

Westminster Christian Academy
Scope and Sequence 2008-09
Science Department



WESTMINSTER CHRISTIAN ACADEMY

Mission

Westminster Christian Academy honors Jesus Christ by providing an excellent education, rooted in biblical truth as interpreted by the Westminster Confession of Faith, for the children of Christian parents. Faculty and staff enable students to discover and embrace a biblical view of the world and integrate that view into every area of life.

Philosophy of Education

Westminster is an independent, co-educational 7-12th grade college preparatory school founded on the following:

- We believe that God is the creator and sustainer of all things and that Jesus Christ is the only redeemer of our fallen world. As a covenantal school, we are committed, in partnership with home and church, to a quality education based on these truths.
- We believe that our curriculum provides an academically diverse student body with knowledge in the traditional liberal arts and the skills and wisdom to apply that knowledge. Teachers are committed to designing and employing creative teaching strategies to meet this goal.
- We believe that a complete education transforms knowledge into practical action. The development and application of Christian character, through leadership, training, community service, co-curricular programs, and the building of relationships, are essential outgrowths of our educational perspective.
- We believe that trust, respect, and open communication are the foundation for the school program and the community atmosphere. We expect staff and students to exemplify biblical standards in their attitude and lifestyles and to take personal responsibility for the growth and development of others.

Educational Objectives

A Westminster Christian Academy education will encourage students to:

- Respond personally to the gift of salvation;
- Develop a biblical value system that guides decision making;
- Develop individuality and self-acceptance based on God's grace and truth alone;
- Accept and appreciate all people as God's image bearers;
- Recognize, embrace, and participate in the interpersonal relationships within the community;
- Develop basic competencies and applicable skills in theology, sciences, physical

education, humanities, foreign languages, and practical and fine arts;

- Become lifelong learners;
- Participate in co-curricular activities with tenacity, poise and perspective;
- Participate in interdisciplinary activities, recognize the interrelatedness of the disciplines, and synthesize the disciplines for themselves;
- Seek God's plan for their lives and follow God's leading in educational choices, career choices and lifestyle;
- Demonstrate responsible stewardship of time, talents, and resources;
- Respect and enjoy God's creation;
- Influence our culture, as redemptive agents in a fallen world, by applying God's standard of truth and grace.

Philosophy of Curriculum

All schools hope to produce students familiar with a wide range of information from broadly based fields of study. All schools hope to produce students of good character with a finely tuned sense of social responsibility. But as outlined in the mission statement above, the purpose of education at Westminster Christian Academy is much larger: as a school shaped by the Reformed tradition, Westminster's commitment is to prepare students to uncover and to use their God-given gifts so that they may offer hope and healing to a world badly in need of both. It is not enough that students know the intricacies of mathematics or science or music; they must grasp how these disciplines—and every other discipline as well—have been created by God to help us understand the beauty of His creation, the tragedy of the Fall, and the importance of commitment to restoration and reconciliation in whatever sphere of influence God places them.

Teachers who embrace that task must recognize three fundamental principles immediately. The first is that whatever their aptitudes or talents, all students have been created in God's image and must not only be treated with the dignity that is inherently theirs but be given the chance to exercise their unique gifts as well. Therefore, Westminster must honor the divinely ordained abilities of all students and offer a program that provides students with diverse skills and interest an opportunity to thrive. The second is that education must be far more than the dissemination of information. Information is important, for students must grasp the Who? and When? and What? and Where? if they are to discover their place in God's world. But that information must be a springboard to a personal understanding of how that information connects to them and how they can use that information to make a difference in this world. Finally, students must recognize that though all knowledge and wisdom comes from God, Christians do not have a monopoly on truth. Therefore, it is appropriate and fitting that students explore

how God has used Christians and non-Christians alike to reveal how He has shaped the world and has acted to influence the lives of men and women throughout the ages.

PROGRAM GOALS - SCIENCE DEPARTMENT

WHAT (discover)...

1. The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation.
2. The student will discover the role and limitations of Science and technology, and recognize that sin effects all of Creation, including the process of investigating it.
3. The student will discover what it means to be created in the image of God, and how that affects his/her relationships with other people as well as the rest of Creation.
4. The student will discover the fundamental concepts and principles of the science course they are taking, and the methods and technology used to discover them.

SO WHAT (embrace)...

The student will embrace, from both a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe.

The student will embrace a Biblical worldview in understanding issues of science, technology, and culture.

The student will perceive the inter-relatedness of science, math, and the other disciplines.

NOW WHAT (integrate)...

1. The student will praise God through the study and responsible care of His Creation.
2. The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation.
3. The student will become a problem solver through observing, data collecting, and experimentation with available technology. Some students will consider a career in Science.

Concepts of Physics

Physics is the study of the fundamental principles by which God providentially governs and maintains His Creation. Because it is commonly recognized as the fundamental science, physics is offered during the first year of the Upper School science sequence.

Students will:

- Gain a working knowledge of the fundamentals of physics, studying units covering motion, forces, energy and work, phases of matter, heat, sound, light, electricity and magnetism, and nuclear reactions.
- Recognize the relevance of physics by relating physics principles to everyday life examples.
- Grow in their understanding of God's character as revealed in the study of physics.
- Develop important teamwork skills necessary in labs and class activities with partners or in small groups.

Key Texts: *Conceptual Physics*, Paul Hewitt, Pearson Prentice Hall, 2006.

Conceptual Physics Laboratory Manual, Paul Robinson, Prentice Hall Inc., 2002

Concepts of Physics Unit Scope and Sequence

I. Mechanics

What...

Students will discover motion in one dimension, vectors and two-dimensional motion, the laws of motion, energy, momentum and collision, rotational motion and the law of gravity, rotational equilibrium and rotational dynamics, and solids and fluids.

So What...

1. Test 1 Unit 1 and Chapter 1 – The Christian View of Science, the Metric System, and Graphing and Science Overview
2. Test 2 Chapter 2 – Linear Motion
3. Test 3 Chapter 4 – Newton's First Law of Motion
4. Test 4 Chapter 5 – Newton's Second Law of Motion
5. Test 5 Chapter 6 – Newton's Third Law of Motion
6. Test 6 Chapter 7 – Momentum
7. Test 7 Chapter 8 – Energy
8. Test 8 Chapter 9 – Circular Motion
9. Test 9 Chapter 10 – Center of Gravity
10. Test 10 Chapter 11 – Rotational Mechanics
11. Lab 1 – Dimensional Analysis Lab
12. Lab 2 – Scientific Method (adapted from Lab #16 Balloon Rockets)
13. Lab 3 – Distance, Time, and Average Speed (Lab #3 The Domino Effect)

14. Lab 4 – Distance vs. Time, Velocity, and Acceleration (Lab #4 Merrily We Roll Along)
15. Lab 5 – Newton's 2nd Law (Lab #12 Constant Force and Changing Mass)
16. Lab 6 – Newton's 2nd Law (Lab #13 Constant Mass and Changing Force)
17. Lab 7 – Newton's 3rd Law (Lab #17 Tension)
18. Lab 8 – Conservation of Momentum (adapted from Lab #20 Tailgated by a Dart)
19. Lab 9 – Work and Power (Running in the Commons)
20. Lab 10 – Conservation of Energy (Pendulum Potential and Kinetic Energy)
21. Lab 11 – Rotational Speed
22. Lab 12 – Balanced Torque (Lab #33 Weighing an Elephant)
23. Lab 13 – Balanced Torque (Lab #34 Keeping in Balance)

Now What...

1. Special discussion – Limitations of science and technology: sin affects all of Creation, including the process of investigating and measuring it.
2. Special discussion – Creation reflects the creator: God's attributes and character are reflected in the unity, beauty, intricacy, goodness, and orderliness of creation.
3. Special discussion – Universal laws: God (and the creation that reflects Him) does not change from place to place and time to time.

4. Special discussion – Physics as a study that enables us increasingly to understand the physical universe. It is limited in that it cannot completely address certain aspects of reality such as the spiritual and the aesthetic. As with any technology, it can be misappropriated.

II. Properties of Matter

What...

Students will discover the atomic nature of matter and the properties and laws of solids, liquids and gases.

So What...

1. Test 11 Chapter 17 – Atomic nature
2. Test 12 Chapter 18 – Solids
3. Test 13 Chapter 19 – Liquids
4. Test 14 Chapter 20 – Gases
5. Lab 14 – Atomic number, ions, and isotopes
6. Lab 15 – Hooke's Law (Lab #43 Stretch)
7. Lab 16 – Scaling (Lab #44 Geometric Physics)
8. Lab 17 – Displacement and Density (Lab #45 Eureka!)
9. Lab 18 – Archimedes' Principle and the Principle of Flotation (Lab #46 Sink or Swim)

Now What...

1. Special discussion – Anti-reductionism: Deeper knowledge and understanding never explains AWAY God, but explains THE WAY God designed His Creation.

III. Thermodynamics

What...

Students will discover thermal physics.

So What...

1. Test 15 Chapter 21 – Temperature, Heat, and Expansion
2. Test 16 Chapter 22 – Heat transfer
3. Lab 19 – Specific Heat (Lab #49 Heat Mixes: Part I)
4. Lab 20 – Specific Heat (Lab #50 Heat Mixes: Part II)
5. Lab 21 – Specific Heat and Boiling Point (Lab #51 Antifreeze in the Summer?)
6. Lab 22 – Absorption and Emission (adapted from Lab #54 Cooling Off)
7. Lab 23 – Newton’s Law of Cooling (adapted from Lab #54 Cooling Off)

Now What...

1. Special discussion – God has a clear design for the care and existence of his creation as is evident in the peculiar behavior of water.
2. The “Fall” (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology) which has sometimes led to pollution, physical harm, death, and destruction.

IV. Vibrations and Waves

What...

Students will discover vibrations and waves, and sound.

So What...

1. Test 17 Chapter 25 – Vibrations and Waves
2. Test 18 Chapter 26 – Sound
3. Lab 24 – Speed of sound (Lab #69 Mach One)

Now What...

1. Special discussion – Man in God’s image: Mankind is similar to (rational and orderly) and different from (able to discover and understand the laws of God’s creation) the rest of creation.
2. Special discussion – We have a responsibility to exercise wise and caring stewardship over God’s Creation not only through the activity of discovering but also through the application of those discovered principles (technology).

3. Special discussion – Studying Physics enables us to better fulfill this mandate of stewardship.

V. Light and Optics

What...

Students will discover reflection and refraction of light, mirrors and lenses, and wave optics.

So What...

1. Test 19 Chapter 27 – Light
2. Test 20 Chapter 28 – Color
3. Test 21 Chapter 29 – Reflection and Refraction
4. Test 22 Chapter 30 - Lenses
5. Lab 25 – Atomic Spectra (Lab #73 Flaming Out)
6. Lab 26 – Virtual Images (Lab #75 Images)
7. Lab 27 – Convex lenses (Lab #82 Bifocals)

Now What...

Special discussion – The dual nature of light and electrons: Particle or Wave? Man's categories are inherently limited and unable to fully envelop the complexities of Creation.

VI. Electricity

What...

Students will discover electric forces and electric fields, electrical energy and capacitance, current and resistance, and direct current circuits.

So What...

1. Lab 28 – Series and parallel circuits (Lab #87 Sparky, the Electrician)

Now What...

1. Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
2. Because Man is created in the image of God, he/she has been given the responsibility to exercise wise stewardship over the rest of Creation.

* Lab numbers refer to Hewitt's *Conceptual Physics Laboratory Manual, Third Edition*

Concepts of Physics Assessments

TESTS (50% of Quarter Grade)

Tests cover one Chapter and include both multiple choice and problem-solving questions. (Chapters referred to are from Paul Hewitt's *Conceptual Physics*)

- Test 1 Unit 1 and Test Chapter 1 – Science Overview
- Test 2 Chapter 2 – Linear Motion
- Test 3 Chapter 4 – Newton's First Law of Motion
- Test 4 Chapter 5 – Newton's Second Law of Motion
- Test 5 Chapter 6 – Newton's Third Law of Motion
- Test 6 Chapter 7 – Momentum
- Test 7 Chapter 8 – Energy
- Test 8 Chapter 9 – Circular Motion
- Test 9 Chapter 10 – Center of Gravity
- Test 10 Chapter 11 – Rotational Mechanics
- Test 11 Chapter 17 – The Atomic Nature of Matter
- Test 12 Chapter 18 – Solids
- Test 13 Chapter 19 – Liquids
- Test 14 Chapter 20 – Gases
- Test 15 Chapter 21 – Temperature, Heat, and Expansion
- Test 16 Chapter 22 – Heat Transfer
- Test 17 Chapter 25 – Vibrations and Waves
- Test 18 Chapter 26 – Sound
- Test 19 Chapter 27 – Light
- Test 20 Chapter 28 – Color

HOMEWORKS (20% of Quarter Grade)

Assigned questions at the end of each Test Chapter covered

LABS (30% of Quarter Grade)

(Unless otherwise specified, labs referred to are from Paul Robinson's *Conceptual Physics Laboratory Manual*)

1. Dimensional Analysis Lab
2. Lab 4 – Merrily We Roll Along
3. Lab 12 – Constant Force, Changing Mass
4. Lab 13 – Constant Mass, Changing Force
5. Lab 20 – Momentum
6. Running for Physics
7. Conservation of Energy Lab
8. Lab 33 – Weighing an Elephant
9. Lab 34 – Keeping in Balance
10. Lab 43 – Stretch
11. Lab 45 – Eureka!

12. Lab 46 – Sink or Swim
13. Lab 49 and 50 – Heat Mixes Part I and II
14. Lab 54 – Cooling Off
15. Lab 64 and 65 – Tick-Tock and Grandfather’s Clock
16. Lab 69 – Mach One
17. Lab 75 – Images
18. Lab 82 – Bifocals

Concepts of Physics

The WHAT (discover)...

1. **The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of...
 - The characteristics and laws of motion, both linear and circular.
 - The characteristics of forces, especially gravitational, frictional, electromagnetic, and nuclear.
 - The characteristics of energy and the transfer of that energy from one form to another.
 - The composition and properties of matter evident in atoms, solids, liquids, and gases.
 - The nature of heat, its effect on objects, and its flow between objects of different temperatures.
 - The motion of waves evident in sound and light.

2. **The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it,** as seen in...
 - Our uncovering the fundamental and universal laws by which God directs and governs the operation of His Creation.
 - God’s graciously enabling man to apply the principles of physics (i.e. technology) to the solution of problems that beset both man and the rest of Creation.
 - The study of Physics enabling us to increasingly understand the physical universe. It is limited in that it cannot completely address certain aspects of reality such as the spiritual and the aesthetic.

3. **The student will discover what it means to be created in the image of God, and how that affects his/her relationships with other people as well as the rest of Creation** through the realization that...
 - We are similar to (rational and orderly) and different from (able to discover and understand the laws of God’s Creation) the rest of Creation.
 - We have a responsibility to exercise wise and caring stewardship over God’s Creation.

- We are better able to fulfill this mandate of stewardship through the study of Physics. Stewardship includes the progressive unlocking of the unrealized potential of Creation.
4. **The student will discover the fundamental concepts and principles of the science course he/she is taking, and the methods and technology used to discover them.** In Concepts of Physics this includes...
- How objects in motion obey certain fundamental laws.
 - How objects possess mechanical energy and transform this energy from one form to another.
 - How matter, at the atomic level, is constructed and how that matter, in the forms of solids and fluids, behaves.
 - How heat flows from one object to another and the effect of heat and temperature on objects.
 - How sound and light behave similarly in their motions but are fundamentally different in composition and characteristics.

The SO WHAT (embrace)...

1. **The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe.** Students will embrace the idea that...
 - Creation is good, orderly, and beautiful. Creation reflects the Creator.
 - The laws that govern the operation of the universe reveal God's ongoing and perfect care and control of His creation.
2. **The student will embrace a Biblical worldview in understanding issues of science, technology, and culture.** Students will embrace the idea that...
 - The "Fall" (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology) which has sometimes led to pollution, physical harm, death, and destruction.
 - Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
 - Because Man is created in the image of God, he/she has been given the responsibility to exercise wise stewardship over the rest of Creation.
3. **The student will perceive the inter-relatedness of physics, other sciences, math, and the other disciplines.** Students will embrace the idea that...
 - Physics is the foundational basis for understanding chemistry.
 - Computers are tools which facilitate the organization, presentation, and interpretation of data.
 - Math is an essential language that enables scientists to articulate the truths of physics.

The NOW WHAT (integrate)...

- 1. The student will praise God through the study and responsible care of His Creation.**
 - The more the student understands the complexities and intricacies of Creation, the more he/she will be moved to praise God. Deeper knowledge and understanding never explains AWAY God, but explains THE WAY God designed His Creation.
- 2. The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation.**
 - Students often bring to class an experiential grasp of the laws of physics but frequently lack an accurate conceptual understanding. This creates opportunities for deeper exploration of the physical world through classroom discussions, laboratory activities, and application of the laws of physics to everyday events.
- 3. The student will become a problem solver through observing, data collecting, and experimentation with available technology. Some students will consider a career in science.**
 - Students will regularly use graphing calculators, computers, and electronic data collection devices for acquisition, analysis, and presentation.
 - Lab activities occur weekly, primarily during the block period, and constitute a significant part of the curriculum and evaluation.

Physics 9

Physics is the study of the fundamental principles by which God providentially governs and maintains His Creation. Because it is commonly recognized as the fundamental science, physics is offered during the first year of the Upper School science sequence. While this course requires less mathematical rigor than the Honors Physics course, these students will apply their algebra and geometry skills to the natural laws at work around them to more fully understand God's creation.

Students will:

- Gain a working knowledge of the fundamentals of physics, studying units covering motion, forces, energy and work, phases of matter, heat, sound, light, electricity and magnetism, and nuclear reactions.
- Recognize the relevance of physics by relating physics principles to everyday life examples.
- Grow in their understanding of God's character as revealed in the study of physics.
- Develop important teamwork skills necessary in labs and class activities with partners or in small groups.

- Apply algebra and geometry to some problem-solving exercises in physics.

Key Texts: *Conceptual Physics*, Paul Hewitt, Pearson Prentice Hall, 2006.

Conceptual Physics Laboratory Manual, Paul Robinson, Prentice Hall Inc., 2002

Regular Physics Unit Scope and Sequence

I. Mechanics

What...

Students will discover motion in one dimension, vectors and two-dimensional motion, the laws of motion, energy, momentum and collision, rotational motion and the law of gravity, rotational equilibrium and rotational dynamics, and solids and fluids.

So What...

1. Test 1 Unit 1 and Chapter 1 – The Christian View of Science, the Metric System, and Graphing and Science Overview
2. Test 2 Chapters 2-3 – Linear and Projectile Motion
3. Test 3 Chapters 4-5 – Newton’s First and Second Laws of Motion
4. Test 4 Chapters 6-7 – Newton’s Third Law of Motion and Momentum
5. Test 5 Chapters 8-9 – Energy and Circular Motion
6. Test 6 Chapters 10-11 – Center of Gravity and Rotational Mechanics
7. Test 7 Chapters 12-14 Test – Universal Gravitation, Gravitational Interactions, and Satellite Motion
8. Lab 1 – Dimensional Analysis Lab
9. Lab 2 – Distance, Time, and Average Speed (Lab #3 The Domino Effect)
10. Lab 3 – Distance vs. Time, Velocity, and Acceleration (Lab #4 Merrily We Roll Along)
11. Lab 4 – Projectile Motion (Lab #7 Bull’s Eye)
12. Lab 5 – Newton’s 2nd Law (Lab #12 Constant Force and Changing Mass)
13. Lab 6 – Newton’s 3rd Law (Lab #17 Tension)
14. Lab 7 – Newton’s Laws (Crash! Lab: Newton’s Laws in Court, Sargent v. Smith Trucking)
15. Lab 8 – Newton’s Laws and Momentum (Crash! Lab: Newton’s Laws in Court, Sullivan v. Mitton)
16. Lab 9 – Conservation of Momentum (adapted from Lab #20 Tailgated by a Dart)
17. Lab 10 – Conservation of Momentum (Crash! Lab: Using Linear Momentum in Accident Reconstruction)
18. Lab 11 – Work and Power (Running for Physics)
19. Lab 12 – Conservation of Energy (Pendulum Potential Energy and Kinetic Energy)
20. Lab 13 – Conservation of Energy (Crash! Lab: Reconstructing a Motorcycle-Vehicle Collision, Matthews vs. Kelly)
21. Lab 14 – Rotational Speed
22. Lab 15 – Balanced Torque (Lab #33 Weighing an Elephant)
23. Lab 16 – Balanced Torque (Lab #34 Keeping in Balance)
24. Lab 17 – Using the Picket Fence to find the mass of the earth

Now What...

5. Special discussion – Limitations of science and technology: sin affects all of Creation, including the process of investigating and measuring it.
6. Special discussion – Creation reflects the creator: God's attributes and character are reflected in the unity, beauty, intricacy, goodness, and orderliness of creation.
7. Special discussion – Universal laws: God (and the creation that reflects Him) does not change from place to place and time to time.
8. Special discussion – Physics as a study that enables us increasingly to understand the physical universe. It is limited in that it cannot completely address certain aspects of reality such as the spiritual and the aesthetic. As with any technology, it can be misappropriated.

II. Properties of Matter

What...

Students will discover the atomic nature of matter and the properties and laws of solids, liquids and gases.

So What...

1. Test 8 Chapters 17-18 – Atomic nature and Solids
2. Test 9 Chapters 19-20 – Liquids and Gases
3. Lab 18 – Estimate the diameter of a BB (Lab #41 Flat as a Pancake)
4. Lab 19 – Estimate the diameter of a molecule of oleic acid (Lab #42 Extra Small)
5. Lab 20 – Hooke's Law (Lab #43 Stretch)
6. Lab 21 – Scaling (Lab #44 Geometric Physics)
7. Lab 22 – Displacement and Density (Lab #45 Eureka!)
8. Lab 23 – Archimedes' Principle and the Principle of Flotation (Lab #46 Sink or Swim)

Now What...

1. Special discussion – Anti-reductionism: Deeper knowledge and understanding never explains AWAY God, but explains THE WAY God designed His Creation.

III. Thermodynamics

What...

Students will discover thermal physics.

So What...

1. Test 10 Chapters 21-22 – Temperature, Heat, Expansion, and Heat Transfer
2. Lab 24 – Specific Heat (Lab #49 Heat Mixes: Part I)
3. Lab 25 – Specific Heat (Lab #50 Heat Mixes: Part II)
4. Lab 26 – Specific Heat and Boiling Point (Lab #51 Antifreeze in the Summer?)
5. Lab 27 – Absorption and Emission (adapted from Lab #54 Cooling Off)
6. Lab 28 – Newton's Law of Cooling (adapted from Lab #54 Cooling Off)

Now What...

1. Special discussion – God has a clear design for the care and existence of his creation as is evident in the peculiar behavior of water.
2. The “Fall” (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology) which has sometimes led to pollution, physical harm, death, and destruction.

IV. Vibrations and Waves

What...

Students will discover vibrations and waves, and sound.

So What...

1. Test 11 Chapters 25-26 – Vibrations, Waves, and Sound
2. Lab 29 – Speed of sound (Lab #69 Mach One)

Now What...

1. Special discussion – Man in God’s image: Mankind is similar to (rational and orderly) and different from (able to discover and understand the laws of God’s creation) the rest of creation.
2. Special discussion – We have a responsibility to exercise wise and caring stewardship over God’s Creation not only through the activity of discovering but also through the application of those discovered principles (technology).
3. Special discussion – Studying physics enables us to better fulfill this mandate of stewardship.

V. Light and Optics

What...

Students will discover reflection and refraction of light, mirrors and lenses, and wave optics.

So What...

1. Test 12 Chapters 27-28 – Light and Color
2. Test 13 Chapters 29-30 – Reflection, Refraction, and Lenses
3. Lab 30 – Atomic Spectra (Lab #73 Flaming Out)
4. Lab 31 – Color Mixing by creating Tie-Dye Shirts
5. Lab 32 – Virtual Images (Lab #75 Images)
6. Lab 33 – Convex lenses (Lab #82 Bifocals)

Now What...

1. Special discussion – The dual nature of light and electrons: Particle or Wave? Man’s categories are inherently limited and unable to fully envelop the complexities of Creation.

VI. Electricity

What...

Students will discover electric forces and electric fields, electrical energy and capacitance, current and resistance, and direct current circuits.

So What...

1. Lab 34 – Series and parallel circuits (Lab #87 Sparky, the Electrician)

Now What...

1. Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
2. Because Man is created in the image of God, he/she has been given the responsibility to exercise wise stewardship over the rest of Creation.

* Lab numbers refer to Robinson's *Conceptual Physics Laboratory Manual*

**Crash! Labs refer to *Crash! The Science of Collisions* by Professor John Kwasnoski, Western New England College, Legal Sciences, 2007

Regular Physics Assessments

TESTS (50% of Quarter Grade)

About 4 per quarter covering 2 chapters each. Primarily multiple choice, equation problems, and short answer. (Chapters referred to are from Paul Hewitt's *Conceptual Physics*, 3rd ed.)

Test 1 Unit 1 and Chapter 1 – Science Overview

Test 2 Chapters 2-3 – Linear Motion and Projectile Motion

Test 3 Chapters 4-5 – Newton's First and Second Laws of Motion

Test 4 Chapters 6-7 – Newton's Third Law of Motion and Momentum

Test 5 Chapters 8-9 – Energy and Circular Motion

Test 6 Chapters 10-11 – Center of Gravity and Rotational Mechanics

Test 7 Chapters 12-14 – Universal Gravitation, Gravitational

Interactions, and Satellite Motion

Test 8 Chapters 17-18 – The Atomic Nature of Matter and Solids

Test 9 Chapters 19-20 – Liquids and Gases

Test 10 Chapters 21-22 – Temperature, Heat, and Expansion and Heat Transfer

Test 11 Chapters 25-26 – Vibrations and Waves and Sound

Test 12 Chapters 27-28 – Light and Color

Test 13 Chapters 29-30 – Reflection and Refraction and Lenses

Test 14 Electricity and Magnetism Chapters Overview

HOMEWORKS (20% of Quarter Grade)

Assigned questions at the end of each chapter covered

LABS (30% of Quarter Grade)

(Unless otherwise specified, numbered labs referred to are from Paul Robinson's *Conceptual Physics Laboratory Manual*)

1. Dimensional Analysis Lab
2. Lab 3 – Dominoes
3. Lab 4 – Merrily We Roll Along
4. Lab 7 – Bull's Eye
5. Lab 12 – Constant Force, Changing Mass
6. Lab 17 – Tension
7. Crash! Lab: Newton's Laws in Court, Sargent v. Smith
8. Crash! Lab: Newton's Laws in Court, Sullivan v. Mitton
9. Lab 20 – Momentum
10. Crash! Lab: Using Linear Momentum in Accident Reconstruction
11. Running for Physics
12. Conservation of Energy using a Pendulum Lab
13. Crash! Lab: Reconstruction of a Motorcycle-Vehicle Collision, Matthews v. Kelly
14. Rotational Motion Lab
15. Lab 33 – Weighing an Elephant
16. Lab 34 – Keeping in Balance
17. Mass of the Earth Lab
18. Lab 41 – Flat as a Pancake
19. Lab 42 – Extra Small
20. Lab 43 – Stretch
21. Lab 44 – Geometric Physics
22. Lab 45 – Eureka!
23. Lab 46 – Sink or Swim
24. Lab 49 and 50 – Heat Mixes Part I and II
25. Lab 51 – Antifreeze in the Summer?
26. Lab 54 – Cooling Off
27. Lab 69 – Mach One
28. Lab 75 – Images
29. Lab 82 – Bifocals
30. Lab 87 – Sparky the Electrician

Physics 9

The WHAT (discover)...

1. **The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of...
 - The characteristics and laws of motion, both linear and circular.

- The characteristics of forces, especially gravitational, frictional, electromagnetic, and nuclear.
 - The characteristics of energy and the transfer of that energy from one form to another.
 - The composition and properties of matter evident in atoms, solids, liquids, and gases.
 - The nature of heat, its effect on objects, and its flow between objects of different temperatures.
 - The motion of waves evident in sound and light.
 - The effects of electricity and magnetism.
2. **The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it, as seen in...**
- Our uncovering the fundamental and universal laws by which God directs and governs the operation of His Creation.
 - God's graciously enabling man to apply the principles of physics (i.e. technology) to the solution of problems that beset both man and the rest of Creation.
 - The study of Physics enabling us to increasingly understand the physical universe. It is limited in that it cannot completely address certain aspects of reality such as the spiritual and the aesthetic.
3. **The student will discover what it means to be created in the image of God, and how that affects his/her relationships with other people as well as the rest of Creation through the realization that...**
- We are similar to (rational and orderly) and different from (able to discover and understand the laws of God's Creation) the rest of Creation.
 - We have a responsibility to exercise wise and caring stewardship over God's Creation.
 - We are better able to fulfill this mandate of stewardship through the study of Physics. Stewardship includes the progressive unlocking of the unrealized potential of Creation.
4. **The student will discover the fundamental concepts and principles of the science course he/she is taking and the methods and technology used to discover...**
- How objects in motion obey certain fundamental laws.
 - How objects possess mechanical energy and transform this energy from one form to another.
 - How matter, at the atomic level, is constructed and how that matter, in the forms of solids and fluids, behaves.
 - How heat flows from one object to another and the effect of heat and temperature on objects.
 - How sound and light behave similarly in their motions but are fundamentally different in composition and characteristics.

- How the behaviors and characteristics of electricity and magnetism and their fields affect charged and magnetized objects respectively.

The SO WHAT (embrace)...

1. The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe. Students will embrace the idea that...

- Creation is good, orderly, and beautiful. Creation reflects the Creator.
- The laws that govern the operation of the universe reveal God's ongoing and perfect care and control of His creation.

2. The student will embrace a Biblical worldview in understanding issues of science, technology, and culture. Students will embrace the idea that...

- The "Fall" (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology) which has sometimes led to pollution, physical harm, death, and destruction.
- Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
- Because Man is created in the image of God, he/she has been given the responsibility to exercise wise stewardship over the rest of Creation.

3. The student will perceive the inter-relatedness between physics, the other sciences, math, and the other disciplines. Students will embrace the idea that...

- Physics is the foundational basis for understanding chemistry.
- Computers are tools which facilitate the organization, presentation, and interpretation of data.
- Math is an essential language that enables scientists to articulate the truths of physics.

The NOW WHAT (integrate)...

1. The student will praise God through the study and responsible care of His Creation.

- The more the student understands the complexities and intricacies of Creation, the more he/she will be moved to praise God. Deeper knowledge and understanding never explains AWAY God but explains THE WAY God designed His Creation.

2. The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation.

- Students often bring to class an experiential grasp of the laws of physics but frequently lack an accurate conceptual understanding. This creates opportunities for deeper exploration of the physical world through classroom discussions, laboratory activities, and application of the laws of physics to everyday events.

3. The student will become a problem solver through observing, data collecting, and experimentation with available technology. Some students will consider a career in science.

- Students will regularly use graphing calculators, computers, and electronic data collection devices for acquisition, analysis, and presentation.
- Lab activities occur weekly, primarily during the block period and will constitute a significant part of the curriculum and evaluation.

Physics 9 Honors

Physics is the study of the fundamental principles by which God providentially governs and maintains His creation. Because it is commonly recognized as the fundamental science, physics is offered during the first year of the upper school science sequence. Though conceptual in presentation, this course is for those students identified as having outstanding math/science abilities. Therefore, this course requires more extensive math and lab work and deeper exploration of topics than regular freshman physics. Admission to this course requires the recommendation of the eighth grade science teacher and the approval of the science department chair.

Students will:

- Gain a working knowledge of the fundamentals of physics, studying units covering motion, forces, energy and work, phases of matter, heat, sound, light, electricity and magnetism, and nuclear reactions.
- Recognize the relevance of physics by relating physics principles to everyday life examples.
- Grow in their understanding of God's character as revealed in the study of physics.
- Develop important teamwork skills necessary in labs and class activities with partners or in small groups.
- Apply algebra and geometry to extensive problem-solving exercises in physics.

Key Texts: *Conceptual Physics*, Paul Hewitt, Pearson Prentice Hall, 2006.

Conceptual Physics Laboratory Manual, Paul Robinson, Prentice Hall Inc., 2002

Physics 9 Honors Unit Scope and Sequence

I. Mechanics

What...

Students will discover motion in one dimension, vectors and projectile motion, Newton's laws of motion, Conservation Laws of energy and momentum, circular motion,

centers of gravity, balanced torques, rotational equilibrium and rotational dynamics, Newton's Universal Gravitation Law, gravitational interactions, and special relativity principles and applications.

So What...

1. Test 1 Chapters 1-2 – Science Overview and Linear Motion– The Christian View of Science, the metric system
2. Test 2 Chapters 3-4 – Projectile Motion and Newton's First Law of Motion
3. Test 3 Chapters 5-6 – Newton's Second and Third Laws of Motion
4. Test 4 Chapter 7 – Momentum
5. Test 5 Chapter 8 – Energy and Machines
6. Test 6 Chapters 9-10– Circular Motion and Center of Gravity
7. Test 7 Chapters 11-12 – Rotational Mechanics and Universal Gravitation
8. Test 8 Chapters 13-14 – Gravitational Interactions and Satellite Motion
9. Test 9 Chapters 15-16 – General and Special Relativity
10. Test 10 First semester final exam
11. Lab 1 –The Domino Effect w/ Vernier's Lab Pro and Logger Pro (Lab # 3 Domino Effect)
12. Lab 2 –Acceleration Due to Gravity w/ Vernier's Lab Pro and Logger Pro (Meridian Lab #4)
13. Lab 3 – Projectile Motion (Lab #7 Bull's Eye)
14. Lab 4 – Newton's 1st Law (Lab # 9 Buckle Up!)
15. Lab 5 – Newton's 2nd Law (Lab #11 Getting Pushy)
16. Lab 6 – Newton's 2nd Law (Labs #12 Constant Force and Changing Mass)
17. Lab 7 – Newton's 2nd Law (Labs #13 Constant Mass and Changing Force)
18. Lab 8 – Newton's 3rd Law (Lab #17 Tension)
19. Lab 9 – Newton's 3rd Law (Lab #18 Tug-Of-War)
20. Lab 10 – Conservation of Momentum (Lab #20 Tailgated by a Dart)
21. Lab 11 – Conservation of Energy (Lab #27 On a Roll)
22. Lab 12 – Centripetal Force (Holt #9)
23. Lab 13 – Rotational Mechanics (Lab #32 Torque Feeler)
24. Lab 14 – Balanced Torque (Lab #34 Keeping in Balance)
25. Lab 15 – Pendulum Physics (Holt Lab #10)

* Note: Unless otherwise specified, labs referred to are from Paul Hewitt's Laboratory Manual for Conceptual Physics, 3rd ed.

Now What...

1. Special discussion – Limitations of science and technology: sin affects all of Creation, including the process of investigating and measuring it.
2. Special discussion – Creation reflects the creator: God's attributes and character are reflected in the unity, beauty, intricacy, goodness, and orderliness of creation.
3. Special discussion – Universal laws: God (and the creation that reflects Him) does not change from place to place and time to time.
4. Special discussion – Physics as a study that enables us increasingly to understand the physical universe. It is limited in that it cannot completely address certain aspects of

reality such as the spiritual and the aesthetic. As with any technology, it can be misappropriated.

5. Special discussion – God’s Creation reveals His character/attributes and activity. Physics allows us better to understand God and His character as we see His “fingerprints” in creation (*digitus dei*).

II. Properties of Matter

What...

Students will discover the atomic nature and structure of matter and the properties and laws of solids, liquids and gases.

So What...

1. Test 11 Chapters 17-18 – Atomic nature and Solids
2. Test 12 Chapters 19-20 – Liquids and Gases
3. Lab 16 – Atomic Architecture Lab (“Bead” lab)
4. Lab 17 – Estimate the diameter of a BB (Lab #41 Flat as a Pancake)
5. Lab 18 – Estimate the diameter of a molecule of oleic acid (Lab #42 Extra Small)
6. Lab 19 – Density Lab
7. Lab 20 – Surface Area to Volume Ratios—Scaling (Lab #44 Geometric Physics)
8. Lab 21 – Archimedes’ Principle and the Principle of Flotation (Lab #46 Sink or Swim)
9. Lab 22 – Charles’ Law (Lab #63 Uncommon Cold)

Now What...

1. Special discussion – God’s Creation reveals His character/attributes and activity. Physics allows us better to understand God and His character as we see his “fingerprints” in creation (*digitus dei*).

III. Thermodynamics

What...

Students will discover the concepts of heat and heat transfer (thermal physics).

So What...

1. Test 13 Chapters 21-22 – Temperature, Heat, Expansion, and Heat Transfer
2. Lab 23 – Specific Heat (Lab #49 Heat Mixes: Part I)
3. Lab 24 – Specific Heat (Lab #50 Heat Mixes: Part II)
4. Lab 25 – Specific Heat and Boiling Point (Lab #51 Antifreeze in the Summer?)

Now What...

1. Special discussion – God has a clear design for the care and existence of His creation evidenced by the unique properties and behaviors of water.
2. Special discussion – God’s Creation reveals His character/attributes and activity. Physics allows us better to understand God and His character as we see His “fingerprints” in creation (*digitus dei*).

IV. Vibrations, Waves, Sound and Light

What...

Students will discover vibrations and waves, sound, light and color as well as basic principles of optics.

So What...

1. Test 14 Chapters 25-26 – Vibrations, Waves, and Sound
2. Test 15 Chapters 27-28 – Light and Color
3. Test 16 Chapters 29-30 – Reflection and Refraction and Lenses
4. Lab 26 – Speed of sound (Lab #69 Mach One)
5. Lab 27 – Flame Tests for Metals (Lab #73 Flaming Out)
6. Lab 28 – Tie-Dye lab
7. Lab 29 – Law of Reflection (Lab #75 Images)
8. Lab 30 – Multiple Reflections (Lab #77 The Kaleidoscope)
9. Lab 31 – Image Formation by Converging Lenses (Lab #82 Bifocals)

Now What...

1. Special discussion –The dual nature of light and electrons: Particle or Wave? Man’s categories are inherently limited and unable to fully envelop the complexities of creation.
2. Special discussion – God’s Creation reveals His character/attributes and activity. Physics allows us better to understand God and His character as we see His “fingerprints” in creation (*digitus dei*).

V. Electricity

What...

Students will discover electric forces and electric fields, electrical energy and capacitance, current and resistance, alternating and direct current circuits, and series and parallel circuits.

So What...

1. Test 17 Chapters 31-32 – Electric Charge and Electric Fields
2. Test 18 Chapters 33-34 – Electric Current and Circuits
3. Lab 32 – Electric Circuit Basics (Lab #87 Sparky, the Electrician)
4. Lab 33 – Electric Current (Lab #88 Brown Out)
4. Lab 34 – Parallel vs. Series Circuits (Lab #91 Cranking Up)

Now What...

1. Special discussion – God’s Creation reveals His character/attributes and activity. Physics allows us better to understand God and His character as we see His “fingerprints” in creation (*digitus dei*).

2. Because Man is created in the image of God, he/she has been given the responsibility to exercise wise stewardship over the rest of Creation.

Physics 9 Honors Assessments

TESTS (50% of Quarter Grade)

About 4 per quarter covering 2 chapters each. Primarily multiple choice, equation problems, and short answer. (Chapters referred to are from Paul Hewitt's *Conceptual Physics*, 3rd ed.)

Test 1 Unit 1 Chapters 1-2 – Science Overview and Linear Motion– The Christian View of Science, the metric system

Test 2 Chapters 3-4 – Projectile Motion and Newton's First Law of Motion

Test 3 Chapters 5-6 – Newton's Second and Third Laws of Motion

Test 4 Chapter 7 – Momentum

Test 5 Chapter 8 – Energy

Test 6 Chapters 9-10 – Circular Motion and Center of Gravity

Test 7 Chapters 11-12 – Rotational Mechanics and Universal Gravitation

Test 8 Chapters 13-14 – Gravitational Interactions and Satellite Motion

Test 9 Chapters 15-16 – General and Special Relativity

Test 10 Chapters 17-18 – The Atomic Nature of Matter and Solids

Test 11 Chapters 19-20 – Liquids and Gases

Test 12 Chapters 21-22 – Temperature, Heat, and Expansion and Heat Transfer

Test 13 Chapters 25-26 – Vibrations and Waves and Sound

Test 14 Chapters 27-28 – Light and Color

Test 15 Chapters 29-30 – Reflection and Refraction and Lenses

Test 16 Chapters 31-32 – Electric Charge and Fields

Test 17 Chapters 33-34 – Electric Current and Circuits

HOMEWORK (25% of Quarter Grade)

Assigned questions at the end of each chapter covered

LABS (2% of Quarter Grade)

(Unless otherwise specified, numbered labs referred to are from Paul Robinson's *Conceptual Physics Laboratory Manual*)

1. The Domino Effect w/ Vernier's Lab Pro and Logger Pro (Lab # 3 Domino Effect)
2. Acceleration Due to Gravity w/ Vernier's Lab Pro and Logger Pro (Meridian Lab #4)
3. Projectile Motion (Lab #7 Bull's Eye)
4. Newton's 1st Law (Lab # 9 Buckle Up!)
5. Newton's 2nd Law (Lab #11 Getting Pushy)
6. Newton's 2nd Law (Labs #12 Constant Force and Changing Mass)
7. Newton's 2nd Law (Labs #13 Constant Mass and Changing Force)
8. Newton's 3rd Law (Lab #17 Tension)
9. Newton's 3rd Law (Lab #18 Tug-Of-War)

10. Conservation of Momentum (Lab #20 Tailgated by a Dart)
11. Conservation of Energy (Lab #27 On a Roll)
12. Centripetal Force (Holt #9)
13. Rotational Mechanics (Lab #32 Torque Feeler)
14. Balanced Torque (Lab #34 Keeping in Balance)
15. Pendulum Physics (Holt Lab #10)
16. Atomic Architecture Lab (“Bead” lab)
17. Estimate the diameter of a BB (Lab #41 Flat as a Pancake)
18. Estimate the diameter of a molecule of oleic acid (Lab #42 Extra Small)
19. Density Lab
20. Surface Area to Volume Ratios—Scaling (Lab #44 Geometric Physics)
21. Archimedes’ Principle and the Principle of Flotation (Lab #46 Sink or Swim)
22. Charles’ Law (Lab #63 Uncommon Cold)
23. Specific Heat (Lab #49 Heat Mixes: Part I)
24. Specific Heat (Lab #50 Heat Mixes: Part II)
25. Specific Heat and Boiling Point (Lab #51 Antifreeze in the Summer?)
26. Speed of sound (Lab #69 Mach One)
27. Flame Tests for Metals (Lab #73 Flaming Out)
28. Tie-Dye lab
29. Law of Reflection (Lab #75 Images)
30. Multiple Reflections (Lab #77 The Kaleidoscope)
31. Image Formation by Converging Lenses (Lab #82 Bifocals)
32. Electric Circuit Basics (Lab #87 Sparky, the Electrician)
33. Electric Current (Lab #88 Brown Out)
34. Parallel vs. Series Circuits (Lab #91 Cranking Up)

Physics 9 Honors

The WHAT (discover)...

1. **The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of...
 - The characteristics and laws of motion, both linear and circular.
 - The characteristics of forces, especially gravitational, frictional, electromagnetic, and nuclear.
 - The characteristics of energy and the transfer of that energy from one form to another.
 - The composition and properties of matter evident in atoms, solids, liquids, and gases.
 - The nature of heat, its effect on objects, and its flow between objects of different temperatures.
 - The motion of waves evident in sound and light.
 - The effects of electricity and magnetism.

2. **The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it, as seen in...**
 - Our uncovering the fundamental and universal laws by which God directs and governs the operation of His Creation.
 - God's graciously enabling man to apply the principles of physics (i.e. technology) to the solution of problems that beset both man and the rest of Creation.
 - The study of Physics enabling us to increasingly understand the physical universe. It is limited in that it cannot completely address certain aspects of reality such as the spiritual and the aesthetic.

3. **The student will discover what it means to be created in the image of God and how that affects his/her relationships with other people as well as the rest of Creation through the realization that...**
 - We are similar to (rational and orderly) and different from (able to discover and understand the laws of God's creation) the rest of creation.
 - We have a responsibility to exercise wise and caring stewardship over God's Creation.
 - We are better able to fulfill this mandate of stewardship through the study of Physics. Stewardship includes the progressive unlocking of the unrealized potential of Creation.

4. **The student will discover the fundamental concepts and principles of the science course he/she is taking and the methods and technology used to discover...**
 - How objects in motion obey certain fundamental laws.
 - How objects possess mechanical energy and transform this energy from one form to another.
 - How matter, at the atomic level, is constructed and how that matter, in the forms of solids and fluids, behaves.
 - How heat flows from one object to another and the effect of heat and temperature on objects.
 - How sound and light behave similarly in their motions but are fundamentally different in composition and characteristics.
 - How the behaviors and characteristics of electricity and magnetism and their fields affect charged and magnetized objects respectively.

The SO WHAT (embrace)...

1. **The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe.**
 - Creation is good, orderly, and beautiful. Creation reflects the Creator.
 - The laws that govern the operation of the universe reveal God's ongoing and perfect care and control of His creation.

- 2. The student will embrace a Biblical worldview in understanding issues of science, technology, and culture.**
 - The “Fall” (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology) which has sometimes led to pollution, physical harm, death, and destruction.
 - Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
 - Because Man is created in the image of God, he/she has been given the responsibility to exercise wise stewardship over the rest of Creation.

- 3. The student will perceive the inter-relatedness between physics, the other sciences, math, and the other disciplines.**
 - Physics is the foundational basis for understanding chemistry.
 - Computers are tools which facilitate the organization, presentation, and interpretation of data.
 - Math is an essential language that enables scientists to articulate the truths of physics.

The NOW WHAT (integrate)...

- 1. The student will praise God through the study and responsible care of His Creation.**
 - The more the student understands the complexities and intricacies of Creation, the more he/she will be moved to praise God. Deeper knowledge and understanding never explains AWAY God but explains THE WAY God designed His Creation.

- 2. The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation.**
 - Students often bring to class an experiential grasp of the laws of physics but frequently lack an accurate conceptual understanding. This creates opportunities for deeper exploration of the physical world through classroom discussions, laboratory activities, and application of the laws of physics to everyday events.

- 3. The student will become a problem solver through observing, data collecting, and experimentation with available technology. Some students will consider a career in science.**
 - Students will regularly use graphing calculators, computers, and electronic data collection devices for acquisition, analysis, and presentation.
 - Lab activities occur weekly, primarily during the block period and will constitute a significant part of the curriculum and evaluation.

Concepts of Chemistry

The marvels of the chemical world reveal the creativity, sovereignty and providence of God. By exploring the principles that govern the behavior of all matter on earth, students will deepen their understanding of God Himself and gain an appreciation for the role that man must play in His earthly design.

Students will:

- Be awed by the precision, design, and complexity of God's Creation.
- Gain a working knowledge of the fundamental principles of chemistry in the context of the thematic units of Water, Materials, Petroleum, Air, Industry, Atoms, and Food.
- Understand how this knowledge will empower them to make wiser and more godly decisions about their use and care of the earth.
- Recognize that, as God's vice regents, it is man's mandate to not only care for and protect the earth but to unlock its potential for the good of mankind.
- Learn techniques, procedures, and safety precautions appropriate for working in a chemical laboratory.
- Develop the teamwork skills needed to learn through experimentation in the laboratory.
- Learn to work cooperatively by appreciating the specific talents of each team member.

Key Texts:

Chemistry in the Community, 5th Edition, The American Chemical Society, W.H. Freeman and Company, 2006.

Concepts of Chemistry Unit Scope and Sequence

I. Water: Exploring Solutions

What...

Students will discover the classifications of matter, the structure of atoms and molecules, the structure of ions and ionic compounds, chemical elements and their formulas, balanced chemical equations and stoichiometry, acid-base reactions, and solution chemistry.

So What...

1. Lab 1- Water Usage Analysis
2. Lab 2- Water Purification
3. Lab 3- Density of Water and Ice
4. Lab 4- Water Testing
5. Lab 5- Solvents
6. Lab 6- Constructing a Solubility Curve
7. Lab 7- Water Softening
8. Test Unit 1A- Sources and Uses of Water
9. Test Unit 1B- Water and Its Contaminants
10. Test Unit 1C- Aqueous Solution Chemistry
11. Test Unit 1D- Water Purification and Treatment

Now What...

1. Special discussion- Early chemists and their quest to find God through the study of matter.
2. Special discussion- Man's privileged place in the order of God's creation.
3. Special discussion - Creation reflects the creator: God's attributes and character are reflected in the unity, beauty, intricacy, goodness, and orderliness of creation.
4. Special discussion - Universal laws: God (and the creation that reflects Him) does not change from place to place and time to time.
5. Special discussion - The special role of water in scripture and creation.

II. Materials: Structure and Uses

What...

Students will discover the fundamentals of matter and change, measurement and unit conversion, atoms and the periodic table, metals and non-metals, and chemical names and formulae.

So What...

- Lab 8- Metal or Non-Metal
- Lab 9- Metal Reactivity- Converting Copper
- Lab 10- Relative Reactivities of Metals
- Lab 11- Retrieving Copper
- Lab 12- Striking it Rich- Metal Alloys

Lab 13- Copper Plating

Test Unit 2A- Physical and Chemical Properties and the Periodic Table

Test Unit 2B- Properties of Metals and Redox Processes

Test Unit 2C- Conserving Matter

Test Unit 2D- Structure and Properties

Metals Research Paper

Now What...

1. Special discussion- Science from a Christian Worldview: Deeper knowledge and understanding never explains AWAY God, but explains THE WAY God designed His Creation.
2. Special discussion- Periodicity: a reflection of God's orderliness.
3. Special discussion- Privileged Glimpse: Each time God allows us understand one level of complexity, there is always another level that is deeper and more profound to investigate. Creation reflects the Creator.

III. Petroleum: Making and Breaking Bonds

What...

Students will discover the fundamentals of hydrocarbons and organic groups.

So What...

1. Lab 14- Modeling Alkanes
2. Lab 15- Heat of Combustion
3. Lab 16- Condensation Polymerization
4. Lab 17- Biodiesel Fuel
5. Test Unit 3A- Petroleum- Source and Structure
6. Test Unit 3B- Petroleum as an Energy Source
7. Test Unit 3C- Petrochemicals
8. Test Unit 3D- Energy Alternatives to Petroleum

Now What...

1. Special discussion- Petrochemical crisis and man's responsibility to exercise wise stewardship over Creation.
2. Special discussion- Petrochemicals as "builder molecules"- unlocking Creation's potential for the good of humanity.

IV. Air: Chemistry and the Atmosphere

What...

Students will discover the fundamental composition of the atmosphere, kinetic molecular theory, gas laws, acid and base reactions, air pollution, and pollution control.

So What...

1. Lab 18- Properties of Gases
2. Lab 19- Acid Rain

3. Skill Building- Using Boyles Law
4. Skill Building- Using Charles Law
5. Skill Building- Molar Volume and Reaction of Gases
6. Test Unit 4A- Gases in the Atmosphere and Gas Behavior
7. Test Unit 4B- Radiation and Climate
8. Test Unit 4C- Acids in the Atmosphere
9. Test Unit 4D- Air Pollutions- Sources, Effects and Solutions

Now What...

1. Special discussion – Privileged Planet: God’s design includes the ability of mankind to discover and understand the cosmos.
2. Special discussion – Cultural Mandate: We have a responsibility to exercise wise and caring stewardship over God’s Creation through pollution control and process design.

V. Atoms: Nuclear Reactions

What...

Students will discover the nature of atoms and atomic energy, the uses and hazards of radioactivity, and the benefits and burdens of nuclear energy.

So What...

1. Lab 20- Isotopes of Pennium
2. Lab 21- Alpha, Beta, and Gamma Radiation
3. Skill Building- Understanding Radioisotopes and Carbon 14
4. Test Unit 6A- The Nature of Atoms
5. Test Unit 6B- Nuclear Radiation
6. Test Unit 6C- Using Radioactivity
7. Test Unit 6D- Nuclear Energy: Benefits and Burdens

Now What...

1. Special discussion- Caring for Creation: Nuclear energy as a viable alternative to fossil fuel based energy production?
2. Special discussion- Ethical dilemma: Scientific motivations in the development of nuclear weapons.
3. Special discussion- Not in My Backyard: Local issues regarding the storage and disposal of radioactive waste.

VI. Food: Matter and Energy for Life

What...

Students will investigate the chemistry of fats, carbohydrates, proteins, minerals and vitamins as they study the mechanisms by which food provides energy for life and growth.

So What...

1. Lab 22: Snack Food Energy
2. Lab 23: Amylase Hydrolysis and Bio-catalysts
3. Lab 24: Vitamin C
8. Lab 25: Analyzing Food Additives
9. Test Unit 7A: Food As Energy
10. Test Unit 7B: Energy Storage and Use
11. Test Unit 7C: Chemistry of Proteins and Enzymes
12. Test Unit 7D: Food Additives

Now What...

1. Special discussion – Genetically Modified Food: Feeding the hungry or corrupting Creation?
2. Special discussion - Spiritual Food: Energy for life and growth in Christ.

Concepts of Chemistry Assessments

TESTS (about 50% of grade):

About 6 per quarter-- each one covering a section from each chapter. About half of each test is multiple choice and true/false, the other half is problem solving and topical essays.

1. Test Unit 1A- Sources and Uses of Water
2. Test Unit 1B- Water and Its Contaminants
3. Test Unit 1C- Aqueous Solution Chemistry
4. Test Unit 1D- Water Purification and Treatment
5. Test Unit 2A- Physical and Chemical Properties and the Periodic Table
6. Test Unit 2B- Properties of Metals and Redox Processes
7. Test Unit 2C- Conserving Matter
8. Test Unit 2D- Structure and Properties
9. Test Unit 3A- Petroleum- Source and Structure
10. Test Unit 3B- Petroleum as an Energy Source
11. Test Unit 3C- Petrochemicals
13. Test Unit 3D- Energy Alternatives to Petroleum
14. Test Unit 4A- Gases in the Atmosphere and Gas Behavior
15. Test Unit 4B- Radiation and Climate
16. Test Unit 4C- Acids in the Atmosphere
17. Test Unit 4D- Air Pollutions- Sources, Effects and Solutions
18. Test Unit 6A- The Nature of Atoms
19. Test Unit 6B- Nuclear Radiation
20. Test Unit 6C- Using Radioactivity
21. Test Unit 6D- Nuclear Energy: Benefits and Burdens
22. Test Unit 7A- Food As Energy
23. Test Unit 7B- Energy Storage and Use
24. Test Unit 7C- Chemistry of Proteins and Enzymes
25. Test Unit 7D- Food Additives

HOMEWORK (about 25% of grade):

Chemistry problems found at the end of each chapter in the text.

LABS (about 25% of grade; from *Chemistry in the Community*, WH Freeman and Company, 2006):

- Lab 1- Water Usage Analysis
- Lab 2- Water Purification
- Lab 3- Density of Water and Ice
- Lab 4- Water Testing
- Lab 5- Solvents
- Lab 6- Constructing a Solubility Curve
- Lab 7- Water Softening
- Lab 8- Metal or Non-Metal
- Lab 9- Metal Reactivity- Converting Copper
- Lab 10- Relative Reactivities of Metals
- Lab 11- Retrieving Copper
- Lab 12- Striking it Rich- Metal Alloys
- Lab 13- Copper Plating
- Lab 14- Modeling Alkanes
- Lab 15- Heat of Combustion
- Lab 16- Condensation Polymerization
- Lab 17- Biodiesel Fuel
- Lab 18- Properties of Gases
- Lab 19- Acid Rain
- Lab 20- Isotopes of Pennium
- Lab 21- Alpha, Beta, and Gamma Radiation
- Lab 22- Snack Food Energy
- Lab 23- Amylase Hydrolysis and Bio-catalysts
- Lab 24- Vitamin C
- Lab 25- Analyzing Food Additives

Concepts of Chemistry Course Scope and Sequence

The WHAT (discover) ...

- 1. The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of...
 - The fundamental structure of atoms.
 - The periodic table and the trends we recognize from it, especially the characteristics of common families of elements.
 - The fundamental laws of Thermodynamics and Mass/Energy Conservation.
- 2. The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it,** as seen in ...
 - Uncovering the fundamental and universal laws by which God directs and governs the operation of His Creation.
 - God's graciously enabling man to apply chemistry principles (technology) to the solution of problems that beset both man and the rest of Creation.
 - The fact that even though chemistry is a study that enables us increasingly to understand the physical universe, it is limited in that it cannot completely address certain aspects of reality such as the spiritual and the aesthetic.
 - The limitations of the accuracy of measurements and their use in calculations.
- 3. The student will discover what it means to be created in the image of God and how that affects his/her relationships with other people as well as the rest of Creation.** The student will discover...
 - How man is similar to (rational and orderly) and different from (able to discover and understand the laws of God's creation) the rest of creation.
 - We have a responsibility to exercise wise and caring stewardship over God's Creation.
 - Studying chemistry enables us to better fulfill this mandate of stewardship.
- 4. The student will discover the fundamental concepts and principles of the science course they are taking and the methods and technology used to discover them.** In Concepts of Chemistry this includes:
 - The application of physics concepts to the study of chemistry.
 - A general understanding of sub-atomic structure as it affects bonding, with special emphasis on understanding how variation in numbers of protons, neutrons, and electrons is basic to the formation of the elements, their isotopes, and ions.
 - Chemical reactions and their symbolic representation in balanced chemical reactions.
 - Introduction to electrochemistry, organic chemistry and nuclear chemistry.

The SO WHAT (embrace) ...

1. The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe. The student will embrace the idea that...

- Creation is good, orderly, and beautiful. Creation reflects the Creator.
- The laws that govern the operation of the universe reveal God's ongoing and perfect care and control of His Creation.

2. The student will embrace a Biblical worldview in understanding issues of science, technology, and culture. The student will embrace the idea that ...

- The "Fall" (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology), which has sometimes led to pollution, destruction, physical harm and death.
- We are charged by God to participate in the redemption of His Creation. By gaining knowledge and understanding of Creation, and applying those insights (technology) in ethical ways, we can positively impact both our environment and the human condition.
- Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
- Because Man is created in the image of God, we have been given the responsibility to exercise wise stewardship over the rest of Creation. We may use it, but we cannot abuse or misuse it.

3. The student will perceive the inter-relatedness between chemistry, the other sciences, math, and the other disciplines. The student will embrace the idea that...

- Physics provides the foundation for the study of chemistry.
- Chemistry is the basis for understanding modern biology.
- Math is an essential language that enables scientists to articulate the truths of chemistry.
- Chemistry, like all sciences, has had a profound impact on history and thought.
- Chemistry and physics are necessary tools to describe living systems (biology).

The NOW WHAT (integrate) ...

1. The student will praise God through the study and responsible care of His Creation. This will be evident when...

- The more the student understands the complexities and intricacies of Creation, the more he/she will be moved to praise Him.
- Deeper knowledge and understanding never explains AWAY God but explains THE WAY God designed His Creation.

2. The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation when he/she...

- Engages in classroom discussions, laboratory activities, and application of chemistry to everyday events.
- Understands the relevance of chemistry and its potential usefulness for addressing problems in our world.

3. The student will become a problem solver through observing, data collecting, and experimentation with available technology as he/she...

- Uses electronic data collection devices and other instruments for data acquisition, analysis, and presentation.
- Engages in lab activities occurring primarily during the block period and constituting a significant part of the curriculum and evaluation.

Chemistry

Chemistry is the study of the basic components God used to create His universe. Chemistry is the study of atoms, what makes them different, how they bond, and the properties of the compounds that result from the combination. While using a combination of traditional and thematic approaches in presenting chemistry principles, the student is challenged to recognize the relevance of chemistry and apply what they have learned to everyday issues and problems.

Students will:

- Gain and demonstrate a working knowledge of properties, classification, and changes in matter.
- Relate chemistry to personal and social issues.
- Be awed by the creativity, complexity, and precise design of God's Creation.
- Be challenged to become God's vice regents in caring for and ruling Creation.

Key Text: *Chemistry: Matter and Change*, Glencoe/McGraw-Hill, 2002

Regular Chemistry Unit Scope and Sequence

I. Philosophy of Science, Lab Safety, and Introduction to Chemistry

What...

Students will discover how a Christian world-and-life view shapes a proper philosophy of science, the fundamentals of chemical experimentation, lab safety, and data analysis.

So What...

1. Test 1 – Philosophy of Science, Lab Safety, Equipment and Procedures
2. Test 2 – Chapters 1-2 – Introduction to Chemistry and Data Analysis
3. Lab 1 – Procedures/Lab Safety
4. Lab 2 – Making a Graph / Effective Use of a Bunsen Burner
5. Lab 3 – Density
6. Lab 4 – Introduction to Measurement

Now What...

1. Special discussion – Our Christian worldview provides a more rational foundation for scientific research than any other worldview.
2. Special discussion – Limitations in accuracy of measurements results in limited confidence in our scientific experimentation/conclusions.
3. Special discussion – God’s Creation reveals His character/attributes and activity. Chemistry allows us better to understand God and his character as we see his “fingerprints” in Creation (*digitus dei*).

II. The Fundamental Properties and Structure of Matter

What...

Students will discover the fundamentals of matter, its atomic structure and the changes matter undergoes, as well as the history and patterns of the periodic table

So What...

1. Test 3 – Chapter 3 – Matter: Properties and Changes
2. Test 4 – Chapter 4 – The Structure of the Atom
3. Test 5 – Chapter 5 – Electrons in Atoms
4. Test 6 – Chapter 6 – The Periodic Table and Periodic Law
5. Lab 5 – Physical and Chemical Changes
6. Lab 6 – Simulating a Hot Pack and a Cold Pack
7. Lab 7 – The Isotopes of Pennium
8. Lab 8 – Paper Chromatography of Pigments and Dyes
9. Lab 9 – Flame Tests: Atomic Emission Spectra
10. Lab 10 – Metals/Nonmetals
11. Lab 11 – Periodic Law

Now What...

1. Special discussion – God’s sovereignty includes control over fundamental atomic structure/behavior
2. Special discussion – God’s Creation reveals His character/attributes and activity. Chemistry allows us better to understand God and his character as we see his “fingerprints” in Creation (*digitus dei*).

III. Changes in Matter

What...

Students will discover the fundamentals of chemical bonding, equation writing, and mathematical relationships related to them.

So What...

1. Test 7 – Chapter 8 – Ionic Compounds
2. Test 8 – Chapter 9 – Covalent Bonding
3. Test 9 – Chapter 10 – Chemical Reactions
4. Test 10 – Chapters 11-12 – The Mole and Stoichiometry
5. Test 11 – Chapter 13 – States of Matter
6. Lab 12 – Formation of a Salt
7. Lab 13 – Properties of Chemical Substances
8. Lab 14 – Shapes of Covalent Molecules and Polarity
9. Lab 15 – Evidence of Chemical Reactions
10. Lab 16 – Types of Chemical Reactions
11. Lab 17 – Observing a Limiting Reactant
12. Lab 18 – The Leftover Aluminum Wire

Now What...

1. Special discussion – Man’s abilities to understand changes and predict results in chemical reactions are examples of our responsibility as God’s vice-regents to discover and employ for good the unrealized potential God built into Creation.
2. Special discussion – God’s Creation reveals His character/attributes and activity. Chemistry allows us better to understand God and his character as we see his “fingerprints” in Creation (*digitus dei*).

IV. Gases

What...

Students will discover the fundamentals of gas behavior and the mathematical relationships that enable us to describe them.

So What...

1. Test 12 – Chapter 14 – Gases
2. Lab 19 – The Cooling Curve
3. Lab 20 – Exploring Properties of Gases
4. Lab 21 – The Uncommon Cold

Now What...

1. Special discussion – God’s Creation reveals His character/attributes and activity. Chemistry allows us better to understand God and his character as we see his “fingerprints” in Creation (*digitus dei*).

V. Thermochemistry and Chemical Kinetics

What...

Students will discover the fundamentals of energy changes associated with chemical reactions and the factors affecting the rates at which those chemical reactions occur.

So What...

1. Test 14 – Chapter 16 – Energy and Chemical Change
2. Test 15 – Chapter 17 – Reaction Rates
3. Lab 23 – The Potato Chip Lab
4. Lab 24 – The Specific Heat of a Metal
5. Lab 25 – Concentration Effects of Reaction Rates

Now What...

1. Special discussion – God’s Creation reveals His character/attributes and activity. Chemistry allows us better to understand God and his character as we see his “fingerprints” in Creation (*digitus dei*).

VI. Solution Chemistry

What...

Students will discover the fundamentals of solutions and applications of them.

So What...

1. Test 13 – Chapter 15 – Solutions
2. Test 16 – Chapter 18 – Chemical Equilibrium
3. Test 17 – Chapter 19 – Acids and Bases
4. Lab 22 – Solvent Properties of Water
5. Lab 26 – Ice Cream Lab
6. Lab 27 – LeChateliers’s Principle
7. Lab 28 – The Properties of Acids and Bases
8. Lab 29 – Titration

Now What...

1. Special discussion – God’s Creation reveals His character/attributes and activity. Chemistry allows us better to understand God and his character as we see his “fingerprints” in Creation (*digitus dei*).

VII. Electrochemistry

What...

Students will discover the fundamentals of electrochemistry and everyday uses of them.

So What...

1. Test 18 – Chapter 20-21 – Redox Reactions and Electrochemistry
2. Lab 30 – Electrolysis of Water
3. Lab 31 – Electroplating

Now What...

1. Special discussion – God’s Creation reveals His character/attributes and activity. Chemistry allows us better to understand God and his character as we see his “fingerprints” in Creation (*digitus dei*).

VIII. Nuclear Chemistry

What...

Students will discover the fundamentals of nuclear chemistry and issues related to uses of nuclear energy.

So What...

1. Test 19 – Chapter 25 – Nuclear Chemistry
2. Class discussion after watching the Frontline presentation: Nuclear Reactions.

Now What...

2. Special discussion – God’s Creation reveals His character/attributes and activity. Chemistry allows us better to understand God and his character as we see his “fingerprints” in Creation (*digitus dei*).

IX. Organic Chemistry

What...

Students will discover the fundamentals of organic chemistry as reflected hydrocarbon and substituted hydrocarbon structure and properties.

So What...

1. Test 20 – Chapter 22-23 – Hydrocarbons and Substituted Hydrocarbons
2. Lab 32 – Modeling Alkanes
3. Lab 33 – Esterification and Gluep

Now What...

Special discussion – God’s Creation reveals His character/attributes and activity. Chemistry allows us better to understand God and his character as we see his “fingerprints” in Creation (*digitus dei*).

Regular Chemistry Assessments

TESTS (about 50% of quarter grade):

Tests (about 5 per quarter) covering 1 or 2 chapters each. Primarily multiple choice, short answer, problem solving, and short essay.

Test 1: Philosophy of Science, Lab Safety, Equipment and Procedures

Test 2: Chapters 1-2 – Introduction to Chemistry and Data Analysis

Test 3: Chapter 3 – Matter: Properties and Changes

Test 4: Chapter 4 – The Structure of the Atom

Test 5: Chapter 5 – Electrons in Atoms

Test 6: Chapter 6 – The Periodic Table and Periodic Law

Test 7: Chapter 8 – Ionic Compounds

Test 8: Chapter 9 – Covalent Bonding

Test 9: Chapter 10 – Chemical Reactions

Test 10: Chapters 11-12 – The Mole and Stoichiometry

Test 11: Chapter 13 – States of Matter

Test 12: Chapter 14 – Gases

Test 13: Chapter 15 – Solutions

Test 14: Chapter 16 – Energy and Chemical Change

Test 15: Chapter 17 – Reaction Rates

Test 16: Chapter 18 – Chemical Equilibrium

Test 17: Chapter 19 – Acids and Bases

Test 18: Chapter 20-21 – Redox Reactions and Electrochemistry

Test 19: Chapter 25 – Nuclear Chemistry

Test 20: Chapter 22-23 – Hydrocarbons and Substituted Hydrocarbons

HOMEWORK (about 25% of the grade)

Study guides that accompany each chapter and practice problem worksheets to practice chapters with heavy math applications. Vocabulary assignments are assigned for each chapter to become more familiar with terms used during lecture periods.

LABS (about 25% of the grade)

1. Lab Procedures / Lab Safety
2. Making a Graph / Effective Use of a Bunsen Burner
3. Density
4. Introduction to Measurement
5. Physical and Chemical Changes
6. Simulating a Hot Pack and a Cold Pack
7. The Isotopes of Pennium
8. Paper Chromatography of Pigments and Dyes
9. Flame Tests – Atomic Emission Spectra
10. Metals/Nonmetals
11. Periodic Law
12. Formation of a Salt

13. Properties of Chemical Substances
14. Shapes of Covalent Molecules and Polarity
15. Evidence of Chemical Reactions
16. Types of Chemical Reactions
17. Observing a Limiting Reactant
18. The Leftover Aluminum Wire
19. The Cooling Curve
20. Exploring Properties of Gases
21. The Uncommon Cold
22. Solvent Properties of Water
23. The Potato Chip Lab
24. The Specific Heat of a Metal
25. Concentration Effects of Reaction Rates
26. The Ice Cream Lab
27. LeChateliers' Principle
28. The Properties of Acids and Bases
29. Titration
30. Electrolysis of Water
31. Electroplating
32. Modeling Alkanes
33. Esterification and GlueP

Regular Chemistry Course Scope and Sequence

The WHAT (discover)...

- 1. The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of ...
 - The fundamental structure of atoms.
 - Quantum mechanics.
 - The history of the development of the periodic table and the trends we recognize from it.
 - The fundamental laws of Thermodynamics and Mass/Energy Conservation.
- 2. The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it,** as seen in...
 - Our uncovering the fundamental and universal laws by which God directs and governs the operation of His Creation.
 - God's graciously enabling man to apply chemistry principles (technology) to the solution of problems that beset both man and the rest of Creation.
 - The fact that while chemistry enables us increasingly to understand the physical universe, it is limited because it cannot completely address certain aspects of reality such as the spiritual and the aesthetic.
 - The limitations of the accuracy of measurements and their use in calculations.
- 3. The student will discover what it means to be created in the image of God and how that affects his/her relationships with other people as well as the rest of Creation** as he/she understands...
 - How Man is similar to (rational and orderly) and different from (able to discover and understand the laws of God's creation) the rest of creation.
 - Man has a responsibility to exercise wise and caring stewardship over God's Creation.
 - Studying chemistry enables Man to better fulfill this mandate of stewardship.
- 4. The student will discover the fundamental concepts and principles of the science course he/she is taking and the methods and technology used to discover them.** In regular chemistry this includes...
 - That physics lays the foundation for an understanding of chemistry.
 - The underlying structure of atoms and how they bond together.
 - The differences between ionic, covalent and metallic compounds and the various types of bonds that may hold these compounds together.
 - Chemical reactions and their symbolic representation in balanced chemical reactions.
 - The branches of electrochemistry, organic chemistry and nuclear chemistry.

The SO WHAT (embrace)...

1. **The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe** as he/she apprehends that ...
 - Creation is good, orderly, and beautiful. Creation reflects the Creator.
 - The laws that govern the operation of the universe reveal God's ongoing and perfect care and control of His creation.

2. **The student will embrace a Biblical worldview in understanding issues of science, technology, and culture** when challenged with the truth that ...
 - The "Fall" (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology), which has sometimes led to pollution, destruction, physical harm and death.
 - We are charged by God to participate in the redemption of His Creation. By gaining knowledge and understanding of Creation, and applying those insights (technology), in ethical ways, we can positively impact both our environment and the human condition.
 - Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
 - Because Man is created in the image of God, we have been given the responsibility to exercise wise stewardship over the rest of Creation. We may unpack, develop and use it, but we must not misuse it.

3. **The student will perceive the inter-relatedness between chemistry, the other sciences, math, and the other disciplines** when he/she understands that...
 - Physics provides the foundation for the study of chemistry.
 - Chemistry is the basis for understanding modern biology.
 - Math is an essential language that enables scientists to articulate the truths of chemistry.
 - Chemistry, like all sciences, has had a profound impact on history and thought.
 - Technology provides electronic tools (computers, CBL's) that facilitate the organization, presentation, and interpretation of data.

The NOW WHAT (integrate)...

1. **The student will praise God through the study of His Creation.** This will be evident when...
 - The student understands the complexities and intricacies of Creation and sees God's character reflected in it.
 - He/she understands that a deeper knowledge and understanding explains THE WAY God designed His Creation but can never explain AWAY God.

2. **The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation when he/she...**
 - Engages in classroom discussions, laboratory activities, and application of chemistry to everyday events.
 - Understands the relevance of chemistry and its potential usefulness for addressing problems in our world through consideration of current events.

3. **The student will become a problem solver through observation, data collection and experimentation with available technology as he/she...**
 - Uses electronic data collection devices and other instruments for data acquisition, analysis, and presentation.
 - Engages in lab activities, which will occur primarily during the block period and will constitute a significant part of the curriculum and evaluation.

4. **Students will recognize that science is an important component of many careers as they...**
 - Are confronted in their textbook reading as well as in classroom discussion of the many avenues available for those interested in pursuing science.

Honors Chemistry

Any study of God's creation inevitably leads to an investigation of the basic components that He made and used to form the universe. Chemistry is the study of these components—atoms—and what makes them different, how they bond together, and the special properties that result. With this basis, other topics, including the phases of matter, formulae, stoichiometry, electronic structure, the Periodic Table, solutions, kinetics, equilibrium, acids and bases, and nuclear and organic chemistry, are covered.

Students will:

- Understand the relationship between the philosophy of science and the Christian faith.
- Realize the continual providence and wisdom of God the Creator in ordering and sustaining His Creation through the natural laws that we try to discover, understand, and apply.
- Be awed by the precision, design, and complexity of God's Creation, especially as it relates to the principles of physics and their application.
- Recognize the moral responsibility that we have to understand the relevant physics and apply it to solving the many challenges humanity and the earth are facing.
- Demonstrate the ability to problem solve, especially by using dimensional analysis, scientific notation, and significant digits.
- Learn techniques and procedures appropriate to the high school-level laboratory, including processes and procedures, observations and data manipulation, and group collaboration and reporting.

- Understand the structure of the periodic table and the descriptive chemistry it predicts.
- Describe atomic structure and chemical bonding based on the principles of current atomic theory.
- Study the common states of matter (gases, liquids, and solids, solutions) in terms of the principles of the Kinetic Theory of Matter.
- Apply acquired information to the study of chemical reaction types and stoichiometry.
- Understand the control of chemical reactions in relation to solution dynamics, equilibrium, reaction kinetics, and thermodynamics.
- Explain electrochemistry as a component of oxidation/reduction and its practical applications of electrochemical and electrolytic cells.

Key Texts: *Chemistry: Connections to Our Changing World*, Prentice Hall, 2002 and accompanying lab manual.

Honors Chemistry Unit Scope and Sequence

I. The Nature of Chemistry

What...

Students will discover the methods of science, what is chemistry, safety in the laboratory, units of measurement, uncertainty in measurement, problem solving strategies. Students will review the physics concepts of energy, temperature, and matter. Students will discover elements, compounds, and mixtures and how to separate them.

So What...

1. Lab 2 – Density of Liquids
2. Lab 5 – Physical and Chemical Changes
3. Lab 6 – Candy Coatings: Compounds or Mixtures?
4. Test 1 Chapter 1 – Chemistry and You

Now What...

1. Special discussion – Limitations of science and technology: Man's finiteness and sinfulness affects all of Creation, including the process of investigating and measuring it.
2. Special discussion – Creation reflects the creator: God's attributes and character are reflected in the unity, beauty, intricacy, goodness, knowability and orderliness of creation.
3. Special discussion – Chemistry as a study that enables us increasingly to understand the physical universe. It is limited in that it cannot completely address certain aspects of reality such as the spiritual and the aesthetic.
4. Special discussion – Why does the study of Matter matter? Answer: 1) to know God better. Therefore even theoretical/pure research is important. (However, since God is an economic God – He doesn't waste anything – even that which appears to have no practical application eventually does.) 2) to serve God by serving others. Therefore applied research results in technologies that free Man to do that which is uniquely human.

II. The Structure of Matter

What...

Students will discover early models of the atom, atomic structure, modern atomic theory, changes in the nucleus, radiant energy, quantum theory, electron configurations, periodic table development and trends, and characteristics of reactive metals, transition metals, inner transition metals, metals and nonmetals, and hydrogen.

So What...

1. Lab 9 – Isotopes of “Pennium”
2. Lab 10 – Flame Tests
3. Lab 13 – Mendeleev for a Day

4. Lab 14 – Chemical Activity of Metals
5. Lab 17 – Exploring the Halides
6. Lab 16 – Reactivity of the Alkaline Earth Metals
7. Test 2 Chapters 2-3 – Energy and Matter/Atomic Structure
8. Test 3 Chapter 4 – Electron Configurations
9. Test 4 Chapters 5-6 – The Periodic Table/Groups of Elements

Now What...

1. Special discussion – The dual nature of light and electrons: Particle or Wave? Man's categories are inherently limited and unable to fully envelop the complexities of creation.
2. Special discussion – Quantum Mechanics: The reason we cannot know Truth (about the universe) precisely is not because there is no Truth (postmodernism) or that Truth is relative (relativism) but because creation is inherently more intricate and complex than merely human instruments can ever measure.
3. Special discussion – Levels: Each time we understand one level of complexity, there is always another level that is deeper and more profound to investigate. Creation reflects the Creator.
4. Special discussion – Anti-reductionism: Deeper knowledge and understanding never explains AWAY God, but explains THE WAY God designed His Creation.

III. Interactions of Matter

What...

Students will discover ionic bonding, covalent bonding, naming chemical compounds, shape of small molecules, polarity, nature of chemical reactions, chemical equations and their classification.

So What...

1. Lab 21 – Conductivity of Molecular and Ionic Compounds
2. Lab 22 – Models of Molecular Compounds
3. Lab 25 – Equation Writing and Predicting Products
4. Lab 26 – Bag of Reactions
5. Lab 27 – Double Replacement Reactions
6. Lab 20 – Solubility and Bond Type
7. Test 5 Chapter 7 – Chemical Formulas and Bonding
8. Test 6 Chapter 8 – Molecular Shape
9. Test 7 Chapter 9 – Chemical Reactions and Equations

Now What...

1. Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
2. Because Man is created in the image of God, he/she has been given the responsibility to exercise wise stewardship over the rest of Creation.

IV. Stoichiometry

What...

Students will discover chemical measurements, mole conversions, empirical and molecular formulas, stoichiometry, limiting reactants and percent yield, chemical reactions that involve heat, heat and enthalpy changes, Hess's Law, and calorimetry.

So What...

1. Lab 31 – The Stoichiometry of a Single Displacement Reaction
2. Lab 34 – Heat of Solution
3. Lab 35 – Determining Heat Capacity
4. Test 8 Chapter 10 – The Mole
5. Test 9 Chapter 11 – The Mathematics of Chemical Equations
6. Test 10 Chapter 12 – Heat in Chemical Reactions

Now What...

1. Special discussion – We have a responsibility to exercise wise and caring stewardship over God's Creation not only through the activity of discovering but also through the application of those discovered principles (technology).
2. Special discussion – Studying Chemistry enables us to better fulfill this mandate of stewardship.

V. States of Matter

What...

Students will discover a model of explain gas behavior, measuring gases, the gas laws, the Ideal Gas Law, how gases work, condensed states of matter, properties of liquids, the natures of solids, and changes of state.

So What...

1. Lab 39 – Diffusion of Two Gases
2. Lab 38 – The Ideal Gas Constant
3. Lab 42 – Melting Points of Common Substances
4. Test 11 Chapter 13 – Gases
5. Test 12 Chapter 14 – Liquids and Solids

Now What...

1. Special discussion – Universal laws: God (and the creation that reflects Him) does not change from place to place and time to time.

VI. Chemical Equilibrium

What...

Students will discover the nature of solutions, concentration of solutions, the formation of solutions, colligative properties, the concept of equilibrium, the Law of

Chemical Equilibrium, Le Chatelier's Principle, solubility equilibria, precipitates, and the common-ion effect.

So What...

1. Lab 44 – Boiling Points of Solutions
2. Lab 45 – Freezing Point Depression with Antifreeze
3. Lab 47 – LeChatelier's Principle
4. Test 13 Chapter 15 – Solutions
5. Test 14 Chapter 16 – Chemical Equilibrium
6. Test 15 Chapter 17 – Solubility and Precipitation

Now What...

1. Special Discussion – Biological applications: cell membranes
2. Special Discussion – It's the dose that makes the poison.

VII. Acids and Bases

What...

Students will discover the definitions of acids and bases, determining the strength of acids and bases, naming and identifying acids and bases, the self-ionization of water and pH, buffers, and acid-base titrations.

So What...

1. Lab 52 – Properties of Acids and Bases
2. Lab 51 – Investigating Hardness of Water
3. Lab 55 – Determining the pH of an unknown
4. Lab 57 – Titration with Oxalic Acid
5. Test 16 Chapter 18 – Acids, Bases, and Salts
6. Test 17 Chapter 19 – Reactions of Acids and Bases

Now What...

VIII. Redox Chemistry

What...

Students will discover oxidation-reduction reactions, types of redox reactions, applications of redox reactions, balancing redox equations, electrochemical cells, voltaic cells, common batteries, and electrolytic cells.

So What...

1. Lab 58 – Activity Series
2. Lab 60 – Quantitative Redox Titration
3. Lab 59 – Rust Marches On
4. Lab 62 – Small Scale Voltaic Cells
5. Test 18 Chapters 20-21 – Oxidation and Reduction/Electrochemistry

Now What...

1. Special Discussion – Risk: “There are always weeds in the garden.” Every technology has its consequences, and they should always be anticipated and evaluated, as much as is possible.

IX. Kinetics and Thermodynamics

What...

Students will discover chemical kinetics, the reaction process, factors affecting reaction rates, spontaneous processes, enthalpy, entropy, and Gibbs Free Energy.

So What...

1. Lab 65 – Concentration and Reaction Order
2. Lab 67 – Hess’s Law
3. Test 19 – Chapters 22-23 Rates of Reaction/Thermodynamics

Now What...

1. Special discussion – Entropy: What is its relationship to the Fall?
2. Special discussion – Science and Faith: The “Fall” (advent of Man’s sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology) which has sometimes led to pollution, physical harm, death, and destruction.

X Chemistry and Our World

What...

Students will discover radioisotopes, biological effects of radiation, harnessing the nucleus, the element carbon, carbon compounds, hydrocarbons, saturated and unsaturated hydrocarbons, polymers, classes of organic compounds (halocarbons, alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, amines, amides), chemistry and living things, carbohydrates, lipids, proteins, and nucleic acids.

So What...

1. Lab 77 – Analyzing Commercial Aspirin
2. Lab 80 – Analysis of Commercial Vitamin C
3. Test 20 Chapter 24 – Applications of Nuclear Energy
4. Test 21 Chapters 25-27 – Carbon and Its Compounds/Classes of Organic Compounds/The Chemistry of Life

Now What...

1. Special discussion – Scientific responsibility: Nuclear energy vs. nuclear bombs.
2. Special discussion – Man in God’s image: Mankind is similar to (rational and orderly) and different from (able to discover and understand the laws of God’s creation) the rest of creation.

Honors Chemistry Assessments

TESTS (about 50% of grade)

Tests (about 5 per quarter) covering 1-2 chapters each. Primarily multiple choice, problem solving, short answer, and essay questions.

Test 1 Chapter 1 – Chemistry and You

Test 2 Chapters 2-3 – Energy and Matter/Atomic Structure

Test 3 Chapter 4 – Electron Configurations

Test 4 Chapters 5-6 – The Periodic Table/Groups of Elements

Test 5 Chapter 7 – Chemical Formulas and Bonding

Test 6 Chapter 8 – Molecular Shape

Test 7 Chapter 9 – Chemical Reactions and Equations

Test 8 Chapter 10 – The Mole

Test 9 Chapter 11 – The Mathematics of Chemical Equations

Test 10 Chapter 12 – Heat in Chemical Reactions

Test 11 Chapter 13 – Gases

Test 12 Chapter 14 – Liquids and Solids

Test 13 Chapter 15 – Solutions

Test 14 Chapter 16 – Chemical Equilibrium

Test 15 Chapter 17 – Solubility and Precipitation

Test 16 Chapter 18 – Acids, Bases, and Salts

Test 17 Chapter 19 – Reactions of Acids and Bases

Test 18 Chapters 20-21 – Oxidation and Reduction/Electrochemistry

Test 19 Chapters 22-23 – Rates of Reaction/Thermodynamics

Test 20 Chapter 24 – Applications of Nuclear Energy

Test 21 Chapters 25-27 – Carbon and Its Compounds/Classes of Organic Compounds/The Chemistry of Life

HOMEWORK (about 25% of grade)

Short answer questions and math problems found at the end of each chapter in the text.

LABS (about 25% of grade)

1. Density of Liquids
2. Physical and Chemical Changes
3. Candy Coatings: Compounds or Mixtures?
4. Isotopes of Pennium
5. Flame Tests
6. Mendeleev for a Day
7. Chemical Activity of Metals
8. Exploring the Halides
9. Reactivity of the Alkaline Earth Metals
10. Conductivity of Molecular and Ionic Compounds
11. Models of Molecular Compounds
12. Equation Writing and Predicting Products
13. Bag of Reactions

14. Double Replacement Reactions
15. Solubility and Bond Type
16. The Stoichiometry of a Single Displacement Reaction
17. Heat of Solution
18. Determining Heat Capacity
19. Diffusion of Two Gases
20. The Ideal Gas Constant
21. Melting Points of Common Substances
22. Boiling Points of Solutions
23. Freezing Point Depression with Antifreeze
24. LeChatelier's Principle
25. Properties of Acids and Bases
26. Investigating Hardness of Water
27. Determining the pH of an unknown
28. Titration with Oxalic Acid
29. Activity Series
30. Quantitative Redox Titration
31. Rust Marches On
32. Small Scale Voltaic Cells
33. Concentration and Reaction Order
34. Hess's Law
35. Analyzing Commercial Aspirin
36. Analysis of Commercial Vitamin C

Honors Chemistry Course Scope and Sequence

The WHAT (discover)...

- 1. The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of ...
 - The fundamental structure of atoms.
 - Quantum mechanics.
 - The history of the development of the periodic table and the trends we recognize from it.
 - The fundamental laws of Thermodynamics and Mass/Energy Conservation.
 - The states of matter: the laws, energy, theories, and interactions of particles in each state.
 - The variety of chemical reactions which will tend to occur in ways that bring the formation of reactants and products into equilibrium.
 - A study of basic chemical processes responsible for the storage, transfer, and utilization of energy.
- 2. The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it,** as seen in...
 - Our uncovering the fundamental and universal laws by which God directs and governs the operation of His Creation.
 - God's graciously enabling man to apply chemistry principles (technology) to the solution of problems that beset both man and the rest of Creation.
 - The fact that while chemistry enables us increasingly to understand the physical universe, it is limited because it cannot completely address certain aspects of reality such as the spiritual and the aesthetic.
 - The limitations of the accuracy of measurements and their use in calculations.
 - The development, use, and progression of models where man's limitations prevent us from knowing directly about God's Creation.
- 3. The student will discover what it means to be created in the image of God and how that affects his/her relationships with other people as well as the rest of Creation.** The student will discover...
 - How man is similar to (rational and orderly) and different from (able to discover and understand the laws of God's Creation) the rest of Creation.
 - Man has a responsibility to exercise wise and caring stewardship over God's Creation.
 - Studying chemistry enables us to better fulfill this mandate of stewardship.
- 4. The student will discover the fundamental concepts and principles of the science course they are taking and the methods and technology used to discover them.**
In honors chemistry this includes...

- That physics lays the foundation for an understanding of chemistry.
- The underlying structure of atoms and how they bond together.
- The differences between ionic, covalent and metallic compounds and the various types of bonds which may hold them together.
- Chemical reactions and their symbolic representation in balanced chemical reactions.
- The thermodynamics, equilibrium, and patterns of change that occur in nature in order to maintain stability, unity and diversity, and richness and harmony in the creation.
- The branches of electrochemistry, organic chemistry and nuclear chemistry studied to show the construction of an arena to display the richness and abundance of a multitude of living and nonliving things and show God's order in all of it.

The SO WHAT (embrace)...

1. **The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe.** The student will embrace the idea that...
 - Creation is good, orderly, and beautiful. Creation reflects the Creator.
 - The laws that govern the operation of the universe reveal God's ongoing and perfect care and control of His Creation.
 - God built creation so that we could unlock its mysteries and discover God's goodness.
2. **The student will embrace a Biblical worldview in understanding issues of science, technology, and culture.** The student will embrace the idea that...
 - The "Fall" (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology) which has sometimes led to pollution, destruction, physical harm and death.
 - We are charged by God to participate in the redemption of His Creation. By gaining knowledge and understanding of Creation, and applying those insights (technology) in ethical ways, we can positively impact both our environment and the human condition.
 - Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
 - Because Man is created in the image of God, we have been given the responsibility to exercise wise stewardship over the rest of Creation. We may use it, but we cannot abuse or misuse it.
3. **The student will perceive the inter-relatedness within chemistry, with other sciences, math, and the other disciplines.** The student will embrace the idea that...
 - Physics provides the foundation for the study of chemistry.
 - Chemistry is the basis for understanding modern biology.

- Math is an essential language that enables scientists to articulate the truths of chemistry.
- Chemistry, like all sciences, has had a profound impact on history and thought.
- Technology provides electronic tools (computers, interfaces, probes) that facilitate the organization, presentation, and interpretation of data.

The NOW WHAT (integrate)...

1. **The student will praise God through the study and responsible care of His Creation.** This will be evident when...
 - The student understands the complexities and intricacies of Creation and sees God's character reflected in it.
 - He/she understands that a deeper knowledge and understanding explains THE WAY God designed His Creation but can never explain AWAY God.
2. **The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation** when he/she...
 - Engages in classroom discussions, laboratory activities, and application of chemistry to everyday events.
 - Understands the relevance of chemistry and its potential usefulness for addressing problems in our world.
3. **The student will become a problem solver through observation, data collection, and experimentation with available technology** as he/she...
 - Uses electronic data collection devices and other instruments for data acquisition, analysis, and presentation.
 - Engages in lab activities, which will occur primarily during the block period and will constitute a significant part of the curriculum and evaluation.

Biology Concepts

Biology Concepts is the study and application of the complexity of life processes in a fallen world. There are five broad themes of study: environmental stewardship, nutrition and biochemical processes, the physiology of illness, genetics and gene technology, and growth and development. In addition to a basic knowledge of biological processes, students will be expected to apply their understanding to issues of justice and mercy in the world around them.

Students will:

- Use a variety of tools in the classroom, laboratory and community to investigate living things.
- Recognize relationships between the structures of life and their functions at the following levels: cells, organs, systems, organisms, populations, and communities.
- Compare and contrast various strategies of life in the following areas: energy needs, movement, response to environment, growth, self-maintenance, and reproduction.
- Relate environmental, health, and origin-of-life issues to the biblical themes of creation, the fall, and redemption.
- Grasp the Biblical and scientific basis for understanding the issues of evolution/creation, ecology/conservation, and biotechnology/bioethics.

Key Text:

1. *Biology: An Everyday Experience, Glencoe, 2003.*

Concepts of Biology Unit Scope and Sequence

I. The World of Life: The Biosphere

What...

Students will discover how matter cycles and energy flows through the biosphere. This unit that emphasizes ecology will include studying about photosynthesis, cell respiration, communities, ecosystems, and populations.

So what...

1. Lab – Population Growth
2. Lab – Competition
3. Lab – Organisms and pH
4. Lab – Compounds in Living Organisms
5. Lab – Enzyme Activity
6. Lab – Factors that influence photosynthesis
7. Lab – Measuring CO₂ Production by Yeast
8. Test 1 – Ecology Test
9. Test 2 – Biological Compounds/Biochemistry Test
10. Test 3 – Photosynthesis and Cell Respiration Test

Now what...

1. Special discussion – Man's place and purpose in a good but fallen Creation.

II. Continuity in the Biosphere

What...

Students will discover cell structure, cell function, and cell reproduction. This unit also includes the study of human reproduction and development.

So what...

1. Lab – Use of the Compound Light Microscope
2. Lab – Observing Cells
3. Lab – Diffusion Through a Membrane
4. Lab – Cell Size and Diffusion
5. Lab – Water and Turgor Pressure
6. Lab – Mitosis and Cytokinesis
7. Lab – A Model of Meiosis
8. Lab – Making and Analyzing a Karyotype
9. Test 4 – Cell Theory, Function, and Reproduction Test
10. Test – Semester 1 Examination

Now what...

1. Special discussion – Man's ability to be a ray of hope in a fallen world. How do we impact a world full of disease (cancer and a myriad of genetic diseases)?
2. Special discussion – Cell size and how God's design makes so much sense.

III. Continuity in the Biosphere through Heredity and Genetics

What...

Students will discover the basic modes of inheritance for all forms of life on earth. This unit will also address specific genetic technologies like cloning, stem cell research, and assisted reproductive techniques.

So what...

1. Lab – Variations in a Human Face
2. Lab – Probability
3. Lab – Corn Dihybrid Genetics
4. Lab – DNA Fingerprinting - gel electrophoresis
5. Test 5 – Genetics Test (Part 1 - modes of inheritance)
6. Test 6 – Genetics Test (Part 2 - biotechnology and bioethics)

Now what...

1. Special discussion – What does it mean to be a human being? What makes you the person that you are? What does it mean that humans are a “special” creation?
2. Special discussion – What is a Christian response to issues like cloning, stem cell research and in vitro fertilization?

IV. Diversity in the Biosphere

What...

Students will appreciate the diversity of life on earth. This unit will explore the patterns of life within the five major kingdoms of life.

So what...

1. Lab – Constructing and Using a Dichotomous Key
2. Lab – Viewing Bacteria / Gram negative vs. Gram positive bacteria in medicine
3. Lab – Variety Among Protists
4. Lab – Growth of Fungi
5. Lab – The Lifecycle of a Common Plant
6. Lab – Tropisms
7. Lab – Flower Dissection and the Formation of a Seed
8. Lab – Tree Ring Growth and Dendrochronology
9. Lab – A study of Invertebrates - hydra, grasshoppers, worms, crayfish, and sea fireflies
10. Lab – Vertebrate Dissection
11. Lab – Natural Selection
12. Test 7 – Classification and Bacteria, Protist, and Fungi Kingdom Test
13. Test 8 – Plant and Animal Kingdom Test
14. Test – Semester 2 Examination

Now what...

1. Special discussion – What does the Creation teach us about God? What is our role as caretaker of this Creation? What does proper stewardship entail?
2. Special discussion – How should we respond to the theories of Darwinian evolution and Intelligent Design?

Concepts of Biology Assessments

TESTS (50% of overall grade):

Unit Tests (2-3 per quarter). Primarily multiple choice, matching, and true/false with several essay type and/or word problem questions.

Test 1 Chapter 16-18 – Introduction to Ecology

Test 2 Chapter 2, 9-10 – Biological Compounds/Biochemistry

Test 3 Chapter 5 – Photosynthesis and Cell Respiration

Test 4 Chapter 3-4, 6, 44 – Cell Theory, Function, and Reproduction

Test 5 Chapter 7 – Modes of Reproduction and Development

Test 6 Chapter 8 – Mendelian Genetics

Test 7 Chapter 11 – Other modes of Gene Expression and Biotechnology

Test 8 Chapter 15, 20 - 23 – The Classification of Life / Monera, Protist, and Fungi

Test 9 Chapter 24-36 – Plants and Animals

HOMEWORK AND LABS (50% of overall grade):

1. You and the Web of Life
2. Population Growth
3. Competition
4. Identifying Chemical Compounds
5. Organisms and pH
6. Compounds in Living Organisms
7. Enzyme Activity
8. DNA Model Construction Activity
9. The Compound Microscope
10. Observing Cells
11. Diffusion Through a Membrane
12. Cell Size and Diffusion
13. Mitosis and Cytokinesis
14. A Model of Meiosis
15. Probability
16. Punnett Square Activities
17. Pedigree Activity
18. Classification Activity
19. Use of a Dichotomous Key
20. Microorganism Activity
21. Flower Dissection
22. Photosynthesis
23. Invertebrate Comparative Dissection
24. Vertebrate Dissection(s)
25. Variation in Size of Organisms
26. Natural Selection - A Simulation

Concepts of Biology Course Scope and Sequence

The WHAT (discover)...

1. **The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of ...
 - The flow of energy, matter, and organization in all of the biochemical reactions and pathways of living things.
 - The balance, homeostasis, and development of cells, systems, organisms, and communities.
 - The continuity of life inherent in reproduction and genetics.
 - The way in which organisms interact with/respond to the environment.
2. **The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it,** as seen in...

- The study of molecular genetics, biotechnology, bioethics, and reproductive technologies.
 - The study of the environment and ecology.
 - The study of Biblical Creation and its relationship to contemporary micro- and macro-evolutionary theory.
3. **The student will discover what it means to be created in the image of God and how that affects his/her relationships with other people as well as the rest of Creation.** The student will discover...
- We are similar to (genetic component – “nature” and environmental component – “nurture”) and different from (spiritual component – the work of the Holy Spirit) the rest of creation.
 - We have a responsibility to exercise wise and caring stewardship of God’s Creation.
 - We are better able to fulfill this mandate of stewardship through the study of Biology.
 - Stewardship includes the progressive unlocking of the unrealized potential of Creation.
4. **The student will discover the fundamental concepts and principles of the science course they are taking and the methods and technology used to discover them.** The student will discover...
- How chemistry, particularly biochemistry, lays the foundation for an understanding of biology which, at the molecular level, is about carbohydrates, proteins, lipids, and nucleic acids.
 - How organisms exchange materials with the environment, collect and release energy (photosynthesis and cell respiration), are made of cells, grow and develop, reproduce and pass genetic characteristics on to their offspring, respond to their environment, and fight disease and infection.
 - How prokaryotes (bacteria), protists, fungi, plants, animals, and humans are similar in certain ways and distinctly different in certain ways.
 - How organisms are ecologically related to each other and to their environment.

The SO WHAT (embrace)...

1. **The student will embrace, both from a Biblical and scientific perspective, God’s role as Creator and Sustainer of His universe.** The student will embrace the idea that...
- Creation is good, orderly, and beautiful. Creation reflects the Creator.
 - The laws that govern the operation of the universe reveal God’s ongoing and perfect care and control of His creation.
 - All created things, both living and nonliving, are interrelated. We must treat them with respect.

- God created Man as a special and unique being. Only Man is created in the image of God.

2. The student will embrace a Biblical worldview in understanding issues of science, technology, and culture. The student will embrace the idea that...

- The “Fall” (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in pollution, extinction, and natural disasters in general, and disease, malnutrition, and self-inflicted human suffering (poor choices) in particular for humans.
- We are charged by God to participate in the redemption of His Creation. By gaining knowledge and understanding of Creation and applying those insights (technology) in ethical ways, we can positively impact both the environment and the human condition.
- *Micro*-evolution, defined as genetic changes within a *kind*, is the result of natural and artificial selection acting on the inherent genetic potential originally created by God in the genome of that kind. There can be tremendous variation within a kind (e.g. Pekinese, Great Dane, fox, wolf). However, Man did NOT evolve from a lower life form but was a special creation.
- *Macro*-evolution, defined as genetic changes causing one *kind* to eventually become an entirely different *kind*, is a popular and influential scientific theory but is not supported by scripture and has only a circumstantial scientific basis. Man did NOT evolve from a lower life form.
- Because Man is created in the image of God, we have been given the responsibility to exercise wise stewardship over the rest of Creation. We may use it, but we cannot abuse or misuse it.
- Biblical ethics, especially as it relates to such issues as biotechnology, ecology, and human health and reproduction, should permeate all phases of scientific research.

3. The student will perceive the inter-relatedness of biology, other sciences, math, and the other disciplines. The student will embrace the idea that...

- Chemistry is the basis for understanding modern biology.
- Math and computers are tools used in biology to organize, present, and interpret data.
- Biology, like all sciences, has had a profound impact on history and thought.
- Computers are tools that facilitate the organization, presentation, and interpretation of data.

The NOW WHAT (integrate)...

1. The student will praise God through the study and responsible care of His Creation. The student will realize that...

- The more the student understands the complexities and intricacies of Creation, the more he/she will be moved to praise Him. Deeper knowledge and understanding never explains AWAY God but explains THE WAY God designed His Creation.

2. **The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation.**
 - Special projects such as collections of leaves and various invertebrate/vertebrate dissections will provide opportunities to creatively pursue a deeper understanding of the concepts of taxonomy, microbiology, anatomy and physiology, and student designed research.
3. **The student will become a problem solver through observing, data collecting, and experimentation with available technology. Some students will consider a career in science.**
 - Students will regularly use graphing calculators, computers, electronic probes, and instruments such as microscopes, spectrophotometers, and gel electrophoresis for data acquisition, analysis, and presentation.
 - Lab activities will be weekly, primarily during the block period and will constitute a significant part of the curriculum and evaluation.

Biology

Biology is the study and application of the complexity of life processes in a fallen world. There are five broad themes of study: environmental stewardship, nutrition and biochemical processes, the physiology of illness, genetics and gene technology, and growth and development. In addition to a basic knowledge of biological processes, students will be expected to apply their understanding to issues of justice and mercy in the world around them.

Students will:

- Use a variety of tools in the classroom, laboratory, and community to investigate living things.
- Recognize relationships between the structures of life and their functions at the following levels: cells, organs, systems, organisms, populations, and communities.
- Compare and contrast various strategies of life in the following areas: energy needs, movement, response to environment, growth, self-maintenance, and reproduction.
- Apply biological and statistical concepts to explain and evaluate new observations.
- Relate environmental, health, and origin-of-life issues to the biblical themes of creation, the fall, and redemption.
- Grasp the Biblical and scientific basis for understanding the issues of evolution/creation, ecology/conservation, and biotechnology/bioethics.

Key Text:

1. *BSCS Biology: An Ecological Approach*, 8th edition, 1998.

Regular Biology Unit Scope and Sequence

I. The World of Life: The Biosphere

What...

Students will discover how matter cycles and energy flows through the biosphere. This unit that emphasizes ecology will include studying about photosynthesis, cell respiration, communities, ecosystems, and populations.

So what...

1. Lab – "How Do Flowers Attract Bees?"
2. Lab – Population Growth
3. Lab – Competition
4. Lab – Organisms and pH
5. Lab – Compounds in Living Organisms
6. Lab – Enzyme Activity
7. Lab – Factors that influence photosynthesis
8. Lab – Alaskan Green Peas and Cell Respiration
9. Lab – Measuring CO₂ Production by Yeast
10. Test 1 – Ecology Test
11. Test 2 – Biological Compounds/Biochemistry Test
12. Test 3 – Photosynthesis and Cell Respiration Test

Now what...

1. Special discussion – Man's place and purpose in a good but fallen creation.

II. Continuity in the Biosphere

What...

Students will discover cell structure, cell function, and cell reproduction. This unit also includes the study of human reproduction and development.

So what...

1. Lab – Use of the Compound Light Microscope
2. Lab – Observing Cells
3. Lab – Diffusion Through a Membrane
4. Lab – Cell Size and Diffusion
5. Lab – Water and Turgor Pressure
6. Lab – Mitosis and Cytokinesis
7. Lab – A Model of Meiosis
8. Lab – Making and Analyzing a Karyotype
9. Test 4 – Cell Theory, Function, and Reproduction Test
10. Test – Semester 1 Examination

Now what...

1. Special discussion – Man's ability to be a ray of hope in a fallen world. How do we impact a world full of disease (cancer and a myriad of genetic diseases)?
2. Special discussion – Cell size and how God's design makes so much sense.

III. Continuity in the Biosphere through Heredity and Genetics

What...

Students will discover the basic modes of inheritance for all forms of life on earth. This unit will also address specific genetic technologies like cloning, stem cell research, and assisted reproductive techniques.

So what...

1. Lab – Variations in a Human Face
2. Activity – Role Play – A Day in the Life of a Genetic Counselor
3. Lab – Probability
4. Lab – Corn Dihybrid Genetics
5. Lab – DNA Fingerprinting - gel electrophoresis
6. Test 5 – Genetics Test (Part 1 - modes of inheritance)
7. Test 6 – Genetics Test (Part 2 - biotechnology and bioethics)

Now what...

1. Special discussion – What does it mean to be a human being? What makes you the person that you are? What does it mean that humans are a “special” creation?
2. Special discussion – What is a Christian response to issues like cloning, stem cell research and in vitro fertilization?

IV. Diversity in the Biosphere

What...

Students will appreciate the diversity of life on earth. This unit will explore the patterns of life within the five major kingdoms of life.

So what...

1. Lab – Constructing and Using a Dichotomous Key
2. Lab – Viewing Bacteria / Gram negative vs. Gram positive bacteria in medicine
3. Lab – Variety Among Protists
4. Lab – Growth of Fungi
5. Lab – The Lifecycle of a Common Plant
6. Lab – Tropisms
7. Lab – Flower Dissection and the Formation of a Seed
8. Lab – Tree Ring Growth and Dendrochronology
9. Lab – A study of Invertebrates - hydra, grasshoppers, worms, crayfish, and sea fireflies
10. Lab – Vertebrate Dissection
11. Lab – Natural Selection

12. Test 7 – Classification and Bacteria, Protist, and Fungi Kingdom Test
13. Test 8 – Plant and Animal Kingdom Test
14. Test – Semester 2 Examination

Now what...

1. Special discussion – What does the Creation teach us about God? What is our role as caretaker of this creation? What does proper stewardship entail?
2. Special discussion – A response to Darwinian Evolution
3. Special discussion – An introduction to Intelligent Design

Regular Biology Assessments

TESTS (50%-60% of overall grade):

Unit Tests (2-3 per quarter). Primarily multiple choice and matching with several questions requiring a written response.

Test 1 Chapters 1-3 – Introduction to Ecology

Test 2 Chapter 4 – Biological Compounds/Biochemistry

Test 3 Chapters 15&19 – Photosynthesis and Cell Respiration

Test 4 Chapter 5 – Cell Theory, Function, and Reproduction

Test 5 Chapters 6-7 – Modes of Reproduction and Development

Test 6 Chapter 8 – Genetics Part I (modes of inheritance)

Test 7 Chapter 8 – Genetics Part II (biotechnology)

Test 8 Chapters 10-12 – The Classification of Life - Bacteria/Protist/Fungi Kingdoms

Test 9 Chapters 13 & 18, 14-17 – Plant and Animal Kingdom

HOMEWORK AND LABS (40%-50% of overall grade):

1. Inv 1.2 – You and the Web of Life
2. Inv 1.4 – How Do Flowers Attract Bees? A Study of Experimental Methods
3. Inv 2.2 – Population Growth
4. Inv 3.2 – Competition
5. Identifying Chemical Compounds
6. Inv 4.1 – Organisms and pH
7. Inv 4.2 – Compounds in Living Organisms
8. Inv 4.3 – Enzyme Activity
9. DNA Model Construction Activity
10. Inv A2.2 – The Compound Microscope
11. Inv 5.1 – Observing Cells
12. Inv 5.2 – Diffusion Through a Membrane
13. Inv 5.3 – Cell Size and Diffusion
14. Inv 5.4 – Mitosis and Cytokinesis
15. Inv 6.1 – A Model of Meiosis
16. Inv 8.1 – Probability

17. Punnett Square Activities
18. Pedigree Activity
19. Role Play – What is it like to be a Genetic Counselor?
20. Monogenic genetic disorder presentations
21. Classification Activity
22. Use of a Dichotomous Key
23. Microorganism Activity
24. Flower Dissection
25. Tropisms
26. Green Pea Respiration Activity
27. Invertebrate Comparative Dissection
28. Vertebrate Dissection(s)
29. Inv 9.1 – Variation in Size of Organisms
30. Inv 9.2 – Natural Selection - A Simulation

Regular Biology Course Scope and Sequence

The WHAT (discover)...

1. **The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of ...
 - The flow of energy, matter, and organization in all of the biochemical reactions and pathways of living things.
 - The balance, homeostasis, and development of cells, systems, organisms, and communities.
 - The continuity of life inherent in reproduction and genetics.
 - The way in which organisms interact with/respond to the environment

2. **The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it,** as seen in...
 - The study of molecular genetics, biotechnology, bioethics, and reproductive technologies.
 - The study of the environment and ecology.
 - The study of Biblical Creation and its relationship to contemporary micro- and macro-evolutionary theory.

3. **The student will discover what it means to be created in the image of God and how that affects his/her relationships with other people as well as the rest of Creation.** The student will discover that...
 - We are similar to (genetic component – “nature” and environmental component – “nurture”) and different from (spiritual component – the work of the Holy Spirit) the rest of creation.
 - We have a responsibility to exercise wise and caring stewardship of God’s Creation.

- We are better able to fulfill this mandate of stewardship through the study of Biology.
Stewardship includes the progressive unlocking of the unrealized potential of Creation.

4. **The student will discover the fundamental concepts and principles of the science course they are taking and the methods and technology used to discover them.**

The student will discover...

- How chemistry, particularly biochemistry, lays the foundation for an understanding of biology which, at the molecular level, is about carbohydrates, proteins, lipids, and nucleic acids.
- How organisms exchange materials with the environment, collect and release energy (photosynthesis and cell respiration), are made of cells, grow and develop, reproduce and pass genetic characteristics on to their offspring, respond to their environment, and fight disease and infection.
- How prokaryotes (bacteria), protists, fungi, plants, and animals and humans are similar in certain ways and different in certain ways.
- How organisms are ecologically related to each other and to their environment.

The SO WHAT (embrace)...

1. **The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe.** The student will embrace the idea that...

- Creation is good, orderly, and beautiful. Creation reflects the Creator.
- The laws that govern the operation of the universe reveal God's ongoing and perfect care and control of His creation.
- All created things, both living and nonliving, are interrelated. We must treat them with respect.
- God created Man as a special and unique being. Only Man is created in the image of God.

2. **The student will embrace a Biblical worldview in understanding issues of science, technology, and culture.** The student will embrace the idea that...

- The "Fall" (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in pollution, extinction, and natural disasters in general, and disease, malnutrition, and self-inflicted human suffering (poor choices) in particular for humans.
- We are charged by God to participate in the redemption of His Creation. By gaining knowledge and understanding of Creation and applying those insights (technology) in ethical ways, we can positively impact both the environment and the human condition.
- *Micro*-evolution, defined as genetic changes within a *kind*, is the result of natural and artificial selection acting on the inherent genetic potential originally created by God in the genome of that kind. There can be tremendous variation within a

- kind (e.g. Pekinese, Great Dane, fox, wolf). However, Man did NOT evolve from a lower life form but was a special creation.
- *Macro*-evolution, defined as genetic changes causing one *kind* to eventually become an entirely different *kind*, is a popular and influential scientific theory but is not supported by scripture and has only a circumstantial scientific basis. Man did NOT evolve from a lower life form.
 - Because Man is created in the image of God, we have been given the responsibility to exercise wise stewardship over the rest of Creation. We may use it, but we cannot abuse or misuse it.
 - Biblical ethics, especially as it relates to such issues as biotechnology, ecology, and human health and reproduction, should permeate all phases of scientific research.
3. **The student will perceive the inter-relatedness of biology, other sciences, math, and the other disciplines.** The student will embrace the idea that...
- Chemistry is the basis for understanding modern biology.
 - Math and computers are tools used in biology to organize, present, and interpret data.
 - Biology, like all sciences, has had a profound impact on history and thought.
 - Computers are tools that facilitate the organization, presentation, and interpretation of data.

The NOW WHAT (integrate)...

1. **The student will praise God through the study and responsible care of His Creation.** The student will realize that...
- The more the student understands the complexities and intricacies of Creation, the more he/she will be moved to praise Him. Deeper knowledge and understanding never explains AWAY God but explains THE WAY God designed His Creation.
2. **The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation.**
- Special projects such as collections of leaves and various invertebrate/vertebrate dissections will provide opportunities to creatively pursue a deeper understanding of the concepts of taxonomy, microbiology, anatomy and physiology, and student designed research.
3. **The student will become a problem solver through observing, data collecting, and experimentation with available technology. Some students will consider a career in Science.**
- Students will regularly use graphing calculators, computers, electronic probes, and instruments such as microscopes, spectrophotometers, and gel electrophoresis for data acquisition, analysis, and presentation.
 - Lab activities will be weekly, primarily during the block period and will constitute a significant part of the curriculum and evaluation.

Honors Biology

Biology is the study of the order and diversity of God's living creation. Three areas of emphasis are the broad themes of modern biology; interpreting observations and experimental results; and relating biological concepts to the biblical themes of creation, the fall, and redemption.

Students will:

- Recognize God's grace and provision in the intricate splendor of all life.
- Recognize relationships between the structures of life and their functions at the following levels: cells, organs, systems, organisms, populations, and communities.
- Compare and contrast various strategies of life in the following areas: energy needs, movement, response to environment, growth, self-maintenance, and reproduction.
- Recognize cause/effect relationships in cell processes, respiration, photosynthesis, mitosis, meiosis, chemical synthesis and decomposition, and chemical transport.
- Relate environmental issues, medical ethics, biotechnology, and origin-of-life (micro vs. macro-evolution) issues to the biblical themes of creation, the fall, and redemption.

Key Text: *Biological Science – A Molecular Approach*, BSCS blue version, 8th Edition, Heath Publishing Co., 2001

Honors Biology Unit Scope and Sequence

I. Energy, Matter, and Organization

What...

Students will discover the fundamentals of the chemistry of life, energy and life and the biosphere, exchanging materials with the environment, autotrophy, and cell respiration.

So What...

1. Lab – Compound Microscope
2. Lab – Organisms and pH
3. Lab – Compounds of Living Things
4. Lab – Enzyme Activity
5. Lab – Photosynthesis
6. Lab – Respiration
7. Test 1 Prologue and Chapter 1 – Methods of Science, General Chem, Biochem
8. Test 2 Chapter 2 – Organisms and Energy, Energy Flow, Metabolism, Digestion and Nutrition
9. Test 3 Chapter 3 – Living Systems, Cellular Material Exchange
10. Test 4 Chapter 4 – Autotrophy and Photosynthesis, Chemoautotrophy
11. Test 5 Chapter 5 – Respiration and Cellular Activities

Now What...

4. Special discussion – The Infinite/Personal God: Man as Equal To Yet Ruler Over Creation
5. Special discussion – Biology: Taxonomic, Ecological, and Molecular Approaches
6. 1st quarter project – Leaf/insect/flower collection

II. The Cell: Homeostasis and Development

What...

Students will discover the fundamentals of cell structures and their functions, transport systems, the cell cycle, expressing genetic information, animal growth and development, and plant growth and development.

So What...

1. Lab – Diffusion Through Membranes
2. Lab – Cell Structures
3. Lab – Single Celled Organisms
4. Test 6 Chapter 6 – Cell Structure, Multicellular Organization
5. Test 7 Chapter 7 – Transport Systems in Animals, Transport Regulation
6. Test 8 Chapter 8 – DNA Replication, Mitosis, Cell Cycle Regulation
7. Test 9 Chapter 9 – The Genetic Code, Transcription, Protein Synthesis, Viruses
8. Test 10 Chapter 10 – Development, Diversity, Cell Differentiation

Now What...

1. 2nd quarter project – Independent research and presentation (poster, paper, video or creative project) on a biological topic of the student's choice
2. Special discussion – Anti-Reductionism: Explains *the way* God created, not explains *away* God's Creation

III. Heredity: Continuity of Life

What...

Students will discover the fundamentals of reproduction, patterns of inheritance, other forms of inheritance, advances in molecular genetics, and population genetics.

So What...

1. DNA Replication and Mitotic Cell Division
2. Transcription and Translation
3. Tropisms
4. Probability
5. Karotypes
6. Gel Electrophoresis
7. Growing plants

8. Test 11 Chapter 11-12a – Plant Development, Growth, Responses; Cell Division
9. Test 12 Chapter 12b – Sexual Reproduction, Human Reproduction
10. Test 13 Chapter 13-14 – Genes, Chromosomes, Inheritance, Mechanisms of Inheritance
11. Test 14 Chapter 15-16 – Genomes, Molecular Genetics, Variation in Populations

Now What...

1. Short oral and poster presentation on a genetic disorder, focusing on the causes, treatments and social and emotional impact of the disorder on the affected person and his/her family
2. 3rd quarter project – View the movies Gattaca and The Island, read Brave New World, and write a paper discussing “What does it mean to be human?” using themes developed in these works of art and in classroom discussions.
3. Special discussion – Man: the Genetic, Environmental, and Spiritual Components
4. Special discussion – Cloning, Biotechnology, and Bioethics
5. Special discussion – Man in God’s Image: Abortion, Euthanasia, Infanticide

IV. Evolution

What...

Students will discover the fundamentals of the theories of the origin of life, diversity and variation, changes in species, and human evolution.

So What...

1. Lab – Structural Characteristics of Animals
2. Lab – Interpretation of Fossils, Archeological Interpretation
3. Test 15 Chapter 17-18 – Origin of Earth, Evolution, Fossils, Taxonomy
4. Test 16 Chapter 19-20 – Origin of Species, Primates, Humans

Now What...

1. Special discussion – Man: Created in the Image of God
2. Special discussions – Genesis 1-3
3. Special discussion – Similarity: Common Ancestry vs. Common Architecture

V. Responding to the Environment

What...

Students will discover the fundamentals of nervous systems, behavior, and immune systems.

So What...

1. Lab – Sensory Receptors
2. Antigen/Antibody Binding
3. Test 18 Chapter 23 – Infection, Immune Response, Immune System

Now What...

1. 4th quarter project – Independent field trip and research and presentation (poster, paper, video or creative project) on a biological topic of the student's choice
2. 4th quarter project – Fetal Pig Dissection
3. Special discussion – Drugs and the Brain

VI. Interactions and Interdependence

What...

Students will discover the fundamentals of ecosystem structure and function, and change in ecosystems.

So What...

1. Lab – Producers in an Ecosystem
2. Test 19 Chapter 24-25 – Ecosystems, Ecology

Now What...

1. Special discussion – Stewardship, Sustainability, and Sound Science
2. Special discussion – Cultural Mandate: “Ruling and Subduing”
3. Field trip to local park; environmental awareness activities

Honors Biology Assessments

TESTS (about 50% of grade):

About 4 per quarter covering 1-2 chapters each. Primarily multiple choice, true/false, and short answer. Some essay questions.

- Test 1 Prologue and Chapter 1 - Methods of Science, General Chem, Biochem
- Test 2 Chapter 2 – Organisms and Energy, Energy Flow, Metabolism, Digestion
- Test 3 Chapter 3 – Living Systems, Cellular Material Exchange
- Test 4 Chapter 4 – Autotrophy and Photosynthesis, Chemoautotrophy
- Test 5 Chapter 5 – Respiration and Cellular Activities
- Test 6 Chapter 6 – Cell Structure, Multicellular Organization
- Test 7 Chapter 7 – Transport Systems in Plants and Animals, Transport Regulation
- Test 8 Chapter 8 – DNA Replication, Mitosis, Cell Cycle Regulation
- Test 9 Chapter 9 – The Genetic Code, Transcription, Protein Synthesis, Viruses
- Test 10 Chapter 10 – Development, Diversity, Cell Differentiation
- Test 11 Chapter 11-12a – Plant Development, Growth, Responses; Cell Division
- Test 12 Chapter 12b – Sexual Reproduction, Human Reproduction
- Test 13 Chapter 13-14 – Genes, Chromosomes, Inheritance, Mechanisms of Inheritance
- Test 14 Chapter 15-16 – Genomes, Molecular Genetics, Variation in Populations
- Test 15 Chapter 17-18 – Origin of Earth, Evolution, Fossils, Taxonomy
- Test 16 Chapter 19-20 – Origin of Species, Primates, Humans
- Test 17 Chapter 21 – Nervous System, Cellular Communication
- Test 18 Chapter 23 – Infection, Immune Response, Immune System
- Test 19 Chapter 24-25 – Ecosystems, Ecology

HOMEWORK (about 10% of grade):
short answer questions found at the end of each chapter in the text.

LABS (about 25% of grade):

1. Compound Microscope
2. Organisms and pH
3. Compounds of Living Things
4. Food Energy
5. Enzyme Activity
6. Diffusion Through Membranes
7. Kidney and Homeostasis
8. Photosynthesis
9. Alcohol and Cell Membranes
10. Respiration
11. Yeast
12. Cell Structures
13. Single Celled Organisms
14. Transpiration
15. Exercise and Heart Rate
16. DNA Replication and Mitotic Cell Division
17. Transcription and Translation
18. Caffeine and Heart Rate
19. Tropisms
20. Reproduction in Mosses and Flowering Plants
21. Probability
22. Seedling Phenotypes
23. Karotypes
24. Gel Electrophoresis
25. Structural Characteristics of Animals
26. Interpretation of Fossils, Archeological Interpretation
27. Sensory Receptors
28. Reaction Time

PROJECTS (about 15% of grade)

- 1st quarter – Leaf/insect/flower collection
- 2nd quarter – Winogradsky Column (Microbiology) Experiment
- 3rd quarter – Microbial Ecology Research; Evolution/Creation Presentation
- 4th quarter – Disease Report/Presentation; Fetal Pig Dissection

Honors Biology Course Scope and Sequence

The WHAT (discover)...

1. **The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of ...

- The flow of energy, matter, and organization in all of the biochemical reactions and pathways of living things.
 - The balance, homeostasis, and development of cells, systems, organisms, and communities.
 - The continuity of life inherent in reproduction and genetics.
 - The way in which organisms interact with/respond to the environment
2. **The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it, as seen in...**
- The study of molecular genetics, biotechnology, bioethics, and reproductive technologies.
 - The study of the environment and ecology.
 - The study of Biblical Creation and its relationship to contemporary micro- and macro-evolutionary theory.
3. **The student will discover what it means to be created in the image of God and how that affects his/her relationships with other people as well as the rest of Creation.** The student will discover that...
- We are similar to (genetic component – “nature” and environmental component – “nurture”) and different from (spiritual component – the work of the Holy Spirit) the rest of creation.
 - We have a responsibility to exercise wise and caring stewardship of God’s Creation.
 - We are better able to fulfill this mandate of stewardship through the study of Biology. Stewardship includes the progressive unlocking of the unrealized potential of Creation.
4. **The student will discover the fundamental concepts and principles of the science course they are taking and the methods and technology used to discover them.** The student will discover...
- How chemistry, particularly biochemistry, lays the foundation for an understanding of biology which, at the molecular level, is about carbohydrates, proteins, lipids, and nucleic acids.
 - How organisms exchange materials with the environment, collect and release energy (photosynthesis and cell respiration), are made of cells, grow and develop, reproduce and pass genetic characteristics on to their offspring, respond to their environment, and fight disease and infection.
 - How prokaryotes (bacteria), protists, fungi, plants, animals, and humans are similar in certain ways and distinctly different in certain ways.
 - How organisms are ecologically related to each other and to their environment.

The SO WHAT (embrace)...

- 1. The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe.** The student will embrace the idea that...
 - Creation is good, orderly, and beautiful. Creation reflects the Creator.
 - The laws that govern the operation of the universe reveal God's ongoing and perfect care and control of His creation.
 - All created things, both living and nonliving, are interrelated. We must treat them with respect.
 - God created Man as a special and unique being. Only Man is created in the image of God.
- 2. The student will embrace a Biblical worldview in understanding issues of science, technology, and culture.** The student will embrace the idea that...
 - The "Fall" (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in pollution, extinction, and natural disasters in general, and disease, malnutrition, and self-inflicted human suffering (poor choices) in particular for humans.
 - We are charged by God to participate in the redemption of His Creation. By gaining knowledge and understanding of Creation and applying those insights (technology) in ethical ways, we can positively impact both the environment and the human condition.
 - *Micro*-evolution, defined as genetic changes within a *kind*, is the result of natural and artificial selection acting on the inherent genetic potential originally created by God in the genome of that kind. There can be tremendous variation within a kind (e.g. Pekinese, Great Dane, fox, wolf). However, Man did NOT evolve from a lower life form but was a special creation.
 - *Macro*-evolution, defined as genetic changes causing one *kind* to eventually become an entirely different *kind*, is a popular and influential scientific theory but is not supported by scripture and has only a circumstantial scientific basis. Man did NOT evolve from a lower life form.
 - Because Man is created in the image of God, we have been given the responsibility to exercise wise stewardship over the rest of Creation. We may use it, but we cannot abuse or misuse it.
 - Biblical ethics, especially as it relates to such issues as biotechnology, ecology, and human health and reproduction, should permeate all phases of scientific research.
- 3. The student will perceive the inter-relatedness of biology, other sciences, math, and the other disciplines.** The student will embrace the idea that...
 - Chemistry is the basis for understanding modern biology.
 - Math is an essential language that enables scientists to articulate the truths of Biology.
 - Biology, like all sciences, has had a profound impact on history and thought.

- Computers are tools that facilitate the organization, presentation, and interpretation of data.

The NOW WHAT (integrate)...

1. **The student will praise God through the study and responsible care of His Creation.** The student will realize that...
 - The more the student understands the complexities and intricacies of Creation, the more he/she will be moved to praise Him. Deeper knowledge and understanding never explains AWAY God but explains THE WAY God designed His Creation.
2. **The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation.**
 - Special projects such as collections of leaves or insects, scientific/creative independent investigations, microbial ecology/water analysis, and fetal pig dissection will provide opportunities to creatively pursue a deeper understanding of the concepts of taxonomy, microbiology, anatomy and physiology, and student designed research.
3. **The student will become a problem solver through observing, data collecting, and experimentation with available technology. Some students will consider a career in science.**
 - Students will regularly use graphing calculators, computers, electronic data collection devices, and instruments such as microscopes, and gel electrophoresis for data acquisition, analysis, and presentation.
 - Lab activities will occur primarily during the block period and will constitute a significant part of the curriculum and evaluation.

Human Anatomy and Physiology

Human Anatomy and Physiology is the study of the pinnacle of God's Creation, mankind. Anatomy is the study of the structure of body parts and their relationships to one another. Physiology concerns the functioning of the body's structural machinery, that is, how the parts of the body work and carry out their life-sustaining activities. Physiology is explainable only in terms of the underlying anatomy. Through this course, students will learn to understand the function of the body God gave them and the importance of taking care of God's temple.

Students will:

- Gain and demonstrate a working knowledge of the structure and function of the human body and its associated medical terms.
- Demonstrate knowledge of the human anatomy associated with the major organ systems.

- Understand the interactions of the major organ systems resulting in maintenance of homeostasis.
- Apply acquired knowledge of physiology to understanding the underlying causes of disease and its effects on the human body.
- Recognize the creativity, complexity, and intricate design of our bodies.
- Understand the major health issues confronting modern society.
- Be challenged to present our bodies as a holy temple to God through purity and the practice of proper nutrition and exercise.
- Develop an understanding of the political, social and economic issues that impact the world and influence our government's health policies and standards for prevention, care and treatment of disease.
- Learn proper dissection techniques, lab procedures and proper use of medical instruments common in the medical field.

Key Text:

1. *Essentials of Human Anatomy & Physiology*, 8th Edition, Elaine N. Marieb, Benjamin Cummings, 2006.
2. *Anatomy & Physiology Coloring Workbook*, 8th Edition, Elaine N. Marieb, Benjamin Cummings, 2006.

Human Anatomy and Physiology – Unit Scope and Sequence

I. Introduction to Anatomy and Physiology

What...

Students will learn the organizational framework and terminology essential to the study of the structure and function of the human body and its diseases and disorders. They will begin to explore the meaning of being made in God's image. These major themes will be explored throughout the course through the progressive and cumulative study of human organ systems.

So What...

1. Test 1 Chapters 1–2 The Human Body: An Orientation and Basic Chemistry
2. Test 2 Chapter 3 – Cells and Tissues
3. Anatomical terms lab
4. Tissue Histology Lab

Now What...

7. Special discussion – The Image of God in Man and the complexity in man's design

II. The Exterior and Movement

What...

Students will explore the diverse structures and functions of the Integumentary, Skeletal, and Muscular Systems.

So What...

1. Test 3 Chapter 4 – The Integumentary System and Body Membranes
2. Test 4 Chapter 5 – The Skeletal System
3. Test 5 Chapter 6 – The Muscular System
4. Integumentary system lab
5. Muscular system lab

Now What...

1. Activity – Skeleton and Muscle Groups in exercise

III. Sensory and Nervous Systems

What...

Students will explore the organization and functioning of the senses and nerves and the complex structures of the brain and its subsequent actions as the command center of our body.

So What...

1. Test 6 Chapter 7 – The Nervous System

2. Test 7 Chapter 8 – The Special Senses
3. Sheep brain dissection
4. Sheep eye dissection

Now What...

1. Special discussion – The brain, last frontier: the limitations of science to understand and investigate the vast complexities of the brain.

IV. Homeostatic Control and the Body's Defenses

What...

Students will explore the organs and hormones involved in maintaining homeostasis and the organs and cells involved in defending the bodies from pathogens in the Endocrine, Immune and Lymphatic Systems.

So What...

1. Test 8 Chapter 9 – The Endocrine System
2. Test 9 Chapter 12 – The Lymphatic and Immune Systems

Now What...

1. Special discussion: Diabetes and obesity epidemic: The link between diabetes and obesity and its effects on health, the health industry and the economy.
2. Special discussion: Consequences of living in a fallen world: when the body attacks itself, autoimmune diseases

V. Circulation and Respiration

What...

Students will explore the structures of the lung and heart and learn their role in nutrient and gas exchange in the Cardiovascular and Respiratory Systems.

So What...

1. Test 10 Chapters 10 – 11 – The Circulatory System and Blood
2. Test 11 Chapter 13 – The Respiratory System
3. Sheep Heart Dissection
4. Blood, Pulse and Blood Pressure Lab
5. Monitoring Your EKG Lab
6. Respiratory System Lab
7. Respiratory Volumes and Lung Capacity Lab

Now What...

1. Special discussion: The biblical importance of the heart and heart disease

VI. Digestion, Nutrition and Metabolism

What...

Students will explore the structures and functions of the digestive system and learn the role that nutrition and diet have on overall health.

So What...

1. Test 12 Chapters 14 The Digestive System
2. Digestive System Dissection

Now What...

1. Video: Super Size Me – the effect of diet on health and the role of the food industry.
2. Video: Dying to be Thin – the obsession of society to have the “perfect” body and its psychological impact on self-esteem and the physiological consequences of eating disorders.
3. Special discussion – presenting our bodies as a living sacrifice to God as an act or worship.

VII. Excretion and Reproduction

What...

Students will explore the structures of the urinary and reproductive systems and learn their function in the development of life.

So What...

1. Test 13 Chapter 15 – The Urinary System
2. Test 14 Chapter 16 – The Reproductive System
3. Sheep Kidney Dissection
4. Urinary and Reproductive System Dissection

Now What...

1. Special discussion: Bioethics and human health and reproduction

Human Anatomy and Physiology Assessments

TESTS (about 50% of grade):

Tests (about 3-4 per quarter) covering 1-2 chapters each. Primarily multiple choice, fill in the blank, short answer, and 1-4 clinic questions.

Test 1 Chapters 1 - 2 – Human Body: An Orientation and Basic Chemistry

Test 2 Chapter 3 – Cells and Tissues

Test 3 Chapter 4 – The Integumentary System: Skin & Body Membranes

Test 4 Chapter 5 – The Skeletal System

Test 5 Chapter 6 – The Muscular System

Test 6 Chapter 7 – The Nervous System

Test 7 Chapter 8 – Special Senses

Test 8 Chapter 9 – The Endocrine System

Test 9 Chapters 10 - 11 – The Cardiovascular System and Blood

Test 10 Chapter 12 – The Lymphatic and Immune System

Test 11 Chapter 13 – The Respiratory System

Test 12 Chapter 14 – The Digestive System

Test 13 Chapter 15 – The Urinary System

Test 14 Chapter 16 – The Reproductive System

HOMEWORK (about 25% of grade)

Assignments from workbook and additional worksheets

LABS (about 25% of grade; some labs take multiple weeks to complete):

1. The Language of Anatomy & Body Cavities
2. The Microscope & Histology Slides
3. The Integumentary System
4. Introduction to Cat Dissection
5. The Skeleton System
6. The Muscular System Dissection
7. The Muscular System and Exercise
8. Dissection of the Sheep Brain
9. Dissection of the Sheep Eye
10. Circulatory System Lab: the Blood, Pulse and Blood Pressure
11. Dissection of the Sheep Heart
12. Monitoring the EKG Before and After Exercise
13. The Respiratory System Dissection
14. The Respiratory System: Pulmonary Volumes and Capacities
15. The Digestive System Dissection
16. The Urinary System Dissection
17. Dissection of the Sheep Kidney

Human Anatomy and Physiology

The WHAT (discover)...

- 1. The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of...
 - The structure of the various organ systems in the body and their interaction with each other
 - The balance, homeostasis, and maintenance of cells, tissues, organs, and systems within the human body.
 - The continuity of life inherent in reproduction and genetics.
 - The way in which human beings interact with and respond to the environment.
- 2. The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it,** as seen in...
 - The study of bioethics and reproductive technologies.
 - The study of the cause and developments of disease and its effects on the human body.
 - The study of the creativity, complexity, and intricate design of our bodies.
- 3. The student will discover what it means to be created in the image of God, and how that affects his/her relationships with other people as well as the rest of Creation.** The students will discover that...
 - We are to be good stewards of our bodies through proper nutrition and exercise.
 - We are better able to fulfill this mandate of stewardship through the study of Human Anatomy and Physiology. Stewardship includes the progressive unlocking of the unrealized potential of the body God gave us.
- 4. The student will discover the fundamental concepts and principles of the science course they are taking and the methods and technology used to discover them.** In Human Anatomy and Physiology this includes...
 - How chemistry, particularly biochemistry, lays the foundation for an understanding of human anatomy and how the laws of physics govern our skeletal, muscular and sensory systems.
 - How human beings exchange materials with the environment, collect and release energy, are made of cells, grow and develop, reproduce and pass genetic characteristics on to their offspring, respond to their environment, and fight disease and infection.
 - How the different organ systems in the human body interact with and relate to each other to make the human being a complete organism.
 - How disease develops and the consequences of disease to the body.

The SO WHAT (embrace)...

1. **The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe.** Students will embrace the idea that...
 - Creation of the human body is good, orderly, and beautiful. Creation reflects the Creator.
 - The laws that govern the operation of the human body reveal God's ongoing and perfect care and control of His creation.
 - All created parts of our body are interrelated. We must treat each part with respect.
 - God created Man as a special and unique being. Only Man is created in the image of God.

2. **The student will embrace a Biblical worldview in understanding issues of science, technology, and culture.** Students will embrace the idea that...
 - The "Fall" (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in disease, malnutrition, and self-inflicted human suffering (poor choices).
 - We are charged by God to participate in the redemption of His Creation. By gaining knowledge and understanding of the human body and applying those insights (technology) in ethical ways, we can positively impact the human condition and ease suffering.
 - Biblical ethics, especially as it relates to such issues as biotechnology and human health and reproduction, should permeate all phases of scientific research.

3. **The student will perceive the inter-relatedness of human anatomy and physiology, other sciences, math, and the other disciplines.** Students will embrace the idea that...
 - Chemistry, biology and physics are the basis for understanding human anatomy and physiology.
 - Math is an essential language that enables medical professional to evaluate the health status of individuals.
 - Human Anatomy and Physiology has a profound impact on politics, economics and cultural perception and thought.

The NOW WHAT (integrate)...

1. **The student will praise God through the study and responsible care of His Creation.**
 - The more the student understands the complexities and intricacies of Creation, the more he/she will be moved to praise Him. Deeper knowledge and understanding never explains AWAY God but explains THE WAY God designed His Creation.

2. **The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation.**
 - Through special discussions students will gain an understanding of the major issues facing the health care industry and how other factors such as politics and economics influence and complicate the issues often determining the quality and type of health care that individuals receive.
 - The numerous dissections will enable the students to explore not only the complexities of the human body but also to develop a respect for the life that was sacrificed to provide them with such an opportunity.

3. **The student will become a problem solver through observing, data collecting, and experimentation with available technology. Some students will consider a career in science.**
 - Students will regularly use dissection instruments and medical instruments commonly used by medical personnel.
 - Lab activities will be weekly, primarily during the block period, and will constitute a significant part of the curriculum and evaluation.

Forensic Science

Forensic Science, often referred to as Criminalistics, is the application of science to law. Major topics include the crime scene and physical evidence; physical properties of glass and soil; organic and inorganic analysis; the microscope and its use in the analysis of hair, fiber, and paint; bacteriology, toxicology, and drug detection; arson and explosives; serology and DNA; entomology; fingerprints; firearms, tool marks, and other impressions; and document and voice examination.

Students will:

- Review and integrate many of the many of the major themes of Physics, Chemistry, Biology, and Earth Science.
- Participate in presentations and discussions about Forensic Science-related issues.
- Investigate “crimes” through hands-on lab activities that require the examination of “evidence.”
- Realize the relationship between God’s moral law and man’s civil law.
- Understand the major topics of Forensic Science in terms of the underlying themes of God’s creation, man’s fall, and Christ’s redemption.

Key Text: *Forensic Science: An Introduction*; Richard Saferstein, Pearson/Prentice Hall, 2008.

Forensic Science Unit Scope and Sequence

I. Crime Scene, Physical Evidence, Glass & Soil

What...

Students will discover the fundamentals of the history and development of forensic science, the organization and services of a crime laboratory, the functions of a forensic scientist, processing the crime scene, legal consideration at the crime scene; the common types of physical evidence and their significance, the metric system, physical properties.

So What...

1. Video – Crime Scene Creatures
2. Test 1 Chapters 1-3 – Introduction, Crime Scene, Physical Evidence

Now What...

1. Special discussion – Forensic Science: Integration of the sciences, math, and technologies
2. Crime Scene Lab (“dead” body)
3. Special Speaker – Police Officer
4. Special discussion – Creation/Fall/Redemption

II. Properties of Matter; Drugs

What...

Students will discover the fundamentals of elements of compounds, the properties of matter, the nature of matter, and the theory of light, the forensic analysis of glass. Students will also learn about drug dependence, the types of drugs, drug control laws, forensic drug analysis, and the collection and preservation of drug evidence.

So What...

1. Glass Density Lab
2. Chromatography Lab (magic markers)
3. Urinalysis Lab (simulated)
4. Drug Comparison Worksheet (internet activity)
5. Mass Spectrometer Lab (simulated) – The Detection of Cocaine
6. Test 2 Chapters 4-5 – Physical Properties, Drugs and Toxicology

Now What...

1. Special Speaker – Detective/Crime Scene Van Driver
2. Special discussion – The Dual Nature of Light – Our models are limited because they reflect our finiteness and because creation is incredibly complex.
3. Special Discussion – Drugs and their effect on the individual and the society.
4. Special discussion – The Biblical basis for understanding addiction
5. Special discussion – Biography of an addict

III. Forensic Toxicology, The Microscope, Forensic Serology

What...

Students will discover the fundamentals of forensic toxicology using alcohol as a model, testing for intoxication, the analysis of blood for alcohol, and alcohol and the law; of different kinds of microscopes (compound, comparison, stereoscopic, polarizing, microspectrophotometer, scanning electron) and how they are used; the nature of blood, immunoassay techniques, forensic characterization of bloodstains, bloodstain patterns, principles of heredity, forensic analysis of violent crimes including rape.

So What...

1. White Powder Lab
2. Microscope Lab (matches/matchbook, layers of paint on sticks)
3. Video – Are We Scaring Ourselves to Death?
4. Spectrophotometer Lab (salicylates in blood)
5. Blood Splatter Lab
6. Test 3 Chapter 6-8 – Forensic Toxicology, the Microscope, Forensic Serology

Now What...

1. Special Speaker – Product Liability Attorney
2. Special Discussion – Redemption involves the wise and moral use of technology

IV. DNA, Trace Evidence (Hair, Fibers)

What...

Students will discover the fundamentals of DNA (replication, typing, PCR, STRs, Mitochondrial), the collection and preservation of biological evidence; forensic examination of fibers and hair and their collection and preservation.

So What...

1. Hair Lab
2. Fiber Lab
3. DNA/Gel Electrophoresis Lab
4. Test 4 Chapter 9-10 – Drugs, Toxicology

Now What...

1. Special Speaker – DEA Agent
2. Special Discussion – *Imago Dei* and Man: the Genetic, Environmental, and Spiritual Components

V. Trace Evidence (Metals, Paint, Soil), Arson, Explosions

What...

Students will discover the fundamentals the forensic analysis of metals and soil, the forensic examination of paint, the forensic analysis of arson the chemistry of fire,

searching the fire scene, collection and preservation of arson evidence, analysis of flammable residues, types of explosives, collection and analysis of evidence of explosives.

So What...

1. Bone Lab
2. Soil Lab
3. Video – Hunt for a Serial Arsonist (Nova)
4. Video – The Bombing of America (Nova)
5. Demonstration – Radioactivity
6. Test 5 Chapter 11-13 – Trace Evidence of Metals, Paint, and Soil; Arson, Explosions.

Now What...

1. Special Speaker – Arson Investigator
2. Special Speaker – Medical Examiner/Airplane Accident Reconstruction

VI. Fingerprints, Firearms, Tool Marks and Impressions, Documents & Voice Examination

What...

Students will discover the fundamentals of the history of and principles of fingerprinting, classification and identification of fingerprints, methods of detecting and preserving and developing fingerprints; bullet comparisons, cartridge cases, automated firearm search systems, gunpowder residues, primer residues on the hands, serial number restoration, collection and preservation of firearm evidence, tool marks, other impressions; handwriting comparison, collection of handwriting exemplars, photocopier and printer examination, alterations and erasures and obliterations, other document problems, and voice examination.

So What...

1. Fingerprint Lab
2. Tool Impression Lab (screwdrivers, clay)
3. Handwriting Analysis Lab
4. Computer Facial Drawing Lab
5. Test 6 Chapter 14-16 – Fingerprints, Firearms, Tool Marks, Document and Voice Examination

Now What...

1. Special Speaker – ATF agent
2. Special discussion – Even though we are all different (fingerprints, handwriting, voice patterns, DNA) we are known individually by God. Even though we are all different, we all need God's redemption. Even though we are all different, "there but for the grace of God go I."

Forensic Science Assessments

TESTS (about 1/3 of grade):

6 tests (3 per quarter) covering 2-3 chapters each. Primarily multiple choice, true/false, and short answer.

Test 1 Chapter 1-3 – Introduction, Crime Scene, Physical Evidence

Test 2 Chapter 4-5 – Physical Properties, Glass Analysis, Drugs

Test 3 Chapter 6-8 – Forensic Toxicology, the Microscope, Forensic Serology

Test 4 Chapter 9-10 – DNA and Trace Evidence: Hairs and Fibers

Test 5 Chapter 11-13 – Trace Evidence: Metals, Paint, Soil; Arson, Explosions

Test 6 Chapter 14-16 – Fingerprints, Firearms, Tool Marks, Document and Voice Examination

HOMEWORK (about 1/3 of grade):

One set of short answer questions found at the end of each chapter in the text.

LABS (about 1/3 of grade):

1. Crime Scene (“dead” body)
2. Glass Density
3. Matches, Paint Chips (microscope use)
4. Chromatography (magic markers)
5. Soil Analysis
6. Qualitative Analysis (white powders)
7. Drugs and Poisons
8. Hair Analysis (human and animal hair)
9. Urinalysis Lab
10. Fiber Analysis (silk, wool, cotton, etc.)
11. Spectrophotometer Lab (aspirin in “blood”)
12. Blood Splatter Lab
13. Fingerprint Lab
14. Bone Lab
15. DNA gel electrophoresis
16. Tool Impression Lab (screwdrivers, clay)
17. Handwriting Analysis
18. Computer Facial Drawing Lab

Forensic Science Course Scope and Sequence

The WHAT (discover)...

- 1. The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of Forensic Science. The student will discover that...
 - Many of the major themes of Physics, Chemistry, Biology, and Earth Science are reviewed and come together as they are applied in Forensic Science.
 - Numerous techniques and technologies studied in this course have been developed to assist the criminal justice system in ensuring that those who perpetrate crimes are apprehended and those who are innocent are absolved.
- 2. The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it.** The student will discover that...
 - God graciously enables man to apply the principles of science (i.e. technology) to the solution of problems (e.g. crimes) that beset both man and the rest of Creation.
 - Science is a God-given tool that enables us to increasingly understand the physical universe. Sadly, in a finite and fallen world, people commit crimes, and sometimes they are not caught despite our best science and technologies.
- 3. The student will discover what it means to be created in the image of God and how that affects his/her relationships with other people as well as the rest of Creation.** The student will discover that...
 - Mankind is similar to (rational and orderly) and different from (able to discover and understand the laws of God's creation) the rest of creation.
 - Because Man is created in the image of God, crimes against other people (fellow image-bearers) are particularly heinous.
 - We have a responsibility to exercise wise and caring stewardship over God's Creation. This includes the establishment of laws that promote the right treatment of others – laws that are often violated.
 - Studying Forensic Science enables us to better fulfill this mandate of stewardship.
- 4. The student will discover the fundamental concepts and principles of the science course he/she is taking and the methods and technology used to discover them.** The student will be...
 - Reviewing the major themes of Physics, Chemistry, Biology, and Earth Science and discovering how they are applied to enable the criminal justice system to ensure that those who perpetrate crimes are apprehended and those who are innocent are absolved.

The SO WHAT (embrace)...

1. **The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe.** The student will embrace the idea that...
 - Creation is good, orderly, and beautiful. Creation reflects the Creator.
 - The natural laws that govern the operation of the universe reveal God's ongoing and perfect care and control of His creation.
 - The man-made laws intended to facilitate the orderly functioning of society should be based upon God's (Biblical) laws that inform us concerning how we are to treat each other.

2. **The student will embrace a Biblical worldview in understanding issues of science, technology, and culture.** The student will embrace the idea that...
 - The "Fall" (sin) has profoundly impacted all of Creation, especially humans and their behavior. Too frequently this manifests itself through crimes such as murder, rape, assault, theft, and destruction of property.
 - Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
 - Because Man is created in the image of God, he/she has been given the responsibility to exercise wise stewardship over the rest of Creation.

3. **The student will perceive the inter-relatedness of Forensic Science with the rest of the sciences, math, law, and law enforcement.** The student will embrace the idea that...
 - Forensic Science is the application of science to criminal and civil laws, and their enforcement.
 - Forensic Science incorporates principles from all the sciences, especially Physics, Chemistry, Biology, and Earth Science.
 - Gathering, processing, interpreting, and presenting evidence requires substantial knowledge of many different sciences, technology (diagnostic equipment), computers and specialized software, and the laws which govern the admissibility of the results in court.

The NOW WHAT (integrate)...

1. **The student will praise God through the study and responsible care of His Creation.** The student will realize that...
 - The more the student understands the complexities and intricacies of Creation, the more he/she will be moved to praise God. Deeper knowledge and understanding never explains AWAY God but explains THE WAY He designed His Creation.
2. **The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation.**
 - Weekly lab activities will give students the opportunity to solve “crimes” using similar or simulated analysis of evidence gathered from “crime scenes.”
3. **The student will become a problem solver through observing, data collecting, and experimentation with available technology. Some students will consider a career in Forensic Science (Criminalistics) or in the judicial system.**
 - Students will regularly use scientific equipment to gather, process, interpret, and present the “evidence” found at the scene of the “crime” – the lab.
 - Lab activities occur weekly, primarily during the block period, and constitute a significant part of the curriculum and evaluation.
 - Special speakers, representing professions in the field of Criminalistics and criminal justice, will be occasionally invited to talk about their careers.

Astronomy and Earth Science

“The heavens declare the glory of God; the skies proclaim the work of his hands... The earth is the Lord’s, and everything in it, the world, and all who live in it.” (Psalm 19:1, 24:1) Astronomy and Earth Science is the study of the earth, the oceans, the atmosphere, and outer space – a survey and overview of the physical (non-biological) universe from minerals to black holes – and our place in it.

Students will:

- Understand the relationship between the philosophy of science and the Christian faith.
- Realize the continual providence and wisdom of God the Creator in ordering and sustaining His creation through the natural laws that we try to discover, understand, and apply.
- Be awed by the precision, design, and complexity of God’s creation, especially as it relates to the principles of earth science and their application.
- Recognize the moral responsibility that we have to understand the relevant earth science and apply it to solving the many challenges humanity and the earth are facing.
- Gain and demonstrate a working knowledge of the earth (e.g., minerals, rocks, water, wind, tectonics), the oceans, the atmosphere (including weather and climate), and astronomy (especially the solar system and outer space).
- Relate earth science to personal and social issues.

Key Texts: *Earth Science (11th ed.)*, Prentice Hall, 2006, and accompanying lab manual.

Earth Science Unit Scope and Sequence

I. Earth Materials

What...

Students will discover the major mineral groups and the properties used to identify them, and the three major categories of rocks – igneous, sedimentary, and metamorphic – and their general characteristics and how they are formed from each other.

So What...

1. Mineral Identification Lab
2. Rock Identification Lab
3. Test 1 Chapters 1-3 – Introduction, Minerals, and Rocks

Now What...

1. Special discussion – Earth Science and the philosophy of science
2. Special discussion – Creation/Fall/Redemption

II. Sculpturing Earth's Surface

What...

Students will discover the fundamentals of weathering, soil, mass wasting, running water, groundwater, glaciers, deserts, and wind, and how they shape the surface of the Earth.

So What...

1. Soil Lab
2. Introduction to Aerial Photographs and Topographic Maps Activity
3. Running Water and Ground Water Activity
4. Arid and Glacial Landscape Activity
5. Test 2 Chapters 4-6 – Weathering, Soil, Mass Wasting, Running and Ground Water, Glaciers, Deserts, and Wind

Now What...

1. Special Speaker – U.S. Dept. of Agriculture soil expert
2. Special Discussion – Stewardship and the wise use of God's resources

III. Forces Within

What...

Students will discover the fundamentals of earthquakes and earth's interior, the theory of plate tectonics, volcanoes and other kinds of igneous activities, and mountain building.

So What...

1. Earthquakes and Earth's Interior Activity
2. Video: Earthquakes
3. Video: Volcanoes
4. Geologic Maps and Structures Activity
5. Test 3 Chapter 7-9 – Earthquakes, Volcanoes, Plate Tectonics

Now What...

1. GPS Lab and “Treasure Hunt”

IV. Deciphering Earth's History

What...

Students will discover the fundamentals of determining geologic time, various dating techniques, and the geologic time scale.

So What...

1. Determining Geologic Ages Activity
2. Energy from Fossil Fuels Lab
3. Test 4 Chapter 10-12 – Mountain Building, Geologic Time, and Earth's History

Now What...

1. Special Speaker – Missouri Conservation Department agent: Christian and the Environment
2. Special Discussion – Origins (something from nothing, life from non-life, information and complexity, human consciousness)
3. Special Discussion – Geological Evolution v. Biological Evolution
4. Special Discussion – The Bible and the Age of the Earth

V. Earth's Dynamic Atmosphere

What...

Students will discover the fundamentals of the composition, structure, and temperature of the atmosphere; conduction, convection, and radiation; moisture, clouds, and precipitation; air pressure and wind; weather patterns and severe storms.

So What...

1. Global Climates Activity
2. Atmospheric Heating Activity and Lab
3. Sunglasses and UV Radiation Lab
4. Sunblock and UV Radiation Lab
5. Solar Homes Lab
6. Wind Power Lab
7. Video – Katrina
8. Video – Tornadoes
9. Video – Lightning
10. Video – Unstoppable Solar Cycles: The Real Story of Greenland

11. Test 5 Chapter 16-18 – The Atmosphere, Moisture, Clouds, Precipitation, Air Pressure, and Wind.
12. Test 6 Chapter 19-20 – Weather Patterns and Severe Storms, and Climate

Now What...

1. Special Discussion – Global Warming and Climate Change
2. Special Discussion – Why Science is Not an Exact Science

VI. Earth's Place in the Universe

What...

Students will discover the fundamentals or the origin of modern astronomy; motions of the earth, moon, and sun; the solar system; light, telescopes, and the sun; stars, stellar evolution, galaxies, red shifts, and the Big Bang theory.

So What...

1. Earth/Sun Relationship Activity
2. Patterns in the Solar System Activity
3. Photovoltaic Cells Lab
4. Video – Mars – Dead or Alive
5. Video – The Elegant Universe
6. Video – The Privileged Planet
7. Test 7 Chapter 21-22 – Origin of Modern Astronomy and the Solar System
8. Test 8 Chapter 23-34 – Light, Astronomical Observations, the Sun, Stars, Galaxies, and the Big Bang

Now What...

1. Special Activity – night viewing of moon and stars; using a telescope
2. Special Discussion – Science and Faith: Concert or Conflict?
3. Special Discussion – The Big Bang Theory and the Origin of the Universe
4. Special Discussion – The Anthropic Principle

Earth Science and Astronomy Assessments

TESTS (about 1/3 of grade):

8 tests (4 per quarter) covering 2-3 chapters each. Primarily multiple choice, true/false, and short answer.

Test 1 Chapter 1-3 – Introduction, Minerals, and Rocks

Test 2 Chapter 4-6 – Weathering, Soil, Running Water, Groundwater, Glaciers, Deserts, and Wind

Test 3 Chapter 7-9 – Earthquakes, Earth's Interior, Plate Tectonics, and Volcanoes

Test 4 Chapter 10-12 – Mountain Building, Geologic Time, Earth's History

Test 5 Chapter 16-18 – Atmosphere, Moisture, Clouds, Precipitation, Air Pressure, and Wind

Test 6 Chapter 19-20 – Weather and Climate

Test 7 Chapter 21-22 – History of Modern Astronomy and the Solar System

Test 8 Chapter 23-24 – Light, the Sun, Beyond Our Solar System

HOMEWORK (about 1/3 of grade):

One set of short answer questions found at the end of each chapter in the text.

LABS (about 1/3 of grade):

1. Minerals
2. Identifying Rocks
3. Soil Lab
4. Running Water and Ground Water (Exercise 4 in lab book)
5. Arid and Glacial Landscapes (Exercise 5 in lab book)
6. Earthquakes (Exercise 8 in lab book)
7. Geologic Maps and Structures (Exercise 7 in lab book)
8. Geologic Time (Exercise 6 in lab book)
9. Earth-sun Relationship (Exercise 12 in lab book)
10. Atmospheric Heating (Lab 13 in Vernier lab book)
11. Atmospheric Moisture (Lab 14 in Vernier lab book)
12. Reflection and Absorption (Lab 23 in Vernier lab book)
13. Greenhouse Effect (Lab 24 in Vernier lab book)
14. Global Climate (Exercise 16 in lab book)
15. GPS lab
16. Solar System (Exercise 18 in lab book)
17. Sunglass Lab (Lab 20 in Vernier lab book)
18. Sunscreen Lab (Lab 21 in Vernier lab book)
19. Photovoltaic Cells (Lab 32 in Vernier lab book)

Astronomy and Earth Science

The WHAT (discover)...

- 1. The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of ...
 - The fundamental structure of atoms, minerals and rocks.
 - Weathering, soil, surface water and ice, and wind.
 - Earth's interior, plate tectonics, the ocean environment, and the atmosphere, including weather and climate.
 - The solar system, light, stars, and galaxies.
- 2. The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it,** as seen in ...
 - Our uncovering the fundamental and universal laws by which God directs and governs the operation of His Creation.
 - God's graciously enabling man to apply scientific principles (technology) to the solution of problems that beset both man and the rest of Creation.
 - The fact that while earth science enables us increasingly to understand the physical universe, it is limited because it cannot completely address certain aspects of reality such as the spiritual and the aesthetic.
 - The limitations of the accuracy of measurements and their use in calculations.
 - The development, use, and progression of models where man's limitations prevent us from knowing directly about God's creation.
- 3. The student will discover what it means to be created in the image of God and how that affects his/her relationships with other people as well as the rest of Creation.** The student will discover...
 - How man is similar to (rational and orderly) and different from (able to discover and understand the laws of God's creation) the rest of creation.
 - Man has a responsibility to exercise wise and caring stewardship over God's Creation.
 - Studying astronomy and earth science enables us to better fulfill this mandate of stewardship.
- 4. The student will discover the fundamental concepts and principles of the science course they are taking and the methods and technology used to discover them.** In Astronomy and Earth Science this includes...
 - That physics and chemistry lay the foundation for an understanding of earth science.
 - That the earth, and especially its surface, is continually changing due to both natural and anthropogenic forces.
 - That the universe contains information about its past and clues about its future.

The SO WHAT (embrace)...

- 1. The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe.** The student will embrace the idea that...
 - Creation is good, orderly, and beautiful. Creation reflects the Creator.
 - The laws that govern the operation of the universe reveal God's ongoing and perfect care and control of His creation.
 - God built creation so that we could unlock its mysteries and discover God's goodness.
- 2. The student will embrace a Biblical worldview in understanding issues of science, technology, and culture.** The student will embrace the idea that...
 - The "Fall" (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology) which has sometimes led to pollution, destruction, physical harm and death.
 - We are charged by God to participate in the redemption of His Creation. By gaining knowledge and understanding of Creation, and applying those insights (technology) in ethical ways, we can positively impact both our environment and the human condition.
 - Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
 - Because Man is created in the image of God, we have been given the responsibility to exercise wise stewardship over the rest of Creation. We may use it, but we cannot abuse or misuse it.
- 3. The student will perceive the inter-relatedness within earth science, with other sciences, math, and the other disciplines.** The student will embrace the idea that...
 - Physics and chemistry provide the foundation for the study of the earth and outer space.
 - Math is an essential language that enables scientists to articulate the truths of earth science.
 - Earth science, like all sciences, has had a profound impact on history and thought.
 - Technology provides electronic tools (computers, interfaces, probes) that facilitate the organization, presentation, and interpretation of data.

The NOW WHAT (integrate)...

- 1. The student will praise God through the study and responsible care of His Creation.** This will be evident when...
 - The student understands the complexities and intricacies of Creation and sees God's character reflected in it.
 - He/she understands that a deeper knowledge and understanding explains THE WAY God designed His Creation but can never explain AWAY God.

2. The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation when he/she...

- Engages in classroom discussions, laboratory activities, and application of earth science to everyday events.
- Understands the relevance of earth science and its potential usefulness for addressing problems in our world.

3. The student will become a problem solver through observation, data collection, and experimentation with available technology as he/she...

- Uses electronic data collection devices and other instruments for data acquisition, analysis, and presentation.
- Engages in lab activities, which will occur primarily during the block period and will constitute a significant part of the curriculum and evaluation. The rest of them will be at night in order to view the moon and stars.

Physics (AP-B)

Motion, forces, energy, work, phases of matter, thermal effects, sound, light, statics, electricity, magnetism, atomic structure, nuclear reactions—these are the main topics of study in AP Physics. Through extensive problem solving and numerous labs, the infinite complexity, awesome diversity, yet remarkable unity of God's creation, laws, and processes are more fully realized and understood. Students will be required to take the AP Physics(B) exam in May. The weekly hands-on laboratory exercises are during the weekly block period and will often include the use of laptop computers, interfaces, and probes for data acquisition.

Students will:

- Understand the relationship between the philosophy of science and the Christian faith.
- Realize the continual providence and wisdom of God the Creator in ordering and sustaining His creation through the natural laws that we try to discover, understand, and apply.
- Be awed by the precision, design, and complexity of God's creation, especially as it relates to the principles of physics and their application.
- Recognize the moral responsibility that we have to understand the relevant physics and apply it to solving the many challenges humanity and the earth are facing.
- Demonstrate the ability to problem solve, especially by using dimensional analysis, scientific notation, and significant digits.
- Learn techniques and procedures appropriate to the college-level laboratory, including processes and procedures, observations and data manipulation, and group collaboration and reporting.
- Understand the principles of the five major content areas of Physics:
 - Newtonian mechanics (kinematics; laws of motion; work, energy, and power; momentum; circular and rotational motion, oscillations and gravitation).
 - Fluid mechanics and thermal physics (pressure, buoyancy, and Bernoulli's principle; temperature and heat; kinetic theory and thermodynamic).
 - Electricity and magnetism (electrostatics; conductors, capacitors, and dielectrics; electric circuits; magnetic fields; electromagnetism).
 - Waves and optics (wave motion; interference, diffraction, and the electromagnetic spectrum; reflection, refraction, mirrors, and lenses).
 - Atomic and nuclear physics (quantum effects, photoelectric effect, energy levels, and wave-particle duality; nuclear reactions and mass-energy equivalence).

Key Text: *College Physics*, 6th Edition, Serway and Faughn, Thomson-Brooks/Cole, 2003

AP Physics Unit Scope and Sequence

I. Mechanics

What...

Students will discover motion in one dimension, vectors and two-dimensional motion, the laws of motion, energy, momentum and collision, rotational motion and the law of gravity, rotational equilibrium and rotational dynamics, and solids and fluids.

So What...

1. Lab 1 - Density and Inertia Balance
2. Lab 2 – Acceleration
3. Lab 3 – Acceleration vs. Angle
4. Lab 4 – Finding g
5. Lab 5 – Picket Fence
6. Lab 6 – Projectile Motion
7. Lab 7 – Bungee Cord
8. Lab 8 – Coefficient of Friction and Angle
9. Lab 9 – Atwood’s Machine
10. Lab 10 – Air Friction
11. Lab 11 – Conservation of Momentum
12. Lab 12 – Collision in 2D
13. Lab 13 – Centripetal Force
14. Lab 14 – Sweet spot
15. Test 1 Chapters 1-2 – Introduction, Motion in One Dimension
16. Test 2 Chapter 3 – Vectors and Two Dimensional Motion
17. Test 3 Chapter 4 – The Laws of Motion
18. Test 4 Chapter 5 – Work and Energy
19. Test 5 Chapter 6 – Momentum and Collisions
20. Test 6 Chapter 7 – Circular Motion and the Law of Gravity
21. Test 7 Chapter 8 – Rotational Equilibrium and Rotational Dynamics

Now What...

1. Special discussion – Limitations of science and technology: sin affects all of Creation, including the process of investigating and measuring it.
2. Special discussion – Creation reflects the creator: God's attributes and character are reflected in the unity, beauty, intricacy, goodness, and orderliness of creation.
3. Special discussion – Universal laws: God (and the Creation that reflects Him) does not change from place to place and time to time.
4. Special discussion – Necessary but not sufficient: Physics as a study that enables us increasingly to understand the physical universe. It is limited in that it cannot completely address certain aspects of reality such as the spiritual and the aesthetic. As with any technology, it can be misappropriated.

II. Thermodynamics

What...

Students will discover thermal physics, energy in thermal processes, and the laws of thermodynamics.

So What...

1. Lab 15 – Size of Molecule
2. Lab 16 – Coefficient of Linear Expansion
3. Lab 17 – Specific Heat
4. Lab 18 – Mechanical Equivalent of Heat
5. Lab 19 – Newton’s Law of Cooling
6. Test 8 Chapters 9-10 – Solids, Fluids, Thermal Physics
7. Test 9 Chapters 11-12 – Heat and the Laws of Thermodynamics

Now What...

1. Special discussion – Anti-reductionism: Deeper knowledge and understanding never explains AWAY God, but explains THE WAY God designed His Creation.
2. Special discussion – Entropy: What is its relationship to the Fall?
3. Special discussion – Scientific restraint: The Fall (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology) which has often led to pollution, physical harm, death, and destruction.

III. Vibrations and Waves

What...

Students will discover vibrations and waves, and sound.

So What...

1. Lab 20 – Pendulum
2. Lab 21 – Speed of Sound (open and closed tubes)
3. Lab 22 – Sound Waves and Beats
4. Lab 23 – Mathematics of Music
5. Test 10 Chapter 13 – Vibrations and Waves
6. Test 11 Chapter 14 – Sound

Now What...

1. Special discussion – Man in God’s image: Mankind is similar to (rational and orderly) and different from (able to discover and understand the laws of God’s creation) the rest of Creation.
2. Special discussion – The Cultural Mandate: We have a responsibility to exercise wise and caring stewardship over God’s Creation not only through the activity of discovering but also through the application of those discovered principles (technology).

IV. Electricity and Magnetism

What...

Students will discover electric forces and electric fields, electrical energy and capacitance, current and resistance, and direct current circuits, magnetism, induced voltages and inductance, and alternating current circuits and electromagnetic waves.

So What...

1. Lab 27 – Electric Fields
2. Lab 28 – Series and Parallel Circuits
3. Lab 29 – RC Circuit
4. Lab 30 – Electromagnetic Fields
5. Lab 31 – Magnetic Field of Coil
6. Test 13 Chapters 15-16 – Electrical Forces and Electric Fields, Energy and Capacitance
7. Test 14 Chapters 17-18 – Current and Resistance, Direct Current Circuits
8. Test 15 Chapters 19-20 – Magnetism, Induced Voltage and Inductance

Now What...

1. Special Discussion – Science and Faith: Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
2. Special Discussion – *Imago Dei*: Because Man is created in the image of God, he/she has been given the responsibility to exercise wise stewardship over the rest of Creation.

V. Light and Optics

What...

Students will discover reflection and refraction of light, mirrors and lenses, and wave optics.

So What...

1. Lab 24 – Reflection
2. Lab 25 – Refraction
3. Lab 26 – Diffraction
4. Quiz Chapter 22-23 – Six Cases of Reflection and Six Cases of Refraction
5. Test 12 Chapter 22-24 – Reflection, Refraction, Mirrors and Lens, Wave Optics

Now What...

1. Special discussion – The dual nature of light and electrons: Particle or Wave? Man's categories are inherently limited and unable to fully envelop the complexities of creation.

VI. Modern Physics

What...

Students will discover introductory relativity, quantum physics, atomic physics, nuclear physics, and unclear energy and elementary particles.

So What...

1. Lab 32 – Half Life
2. Test 16 Chapters 29-30 – Nuclear Physics, Nuclear Energy and Elementary Particles

Now What...

1. Special discussion – Quantum Mechanics: The reason we cannot know precisely is not because there is no Truth (postmodernism) or that Truth is relative (relativism) but because creation is inherently more complex than merely human instruments can ever measure.
2. Special discussion – Levels: Each time we understand one level of complexity, there is always another level that is deeper and more profound to investigate. Creation reflects the Creator.
3. Special discussion – Scientific responsibility: Nuclear energy vs. nuclear bombs.
4. Special project – PowerPoint presentation of a Nobel Prize winner in Physics: The individual and the discovery.

AP Physics Assessments

TESTS (about 50% of grade):

About 4 per quarter covering 1-2 chapters each. About half of the test is multiple choice and true/false, the other half is problem solving.

Test 1 Chapters 1-2 – Introduction, Motion in One Dimension

Test 2 Chapter 3 – Vectors and Two Dimensional Motion

Test 3 Chapter 4 – The Laws of Motion

Test 4 Chapter 5 – Work and Energy

Test 5 Chapter 6 – Momentum and Collisions

Test 6 Chapter 7 – Circular Motion and the Law of Gravity

Test 7 Chapter 8 – Rotational Equilibrium and Rotational Dynamics

Test 8 Chapters 9-10 – Solids, Fluids, Thermal Physics

Test 9 Chapters 11-12 – Heat and the Laws of Thermodynamics

Test 10 Chapter 13 – Vibrations and Waves

Test 11 Chapter 14 – Sound

Quiz Chapter 22-23 – Six Cases of Reflection and Six Cases of Refraction

Test 12 Chapter 22-24 – Reflection, Refraction, Mirrors and Lens, Wave Optics

Test 13 Chapters 15-16 – Electrical Forces and Electric Fields, Energy and Capacitance

Test 14 Chapters 17-18 – Current and Resistance, Direct Current Circuits

Test 15 Chapters 19-20 – Magnetism, Induced Voltage and Inductance

Test 16 Chapters 29-30 – Nuclear Physics, Nuclear Energy and Elementary Particles

HOMEWORK (about 25% of grade):

Math/Physics problems found at the end of each chapter in the text.

LABS (about 25% of grade):

1. Density and Inertia Balance
2. Acceleration
3. Acceleration vs. Angle
4. Finding g
5. Picket Fence
6. Projectile Motion
7. Bungee Cord
8. Coefficient of Friction and Angle
9. Atwood's Machine
10. Air Friction
11. Conservation of Momentum
12. Collision in 2D
13. Centripetal Force
14. Sweet Spot
15. Size of Molecule
16. Coefficient of Linear Expansion
17. Specific Heat

18. Mechanical Equivalent of Heat
19. Newton's law of Cooling
20. Pendulum
21. Speed of Sound (resonance in open and closed tubes)
22. Sound Waves and Beats
23. Mathematics of Music
24. Reflection
25. Refraction
26. Diffraction
27. Electric fields
28. Series and Parallel Circuits
29. RC Circuit
30. Electromagnetic Fields
31. Magnetic Field of Coil
32. Half Life

AP Physics Course Scope and Sequence

The WHAT (discover)...

- 1. The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation** through the study of ...
 - The characteristics and laws of motion, both linear, curvilinear, and circular, in all moving objects.
 - Energy and the transfer of that energy from one form to another.
 - The composition and properties of matter, especially solids, liquids, and gases.
 - The nature of heat, its effect on objects, conversion into other forms, and fundamental thermodynamic principles.
 - Wave motion and its application to sound, light, and optical systems.
 - The interaction of electricity and magnetism and their resulting effects.
 - The atom and the atomic and nuclear physics' principles which flow from it.
- 2. The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it,** as seen in...
 - Our uncovering the fundamental and universal laws by which God directs and governs the operation of His Creation.
 - God's graciously enabling man to apply physics principles (technology) to the solution of problems that beset both man and the rest of Creation.
 - Physics as a study that enables us increasingly to understand the physical universe. It is limited in that it cannot completely address certain aspects of reality such as the spiritual and the aesthetic. As with any technology, it can be misappropriated.
- 3. The student will discover what it means to be created in the image of God and how that affects his/her relationships with other people as well as the rest of Creation.** Students will discover that...
 - Mankind is similar to (rational and orderly) and different from (able to discover and understand the laws of God's Creation) the rest of Creation.
 - We have a responsibility to exercise wise and caring stewardship over God's Creation not only through the activity of discovering but also through the application of those discovered principles (technology).
 - Studying Physics enables us to better fulfill this mandate of stewardship.
- 4. The student will discover the fundamental concepts and principles of the science course he/she is taking and the methods and technology used to discover them.** In AP Physics this includes...
 - How objects in motion obey certain fundamental laws and behave in predictable ways.
 - How objects possess different kinds of energy and transform this energy from one form to another.

- How matter, at the atomic level, is constructed and how that matter in the form of solids, fluids, and gases, behaves.
- How heat flows from one object to another, resulting in temperature and phase changes, and how it can be converted into other forms of energy according to the laws of thermodynamics.
- How sound and light behave similarly in their motions but are fundamentally different in composition and characteristics.
- How electricity and magnetism behave and interact and how their fields affect charged and magnetized objects respectively.
- How the structure of the atom yields the basic principles of atomic, quantum, and nuclear physics.

The SO WHAT (embrace)...

1. **The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe.** Students will embrace the idea that...
 - Creation is good, orderly, and beautiful. Creation reflects the Creator.
 - The laws that govern the operation of the universe reveal God's ongoing and perfect care and control of His creation. The fact that these laws, when fully discovered, are consistent and orderly from place to place in the universe and from past to future reveals God's unchanging nature and omnipotence.
2. **The student will embrace a Biblical worldview in understanding issues of science, technology, and culture.** Students will embrace the idea that...
 - The "Fall" (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology) which has sometimes led to pollution, physical harm, death, and destruction.
 - Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
 - Because Man is created in the image of God, he/she has been given the responsibility to exercise wise stewardship over the rest of Creation.
3. **The student will perceive the inter-relatedness between physics, the other sciences, math, and the other disciplines.** Students will embrace the idea that...
 - Physics is the basis for understanding chemistry.
 - Computers are tools which facilitate the organization, presentation, and interpretation of data.
 - Math is an essential language that enables scientists to articulate the truths of physics.

The NOW WHAT (integrate)...

1. **The student will praise God through the study and responsible care of His Creation** by realizing that...

- The more the student understands the complexities and intricacies of Creation, the more he/she will be moved to praise God. Deeper knowledge and understanding never explains AWAY God but explains THE WAY God designed His Creation.
2. **The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation.**
 - Students often bring to class experiential grasp of the laws of physics but frequently lack an accurate conceptual understanding. This creates opportunities for deeper exploration of the physical world through classroom discussions, laboratory activities, and application of the laws of physics to everyday events.
 3. **The student will become a problem solver through observing, data collecting, and experimentation with available technology. Some students will consider a career in science.**
 - Students will regularly use graphing calculators, computers, and electronic data collection devices for acquisition, analysis, and presentation.
 - Lab activities occur weekly, primarily during the block period and will constitute a significant part of the curriculum and evaluation.

Chemistry (AP)

Building upon the foundation of first-year chemistry, AP Chemistry is a two semester course designed to be the equivalent of a freshman college chemistry course. Through extensive problem solving and numerous labs, the infinite complexity, awesome diversity yet remarkable unity of God's creation, laws, and processes are more fully realized and understood. Topics covered will be similar to those in Honors Chemistry but will be presented in more depth and with a higher degree of difficulty. Students will be required to take the AP exam. The weekly hands-on laboratory exercises are during the weekly block period and will usually include the use of laptop computers, interfaces, and probes for data acquisition.

Students will:

- Understand the relationship between the philosophy of science and the Christian faith.
- Realize the continual providence and wisdom of God the Creator in ordering and sustaining His Creation through the natural laws that we try to discover, understand, and apply.
- Be awed by the precision, design, and complexity of God's Creation, especially as it relates to the principles of physics and their application.
- Recognize the moral responsibility that we have to understand the relevant physics and apply it to solving the many challenges humanity and the earth are facing.
- Demonstrate the ability to problem solve, especially by using dimensional analysis, scientific notation, and significant digits.
- Learn techniques and procedures appropriate to the college-level laboratory, including processes and procedures, observations and data manipulation, and group collaboration and reporting.
- Understand the structure of the periodic table and the descriptive chemistry it predicts.
- Describe atomic structure and chemical bonding based on the principles of current atomic theory.
- Study the common states of matter (gases, liquids, and solids, solutions) in terms of the principles of the Kinetic Theory of Matter.
- Apply acquired information to the study of chemical reaction types and stoichiometry.
- Understand the control of chemical reactions in relation to solution dynamics, equilibrium, reaction kinetics, and thermodynamics.
- Explain electrochemistry as a component of oxidation/reduction and its practical applications of electrochemical and electrolytic cells.

Key Texts:

1. *Chemistry and Chemical Reactivity*, 5th Edition, Kotz & Treichel, Thomson-Brooks/Cole, 2003.
2. *Advanced Chemistry with Vernier: Experiments for AP, IB, and College General Chemistry*, Randall, Vernier Software & Technology, 2004.

AP Chemistry Unit Scope and Sequence

I. The Basic Tools of Chemistry

What...

Students will discover matter and measurement, atoms and elements, molecules and ions and their compounds, chemical equations and stoichiometry, reactions in aqueous solution, and principles of reactivity involving energy and chemical reactions.

So What...

1. Lab 1 – Determination of a Chemical Formula
2. Lab 2 – Determination of % of Water in a Compound
3. Lab 3 – Molar Mass of a Volatile Liquid
4. Lab 6 – Standardization of a Solution of Sodium Hydroxide
5. Lab 7 – Acid/Base Titration
6. Lab 9 – Determination of Mole Ratios in a Chemical Reaction
7. Lab 31 – Determining Avogadro's Number
8. Lab 34 – Vapor Pressure and Heat of Vaporization
9. Test 1 Chapter 1-2 – Matter and Measurement, Atoms and Elements
10. Test 2 Chapter 3-4 – Molecules, Ions, Compounds, Chemical Equations and Stoichiometry
11. Test 3 Chapter 5 – Reactions in Aqueous Solution
12. Test 4 Chapter 6 – Energy and Chemical Reactions

Now What...

1. Special discussion – Limitations of science and technology: sin affects all of Creation, including the process of investigating and measuring it.
2. Special discussion – Creation reflects the creator: God's attributes and character are reflected in the unity, beauty, intricacy, goodness, and orderliness of creation.
3. Special discussion – Universal laws: God (and the creation that reflects Him) does not change from place to place and time to time.
4. Special discussion – Necessary but not sufficient: Chemistry as a study enables us increasingly to understand the physical universe. It is limited in that it cannot completely address certain aspects of reality such as the spiritual and the aesthetic.

II. The Structure of Atoms and Molecules

What...

Students will discover atomic structure, atomic electron configurations and chemical periodicity, bonding and molecular structure including orbital hybridization, and carbon and introductory organic chemistry.

So What...

1. Lab 22 – Synthesis and Analysis Aspirin
2. Test 5 Chapter 7-8 – Atomic Structure, Electron Configurations, and Periodicity
3. Test 6 Chapter 9-10 – Bonding and Molecular Structure and Orbital Hybridization

4. Test 7 Chapter 11 – Carbon and Organic Chemistry

Now What...

1. Special discussion – The dual nature of light and electrons: Particle or Wave? Man's categories are inherently limited and unable to fully envelop the complexities of creation.
2. Special discussion – Quantum Mechanics: The reason we cannot know precisely is not because there is no Truth (postmodernism) or that Truth is relative (relativism) but because creation is inherently more complex than merely human instruments can ever measure.
3. Special discussion – Levels: Each time we understand one level of complexity, there is always another level that is deeper and more profound to investigate. Creation reflects the Creator.
4. Special discussion – Anti-reductionism: Deeper knowledge and understanding never explains AWAY God, but explains THE WAY God designed His Creation.

III. States of Matter

What...

Students will discover gases and their properties, intermolecular forces within liquids and solids, and solutions and their behavior.

So What...

Lab 4 – Molar Mass by Freezing-Point Depression

Lab 5 – Molar Volume of a Gas

Lab 18 – Liquid Chromatography

Lab 30 – Exploring the Properties of Gases

Lab 16 – Conductimetric Titration and Gravimetric Determination of a Precipitate

Test 8 Chapter 12-13 – Gases and Their Properties, Intermolecular Forces, Liquids, and Solids

Test 9 Chapter 14 – Solutions and Their Behavior

Now What...

Special Discussion – Science and Faith: Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.

Special Discussion – *Imago Dei*: Because Man is created in the image of God, he/she has been given the responsibility to exercise wise stewardship over the rest of Creation.

IV. The Control of Chemical Reactions

What...

Students will discover chemical kinetics, chemical equilibria, the chemistry of acids and bases, aqueous equilibria, entropy and free energy, and electron transfer reactions and their applications.

So What...

Lab 8 – Oxidation-Reduction Titration: The Reaction of Fe^{2+} and Ce^{4+}

Lab 10 – Determination of Equilibrium Constant

Lab 11 – Investigating Indicators

Lab 12 – Decomposition of Hydrogen Peroxide

Lab 13 – Determining the Enthalpy of a Chemical Reaction

Lab 19 – Buffers

Lab 20 – Electrochemistry: Voltaic Cells

Lab 21 – Electroplating

Lab 24 – Determining the K_a by the Half-Titration of a Weak Acid

Lab 25 – The Rate and Order of a Chemical Reaction

Lab 26 – The Enthalpy of Neutralization of Phosphoric Acid

Lab 29 – The Base Hydrolysis of Ethyl Acetate

Lab 32 – Potentiometric Titration of Hydrogen Peroxide

Lab 35 – Rate Determination and Activation Energy

Test 10 Chapter 15 – Chemical Kinetics

Test 11 Chapter 16-17 – Chemical Equilibria and the Chemistry of Acids and Bases

Test 12 Chapter 18 – Aqueous Equilibria

Test 13 Chapter 19 – Entropy and Free Energy

Test 14 Chapter 20 – Electron Transfer Reactions

Now What...

Special discussion – Entropy: What is its relationship to the Fall?

Special Discussion – Science and Faith: The Fall (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology) which has sometimes led to pollution, physical harm, death, and destruction.

Special discussion – Man in God's image: Mankind is similar to (rational and orderly) and different from (able to discover and understand the laws of God's creation) the rest of Creation.

Special discussion – Cultural Mandate: We have a responsibility to exercise wise and caring stewardship over God's Creation not only through the activity of discovering but also through the application of those discovered principles (technology).

V. The Chemistry of the Elements

What...

Students will discover the chemistry of the main group elements, the chemistry of the transition elements, and introductory nuclear chemistry.

So What...

Lab 14 – Separation and Qualitative Analysis of Cations and Anions

Lab 15 – Synthesis of Alum

Lab 17 – Determining the Concentration of a Solution: Beer's Law

Lab 27 – Alpha, Beta, and Gamma (optional)

Lab 28 – Radiation Shielding (optional)

Lab 33 – Determining the Half-Life of an Isotope

Test 15 Chapter 21-22 – The Chemistry of the Main Group Elements and the Transition Elements

Test 16 Chapter 23 – Nuclear Chemistry

Now What...

1. Special discussion – Scientific responsibility: Nuclear energy vs. nuclear bombs.
2. Special project – PowerPoint presentation of a Nobel Prize winner in Chemistry: The individual and the discovery.
3. Special discussion – The Cultural Mandate: Studying Chemistry enables us to better fulfill God's call to serve and protect His Creation, i.e., Biblical stewardship.

AP Chemistry Assessments

TESTS (about 50% of grade):

About 4 per quarter covering 1-2 chapters each. About half of each test is multiple choice and true/false, the other half is problem solving.

Test 1 Chapters 1-2 – Matter and Measurement, Atoms and Elements

Test 2 Chapters 3-4 – Molecules, Ions, Compounds, Equations and Stoichiometry

Test 3 Chapter 5 – Reactions in Aqueous Solution

Test 4 Chapter 6 – Energy and Chemical Reactions

Test 5 Chapters 7-8 – Atomic Structure, Electron Configurations, and Periodicity

Test 6 Chapters 9-10 – Bonding and Molecular Structure, Orbital Hybridization

Test 7 Chapter 11 – Carbon: More than Just Another Element

Test 8 Chapters 12-13 – Gases, Intermolecular Forces, Liquids, and Solids

Test 9 Chapter 14 – Solutions and Their Behavior

Test 10 Chapter 15 – Chemical Kinetics

Test 11 Chapters 16-17 – Chemical Equilibria, Chemistry of Acids and Bases

Test 12 Chapter 18 – Other Aspects of Aqueous Equilibria

Test 13 Chapter 19 – Entropy and Free Energy

Test 14 Chapter 20 – Electron Transfer Reactions

Test 15 Chapters 21-22 – Main Group Elements and the Transition Elements

Test 16 Chapter 23 – Nuclear Chemistry

HOMEWORK (about 25% of grade):

Math/Chemistry problems found at the end of each chapter in the text.

LABS (about 25% of grade; from *Advanced Chemistry with Vernier*, by Jack Randall, 2004):

1. Determination of a Chemical Formula
2. Determination of % of Water in a Compound
3. Molar Mass of a Volatile Liquid
4. Molar Mass by Freezing-Point Depression
5. Molar Volume of a Gas
6. Standardization of a Solution of Sodium Hydroxide
7. Acid/Base Titration
8. Oxidation-Reduction Titration: The Reaction of Fe^{2+} and Ce^{4+}
9. Determination of Mole Ratios in a Chemical Reaction
10. Determination of Equilibrium Constant
11. Investigating Indicators
12. Decomposition of Hydrogen Peroxide
13. Determining the Enthalpy of a Chemical Reaction
14. Separation and Qualitative Analysis of Cations and Anions
15. Synthesis of Alum
16. Conductimetric Titration and Gravimetric Determination of a Precipitate
17. Determining the Concentration of a Solution: Beer's Law

18. Liquid Chromatography
19. Buffers
20. Electrochemistry: Voltaic Cells
21. Electroplating
22. Synthesis and Analysis Aspirin
23. Determining the K_{sp} of Calcium Hydroxide
24. Determining the K_a by the Half-Titration of a Weak Acid
25. The Rate and Order of a Chemical Reaction
26. The Enthalpy of Neutralization of Phosphoric Acid
27. Alpha, Beta, and Gamma (optional)
28. The Base Hydrolysis of Ethyl Acetate
29. Exploring the Properties of Gases
30. Determining Avogadro's Number
31. Potentiometric Titration of Hydrogen Peroxide
32. Determining the Half-Life of an Isotope
33. Vapor Pressure and Heat of Vaporization
34. Rate Determination and Activation Energy

AP Chemistry Course Scope and Sequence

The WHAT (discover)...

The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation through the study of ...

- The nature of and the relationship between matter and energy as seen in chemical reactions.
- The structure of atoms and molecules, their organization representation in the Periodic Table of Elements, and the intermolecular and intramolecular forces between them.
- Energy and the transfer of that energy from one form to another.
- The composition and properties of matter, especially solids, liquids and solutions, and gases.
- The nature of heat, its effect on objects, conversion into other forms, and fundamental thermodynamic principles.
- The principles of reactivity, especially in the areas of kinetics, equilibria (chemical and aqueous), acids and bases, and redox reactions.
- The principles of thermodynamics, especially the conservation of energy the role of entropy.

The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it, as seen in...

- Our uncovering the fundamental and universal laws by which God directs and governs the operation of His Creation.
- God's graciously enabling man to apply chemistry principles (technology) to the solution of problems that beset both man and the rest of Creation.
- Chemistry as a study that enables us increasingly to understand the physical universe. It is limited in that it cannot completely address certain aspects of reality such as the spiritual and the aesthetic. As with any technology, it can be misappropriated.

The student will discover what it means to be created in the image of God and how that affects his/her relationships with other people as well as the rest of Creation.

Students will discover that...

- Mankind is similar to (rational and orderly) and different from (able to discover and understand the laws of God's creation) the rest of Creation.
- We have a responsibility to exercise wise and caring stewardship over God's Creation not only through the activity of discovering but also through the application of those discovered principles (technology).
- Studying Chemistry enables us to better fulfill this mandate of stewardship.

The student will discover the fundamental concepts and principles of the science course he/she is taking and the methods and technology used to discover them. In AP Chemistry this includes...

- How matter, energy, and their interactions obey certain fundamental laws and behave in predictable ways.
- How the structure of the atom was discovered and how it is presented on the Periodic Table of Elements.
- How atoms and molecules interact with each other via intermolecular and intramolecular forces.
- How matter, at the atomic level, is constructed and how that matter in the form of solids, liquids and solutions, and gases, behaves.
- How heat flows from one object to another, resulting in temperature and phase changes, and can be converted into other forms of energy according to the laws of thermodynamics.
- How the structure of the atom yields the basic principles of atomic, quantum, and nuclear physics.
- How chemical reactions are controlled through the understanding of kinetics, equilibria (both chemical and solution), acids and bases, entropy and free energy, and electron transfer.

The SO WHAT (embrace)...

The student will embrace, both from a Biblical and scientific perspective, God's role as Creator and Sustainer of His universe. Students will embrace the idea that...

- Creation is good, orderly, and beautiful. Creation reflects the Creator.
- The laws that govern the operation of the universe reveal God's ongoing and perfect care and control of His creation. The fact that these laws, when fully discovered, are consistent and orderly from place to place in the universe and from past to future reveals God's unchanging nature and omnipotence.

The student will embrace a Biblical worldview in understanding issues of science, technology, and culture. Students will embrace the idea that...

- The "Fall" (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in the periodic misapplication of fundamental principles (technology), which has sometimes led to pollution, physical harm, death, and destruction.
- Biblical Ethics should permeate all phases of scientific research into, development from, and application of fundamental principles.
- Because Man is created in the image of God, he/she has been given the responsibility to exercise wise stewardship over the rest of Creation.

The student will perceive the inter-relatedness between chemistry, the other sciences, math, and the other disciplines. Students will embrace the idea that...

- Chemistry is the basis for understanding biology.

- Computers are tools which facilitate the organization, presentation, and interpretation of data.
- Math is an essential language that enables scientists to articulate the truths of chemistry.

The NOW WHAT (integrate)...

The student will praise God through the study and responsible care of His Creation.

Students will realize that...

- The more the student understands the complexities and intricacies of Creation, the more he/she will be moved to praise God. Deeper knowledge and understanding never explains AWAY God but explains THE WAY God designed His Creation.

The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation.

- Students often bring to class experiential grasp of the principles of chemistry but frequently lack an accurate conceptual understanding. This creates opportunities for deeper exploration of the physical world through classroom discussions, laboratory activities, and application of the principles of chemistry to everyday experiences.

The student will become a problem solver through observing, data collecting, and experimentation with available technology. Some students will consider a career in science.

- Students will regularly use graphing calculators, computers, and electronic data collection devices for acquisition, analysis, and presentation.
- Lab activities occur weekly, primarily during the block period, and constitute a significant part of the curriculum and evaluation.

Biology (AP)

AP Biology is a two-semester course equivalent to a freshman college biology course. Students will be introduced to the diversity of life and the processes that regulate that diversity. Throughout the course students will learn to recognize the biological themes that unify the diversity of life and ultimately point to the creator God. Emphasis is placed on laboratory technique and the importance of biology in modern culture. All students will be required to take the AP Biology exam in May.

Students will:

- Recognize God's incomparable design apparent in the diversity of life.
- Recognize the importance of environmental stewardship and our moral responsibility to God's Creation
- Understand the relationships that all organisms share with each other and with the earth and how the actions of humanity result in a cascade of events that can adversely affect the earth and all living organisms
- Study the relationship between structures and their functions in an organism at the following levels: cells, organs, systems, organisms, populations, and communities.
- Describe the characteristics of life and explain the diversity of organisms in their different strategies to the following life functions: energy needs, movement, response to environment, growth and development, homeostasis, and reproduction.
- Understand the following cellular processes: respiration, photosynthesis, mitosis, meiosis, macromolecule synthesis and degradation & molecular transport.
- Relate environmental issues, medical ethics, biotechnology, and origin of life (micro vs. macro-evolution) issues to the biblical themes of Creation, Fall, and Redemption.
- Learn laboratory techniques and procedures recommended for the AP Biology course.
- Design and develop biological experiments using the scientific as a model.

Key Texts:

1. *Biology*, Neil A. Campbell and Jane B. Reece, 7th Edition, Benjamin Cummings, 2005
2. *Student Study Guide for Biology*, Martha R. Taylor, 7th Edition, Benjamin Cummings, 2005
3. *Biology Lab Manual*, College Examination Board, 2001

AP Biology – Unit Scope and Sequence

I. The Chemistry of Life

What...

Students will discover the fundamentals of chemical context of life, water and the fitness of the environment, carbon and the molecular diversity of life, the structure and function of macromolecules, and metabolism.

So What...

1. Test 1 Chapters 2-5 – Chemical Context of Life, Water, Carbon, Macromolecules
2. AP Lab 11, Part A – Designing Pill Bug Behavior Lab
3. Fat Extraction lab

Now What...

Special discussion – God as creator: the evidence of God’s design apparent in the structure and the unity present in all living organisms.

Special discussion – Scientific research and the Christian: the limitations on scientific investigations, measurements and data analysis due to man’s finite and fallen condition.

II. The Cell

What...

Students will discover the fundamentals of the cell, membrane structure and function, cellular respiration and photosynthesis,

So What...

1. Test 2 Chapters 6-8 – The Cell, Membranes and Metabolism
2. Test 3 Chapters 9-10 – Cellular Respiration, Photosynthesis
3. AP Lab 2 – Enzyme Catalysis
4. AP Lab 1 – Diffusion and Osmosis
5. AP Lab 5 – Cellular Respiration
6. AP Lab 4 – Plant pigments and photosynthesis

Now What...

Special discussion - Anti-Reductionism: Explains *the way* God created, but does not explain *away* God’s Creation

III. Genetics

What...

Students will discover the fundamentals of the cell cycle, meiosis and sexual life cycles, Mendel and the gene idea, the chromosomal basis of inheritance, the molecular basis of inheritance, genes and proteins, the genetics of viruses and bacteria, the organization and control of eukaryotic genomes, DNA technology and genomics, and the genetic basis of development.

So What...

1. Test 4 Chapters 12-13 – The Cell Cycle and Meiosis
2. Test 5 Chapters 14-15 – Mendel and Genes, Chromosomes and Inheritance
3. Test 6 Chapters 16-17 – Molecular Basis for Inheritance, Gene to Protein
4. Test 7 Chapters 18-21 – Microbial Genetics, Eukaryotic Genomic Organization and Control, DNA Technology and Genomics and the Genetic Basis of Development
5. AP Lab 3 – Mitosis and Meiosis
6. AP Lab 6 – Molecular biology
7. AP Lab 7 – Genetics of organisms

Now What...

Special discussion – Man: the Genetic, Environmental, and Spiritual Components

Special discussion – Stem Cells, Cloning, Biotechnology, and Bioethics

IV. Mechanisms of Evolution

What...

Students will discover fundamentals of the theories of natural selection, descent with modification, evolution of populations, origin of species, and phylogeny and systematics.

So What...

1. Test 8 Chapters 22-26 – Descent with Modification, Evolution of Populations, Origin of Species, Fossil Record and Geologic Time and Phylogeny and Systematics
2. AP Lab 8 – Population genetics and evolution

Now What...

Special discussion – Biblical creation, Genesis 1-3

Special discussion – Microevolution versus macroevolution and the Christian response.

V. The Evolutionary History of Biological Diversity

What...

Students will discover the fundamentals of the theories of early earth and the origin of life, prokaryotes and the origins of metabolic diversity, plant diversity, fungi, invertebrate and vertebrate evolution and diversity.

So What...

1. Test 9 Chapters 27-31 – Early Earth and Origin of Life, Prokaryote and Eukaryote Diversity, Plant Diversity and Fungi
2. Test 10 Chapters 32-34 – Invertebrates and Vertebrates
3. Survey of Life Organizational Chart
4. Lab – Survey of Protists
5. Lab – Survey of Invertebrates
6. Lab – Survey of Vertebrates

Now What...

1. Special Discussion: The evidence of God's design shown through the similarity and unity in all living organisms

VI. Plant Form and Function

What...

Students will discover the fundamentals of plant structure and growth, transport in plants, plant nutrition, plant reproduction and biotechnology, and plant responses to internal and external signals.

So What...

1. Test 11 Chapters 35-39 – Plant Structure, Growth, Transport, Nutrition, Reproduction, Development, and Control Systems
2. AP Lab 9 – Transpiration

Now What...

Special Discussion: Cultural Responsibility: Studying plants enables us to learn their growth requirements and life cycles allowing us to gain the knowledge needed to exercise better crop maintenance and productivity to help alleviate the world's hunger problems.

Special Discussion: Genetically modified foods: The limits and potentials and the consequences of modifying the basic form that God has designed.

VII. Animal Form and Function

What...

Students will discover the fundamentals of animal structure and function, animal nutrition, circulation and gas exchange, the body's defenses, regulating the internal environment, chemical signals in animals, animal reproduction, animal development, nervous systems, and sensory and motor mechanisms.

So What...

1. Test 12 Chapters 40-44 – Animal Structure, Nutrition, Circulation, Gas Exchange, Immune System and Osmoregulation and Excretion
2. Test 13 Chapters 45-49 – Controlling Internal Environment, Chemical signals, Reproduction, Development, Nervous System, Sensory and Motor Mechanisms
3. AP Lab 10 – Physiology of the circulatory system

Now What...

Special project – Disease Report/Presentation

VIII. Ecology

What...

Students will discover the fundamentals of ecology and the biosphere, behavioral biology, population ecology, community ecology, ecosystems, and conservation biology.

So What...

1. Test 14 Chapters 50-55 – Ecology
2. AP Lab 11, Part B – Animal behavior
3. AP Lab 12 – Dissolved O₂ and aquatic primary productivity

Now What...

Special discussion – The responsibility of man to exercise sound environmental stewardship

Special discussion – Cultural Mandate: “Ruling and Subduing” God’s creation

AP Biology Assessments

TESTS (about 50% of grade):

About 4 per quarter covering 2-5 chapters each. Primarily multiple choice and short answer or essay.

- Test 1 Chapters 2-5 – The Chemistry of Life
- Test 2 Chapters 6-8 – The Cell, Membranes and Metabolism
- Test 3 Chapters 9 & 10 – Cellular Respiration and Photosynthesis
- Test 4 Chapters 12 & 13 – The Cell Cycle, Mitosis and Meiosis
- Test 5 Chapters 14 & 15 – Mendel and the Genes, Chromosomes and Inheritance
- Test 6 Chapters 16 & 17 – Molecular Basis for Inheritance, From Gene to Protein
- Test 7 Chapters 18-21 – Genetics of Viruses and Bacteria, Eukaryotic Genomes, DNA Technology and Genomics, and the Genetic Basis of Development
- Test 8 Chapters 22-25 – Mechanisms of Evolution
- Test 9 Chapters 26-31 – Introduction to Biological Diversity
- Test 10 Chapters 32-34 – Introduction to Animal Diversity: Invertebrates and Vertebrates
- Test 11 Chapters 35-39 – Plant Form & Function
- Test 12 Chapters 40-44 – Animal Form and Function Part I
- Test 13 Chapters 45-49 – Animal Form and Function Part II
- Test 14 Chapters 50-55 – Ecology

HOMEWORK (about 25% of grade):

Multiple choice and interactive questions from study guide in addition to extra worksheets and articles.

LABS (about 25% of grade; 1-12 are the recommended AP labs):

1. Osmosis and diffusion
2. Enzyme catalysis
3. Mitosis and meiosis
4. Plant pigments and photosynthesis
5. Cell respiration
6. Molecular biology
7. Genetics of organisms
8. Population genetics and evolution
9. Transpiration
10. Physiology of the circulatory system
11. Animal behavior
12. Dissolved O₂ and aquatic primary productivity
13. Microscopes and cells
14. Fat Extraction
15. Survey of Protists
16. Survey of Invertebrates

AP Biology

The WHAT (discover)...

The student will discover God's attributes and character reflected in the unity, beauty, intricacy, goodness, and orderliness of Creation through the study of ...

- The flow of energy, matter in all of the biochemical reactions and pathways of living things.
- The balance, homeostasis, and development of cells, systems, organisms, and communities.
- The continuity of life inherent in reproduction and genetics.
- The way in which organisms interact with and respond to the environment

The student will discover the role and limitations of science and technology and recognize that sin affects all of Creation, including the process of investigating it, as seen in...

- The study of molecular genetics, biotechnology, bioethics, and stem cell technologies.
- The study of the environment and ecology.
- The study of Biblical Creation and its relationship to contemporary micro- and macro-evolutionary theory.

The student will discover what it means to be created in the image of God and how that affects his/her relationships with other people as well as the rest of Creation .

Students will discover that...

- We are similar to (genetic component – “nature” and environmental component – “nurture”) and different from (spiritual component – the work of the Holy Spirit) the rest of creation.
- We have a responsibility to exercise a wise and caring stewardship of God’s Creation.
- We are better able to fulfill this mandate of stewardship through the study of biology and the progressive unlocking of the mysteries of Creation.

The student will discover the fundamental concepts and principles of the science course he/she is taking and the methods and technology used to discover them. In AP Biology this includes...

- How chemistry, particularly biochemistry, lays the foundation for an understanding of biology which, at the molecular level, is about carbohydrates, proteins, lipids, and nucleic acids.
- How organisms exchange materials with the environment, collect and release energy (photosynthesis and cell respiration), are made of cells, grow and develop, reproduce and pass on genetic characteristics to their offspring, respond to their environment, and fight disease and infection.

- How bacteria, protists, fungi, plants, animals, and humans share many fundamental characteristics and metabolic processes, but are strikingly different other certain ways.
- How organisms are connected to each other ecologically and to their environment.

The SO WHAT (embrace)...

The student will embrace, both from a Biblical and scientific perspective, God’s role as Creator and Sustainer of His universe. Students will embrace the idea that...

- Creation is good, orderly, and beautiful. Creation reflects the Creator.
- The laws that govern the operation of the universe reveal God’s ongoing and perfect care and control of His creation.
- All created things, both living and nonliving, are interrelated. We must treat them with respect.
- God created Man as a special and unique being. Only Man is created in the image of God.

The student will embrace a Biblical worldview in understanding issues of science, technology, and culture. Students will embrace the idea that...

- The “Fall” (sin) has profoundly impacted all of Creation, including humans and their behavior. This has resulted in pollution, extinction, disease, natural disasters and self-inflicted human suffering (poor choices) in particular for humans.
- We are commissioned by God to participate in the redemption of His Creation. By gaining knowledge and understanding of Creation and applying those insights in ethical ways, we can positively impact both the environment and the human condition.
- *Micro*-evolution, defined as genetic changes within a *kind*, is the result of natural and artificial selection acting on the inherent genetic potential in the genome of that kind. There can be tremendous variation within a kind (e.g. Poodle, Great Dane, wolf). However, Man did NOT evolve from a lower life form but was a special creation.
- *Macro*-evolution, defined as genetic changes causing one *kind* to eventually become an entirely different *kind*, is a changing scientific theory that has only a circumstantial scientific basis and is not supported by scripture.
- Because Man is created in the image of God, we have been given the responsibility to exercise wise stewardship over the rest of Creation.
- Biblical ethics, especially as it relates to such issues as biotechnology and ecology should permeate all phases of scientific research.

The student will perceive the inter-relatedness of biology, other sciences, math, and the other disciplines. Students will embrace the idea that...

- Chemistry is the basis for understanding modern biology.
- Math is an essential language that enables scientists to articulate the truths of Biology.
- Biology, like all sciences, has had a profound impact on history and thought.

The NOW WHAT (integrate)...

The student will praise God through the study and responsible care of His Creation.

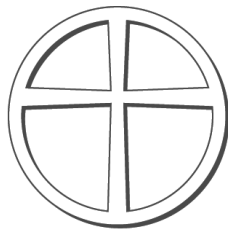
- The more the student understands the complexities and intricacies of Creation, the more he/she will be moved to praise Him. Deeper knowledge and understanding never explains AWAY God but explains THE WAY God designed His Creation.

The student will act upon the awesome responsibility that God has entrusted to him/her in exploring, caring for, experimenting upon, and restoring Creation.

- Students will understand the importance of exercising stewardship of God's Creation and that the earth and its biodiversity are closely linked together.

The student will become a problem solver through observing, data collecting, and experimentation with available technology. Some students will consider a career in science.

- Students will regularly use instruments such as microscopes, centrifuges, and gel electrophoresis for data acquisition, analysis, and presentation.
- Lab activities will occur primarily during the block period and will constitute a significant part of the curriculum and evaluation.



WESTMINSTER

CHRISTIAN ACADEMY

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