STUDYWALKS · COURSE SYLLABUS

Chemistry — High School Course with CLEP Preparation

Chemistry explains what matter is made of and how it changes.

CREDIT LABEL	HOURS GOAL	STUDYWALKS LEARNING HOURS	SUGGESTED OFFLINE HOURS
1.0 credit	**120 h**	**29.5 h**	**90.5 h**
high school, with the study plan	the 1.0-credit convention	measured runtime plus assessment time	reading, review and writing

29.5 h StudyWalks (6.3 h of lessons, 18 h of lectures, 5.3 h of quizzes and exams) + **90.5 h** suggested offline study = **120 h**. 665 lessons in 12 units; prepares for the CLEP Chemistry exam.

High school credit is granted by the homeschool parent under the state's rules. StudyWalks supplies the record: hours, scores and this syllabus. The credit label is a suggestion; the parent makes the final call.

Course contents

Unit	Title and lecture topics	Lessons	Lecture
1	**Essential Ideas: Matter, Measurement, and Uncertainty** What chemistry studies, and how · Hypothesis, theory, law · The three domains · Matter, and its states · Mass, weight, and what is conserved · Pure substances: element and compound · Mixtures, and the two kinds · The smallest units · Property and change, twice over · Properties that scale, and properties that do not · Two labels built out of properties · What a measurement is made of · Base units, defined by constants · From base unit to bench quantity · Three measurements carried out · Which numbers carry uncertainty · Counting them, and the zero problem · Two rules that count different things · Two words that are not synonyms · Carrying the units through · One step, then several, then all of it	57	1 h 33 min (3 parts)
2	**Atoms, Molecules, and Ions** Three laws, before any particle · Finding the pieces · The three particles · Naming and counting · Two ways an atom can vary · Two kinds of ion · Weighing an atom · Where those numbers come from · Three ways to write a compound · Two things a formula does not tell you · The table's origin and its law · Reading the table · Two kinds of bond · What charge an ion carries · Building an ionic formula · Naming ionic compounds · Naming molecular compounds · Naming acids · The whole analysis	56	1 h 29 min (3 parts)
3	**Composition, Solutions, and Stoichiometry** Formula mass and the mole · Two conversions that chain · From composition to formula · Solutions and molarity · Two properties that vary independently · Dilution · Four more concentration units · Writing and balancing · Three ways to write one reaction · Solubility and precipitation · Acids and bases · Tracking electrons · Redox reactions · Which kind is it · What a balanced equation gives you · Which reactant runs out · Ceiling and reality · Measuring an unknown concentration · Two analytical methods · The whole analysis	54	1 h 34 min (3 parts)

Unit	Title and lecture topics	Lessons	Lecture
4	**Thermochemistry** What energy is · Heat, temperature, and where the boundary sits · Heat capacity · Calorimetry · The bomb calorimeter · The first law, state functions, and enthalpy · Thermochemical equations · Standard state, and combustion · Formation enthalpies · Hess's law · The summation form, and the capstone	36	1 h 3 min (2 parts)
5	**Electronic Structure and Periodic Properties** Describing a wave · Where classical physics broke · Line spectra, and the Bohr model · Matter waves, and a limit on knowing · The quantum model, and the orbital · The four quantum numbers · Orbital shapes · Three rules for filling · Writing it down · Reading the table · Effective nuclear charge, and the trends it drives	48	1 h 7 min (2 parts)
6	**Chemical Bonding and Molecular Geometry** Two ways to bond · Polarity as a continuum · Lewis structures · When the octet does not hold, and formal charge · Resonance · Bond properties, and two energies · VSEPR, and two geometries · Two, three and four domains · Five and six domains, and assigning one · What shape does to polarity · One molecule, end to end · Valence bond theory · Hybridization · Multiple bonds, and what they cost · Molecular orbital theory · Magnetism, domains, and one molecule twice	58	1 h 29 min (3 parts)
7	**Gases** Pressure, and its units · Measuring pressure · The four gas laws · The ideal gas law · STP, and standard molar volume · Density, molar mass, and mixtures · Gas stoichiometry · Molecules in motion · Graham's law · Kinetic-molecular theory · Real gases	45	1 h 9 min (2 parts)
8	**Liquids, Solids, Solutions, and Colloids** What sets a phase, and two kinds of force · The three intermolecular forces · What intermolecular forces do to a liquid · Vapour pressure, and boiling · Phase changes, and their energies · Phase diagrams · Four kinds of solid · Defects, and the repeating unit · The three cubic cells · Ionic cells, and one substance traced · How dissolution works · Electrolytes, and how much dissolves · What changes solubility · Colligative properties, and the concentration they use · The four colligative effects · The electrolyte correction, colloids, and one solution traced	64	1 h 35 min (3 parts)
9	**Kinetics** What a reaction rate is · What changes a rate · Rate laws, and where they come from · Integrated rate laws · Half-life · Why reactions have rates at all · Temperature, quantified · Mechanisms · The slow step, and deriving a rate law · Catalysis, and one reaction traced	43	1 h 3 min (2 parts)
10	**Equilibrium: Fundamentals, Acids and Bases, and Solubility** What equilibrium is · The equilibrium constant · Q, and what it predicts · Solving equilibrium problems · Le Châtelier, as a consequence · Three definitions of an acid · Water, and the pH scale · Strong acids and bases · Weak acids and bases · Polyprotic acids, and salts · Indicators, and titration · Buffers · Two capstones on acid-base equilibrium · The solubility product · Precipitation, predicted and directed · Complex ions, and the unit's close	67	1 h 46 min (3 parts)
11	**Thermodynamics and Electrochemistry** What spontaneity means · What entropy is · What raises entropy · The second and third laws · Gibbs free energy · Free energy from tables · Free energy, Q, and K · Redox, revisited · The galvanic cell · Cell potential and its reference · Reading the potential · Potential, free energy, and K · Nonstandard conditions, and the capstone · Batteries and fuel cells · Corrosion, and defending against it · Running the cell backwards · One couple, three cells	58	1 h 56 min (4 parts)

Unit	Title and lecture topics	Lessons	Lecture
12	**Descriptive, Organic, and Nuclear Chemistry** Reading the table · The reactive metals · Oxidation state, and its exception · The boundary · How nonmetals bond and behave · Structure, and hydrogen's two homes · Nitrogen, oxygen, and sulfur · Predicting an oxidation state · The halogens and the noble gases · The periodic capstone · What a transition metal is · Coordination compounds · Two kinds of isomerism · Crystal field splitting · Colour, and the capstone · Carbon, and the saturated chain · Multiple bonds · Two reaction types · Functional groups built on oxygen · Functional groups built on nitrogen · Oxidation level, and the capstone · The nucleus, counted and weighed · Stability, and the decay modes · Decay over time · Fission, fusion, and the reactor · Radiation and biology · The closing capstone	79	2 h 32 min (5 parts)

Assessment and grading

- **Unit quizzes.** 12 quizzes, 10 questions each, checked as the student goes, each answer with the lesson to review. Untimed; retakes are unlimited.
- **Mid exam.** 50 questions on units 1–6, drawn fresh each time and scored at the end with a breakdown by content area. Untimed; retakes are unlimited.
- **Final exam.** 75 questions, 90 minutes, on the whole course. Scored 20–80; 50 passes (50 of 75 correct, about 67%). Retakes are unlimited with a 24-hour wait, each a fresh draw.

Suggested composite grade

Part	Weight
Unit quizzes (average of best scores)	20%
Mid exam (best score)	20%
Final exam (percent correct)	60%

Suggested letter scale

Letter	Composite
A	90–100
B	80–89
C	70–79
D	60–69
F	below 60

Suggested; the parent sets the grade. A passing final is the completion standard for the course record.

Study plan

The 90.5 offline hours are spread over the units in proportion to each unit's StudyWalks time. For each unit: read the matching sections of *Chemistry 2e (OpenStax); General Chemistry: Principles, Patterns, and Applications*, review the unit quiz misses, and write a one-page unit summary. Log the time as you go.

Unit	Title	StudyWalks	Offline, suggested	Unit total
1	Essential Ideas: Matter, Measurement, and Uncertainty	2 h 5 min	7 h 40 min	9 h 45 min
Lessons and lectures		**24 h 34 min**	**90 h 30 min**	**115 h 4 min**
Quizzes, mid exam and final (stated time)		**5 h 18 min**	**—**	**5 h 18 min**

Unit	Title	StudyWalks	Offline, suggested	Unit total
2	Atoms, Molecules, and Ions	2 h 1 min	7 h 25 min	9 h 26 min
3	Composition, Solutions, and Stoichiometry	2 h 5 min	7 h 40 min	9 h 45 min
4	Thermochemistry	1 h 23 min	5 h 5 min	6 h 28 min
5	Electronic Structure and Periodic Properties	1 h 34 min	5 h 45 min	7 h 19 min
6	Chemical Bonding and Molecular Geometry	2 h 2 min	7 h 30 min	9 h 32 min
7	Gases	1 h 35 min	5 h 50 min	7 h 25 min
8	Liquids, Solids, Solutions, and Colloids	2 h 11 min	8 h 5 min	10 h 16 min
9	Kinetics	1 h 27 min	5 h 20 min	6 h 47 min
10	Equilibrium: Fundamentals, Acids and Bases, and Solubility	2 h 25 min	8 h 55 min	11 h 20 min
11	Thermodynamics and Electrochemistry	2 h 29 min	9 h 10 min	11 h 39 min
12	Descriptive, Organic, and Nuclear Chemistry	3 h 17 min	12 h 5 min	15 h 22 min
Lessons and lectures		**24 h 34 min**	**90 h 30 min**	**115 h 4 min**
Quizzes, mid exam and final (stated time)		**5 h 18 min**	—	**5 h 18 min**

Unit times are the unit's lecture runtime plus its lessons at the course's measured average lesson length; totals can differ from the learning hours by rounding.

Sources

- **Anchor:** OpenStax, *Chemistry 2e* (Flowers, Theopold, Langley & Robinson). Web edition, revision dated February 14, 2019. Twenty-one chapters. CC BY-NC-SA 4.0
- **Secondary witness:** Averill & Eldredge, *General Chemistry: Principles, Patterns, and Applications* (Saylor Foundation / Open Textbook Library). Independently authored, of non-OpenStax lineage. CC BY-NC-SA

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