

## Physics

Physics is intended to provide a more in- depth study of the physical universe. In preceding years students should have developed a basic understanding for the macroscopic and microscopic world of forces, motion, waves, light, and electricity. The physics course will expand upon that prior knowledge and further develop both. The curriculum will also seek to teach the symbolic and mathematical world of formulas and symbols used in physics. The major concepts covered are kinematics, forces and motion, work and energy, waves, sound and light, electricity and magnetism, and nuclear physics.

Students at this level should show development in their ability and understanding of scientific inquiry. The units contain experiments and projects that seek to develop a deeper conceptual meaning for students and actively engage them. The continued exposure to science concepts and scientific inquiry will serve to improve the students' skill and understanding.

Physics should be preceded by Algebra I and II courses and geometry.

Upon completion of the course, students should be able to do the following:

- Use scalars and vectors to visualize and calculate concepts of motion.
- Articulate Newton's and Kepler's laws of motion.
- Demonstrate an understanding of how energy is transferred and changed from one form to another.
- Describe how sound and light waves act and react.
- Differentiate between static and current electricity and describe each one.
- Know the relationship between magnetism and electricity.
- Have a general understanding of atomic theory, including fusion and fission.

| Unit 1: Kinematics |  |
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| Assignments        |  |
| Physics            | 1. Course Overview   |
|                    | 2. Introduction to the Language of Physics   |
|                    | 3. The Scientific Method   |
|                    | 4. Lab Safety  |
|                    | 5. Experiment: Making a Soda Straw Balance<br>Experiment: Making a Simple Model of the Solar |
|                    | 6. System  |
|                    | 7. Quiz 1: Measurements  |
|                    | 8. Scalars and Vectors   |
|                    | 9. Experiment: Domino Lab  |
|                    | 10. Quiz 2: Scalars and Vectors  |
|                    | 11. Speed and Velocity   |
|                    | 12. Project: Tutorial for Making a Scatter Plot Using an Electronic Spreadsheet Program*     |
|                    | 13. Quiz 3: Speed and Velocity   |
|                    | 14. Acceleration and Acceleration Due to Gravity   |
|                    | 15. Experiment: Determining Reaction Time  |
|                    | 16. Quiz 4: Acceleration and Acceleration Due to Gravity                                     |
|                    | 17. Vectors  |
|                    | 18. Projectiles  |
|                    | 19. Project: Virtual Lab - Projectiles   |
|                    | 20. Mechanics  |
|                    | 21. Quiz 5: Review   |
|                    | 22. Project: Research Branches of Physics  |
|                    | 23. Special Project*   |
|                    | 24. Test   |
|                    | 25. Alternate Test*  |
|                    | 26. Glossary and Credits   |

| Unit 2: Dynamics |   |
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| Assignments      |   |
| Physics          | 1. Newton's First and Second Laws                           |
|                  | 2. Newton's Laws and Free Body Diagrams                     |
|                  | 3. The Problems of Newton's Laws                            |
|                  | 4. Report: Isaac Newton*                                    |
|                  | 5. Quiz 1: Newton's First and Second Laws of Motion         |
|                  | 6. Project: Virtual Lab - Newton's Laws                     |
|                  | 7. Gravity  |
|                  | 8. Quiz 2: Gravity  |
|                  | 9. Uniform Circular Motion                                  |
|                  | 10. Project: Virtual Labs - Circular Motion                 |
|                  | 11. Experiment: Circular Motion                             |
|                  | 12. Quiz 3: Uniform Circular Motion                         |
|                  | 13. Newton's Third Law and Conservation of Momentum         |
|                  | 14. Project: Virtual Lab - Conservation of Momentum         |
|                  | 15. Experiment: Explosion*                                  |
|                  | 16. Project: Car Racing Collision                           |
|                  | 17. Quiz 4: Newton's Third Law and Conservation of Momentum |
|                  | 18. Kepler's Laws of Planetary Motion                       |
|                  | 19. Report: Solar System*                                   |
|                  | 20. Experiment: Kepler's Law*                               |
|                  | 21. Dynamics  |
|                  | 22. Quiz 5: Unit Review                                     |
|                  | 23. Special Project*  |
|                  | 24. Test  |
|                  | 25. Alternate Test*   |
|                  | 26. Glossary and Credits                                    |

| Unit 3: Work and Energy |   |
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| Assignments             |   |
| Physics                 | 1. Work, Kinetic, and Potential Energy              |
|                         | 2. Report: Nuclear Energy*                          |
|                         | 3. Quiz 1: Work, Kinetic and Potential Energy       |
|                         | 4. Conservation of Energy                           |
|                         | 5. Power and Efficiency                             |
|                         | 6. Simple Machines                                  |
|                         | 7. Machine Efficiency                               |
|                         | 8. Project: Virtual Lab - Simple Machines           |
|                         | 9. Experiment: Simple Machines                      |
|                         | 10. Quiz 2: Work and Energy to Power and Efficiency |
|                         | 11. Heat Energy                                     |
|                         | 12. Latent Heat                                     |
|                         | 13. Experiment: Latent Heat*                        |
|                         | 14. Laws of Thermodynamics                          |
|                         | 15. Energy  |
|                         | 16. Quiz 3: Chapter Review                          |
|                         | 17. Project: Classifying forms of Energy            |
|                         | 18. Special Project*                                |
|                         | 19. Test  |
|                         | 20. Alternate Test*                                 |
|                         | 21. Glossary and Credits                            |

| Unit 4: Introduction to Waves |   |
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| Assignments                   |   |
| Physics                       | 1. Characteristics of Waves                           |
|                               | 2. Experiment: Wave Speeds                            |
|                               | 3. Experiment: Pulses*                                |
|                               | 4. Quiz 1: Characteristics of Waves                   |
|                               | 5. Wave Phenomena                                     |
|                               | 6. Experiment: Waves                                  |
|                               | 7. Experiment: Bending Waves*                         |
|                               | 8. Quiz 2: Characteristics of Waves to Wave Phenomena |
|                               | 9. Sound Waves  |
|                               | 10. Project: Virtual Lab - Sound                      |
|                               | 11. Project: Virtual Lab - Doppler Effect             |
|                               | 12. Experiment: Doppler Effect*                       |
|                               | 13. Project: Sound Resonance                          |
|                               | 14. Wave Motion                                       |
|                               | 15. Quiz 3: Chapter Review                            |
|                               | 16. Special Project*                                  |
|                               | 17. Test  |
|                               | 18. Alternate Test*                                   |
|                               | 19. Glossary and Credits                              |

| Unit 5: Light                              |   |
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| Assignments                                |   |
| 1. Speed of Light: Historical Calculations | 11. Light Phenomena and Models of Light |
| 2. Properties of Light                     | 12. Project: Digital Transmissions      |
| 3. Experiment: Light Angles                | 13. Experiment: Light Observations*     |
| 4. Experiment: Water Refraction*           | 14. Light and Sound                     |
|  | 15. Quiz 3: Chapter Review              |
| 6. Mirrors                                 | 16. Special Project*                    |
| 7. Experiment: Convergence                 | 17. Test                                |
| 8. Lenses                                  | 18. Alternate Test*                     |
| 9. Project: Virtual Lab - Light            | 19. Glossary and Credits                |
| 10. Quiz 2: Speed of Light to Lenses       |   |

| Unit 6: Semester Review and Exam |                            |
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| Assignments                      |                            |
| 1. Review                        | 3. Alternate Exam - Form A |
| 2. Exam                          | 4. Alternate Exam - Form B |

| Unit 7: Static Electricity                         |                                |
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| Assignments  |                                |
| 1. Electric Charges                                | 9. Potential and Energy        |
| 2. Coulomb's Law                                   | 10. Electric Fields and Forces |
| 3. Experiment: Static Electricity*                 | 11. Quiz 3: Chapter Review     |
| 4. The Transfer of Charges                         | 12. Special Project*           |
| 5. Quiz 1: Electric Charges to Transfer of Charges | 13. Test                       |
| 6. Electric Fields                                 | 14. Alternate Test*            |
| 7. Quiz 2: Electric Charges to Electric Fields     | 15. Glossary and Credits       |
| 8. Electric Potential                              |                                |

| Unit 8: Electric Currents               |                                      |
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| Assignments                             |                                      |
| 1. Sources of EMF                       | 8. Circuits                          |
| 2. Project: Research and Report*        | 9. Quiz 3: Chapter Review            |
| 3. Fluid Flow                           | 10. Project: Virtual Labs - Circuits |
| 4. Quiz 1: Sources of EMF to Fluid Flow | 11. Special Project*                 |
| 5. Resistance                           | 12. Test                             |
| 6. Quiz 2: Sources of EMF to Resistance | 13. Alternate Test*                  |
| 7. Ohm's Law                            | 14. Glossary and Credits             |

| Unit 9: Magnetism                            |   |
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| Assignments                                  |   |
| 1. Fields and Forces                         | 10. Quiz 2: Fields and Forces to Electromagnetism |
| 2. Experiment: Magnetic Fields*              | 11. Electron Beams                                |
| 3. Forces                                    | 12. Magnetic Fields and Forces                    |
| 4. Quiz 1: Fields and Forces to Forces       | 13. Quiz 3: Chapter Review                        |
| 5. Electromagnetism                          | 14. Special Project*                              |
| 6. Experiment: Induced Magnetic Fields*      | 15. Test  |
| 7. Electromagnetic Induction                 | 16. Alternate Test*                               |
| 8. Applications of Electromagnetic Induction | 17. Glossary and Credits                          |
| 9. Project: Electromagnetism                 |   |

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| Physics | <b>Unit 10: Atomic and Nuclear Physics</b>   |   |
|         | <b>Assignments</b>   |   |
|         | <ol style="list-style-type: none"> <li>1. Quantum Theory</li> <li>2. X-Rays, Matter Waves, and the Uncertainty Principle</li> <li>3. Quiz 1: Quantum Theory to X-rays, Matter Waves, and the Uncertainty Principle</li> <li>4. Early Atomic Models</li> <li>5. Report: Early Atomic Physics*</li> <li>6. Bohr Model</li> <li>7. Modern Physics</li> <li>8. Project: Radiowaves</li> <li>9. Nuclear Forces</li> <li>10. Nuclear Theory</li> </ol> | <ol style="list-style-type: none"> <li>11. Quiz 2: Quantum Theory to Nuclear Theory</li> <li>12. Radioactive Decay</li> <li>13. Nuclear Reactions</li> <li>14. Fusion and Applications of Nuclear Energy</li> <li>15. Quiz 3: Chapter Review</li> <li>16. Research Physicists</li> <li>17. Special Project*</li> <li>18. Test</li> <li>19. Alternate Test*</li> <li>20. Glossary and Credits</li> </ol> |

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| Physics | <b>Unit 11: Semester Review and Exam</b>                  |  |
|         | <b>Assignments</b>  |  |
|         | <ol style="list-style-type: none"> <li>2. Exam</li> </ol> | <ol style="list-style-type: none"> <li>3. Alternate Exam - Form A</li> <li>4. Alternate Exam - Form B</li> </ol> |

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| Physics | <b>Unit 12: Final Exam</b>   |   |
|         | <b>Assignments</b>   |   |
|         | <ol style="list-style-type: none"> <li>1. Exam</li> <li>2. Alternate Exam - Form A*</li> </ol> | <ol style="list-style-type: none"> <li>3. Alternate Exam - Form B*</li> </ol> |