital'.	**03**

Q.3	What is mass spectrometry? Explain the construction and working of a mass spectrometer. How can average atomic mass of an element be calculated from data obtained?	**1+4 +2**	**OR**	Explain formation of covalent bonds in O_2 molecule on the basis of molecular orbital theory and valance bond theory. Justify that molecular orbital theory is superior to valence bond theory.	**3+3 +1**
Q.4	Describe by giving balanced chemical equations			Discuss the effect of following changes on the	

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

(i)	Write down the electronic configuration of an element with atomic number 24 and also of its ion with charge+3. Describe the reason for any discrepancy in electronic configuration of element.	
(ii)	Draw molecular orbital diagram for N_2 and	

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

(v)	What is Azimuthal quantum number? Describe its significance.	1+2	OR	Explain why: i is the falling drop of water spherical in shape?	1.5 + 1.5

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

(xii)	Describe how *(n+l)* rule and Hund's rule are applied in writing the electronic and orbital configuration of *Mn (Z=25)*.	**03**
(xiii)	Calculate concentration of H^+ ion in 1.0 M solution	

Second Annual 2025 | Section A Q8 | 1 mark

		energy		constant	en
8.	If an element "X" has 1st ionization energy $495kJ/mol$ and 2nd ionization energy $4560kJ/mol$, this indicates that there is/are _____ valence electrons.	1	2	3	5

Second Annual 2025 | Section A Q16 | 1 mark

		acids			
16.	Which sub-shell can hold a maximum of 14 electrons?	*f*	*d*	*p*	*s*
	Which of the following halogens exists in				

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

(i)	Write the electronic configuration of phosphorus $(^{31}_{15}P)$ and Carbon $(^{12}_{6}C)$ according to Hund's rule.	**1.5 + 1.5**
(ii)	How azimuthal quantum number helps to determine	

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

		1.5
(ii)	How azimuthal quantum number helps to determine the number of electrons in d- sub shell? Explain briefly.	03
(iii)	Why Bond energy in F_2 is lower than in Cl_2?	

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

(iv)	Determine the number of protons, neutrons and electrons in Na^+ and Cl^- ions.	1.5 + 1.5
(v)	Consider the following substances to identify the type	

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

Compare s and p orbitals. (Three points)	1x3

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

Write electronic configuration of following: **a.** $^{52}_{24}Cr$ **b.** $^{35}_{17}Cl^{-1}$	03

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

Magnesium has three isotopes, Mg-24, Mg-25 and Mg-26 with abundances of 79%, 10% and 11% respectively. Calculate its average atomic mass.	03

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

For 3d orbital, give allowed values of following quantum numbers: **a.** Principal **b.** Azimuthal **c.** Magnetic	1x3

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

Write electronic configuration of following: **a.** $^{65}_{30}Zn$ **b.** $^{40}_{20}Ca^{+2}$	**1.5** **+** **1.5**

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

A naturally occurring sample of chlorine contains only two isotopes $Cl-35$ and $Cl-37$, $Cl-35$ with 75.76% abundance. Average atomic mass of chlorine is 35.48 amu. Calculate percentage abundance of $Cl-37$.	**03**	**OR**	The solubility of CaF_2 is $2.05\times10^{-4}M$ at $25°C$. Calculate its K_{sp}.	**1x3**

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

For **4f orbital**, give allowed values of following quantum numbers: **a.** Principal **b.** Azimuthal **c.** Magnetic	**1x3**	**OR**	Briefly explain standard enthalpy of electron affinity and standard enthalpy of Lattice ($\Delta H_{Lattice}$) with examples.	**1.5 + 1.5**

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

Draw the shape of 3s, $3p_x$ and $3dz^2$ orbitals.	3

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

A naturally occurring sample of cerium contains only four isotopes. ^{136}Ce having isotopic mass of 135.91 and %age abundance 0.185%, ^{138}Ce having isotopic mass of 137.91 and %age abundance of 0.25%, ^{140}Ce having isotopic mass of 139.91 and %age abundance of 88.45%. The relative atomic mass of the Ce is 140.116. Use these data to calculate the relative isotopic mass of the fourth isotope in this sample of cerium.	1+2

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

For 6f orbital, give allowed values of following quantum numbers. i. Principal quantum number ii. Azimuthal quantum number iii. Magnetic quantum number	1+1+1

First Annual 2025 | Section A Q2 | 1 mark

theoretical yield 500g, percentage yield is:				
Which pair has the same electronic configuration as possessed by Neon?	Na^+, Cl^-	K^+, Cl^-	Na^+, Mg^+	Na^+, F^-
Select the molecule which has a dipole				

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

energy of the molecule to the temperature.	
Calculate energy and frequency of radiation emitted d when electron jumps from n=4 to n=2 of hydrogen atom.	03
The dipole moment of HF is 2.03 D, and the bond	

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

State Hund's rule. Write its importance.	03

Second Annual 2025 | Section A Q2 | 1 mark

2.	The discrete-line spectrum of hydrogen is explained by:	Rutherford's model	Quantum theory	Bohr's model	Thomson's model	○	○	○	○

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

OR	State Hund's rule and Pauli is exclusion principle.	1.5 +1.5
	Classify the following	

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

Why is there a large ionization energy gap between second and third values in Mg atoms?	03

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

(iii)	State Hund's rule. How it helps to fill electrons in $_{7}N$ and $_{15}P$?	1+2	OR	The experimental yield is mostly less than the theoretical yield? What are the reasons?	03

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

State the principle of Mass spectrometry and tell the methods of ionization of the sample species.	03

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

(vi)	Explain the spin quantum number and establish a connection of it with Pauli's exclusion principle.	03

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

OR	Describe the shapes of $2s$, $2p_x$ and $2p_y$ orbitals.	03

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Chemical Bonding

Domain B: Physical Chemistry

FBISE model paper | Section A Q8 | 0.5 marks

8.	Which species is **not** tetrahedral?	CCl_4	CH_4	$NH^{1+}{}_4$	$ICl^{1-}{}_4$

FBISE model paper | Section A Q13 | 0.5 marks

13.	Which of these molecules is polar?	CO_2	BF_3	CH_4	NH_3

FBISE model paper | Section A Q57 | 0.5 marks

Scenario for MCQ 57 to 60	**A chemist compares the molecules BF_3, NF_3, and NH_3, noting that BF_3 has no dipole moment despite having polar B–F bonds, that NF_3 and NH_3 are both polar but differ in bond angles and boiling points, and that NH_3 has an unusually high boiling point compared to similar-sized molecules, leading her to apply VSEPR theory, Valence Bond Theory, orbital hybridization, and intermolecular force concepts to explain these observations.**

57.	Why does BF_3 have zero net dipole moment despite having polar B–F bonds?	The B–F bonds are non-polar because fluorine and boron have the same electronegativity	BF_3 is trigonal planar; the three bond dipoles are symmetrically arranged and cancel out exactly	BF_3 is trigonal pyramidal and dipoles cancel due to lone pair	The bond dipoles in BF_3 are too weak to create a net dipole

FBISE model paper | Section A Q58 | 0.5 marks

Scenario for MCQ 57 to 60	**A chemist compares the molecules BF_3, NF_3, and NH_3, noting that BF_3 has no dipole moment despite having polar B–F bonds, that NF_3 and NH_3 are both polar but differ in bond angles and boiling points, and that NH_3 has an unusually high boiling point compared to similar-sized molecules, leading her to apply VSEPR theory, Valence Bond Theory, orbital hybridization, and intermolecular force concepts to explain these observations.**

58.	Using VSEPR theory, what is the correct geometry and bond angle of NH_3?	Trigonal planar, 120°	Tetrahedral, 109.5°	Trigonal pyramidal, 107°	Bent, 104.5°

FBISE model paper | Section A Q59 | 0.5 marks

Scenario for MCQ 57 to 60	**A chemist compares the molecules BF_3, NF_3, and NH_3, noting that BF_3 has no dipole moment despite having polar B–F bonds, that NF_3 and NH_3 are both polar but differ in bond angles and boiling points, and that NH_3 has an unusually high boiling point compared to similar-sized molecules, leading her to apply VSEPR theory, Valence Bond Theory, orbital hybridization, and intermolecular force concepts to explain these observations.**

59.	Which of the following orbitals overlap in the ammonia (NH_3) molecule to form the N–H bonds?	p–p	sp^2–p	sp^3–s	s–s

FBISE model paper | Section A Q60 | 0.5 marks

Scenario for MCQ 57 to 60	**A chemist compares the molecules BF_3, NF_3, and NH_3, noting that BF_3 has no dipole moment despite having polar B–F bonds, that NF_3 and NH_3 are both polar but differ in bond angles and boiling points, and that NH_3 has an unusually high boiling point compared to similar-sized molecules, leading her to apply VSEPR theory, Valence Bond Theory, orbital hybridization, and intermolecular force concepts to explain these observations.**

60.	Which type of intermolecular force is mainly responsible for the unusually high boiling point of NH_3 compared to PH_3?	London dispersion forces	Dipole–dipole interactions	Hydrogen bonding	van der Waals forces only

FBISE model paper | Section C Q8 OR | 6 marks

Predict the shapes and bond angles of methane, ammonia and water using VSEPR theory, and explain the type of hybridization of the central atom in each molecule.

First Annual 2025 | Section A Q2 | 1 mark

2.	Which pair of elements will most likely form an ionic bond?	*C & H*	*B & Cl*	*Na & O*	*H & Cl*	◯	◯	◯	◯

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

(ii)	Briefly explain the structure of PCl_3 & NH_4^+ ion on the basis of VSEPR theory.	1.5 + 1.5

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

(iii)	Keeping in view the factors affecting bond energy, Justify the order of bond energies in the following: **a)** $Cl_2 > F_2$ **b)** $H_2 > HBr$ **c)** $N_2 > O_2$	03
(iv)	Write down three differences between limiting and non–limiting reactants	03

First Annual 2025 | Section C Q3 OR | 7 marks

Q.3	What is mass spectrometry? Explain the construction and working of a mass spectrometer. How can average atomic mass of an element be calculated from data obtained?	**1+4 +2**	**OR**	Explain formation of covalent bonds in O_2 molecule on the basis of molecular orbital theory and valance bond theory. Justify that molecular orbital theory is superior to valence bond theory.	**3+3 +1**
Q.4	Describe by giving balanced chemical equations			Discuss the effect of following changes on the	

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

	discrepancy in electronic configuration of element.	
(ii)	Draw molecular orbital diagram for N_2 and calculate its bond order.	**03**

First Annual 2025 | Section C Q3 | 7 marks

Q.3	What is hybridization? Write down three differences between sp^3 and sp^2 hybridizations. Explain bonding in BF_3 on the basis of hybridization.	1+3 +3	OR
Q.4	Explain one physical and one chemical method to		

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

Write any three differences between sigma (σ) and pi (π) bonds.	1x3

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

		1.5			
(v)	Consider the following substances to identify the type of Bond (ionic, polar or non-polar covalent bond) on the basis of Electronegativity difference $O_2(O:3.44), KCl(K:0.82), HCl(Cl:3.16)(H:2.20)$	03	OR	Write K_{sp} expression for the following molecules: **a.** CaF_2 **b.** $MgSO_4$	1.5 + 1.5
(vi)	Determine the limiting reactant when 10g of Al reacts				

Second Annual 2025 | Section C Q3 | 4 marks

Q.3	What is hybridization? Explain hybridization with molecular diagrams in Methane *(CH_4)* and Boron Tri Fluoride *(BF_3)*.	1+3 +3
Q.4	Calculate the mass of Calcium Nitride prepared from	

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_2H_2, NH_3, HCl, H_2O	2+1

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

What is meant by electronegativity? Explain its trend along the period of periodic table.	03

First Annual 2026 | Section C Q6 OR | 6 marks

Q.6	How ethyl chloride can be prepared from the following: **a.** ethene **b.** ethane **c.** ethanol Write complete balanced equations with conditions involved in each reaction.	**2x3**	**OR**	Explain in detail the type of hybridization, bond angles and geometrical shapes of following molecules: **a.** BF_3 **b.** C_2H_2	**3+3**

First Annual 2026 | Section A Q10 | 1 mark

According to VSEPR theory bond angle in methane is:	90°	109.5°	120°	180°

First Annual 2026 | Section C Q6 OR | 6 marks

OR	Explain in detail the type of hybridization, bond angles and geometrical shapes of following molecules: **a.** C_2H_4 **b.** NH_3	3+3

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

x.	Predict the geometry of XeF_4	Tetrahedral	Trigonal planner	Square planner	V-shaped

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

xi.	Which electronic configuration represents the most electronegative element?	ns^2np^2	ns^2np^1	ns^2np^4	ns^2np^5

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

(xii)	Define electronegativity. Explain the trend of electronegativity down the group of the periodic table.	1+2

First Annual 2025 | Section A Q3 | 1 mark

	configuration as possessed by Neon?				
3.	Select the molecule, which has a dipole moment equal to zero. ($\mu = 0$)	C_6H_6	HBr	SO_2	NH_3
	A molecule that has one lone pair and two bond				

First Annual 2025 | Section A Q4 | 1 mark

A molecule has two lone pairs and two bond pairs around the central metal atom, it is expected to be:	Triangular geometry	Linear geometry	V–shaped geometry	Tetrahedral geometry
The volume occupied by Nitrogen gas (N_2)				

First Annual 2025 | Section A Q9 | 1 mark

		water			chloride
9.	In crystal lattice of ice, each O–atom of water molecule is attached to:	Four hydrogen atoms	Three hydrogen atoms	Two hydrogen atoms	Five hydrogen atoms
	Formation of NH_3 is a reversible exothermic	More reactant	More H_2 will	More N_2 will	More NH_3 will

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

Why bond formation is **NOT** possible between two He-atoms? Prove with the molecular orbital theory.	03

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

hydrogen atom. The dipole moment of HF is 2.03 D, and the bond length is 120 pm. Calculate the percentage of ionic character of HF bond.	03

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

	theory.	
	By using VSEPR theory, predict the geometry, bond angle of the following: **a)** CH_2O **b)** SO_3 **c)** $CHCl_3$	**03**

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

(xiii)	How the anomalous behaviour of water will be explained when its density becomes maximum at $4°C$?	**03**

First Annual 2025 | Section C Q4 | 6 marks

into kJ/mol Carbon atom shows sp^3, sp^2, sp hybridization. Give one example of each along the structures.	2x3

Second Annual 2025 | Section A Q3 | 1 mark

3.	What is the bond angle in methane according to VSEPR theory?	90°	109.5°	120°	180°

Second Annual 2025 | Section A Q4 | 1 mark

4.	s-s overlap leads to the formation of:	Sigma bond	Pi bond	Metallic bond	Ionic bond	○	○	○	○

Second Annual 2025 | Section A Q8 | 1 mark

8.	The anomalous behaviour of water at 4 °C is explained by:	Van der Waals forces	Ionic bonding	Hydrogen bonding	Metallic bonding

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

OR	Use VSEPR theory to draw the shapes of PH_3 and H_2S molecules.	03

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

(iv)	Write three differences between Sigma *(σ)* and Pi *(π)* bond.	1x3

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

(v)	Predict whether CO_2 and H_2O are polar or non-polar. Justify your answer with reference to molecular geometry regarding dipole moment.	1+2
(vi)	Differentiate liquid crystals from pure liquids or	

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

Why ice has low density? Explain briefly give its one application in real life.	2+1
Differentiate between amorphous and crystalline	

Second Annual 2025 | Section C Q6 | 6 marks

Q.6	Briefly explain and draw orbital diagram for the formation of N_2 and O_2 according to Valence Bond theory.	**3+3**	**OR**	Justify the following statements: **a.** Boiling point of Halogens increases down the group. **b.** Methane is gas while Hexane is liquid.	**3+3**

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

(ii)	Draw the shapes of the following molecules according to VSEPR. Mention name of geometry and bond angles (approx.): **a.** H_2S **b.** SF_6	**1.5 + 1.5**

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

	$CH_3COONa + NaOH \xrightarrow{140°C}$	
	Explain the formation of ethyne molecule on the basis of hyberdizalion with the help of diagram.	03

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

(ix)	Ice has low density than water and it occupies 9% more space than liquid water, why?	03

Q.4	Draw the molecular orbital diagram of the following molecules: a. N_2 b. O_2^{-2}	3+3

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Domain B: Physical Chemistry

FBISE model paper | Section A Q9 | 0.5 marks

9.	Number of moles present in 50 cm^3 of a 0.0800 $moldm^{-3}$ solution of sodium carbonate is:	4 moles	0.4 moles	0.004 moles	0.04 moles

FBISE model paper | Section A Q10 | 0.5 marks

10.	What volume will be occupied by 2 moles of oxygen gas at STP?	11.2 dm^3	22.4 dm^3	44.8 dm^3	2.24 dm^3

FBISE model paper | Section A Q15 | 0.5 marks

15.	There are 6.02×10^{23} atoms in 0.25 mol of:	He	H_2O	BH_3	CH_4

FBISE model paper | Section A Q65 | 0.5 marks

Scenario for MCQ 65 to 68	**In a laboratory experiment, 1.0 g of ammonium nitrate (NH_4NO_3) is added to 0.8 g of sodium hydroxide (NaOH). The reaction proceeds according to the equation:** **$NH_4NO_3 + NaOH \rightarrow NaNO_3 + NH_3 + H_2O$** **values: NH_4NO_3 = 80.0, NaOH = 40.0, $NaNO_3$ = 85.0, NH_3 = 17.0, H_2O = 18.0**				
65.	Which reagent is the limiting reagent in this reaction, and why?	NaOH, because it has a low mass	NaOH, because it has fewer moles compared to NH_4NO_3	NH_4NO_3, because it has fewer moles compared to NaOH	NH_4NO_3, because it produces less moles of product

FBISE model paper | Section A Q66 | 0.5 marks

Scenario for MCQ 65 to 68	**In a laboratory experiment, 1.0 g of ammonium nitrate (NH_4NO_3) is added to 0.8 g of sodium hydroxide (NaOH). The reaction proceeds according to the equation:** **$NH_4NO_3 + NaOH \rightarrow NaNO_3 + NH_3 + H_2O$** **values: NH_4NO_3 = 80.0, NaOH = 40.0, $NaNO_3$ = 85.0, NH_3 = 17.0, H_2O = 18.0**				
66.	What is the maximum mass of $NaNO_3$ that could be produced in this reaction?	0.425 g	1.06 g	0.850 g	2.12 g

FBISE model paper | Section A Q67 | 0.5 marks

Scenario for MCQ 65 to 68	**In a laboratory experiment, 1.0 g of ammonium nitrate (NH_4NO_3) is added to 0.8 g of sodium hydroxide (NaOH). The reaction proceeds according to the equation:** $$NH_4NO_3 + NaOH \rightarrow NaNO_3 + NH_3 + H_2O$$ **values: NH_4NO_3 = 80.0, NaOH = 40.0, $NaNO_3$ = 85.0, NH_3 = 17.0, H_2O = 18.0**				
67.	What volume of NH_3 gas is formed at STP?	0.28 dm^3	1.12 dm^3	2.24 dm^3	22.4 dm^3

FBISE model paper | Section A Q68 | 0.5 marks

Scenario for MCQ 65 to 68	**In a laboratory experiment, 1.0 g of ammonium nitrate (NH_4NO_3) is added to 0.8 g of sodium hydroxide (NaOH). The reaction proceeds according to the equation:** $$NH_4NO_3 + NaOH \rightarrow NaNO_3 + NH_3 + H_2O$$ **values: NH_4NO_3 = 80.0, NaOH = 40.0, $NaNO_3$ = 85.0, NH_3 = 17.0, H_2O = 18.0**				
68.	If the actual mass of $NaNO_3$ obtained is 0.80 g, what is the percentage yield of the reaction?	75.5 %	85.0%	50.0%	100%

FBISE model paper | Section B Q1 | 4 marks

Q1	In a laboratory experiment, 12.0 g of magnesium reacts with 14.0 g of hydrochloric acid according to the equation: $Mg + 2HCl \rightarrow MgCl_2 + H_2$ Identify the reactant which is in excess and explain your answer. Calculate the maximum volume of hydrogen gas produced at room temperature and pressure (RTP).	**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 th following: why each salt solution shows acidic, basic, c neutral behaviour. Identify the ions responsible fc hydrolysis in each case. Name the parent acid and parent base for each sal

First Annual 2025 | Section A Q4 | 1 mark

4.	The number of molecules present in 67.2 dm^3 of *He* gas at STP is:	6.02×10^{24}	1.204×10^{24}	1.806×10^{24}	2.4×10^{24}	○	○	○	○

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

	a) $Cl_2 > F_2$ **b)** $H_2 > HBr$ **c)** $N_2 > O_2$	
(iv)	Write down three differences between limiting and non–limiting reactants.	**03**
(v)	State any three differences between crystalline and	

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

			Describe by giving an example.	
What is molar volume? Calculate the volume occupied by 2000g of Cl_2 gas at STP.	**1+2**	**OR**	How are the elements arranged in different blocks of periodic table?	**03**
Why does carbon form a large number of organic			Complete the following reactions:	

First Annual 2025 | Section C Q6 | 7 marks

Q.6	300 g Zn is reacted with 300 g HCl. $Zn + 2HCl \longrightarrow ZnCl_2 + H_2$ Calculate the mass of H_2 produced. In an experiment, if 6g H_2 is obtained, calculate percentage yield.(Atomic masses $Zn=65.38\ g/mol$ $H=1\ g/mol$ $Cl=35.5\ g/mol$)	**07**	**OR**	(iii) reaction with $K_2Cr_2O_7/H_2SO_4$ 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**

1HA-L25005-(D)

Second Annual 2025 | Section A Q2 | 1 mark

	between hydrochloric acid molecules is:			Forces	Bonding
2.	The reactant that determines the maximum yield of a chemical reaction is called the:	Excess reactant	By-product	Catalyst	Limiting reactant

Second Annual 2025 | Section A Q3 | 1 mark

	yield of a chemical reaction is called the:	reactant		
3.	If 2 moles of H_2 react with 32g of O_2, the number of moles of H_2O formed will be: $2H_2 + O_2 \rightarrow 2H_2O$	1	3	2

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

What mass of *Mg* is needed to produce *100cm³* of H_2 at STP? $Mg + 2HCl \rightarrow MgCl_2 + H_2$	03

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

(vi)	Determine the limiting reactant when 10g of *Al* reacts with 20g of Fluorine according to given equation: $2Al + 3F_2 \rightarrow 2AlF_3$	03	OR	Justify the followings: **a.** Atomic size decreases along the period. **b.** Metallic character increases along the Group.	1.5 + 1.5

	III Fluoride (BF_3).			with Hydrogen Bromide.	
Q.4	Calculate the mass of Calcium Nitride prepared from 54.9 g of Ca and 43.2 g of N_2. $3Ca + N_2 \rightarrow Ca_3N_2$ If actual yield is 0.13 moles of Ca_3N_2 then calculate the percentage Yield.	**4+3**	**OR**	Complete the following chemical equations by identifying the major products obtained for the preparation of alkyl halides: **a.** $CH_3\ CH_2\ OH \xrightarrow[ZnCl_2]{HCl}$ **b.** $CH_3\ CH_2\ OH \xrightarrow{SOCl_2}$	**3+2 +2**

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

Calculate the mass of SO_2 that will be produced with 155g of Cu from the roasting of CuS. $CuS + O_2 \rightarrow Cu + SO_2$ $(Cu = 63.5 gmol^{-1},\ S = 32 gmol^{-1})$	03

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

Calculate the volume of 177.5 g of chlorine gas at STP.	03

Q.3 Phosgene is a toxic gas. This gas is prepared by the reaction of carbon monoxide with chlorine.

$$CO_{(g)} + Cl_{2(g)} \rightarrow COCl_{2(g)}$$

The following data were obtained for kinetic study of this reaction.

Experiment	Initial $[CO]$	Initial $[Cl_2]$	Initial rate $(moles\ dm^{-3}s^{-1})$
1	1.000	0.100	1.29×10^{-29}
2	0.100	0.100	1.30×10^{-30}
3	0.100	1.000	1.30×10^{-30}

a. Calculate the numerical value of the rate constant (k) for this reaction using initial rates.

b. Using half life method calculate ... of

06

OR

Hydrogen gas is produced by the following reaction:

$$2Al + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2$$

When 40.5 g of Aluminium reacts with 196 g of H_2SO_4 then:

a. Calculate the amount of H_2 in gram produced during this reaction.

b. Calculate the amount of excess reactant left unreacted after the completion of chemical reaction.

$(Al = 27g\ mol^{-1})(S = 32g\ mol^{-1})$

06

0.2 moles of $NaCl$, when completely ionized produce Na^+ ions:	1.204×10^{22}	1.204×10^{23}	2.4×10^{22}	2.4×10^{23}

At STP, 71 g of Cl_2 gas occupies:	$11.2\ dm^3$	$22.4\ dm^3$	$44.8\ dm^3$	$2\ dm^3$

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

Calculate the mass of SO_2 that will be produced with 155g of Cu from the roasting of CuS. $CuS + O_2 \rightarrow Cu + SO_2$ $(Cu = 63.5 gmol^{-1},\ S = 32 gmol^{-1})$	03

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

03	OR	How many grams of O_2 molecules are there in $20 dm^3$ of oxygen gas at STP?	03

sgene is a toxic gas. This gas is prepared by reaction of carbon monoxide with chlorine.

$$CO_{(g)} + Cl_{2(g)} \rightarrow COCl_{2(g)}$$

following data were obtained for kinetic study is reaction.

eriment	Initial $[CO]$	Initial $[Cl_2]$	Initial rate moles $(moles\ dm^{-3}s^{-1})$
1	1.000	0.100	$1.29x10^{-29}$
2	0.100	0.100	$1.30x10^{-30}$
3	0.100	1.000	$1.30x10^{-30}$

Calculate the numerical value of the rate

06

OR

Calcium ions can be precipitated from solution by sodium oxalate.

$$Ca^{+2} + Na_2C_2O_4 \rightarrow CaC_2O_4 + 2Na^+$$

When 15g Ca^{+2} can be precipitated by 15g of $Na_2C_2O_4$ then:

a. Calculate the amount of CaC_2O_4 precipitates formed in gram.

b. Calculate the amount of excess reactant left unreacted after the completion of chemical reaction.

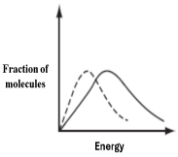
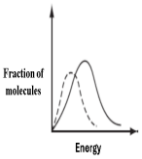
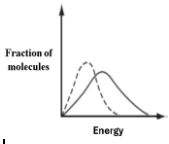
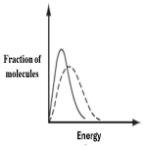
06

FBISE model paper | Section A Q1(i) | 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	O	O

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	○	○
vi.	Suggest volume occupied by one mole of gas at STP.	$224.14dm^3$	$2.414dm^3$	$0.022414cm^3$	$22414cm^3$	○	○

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

Starting from 20g of N_2, calculate the mass of gaseous product (NH_3) in the given reaction. $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	1+2

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

Calculate volume of 4.5g of H_2 at STP by using mole-volume relationship.	03

First Annual 2025 | Section A Q1 | 1 mark

Amount of salt obtained in a reaction between acid and base is 250g. Having theoretical yield 500g, percentage yield is:	45%	50%	25%	35%
Which pair has the same electronic				

First Annual 2025 | Section A Q5 | 1 mark

The volume occupied by Nitrogen gas *(N_2)* having number of moles 2.75 at STP is:	56.64 dm^3	45.46 dm^3	61.64 dm^3	3.89 dm^3
		Electrons, ion		

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

(i)	Calculate mass of positive and negative ions produced when 3.26×10^{22} molecules of $CaCl_2$ were dissolved in solution.	03
(ii)	What is the effect of catalyst on the following:	

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

What is the limiting reactant? How does it control the quantity of the product formed?	2+1
What is critical solution temperature? Explain by	03

First Annual 2025 | Section C Q6 | 7 marks

	i) Low Temperature ii) High Pressure	
Q.6	The percentage yield of the following reaction is 76% $2Al + 3Cl_2 \longrightarrow 2AlCl_3$ How many grams of $AlCl_3$ will be obtained from 36.5g of Aluminum metal?	07

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Second Annual 2025 | Section A Q1 | 1 mark

1.	Which component determines the maximum amount of product formed in a reaction?	Excess reactant	Limiting reactant	Catalyst	Solvent	○	○	○	○

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

(i)	What volume of SO_2 at STP is produced on heating *9.7g* of *ZnS* *(Zn=65g/mol)* $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$	03

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

(ii)	Calculate the mass of Nitrogen gas if it occupies *1dm³* volume at STP.	03

Q.5	Calculate the amount of excess reactant which is left behind when 50g of sodium reacts with 100g of water according to given equation: $2Na + 2H_2O \rightarrow 2NaOH + H_2$	06

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

When 150 g of Mg is treated with dilute hydrochloric acid, what volume of hydrogen gas can be collected at STP. HCl (dil) is in excess. $Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$	03
The experimental yield is mostly less than the	

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

The experimental yield is mostly less than the theoretical yield? What are the reasons?	03

20 g of H_2SO_4 on dissolving water completely ionizes. Calculate:

No. of H_2SO_4 molecules

Q.3 20 g of H_2SO_4 on dissol
ionizes. Calculate:
a. No. of H_2SO_4 molecules

Q.3 20 g of H_2SO_4 on dissol
ionizes. Calculate:
a. No. of H_2SO_4 molecules
b. No. of H^+ and SO_4^{-2} ions

Q.3 20 g of H_2SO_4 on diss
ionizes. Calculate:
a. No. of H_2SO_4 molecules
b. No. of H^+ and SO_4^{-2} ions
c. Mass of individual ions

Q.4

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

(i)	A sample of water contains 2.5 g of chlorine gas in it. Determine the volume of this chlorine at STP.	03

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

(ii)	Justify that a limiting reactant controls the quantity of the product formed in a reaction.	03

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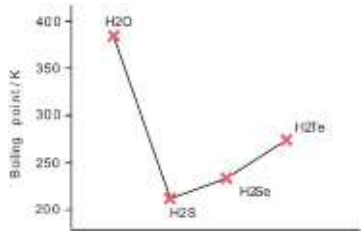
States and phases of matter

Domain B: Physical Chemistry

FBISE model paper | Section A Q36 | 0.5 marks

36.	Which property is characteristic of crystalline solids but not amorphous solids?	They have irregular shapes	They show cleavage along definite planes	They soften gradually when heated	They possess isotropic physical properties

FBISE model paper | Section A Q39 | 0.5 marks

39.	The diagram shows the variation of the boiling points of the Group VI hydrides  What explains the much higher boiling point of water compared to the other hydrides?	Strong OH bond energy	Polarity of OH bonds	High electronegativity of oxygen	Hydrogen bonding between H_2O molecules

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

aqueous solution.

Describe any three properties of water which are due to hydrogen bonding.	03

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

	and non- limiting reactants.	
(v)	State any three differences between crystalline and non– crystalline solids.	03
(vi)	Why Enthalpy of solution for NH_4NO_3 is +25.7 kJ/mol (endothermic process) whereas that of	1.5

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

	... $C_6H_5OH + 2[H]$ ...	
OR	Explain why: i is the falling drop of water spherical in shape? ii has water high surface tension than Ether?	1.5 + 1.5
	What is the Photo chemical smog? Briefly	

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

(vi)	Justify the difference in the boiling points of $CH_4(-162°C)$, $HCl(-85°C)$ and $H_2O(100°C)$.	03
(vii)	What is entropy? Describe the increase or	

Second Annual 2025 | Section A Q1 | 1 mark

1.	The type of intermolecular forces present between Hydrochloric acid molecules is:	Ionic bond	Metallic Force	Dipole Dipole Forces	Hydrogen Bonding
	The reactant that determines the maximum	Excess			Limiting

Second Annual 2025 | Section A Q4 | 1 mark

	$Zn_{(s)} + O_{2(g)} \rightarrow ZnO_{(s)}$				
4.	Which property of water is explained by hydrogen bonding?	Low boiling point	High surface tension	High vapor pressure	Low viscosity
	The enthalpy change when 1 mole of a				

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

Why Heat of vaporization ΔH_v is always greater than ΔH_f Heat of fusion?	03

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

				b. Metallic character increases along the Group.	1.5
(vii)	Differentiate between crystalline and amorphous solids with examples.	03	OR	Write the General formulas of Primary, Secondary and Tertiary amines.	1x3
(viii)	Differentiate between Exothermic and Endothermic	1.5		What is Catenation? How is it	

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

	halides. Write correct order of reactivity for them.			detect presence of carbonyl compounds.	
(xiii)	Write any three differences between boiling and evaporation.	1x3	OR	Complete the given equations by identifying the major products: a. $CH_3-CH_2-Cl + KCN \rightarrow$	1.5

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

State three properties of crystalline solids.	03

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

(xiii)	Water has low vapour pressure than CCl_4 and ether. Why?	03

First Annual 2026 | Section A Q16 | 1 mark

Dipole forces are present in ——— molecules.	Non-polar	Non-metallic	Metallic	Polar