STUDYWALKS · COURSE SYLLABUS

Natural Sciences — High School Course with CLEP Preparation

Natural Sciences is the science a general-education requirement asks of a student who is not a science major: half biology, from cells and genes to evolution and ecology, and half physical science, from atoms and reactions to motion, energy, the stars and the Earth. This course works through each idea one lesson at a time, with every worked number checked.

CREDIT LABEL	HOURS GOAL	STUDYWALKS LEARNING HOURS	SUGGESTED OFFLINE HOURS
1.0 credit	**120 h**	**48 h**	**72 h**
high school, with the study plan	the 1.0-credit convention	measured runtime plus assessment time	reading, review and writing

48 h StudyWalks (12.2 h of lessons, 23.8 h of lectures, 11.8 h of quizzes and exams) + **72 h** suggested offline study = **120 h**. 860 lessons in 37 units; prepares for the CLEP Natural Sciences 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	**Getting Ready: The Exam and the Nature of Science** The Exam Itself · What Counts as Science · The Method and the Experiment · Theories, Models and the Scientific Community · Units and Numbers · Judging and Reading Data · Evidence Over Authority	26	44 min (2 parts)
2	**The Chemistry of Life** Atoms and Isotopes · Bonds · Water and pH · The Molecules of Life	23	32 min
3	**Cell Structure and Function** Cells and How We See Them · Two Kinds of Cells · Inside the Eukaryotic Cell · The Remaining Organelles · The Membrane and Transport · One Cell at Work	24	41 min (2 parts)
4	**Bioenergetics: Energy, Enzymes and Cellular Respiration** Energy and Its Laws · Enzymes · Aerobic Respiration · Without Oxygen, and Other Fuels	22	32 min
5	**Photosynthesis** Who Photosynthesizes, and Where · Light Into Chemical Energy · Building the Sugar · Testing and Linking	14	24 min
6	**Cell Division: Mitosis and Meiosis** What Divides · The Cell Cycle and Mitosis · Fission and Reproduction · Meiosis	18	27 min
7	**Patterns of Heredity** Mendel's Peas and His Cross · The Words of Heredity · Predicting a One-Gene Cross · Testing Genotypes and Adding a Second Gene · Beyond Simple Dominance · Genes on the X · When Genes Do Not Act Alone · Errors in Chromosome Number · The Whole Unit in One Problem	24	45 min (2 parts)

Unit	Title and lecture topics	Lessons	Lecture
8	**The Chemical Nature of the Gene: DNA, Replication and Protein Synthesis** The Structure of DNA · Copying and Repairing DNA · From Gene to Protein · Controlling Genes, and the Whole Unit	24	33 min
9	**Biotechnology and Genomics** Sorting and Copying DNA · Cloning Genes and Animals · Changing Organisms and People · Whole Genomes, Whole Proteomes, One Project	12	22 min
10	**Evolution: Natural Selection and Its Evidence** The Idea and Its History · How Natural Selection Works · Divergence, Convergence and Shared Structure · The Lines of Evidence · Evolution in Numbers · The Forces That Move Frequencies · Three Misconceptions · The Whole Unit on One Island	28	45 min (2 parts)
11	**Speciation and the History of Life** What Makes a Species · How New Species Form · The Earliest Life · Fossils and Deep Time · Life Through the Eras, and One Canyon	20	31 min
12	**Classification and the Tree of Life** Naming and Ranking Life · Reading a Tree · Building a Tree · A Web, and a New Find	17	27 min
13	**Microbes, Protists and Fungi** Three Domains and the Prokaryotic Cell · How Prokaryotes Live · Viruses · Protists · Fungi and the Pond	22	33 min
14	**Plants: Diversity, Structure and Reproduction** Plants and the Move to Land · Sorting the Land Plants · Seeds and Naked Seeds · The Flowering Plants	23	32 min
15	**Animal Diversity** What Makes an Animal · Reading a Body Plan · The First Invertebrate Phyla · Shells, Segments and Tube Feet · Chordates and the Move to Land · Making Their Own Heat	24	39 min (2 parts)
16	**Body Systems I: Homeostasis, Digestion, Circulation, Respiration and Excretion** Organization and the Feedback Loop · Heat, Sugar and Amplification · Digestion · The Pump and Its Pipes · Blood and Its Circuits · Air and Breathing · Water Balance and the Race	24	40 min (2 parts)
17	**Body Systems II: Nervous, Endocrine, Musculoskeletal and Immune** The Signal in a Neuron · The Nervous System's Map · Hormones · The Frame · Muscle · Innate and Adaptive Defense · Memory, Disorders and the Fall	24	41 min (2 parts)
18	**Reproduction and Development** Ways to Make Offspring · The Organs and the Gametes · Hormones and Cycles · From Zygote to Newborn	16	26 min
19	**Populations and Communities** Counting a Population · Who Dies, and When · Two Models of Growth · What Holds Growth Back · Life Histories and the Human Population · Predators, Prey and Defenses · Competition and Partnership · Rebuilding and the Whole Unit	24	41 min (2 parts)
20	**Ecosystems, the Biosphere and Conservation** Who Eats Whom · Energy Up the Levels · Water and Carbon · Nitrogen and Phosphorus · Acid Rain and the Land Biomes · Life in Water · Biodiversity Under Pressure · Protection and the Whole Unit	26	44 min (2 parts)

Unit	Title and lecture topics	Lessons	Lecture
21	**Atoms and the Periodic Table** From an Idea to a Nucleus · The Particles and Their Counts · Isotopes, Ions and Averages · Atoms and Light · Where the Electrons Are · The Table · Reading the Trends · One Element, the Whole Unit	27	44 min (2 parts)
22	**Nuclear Reactions and Elementary Particles** The Nucleus and Its Stability · The Ways a Nucleus Decays · Half-Life and Dating · Mass Into Energy · Splitting Heavy Nuclei · Fusion and Radiation at Work · Forces and Their Carriers · The Particles · One Sample, Every Idea	25	46 min (2 parts)
23	**Chemical Bonding and Molecular Structure** Sorting Matter · Ions and the Ionic Bond · Sharing Electrons · Pull and Shape · Shape and Polarity · Forces Between Molecules · Metals and Names · One Bench of Substances	27	46 min (2 parts)
24	**Chemical Reactions** Changes and Equations · Counting by the Mole · Patterns of Reaction · Acids and Bases · Measuring Acidity · Energy and Rate · Equilibrium · Solutions and Carbon Compounds · A Camp Stove	29	50 min (2 parts)
25	**Motion and Forces** Where and Which Way · Speed, Velocity and Acceleration · Falling and Graphing · Two Directions at Once · Toward Causes · The Second Law · Forces in Pairs · Balance and Resistance · Circles and Gravity · One Sled	28	48 min (2 parts)
26	**Energy, Momentum and Fluids** Work · Energy and Its Conservation · Power, Efficiency and Resources · Momentum · Fluids, and the Water Slide	22	35 min
27	**Heat, Thermodynamics and States of Matter** Temperature and Its Scales · States of Matter and Expansion · The Behavior of Gases · Heat, Specific Heat and Latent Heat · Phase Changes and Phase Diagrams · Three Ways Heat Travels · The Laws of Thermodynamics · The Unit in One Scenario	28	50 min (2 parts)
28	**Relativity and the Quantum** Frames and Postulates · Time, Length and the Speed Limit · Mass, Energy and Gravity · The Quantum · The Unit in One Scenario	15	28 min
29	**Electricity and Magnetism** Electric Charge · Force, Field and Voltage · Current and Circuits · Magnetism · Induction and Its Machines	21	32 min
30	**Waves, Sound and Light** How Waves Behave · Sound · Light as an Electromagnetic Wave · Optics	21	34 min
31	**The Sky, Gravity and the Solar System** The Sky We See · From Earth-Centered to Sun-Centered · Kepler, Newton and Orbits · Earth, Moon and Sun · The Solar System and Its Two Families · The Rocky Worlds · The Giant Planets · The Small Bodies · Origins and the Whole Unit	30	49 min (2 parts)
32	**Stars, Galaxies and the Universe** Light and the Spectrum · Reading Starlight · The Sun · Measuring and Sorting Stars · Where Stars Come From · How Stars Live and Die · Galaxies · The Expanding Universe · The Unit in One Scenario	30	53 min (2 parts)

Unit	Title and lecture topics	Lessons	Lecture
33	**Earth's Interior, Plate Tectonics, Earthquakes and Volcanoes** Earth's Layers and the Waves That Reveal Them · Heat, Magnetism and Floating Crust · Minerals and Rocks · From Drift to Plates · Hot Spots and Plate Forces · Stress, Folds and Faults · Earthquakes · Magma and Volcanoes · The Unit in One Scenario	28	50 min (2 parts)
34	**Rocks, Surface Processes and Earth History** The Rock Cycle and Igneous Rock · Weathering and Soil · Sediment and Sedimentary Rock · Metamorphic Rock · Water and Gravity at Work · Ice, Waves and Wind · Putting Events in Order · Ages in Years and Earth's Story · The Unit in One Scenario	28	47 min (2 parts)
35	**The Atmosphere, Weather and Climate** What Air Is · The Layers of the Atmosphere · Energy In and Out · Water in the Air · Pressure and Wind · Air Masses and Fronts · Storms · Climate and Its Change · The Unit in One Scenario	28	49 min (2 parts)
36	**The Hydrosphere, Resources and the Environment** Earth's Water and Its Cycle · The Ocean Basin and Seawater · The Moving Ocean · Groundwater · Polluting Water · Resources From the Earth · Acid Rain and Overharvesting · The Unit in One Scenario	24	42 min (2 parts)
37	**Mixed Problems and Capstone** Reading the Exam · Processes That Cross the Sciences · Methods and Data · Single Steps Inside Larger Questions · The Whole Course in One Scenario	14	29 min

Assessment and grading

- **Unit quizzes.** 37 quizzes, 10 questions each, checked as the student goes, each answer with the lesson to review. Untimed; retakes are unlimited.
- **Mid exam.** 60 questions on units 1–19, drawn fresh each time and scored at the end with a breakdown by content area. Untimed; retakes are unlimited.
- **Final exam.** 120 questions, 90 minutes, on the whole course. Scored 20–80; 50 passes (80 of 120 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 72 offline hours are spread over the units in proportion to each unit's StudyWalks time. For each unit: read the matching sections of *Concepts of Biology (OpenStax); Chemistry 2e (OpenStax); College Physics 2e (OpenStax)*, 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	Getting Ready: The Exam and the Nature of Science	1 h 7 min	2 h 15 min	3 h 22 min
2	The Chemistry of Life	51 min	1 h 40 min	2 h 31 min
3	Cell Structure and Function	1 h 1 min	2 h	3 h 1 min
4	Bioenergetics: Energy, Enzymes and Cellular Respiration	50 min	1 h 40 min	2 h 30 min
5	Photosynthesis	35 min	1 h 10 min	1 h 45 min
6	Cell Division: Mitosis and Meiosis	43 min	1 h 25 min	2 h 8 min
7	Patterns of Heredity	1 h 5 min	2 h 10 min	3 h 15 min
8	The Chemical Nature of the Gene: DNA, Replication and Protein Synthesis	53 min	1 h 45 min	2 h 38 min
9	Biotechnology and Genomics	32 min	1 h 5 min	1 h 37 min
10	Evolution: Natural Selection and Its Evidence	1 h 9 min	2 h 20 min	3 h 29 min
11	Speciation and the History of Life	48 min	1 h 35 min	2 h 23 min
12	Classification and the Tree of Life	41 min	1 h 20 min	2 h 1 min
13	Microbes, Protists and Fungi	51 min	1 h 40 min	2 h 31 min
14	Plants: Diversity, Structure and Reproduction	52 min	1 h 45 min	2 h 37 min
15	Animal Diversity	1 h	2 h	3 h
16	Body Systems I: Homeostasis, Digestion, Circulation, Respiration and Excretion	1 h	2 h	3 h
17	Body Systems II: Nervous, Endocrine, Musculoskeletal and Immune	1 h 2 min	2 h 5 min	3 h 7 min
18	Reproduction and Development	40 min	1 h 20 min	2 h
19	Populations and Communities	1 h 2 min	2 h 5 min	3 h 7 min
20	Ecosystems, the Biosphere and Conservation	1 h 6 min	2 h 10 min	3 h 16 min
21	Atoms and the Periodic Table	1 h 7 min	2 h 15 min	3 h 22 min
22	Nuclear Reactions and Elementary Particles	1 h 8 min	2 h 15 min	3 h 23 min
23	Chemical Bonding and Molecular Structure	1 h 9 min	2 h 20 min	3 h 29 min
Lessons and lectures		**36 h 3 min**	**72 h**	**108 h 3 min**
Quizzes, mid exam and final (stated time)		**11 h 48 min**	**—**	**11 h 48 min**

Unit	Title	StudyWalks	Offline, suggested	Unit total
24	Chemical Reactions	1 h 15 min	2 h 30 min	3 h 45 min
25	Motion and Forces	1 h 12 min	2 h 25 min	3 h 37 min
26	Energy, Momentum and Fluids	54 min	1 h 50 min	2 h 44 min
27	Heat, Thermodynamics and States of Matter	1 h 14 min	2 h 30 min	3 h 44 min
28	Relativity and the Quantum	40 min	1 h 20 min	2 h
29	Electricity and Magnetism	50 min	1 h 40 min	2 h 30 min
30	Waves, Sound and Light	52 min	1 h 45 min	2 h 37 min
31	The Sky, Gravity and the Solar System	1 h 15 min	2 h 30 min	3 h 45 min
32	Stars, Galaxies and the Universe	1 h 18 min	2 h 35 min	3 h 53 min
33	Earth's Interior, Plate Tectonics, Earthquakes and Volcanoes	1 h 14 min	2 h 25 min	3 h 39 min
34	Rocks, Surface Processes and Earth History	1 h 11 min	2 h 20 min	3 h 31 min
35	The Atmosphere, Weather and Climate	1 h 13 min	2 h 25 min	3 h 38 min
36	The Hydrosphere, Resources and the Environment	1 h 2 min	2 h 5 min	3 h 7 min
37	Mixed Problems and Capstone	41 min	1 h 20 min	2 h 1 min
Lessons and lectures		**36 h 3 min**	**72 h**	**108 h 3 min**
Quizzes, mid exam and final (stated time)		**11 h 48 min**	**—**	**11 h 48 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:** Samantha Fowler, Rebecca Roush and James Wise. *Concepts of Biology*. OpenStax, Rice University. CC BY-NC-SA 4.0
- **Anchor:** Paul Flowers, Klaus Theopold, Richard Langley and William R. Robinson. *Chemistry 2e*. OpenStax, Rice University. CC BY-NC-SA 4.0
- **Anchor:** Paul Peter Urone and Roger Hinrichs. *College Physics 2e*. OpenStax, Rice University. CC BY-NC-SA 4.0
- **Anchor:** Andrew Fraknoi, David Morrison and Sidney C. Wolff. *Astronomy 2e*. OpenStax, Rice University. CC BY-NC-SA 4.0
- **Anchor:** Steven Earle. *Physical Geology*. LibreTexts. CC BY 4.0
- **Anchor:** Roland Stull. *Practical Meteorology*. LibreTexts (the atmosphere unit). CC BY-NC-SA 4.0
- **Witness:** Boundless. *General Biology*. LibreTexts. CC BY-SA 4.0
- **Witness:** Bruce Averill and Patricia Eldredge. *General Chemistry: Principles, Patterns, and Applications*. Saylor Foundation. CC BY-NC-SA 3.0
- **Witness:** Benjamin Crowell. *Conceptual Physics*. Light and Matter. CC BY-SA 3.0
- **Witness:** NASA Science (science.nasa.gov): the solar system, the Sun, stars, galaxies and the universe. Public domain (U.S. government work)
- **Witness:** Chris Johnson, Matthew D. Affolter, Paul Inkenbrandt and Cam Mosher. *An Introduction to Geology*. LibreTexts. CC BY-NC-SA 4.0

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