Assessment for Physics 151

Written and coordinated for the Dept. of Physics and Astronomy by Kathryn Dimiduk,
Outcomes written by John Caffo
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The Department of Physics and Astronomy has set the following goals for Physics 151.

Goals:

1. Students will know and be able to apply basic physics concepts in mechanics, sound, fluids and heat.

2. Students will be able to solve problems at the level of standard first year algebra-based general physics texts by using physics content knowledge in mechanics, sound, fluids and heat.

3. Students will be able to use appropriate scientific reasoning skills to work with physics content as required for national tests such as the MCAT, PCAT and DCAT.

4. Students will be able to use appropriate mathematical skills needed to solve problems.

5. Students will be able to make use of units, vectors and graphs as needed to solve problems.

The success in meeting these goals will be assessed by the following outcomes. The outcomes were chosen to cover some of the most important topics and to demonstrate a range of skills in solving problems, not necessarily to cover all the topics in the course.

Outcomes:

Outcome 1: Unit Conversion: Students will be able to convert from non metric system units to metric system units and vise versa (for example, from miles to hour to meters per second).
Relates to NM HED Area III-4: Apply quantitative analysis to scientific problems

Outcome 2: Vectors: Students will be able to do simple operations with vectors. These include resolving a vector into components, adding vectors using components, finding the magnitude of a vector given its components and finding the direction of a vector given its components.

NM HED Area III competencies 2, 4 and 5: Solve problems scientifically, Apply quantitative analysis to scientific problems, and Apply scientific thinking to real world problems.

Outcome 3: Motion with Constant Acceleration: Students will be able to solve problems involving motion with constant acceleration. Many everyday type events will be modeled as problems of this type. These include both horizontal motion (examples, an aircraft taking off on the runway, an automobile coming to a stop) and vertical motion near Earth's surface where the acceleration of gravity can be considered constant (for example, a ball thrown straight up in the air). Projectile motion problems also fall into this category; these involve objects experiencing vertical and horizontal motion at the same time (for example, a baseball hit at an angle of 30 degrees above the horizontal).

NM HED Area III competencies 2, 4 and 5: Solve problems scientifically, apply quantitative analysis to scientific problems, and apply scientific thinking to real world problems.

Outcome 4: Newton's Second Law: Students will be able to solve a variety of problems with Newton's second law. This law which deals with forces, inertial mass and acceleration is a foundation of Newtonian Mechanics and has wide application to science and engineering. Problems of various types (possible examples include effects of forces on objects, circular motion, orbits of planets, inclined planes and motion with friction) will be analyzed.

NM HED Area III competencies 2, 4 and 5: Solve problems scientifically, apply quantitative analysis to scientific problems, and Apply scientific thinking to real world problems.

Outcome 5: Fluids: Students will be able to solve problems involving fluid statics and fluid flow. Applications of fluid statics may, for example, include pressure in a fluid and buoyancy. Use of Bernoulli's equation and the continuity equation are examples of fluid flow.

NM HED Area III competencies 2, 4 and 5: Solve problems scientifically, apply quantitative analysis to scientific problems, and Apply scientific thinking to real world problems.

Assessment Data Collection:

For each outcome the material will be covered in lecture using an appropriate mix of demonstrations, presentation of theory, examples and keypad questions. Homework will ask students to work problems related to these outcomes skills. Students taking the lab will also cover some of the material in lab. Many students will also see the material in problem sessions and supplemental instruction sessions. Assessment will come from exams as that is easier to monitor individual student achievement as opposed to using homework assignments for which

considerable help is available. Keypad assessments can be used for some of the easiest questions, though one has to consider the issue of student collaboration.

Individual teachers will provide questions in coordination with the department assessment coordinator for each outcome. For multiple choice questions, several questions for each outcome should be used to test different aspects and difficulty levels. These questions can be split across multiple exams such as a midterm and a final exam. For workout problems more information can be gathered from each problem especially if a problem contains multiple parts or is scored with partial credit. Therefore for workout problems each outcome should have one or more problems. The workout problems have to be designed to assess more than one piece of an outcome and to assess various skill levels of an outcome.

Rubric:

Evaluation: Different teachers place different emphasis on the topics and only the teachers themselves are aware of the true difficulty and context of the questions (whether examples were worked in class, whether clicker exercises were used in class and how many homework problems addressed the subject are examples). Only the teacher of the class is in a reasonable position to determine the curve and grading scale for the test. Likewise, only the teacher of the class is in a position to correctly evaluate performance on the outcome questions.

For each SLO, there should typically be either three or more multiple choice questions covering the broad concept, or one or more workout problems that use the concept in more than one context and that can be graded to show different levels of mastery.

The SLO can be assessed with either of two methods. Method 1 assesses students' performance based on the percentage of questions they answered correctly in each rubric as a group. The instructor can then examine the percentage of students demonstrating Exemplary, Satisfactory, or Unsatisfactory performance on each SLO. Method 2 is more simply based on the average score of all students on all questions in each rubric. The instructor can use this average score to decide if the class performance as a whole is Exemplary, Satisfactory, or Unsatisfactory. The table below provides more detail on what is meant by Exemplary, Satisfactory, or Unsatisfactory performance on each SLO.

Physics 151 Rubric for Grading Outcomes Assessment

Exemplary	**Satisfactory**	**Unsatisfactory**
Method 1: a student correctly solves all three problems (or at least 75% if more than 3 multiple choice problems). For a workout problem a score of 75% typically means that a student demonstrates understanding of solving the problem and correctly apply relevant definitions, equations and concepts. A student may make a small error in solving the problem. Method 2: the average score of students on the problems is at least 75%.	Method 1: a student correctly solves at least 50% of the problems. Makes a mistake in concepts or applying equations. For a workout problem a student makes an attempt consistent with course content but has misunderstood a needed concept or misremembered a formula or made several smaller mistakes. Method 2: the average score of students on the problems is 50-75%	Method 1: a student solves 50% or less of the problems correctly. Doesn't know definitions, equations and concepts. Cannot apply definitions, equations and concepts to a problem. Makes multiple errors. For a workout problem shows serious lack of understanding in solving problems. Method 2: the average score of students on the problems is less than 50%.