# Differentiated Physics Objectives

| Science of Physics<br>The student will be able to: | LPS<br>Standard | State<br>Standard | Text<br>Pages |
|---|---|---|---|
| 1. define the study of physics and identify activities and fields in the areas of physics. | | 12.8.2 | 2 |
| 2. describe and implement the steps of the scientific method. | 12.2.1a | 12.1.2 | |
| 3. understand the fundamental units of the metric system and perform conversions using scientific notation. | | 12.1.2f<br>12.1.3a | 2-4 |
| 4. distinguish between accuracy and precision in measurement and how to minimize errors in reading instruments (parallax). | 12.2.1b | 12.1.3c | |
| 5. perform calculations using measurements and round the answer to the correct number of significant digits. | 12.2.1b | 12.1.3 | Appendix 1 |
| 6. interpret data in tables and graphs and recognize equations that summarize the data presented. | 12.2.1b | 12.1.3 | |
| 7. use dimensional analysis to check the validity of an expression. | | 12.1.2d | 4-6 |

| Motion and Forces<br>The student will be able to: | LPS<br>Standard | State<br>Standard | Text<br>Pages |
|---|---|---|---|
| 1. describe motion in terms of frame of reference, displacement, time, and velocity. | 12.2.1c | 12.3.4a | 27-30 |
| 2. solve problems involving displacement, time, and velocity. | 12.2.1c | 12.1.3d<br>12.3.4a | 27-30 |
| 3. interpret graphs depicting position vs time, and velocity vs time. | 12.2.1b<br>12.2.1c | 12.1.2c | 46-50 |
| 4. distinguish between average and instantaneous velocity. | 12.2.1c | 12.3.4a | 28-30 |
| 5. define acceleration and distinguish between instantaneous, uniform, and average acceleration. | 12.2.1c | 12.3.4a | 31-42 |
| 6. solve problems involving velocity, displacement, time, and acceleration | 12.2.1c | 12.3.4a | 27-42 |
| 7. understand that all freely falling objects uniformly accelerate at the same rate due to gravity. | 12.2.1e | 12.3.4b | 42-46 |
| 8. know the difference between scalar and vector quantities. | | 12.1.2 | 9-17 |
| 9. solve problems involving vector quantities graphically and mathematically. | | 12.3.4 | 10-12<br>15-16 |
| 10. describe projectile motion and solve complex problems in two dimensions. | 12.2.1e | 12.1.2b | 59-70 |
| 11. develop an understanding of Newton's 3 Laws of Motion and use them to solve problems involving force, mass, and acceleration. | 12.2.1d | 12.1.1a<br>12.3.4a | 85-92 |
| 12. distinguish between weight and mass. | 12.2.1d | 12.3.4b | 97 |
| 13. define friction and solve problems involving kinetic and static friction. | 12.2.1d<br>12.2.1g | 12.1.1a<br>12.3.4 | 101-105 |

| | LPS Standard | State Standard | Text Pages |
|---|---|---|---|
| 14. relate air resistance to a falling objects terminal speed. | 12.2.1d 12.2.1g | 12.1.1a 12.3.4a | |
| 15. relate the key contributions of early scientists to the study of physics. | | 12.8.3 | |
| 16. define work, power, and energy, and solve problems involving these concepts. | 12.2.2a 12.2.2b | 12.3.5b | 154-178 |
| 17. define potential energy, kinetic energy, and the Work-Kinetic Energy Theorem. | 12.2.2a | 12.1.1a 12.3.5b | 157-164 |
| 18. solve problems involving potential energy, kinetic energy, and the Work-Kinetic Energy Theorem. | 12.2.2a | 12.1.1a 12.1.2a 12.3.5b | 154-178 |
| 19. state the Law of Conservation of Energy, recognize the forms energy can take, and solve problems using conservation of energy. | 12.2.2b | 12.3.5a | 164-172 |
| 20. define momentum in terms of an objects mass and velocity. | 12.2.1d | 12.3.5a | 188 |
| 21. define impulse and how the momentum of an object can change in terms of force and time. | 12.2.1d | 12.1.1a 12.3.4 | 188 |
| 22. solve problems using the Impulse-Momentum Theorem. | | 12.1.1a 12.3.4 | 188-191 |
| 23. state the Law of Conservation of Momentum and use it to solve problems involving the interaction between two objects. | 12.2.1d | 12.1.1a 12.3.4 | 192-201 |
| 24. describe circular motion and solve problems using centripetal force and centripetal acceleration. | | 12.3.4 | 131-137 |
| 25. solve problems using Newton's Universal law of Gravitation. | 12.2.1e | 12.3.4b | 94-97 |

| Thermodynamics and Heat  The student will be able to: | LPS Standard | State Standard | Text Pages |
|---|---|---|---|
| 1. define temperature and the temperature scales. | 12.2.3a | 12.1.2a | 346-348 |
| 2. relate temperature to the kinetic energy of atoms and molecules, and the effect it has on the expansion of matter. | | 12.1.2a 12.3.5b | 350-357, |
| 3. define specific heat, heat of fusion, and heat of vaporization. | 12.2.3a 12.2.3b | 12.3.5 | 358-369 |
| 4. describe energy transfer by conduction, convection, and radiation. | 12.2.3a 12.2.3b | 12.3.5c | 382-392 |
| 5. state the 1st and 2nd Law of Thermodynamics. | | 12.3.5b,d | 426-429 435-442 |
| 6. define entropy. | | 12.3.5d | 442-446 |

| Wave Mechanics<br>The student will be able to: | LPS Standard | State Standard | Text Pages |
|---|---|---|---|
| 1. explain the conditions of simple harmonic motion. | | | 274-276 |
| 2. calculate the period and frequency of an object moving with simple harmonic motion. | | 12.3.6c | 277-282 |
| 3. distinguish between longitudinal and transverse waves and describe the components of each. | 12.2.3f | 12.1.2a | 459-460 |
| 4. describe how waves transfer energy. | 12.2.3f | 12.3.6a | |
| 5. understand constructive and destructive interference. | 12.2.3f | 12.1.2a<br>12.3.6a | 495-498 |

| Sound and Light<br>The student will be able to: | LPS Standard | State Standard | Text Pages |
|---|---|---|---|
| 1. describe the nature of sound waves and solve problems relating to frequency, wavelength, and velocity. | 12.2.1f<br>12.2.3f | 12.1.2d<br>12.3.6c | 465-470 |
| 2. define the Doppler effect and identify some of its applications. | | 12.1.2a | 475-480 |
| 3. relate physical properties of sound waves to intensity and resonance. | | 12.3.6a | 470-475 |
| 4. understand standing waves and fundamental frequency in open and closed pipes. | | | 508-510 |
| 5. recognize that light is an electromagnetic wave with a wide range of wavelengths. | 12.2.3f | 12.3.6b,d | 733-738 |
| 6. state the speed of light and solve problems involving light. | 12.2.3f | 12.1.3a,d | 739-740 |
| 7. describe how the brightness of a light source is affected by distance. | 12.2.3f | 12.1.3e<br>12.3.6a | 742 |
| 8. state the Law of Reflection. | 12.2.3f | | 761-762 |
| 9. describe images formed by plane and curved mirror. | | 12.1.2a | 763-776 |
| 10. solve problems regarding image location and size. | | 12.1.2b | 763-776 |
| 11. describe polarization of light. | 12.2.3f | | 746-751 |
| 12. define refraction, state Snell's Law, and solve problems using Snell's Law. | 12.2.3f | 12.1.2b | 783-789 |
| 13. draw ray and image diagrams for mirrors and lenses. | | 12.1.2a | 796-805 |
| 14. describe images formed by curved lenses. | | 12.1.2a | 796-805 |
| 15. explain the operation of optical instruments. | | 12.6.2b | 805-814 |
| 16. predict whether light will be refracted, or undergo total internal reflection. | | 12.1.2a,d | 790-793 |
| 17. calculate the wavelength of light from double slit interference patterns. | | 12.1.2b | 832-835 |
| 18. define diffraction and diffraction grating. | | | 840-845 |

| Electricity and Magnetism<br>The student will be able to: | LPS<br>Standard | State<br>Standard | Text<br>Pages |
|---|---|---|---|
| 1. know the two types of electrical charges and how to place charges on an object. | 12.2.3c | 12.3.4c | 522-524 |
| 2. know Coulomb's Law of Electrostatics and use it to solve problems in electrostatics. | | 12.3.4c | 527-531 |
| 3. describe the forces between charges. | | 12.3.4c | 527-531 |
| 4. define an electric field and know how to measure it. | 12.2.3c | 12.1.2a<br>12.3.4d | 531-536 |
| 5. solve problems involving electric fields, forces, and charge. | | 12.1.2b<br>12.3.4d | 531-536 |
| 6. describe where a charge resides on solid and hollow conductors, and recognize the relationship between conductor shape and field strength. | 12.2.3c | 12.3.4d | 540-545 |
| 7. discern between electrical potential energy and electrical potential difference. | | | 558-564 |
| 8. define the electrical potential difference in terms of work done in moving a unit test charge. | | 12.3.4d | 558-560 |
| 9. solve problems involving electrical potential. | 12.2.3c<br>12.2.3d | | 558-564 |
| 10. define capacitance, describe the principles of capacitance, and solve capacitance problems. | | 12.3.4c | 570-574 |
| 11. define electric current and the ampere. | 12.2.3d | | 587-589 |
| 12. write Ohm's Law and use it to solve problems involving resistance, potential difference, and current. | 12.2.1f<br>12.2.3d | 12.1.3d | 589-594 |
| 13. define electric power and use it to explain how heaters convert electrical energy to thermal energy. | | 12.1.3d | 594-595 |
| 14. describe how public energy use is measured and solve problems involving the use and cost of electrical energy. | | 12.7.3 | 595 |
| 15. describe and draw a series and parallel circuit. | | 12.1.2a | 598-603 |
| 16. calculate current, voltage drops, and resistance in series and parallel. | | 12.1.2b | 598-610 |
| 17. summarize the properties of magnets and magnetic fields. | 12.2.3e | 12.3.4d | 629-630 |
| 18. describe the field around a current carrying wire. | | 12.3.4d | 644-653 |
| 19. list the factors that determine the magnitude of the force on a wire and solve problems involving the same. | | 12.3.4d | 644-653 |
| 20. explain how a changing magnetic field can produce an electric current. | | 12.3.4d<br>12.3.6d | 670-675 |

**Textbook:** *Physics*, Cutnell & Johnson, John Wiley & Sons, 2001