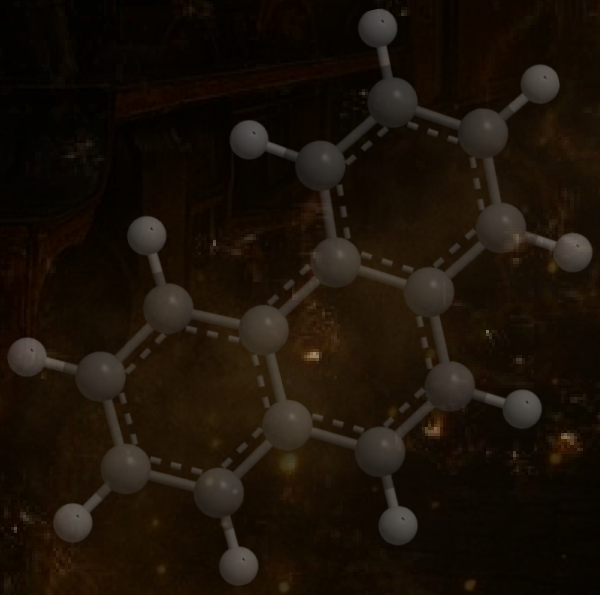
ILLUMINATIO



STUDY GUIDE

Round 1

Embark on a meticulous expedition into the domain of Quantitative Solution Analysis with Round 1. Can you channel your mathematical precision to unveil the hidden figures concealed within uniform liquids, pushing the boundaries of analytical accuracy? In the silent merging of substances, the laws of proportion disclose their secrets, providing invaluable insights into the fundamental rules governing the precise combination of matter. Are you bold enough to explore undefined mixtures, challenging the limits of experimental exactness as you strive to illuminate the true strength of the molecular landscape.

Content You Are Expected to Know: (The scope is intentionally broad. Not all topics will appear)

- **Indicator Theory & pH Graphs:** The pH Story When you slowly add a Strong Base to a Weak Acid, the pH doesn't go up in a straight line.
- **Volumetric Analysis:** Students are required to demonstrate a comprehensive understanding of the fundamental principles of titration, its essential experimental components, and the broader scope of related analytical topics.
- **Stoichiometry:** It focuses on using balanced equations to relate quantities of substances in a reaction, allowing precise calculation of what is required and produced. It links simple particle ratios to measurable amounts used in practical chemical work.
- **Redox Reaction:** A redox reaction entails the transfer of electrons between two entities, resulting in simultaneous oxidation and reduction processes. In essence, one species loses electrons while the other gains them.
- **Separation Techniques:** It encompasses the physical methods employed to isolate distinct constituents from a mixture. Students are required to demonstrate proficiency in the various methodologies used to achieve this separation.
- **Reaction Kinetics:** It examines the rate at which chemical reactions proceed and the factors that influence this rate, including concentration and temperature. It provides a systematic understanding of how molecular interactions and energy requirements govern the progression of reactions.
- **Dilution:** Students are required to demonstrate proficiency in the Methodologies of Solution Preparation and Dilution.

The attached links can serve as useful references for guidance and further understanding:

- https://youtu.be/dLNsPqDGzms?si=X88ACxiPZREXbnnv
- https://youtu.be/5rtJdjas-mY?si=s_stILv0tYIjbQ08
- https://www.youtube.com/watch?v=IY_-0E1VjrQ&t=1s
- https://studymind.co.uk/notes/titrations/?utm_source=chatgpt.com
- https://www.khanacademy.org/science/chemistry/chem-kinetics
- https://dn790008.ca.archive.org/0/items/chem-7-zumdahl/Zumdahl_Text.pdf
- https://ghostwriter144.neocities.org/img/scienceChemistryTheCentralScience12th.pdf

ROUND 2

Content You Are Expected to Know:

- **Electrochemistry:** General ideas of electrochemical processes and how chemical reactions relate to electrical output.
- **Redox reactions:** Principles of oxidation–reduction changes and overall electron flow.
- **Energetics / Thermodynamics:** How energy considerations influence reaction direction and feasibility.
- **Chemical Equilibrium:** How reversible reactions reach balance and respond to environmental changes.
- **Reactivity series of metals:** Broad trends in metal behavior and displacement tendencies.
- **Chemical Bonding & Stoichiometry:** Ionic, covalent, hybridization, metallic bonding, VSEPR theory, intermolecular forces, mole calculations, limiting reagents, and percentage yield.
- **History of the Atom & Nuclear Chemistry:** Key atomic models (Dalton to quantum), subatomic particles, isotopes, radioactive decay, half-life, and basic nuclear reactions. Be familiar with the names of relevant scientists and the discoveries accredited to them.
- **Organic Chemistry:** Functional groups, reaction types, mechanisms, isomerism, and naming conventions—core concepts that appear frequently in O/A Levels.
- **Kinetics:** Factors influencing reaction rates and observable changes.
- Chemical cells: Essential principles of their operation and the variables affecting their performance.
- **Practical Cell Construction:** Ability to assemble simple electrochemical cells, choose electrode–electrolyte pairs, interpret voltage output, and reason about practical deviations.
- **General Preparation Resources:** This section provides high-quality, principle-centered preparation pathways for the competition. Focus on mechanisms, reasoning, and experimental interpretation rather than memorization.

1. Core Theory & Conceptual Mastery

Participants should be able to connect theory with unfamiliar contexts and experimental nuance, especially under time pressure.

Khan Academy — Chemistry

Electrochemistry, redox processes, equilibrium, thermodynamics, kinetics

Develop strong conceptual intuition — not just recall.

ChemLibreTexts

Detailed explanations bridging theory and observed behavior

Particularly helpful for:

- Cell potentials and spontaneity
- Energetics vs kinetics
- Corrosion mechanisms and prevention

Save my exams
Covers a broad range of topics mentioned above in a concise manner.

Cambridge International AS & A Level Chemistry Textbooks
Serve as the baseline reference. Participants are expected to apply these fundamentals in new or modified scenarios.
Book Link: Chemistry

2. Electrochemical Cells & Demonstrations
Practical understanding of electrochemical cells and real-world deviations from theory is essential. The links below illustrate hands-on setups, measurements, and conceptual reasoning.
Demonstration Videos:
- https://youtu.be/8NCoTWfLzPU?si=eBwi3DDgQVrix5bh
- https://youtu.be/8V3OY5cqQyg?si=3ublhlQ5hzy1Eul0
- https://youtu.be/8gTA4hiNQgs?si=N-AGY1VJoIKIPwci
- https://youtu.be/H_ycVfQl8zU?si=WTpE3n3mp77pzzeb
- https://youtu.be/AdAU3WUwYvY?si=RRXQaUK8STNk9z6o

Watch with a focus on:
- Construction and interpretation of simple galvanic cells
- Measurement of voltage and identification of real-life deviations from theoretical predictions
- Effects of electrode choice, electrolyte concentration, and internal cell resistance
- Connections between electron flow, energy changes, and observable output
- Understanding these demonstrations will help you analyze unseen experimental setups and reason about performance differences relative to ideal models.

3. Organic Functional Group Identification (Video Playlist)
Real chemistry problems often embed tests within mixed-information contexts, requiring careful interpretation.
Identification Test Demonstration Playlist (YouTube):
- https://youtu.be/1frcZAUCBTY?si=Mn7PWzKaxwfaIAyr (playlist)

Playlist covers:
- Key functional group tests
- Carbonyl identification (including differentiation of aldehydes and ketones)
- Iodoform test logic
- Alcohol vs alkene vs carbonyl test interpretation
- Colour changes, precipitate formation, and logical deduction
- Approach these videos with an eye toward reasoning from observation to structure or functional group, not rote memorization of results.

Preparation Philosophy
- This round rewards chemical intuition, experimental insight, and flexible reasoning. Expect unfamiliar contexts, rapid-fire questions and modified setups. Success will come from connecting core principles — electron flow, energy landscapes, reaction mechanisms, and observation interpretation — across topics.