SE/SP PHYSICS PROFICIENCIES 2008/2009

Students enrolled in this course [SE Physics – Junior & Senior years] will demonstrate mastery of the following proficiency requirements as outlined in the curriculum guide and receive a passing grade in accordance with Board of Education policies on grading and attendance.

1. Understand and apply the MKS, CGS, and English systems of units to appropriate physics problems. (CCCS #5.3)
2. Demonstrate the ability to successfully complete appropriate laboratory experiments including: data collection, data organization, data analysis, error analysis, conclusion drawing and the development of appropriate scientific models. (WRS #2), (CCCS #5.3)
3. Demonstrate knowledge of and adherence to safety rules in the science laboratory. (WRS #2)
4. Demonstrate the ability to analyze data through graphical techniques including: the development of appropriate equations and the application of integral and differential calculus to the relationships between graphs. (WRS #2), (WRS #3), (CCCS #5.1), (CCCS #5.3)
5. Demonstrate the ability to solve appropriate physics problems using vector analysis. (CCCS #5.3)
6. Develop an understanding of the importance of controlling multiple variables in experimental situations. (CCCS #5.3)
7. Demonstrate the ability to solve certain difficult physics problems through the development of appropriate computer programs and to use the computer in the laboratory as a tool for measurement and data analysis. (CCCS #5.4, #8.1)
8. Demonstrate an understanding of the generation of error, its propagation through a series of manipulations and its effect on the significance of experimental results. (CCCS #5.3)
9. Develop an appreciation of the relationship between physics concepts and the corresponding mathematical concepts. (CCCS #5.3)
10. Demonstrate the ability to develop conceptual models to explain experimental results. (CCCS #5.3), (WRS #2)
11. Demonstrate the ability to solve physics problems from a variety of reference frames. (WRS #2)
12. Demonstrate the ability to use physics concepts in a wide variety of applications.
13. Demonstrate the ability to read appropriate scientific literature, organize the information contained therein and write a clear, concise synopsis. (CCCS #5.2), (WRS #2)
14. Demonstrate the ability to write a well organized and clearly worded lab report. (CCCS #5.3), (WRS #2)
15. Demonstrate the ability to present a clearly organized oral report using appropriate technological tools such as “PowerPoint” or “Presentations”. CCCS #5.3), (WRS #2)
16. Demonstrate knowledge and appreciation of the historical context of the major developments in physics. (CCCS #5.2)
17. Become familiar with recent developments in physics with a particular emphasis on those developments likely to have significant impact on society. (CCCS #5.2)
18. Demonstrate the ability to use knowledge from other disciplines [i.e. calculus, statistics, computer programming, and electronics] to understand and solve problems in physics. (CCCS #5.3), (WRS #2)
19. Demonstrate an awareness of physics related career opportunities. (WRS #1)
20. Demonstrate a thorough understanding of the mechanical concepts of force, displacement, velocity, and acceleration, and their applications to real world problems. (CCCS #5.2), (CCCS#5.7)
21. Demonstrate a thorough understanding of Newton's three Laws of Motion and their application to problems in mechanical systems. (CCCS#5.7)
22. Demonstrate the ability to use momentum, energy conservation and the Work-Energy Theorem in the solving of appropriate physics problems. (CCCS #5.2), (CCCS#5.7)
23. Demonstrate the ability to apply mechanical concepts and conservation laws to systems in rotary motion. (CCCS#5.7)
24. Demonstrate a thorough knowledge of simple machines including both mechanical advantage and efficiency. (CCCS#5.7)

25. Demonstrate an understanding of damped and undamped simple harmonic motion, its relationship to rotary motion, the effects of forced oscillations and the relationship of SHM to real world physical problems. (CCCS#5.7)
26. Demonstrate a thorough familiarity with the characteristics and properties of mechanical waves including, but not limited to reflection, refraction, diffraction, interference and polarization. (CCCS#5.7)
27. Demonstrate an understanding of sound, its wave nature and its measurable characteristics. (CCCS#5.7)
28. Demonstrate a familiarity with the classical development of the theories of light and the measurement of its intensity and speed. (CCCS #5.2), (CCCS#5.7)
29. Demonstrate an understanding of the wave nature of light including its ability to reflect, refract, diffract, interfere, and to be polarized. (CCCS #5.2), (CCCS#5.7)
30. Demonstrate an understanding of ray optics in both lenses and mirrors including; (CCCS#5.7)
    a. the qualitative determination of the position of real and virtual images through ray diagrams.
    b. the quantitative prediction of the position and magnification of real and virtual images.
    c. determining the focal lengths of mirrors and lenses [through the lensmaker's formula].
31. Demonstrate an understanding of the conflicting evidence [Michelson-Morley Interferometer, Photoelectric Effect and Blackbody Radiation] regarding light, its interaction with the environment and the resulting wave-particle duality theory. (CCCS #5.2)
32. * Demonstrate an understanding of the application of Special Relativity and its resultant effects on time, length, mass & energy. (CCCS #5.2), (CCCS#5.7)
33. * Demonstrate an understanding of nuclear physics, the resulting types of radioactive decay and the effects on living systems. (CCCS #5.2), (CCCS#5.7)
34. * Demonstrate an understanding of electrostatics including the relationships among electric fields, forces and potentials. (CCCS#5.7)
35. * Demonstrate the ability to use Gauss's Law in the determination of the electric fields near point sources, spheres, planes and cylinders for both conducting and insulating bodies. (CCCS#5.7)
36. * Demonstrate the ability to determine the capacitance of capacitors of various designs including parallel plate, spherical shell and cylindrical shell both with and without the presence of an insulating medium. (CCCS#5.7)
37. * Demonstrate an understanding of the use and function of capacitors is series, parallel and in combined electrical RC circuits. (CCCS#5.7)
38. * Demonstrate the ability to evaluate simple DC circuits through the use of Ohm's Law, Kirchoff's Rules and other applicable principles of DC circuits. (CCCS#5.7)
39. * Demonstrate an understanding of the generation of magnetic fields by matter and the resulting interaction of magnetic fields and para-, dia- and ferro-magnetic materials. (CCCS#5.7)
40. * Demonstrate an understanding of the relationship between magnetic fields and moving charged particles. (CCCS#5.7)
41. * Demonstrate the ability to predict both the direction and magnitude of the magnetic fields near wires, coils, and solenoids using either the Biot-Savart Law and/or Ampere's Law. (CCCS#5.7)
42. * Demonstrate the ability to calculate magnetic flux and to use both Faraday's Law and Lenz's Law to predict the resulting EMF within an appropriate conducting element. (CCCS#5.7)
43. * Demonstrate the ability to use inductors, capacitors and resistors together in an electrical circuit and to calculate the resulting effects and interactions with AC electrical signals. (CCCS#5.7)
44. * Demonstrate an understanding of the relationship between electric and magnetic fields and the development of Maxwell’s equations. (CCCS#5.7)
45. * Develop an understanding of the basic cosmological principles and their relationship to basic physical principles. (CCCS #5.2), (CCCS#5.7), (CCCS # 5.9)
46. * Demonstrate an understanding of fluid statics and dynamics. (CCCS#5.7)
47. * Demonstrate an understanding of kinetic theory and its relationship to temperature and heat. (CCCS#5.7)
48. * Demonstrate an understanding of the Laws of Thermodynamics and their application to gases and heat engines. (CCCS#5.7)

The items marked with an asterisk (*) above will normally be covered during the senior year program.