

Grammar & Composition Grade 12



English 12 is designed to incorporate a program of English literature, composition, grammar, vocabulary, and outside reading into a senior-level English class. The study of grammar is not stressed in the senior year as much as in earlier years because of the extensive background that students should have gained from previous study; however, grammar is still taught briefly each day. Grammar instruction includes correcting homework exercises from *Workbook VI for Handbook of Grammar and Composition* and briefly presenting new material from *Handbook of Grammar and Composition*.

Added Enrichment

- English teaching transparencies

Evaluation

- Grammar quizzes (17)
- Tests (8), mid-semester tests (2)
- Semester exam, final exam

Compositions:

- Essays (5)
- Argumentative essay
- Oral book reviews (2)
- Full book review
- Vocation project
- Character analysis
- Extended definition

Optional (graded at teacher discretion):

- Paragraphs, book reviews
- Character sketch, original poem
- Extemporaneous compositions, résumé
- Descriptions, narrative

Grammar

- Capitalization:
 - Proper nouns and words formed from proper nouns:
 - Particular persons, places, things:
 - Political and economic organizations and alliances
 - Words referring to Deity and Holy Scripture
 - Words from proper nouns
 - Common noun or adjective when part of proper name
 - Titles of persons, titles of works
 - First word of every sentence
 - Pronoun *I* and interjection *O*
 - First word of every line of poetry
- Punctuation:
 - End marks:
 - Period for declarative sentences, abbreviations, indirect question, and polite request
 - Question mark for interrogative sentences
 - Exclamation point for exclamatory sentences
 - Commas:
 - Before a coordinating conjunction joining two independent clauses
 - To indicate:
 - Omissions or avoid possible misreading
 - Nonessential elements in a sentence:
 - Appositive and appositive phrase
 - Participial phrase
 - Adjective and adverb clauses
 - Direct address
 - *Well, yes, no, or why*
 - Parenthetical expressions
 - To set off introductory phrases or clauses
 - In dates and addresses
 - After salutations and closings of letters
 - Semicolons:
 - Between independent clauses:
 - If not using coordinating conjunction
 - Joined by transitional words
 - Joined by coordinating conjunction if clauses already contain commas
 - Between items in a series if the items contain commas

Colons:

- Before a list of items
- To introduce a formally announced statement or quotation
- Between:
 - Independent clauses when second clause further explains first one
 - Chapter and verse of Bible reference
 - Hour and minute of time reference
- After salutation of a business letter

Italics:

- For titles of books, magazines, newspapers, plays, works of art, ships, trains, aircraft, and spacecraft
- For words, letters, numbers referred to as such
- For foreign words or phrases

Hyphens:

- To divide a word at the end of line
- In compound numbers
- In fractions used as adjectives
- In prefixes before a proper noun or adjective
- In compound adjectives before a noun

Quotation Marks:

- In a direct quotation
- To enclose:
 - Titles of short poems, songs, chapters, articles, and other parts of books or magazines
 - A quoted passage of more than one paragraph: at the beginning of each paragraph and at the end of the last paragraph

Apostrophes:

- To form:
 - Possessive case of nouns
 - Individual possession within a group
 - Possessive case of indefinite pronouns
- To show omissions from words
- With *s* to form plurals of letters, numbers, signs, and words used as words

Grammar & Composition cont.

Grammar cont.

- Dashes:
 - After a series of words or phrases giving details about a statement that follows
 - To indicate an abrupt change or break in a sentence
 - To set off parenthetical elements or confidential comments
- Parentheses:
 - To enclose:
 - Parenthetical elements
 - Brief confirmatory information
- Brackets:
 - To enclose editorial comments within quotations
 - To replace parentheses within parentheses
- The sentence:
 - Definition of sentence
 - Kinds of sentences classified by purpose: declarative, imperative, interrogative, exclamatory
 - Recognizing subjects and verbs: complete subject, simple subject, complete predicate, simple predicate, and verb phrase
 - Overcoming problems locating subjects and verbs:
 - Finding:
 - Subject in an inverted sentence: interrogative sentence, sentence beginning with *there* or *here*
 - Subject of an imperative sentence
 - Subject before its appositive
 - Verb phrase that is interrupted by other words
 - Diagraming subjects and verbs
 - Recognizing and diagraming compound subjects and verbs
 - Recognizing and diagraming complements: direct object, indirect object, objective complement, predicate nominative, predicate adjective
 - Fragments and run-on sentences
 - Recognizing and diagraming simple, compound, complex, and compound-complex sentences
 - Sentence improvement:
 - Unity and coordination
 - Subordination:
 - Choosing what to subordinate
 - Avoiding upside-down, illogical, and excessive subordination
 - Placement of modifiers:
 - Avoid:
 - Squinting modifiers and split constructions
 - Dangling participial phrases
 - Dangling gerund and infinitive phrases
 - Elliptical clauses
 - Pronoun reference
 - Clear and logical construction
 - Parallelism
 - Point of view:
 - Avoid unnecessary shifts in:
 - Subject, voice, and tense
 - Mood, person, number, discourse, and tone
 - Consistency of subject, tense, or voice
 - Clear and effective diction
 - Conciseness
- Parts of speech:
 - Recognizing eight parts of speech
- Verbs:
 - Recognizing action (transitive and intransitive), linking, and helping verbs
 - Distinguishing verbs from verbals: participles, gerunds, and infinitives
 - Using principal parts of verbs
 - Regular verb endings
 - Irregular verbs
 - Using correct principal parts
 - Verb tenses: progressive and emphatic forms
 - When to use the verb tenses
 - Using logical verb tense sequence between clauses and between verbals and independent clause
 - Avoiding unnecessary shifts in sentences: in subjects, verb tense, voice of verbs
 - Active and passive voice
 - Mood: indicative, imperative, and subjunctive
 - Avoid incorrect verb forms
 - Use troublesome verbs correctly and avoid verb usage errors
- Nouns:
 - Recognizing nouns:
 - Compound, common, proper, and collective
 - Concrete and abstract
 - Substantives
 - Keeping agreement of subject and verb
 - Recognizing and diagraming nouns as predicate nominatives, direct objects, indirect objects, objects of prepositions, direct address, appositives, and objective complements
 - Using parallelism
- Pronouns:
 - Antecedents
 - Recognizing personal, interrogative, demonstrative, indefinite, compound, relative
 - Recognizing reflexive and intensive pronouns
 - Keeping agreement of verbs and indefinite pronoun subjects
 - Making pronouns agree with their antecedents:
 - In number and in gender
 - In person
 - Nominative case:
 - For subjects, predicate nominatives, appositives of subjects, appositives of predicate nominatives, appositives to subjects, and appositives to predicate nominatives
 - For complements of the infinitive *to be*
 - Objective case:
 - For direct objects, indirect objects, objects of prepositions and for appositives of direct objects, indirect objects, objects of prepositions and for appositives to direct objects, indirect objects, and objects of prepositions
 - For subjects of infinitives and complements of the infinitive *to be*
 - Possessive case:
 - Using correct case for *who*, *whom*, *whoever*, and *whomever* and in incomplete clauses beginning with *than* or *as*
 - Avoid pronoun usage problems: double subject, possessive case before a gerund

Grammar & Composition cont.

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Grammar cont.

- Adjectives:
 - Recognizing and diagraming adjectives: Participles and proper adjectives and infinitives as adjectives
 - Distinguishing adjectives from nouns and pronouns
 - Recognizing and diagraming predicate adjectives
 - Using and diagraming:
 - Prepositional and participial phrases as adjectives
 - Infinitive phrases as adjectives
 - Adjective clauses
 - Placing and punctuating adjective modifiers
 - Using adjectives in comparison
 - Avoiding double comparison and double negatives
- Adverbs:
 - Recognizing and diagraming adverbs
 - Infinitives as adverbs
 - Nouns as adverbs
 - Distinguishing adverbs from adjectives
 - Using and diagraming:
 - Prepositional phrases as adverbs
 - Infinitive phrases as adverbs
 - Adverb clauses
 - Correct placement of adverb modifiers
 - Distinguishing dependent clauses
 - Using adverbs in comparison
- Prepositions:
 - Recognizing prepositions, prepositional phrases, and objects of prepositions
 - Distinguishing between prepositions and adverbs
 - Using prepositions correctly
- Conjunctions:
 - Recognizing coordinating, correlative, and subordinating conjunctions
 - Using parallel structure
- Interjections:
 - Definition
 - Punctuation with interjections
 - Other parts of speech used as interjections
 - Diagraming interjections
- Recognizing and diagraming:
 - Nominative absolute and expletives
 - Nominative absolute phrases
- Word study:
 - Using the dictionary:
 - Kinds of dictionaries
 - Selecting a dictionary
 - Using the dictionary
 - Parts of the dictionary
 - Usage and diction:
 - Levels of usage
 - Using correct diction
 - Using clear and effective diction
 - Appropriateness
 - Exactness and vividness
 - Figurative language
 - Gobbledygook

- Jargon
- Triteness
- Wordiness:
 - Sentences beginning with *there*, *it*, and *this*
 - Wordy expressions
 - Redundancies
 - Glossary of diction

Composition

- Manuscript form:
 - Abbreviations, numbers, titles
 - Abbreviations in footnotes and parenthetical references
- The Writing Process: plan, write, rewrite, edit
- Introducing paragraphs:
 - Topic sentence
 - Summarizing sentence
 - Paragraph development by examples, incidents, reasons, comparison and contrast, and combination of methods
 - Paragraph unity
 - Paragraph coherence: chronological order, order of importance, transitional expressions, space order, pronoun reference, and repetition
 - Paragraph with proper emphasis
- Essays (6):
 - Essay answer
 - Narrative and argumentative essays
- Outline:
 - Topical and sentence outlines
 - Format of outline
 - Parallelism in an outline
 - Steps to preparing an outline
- Extended definition
- Writing descriptions about persons, places, and things (6):
 - Steps: point of view, careful selection of details, arrangement of details, use of exact nouns and verbs
- Character sketch
- Critical book reviews: written and oral review
- Writing letters:
 - Friendly: letter parts, thank-you note, bread-and-butter note
 - Business:
 - Letter parts, order letter, request letter, complaint letter, and letter to a government official
 - Letter of application, résumé
- **Vocation Project (Research paper):**
 - Planning the paper:
 - Selecting subject
 - Finding sources: encyclopedia, periodical databases, *Essay and General Literature Index*, published bibliographies
 - Writing bibliography cards
 - Making a preliminary outline
 - Taking notes: writing note cards, avoiding plagiarism
 - **Writing a questionnaire cover letter and conducting an interview**
 - Writing the paper: introduction, body
 - Using parenthetical citations
 - Rewriting the paper: check organization, introduction, conclusion, unity, coherence, and citations

Grammar & Composition cont.

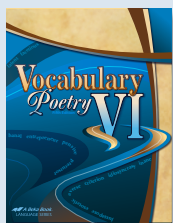
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Composition cont.

- Editing the paper: check each paragraph, sentence, word; capitalization and punctuation
- Research paper cont.:
- Typing the paper:
 - General information
 - Formatting pages: title page, pledge page, outline page, first page, and succeeding pages
 - Inserting footnotes or endnotes

- Additional guidelines:
 - Abbreviations in citation entries
 - Ellipsis marks in quotations
 - Block quotations
- Documentation for research paper:
 - Parenthetical citations
 - Endnotes and footnotes
- Typing instructions

Vocabulary, Poetry Grade 12



Knowing and using a selection of choice vocabulary words gives high school students an advantage, whether it is in a job interview, on a college entrance exam, or simply in meeting today's expectations for expression and communication. Mastering the vocabulary words in *Vocabulary, Poetry VI* will help students in their writing, speaking, and reading comprehension. Many of the words are taken from *English Literature*. Students will study the antonyms and synonyms included with the definitions and learn prefixes, root words, and suffixes, expanding their vocabulary even further. Students will also memorize ten poems throughout the year. The students will benefit from reciting and memorizing poetry.

Added Enrichment

- Vocabulary lists (12):
 - Total words and definitions (144)
 - Organized by word origin or by roots, prefixes, and suffixes
- Practice exercises (100) including:
 - Pretest over vocabulary words and their meanings
 - Cumulative review of vocabulary words and definitions
- Each vocabulary word includes:
 - Pronunciation, etymology, part of speech
 - Definition, sample sentence
 - Synonyms, antonyms
 - Related forms of the word
 - Pronunciation key
- Vocabulary chart showing:
 - Prefixes (48), suffixes (48)
 - Greek and Latin roots and meanings (100)
 - Guidelines for solving analogy questions
 - Index includes vocabulary words; prefixes, roots, suffixes; synonyms antonyms

Evaluation

- Weekly quizzes (8)
- Quarterly review (1 each 9 weeks; each counts as 2 quiz grades)
- Poetry quizzes: written (9), oral (1)

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Skills Development

- Master vocabulary words and definitions
- Use vocabulary words in sentences and in proper context
- Memorize vocabulary definitions
- Master 48 prefixes, 100 roots, and 48 suffixes
- Learn more than 1,000 synonyms, antonyms, and related words for vocabulary words
- Analyze word meanings based on their prefixes, roots, and suffixes
- Develop ability to solve analogy questions
- Apply spelling and phonics concepts through teacher-directed oral practice and independent written practice

Poetry Skills Development

- Memorize 10 lyrical poems
- Develop appreciation for poetry
- Lay foundation for future literature study
- Recite in unison
- Use appropriate expression and volume
- Increase vocabulary
- Demonstrate comprehension of emotion and content
- Develop a mental visualization of the poem
- Discuss meaning and purpose of poems
- Use proper punctuation in writing and reciting poems

Literature Grade 12



English Literature presents a chronological study of English literature from the Anglo-Saxon period to the Modern Age (twentieth century). Classics such as *Beowulf*, *The Importance of Being Earnest*, *Pride and Prejudice*, *Paradise Lost*, *Robinson Crusoe*, *David Copperfield*, and *The Canterbury Tales* were chosen not only for their literary value but also for their character development. Students will learn about a variety of literary genres and will further analyze literature through in-depth studies of a tragedy, an allegory, and a novel. In order to help students visualize the works and time periods they are studying, *English Literature* contains a variety of illustrations and photographs of English people, places, and art.

Literary Value

- 105 authors, including well-known writers such as Elizabeth Barrett Browning, Geoffrey Chaucer, Daniel Defoe, Charles Wesley, and Oscar Wilde
- Prose selections (24), poems (221), plays (4), essays (13), devotional works (7), and sermon (1)

Added Enrichment

- Footnotes define and explain unfamiliar words
- Comprehension and discussion questions after selections
- Character-building quotations and verses
- Introductory paragraphs for interest and background information
- Author biographies and literary terms
- Glossary of literary terms
- Unit reviews
- Introduction to each literary period describing literary characteristics of that age

Evaluation

- Comprehension quizzes (22)
- Homework reading quizzes (29)
- Tests (8), 9-weeks exam (2)
- Semester exam, final exam

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Reading Skills Development

- Develop skills in reading comprehension
- Further develop oral reading skills
- Be able to identify significant quotations and the selections in which they are featured
- Increase vocabulary
- Further develop writing skills
- Study various literary forms: lyric and epic poetry, drama, allegory, Romantic and Victorian poetry, and modern fiction
- Study meaning and use of literary terms and devices such as theme, plot, imagery, figurative language, analogy, aside, caesura, carol, comic relief, exemplum, idyll, kenning, madrigal, metonymy, ode, rondeau, scap, surrealism, and terza rima
- Study historical backgrounds and writing techniques to better understand each literary period
- Study the development of plot, theme, setting, and character(s) in short stories, essays, and other notable works of English literature

Comprehension, Discussion, & Analysis Skills Development

- Read entire works: *The Pilgrim's Progress* and *Macbeth*
- Develop proper discernment according to the truths of Scripture
- Answer factual, interpretive, and inferential comprehension and discussion questions
- Improve ability to use deductive reasoning, understand cause and effect, and draw conclusions
- Build appreciation for good literature and a love of reading
- Develop an understanding of people's motives and feelings while recognizing consequences of particular actions
- Learn to analyze literature while studying selections
- Comprehend and appreciate the basic elements of a work of literature
- Learn to appreciate the rhyme, rhythm, and figurative language of poetry

Jesus & His Followers—First Semester Grade 11



Jesus and His Followers traces the life of Christ from His arrival as a Babe in Bethlehem, through His death on the cross at Calvary, to His ascension into heaven. This practical, personal study of the gospels is designed to reach both the head and the heart of the student. Through the teachings of Jesus and the example He set for His followers, the student learns how to live a more abundant and fruitful Christian life. Practical applications and thought-provoking questions encourage the student to examine his walk with Christ and apply God's Word to his life. Memory passages have been selected to correlate with the topics discussed to help the student become grounded in the Scriptures.

Evaluation

- Verses:
 - Verse quizzes (16)
 - 9-weeks verses exam (1)
 - Final verses exam (1)
- Content:
 - Unit quizzes (8)
 - 9-weeks content exam (1)
 - Final content exam (1)

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Lessons 72

- The Bible—God communicates with us:
 - How our English Bible came to us
 - The English Bible in the 20th Century
 - Four portraits of Christ in the Gospels
- Jesus' birth and preparation for ministry:
 - The first Christmas
 - In the Temple at age twelve
 - Jesus is baptized
 - The trinity of God
 - The purpose of water baptism
 - Salvation is a prerequisite
 - Jesus is tempted
 - The background of the tempter
 - The essence of temptation
- Jesus' early ministry:
 - Miracle at the wedding in Cana
 - What Scripture says about alcohol
 - Drugs—a blessing or a curse?
 - Jesus cleanses the Temple
 - The Spirit of God dwelling in the believer
 - New birth and the new nature
 - Samaritan woman at the well
- His popular ministry in Galilee:
 - Jesus heals and forgives sin
 - Causes of sickness
 - Ten lepers and Jairus's daughter
 - Promises for answered prayer
 - Feeding the multitude
 - Jesus walks on water and offers living Bread
 - Jesus meets with opposition
 - Jesus meets demonic activity
- The Master Teacher:
 - Jesus teaches through parables
 - Jesus calls the disciples and chooses apostles
 - Jesus teaches His followers to pay taxes
 - Jesus reveals what hell is like
- Various Encounters: The Sabbath encounter

- Christ encounters the hypocritical Pharisees:
- Mount of Transfiguration
 - Two ways to increase faith
- Encounters with a young ruler and Zacchaeus
- Widow's Son and Lazarus
- The Passion Week:
 - Triumphal entry
 - Passover supper and Garden of Gethsemane
 - Paul instructs the church about the Lord's table
 - Jesus speaks to the eleven
 - The vine and the branches
 - Persecution inevitably awaits His followers
 - Jesus' prayer for His disciples
 - Jesus' trial and crucifixion
- Resurrection: Post-resurrection appearances
- Ascension
- Sermon on the Mount
 - The Beatitudes produce "overflowing joy"
 - Disciples called to be "salt" and "light"
 - Guidelines for giving and praying
 - The Lord's Prayer—an outline for prayer
 - Guidelines to combat materialism
 - Practical points to avoid pitfalls

Music 51 songs

- Hymns, gospel songs, holiday songs

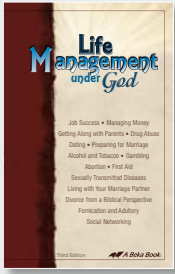
Memory Work

- Passages (16 containing 48 verses)

Prayer Time

- Learn to pray for others, missions, our nation, those in authority over us. Include praise and thanksgiving to God.

Life Management— Second Semester Grade 11



The successful Christian life is a life under biblical management. *Life Management under God* is an application of biblical principles in practical areas of life. Each lesson provides a marvelous opportunity to apply God's truth to everyday problems and situations. Great effort has been taken to also include critical topics from a scriptural point of view. This study can help each student obtain success by instructing him on how to apply the Word of God, life's greatest certainty, to his own life.

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Evaluation

- Verses:
 - Verse quizzes (17)
 - 9-weeks verses exam (1)
 - Final verses exam (1)
- Content:
 - Unit quizzes (7)
 - 9-weeks content exam (1)
 - Final content exam (1)

Lessons 70

- How to relate to others:
 - Being a friend
 - Relationships with the opposite sex
 - Getting along with your family
 - Learning to forgive
 - Living courteously
- Your safety and well-being:
 - First aid
 - Alcohol and tobacco
 - Illegal drugs
- Developing balanced living habits:
 - Nutrition for optimum living
 - Exercise for vibrant living
 - Dealing with stress and fatigue
 - Promoting spiritual health
- Job success:
 - Part-time work and your life's work
 - How to get a job
 - How to get along with your boss and relate to your fellow workers

- Taking responsibility:
 - Time management for efficient living
 - Managing your money
 - Responsibilities of citizenship
- Preparing for marriage from a biblical perspective:
 - Falling in love
 - Living with your marriage partner
 - Looking at the issue of divorce
 - Fornication and adultery
 - Sexually transmitted diseases
- Issues that affect your life:
 - Creation versus evolution, abortion
 - Gambling, social networking

Music 44 songs

- Songs, holiday songs

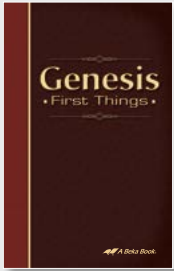
Memory Work

- Passages (29 containing 72 verses)

Prayer Time

- Learn to pray for each other, our nation, those in authority over us

Genesis—First Semester Grade 12



Genesis—First Things introduces the student to the fascinating record of God's Creation and the beginning of Israel, His chosen nation. Relevant topics such as marriage, government, and the sanctity of life are addressed from a Christian perspective through the stories of Genesis. This course imparts practical application and proposes many thought-provoking questions that encourage a student to think biblically and develop a Christian world-view. Memory passages have been selected to correlate with the topics discussed and help the student become grounded in the Word of God.

Evaluation

- Verses:
 - Verse quizzes (14)
 - 9-weeks verses exam (1)
 - Final verses exam (1)
- Content:
 - Content quizzes (6)
 - 9-weeks content exam (1)
 - Final content exam (1)

➤ **RED** indicates first introduction of content.

Lessons 69

- About Genesis:
 - The inspiration of the sacred Scriptures
 - The Bible and scientific discoveries
- Creation and the nature of man:
 - Man is the crown jewel of creation
 - Man's practice of paganism
 - Man's dominion of the earth
- Beginning of marriage and family:
 - Perfect marriage
 - Adam's Fall
 - Cain, Abel, and Seth
- Earth's great catastrophe and its effect on man:
 - Noah prepares the ark
 - After the Flood:
 - Atmospheric changes
 - Civil government mandate
- Nations begin to form:
 - Tower of Babel
 - Origin of nations
- Beginning of Israel: journeys of Abraham, Isaac, Jacob, and Joseph

Music 40 songs

- Hymns of the faith, holiday songs

Memory Work

- Passages (14 containing 47 verses)

Prayer Time

- Learn to pray for each other, our nation, those in authority over us

Book of the Revelation — Second Semester Grade 12



Using the seven churches of Asia Minor as an outline of church history, *Book of the Revelation* chronicles the life of the church from the apostolic church of the first century to the Laodicean church of the twentieth century. The text focuses particularly on godly men and women who allowed themselves to be used by God. This gives students a greater appreciation for their Christian heritage and provides them with good role models such as John Wycliffe, George Whitefield, David Livingstone, Fanny Crosby, and Billy Sunday. *Book of the Revelation* continues with a look at the future events revealed to John on the isle of Patmos. The prophecies of Revelation are clearly explained to help students develop a greater desire for the Lord's return and to encourage them to watch and be ready.

Evaluation

- Verses:
 - Verse quizzes (13)
 - 9-weeks verses exam (1)
 - Final verses exam (1)
- Content:
 - Content quizzes (15)
 - Test (1)
 - Final content exam (1)

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Lessons 69

- Church history:
 - Ephesus: seven periods of church history
 - Smyrna: some famous martyrs
 - Pergamos:
 - Emperor Constantine
 - Arian and Augustine and the Pelagian controversies
 - Doctrine of Balaam weakens the believers
 - Doctrine of the Nicolaitans gets a stronghold
 - The spread of the Gospel to Africa and Ireland
 - Thyatira:
 - Rise of the Papacy
 - Doctrines of men
 - Long line of popes
 - Reactions and divisions:
 - Mohammed and Islam
 - Eastern Catholics break with the Roman Church
 - Sardis:
 - The English Reformation
 - State churches and denominations
 - Separatists and pilgrims
 - Philadelphia:
 - Pietists and Moravians
 - Great Awakening circuit riding preachers and camp meetings
 - America's Second Great Awakening
 - Victorian Era
 - Heroes of the faith in the 1800s
 - Satan's response to the Philadelphia Church:
 - The rise of false philosophies and cults
 - How we should respond when encountering a cult
 - Laodicea:
 - Revival fires in the first half of the 20th Century: Satan counter-moves with Neo-orthodoxy
 - The Laodicean Church in the last half of the 20th Century:
 - History of New Evangelicalism
 - Social revolution in the 1960s and '70s
 - Progressive Education and Materialism impact the Laodicean Church

- Things to come:
 - Rapture of the Church:
 - Why we believe the Rapture occurs before the Tribulation
 - Throne of God and Six Seal Judgments:
 - The First Parenthesis: 144,000 Jewish Evangelists
 - Seventh Seal is opened:
 - Six Trumpet Judgments
 - The Second Parenthesis:
 - Mighty angel
 - Bitter-sweet book
 - Measuring rod
 - Two faithful witnesses
 - Third Parenthesis:
 - Antichrist and False Prophets:
 - Great Dragon persecutes Israel
 - Winepress of God's Wrath
 - 7th Trumpet:
 - Seven last plagues
 - The Great Day of the Lord's Wrath
 - Babylon and its fall
 - Second Coming of Christ: to judge and make war
 - Christ's Millennial Reign and Satan's Doom:
 - Resurrection of the saved and the lost
 - Great White Throne Judgment
 - The New Jerusalem

Music 42 songs

- Hymns of the faith, choruses

Memory Work

- Passages (19 containing 53 verses)

Prayer Time

- Learn to pray for each other, our nation, those in authority over us

American Government Grade 12



American Government in Christian Perspective seeks to give students a clear understanding of the historical and philosophical elements that make the United States a unique nation. Only when students fully understand these foundational elements will they be able to love and appreciate our republic. *American Government in Christian Perspective* traces the roots of our political institutions and examines the Constitution itself. Through a clear explanation of the legislative, executive, and judicial branches of government, students learn how a republic actually functions. Students will also study state and local government and be better able to understand their local systems, which will in turn develop a better understanding of and a greater appreciation for American philosophy and ideology.

Added Enrichment

- Special feature boxes (44):
 - Give better understanding of the following:
 - Foundations of American liberty
 - Operation of opposing government systems
 - Symbols of American government
 - Concepts of American government
 - Highlight those who have helped shape American government through their writings and biographical sketches

- Important U.S. documents: the Constitution of the United States, the Declaration of Independence, and the Articles of Confederation
- *State and Local Government* (5 sections)
 - Helps students understand the state and local government by completing the study outline for their state

Evaluation

- Reading quizzes (15)
- Review quizzes (19); (includes memorization quizzes for “The Star-Spangled Banner,” the Preamble to the Constitution, and four Scripture passages totaling 15 verses)
- Current events (14; each counts as quiz grade)
- Patriotic project (counts as test grade)
- Tests (4), 9-weeks exam (1)
- Final exam

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Foundations of American Government

- America—a unique nation:
 - Miracle of America:
 - A blessed nation
 - American character
 - Need for vigilance
 - American symbols
 - Patriotism versus nationalism
- Government under God:
 - Foundations of civil government: nature of government
 - Forms of government:
 - Theocracy and human governments
 - Constitutional republic
 - Dictatorship
 - Christians and government:
 - Christian’s response and responsibilities to government
 - Character and government
- Shaping of the American republic:
 - English heritage:
 - Bible and Christianity in England
 - English common law and government
 - Struggle for liberty
 - English tradition takes root in America:
 - Compacts, colonies, and charters
 - Colonial law and government
 - Local government
 - Steps toward unity:
 - Spiritual revival in the colonies
 - Early efforts at political union
 - A nation is born:
 - Steps toward independence
 - Independence declared

Our Constitutional Republic

- Constitution of the United States:
 - From Plymouth to Philadelphia:
 - Roots of America’s Constitution
 - Articles of Confederation
 - New Constitution adopted:
 - Constitutional Convention, 1787
 - Bundle of compromises
 - Federalists and Anti-Federalists
 - Main features of the Constitution:
 - Supreme law of the land
 - Purposes of our government
 - Rights and responsibilities of the American people
 - Republican and limited government
- Congress—legislative branch:
 - Structure of Congress:
 - Congressional houses and leadership
 - Constitutional qualifications
 - Procedures within Congress: process, pay, privileges, and penalties
 - Responsibilities of Congress:
 - Lawmaking and the process
 - Representation and oversight
 - Powers of Congress that they can and cannot exercise
- President—executive branch:
 - President and the Constitution: creation, term, tenure, qualifications, succession, and compensation
 - President’s leadership: constitutional powers and God-given authority
 - Vice President
 - Roles of the President: chief of state, commander in chief
 - President’s team:
 - White House office
 - Office of Management and Budget
 - Other advisory bodies

American Government cont.

➤ RED indicates first introduction of content.

Our Constitutional Republic cont.

- Bureaucracy—executive branch:
 - From patronage to a merit system
 - Growth of the bureaucracy
- Organization of the bureaucracy:
 - Executive departments
 - Agencies
 - Government corporations
- Power of the bureaucracy:
 - Bureaucracy and the Constitution
 - Legacy of expanding bureaucracy
- Reform of the bureaucracy: reorganization, reduction, and removal
- Federal Courts—judicial branch:
 - Constitutional and legislative courts: nominating federal judges and justices
 - Judicial process:
 - Civil and criminal cases
 - Procedure in a trial court and an appeals court
 - Supreme Court:
 - Judicial review: *Marbury v. Madison*
 - Legal road to the Supreme Court
 - Court in session
 - Changing role of the Court: Earl Warren
- Bill of Rights and other amendments:
 - Bill of Rights:
 - Background of the Bill of Rights
 - Our civil rights and responsibilities
 - Original meaning of separation of church and state
 - Other amendments
 - Importance of various court cases

Our Federal Republic

- American federalism:
 - Federalism defined
 - Founders' choice
 - Constitution and federalism: dividing power and fulfilling obligations
 - History of federalism: rise of central power:
 - Dual, cooperative, and coercive federalism
 - Federalism today:
 - States and the Supreme Court
 - States and Congress: the 10th Amendment
- State and local government:
 - Fifty individual states:
 - State constitutions and the federal Constitution
 - Changing states constitutions
 - Functions of state government
 - State executive officers
 - State legislators:
 - Terms, sessions, and apportionment
 - Qualifications, elections, compensation, and personnel
 - Powers of the state legislature
 - Officers and organization of the state legislature
 - Legislative process
 - Voter participation in the lawmaking process

- State courts
- Local government: county, New England town, township, and municipal government
- Financing state and local government
- American citizen in action—making a difference:
 - United States citizen:
 - Citizenship defined
 - Citizenship by birth and naturalization
 - Citizen and his government: elected and appointed
 - Political participation in America:
 - Citizen and the military, voting process, political party, interest group, public opinion, and news media
 - Other forms of political action
 - Citizen and his character: importance of righteousness in the preservation of the nation

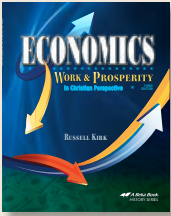
State and Local Government Study Outline

- A research guide divided into five sections to help students better understand their state and local government:
 - Section 1—My home state
 - State history
 - Voter requirements
 - Elections
 - State constitution overview
 - Changing the state constitution
 - Section 2—State executive officers
 - The governor's office
 - Gubernatorial qualifications, elections, and terms
 - Powers and duties of the governor
 - Lieutenant governor
 - Secretary of state
 - State attorney general
 - State treasurer
 - State auditor
 - State comptroller
 - State superintendent of education
 - Other state offices
 - Section 3—State legislature
 - Overview
 - Terms and sessions
 - Apportionment
 - Qualifications and elections
 - Officers, organizations, and powers
 - Legislative committees
 - The legislative process
 - Section 4—State courts
 - State court levels
 - The jury system
 - Section 5—Local government
 - County government
 - New England town government
 - Township government
 - Municipal government

Prayer Time

- Learn to pray for our nation and for government officials

Economics Grade 12



The purpose of *Economics: Work and Prosperity* is to teach basic economic principles and to give students a clear understanding of free-enterprise capitalism, individual moral responsibility, and the biblical work ethic from a conservative Christian perspective. This course emphasizes God's Word as the one standard for man's thoughts and actions and encourages man's dependence upon God rather than upon government. It stresses acceptance of moral responsibility and accountability to God and man. Finally, this course strengthens the link between economic freedom and the political and individual freedoms Americans enjoy.

Added Enrichment

- Special feature boxes (27):
 - Emphasize the importance of responsibility in economics
 - Highlight people that have had positive and negative influence on economics
 - Include illustrations of the success of capitalism, comparison and contrasts of different economies, and relationships of economics and government

Evaluation

- Reading quizzes (18)
- Review quizzes (17)
- Current events (18; each counts as quiz grade)
- Research paper (1; counts as test grade)
- Tests (4), 9-weeks exam (1)
- Final exam

➤ **RED** indicates first introduction of content.

Everybody's Economics

- Why bother about economics?
- Building an economy: the Pilgrims at Plymouth
- Economists and the language of economics
- Everything has to be worked for
- Goods, wants, and needs
- Goods for production and goods to use up
- What makes goods valuable?

Economists & Economic Laws

- First principles of economics
- Early economic history
- Adam Smith and *The Wealth of Nations*
- Ways to prosperity

Factors of Production

- Prosperity does not grow on trees
- Factors of natural resources, labor, capital, and entrepreneurship
- Achieving economic prosperity

Laws of Supply & Demand

- Value of goods
- Marginal utility and value
- Basic laws of supply and demand
- Supply and demand in balance
- Government and economic laws

Productive Market Economy

- Market signals
- Contrasting economic systems
- Profits and productivity

Good That Competition Does

- Healthy competition
- Perfect competition
- Monopolies and monopolistic competition
- Oligopolies
- Competitive encouragement in the free market

Efficiency of Production

- Source of efficiency
- Total cost and efficiency
- Division of labor
- Scale of production
- Absolute and comparative advantage
- Geographic specialization and trade

Why Everybody Needs to Save

- Fables in support of saving
- Saving in Old Egypt and in modern countries
- Rewards of saving
- Wise and foolish saving
- Many forms of saving
- Savings in stocks, bonds, and mutual funds
- Compulsory saving

What Money Is Good For

- Three functions of money
- Metallic and paper money
- Money supply
- The Treasury, Federal Reserve, and commercial banks
- Use and abuse of money

Economics cont.

➤ RED indicates first introduction of content.

Government & the Economy

- Purpose of government
- Government and macroeconomics
- Government's potential danger to economics
- American government and the economy

Successes & Difficulties in the Market Economy

- Achievements of the market economy
- Business cycles
- Inflation
- Selfishness and envy

Promise & Performance in the Command Economy

- Goals, tools, and permanent problems of a command economy
- Infiltration of socialism

Look at the Global Economy

- Growth of the global economy
- Global issues in perspective

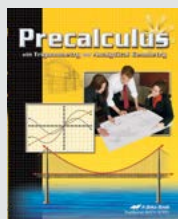
Cheerful View of Our Economic Future

- Refuting the prophets of doom
- Killing the goose that lays the golden eggs
- Building the moral foundation of economics

Prayer Time

- Learn to pray for our nation and for government officials

Precalculus Grade 12



The purpose of *Precalculus* is to teach the student how to select and apply various techniques to solve mathematical problems in a skillful, systematic, and logical manner. Students will learn the underlying principles of trigonometry and interrelationships of lines and functions with graphical and analytical problem-solving techniques from a study in analytical geometry. The study culminates with an introduction to selected calculus topics.

Topical Interest Essays

- The History of Pi
- Distance of travel due to earth's rotation
- Mathematics in Astronomy—Eratosthenes' calculation of earth's circumference
- Sir Isaac Newton
- Oscilloscope Measurement of Household Voltage
- Mathematics in Engineering
- The Place of Imaginary Numbers
- Euler's Formula $e^{i\pi} + 1 = 0$
- Missile Guidance Technology
- Mathematics in Physics—Projectile Motion
- Mathematics in Biology
- Summation—A Calculation of Pi
- The Design of Cylindrical Containers
- Mathematics in Physics—Fluid pressure on a vertical surface

Evaluation

- Quizzes (49)
- Tests (9)
- 9-weeks exam (2)
- Semester exam
- Final exam

➤ **RED** indicates first introduction of content.

Trigonometry & Analytical Trigonometry

- Basic trigonometric ratios
- Solving right triangles
- Advanced trigonometric ratios
- Trigonometric functions
- Solving trigonometric equations
- Trigonometric graphs:
 - Intercepts
 - Symmetry, sinusoid
 - Amplitude, period, key angles, key points
 - Vertical and horizontal scaling
 - Vertical and horizontal translation
 - Phase shift
 - Vertical asymptotes
- Signs of the functions by quadrant
- Periodic motion: simple harmonic motion, frequency, rotating object, suspended object
- Identities:
 - Reciprocal, cofunction, Pythagorean, quotient
 - Negative angle, double angle, half angle
 - Sum and difference, product to sum, sum to product
 - Verifying
 - Used to find unknown values
- Special angle function values (30° , 45° , etc.; $\frac{\pi}{6}$, $\frac{\pi}{4}$, etc.)
- Inverse function values using a calculator
- Function values:
 - Angles in degrees
 - Angles in radians
 - Finding unknown function values
 - Function values using the unit circle, line diagrams of function values
 - Using a calculator, using right triangles, using special triangles:
 - 30° - 60° - 90°
 - 45° - 45° - 90°
 - 90° ; $\frac{\pi}{6}$ - $\frac{\pi}{3}$ - $\frac{\pi}{2}$, $\frac{\pi}{4}$ - $\frac{\pi}{4}$ - $\frac{\pi}{2}$

- Reducing trigonometric function angles: reference angle, reference triangle
- Rewriting as a cofunction

Coordinate Geometry

- Basic review, terminology
- Trigonometric Function graphs:
 - Intercepts, symmetry, sinusoid
 - Amplitude, period, key angles, key points
 - Vertical and horizontal scaling
 - Vertical and horizontal translation, phase shift
 - Vertical asymptotes
- Angles in degrees and radians
- Graphing by addition of ordinates
- Inverse functions, inverse trigonometric functions
- Intercepts: x-intercept, y-intercept
- Symmetry: x-axis, y-axis, origin
- Domain:
 - Limiting operations
 - Determining
- Complex number plane
- Points of intersection
- Distance
- Slope:
 - Variation, inclination
 - Parallel and perpendicular lines
 - Angle between two intersecting lines
- Straight line:
 - Inclination
 - Distance to a point
 - Systems of lines
 - Equation forms:
 - Slope-intercept
 - Point-slope, two-point, intercept, parallel to axes, general
- Midpoint

Precalculus cont.

➤ **RED** indicates first introduction of content.

Coordinate Geometry cont.

- Parametric equations:
 - Eliminating the parameter
 - Developing equations: Schrödinger's wave model graph
 - Involute of a circle, brachistochrone, cycloids
- Locus of a point
- Conic sections:
 - Circle: center, radius
 - Ellipse:
 - Vertices, foci, major and minor axes, latus rectum, eccentricity
 - Parabola:
 - Vertex
 - Focus, latus rectum, eccentricity
 - Hyperbola: vertices, foci, transverse and conjugate axes, latus rectum, eccentricity, asymptotes, conjugate hyperbolas
 - Horizontal and vertical translation, rotation of axes
- Graphing in three dimensions:
 - Traces, cylinders, elements
 - Graphs: ellipsoid, paraboloid, hyperboloid of one sheet, hyperboloid of two sheets, hyperbolic paraboloid, cone

Polar Coordinates

- Graphing techniques
- Terminology, conversions
- Analysis techniques: branch tangents at the pole, symmetry, determining angles resulting in undefined values
- Rotation of axes
- Graphs: lines, circles, roses, cardioids, limaçons, parabolas

Angles

- Angles on the Cartesian plane:
 - In degrees
 - In radians
- Initial side, terminal side, standard position
- Quadrant of an angle, coterminal angles, positive and negative angles: in degrees, in radians, conversions
- Bearing
- Key angles for a trigonometric function graph
- Trigonometric function values:
 - Reference angle by quadrant: in degrees, in radians
- Special angles: 30° , 45° , etc.; $\frac{\pi}{6}$, $\frac{\pi}{4}$, etc.

Functions

- Functional notation
- Domain and range:
 - Finding, using inequalities, using intervals, characteristics
- Functions: even, odd, periodic, inverse
- Horizontal line test, vertical line test, one-to-one functions

Triangles

- Solving right triangles
- Solving oblique triangles:
 - Law of sines, law of cosines
 - The ambiguous case

- Using angles of elevation and depression
- Finding area
- Right triangle trigonometry
- Reference triangle
- 30° - 60° - 90° , 45° - 45° - 90° ; $\frac{\pi}{6}$ - $\frac{\pi}{3}$ - $\frac{\pi}{2}$, $\frac{\pi}{4}$ - $\frac{\pi}{4}$ - $\frac{\pi}{2}$

Complex Numbers

- Imaginary numbers and basic quantities
- Standard form
- Graphing on the complex plane
- Magnitude, argument, trigonometric form, polar form, conversions
- Multiplying and dividing complex numbers
- Finding roots and powers: De Moivre's theorem

Distance

- Length of an arc:
 - Using degrees
 - Using radians
- Distance between two points:
 - In two dimensions
 - In three dimensions
 - Horizontal and vertical distance
 - From a line to a point

Vectors

- Scalar, equal vectors, unequal vectors, negative vector, resultant, vector sum

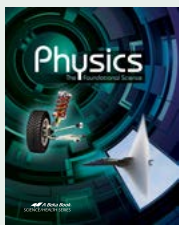
Regression Analysis

- Method of least squares: general equations for solution
- Close-fit curve
- Summation notation
- Pearson-r correlation coefficient
- Linear and non-linear data: $y = mx + b$, $y = ae^{bx}$, $y = ax^2$, $y = a + bx + cx^2 \dots + mx^n$

Introductory Calculus

- History, limits
- First derivative of a polynomial: using limits, using the short method
- Slope using derivatives
- Second derivative of a polynomial: maximum and minimum, critical points
- Rate of change:
 - Average
 - Instantaneous
- Velocity:
 - Average
 - Instantaneous
- Acceleration:
 - Average
 - Instantaneous
- Anti-derivative
- Area under a curve

Physics Grade 12



Physics: The Foundational Science describes the laws that govern the interactions between matter and energy. Clear and thorough explanations penetrate the most perplexing questions. Whenever possible, the principles of physics are illustrated by everyday experience and practical devices. Numerous illustrative problems are solved in detail.

This course will play an important role in showing students the harmony between scientific knowledge and Christian belief. The premise of the book is that we live in a God-created world governed by laws discoverable by reverent scientific inquiry. Issues of vital importance to Christians are handled in depth.

Physics: The Foundational Science adopts the traditional procedure of starting with solids, liquids, and gases—tangible things familiar to students. By putting the study of matter first, this course offers a smooth transition between chemistry and physics. An extended treatment of mechanics follows so that the student will be well prepared for further study in physics and engineering. While taking a traditional approach, this text more than adequately covers the most recent developments in physics for a broad range of topics: from particle physics to electronics and from lasers to relativity. The emphasis throughout is upon solid advances in knowledge rather than upon theoretical speculation.

Added Enrichment

- Feature boxes include:
 - Information on physics in action in the everyday world (10)
 - Articles highlighting Christian physicists and their contributions (6)
 - Information about related physics topics (3)
 - Key symbols and abbreviations at the beginning of each chapter
 - Key equations listed at the end of each chapter
 - Laboratory exercises (20)

Evaluation

- Reading quizzes (23)
- Review quizzes (42)
- Science project includes background paper, investigation plan, experimentation, follow-up paper, and oral presentation (counts as 2 quiz grades and 2 test grades)
- Tests (8), 9-weeks exam (2)
- Semester exam, final exam

➤ **RED** indicates first introduction of content.

Introduction to Physics

- Nature of science:
 - Branches of science, man's dominion, God's revelation
 - **Classical and modern physics**
- The Scientific Method: cogitation, observation, experimentation, scientific method, hypothesis, data
- Measurement:
 - Units of measurement:
 - **Fundamental and derived quantities**
 - Systems of units:
 - FPS, MKS
 - **CGS**
 - Standards of measurement:
 - Length, mass, time
 - **Need for consistent standards**
 - Scientific notation
 - Measurement calculations: metric-metric conversions, calculations with physical qualities, dimensional analysis
 - Significant digits:
 - Determining, calculation rules, accuracy and precision
 - **Tolerance, error of measurement, systematic and random errors**
 - Mathematical techniques:
 - Fractions, literal equations, proportions
 - **Steps in working physics problems**

Matter

- Nature of matter:
 - Characteristics:
 - Inertia
 - Mass, weight, density, specific gravity

- Pure substances and mixtures:
 - Molecule, elemental molecule, compound, mixtures
 - Homogeneous, heterogeneous, solid, liquid, gas, plasma
- Composition of matter:
 - Atom, nucleus, proton, atomic number, neutron, mass number
 - Isotope, atomic mass, atomic mass units
 - Electron, ion, anion, cation, element, periods, groups
 - Valence electrons
- Elementary particles:
 - Einstein's equation, photons, mass gain, nuclear mass defect
 - Subatomic particles
 - **Elementary particles**
 - Quarks
 - **Hadrons, mesons, baryons, gluon**
 - **Leptons**
 - Neutrino, positron, gamma radiation
 - **Pair production**
- Particle reactions:
 - **Antiparticles, antimatter, annihilation, electron capture**
 - Heavy atoms
 - Radioactive decay, half-life
 - **Reaction implications**

Liquid State

- Characteristics of a liquid:
 - Surface tension
 - Adhesion, cohesion
 - Capillarity:
 - **Capillary tubes, meniscus**

Physics cont.

► **RED** indicates first introduction of content.

Liquid State cont.

- Hydrostatics:
 - Law of liquid pressure:
 - Force, pressure
 - Defined, equation, Pascal's vases, water head, lateral force
 - Pascal's principle: transmission of liquid pressure, hydraulic device
 - Archimedes' principle: derivation, buoyant force
- Hydrodynamics:
 - Principle of viscosity: poise
 - Principle of continuity:
 - Ideal liquids
 - Cavitation, laminar flow, eddy currents, volume flow rate
 - Bernoulli's principle: velocity and pressure, lateral pressure

Gaseous State

- Air pressure:
 - Gases in the air, vacuum, atmospheric pressure
 - Gases compared to liquids:
 - Archimedes' principle, Bernoulli's principle, airfoil
- Barometers:
 - *Horror vacui*, Pascal's discovery
 - Standard atmospheric pressure
 - Gauge and absolute pressure
 - Aneroid barometer
- Gas laws:
 - Boyle's law, inverse proportion, Charles's law
 - Absolute zero, absolute temperature, direct proportion
 - Combined gas law, Avogadro's law, mole, Avogadro's number
 - Universal gas constant, ideal gas law
- Pneumatic devices: entrained, water and exhaust pumps, compressors, siphon

Solid State

- Characteristics of solids:
 - Elasticity, plasticity
 - Rigidity, resilience, elastic limit
 - Mechanical working, forging, rolling, malleability, drawing, ductility
- Moduli of deformation:
 - Hooke's law: tensile force, restorative force
 - Forces of deformation: stress, strain
 - Tensile stress:
 - Tension, Young's modulus, proportional limit, elastic limit
 - Ultimate tensile strength, breaking point, brittle, compression
 - Shear stress and volume stress

Introduction to Motion

- Kinematics: translational, rectilinear, and curvilinear motion
- Speed and velocity:
 - Rates of motion:
 - Velocity
 - Constant velocity, uniform, variable velocity, sign convention
 - Velocity equations: change in position over time, graph of displacement vs. time, instantaneous velocity
- Acceleration:
 - Types of acceleration: average, uniform, variable
 - Acceleration equations:
 - Graph of velocity vs. time, instantaneous acceleration, deceleration

- Horizontal motion: final velocity, average velocity, displacement, common equations
- Vertical motion:
 - Free-fall acceleration, effect of air resistance, terminal velocity

Vectors & Projectile Motion

- Introduction to vectors:
 - Vector properties
 - Parallel, antiparallel, collinear, perpendicular
 - Skewed, vector diagram, concurrent vectors
 - Resultant
- Vector composition of collinear vectors
- Vector composition of perpendicular vectors:
 - Parallelogram method
 - Pythagorean method:
 - Magnitude
 - Direction
- Vector composition of skewed vectors:
 - Parallelogram method: law of cosines, law of sines
- Vector resolution
- Vector composition revisited: component method
- Projectile motion:
 - Projectile motion and gravity, rate of fall, final velocity, trajectory
 - Effect of air resistance, critical velocity
 - Escape velocity

Forces in Nature

- Newton's three laws of motion:
 - Newton's first law:
 - Inertia, force
 - Friction
 - Alternative formulations
 - Newton's second law: determinants of force, units of force, meaning of mass, mass vs. weight
 - Newton's third law: action-reaction
- Friction—the cause, kinetic and static friction
- Laws of kinetic friction, normal force:
 - Coefficients of friction: coefficients of kinetic and static friction
 - Reducing friction: minimizing roughness, lubricating, rollers and bearings
- Four fundamental forces: strong, electromagnetic, weak, and gravitational forces
- Gravity and gravitation—geocentric, heliocentric:
 - Laws of planetary motion:
 - Empirical, law of orbits
 - Mathematical description of law of areas
 - Aphelion, perihelion
 - Quantitative treatment of law of periods
 - Universal gravitation:
 - Kinematics, dynamics
 - Universal law of gravitation, Cavendish's measurement of G
- Earth's gravitational field:
 - Factors affecting g , static equilibrium, center of gravity
 - Stable, unstable, and neutral equilibrium, instability
 - Determining the CG, multiple suspensions, center of mass
 - Gravitational field, gravitational field strength

Physics cont.

► **RED** indicates first introduction of content.

Concurrent Forces

- Force as a vector:
 - Free-body diagram, principle of transmissibility, tension
 - Center of gravity, friction, translational equilibrium, equilibrant
- Force problems:
 - Friction, level surfaces, angled forces, inclined plane
 - Load-bearing structures

Circular & Periodic Motion

- Uniform circular motion:
 - Centripetal acceleration: rate of, centripetal force, centrifugal force, roadway and railway curves
- Periodic motion:
 - Motion of a spring:
 - Spring constant, equilibrium, oscillatory motion
 - Period, amplitude, frequency, simple harmonic motion
 - Motion of a pendulum: laws of a pendulum, physical pendulum
 - Resonance: natural frequency, resonance

Work & Machines

- Work:
 - Scientific definition, work and force, basic work equation
 - Units of work, scalar quantity
 - Applied at an angle
 - Concurrent applied forces
 - Negative work, net work, work and potential energy
- Power: watt, horsepower, defining work in terms of power
- Simple machines:
 - Lever:
 - Law of levers, fulcrum, load
 - Input force, output force, input distance, output distance
 - Input lever arm, output lever arm, input work, output work
 - Mechanical advantage, classes of levers
 - Inclined plane, wedge, and screw; pulley: block and tackle; wheel and axle
 - Efficiency

Energy & Momentum

- Energy:
 - Kinetic energy:
 - Kinetic energy equation, work and kinetic energy, relative contributions of mass and velocity
 - Potential energy:
 - Gravitational, elastic force
 - Conservative forces: nonconservative force, dissipative force
 - Conservation of energy:
 - Mechanical energy
 - Law of conservation of mechanical energy
 - Law of conservation of energy
- Momentum:
 - Original formulation of Newton's second law:
 - Two useful interpretations
 - Law of conservation of momentum
 - Colliding objects:
 - Elastic and inelastic collisions, elastic one-dimensional collisions
 - Completely inelastic one-dimensional collisions
- Impulse

Rotary Motion: Angular, Circular, & Rotary Motion

- Angular velocity and angular acceleration:
 - Arc length, rim speed, radians
 - Rotary motion:
 - Angular displacement, angular velocity, and angular acceleration
 - Basic equations for rotary motion, linear motion and angular motion
- Radian measure for circular motion
- Rotational inertia: experimental study of, equation for, I for various bodies
- Torque:
 - Law of torque: radius of a force
 - Work, power, kinetic energy, and momentum:
 - Total kinetic energy of moving body
 - Conservation of energy in rotary motion
 - Conservation of angular momentum
 - Flywheels
 - Angular momentum as a vector:
 - Right-hand rule
 - Gyroscope
- Parallel forces:
 - Effects of parallel forces on rotating body
 - Effects of static equilibrium: translational equilibrium, rotational equilibrium

Heat

- Thermometry:
 - Thermal equilibrium
 - Constructing a temperature scale:
 - Fahrenheit, Celsius, and Kelvin scales
 - Triple point, absolute scale
 - Converting among temperature scales
- Thermal expansion:
 - Effects of heating a solid: linear, area, and volume expansion
 - Liquid expansion
- Heat exchange:
 - Caloric theory
 - Units of heat
 - Law of heat exchange:
 - Heat capacity
 - Specific heat
 - Phase changes: melting, freezing, exothermic, heat of vaporization, condensation, calorimeter, calorimetry
 - Heat transfer:
 - Heat conduction, thermal conductor, thermal conductivity
 - Thermal insulator, heat flow
 - Conduction, convection, radiation

Laws of Thermodynamics

- First Law of Thermodynamics:
 - Internal energy:
 - System, surroundings
 - Closed system, open system, isolated system
 - Equilibrium, internal energy, thermal energy
 - Mechanical equivalent of heat
 - Thermodynamics
 - Internal energy equation
 - Qualitative explanation of adiabatic processes, isothermal

Physics cont.

► **RED** indicates first introduction of content.

Laws of Thermodynamics cont.

- Ideal gas law:
 - Reversible and irreversible processes
- Second Law of Thermodynamics:
 - Entropy:
 - Quantitative definition
 - Tendency to minimum energy and maximum entropy
 - Other formulations of the second law
 - Cause of ordered complexity
 - Evolution and the second law of thermodynamics: evolution's challenge to science
- Zeroth and Third Laws of Thermodynamics: thermal equilibrium

Waves

- Transverse waves:
 - Wave pulse, crest, trough
 - Elastic medium
 - Energy transport
 - Wave properties:
 - Simple harmonic motion, sinusoidal, periodic
 - Frequency, period, speed, wavelength, amplitude
 - Wave classification:
 - One-, two-, and three-dimensional waves
 - Interface, wavefront, ray; straight, spherical, and plane waves
- Longitudinal waves:
 - Compression pulse, rarefaction pulse, longitudinal waves
 - Sinusoidal character of longitudinal waves
 - Water waves, sound waves
- Boundary effects:
 - Reflection:
 - Angle of incidence, angle of reflection, law of reflection, reflection of sound, sonar
 - Refraction: of sound waves
 - Diffraction: of sound waves
- Superposition:
 - Composite wave trains
 - Constructive and destructive interference
 - Standing wave train, standing wave:
 - Node, antinode, loop, envelope of oscillation

Sound

- Nature of sound:
 - Graphical representation of sound waves:
 - Displacement and pressure wave trains
- Speed of sound:
 - Hardness
 - Density, temperature, effect of air temperature
- Doppler effect:
 - General Doppler equation
 - Sonic booms, supersonic speed, shock wave
- Characteristics of sound:
 - Intensity:
 - Threshold of hearing, quantitative treatment, amplifying
 - Loudness:
 - Nonlinear receiver, relative intensity, quantitative treatment
 - Decibel

- Pitch:
 - Sonic spectrum, mean free path, audio spectrum
- Infrasonic and ultrasonic waves
- Cavitation
- Ear's nonlinear response to frequency

Nature of Light

- Early light theories:
 - Ancient contributions, camera obscura, rectilinear propagation
- Huygens' theory
- Newton's theory:
 - Corpuscles
- Young's demonstration, Herschel's discovery
- Infrared rays
- Maxwell's theory, electromagnetic waves, photons, wave-particle duality
- Electromagnetic spectrum:
 - Nature of an electromagnetic wave: range of wavelengths, electromagnetic spectrum, Planck's constant
 - Regions within the electromagnetic spectrum: visible light, infrared, ultraviolet
- Color:
 - Spectrum of visible light:
 - ROY G. BV
 - Solar spectrum
 - Monochromatic, composite light
 - Light mixing:
 - Additive mixing, primary colors
 - Secondary and complementary colors
 - Objects' colors:
 - Surface color
 - Transparent, translucent, opaque, color filters, hue, pure color, brightness
 - Pigment mixing:
 - Subtractive mixing, subtractive primaries
 - Subtractive secondaries

Reflection of Light

- Laws of reflection:
 - Absorbed, scattered, transmitted, reflected, reflectance, specular and diffuse reflection
 - First law of reflection
 - Second law of reflection
- Mirror images:
 - Plane mirrors: virtual and real images, right-angled mirror, double mirror
 - Concave mirrors:
 - Spherical mirrors, concave, convex
 - Vertex, center of curvature, principal axis
 - Secondary axis, radius of curvature, aperture, point source
 - Focal point, focal length, focal plane, ray diagram
 - Principal rays: central, parallel, and focal rays; real and virtual image
 - Convex mirrors: spherical aberration
 - Parabolic mirrors
- Mirror equation:
 - Establishing the mirror equation: geometric relationships, important sign conventions
 - Lateral magnification: comparing heights, important references

Physics cont.

► **RED** indicates first introduction of content.

Refraction of Light

- Laws of refraction:
 - Optical density
 - Refraction
 - Refractive index, refractometer
 - First law of refraction: angle of incidence, angle of refraction
 - Second law of refraction: principle of reversibility
 - Refraction effects: mirage
 - Total internal reflection: critical angle
- Lenses:
 - Convex and concave lenses
 - Planar lenses, sign convention, focal length of lens
 - Converging lenses:
 - Principal axis, principal focal point, optical center, focal length
 - Secondary focal point, converging images, ray diagrams
 - Optical plane; parallel, central, and focal rays
 - Diverging lenses
 - Lensmaker equation
- Thin lens equation:
 - Lateral magnification: lens combinations, corrective lenses
 - Myopia, hyperopia, power of a lens

Wave Optics

- Interference:
 - In phase, out of phase, antinode, node
 - Newton's rings: fringes, cause of, optically flat
 - Interference fringes in soap film:
 - Monochromatic and color fringes
 - Iridescence
- Diffraction:
 - Obstacle diffraction: umbra, penumbra
 - Single-slit diffraction: diffraction fringes, antinode, node, fringe formation
 - Multiple-slit diffraction: double slits, coherent light, triple slits, zeroth-order maximum, first-order maximum, second-order maximum
 - Diffraction gratings:
 - Diffraction angle, grating constant, reflection grating, transmission grating, phase gratings
- Dispersion:
 - Dispersion of white light:
 - By a prism
 - By diffracting grating
 - Chromatic aberration
 - Rainbows:
 - Formation, primary bow, secondary bow
 - Supernumerary bows, miniature bows, lunar bow
- Polarization: unpolarized, polarized, by selective absorption, by reflection
- Scattering, structural colors

Electrostatics

- Charge:
 - Static electricity: discharge, law of electric charges, neutralized
 - Charge carriers:
 - Anion, cation
 - Current in gases, liquids, and solids
 - Conductors, delocalized electrons, insulators, semiconductors

- Transfer of charge: conduction, induction, grounded, electroscope
- Coulomb's law:
 - Law of electric force, coulomb
 - Microcoulombs, permittivity
 - Comparing gravitation and electric force, charge conservation
- Electric fields:
 - Electric field strength: first formulation, second formulation
 - Electric field maps:
 - Lines of force
 - Uniform field
- Electric potential:
 - Electric potential energy vs. electric potential
 - Potential difference
 - Potential gradient: GPE, EPE
 - Distribution of free electrons: corona discharge, equipotential surface, equipotential lines

Magnetism

- Magnetic materials:
 - Dipolarity: magnetite, lodestone, north pole, south pole, dipolar, monopoles, law of magnetic poles
 - Making magnets:
 - Magnetization, contact, induction, demagnetization, keeper, temporary vs. permanent magnets
 - Permalloy, alnico
- Coulomb's law of magnetic force
- Magnetic fields:
 - Mapping a magnetic field, lines of flux
 - Magnetic induction
 - Permeability
- Magnetic moment:
 - Spin magnet, orbital magnets, domain theory
 - Saturation
 - Diamagnetic, paramagnetic, ferromagnetic
- Electromagnets:
 - Conventional current
 - Oersted's discovery
 - Ampere's right-hand rule
 - Solenoid
- Magnetic force: two loops or two solenoids, two parallel conductors, ampere, coulomb, force of a straight conductor
- Defining magnetic induction:
 - Direction of magnetic force: three-finger rules
 - Force on a moving charge
 - Magnetic flux: flux density

Current Generation

- Electromagnetic induction:
 - Current in a moving conducting loop:
 - Right-handed three-finger rule, magnetic flux
 - Electromagnetic induction
 - Different motions in a magnetic field
- Galvanometer
- Discovery of electromagnetic induction:
 - Law of induction
- Lenz's law: direction of current

Physics cont.

➤ **RED** indicates first introduction of content.

Current Generation cont.

- Electric generators:
 - Simple AC generators: armature, slip rings, brushes, alternating current, AC frequency
 - Simple DC generators: direct current, commutator
 - Complex generators: rotor, stator, prime mover, three-phase current
- Motors:
 - Motor effect: electric motor, torque, torque arm, two-pole motor
 - Energy losses: hysteresis, eddy currents
- Electrochemical cells:
 - Current production: electrodes, electrolyte, salt bridge, load, anode, cathode, electromotive force
 - Batteries: cells in series and in parallel
- Thermoelectricity:
 - Seebeck effect: thermocouple, Seebeck voltage and effect
 - Peltier effect
- Piezoelectricity:
 - Piezoelectric effect and devices

Electric Circuits

- Resistance:
 - Defining resistance
 - Resistance in a conductor
 - Ohmic, nonohmic, resistivity
 - Rheostat
 - Nichrome
 - Insulators, semiconductor, conductor, superconductivity
- Ohm's Law:
 - Elements of a circuit: current source, conventional current
 - Circuits with a single resistance: Ohm's law
 - IR drop: voltage, energy transactions
 - Quantitative treatment of equivalent resistance:
 - Series and parallel resistors
 - Rules for resistances in series
 - Equivalent parallel resistance, rules for resistance in parallel
- Complex circuits:
 - Networks
 - Circuit resistance and current:
 - Open circuit
 - Open-circuit voltage
 - Closed circuit
 - Closed-circuit voltage
 - Short circuit
 - Measuring electricity: multimeter, galvanometer, ammeter, voltmeter, ohmmeter
 - Kirchhoff's Laws: first law, junctions, principle of charge conservation, second law

Electrical Devices

- Electrical work:
 - Work and heat:
 - Calculation of joule heat
 - Work and power:
 - Three equations for electric power
 - Energy consumption

- Effective values of current and voltage: house current, in phase
- Capacitor:
 - Calculating capacitance: farad, dielectric, dielectric constant, permittivity of free space, dielectric strength
 - Capacitor combinations: parallel and series capacitors
- Inductance: single loop, self-induced emf, coil, self-inductance, inductor, mutual inductance
- Inductor combinations: series and parallel inductors, series-aiding and series-opposing combinations
- Transformers:
 - Transformer equation
 - Step-up and step-down transformers
 - Efficiency

Advanced Physics Concepts

- Quantum theory:
 - Blackbody radiation:
 - Incandescence
 - Radiance
 - Stefan-Boltzmann law, Wien's law
 - Quanta: Planck, quantum theory
- Photons:
 - Photoelectric effect:
 - Photoelectrons, work function
 - Saturation potential, stopping potential
 - Threshold frequency, Einstein's hypothesis, Compton effect
- Matter waves:
 - Momentum of light
 - De Broglie's equation, matter waves
 - Wave-particle duality, complementarity
- Quantum numbers:
 - Pauli exclusion principle, orbital
 - Principal, subshell, magnetic, and spin quantum numbers
 - Angular momentum
- Spectral lines:
 - Line emission spectra:
 - Line absorption spectrum, emission spectra and classical theory, quantized, ground and excited states
 - Quantitative relationships between wavelength, energy, and quantum numbers
 - Wave mechanics:
 - Wave mechanical model, wave function
 - Uncertainty principle:
 - Mathematical formulation, philosophical implications

Relativity

- Speed of light:
 - Galileo's, Rømer's, and Michelson's methods; ether, interferometer
- Theories of relativity:
 - Physical absolutes, relativism:
 - Special relativity:
 - Five applications, rest mass, time dilation, length contraction
 - Quantitative aspects
 - General relativity: its effects, conclusion