

Paper II

Chemistry Strategy

A PYQ-based plan for Prelims Paper II, made from all 720 Chemistry questions asked from 2021 to 2026, sorted into the same 12 units as the VKC test series (C1–C12).

The whole strategy in three lines

300

marks: three-quarters of Prelims. Paper II, not GS, decides whether you clear Stage I.

40·40·40

Inorganic, Physical, Organic: the split has not changed once in six years. Plan each block on its own.

29

topic families were asked in all six papers. Learn that list first; it is your sure-shot zone.

Prelims: 10 January 2027 (confirm on your admit card). About 10 weeks from 29 October 2026. Paper II gets about 75% of your study time; the GS plan from the GS strategy fits in the other 25%.



01 The marks math of Paper II

Same pattern as GS, three times the weight. Every Paper II question is worth three GS questions.

+2.5

for a right answer (120
Q = 300 marks)

-0.83

for a wrong answer
(one-third)

2 h

for 120 questions: one
minute each, on
average

10%

minimum in each paper
to be counted

What you need: Stage I cut-offs for the Chemist stream (General, out of 400)

Year	2021	2022	2023	2024	2025
Stage I cut-off	217	224	210	193	167

The highest of these is 224/400. Chemistry 180+ (60%) with GS 50 gives 230, above every cut-off of the last five years. That is VKC's target on every result page of the test series.

Your target: 180+ in Paper II

Attempted	Right	Wrong	Score /300
100	80	20	183.3
90	75	15	175.0
110	82	28	181.7

The third row: 10 more attempts gave only 2 more right answers, and the score went down from the first row. In Paper II a careless attempt costs 0.83 marks.

The guessing rule, Paper II version

Options you can cut	Expected marks	Decision
None (1 in 4)	0.00	Leave it
One (1 in 3)	+0.28	Only with a second clue
Two (1 in 2)	+0.83	Always attempt

Cutting two options in chemistry is often quick: a wrong unit, a wrong sign, an impossible geometry, a product that breaks Bredt's rule.

Why 60% is realistic: the physical block is mostly formula work and repeats every year. A student who banks 34 of its 40 questions already has 85 marks before touching organic.



02 What 720 PYQs say, unit by unit

Every question of Paper II from 2021 to 2026, sorted into the 12 units of the VKC test series. UPSC sets the three blocks in the same order every year.

Unit	Test-series unit	2021	2022	2023	2024	2025	2026	Avg / paper
Inorganic and analytical · Q1–40 · always 40 questions = 100 marks								
■ C1	Chemical periodicity	11	17	19	15	14	18	15.7
■ C2	Bonding, solids, complexes	17	14	12	16	13	11	13.8
■ C3	Acids and bases	8	5	5	5	9	7	6.5
■ C4	Volumetric analysis	4	4	4	4	4	4	4.0
Physical · Q41–80 · always 40 questions = 100 marks								
■ C5	Gaseous state	7	7	7	7	10	8	7.7
■ C6	Thermodynamics	11	15	12	11	15	14	13.0
■ C7	Solutions	9	7	7	7	5	7	7.0
■ C8	Electrochemistry (conductance)	13	11	14	15	10	11	12.3
Organic · Q81–120 · always 40 questions = 100 marks								
■ C9	Basic organic	12	6	8	10	5	4	7.5
■ C10	Stereochemistry	13	8	9	11	9	11	10.2
■ C11	Organic reactions	10	19	19	14	21	18	16.8
■ C12	Rearrangements, NGP	5	7	4	5	5	7	5.5

What the data shows

- **The blocks are fixed:** exactly 40 inorganic, 40 physical and 40 organic questions every year, in that order.
- **C4 Volumetric analysis gives exactly 4 questions every year**, and primary standards were asked in all six papers.
- **Physical is the numerical block:** 85 of the 112 numericals in six years came from Q41–80.

- **Organic reactions (C11) nearly doubled:** from 10 questions in 2021 to about 18 a year since 2022, often research-level mechanisms.
- **Organic is drawn, not written:** 200 of the 240 organic questions carry structures. Practise reading mechanisms from pictures.
- **Statement-type questions are rising:** 13 in 2021, 23–25 in 2024 and 2026.

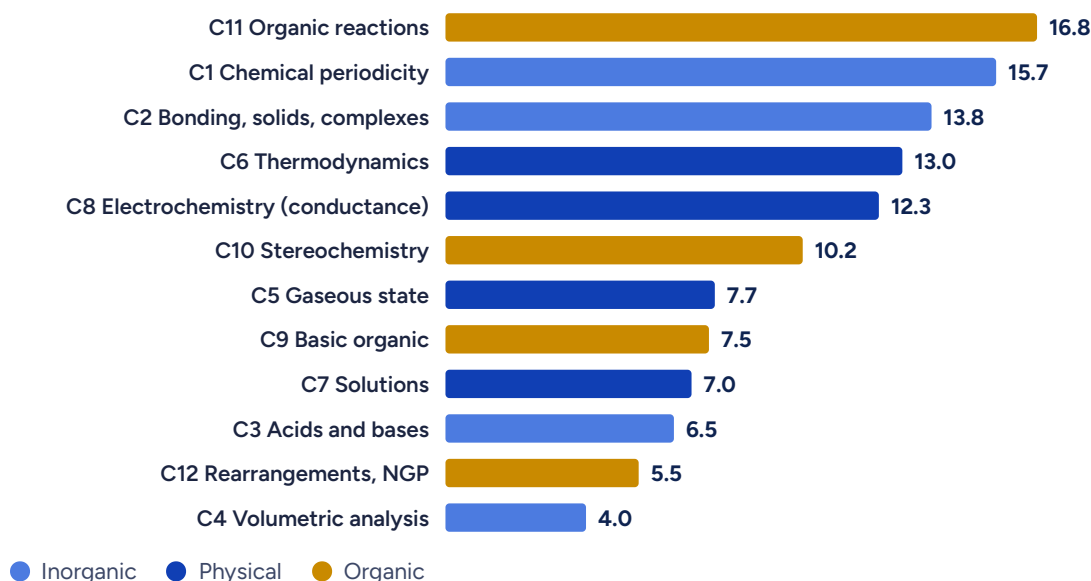
Method: each question is counted once, in the unit it tests, using the topic of VKC's worked solution for that question. Numericals are counted from the question text, so the count is approximate.



03 Three blocks, three games

Each block is 100 marks, but each needs a different way of preparing. The marks plan below gets you about 195/300.

Average questions per paper



Block	Nature of the questions	How to prepare	Your aim
Physical C5–C8 · 40 Q	Formula-based numericals and standard concepts. The same ideas every year: conductance, ionic mobility, Joule–Thomson, kinetic theory, colligative properties.	Formula sheet (page 9) + every PYQ numerical, twice. Bank these marks.	34 right ≈ 85%
Inorganic C1–C4 · 40 Q	Facts and trends: periodic properties, s/p-block compounds, bonding, solid state, complexes, pH and buffers, titrations.	One book, made into one-page trend sheets. C3 and C4 are short and near-certain.	30 right ≈ 75%
Organic C9–C12 · 40 Q	Structure-based mechanisms. Stereochemistry and rearrangements follow patterns; C11 has become research-level.	Stereo and NGP/rearrangement first (patterns). In C11, attempt only with two options cut.	21 right ≈ 52%

Marks plan

34 + 30 + 21 = **85 right** out of about 105 attempted.

$85 \times 2.5 - 20 \times 0.83 = \approx \mathbf{196 / 300}$

With GS 50, that is about 246/400, well above the highest recent cut-off of 224.



04 The sure-shot list: asked in all six papers

Each family below came in every paper from 2021 to 2026. Revise these first in each unit, then the rest of the syllabus.

Physical (C5–C8)

- Ionic mobility, transport number, moving-boundary method
- Kohlrausch's law and molar conductivity
- Conductometric titrations
- Debye–Hückel–Onsager, Walden's rule
- Kinetic theory: rms, average, most probable speeds
- Maxwell distribution of speeds
- Mean free path and collision frequency
- Colligative properties, van 't Hoff factor
- Henry's law
- Spontaneity and Gibbs energy

Inorganic and analytical (C1–C4)

- Electronic configuration, Slater's rules, shielding
- Nodes, wave functions, radial distribution
- Oxoacids and oxides of P and N; boron hydrides
- Fajans' rules, radius ratio, lattice energy
- Isomerism in complexes
- Naming of complexes, types of ligands
- Werner, VBT, EAN rule, magnetic moment
- pH, Kw, buffers, Henderson equation

- Primary standards in volumetric analysis

Organic (C9–C12)

- R/S, E/Z, meso compounds, Fischer projections
- Conformations of ethanes and cyclohexanes
- Stereochemistry of E2, SN2 and additions
- Carbocation and radical stability, aromaticity
- Elimination: E1, E2, E1cb, Hofmann vs Zaitsev
- Electrophilic addition, Markovnikov, peroxide effect
- Friedel–Crafts and directing effects
- Arynes and SNAr
- Neighbouring group participation
- Pinacol and carbocation rearrangements

Asked in five of the six papers

- Periodic trends: IE, electron gain, radii, electronegativity
- Work in isothermal and adiabatic expansion
- State functions, exact differentials, Maxwell relations
- Joule–Thomson effect and inversion temperature
- Graham's law of effusion
- Ostwald's dilution law
- Point defects in solids
- Michael addition and enolate alkylation

Low-return areas: in six years there was no spectroscopy question, one question on chemical kinetics, one on polymerisation and only one on cell EMF. Spend Prelims time on the units above; those topics belong to Mains.



05 One book per block, and only these chapters

You already know chemistry. The job now is revision against the PYQs, not new reading. Use the book you studied from if it covers the same chapters.

Unit	The one source	Read only
C1, C2	J. D. Lee, <i>Concise Inorganic Chemistry</i> + NCERT XI–XII for s/p-block facts	Atomic structure and periodic table; ionic and covalent bonding, VSEPR, MO; solid state and defects; s- and p-block compounds (oxoacids, boranes, interhalogens); coordination compounds: naming, isomerism, VBT, magnetism.
C3	Puri, Sharma and Pathania, <i>Principles of Physical Chemistry</i>	Ionic equilibria: Ostwald's law, K_w , pH, buffers, Henderson equation, salt hydrolysis, solubility product, indicators. Add HSAB from J. D. Lee.
C4	Vogel's <i>Textbook of Quantitative Chemical Analysis</i>	Titrimetry only: primary and secondary standards, acid–base, redox (permanganate, dichromate, iodometry), complexometric (EDTA), precipitation titrations, indicators.
C5–C8	Puri, Sharma and Pathania	Gaseous state (kinetic theory, Maxwell, real gases); thermodynamics I–III and Joule–Thomson; solutions and colligative properties; electrochemistry: conductance, Kohlrausch, transport number, conductometric titrations. Not EMF-heavy cells.
C9, C11, C12	Peter Sykes, <i>A Guidebook to Mechanism in Organic Chemistry</i>	All of it: electronic effects, intermediates, substitution, elimination, addition, aromatic substitution, rearrangements and NGP. For 2025–26 level, read Clayden's chapters on NGP, rearrangements and fragmentation.
C10	D. Nasipuri, <i>Stereochemistry of Organic Compounds</i>	Chirality, R/S and E/Z, meso, projections, conformations of ethanes, cyclohexanes and decalins, stereochemistry of S_N2 , E2 and additions.

The PYQs are source number one. All six Paper II papers are solved on vkcsience.com, with a worked explanation for every question. After each unit, solve that unit's PYQs from all six years together.

Make three sheets, not notes. A formula sheet for physical (page 9 is a start), a trend sheet for inorganic, and a mechanism sheet for organic with the 10 sure-shot families drawn by hand.



06 10-week plan, test by test

Physical first because it gives the most marks per hour, then inorganic, then organic. Each week ends with that unit's sectional test; the part tests close each block; the mocks come last.

Week	Dates	Chemistry work (4–5 hours a day)	Test that week
Week 1	29 Oct – 4 Nov	Take Chemistry Mock 1 (free) cold as a baseline. Then C5 Gaseous state and C7 Solutions.	Mock 1 → C5, C7
Week 2	5 – 11 Nov	C8 Electrochemistry: conductance, Kohlrausch, transport number, conductometric titrations.	C8
Week 3	12 – 18 Nov	C6 Thermodynamics and equilibrium. Then revise the whole physical block.	C6 · Part B
Week 4	19 – 25 Nov	C1 Chemical periodicity and s/p-block compounds.	C1
Week 5	26 Nov – 2 Dec	C2 Bonding, solid state, coordination compounds.	C2
Week 6	3 – 9 Dec	C3 Acids and bases, C4 Volumetric analysis. Revise inorganic.	C3, C4 · Part A
Week 7	10 – 16 Dec	C10 Stereochemistry: R/S, conformations, stereochemistry of reactions.	C10
Week 8	17 – 23 Dec	C9 Basic organic and C12 Rearrangements and NGP.	C9, C12
Week 9	24 – 30 Dec	C11 Organic reactions: substitution, elimination, addition, aromatic substitution.	C11 · Part C · Mock 2
Week 10	31 Dec – 6 Jan	Full mocks every other day. Between mocks, only the error log and the three sheets.	Mocks 3, 4, 5
Last days	7 – 9 Jan	Mock 6 on the 7th, then revision only. Sleep well before the 10th.	Mock 6

Sectional and part tests are live; Mocks 4–6 open closer to the exam. If a test is not open in your week, solve that unit's PYQs from vkcsience.com and take the test when it opens. Every test stays open till the exam.

A full study day (about 6 hours)

- 2.5 h: the week's unit from its one source
- 1.5 h: that unit's PYQs and test questions
- 30 min: add to the formula, trend or mechanism sheet
- 1.5 h: GS, from the GS strategy plan

After every test

- Read the solution of every wrong and every guessed question
- Write each mistake in an error log: unit, what you did, the right idea
- Check the topic-wise analysis on your result page and redo the weakest unit's PYQs



07 In the exam hall: 120 questions in 120 minutes

Paper II is in the afternoon, after GS. The paper's own order (inorganic, physical, organic) is fine, but do not get stuck in organic.

Block	Time	How
Inorganic Q1–40	about 30 min	Mostly direct recall. Answer fast, mark the doubtful ones.
Physical Q41–80	about 40 min	Numericals: write the formula first, check units and the order of magnitude, then calculate. Skip any numerical taking more than 2 minutes.
Organic Q81–120	about 35 min	First pass: stereo, NGP and pattern questions. Leave long multi-step mechanisms for the second pass.
Second pass	about 15 min	Marked questions only. Two options cut means attempt. Fill the OMR carefully.

Elimination tricks for chemistry

- **Units and signs:** a conductance in the wrong unit or a negative entropy for heating is wrong at once.
- **Limits:** check the answer when $c \rightarrow 0$, $T \rightarrow 0$ or the gas becomes ideal.
- **Organic:** remove products that break Bredt's rule, valency or charge balance, or that need a primary carbocation.
- **Stereo:** anti-periplanar for E2, inversion for SN2, retention with NGP.

Three rules for the day

1. Never leave a physical numerical half-done: finish it or skip it.
2. In C11, attempt only when two options are cut.
3. Keep 10 minutes in hand for the OMR.

Four rules to remember

1. Paper II is 300 of the 400 marks: give it 75% of your time.
2. Physical first: 34 of 40 is the base of your score.
3. Learn the sure-shot list in every unit before anything else.
4. Test every week with the matching C-test; keep an error log.



08 Formula sheet for the physical block

These relations answer most of the physical-block numericals of the last six years. Revise this page the night before every mock.

C5 Gaseous state

$$u_{\text{rms}} = \sqrt{3RT/M}, \bar{u} = \sqrt{8RT/\pi M}, u_{\text{mp}} = \sqrt{2RT/M}$$

$$u_{\text{mp}} : \bar{u} : u_{\text{rms}} = 1 : 1.128 : 1.225$$

$$\text{Graham: } r_1/r_2 = \sqrt{M_2/M_1}$$

$$\text{Mean free path: } \lambda = kT / (\sqrt{2} \pi d^2 p)$$

$$\text{Real gas: } Z = pV/nRT; (p + an^2/V^2)(V - nb) = nRT$$

$$T_c = 8a/27Rb, p_c = a/27b^2, V_c = 3b$$

$$\text{Boyle temperature } T_B = a/Rb; \text{ inversion temperature } T_i = 2a/Rb$$

C6 Thermodynamics

$$\Delta U = q + w; \text{ reversible isothermal: } w = -nRT \ln(V_2/V_1)$$

$$\text{Against constant } p_{\text{ext}}: w = -p_{\text{ext}}\Delta V$$

$$C_p - C_v = R; \text{ adiabatic: } pV^\gamma \text{ and } TV^{\gamma-1} \text{ constant}$$

$$\Delta H = \Delta U + \Delta n_g RT; \text{ Kirchhoff: } \Delta H_2 = \Delta H_1 + \Delta C_p(T_2 - T_1)$$

$$\text{Carnot: } \eta = 1 - T_{\text{cold}}/T_{\text{hot}}$$

$$\Delta S = nR \ln(V_2/V_1) \text{ (isothermal); } nC_p \ln(T_2/T_1) \text{ (heating);}$$

$$\Delta H/T \text{ (phase change)}$$

$$\Delta G = \Delta H - T\Delta S; \Delta G^\circ = -RT \ln K; \text{ Joule-Thomson: } \mu \approx (2a/RT - b)/C_p$$

C7 Solutions

$$\text{Raoult: } p = x p^\circ; \text{ relative lowering } (p^\circ - p)/p^\circ = x_{\text{solute}}$$

$$\text{Henry: } p = K_H x$$

$$\Delta T_b = i K_b m, \Delta T_f = i K_f m, \pi = i c R T$$

$$\text{Dissociation into } n \text{ ions: } i = 1 + \alpha(n - 1)$$

$$\text{Association of } n \text{ molecules: } i = 1 - \alpha(1 - 1/n)$$

C8 Conductance

$$\kappa = G \times (l/A); \Lambda_m = 1000 \kappa / c \text{ (}\kappa \text{ in S cm}^{-1}, c \text{ in mol L}^{-1}\text{)}$$

$$\text{Strong electrolytes: } \Lambda_m = \Lambda_m^\circ - A\sqrt{c}$$

$$\text{Kohlrausch: } \Lambda_m^\circ = v_+ \lambda_+^\circ + v_- \lambda_-^\circ$$

$$\text{Weak: } \alpha = \Lambda_m/\Lambda_m^\circ; \text{ Ostwald: } K_a = c\alpha^2/(1 - \alpha)$$

$$\text{Sparingly soluble 1:1 salt: } s = 1000 \kappa / \Lambda_m^\circ, K_{sp} = s^2$$

$$t_+ = \lambda_+ / (\lambda_+ + \lambda_-), t_+ + t_- = 1; \text{ mobility } u = \lambda/F; \text{ Walden: } \Lambda^\circ \eta \text{ constant}$$

C3 Acids and bases (25 °C)

$$K_w = 1.0 \times 10^{-14}, \text{ pH} + \text{pOH} = 14 \cdot \text{Henderson: } \text{pH} = \text{p}K_a + \log([A^-]/[HA]) \cdot \text{Weak acid: } [H^+] \approx \sqrt{K_a c}$$

$$\text{Salt of weak acid + strong base: } \text{pH} = 7 + \frac{1}{2}\text{p}K_a + \frac{1}{2}\log c \cdot \text{weak base + strong acid: } \text{pH} = 7 - \frac{1}{2}\text{p}K_b - \frac{1}{2}\log c \cdot K_{sp} = s^2 \text{ (AB), } 4s^3 \text{ (AB}_2\text{)}$$



09 Your test series, unit by unit

The VKC Paper II series uses the same 12 units as this analysis, so each week of the plan ends with the matching test.

Test	Covers	Pattern
C1–C12 sectionals	One unit each, at PYQ level, with the sure-shot families of that unit	30 Q · 30 min · 75 marks
Part A, B, C	One block each, in UPSC's order (Q1–40, 41–80, 81–120)	40 Q · 40 min · 100 marks
Mocks 1–6	The full paper: 40 inorganic, 40 physical, 40 organic	120 Q · 120 min · 300 marks

Mock 1 is free for everyone. The Chemistry pass (₹799) opens every Paper II test; the complete pass (₹999) adds all GS tests. Result pages show your score against VKC's target, topic-wise analysis and a solution for every question.



Paper II PYQs 2021–2026, solved
vkcsience.com → Geo-Scientist
→ Prelims Chemistry



Geo-Scientist Prelims test series
C1–C12 · Parts A–C · Mocks 1–6
Chemistry Mock 1 free



Telegram channel
t.me/upsc_chemistry_vkc
Doubts: the VKC discussion group

Cut-offs: UPSC cut-off notices for CGSE (Chemist, General, Stage I). Question counts: VKC analysis of the 2021–2026 Paper II papers, using the topic of each worked solution on vkcsience.com.

