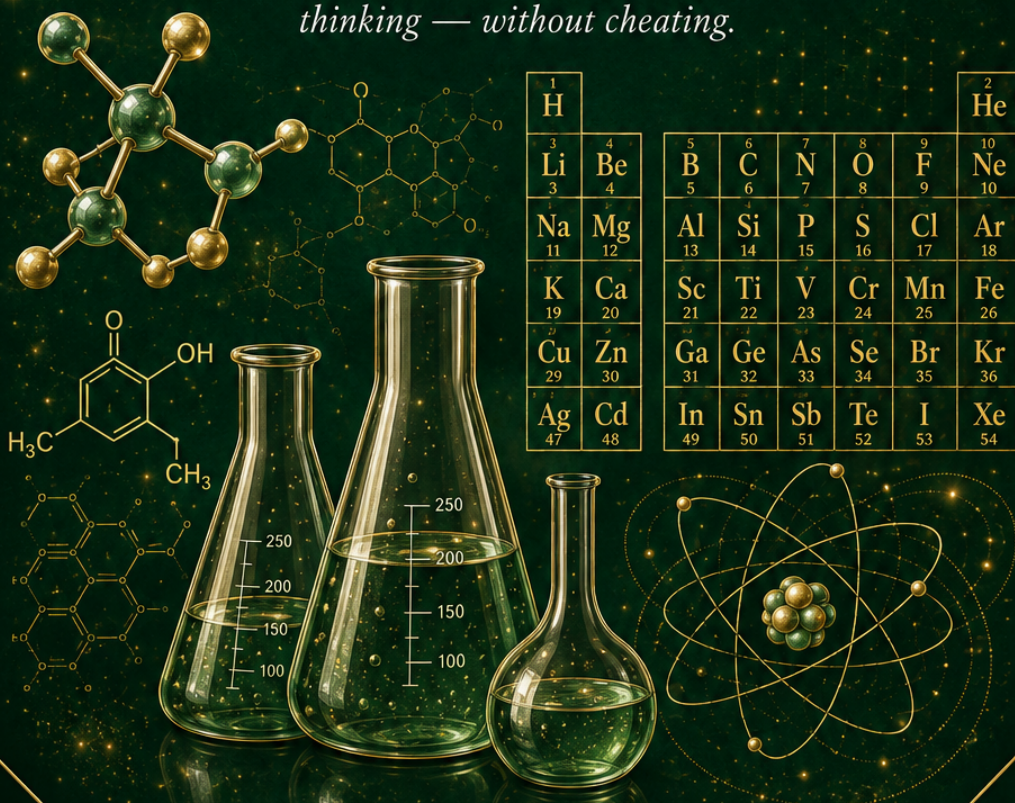


# IBDP CHEMISTRY

## 100 AI PROMPTS

for Smarter Revision *and* Exam Prep

*Active recall, exam technique, and mark-scheme thinking — without cheating.*



1 H						2 He	
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe
29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe

by James R. Martin

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## How to Use This Book

For a long time, high-quality tutoring has been a major contributor to elite academic achievement. Used well, AI can now act as a powerful tutor that most students and parents could not previously afford.

This book is a **starting point**, not a rulebook. Each prompt is designed to help you revise, test your understanding, and think more clearly — not to give perfect answers. You are encouraged to **adapt, improve, and remix** these prompts.

You are learning how to think carefully about the questions you ask — a skill that will matter far beyond these exams.

## **Note on Exam Boards and Syllabi**

This revision guide is designed for the International Baccalaureate Diploma Programme (IBDP) Chemistry course, covering both Standard Level (SL) and Higher Level (HL) content. The prompts align with the IB Chemistry syllabus and reflect the emphasis on conceptual understanding, quantitative problem solving, and the application of chemistry to real-world contexts.

IB Chemistry assessment consists of Paper 1 (multiple choice questions testing breadth of knowledge across the syllabus), Paper 2 (structured and extended response questions requiring calculations, explanations, and data analysis), and Paper 3 (HL only, covering options and data-based questions). The Data Booklet is available in all papers and contains essential reference data including atomic masses, bond enthalpies, electrode potentials, and spectroscopic data.

The Internal Assessment (IA) is an individual scientific investigation worth 20% of your final grade, assessed against criteria including Personal Engagement, Exploration, Analysis, Evaluation, and Communication. Several prompts in this guide specifically target practical skills, experimental design, and IA preparation to help you plan and execute a strong investigation.

HL-only topics and extensions are indicated where relevant, including Born-Haber cycles, entropy and Gibbs free energy, buffer chemistry, reaction mechanisms, and spectroscopic analysis. SL students should focus on core prompts and use HL-tagged prompts as extension material to deepen their understanding of fundamental concepts.

Throughout your revision, pay close attention to IB command terms — 'define', 'explain', 'calculate', 'deduce', 'compare', 'discuss', and 'evaluate' each require different depths and types of response. Practise using correct chemical nomenclature, balanced equations, and appropriate significant figures in all your work.

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# Section 1

## Stoichiometric Relationships

Stoichiometry is the quantitative foundation of chemistry, connecting the mole concept to balanced equations and enabling calculations of masses, volumes, and concentrations in chemical reactions. Mastery of this topic is essential for success across the entire IB Chemistry course.

You must be fluent in converting between mass, moles, particles, and volume of gases, as well as determining empirical and molecular formulae from experimental data. Solution chemistry calculations involving concentration and dilution are equally important.

These prompts build your confidence with the multi-step calculations that IB Chemistry examiners expect, developing both accuracy and the ability to show clear, logical working that earns method marks even when arithmetic errors occur.

### **Prompt 1: Mole Concept Calculations**

#### **Copy this prompt into your AI tool:**

*Present five problems requiring conversions between mass, moles, and number of particles for different substances. Include compounds as well as elements. After each calculation, ask me to state the conversion factor I used and verify my answer is physically reasonable.*

#### **What this helps you practise:**

Converting between mass, moles, and number of particles

#### **How to use it well:**

Run this prompt until mole conversions are

automatic — this foundational skill is required in virtually every quantitative chemistry question across both papers.

### **Prompt 2: Empirical and Molecular Formulae**

#### **Copy this prompt into your AI tool:**

*Provide percentage composition data or combustion analysis results for four compounds and ask me to determine the empirical formula of each. For two of them, provide molar mass data and ask me to determine the molecular formula. Check each step of my working for accuracy.*

#### **What this helps you practise:**

Determining empirical and molecular formulae from composition data

#### **How to use it well:**

These calculations follow a strict sequence — practise the stepwise approach of converting percentages to moles to ratios until it becomes second nature.

### **Prompt 3: Balanced Equation Writing**

#### **Copy this prompt into your AI tool:**

*Present eight chemical reactions described in words — including combustion, neutralisation, redox, and precipitation — and ask me to write balanced chemical equations with state symbols. For two reactions, ask me to write the ionic equation and identify spectator ions.*

#### **What this helps you practise:**

Writing and balancing chemical equations with state symbols

#### **How to use it well:**

Balanced equations are the starting point for all stoichiometric calculations — practise writing them quickly and accurately to save time in exams.

#### **Prompt 4: Limiting Reagent Problems**

##### **Copy this prompt into your AI tool:**

*Present three reactions with given masses of two reactants and ask me to determine the limiting reagent, calculate the mass of product formed, and find the mass of excess reagent remaining. Include one problem involving solutions with given concentrations and volumes. At SL, apply stoichiometry to straightforward reactions; at HL, extend to back-titration and multi-step calculations involving limiting reagents and theoretical yield.*

##### **What this helps you practise:**

Identifying limiting reagents and calculating product yields

##### **How to use it well:**

Limiting reagent problems are a classic Paper 2 question type — practise the systematic approach of calculating moles of each reactant before comparing.

#### **Prompt 5: Gas Volume Calculations**

##### **Copy this prompt into your AI tool:**

*Pose problems involving the molar volume of gases at STP and the ideal gas equation. Ask me to calculate volumes of gases produced or consumed in reactions, and to convert between different temperature and pressure conditions. Include a problem requiring use of the Data Booklet gas constant.*

##### **What this helps you practise:**

Calculating gas volumes using molar volume and the ideal gas equation

##### **How to use it well:**

Gas calculations require careful attention to temperature units and pressure conditions — practise ensuring all values are in correct SI units before substituting.

## **Prompt 6: Solution Concentration and Dilution**

### **Copy this prompt into your AI tool:**

*Present problems involving preparation of solutions of specified concentration, dilution calculations using  $c_1V_1 = c_2V_2$ , and back-titration scenarios. For each, ask me to show all working with correct units.*

*Include a problem requiring conversion between different concentration units.*

### **What this helps you practise:**

Calculating concentrations and performing dilution calculations

### **How to use it well:**

Solution chemistry calculations underpin the acids and bases topic — build strong concentration skills here to support your work in later sections.

## **Prompt 7: Percentage Yield and Atom Economy**

### **Copy this prompt into your AI tool:**

*Present a reaction with theoretical and actual yields and ask me to calculate percentage yield. Then ask me to calculate the atom economy of the reaction and explain its significance for green chemistry.*

*Compare two reaction pathways for the same product in terms of atom economy.*

### **What this helps you practise:**

Calculating percentage yield and atom economy

### **How to use it well:**

Atom economy questions connect stoichiometry to sustainability — practise explaining why high atom economy is desirable in industrial processes.

## **Prompt 8: Titration Calculations**

### **Copy this prompt into your AI tool:**

*Present titration data for an acid-base reaction and ask me to calculate the unknown concentration.*

*Include a titration requiring the use of a mole ratio from the balanced equation. Then present a back-*

*titration scenario and ask me to determine the amount of an unreacted substance.*

**What this helps you practise:**

Performing titration calculations from experimental data

**How to use it well:**

Titration calculations appear on both Paper 2 and in IA contexts — practise the complete calculation from burette reading to final concentration with clear working.

**Prompt 9: Avogadro's Constant Applications**

**Copy this prompt into your AI tool:**

*Pose problems that require me to calculate the number of atoms, molecules, or ions in given quantities of substances. Include a problem involving the number of atoms in a molecule, the number of ions in an ionic compound, and the mass of a single atom or molecule using Avogadro's constant.*

**What this helps you practise:**

Applying Avogadro's constant to particle-level calculations

**How to use it well:**

These calculations test your understanding of the mole concept at the particle level — practise distinguishing between atoms, molecules, and formula units.

**Prompt 10: Multi-Step Stoichiometry Problems**

**Copy this prompt into your AI tool:**

*Create an IB Paper 2 style question that requires three or more stoichiometric steps — such as finding the mass of a product from a solution concentration, or combining gas volume and mass calculations in a multi-reaction sequence. Mark my response and identify where method marks apply.*

**What this helps you practise:**

Completing extended multi-step stoichiometric calculations

**How to use it well:**

Extended stoichiometry questions test your ability to chain calculation steps — use this prompt to practise maintaining accuracy across multiple conversions.

**Prompt 11: Stoichiometry Error Analysis**

**Copy this prompt into your AI tool:**

*Present a worked stoichiometric calculation containing two deliberate errors — one in equation balancing and one in unit conversion. Ask me to identify both errors, explain why they are wrong, and correct the calculation. Discuss how each error would affect the final answer.*

**What this helps you practise:**

Identifying and correcting common stoichiometric calculation errors

**How to use it well:**

Error-spotting builds the checking habits that prevent careless mistakes under exam pressure — practise catching errors in others' work to train your own vigilance.

**Prompt 12: Hydrated Salt Analysis**

**Copy this prompt into your AI tool:**

*Present experimental data from heating a hydrated salt to constant mass and ask me to calculate the number of moles of water of crystallisation per mole of anhydrous salt. Then ask me to determine the formula of the hydrate and evaluate potential sources of error in the experiment.*

**What this helps you practise:**

Determining formulae of hydrated salts from experimental data

**How to use it well:**

Hydrate analysis combines stoichiometric calculations with practical data interpretation — practise the complete process from mass data to hydrate formula determination.

## Section 2

### Atomic Structure

Atomic structure in IB Chemistry covers the development of atomic models, electron configuration, isotopes, and the electromagnetic spectrum. Understanding how electrons are arranged in atoms is fundamental to explaining chemical bonding, periodicity, and reactivity.

You must be able to write full and condensed electron configurations, understand the evidence from emission spectra for energy levels and sublevels, and calculate relative atomic mass from isotopic data. HL students extend to orbital shapes, the Aufbau principle, and Hund's rule.

These prompts develop your understanding of atomic structure from the historical development of models through to the quantum mechanical description, building the conceptual foundation that supports all subsequent chemistry topics.

#### **Prompt 13: Electron Configuration Writing**

##### **Copy this prompt into your AI tool:**

*Test me on writing the full electron configuration for ten elements and ions across different periods, including transition metals. Then ask me to write condensed (noble gas core) configurations for five of them. Include cases where chromium and copper exhibit exceptional configurations.*

##### **What this helps you practise:**

Writing electron configurations for atoms and ions

##### **How to use it well:**

Practise electron configurations until they are automatic, as they underpin explanations of

periodicity, bonding, and transition metal chemistry throughout the course.

**Prompt 14: Isotopes and Relative Atomic Mass**  
**Copy this prompt into your AI tool:**

*Present mass spectrometry data showing isotopic abundances for three elements and ask me to calculate the relative atomic mass of each. Then give me a relative atomic mass and isotopic masses and ask me to calculate the percentage abundance.*

*Explain how a mass spectrometer separates isotopes.*

**What this helps you practise:**

Calculating relative atomic mass from isotopic abundance data

**How to use it well:**

Mass spectrometry calculations appear on Paper 1 and Paper 2 — practise the weighted average calculation and understand how to read mass spectra.

**Prompt 15: Emission Spectra and Energy Levels**  
**Copy this prompt into your AI tool:**

*Present the hydrogen emission spectrum and ask me to explain how it provides evidence for discrete energy levels. Then ask me to calculate the energy of a photon for a given spectral line using  $E = hf$ . Ask me to explain why the lines converge at higher energies and what this convergence limit represents.*

**What this helps you practise:**

Interpreting emission spectra as evidence for quantised energy levels

**How to use it well:**

Emission spectra questions combine conceptual explanation with calculation — practise both aspects,

as IB examiners test understanding alongside numerical skill.

### **Prompt 16: Ionisation Energy Trends**

#### **Copy this prompt into your AI tool:**

*Present successive ionisation energy data for an unknown element and ask me to deduce its group in the periodic table. Then ask me to explain the trend in first ionisation energy across Period 3, accounting for the anomalies at aluminium and sulfur. Assess the quality of my explanations. As a TOK extension, discuss whether atomic models — from Dalton to quantum mechanics — represent reality or are merely useful fictions, and what this reveals about how scientific knowledge progresses.*

#### **What this helps you practise:**

Interpreting ionisation energy data to determine electron structure

#### **How to use it well:**

Ionisation energy questions test your ability to connect macroscopic data to electron configuration — practise explaining each discontinuity in terms of subshell structure.

### **Prompt 17: Atomic Models Historical Development**

#### **Copy this prompt into your AI tool:**

*Ask me to describe the key features and limitations of the Dalton, Thomson, Rutherford, and Bohr atomic models in chronological order. For each transition, ask me to identify the experimental evidence that necessitated the new model. Evaluate whether my descriptions are scientifically accurate.*

#### **What this helps you practise:**

Explaining the historical development of atomic models

### **How to use it well:**

The nature of science component of IB Chemistry includes understanding how models evolve — practise concise descriptions that highlight evidence-driven change.

### **Prompt 18: Orbital Shapes and Quantum Numbers**

#### **Copy this prompt into your AI tool:**

*Test me on sketching the shapes of s, p, and d orbitals and explain how they differ in energy within the same principal energy level. Then present electron configurations and ask me to draw orbital diagrams showing electron spin. Assess my application of the Aufbau principle, Hund's rule, and the Pauli exclusion principle. SL students should describe electron configurations up to Z=36; HL students should additionally explain the first ionisation energy anomalies and the convergence of successive ionisation energies.*

#### **What this helps you practise:**

Drawing orbital diagrams and applying electron filling rules

#### **How to use it well:**

HL students must understand orbital shapes and filling order — use this prompt to build visual and conceptual fluency with quantum mechanical descriptions of atoms.

### **Prompt 19: Electromagnetic Spectrum and Photon Energy**

#### **Copy this prompt into your AI tool:**

*Present five different types of electromagnetic radiation and ask me to arrange them in order of increasing frequency, wavelength, and energy. Then give me the wavelength of a photon and ask me to*

*calculate its frequency and energy. Connect each radiation type to its interaction with matter.*

**What this helps you practise:**

Relating electromagnetic radiation properties to photon energy

**How to use it well:**

Understanding the electromagnetic spectrum supports work on spectra, spectroscopy, and photochemistry — practise the calculations and conceptual connections.

**Prompt 20: Mass Spectrometry Interpretation**

**Copy this prompt into your AI tool:**

*Present a mass spectrum of an element showing multiple peaks and ask me to identify each isotope, determine relative abundances, and calculate the relative atomic mass. Then present a mass spectrum of a simple molecule and ask me to identify the molecular ion peak and major fragmentation products.*

**What this helps you practise:**

Interpreting mass spectra for elements and simple molecules

**How to use it well:**

Mass spectra interpretation appears on Paper 1 and connects to organic spectroscopy at HL — practise reading spectra systematically from the molecular ion peak down.

**Prompt 21: Electron Configuration and Ion Formation**

**Copy this prompt into your AI tool:**

*Present atoms and ask me to predict which ions they are most likely to form, writing the electron configuration of each ion. Include transition metal ions where d-electron removal occurs. Then ask me*

*to explain why some elements form multiple stable ion charges while others do not.*

**What this helps you practise:**

Predicting ion charges from electron configuration

**How to use it well:**

Understanding ion formation through electron configuration is essential for bonding and electrochemistry — practise the rules for electron removal order.

**Prompt 22: Atomic Structure Exam Question Synthesis**

**Copy this prompt into your AI tool:**

*Create an IB Paper 2 style question that combines electron configuration with ionisation energy data interpretation and emission spectra analysis. Include a calculation, an explanation, and a data interpretation component. Mark my response using IB standards and identify strengths and weaknesses.*

**What this helps you practise:**

Completing multi-part atomic structure exam questions

**How to use it well:**

Use this as an extended practice question to develop the ability to connect different aspects of atomic structure within a single coherent exam response.

**Prompt 23: Atomic Structure Misconception Check**

**Copy this prompt into your AI tool:**

*Present eight statements about atomic structure and ask me to identify which are correct and which contain common misconceptions. For each incorrect statement, ask me to explain the misconception and provide the correct scientific understanding. Include statements about electron orbits versus orbitals and isotope properties.*

**What this helps you practise:**

Identifying and correcting atomic structure  
misconceptions

**How to use it well:**

Paper 1 multiple choice questions often target  
common misconceptions — use this prompt to  
identify and correct any misunderstandings before  
the exam.

## Section 3

### Periodicity

Periodicity examines the recurring patterns in physical and chemical properties of elements as atomic number increases. Understanding these trends and their underlying causes in terms of electron configuration is one of the most powerful tools in chemistry for predicting element behaviour.

At SL, you must explain trends in atomic radius, ionic radius, ionisation energy, electronegativity, and metallic character across periods and down groups. You should also understand the properties of Period 3 oxides and chlorides. HL extends to transition metal chemistry, including variable oxidation states, complex ion formation, and colour.

These prompts develop your ability to explain periodic trends using atomic structure concepts and to apply trend knowledge to predict and compare the properties of unfamiliar elements.

#### **Prompt 24: Periodic Trend Explanations**

##### **Copy this prompt into your AI tool:**

*Ask me to explain the trend in atomic radius, first ionisation energy, electronegativity, and electron affinity across Period 3 and down Group 1. For each trend, require me to reference nuclear charge, shielding, and atomic structure. Evaluate whether my explanations are sufficiently detailed for full IB marks.*

##### **What this helps you practise:**

Explaining periodic trends using atomic structure concepts

##### **How to use it well:**

Trend explanations must reference specific

structural factors — practise constructing three-part explanations covering the factor, its effect, and the resulting trend.

### **Prompt 25: Ionic Radius Comparisons**

#### **Copy this prompt into your AI tool:**

*Present pairs of ions and ask me to predict which is larger, justifying my answer in terms of electron configuration, nuclear charge, and electron-electron repulsion. Include isoelectronic pairs and comparisons between cations and anions of the same element.*

#### **What this helps you practise:**

Comparing ionic radii using electronic structure arguments

#### **How to use it well:**

Ionic radius comparisons are a common Paper 1 question — practise the reasoning for isoelectronic species where nuclear charge is the determining factor.

### **Prompt 26: Period 3 Oxides Properties**

#### **Copy this prompt into your AI tool:**

*Ask me to write the formulae of Period 3 oxides from  $\text{Na}_2\text{O}$  to  $\text{Cl}_2\text{O}_7$  and classify each as basic, amphoteric, or acidic. Then ask me to describe the bonding in each oxide and explain how bonding type relates to the acid-base character. Include reactions of selected oxides with water. Connect to TOK by evaluating Mendeleev's predictions of undiscovered elements — does the success of predictions validate a scientific model, and how does this relate to paradigm shifts in chemistry?*

#### **What this helps you practise:**

Classifying and explaining properties of Period 3 oxides

**How to use it well:**

Period 3 oxide chemistry demonstrates the transition from ionic to covalent bonding — practise connecting structure to properties systematically across the period.

**Prompt 27: Transition Metal Properties**

**Copy this prompt into your AI tool:**

*Test me on listing the characteristic properties of transition metals: variable oxidation states, formation of coloured compounds, catalytic activity, and complex ion formation. For each property, ask me to provide a specific example and explain the underlying reason in terms of d-orbital electron configuration.*

**What this helps you practise:**

Explaining transition metal properties using d-orbital theory

**How to use it well:**

HL students should practise linking each transition metal property to d-electron configuration, as IB examiners expect these connections to be made explicitly.

**Prompt 28: Complex Ion Formation and Nomenclature**

**Copy this prompt into your AI tool:**

*Present five complex ions and ask me to name each using IUPAC nomenclature, identify the central metal ion, state its oxidation number, and describe the coordination geometry. Then give me names and ask me to write the formulae. Include complexes with different ligand types.*

**What this helps you practise:**

Naming complex ions and determining oxidation states

### **How to use it well:**

HL students must be fluent with complex ion nomenclature — practise systematic naming including the ligand prefixes and metal ion oxidation state notation.

### **Prompt 29: Colour in Transition Metal Compounds**

#### **Copy this prompt into your AI tool:**

*Ask me to explain why transition metal compounds are often coloured, referencing d-orbital splitting, ligand field theory, and the absorption of specific wavelengths. Then present the colour of a solution and ask me to determine what colour of light is absorbed. Include the effect of changing ligands on colour.*

#### **What this helps you practise:**

Explaining the origin of colour in transition metal compounds

#### **How to use it well:**

HL students should connect d-orbital splitting to the complementary colour absorbed — practise using the colour wheel to predict observed colours.

### **Prompt 30: Electronegativity and Bond Polarity**

#### **Copy this prompt into your AI tool:**

*Present pairs of elements and ask me to predict the electronegativity difference, the type of bond formed, and the direction of bond polarity. Then ask me to arrange molecules in order of increasing polarity and explain how molecular geometry affects overall molecular polarity.*

#### **What this helps you practise:**

Predicting bond polarity from electronegativity differences

#### **How to use it well:**

Electronegativity underpins bonding and

intermolecular forces — practise applying the periodic trend to predict bond character across different element pairs.

### **Prompt 31: Metallic Character and Reactivity Trends**

#### **Copy this prompt into your AI tool:**

*Ask me to explain the trend in metallic character across a period and down a group. Then present reactions of Group 1 and Group 17 elements and ask me to arrange them in order of reactivity, explaining the trend. Include a question about the reactivity series and its connection to ionisation energy.*

#### **What this helps you practise:**

Explaining trends in metallic character and group reactivity

#### **How to use it well:**

Reactivity trends connect periodicity to practical chemistry — practise explaining why metals become more reactive down a group while halogens become less reactive.

### **Prompt 32: Predicting Properties of Unknown Elements**

#### **Copy this prompt into your AI tool:**

*Present an element by its position in the periodic table without naming it. Ask me to predict its electron configuration, first ionisation energy, electronegativity, common oxidation states, oxide formula, and likely bonding in its chloride. Then reveal the element and assess my predictions.*

#### **What this helps you practise:**

Using periodic trends to predict properties of elements

#### **How to use it well:**

Prediction questions test whether you truly understand periodic trends rather than just

memorising them — practise applying trends to unfamiliar elements.

### **Prompt 33: Periodicity Data Analysis**

**Copy this prompt into your AI tool:**

*Present a data table of physical properties (melting point, electrical conductivity, atomic radius) across Period 3 and ask me to identify and explain patterns. Ask me to account for any anomalies by reference to structure and bonding. Include a graph interpretation component.*

**What this helps you practise:**

Analysing and explaining periodic property data

**How to use it well:**

Data analysis questions combine knowledge of trends with interpretation skills — practise explaining why silicon's high melting point breaks the expected pattern.

### **Prompt 34: Periodicity Exam Question**

#### **Synthesis**

**Copy this prompt into your AI tool:**

*Create an IB Paper 2 style question that combines periodic trend analysis with transition metal chemistry. Include a data interpretation task, a trend explanation, and a question about complex ion properties. Mark my response against IB standards, noting command term compliance.*

**What this helps you practise:**

Completing multi-part periodicity exam questions under IB conditions

**How to use it well:**

Use this as an extended practice question to develop the ability to connect different aspects of periodicity within a single coherent exam response.

## Section 4

### Bonding and Structure

Chemical bonding and structure explain how atoms combine and how the resulting arrangements determine physical and chemical properties. This topic connects atomic structure to the macroscopic behaviour of materials through ionic, covalent, and metallic bonding models.

You must understand the formation of ionic, covalent, and metallic bonds, predict molecular shapes using VSEPR theory, explain intermolecular forces, and connect bonding and structure to properties such as melting point, solubility, and electrical conductivity.

These prompts build your ability to move between different levels of description — from electron-level bonding to molecular geometry to bulk physical properties — a multi-scale reasoning skill that IB Chemistry examiners test extensively.

#### **Prompt 35: Lewis Structure Drawing**

##### **Copy this prompt into your AI tool:**

*Ask me to draw Lewis structures for ten molecules and polyatomic ions of increasing complexity, including species with lone pairs, multiple bonds, and expanded octets. After each, check my electron count and ask me to identify any resonance structures. Include a species with an incomplete octet.*

##### **What this helps you practise:**

Drawing accurate Lewis structures for molecules and ions

##### **How to use it well:**

Lewis structures are the foundation for VSEPR

predictions — practise counting valence electrons carefully and distributing them to satisfy the octet rule.

### **Prompt 36: VSEPR Shape Prediction**

#### **Copy this prompt into your AI tool:**

*Present eight molecules and ions and ask me to draw the Lewis structure, determine the number of bonding and lone pairs around the central atom, predict the molecular geometry and bond angle using VSEPR theory. Include molecules with two, three, four, five, and six electron domains.*

#### **What this helps you practise:**

Predicting molecular shapes and bond angles using VSEPR theory

#### **How to use it well:**

VSEPR prediction follows a systematic process — practise the sequence of Lewis structure to electron domain count to geometry name for every common shape.

### **Prompt 37: Ionic Bonding and Properties**

#### **Copy this prompt into your AI tool:**

*Ask me to explain the formation of ionic bonds between metal and non-metal atoms, including electron transfer and lattice formation. Then present four properties of ionic compounds — melting point, solubility, conductivity, brittleness — and ask me to explain each in terms of ionic bonding and lattice structure.*

#### **What this helps you practise:**

Explaining ionic bond formation and linking to physical properties

#### **How to use it well:**

Property explanations must reference the ionic lattice structure — practise explaining each property

by describing what happens to the ions at the molecular level.

### **Prompt 38: Covalent Bonding and Molecular Properties**

**Copy this prompt into your AI tool:**

*Test me on distinguishing between polar and non-polar covalent bonds, then determine whether given molecules are polar or non-polar overall. For each molecule, ask me to explain how molecular geometry affects polarity. Include a molecule where bond dipoles cancel and one where they do not.*

**What this helps you practise:**

Distinguishing between polar and non-polar molecules

**How to use it well:**

Molecular polarity depends on both bond polarity and geometry — practise using symmetry arguments to determine overall molecular dipole moments.

### **Prompt 39: Intermolecular Forces Identification**

**Copy this prompt into your AI tool:**

*Present ten substances and ask me to identify the strongest intermolecular force present in each: London dispersion, dipole-dipole, or hydrogen bonding. Then ask me to use these forces to rank the substances by boiling point and explain the trend. Include a case where molecular mass overrides dipole effects.*

**What this helps you practise:**

Identifying intermolecular forces and predicting their effects on properties

**How to use it well:**

Intermolecular forces determine physical properties — practise the hierarchy of forces and understand when London dispersion forces dominate despite being individually weak.

## **Prompt 40: Metallic Bonding and Alloy Properties**

### **Copy this prompt into your AI tool:**

*Ask me to describe the metallic bonding model using delocalised electron theory and explain how it accounts for electrical conductivity, malleability, and thermal conductivity. Then ask me to explain how the introduction of different-sized atoms in alloys changes mechanical properties. Link to TOK by assessing whether bonding models are simplifications that distort reality or essential tools for constructing chemical knowledge — and how we decide when a model is 'good enough'.*

### **What this helps you practise:**

Explaining metallic bonding and alloy properties

### **How to use it well:**

Metallic bonding explanations require reference to the sea of delocalised electrons — practise precise descriptions of how this model explains each property.

## **Prompt 41: Giant Structures Comparison**

### **Copy this prompt into your AI tool:**

*Present four giant structures — ionic lattice, metallic lattice, giant covalent (diamond and graphite), and giant covalent (silicon dioxide) — and ask me to compare their melting points, hardness, electrical conductivity, and solubility. For each comparison, require an explanation based on structure and bonding.*

### **What this helps you practise:**

Comparing properties of different giant structural types

### **How to use it well:**

Giant structure comparison is a common Paper 2 question — practise constructing systematic

comparisons that explicitly connect structural features to observable properties.

### **Prompt 42: Hybridisation and Sigma/Pi Bonds**

#### **Copy this prompt into your AI tool:**

*Present molecules containing single, double, and triple bonds and ask me to identify the hybridisation of the central atom in each. Then ask me to determine the number of sigma and pi bonds. Include molecules where different carbon atoms have different hybridisations.*

#### **What this helps you practise:**

Determining hybridisation states and bond types in molecules

#### **How to use it well:**

HL students should practise linking hybridisation to molecular geometry —  $sp^3$  gives tetrahedral,  $sp^2$  gives trigonal planar, and  $sp$  gives linear arrangements.

### **Prompt 43: Bond Strength and Length Relationships**

#### **Copy this prompt into your AI tool:**

*Present pairs of bonds and ask me to predict which is stronger and which is shorter, justifying my answers. Include comparisons between single, double, and triple bonds of the same elements, and between bonds of different elements. Connect bond strength to reactivity.*

#### **What this helps you practise:**

Comparing bond strengths and lengths using periodic trends

#### **How to use it well:**

Bond energy data from the Data Booklet is used in enthalpy calculations — understanding the trends helps you predict values and check calculated answers for reasonableness.

#### **Prompt 44: Structure and Property Prediction**

##### **Copy this prompt into your AI tool:**

*Present me with an unfamiliar substance by its formula and ask me to predict its bonding type, structure, and physical properties. Then provide experimental data and ask me to evaluate whether my predictions were correct. Include substances that could be ambiguous between bonding types.*

##### **What this helps you practise:**

Predicting properties from formula and bonding analysis

##### **How to use it well:**

Prediction questions test deep understanding of bonding models — practise the reasoning chain from formula to bonding type to structure to expected properties.

#### **Prompt 45: Bonding and Structure Exam Question Synthesis**

##### **Copy this prompt into your AI tool:**

*Create an IB Paper 2 question that requires Lewis structures, VSEPR shape prediction, intermolecular force identification, and property explanation for a set of related compounds. Include a comparison component and a question requiring a diagram.*

*Mark my response against IB standards.*

##### **What this helps you practise:**

Completing multi-part bonding and structure exam questions

##### **How to use it well:**

Use this as an extended practice question to develop the ability to connect bonding theory to observable properties in the systematic way IB examiners reward.

## Section 5

### Energetics and Thermochemistry

Energetics explores the energy changes that accompany chemical reactions, quantified through enthalpy changes and explained through bond-breaking and bond-forming processes.

Understanding whether a reaction is exothermic or endothermic and being able to calculate enthalpy changes are core skills.

At SL, you must master calorimetry calculations, Hess's law applications, and bond enthalpy calculations. HL extends to Born-Haber cycles for ionic compounds, entropy, and Gibbs free energy, providing a complete thermodynamic picture of chemical spontaneity.

These prompts develop both your calculation skills and your conceptual understanding of energy changes, ensuring you can explain why reactions release or absorb energy and predict the spontaneity of chemical processes.

#### **Prompt 46: Enthalpy Change Calculations**

##### **Copy this prompt into your AI tool:**

*Present calorimetry data from three experiments — a neutralisation, a combustion, and a dissolution — and ask me to calculate the enthalpy change for each. Require me to state assumptions, use  $q = mc\Delta T$ , convert to molar quantities, and include appropriate signs. Check my significant figures.*

##### **What this helps you practise:**

Calculating enthalpy changes from calorimetry experimental data

##### **How to use it well:**

Calorimetry calculations appear on Paper 2 and in IA

work — practise the complete sequence from raw data to molar enthalpy change with clear unit handling.

### **Prompt 47: Hess's Law Applications**

#### **Copy this prompt into your AI tool:**

*Present a target reaction and a set of known enthalpy changes, then ask me to apply Hess's law to calculate the unknown enthalpy change. Include one problem using enthalpies of formation and one using enthalpies of combustion. Assess whether I correctly manipulate and combine the given equations.*

#### **What this helps you practise:**

Applying Hess's law to calculate enthalpy changes indirectly

#### **How to use it well:**

Hess's law problems require careful equation manipulation — practise reversing and scaling equations while remembering to adjust the enthalpy values accordingly.

### **Prompt 48: Bond Enthalpy Calculations**

#### **Copy this prompt into your AI tool:**

*Test me with a reaction and ask me to calculate the enthalpy change using mean bond enthalpies from the Data Booklet. Require me to draw structural formulae, identify all bonds broken and formed, and complete the calculation. Then ask me to explain why the calculated value differs from the experimental value.*

#### **What this helps you practise:**

Estimating enthalpy changes using mean bond enthalpies

#### **How to use it well:**

Bond enthalpy calculations require drawing out all

bonds — practise the systematic approach of listing every bond broken and formed to avoid omissions.

### **Prompt 49: Energy Profile Diagrams**

#### **Copy this prompt into your AI tool:**

*Ask me to draw and label energy profile diagrams for exothermic and endothermic reactions, showing reactant and product energy levels, activation energy, and enthalpy change. Then present a catalysed reaction and ask me to modify the diagram. Include a question about the Maxwell-Boltzmann distribution. At SL, calculate enthalpy changes using calorimetry data; at HL, apply Born-Haber cycles and lattice enthalpy comparisons to evaluate ionic bonding strength.*

#### **What this helps you practise:**

Drawing and interpreting energy profile diagrams

#### **How to use it well:**

Energy profile diagrams must be precisely labelled — practise including all required features and explaining what each part of the diagram represents physically.

### **Prompt 50: Born-Haber Cycle Construction**

#### **Copy this prompt into your AI tool:**

*Test me on constructing a Born-Haber cycle for a named ionic compound, labelling each step with the appropriate enthalpy term. Then provide all but one enthalpy value and ask me to calculate the missing one — typically lattice enthalpy. Assess my understanding of each energy step in the cycle.*

#### **What this helps you practise:**

Constructing Born-Haber cycles and calculating lattice enthalpies

#### **How to use it well:**

HL students should practise drawing Born-Haber cycles from scratch and in the correct energy

direction, as the sign conventions must be consistent throughout.

### **Prompt 51: Entropy and Spontaneity**

#### **Copy this prompt into your AI tool:**

*Present five reactions and ask me to predict the sign of the entropy change for each, justifying my prediction by considering changes in state, number of moles of gas, and molecular complexity. Then ask me to explain why some endothermic reactions occur spontaneously using the concept of entropy.*

#### **What this helps you practise:**

Predicting entropy changes and explaining spontaneity

#### **How to use it well:**

HL students must move beyond enthalpy alone — practise identifying the factors that determine entropy change and explaining spontaneity using Gibbs free energy.

### **Prompt 52: Gibbs Free Energy Calculations**

#### **Copy this prompt into your AI tool:**

*Present reactions with given enthalpy and entropy values and ask me to calculate the Gibbs free energy change at a specified temperature. Then ask me to determine the temperature at which a non-spontaneous reaction becomes spontaneous. Include a discussion of the limitations of thermodynamic predictions.*

#### **What this helps you practise:**

Calculating Gibbs free energy and predicting reaction spontaneity

#### **How to use it well:**

HL students should practise the  $\Delta G = \Delta H - T\Delta S$  equation and understand the four possible combinations of enthalpy and entropy signs and their implications.

**Prompt 53: Enthalpy of Formation Applications**

**Copy this prompt into your AI tool:**

*Ask me to define standard enthalpy of formation and use it to calculate the enthalpy change for three reactions using the formula  $\Delta H = \Sigma\Delta H_f(\text{products}) - \Sigma\Delta H_f(\text{reactants})$ . Include a reaction where the enthalpy of formation of an element in its standard state is zero and ask me to explain why.*

**What this helps you practise:**

Using enthalpies of formation to calculate reaction enthalpy changes

**How to use it well:**

The formation enthalpy method is often the most efficient Hess's law approach — practise it alongside the cycle method to have multiple strategies available.

**Prompt 54: Lattice Enthalpy and Ionic Compound Stability**

**Copy this prompt into your AI tool:**

*Present pairs of ionic compounds and ask me to predict which has the greater lattice enthalpy, justifying my answer in terms of ionic charge and radius. Then ask me to explain how lattice enthalpy relates to the melting point and solubility of ionic compounds.*

**What this helps you practise:**

Comparing lattice enthalpies and linking to ionic compound properties

**How to use it well:**

HL students should practise the charge-radius argument for lattice enthalpy trends, as this reasoning appears in both calculation and explanation questions.

## **Prompt 55: Thermochemistry Exam Question Synthesis**

### **Copy this prompt into your AI tool:**

*Design an IB Paper 2 style question that combines calorimetry data with Hess's law or Born-Haber cycle analysis. Include a calculation from experimental data, a Hess's law application, and a discussion of assumptions or limitations. Mark my response against IB standards.*

### **What this helps you practise:**

Completing multi-part thermochemistry exam questions under IB conditions

### **How to use it well:**

Use this as an extended practice question to develop the ability to connect experimental data to theoretical energy calculations in a coherent exam response.

## **Prompt 56: Energetics Conceptual Understanding**

### **Copy this prompt into your AI tool:**

*Present five statements about energetics and ask me to evaluate each as true or false. Include statements about the relationship between bond breaking and energy, the meaning of negative enthalpy changes, and common misconceptions about spontaneity and reaction rate. For each false statement, provide the correction.*

### **What this helps you practise:**

Identifying and correcting conceptual errors in thermochemistry

### **How to use it well:**

Conceptual clarity prevents errors in reasoning — use this prompt to ensure you understand the physics behind energy changes, not just the calculation methods.

## Section 6

### Chemical Kinetics and Equilibrium

Chemical kinetics studies the rates of chemical reactions and the factors that affect them, while equilibrium describes the dynamic balance reached in reversible reactions. Together, these topics explain both how fast reactions occur and how far they proceed.

You must understand collision theory, the effect of concentration, temperature, surface area, and catalysts on reaction rate, and the qualitative and quantitative treatment of equilibrium. HL students extend to rate expressions, the Arrhenius equation, and the equilibrium law with  $K_c$  calculations.

These prompts develop your ability to explain rate phenomena using particle-level reasoning and to apply equilibrium principles both qualitatively through Le Chatelier's principle and quantitatively through equilibrium constant calculations.

#### **Prompt 57: Collision Theory Explanations**

##### **Copy this prompt into your AI tool:**

*Present five changes to reaction conditions — increasing temperature, increasing concentration, adding a catalyst, decreasing volume of gases, and increasing surface area — and ask me to explain the effect on reaction rate using collision theory.*

*Require me to reference collision frequency and activation energy in each explanation.*

##### **What this helps you practise:**

Explaining rate changes using collision theory

##### **How to use it well:**

Collision theory explanations must reference both collision frequency and energy — practise

constructing complete explanations that include both factors for full marks.

---

**Prompt 58: Rate of Reaction Graphs**

**Copy this prompt into your AI tool:**

*Present concentration-time and volume-time graphs for reactions under different conditions and ask me to compare initial rates, identify when equilibrium is reached, and explain how changing conditions would alter the graph. Include a question about determining rate from the gradient of a tangent line.*

**What this helps you practise:**

Interpreting rate graphs and determining reaction rates

**How to use it well:**

Graph interpretation combines mathematical skills with chemistry knowledge — practise reading rate information from different graph types systematically.

---

**Prompt 59: Rate Expressions and Order of Reaction**

**Copy this prompt into your AI tool:**

*Present experimental rate data for a reaction and ask me to determine the order with respect to each reactant, write the rate expression, and calculate the rate constant with appropriate units. Then ask me to explain why the rate expression cannot be deduced from the stoichiometric equation alone.*

**What this helps you practise:**

Determining rate expressions from experimental data

**How to use it well:**

HL students should practise the systematic method of comparing experiments to find orders — this technique appears regularly on Paper 2.

## **Prompt 60: Le Chatelier's Principle Applications**

### **Copy this prompt into your AI tool:**

*Present a reversible reaction at equilibrium and apply five different changes: increasing concentration of a reactant, decreasing temperature for an exothermic reaction, increasing pressure, adding a catalyst, and removing a product. For each, ask me to predict the shift direction and explain the effect on equilibrium composition.*

### **What this helps you practise:**

Predicting equilibrium shifts using Le Chatelier's principle

### **How to use it well:**

Le Chatelier's principle appears on every IB Chemistry paper — practise precise predictions that distinguish between changes in position and changes in equilibrium constant.

## **Prompt 61: Equilibrium Constant Calculations**

### **Copy this prompt into your AI tool:**

*Present equilibrium concentration data and ask me to write the equilibrium expression and calculate  $K_c$ . Then give me initial concentrations and  $K_c$  and ask me to calculate equilibrium concentrations using an ICE table. Include a question about the units of  $K_c$  and what its magnitude indicates. SL students should explain factors affecting rate; HL students should additionally derive and apply rate expressions from experimental data and discuss the Arrhenius equation.*

### **What this helps you practise:**

Calculating equilibrium constants and using ICE tables

### **How to use it well:**

HL students should practise ICE table problems of increasing difficulty — start with simple cases and

progress to those requiring the quadratic formula or approximations.

### **Prompt 62: Arrhenius Equation and Activation Energy**

**Copy this prompt into your AI tool:**

*Present rate constant data at two temperatures and ask me to calculate the activation energy using the Arrhenius equation from the Data Booklet. Then ask me to explain the physical meaning of the pre-exponential factor and the relationship between the Arrhenius equation and collision theory.*

**What this helps you practise:**

Using the Arrhenius equation to determine activation energy

**How to use it well:**

HL students should practise both the two-point calculation and the graphical method of determining activation energy from  $\ln k$  versus  $1/T$  plots.

### **Prompt 63: Catalysis Mechanisms**

**Copy this prompt into your AI tool:**

*Challenge me to explain how catalysts increase reaction rate without being consumed, referencing activation energy and alternative reaction pathways.*

*Then present examples of homogeneous and heterogeneous catalysis and ask me to describe the mechanism of each. Include the role of catalysts in industrial processes.*

**What this helps you practise:**

Explaining catalytic mechanisms and their industrial significance

**How to use it well:**

Catalyst explanations must go beyond simply stating that activation energy is lowered — practise describing the alternative pathway that makes this possible.

### **Prompt 64: Reaction Mechanism and Rate-Determining Step**

**Copy this prompt into your AI tool:**

*Present a reaction mechanism with multiple elementary steps and ask me to identify the rate-determining step, write the overall equation, and deduce the rate expression from the mechanism. Then ask me to verify the mechanism is consistent with experimentally determined rate data.*

**What this helps you practise:**

Analysing reaction mechanisms and identifying rate-determining steps

**How to use it well:**

HL students should practise connecting mechanisms to rate expressions — the rate-determining step determines the form of the rate equation.

### **Prompt 65: Equilibrium and Industry**

**Copy this prompt into your AI tool:**

*Present the Haber process or Contact process and ask me to explain the choice of temperature, pressure, and catalyst in terms of kinetics and equilibrium. Then ask me to discuss the compromise conditions used industrially, explaining why maximum yield is not always the economic optimum.*

**What this helps you practise:**

Explaining industrial compromise conditions using kinetics and equilibrium

**How to use it well:**

Industrial chemistry questions combine kinetics with equilibrium analysis — practise discussing the conflict between rate and yield and how industry resolves it.

### **Prompt 66: Dynamic Equilibrium Conceptual Understanding**

**Copy this prompt into your AI tool:**

*Present five statements about dynamic equilibrium and ask me to evaluate each as true or false. Include misconceptions about reactions stopping at equilibrium, equal concentrations at equilibrium, and the effect of catalysts on equilibrium position.*

*For each false statement, provide a corrected explanation.*

**What this helps you practise:**

Identifying and correcting equilibrium misconceptions

**How to use it well:**

Common equilibrium misconceptions cost marks on Paper 1 — use this prompt to ensure you understand that equilibrium is dynamic and that concentrations need not be equal.

**Prompt 67: Kinetics and Equilibrium Exam Question Synthesis**

**Copy this prompt into your AI tool:**

*Construct an IB Paper 2 style question that combines rate analysis with equilibrium concepts in an industrial or laboratory context. Include a rate determination from data, a Le Chatelier's principle application, and an equilibrium constant calculation.*

*Mark my response against IB standards.*

**What this helps you practise:**

Completing integrated kinetics and equilibrium exam questions

**How to use it well:**

Use this as an extended practice question to develop the ability to apply both kinetic and thermodynamic reasoning to the same chemical system.

## Section 7

### Acids, Bases, and Redox

Acids, bases, and redox chemistry encompass two of the most important reaction types in chemistry. Understanding proton transfer (Bronsted-Lowry theory) and electron transfer (oxidation-reduction) provides a framework for analysing a vast range of chemical processes.

At SL, you must master pH calculations for strong acids and bases, identify conjugate acid-base pairs, assign oxidation states, and balance redox equations. HL extends to weak acid equilibria, buffer chemistry, pH curves, indicators, and electrochemical cells with electrode potentials.

These prompts develop both your calculation skills and your conceptual understanding of acid-base and redox processes, preparing you for the quantitative and explanatory questions that dominate this topic on Paper 2.

#### **Prompt 68: pH Calculations for Strong Acids and Bases**

**Copy this prompt into your AI tool:**

*Present five solutions of strong acids and bases with given concentrations and ask me to calculate the pH of each. Include a dilution problem and a mixing problem where I must determine the resulting pH. Require me to show the relationship between  $[H^+]$ ,  $[OH^-]$ , and  $K_w$  throughout.*

**What this helps you practise:**

Calculating pH for strong acids and bases

**How to use it well:**

pH calculations are fundamental — practise until

converting between concentration and pH in both directions is automatic and error-free.

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**Prompt 69: Bronsted-Lowry Acid-Base Theory**

**Copy this prompt into your AI tool:**

*Test me with acid-base reactions and ask me to identify the Bronsted-Lowry acid, base, conjugate acid, and conjugate base in each. Include an amphiprotic substance and a reaction in a non-aqueous solvent. Then ask me to explain the relationship between acid strength and conjugate base strength.*

**What this helps you practise:**

Identifying conjugate acid-base pairs in reactions

**How to use it well:**

Paper 1 frequently tests conjugate pair identification — practise recognising proton donors and acceptors in reactions that go beyond simple aqueous examples.

---

**Prompt 70: Weak Acid and Ka Calculations**

**Copy this prompt into your AI tool:**

*Present a weak acid with given  $K_a$  and concentration and ask me to calculate the pH, showing all steps including the quadratic or approximation method. Then give me pH data for a weak acid and ask me to calculate  $K_a$ . Assess whether I justify any approximations made.*

**What this helps you practise:**

Calculating pH of weak acids and determining  $K_a$  values

**How to use it well:**

HL students should practise both directions of  $K_a$ -pH calculations and understand when the approximation  $[HA]_0 \gg [H^+]$  is valid and when the quadratic is needed.

## **Prompt 71: Buffer Solution Chemistry**

### **Copy this prompt into your AI tool:**

*Test whether I can explain how buffer solutions resist changes in pH when small amounts of acid or base are added. Then present a buffer composition and ask me to calculate its pH using the Henderson-Hasselbalch equation. Include a problem where I must determine the buffer components needed for a target pH. At SL, identify acids, bases and calculate pH for strong acids; at HL, extend to buffer calculations, pH curves for weak acid–strong base titrations, and selecting appropriate indicators.*

### **What this helps you practise:**

Explaining buffer action and calculating buffer pH

### **How to use it well:**

HL buffer questions require both conceptual understanding and calculation — practise explaining the mechanism of buffering as well as applying the Henderson-Hasselbalch equation.

## **Prompt 72: Oxidation State Assignment**

### **Copy this prompt into your AI tool:**

*Present ten compounds and ions and ask me to determine the oxidation state of a specified element in each. Include species with elements in unusual oxidation states and polyatomic ions. Then present a reaction and ask me to identify which species is oxidised and which is reduced.*

### **What this helps you practise:**

Assigning oxidation states and identifying redox changes

### **How to use it well:**

Oxidation state assignment must be systematic — practise applying the rules in order of priority to handle complex species confidently.

## **Prompt 73: Balancing Redox Equations**

**Copy this prompt into your AI tool:**

*Present four unbalanced redox equations and ask me to balance each using the half-equation method in both acidic and basic conditions. For each, require me to identify the oxidation and reduction half-equations separately before combining them. Assess whether I correctly balance electrons, atoms, and charges. Extend into TOK by discussing the ethical responsibilities of chemists — considering examples such as chemical weapons, environmental pollutants, or pharmaceutical controversies — and whether scientific knowledge carries inherent moral obligations.*

**What this helps you practise:**

Balancing redox equations using the half-equation method

**How to use it well:**

The half-equation method is systematic and reliable — practise it step by step until you can balance complex redox equations efficiently under exam time pressure.

**Prompt 74: pH Curves and Indicators**

**Copy this prompt into your AI tool:**

*Ask me to sketch pH curves for strong acid-strong base, weak acid-strong base, and strong acid-weak base titrations. For each, ask me to identify the equivalence point pH, explain why it differs between titration types, and select an appropriate indicator from Data Booklet values.*

**What this helps you practise:**

Sketching pH curves and selecting appropriate indicators

**How to use it well:**

HL students should practise sketching all four titration curve types and matching indicators — the equivalence point pH determines indicator choice.

**Prompt 75: Electrochemical Cell Analysis**

**Copy this prompt into your AI tool:**

*Present a voltaic cell and ask me to identify the anode, cathode, direction of electron flow, and overall cell reaction. Then ask me to calculate the standard cell potential using electrode potential values from the Data Booklet. Include a question about the spontaneity of the cell reaction.*

**What this helps you practise:**

Analysing electrochemical cells and calculating cell potentials

**How to use it well:**

HL students should practise reading standard electrode potentials from the Data Booklet and applying  $E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$  consistently.

**Prompt 76: Electrolysis Calculations**

**Copy this prompt into your AI tool:**

*Set me an electrolysis challenge: present an electrolysis experiment and ask me to predict the products at each electrode, write electrode equations, and calculate the mass of product deposited using Faraday's laws. Include a question about the selective discharge of ions from a mixture.*

**What this helps you practise:**

Predicting electrolysis products and performing Faraday's law calculations

**How to use it well:**

Electrolysis combines redox chemistry with stoichiometry — practise the complete calculation from current and time to moles of electrons to mass of product.

**Prompt 77: Reactivity Series and Displacement**

**Copy this prompt into your AI tool:**

*Present the reactivity series and ask me to predict whether given displacement reactions will occur. Then give me experimental observations and ask me to deduce the relative positions of metals in the reactivity series. Connect the reactivity series to electrode potential values.*

**What this helps you practise:**

Predicting displacement reactions using the reactivity series

**How to use it well:**

Displacement predictions are tested on Paper 1 — practise using electrode potentials to make quantitative predictions about reaction feasibility.

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**Prompt 78: Acids Bases and Redox Exam**

**Question Synthesis**

**Copy this prompt into your AI tool:**

*Set me an IB Paper 2 style question that combines acid-base chemistry with redox analysis. Include a pH calculation, a titration curve interpretation, and an electrochemistry component. Mark my response against IB standards and identify areas for improvement.*

**What this helps you practise:**

Completing integrated acid-base and redox exam questions

**How to use it well:**

Use this as an extended practice question to develop the ability to connect proton transfer and electron transfer chemistry within a single exam response.

## Section 8

### Organic Chemistry

Organic chemistry studies the structure, properties, and reactions of carbon-based compounds. The IB course covers homologous series, functional groups, reaction mechanisms, and the analytical techniques used to identify organic compounds.

At SL, you must recognise and name members of the main homologous series, understand key reaction types (substitution, addition, elimination, condensation, oxidation), and predict products of organic reactions. HL extends to reaction mechanisms, stereoisomerism, and spectroscopic analysis using IR, mass spectrometry, and NMR.

These prompts build your ability to connect molecular structure to reactivity, predict reaction products, and interpret spectroscopic data — the core skills that IB Chemistry examiners assess in organic chemistry questions.

#### **Prompt 79: IUPAC Nomenclature Practice**

##### **Copy this prompt into your AI tool:**

*Present ten structural formulae of organic compounds from different homologous series and ask me to name each using IUPAC nomenclature. Then give me ten IUPAC names and ask me to draw the structural formulae. Include branched chains, functional group combinations, and positional isomers.*

##### **What this helps you practise:**

Naming and drawing organic compounds using IUPAC conventions

##### **How to use it well:**

Nomenclature is the language of organic chemistry

— practise until naming and drawing from names is automatic, as errors here cascade through reaction questions.

---

### **Prompt 80: Functional Group Identification**

#### **Copy this prompt into your AI tool:**

*Present structural formulae of ten organic compounds and ask me to identify all functional groups present in each. Then ask me to classify each compound by its homologous series and predict its characteristic chemical properties based on the functional groups identified.*

#### **What this helps you practise:**

Identifying functional groups and predicting chemical behaviour

#### **How to use it well:**

Functional group recognition is the key to predicting organic reactions — practise identifying groups in complex molecules with multiple functional groups.

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### **Prompt 81: Isomerism Types**

#### **Copy this prompt into your AI tool:**

*Give me a molecular formula and ask me to draw all structural isomers. Then present molecules and ask me to identify whether they exhibit geometric (cis-trans) isomerism or optical isomerism, explaining the structural requirements for each type. Include a molecule with a chiral centre.*

#### **What this helps you practise:**

Drawing structural isomers and identifying stereoisomerism

#### **How to use it well:**

Isomerism questions appear on Paper 1 and Paper 2 — practise systematic approaches to finding all structural isomers and identifying chiral centres.

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### **Prompt 82: Addition Reactions of Alkenes**

**Copy this prompt into your AI tool:**

*Present an alkene and ask me to predict the products of hydrogenation, halogenation, hydrohalogenation, and hydration reactions. For each reaction, ask me to name the product, state the reaction type, and identify the reagents and conditions required. Include Markovnikov's rule for unsymmetrical alkenes.*

**What this helps you practise:**

Predicting products of alkene addition reactions

**How to use it well:**

Alkene reactions are among the most tested organic topics — practise predicting products for each reaction type and understanding the conditions that determine selectivity.

---

**Prompt 83: Substitution and Elimination Reactions**

**Copy this prompt into your AI tool:**

*Present a haloalkane and ask me to predict the products of nucleophilic substitution (with  $\text{OH}^-$ ,  $\text{CN}^-$ , and  $\text{NH}_3$ ) and elimination reactions. Then ask me to explain the factors that favour substitution versus elimination, including the nature of the nucleophile and reaction conditions. SL students should identify functional groups and predict products of simple reactions; HL students should additionally apply reaction mechanisms including  $\text{SN1}$ ,  $\text{SN2}$ , and electrophilic addition with stereochemical considerations.*

**What this helps you practise:**

Predicting products of substitution and elimination reactions

**How to use it well:**

Understanding when substitution or elimination occurs is key to organic synthesis — practise

identifying the controlling factors for each reaction pathway.

### **Prompt 84: Reaction Mechanisms Drawing**

**Copy this prompt into your AI tool:**

*Ask me to draw the mechanism for an SN1 reaction, an SN2 reaction, and an electrophilic addition reaction using curly arrows to show electron pair movement. For each, evaluate whether my arrows start from the correct electron source and end at the correct electrophilic centre.*

**What this helps you practise:**

Drawing organic reaction mechanisms with curly arrows

**How to use it well:**

HL students must draw mechanisms correctly — practise the convention that curly arrows always flow from electron-rich regions to electron-poor regions.

### **Prompt 85: Oxidation of Alcohols**

**Copy this prompt into your AI tool:**

*Present primary, secondary, and tertiary alcohols and ask me to predict the products of oxidation with acidified potassium dichromate for each. Ask me to write balanced equations, identify the colour change observed, and explain why tertiary alcohols resist oxidation. Include the distinction between distillation and reflux conditions.*

**What this helps you practise:**

Predicting and explaining the oxidation products of different alcohols

**How to use it well:**

Alcohol oxidation is a key synthetic pathway — practise predicting products based on alcohol classification and understanding the role of experimental conditions.

### **Prompt 86: IR Spectroscopy Interpretation**

#### **Copy this prompt into your AI tool:**

*Present IR spectra for three organic compounds and ask me to identify the functional groups present by matching absorption peaks to the Data Booklet IR correlation table. Then give me a molecular formula and an IR spectrum and ask me to deduce the structure of the compound.*

#### **What this helps you practise:**

Interpreting IR spectra to identify functional groups

#### **How to use it well:**

HL students should practise reading IR spectra systematically, starting with the broad O-H or N-H peaks and working through the fingerprint region.

### **Prompt 87: NMR Spectroscopy Analysis**

#### **Copy this prompt into your AI tool:**

*Present a  $^1\text{H}$  NMR spectrum with integration ratios and splitting patterns for an unknown compound with a given molecular formula. Ask me to determine the number of distinct hydrogen environments, interpret the splitting pattern, and deduce the structure. Provide the Data Booklet chemical shift table.*

#### **What this helps you practise:**

Interpreting proton NMR spectra to determine molecular structure

#### **How to use it well:**

HL students should practise NMR interpretation using the three-step approach: count environments from integration, deduce neighbours from splitting, and match shifts to groups.

### **Prompt 88: Organic Synthesis Pathways**

#### **Copy this prompt into your AI tool:**

*Test me with a target molecule and a starting material and ask me to design a synthesis pathway using the reactions studied in the IB course. Require me to state each reagent and condition and identify the type of reaction at each step. Evaluate whether my pathway is efficient and whether I have chosen appropriate reactions.*

**What this helps you practise:**

Designing multi-step organic synthesis pathways

**How to use it well:**

Synthesis questions test your overview of organic reactions — practise working backwards from the target molecule to identify the required transformations.

**Prompt 89: Organic Chemistry Exam Question Synthesis**

**Copy this prompt into your AI tool:**

*Draft an IB Paper 2 style question that combines functional group chemistry with reaction prediction, mechanism drawing, and spectroscopic analysis.*

*Include a naming task, a product prediction, a mechanism for HL, and spectrum interpretation.*

*Mark my response against IB standards.*

**What this helps you practise:**

Completing multi-part organic chemistry exam questions

**How to use it well:**

Use this as an extended practice question to develop the ability to connect structural analysis, reaction chemistry, and analytical techniques in a single exam response.

## Section 9

### Practical Skills and Internal Assessment

The Internal Assessment (IA) is an individual scientific investigation worth 20% of your IB Chemistry grade, assessed against five criteria: Personal Engagement, Exploration, Analysis, Evaluation, and Communication. Strong practical skills developed throughout the course directly support your IA performance.

A successful chemistry IA requires a focused research question, a well-designed methodology with appropriate variable control, thorough data analysis including uncertainty propagation, critical evaluation of results and methodology, and clear scientific communication following IB conventions.

These prompts guide you through every stage of the IA process and build the broader practical skills — experimental design, safe laboratory practice, data collection and processing, and scientific writing — that support both your IA and Paper 3 data-based questions.

#### **Prompt 90: IA Topic Generation**

##### **Copy this prompt into your AI tool:**

*Ask me about my interests in chemistry and everyday chemical phenomena I find intriguing. Based on my responses, suggest five potential IA investigation topics that allow for quantitative data collection, meaningful chemical analysis, and demonstration of personal engagement. For each, outline the key variables and chemistry concepts involved.*

##### **What this helps you practise:**

Generating personally engaging IA topic ideas

### **How to use it well:**

Start here to find a topic where genuine interest drives the investigation — personal engagement must be authentic to score well on Criterion C.

### **Prompt 91: Research Question Development**

#### **Copy this prompt into your AI tool:**

*I will share my IA topic idea. Help me refine it into a focused, testable research question that allows for quantitative data collection and connects to IB Chemistry syllabus content. Evaluate whether the question is appropriately scoped for the time and resources available.*

#### **What this helps you practise:**

Crafting a focused and feasible IA research question

#### **How to use it well:**

A well-defined research question prevents scope creep — use this prompt to ensure your question is specific, measurable, and achievable within practical constraints.

### **Prompt 92: Experimental Design Review**

#### **Copy this prompt into your AI tool:**

*Test me on describing my planned IA experiment. Evaluate my experimental design for scientific validity: are variables correctly identified and controlled? Is the method reproducible? Are safety considerations addressed? Suggest improvements to strengthen the methodology and identify potential sources of error.*

#### **What this helps you practise:**

Designing valid and reproducible chemistry experiments

#### **How to use it well:**

Use this prompt before beginning data collection to catch design flaws that would compromise your results and be difficult to correct retrospectively.

### **Prompt 93: Data Processing Techniques**

#### **Copy this prompt into your AI tool:**

*Present raw chemistry data from a titration, rate, or calorimetry experiment and ask me to process it appropriately: calculate averages, propagate uncertainties, determine derived quantities, and describe how to construct an appropriate graph. Assess whether my data processing meets IB IA Analysis criterion standards.*

#### **What this helps you practise:**

Processing experimental data to IB IA standards

#### **How to use it well:**

Practise data processing with different experiment types to build the analytical skills that earn marks on the Analysis criterion across all chemistry IA topics.

### **Prompt 94: Uncertainty and Error Analysis**

#### **Copy this prompt into your AI tool:**

*I will describe my IA measurements and their uncertainties. Guide me through calculating percentage uncertainties, propagating them through my calculations, and determining the overall uncertainty in my result. Ask me to compare my result with a literature value and calculate the percentage error.*

#### **What this helps you practise:**

Performing thorough uncertainty analysis for IA investigations

#### **How to use it well:**

Uncertainty analysis distinguishes strong IAs from average ones — use this prompt to ensure your error propagation is mathematically correct and scientifically meaningful.

### **Prompt 95: IA Evaluation Criteria**

#### **Copy this prompt into your AI tool:**

*Present a set of hypothetical IA results with identified weaknesses and ask me to write an evaluation that addresses systematic and random errors, methodological limitations, and specific improvements. Grade my evaluation against the IB Evaluation criterion markband descriptors.*

**What this helps you practise:**

Writing critical IA evaluations that meet top markband descriptors

**How to use it well:**

The Evaluation criterion requires specific, actionable criticism — practise going beyond generic statements to connect particular weaknesses to particular improvements.

**Prompt 96: Scientific Report Writing**

**Copy this prompt into your AI tool:**

*Test me with a paragraph from a chemistry investigation report and ask me to improve its scientific communication quality. Test whether I can identify where chemical nomenclature is incorrect, where units are missing, and where the language should be more precise. Grade against Criterion E descriptors.*

**What this helps you practise:**

Writing with scientific precision in chemistry investigation reports

**How to use it well:**

The Communication criterion assesses the overall quality of your report — use this prompt to develop the formal, precise scientific writing style IB examiners expect.

**Prompt 97: Laboratory Safety Assessment**

**Copy this prompt into your AI tool:**

*Present five experimental procedures and ask me to identify the chemical hazards present in each, state*

*the appropriate safety precautions, and describe the correct disposal method for waste chemicals.*

*Include hazards related to concentrated acids, flammable solvents, and toxic substances.*

**What this helps you practise:**

Assessing chemical hazards and planning safety precautions

**How to use it well:**

Safety considerations must be addressed in your IA methodology — practise identifying hazards using GHS pictograms and referencing safety data sheets.

**Prompt 98: IA Draft Feedback Session**

**Copy this prompt into your AI tool:**

*I will share a section of my IA draft. Provide detailed feedback against all five IB IA criteria: Personal Engagement, Exploration, Analysis, Evaluation, and Communication. For each criterion, suggest specific improvements and estimate the current markband level.*

**What this helps you practise:**

Receiving structured feedback on IA chemistry investigation drafts

**How to use it well:**

Submit sections of your IA iteratively to refine each criterion before final submission — address the weakest criterion first for maximum mark improvement.

**Prompt 99: Data-Based Question Practice**

**Copy this prompt into your AI tool:**

*Simulate an HL Paper 3 data-based question by presenting unfamiliar experimental chemistry data.*

*Ask me to process the data, draw conclusions, evaluate the methodology, and suggest improvements. Include questions about graphical*

*analysis, uncertainty, and the validity of the experimental approach.*

**What this helps you practise:**

Completing Paper 3 data-based questions under exam conditions

**How to use it well:**

HL students should practise data-based questions regularly, as they test practical skills in written format using the same analytical framework as the IA.

**Prompt 100: IA Self-Assessment Checklist**

**Copy this prompt into your AI tool:**

*Present the five IB IA criteria with their top markband descriptors and ask me to self-assess my current IA draft against each one. For any criterion where I identify a gap, guide me to create an action plan with specific steps to reach the highest markband before submission.*

**What this helps you practise:**

Self-assessing IA work against IB markband descriptors

**How to use it well:**

Use this as a final quality check before submission to ensure every criterion has been addressed to the highest standard your investigation supports.

## **Final Closing Note**

You have now worked through 100 prompts designed to help you think more clearly, revise more effectively, and prepare more confidently for your GCSE.

Remember: the goal was never to rely on AI for answers. The goal was to use it as a tool to test, challenge, and strengthen your own understanding.

The strongest students are not those who avoid difficulty, but those who engage with it deliberately. Each mistake you identified, each explanation you improved, and each gap you filled has strengthened your thinking.

As you continue your studies, aim to depend less on prompts and more on your own judgement. AI can support you — but your reasoning, clarity, and persistence are what earn marks.

Approach your exams calmly. Think carefully. Write clearly.

You are more prepared than you think.

## Using AI Beyond This Book

The prompts in this book are starting points, not final forms.

As you grow more confident, begin modifying them:

- Add constraints (for example, “limit to three key points”).
- Increase difficulty gradually.
- Ask the AI to challenge your reasoning.
- Request alternative explanations.
- Ask it to critique your thinking rather than provide answers.

The most powerful use of AI is not asking it to tell you things — it is asking it to test and refine your thinking.

In the future, those who understand how to use tools intelligently will have an advantage. Treat AI as a tutor, not a shortcut. The skill of asking better questions will continue to matter long after your exams are over.

## **About the Author**

James R. Martin holds an MSci in Physics from the University of Bristol and a PGCE with a Physics focus from the University of Oxford. He has over a decade of experience teaching and tutoring students aged 11–18 across a range of subjects, including Physics, Biology, Chemistry, Mathematics, Economics, and Electronics.

He has worked with multiple syllabi, including GCSE, A-Level, KS3, and the International Baccalaureate Diploma Programme (IBDP), supporting students of varying abilities to develop clarity, confidence, and exam success.

His work focuses on effective revision strategies, independent thinking, and the responsible use of artificial intelligence as a tool to strengthen — not replace — understanding.

## **Other Titles in This Series**

The *100 AI Prompts for Smarter Revision* series supports students across GCSE, A-Level, and IB DP subjects.

### **GCSE**

- English Language
- English Literature
- Mathematics
- Physics
- Biology
- Chemistry
- Geography
- History
- Computer Science
- Economics
- Business Studies
- Religious Studies
- Psychology
- French
- Spanish
- German

### **A-Level**

- Mathematics
- Further Mathematics
- Physics
- Chemistry
- Biology
- Economics
- History
- Geography
- English Literature
- Psychology
- Computer Science

- Politics
- Business

**IBDP**

- Mathematics: Analysis & Approaches
- Mathematics: Applications & Interpretation
- Physics
- Chemistry
- Biology
- Economics
- Geography
- History
- English A: Literature
- English A: Language & Literature
- Psychology
- Business Management
- Computer Science