Survey of Physical Science PH1113 Lecture and PH 1122 Lab Assessment Report 2007-2009

Submitted by Charles Tomlinson

**Introduction**

Survey of Physical Science, PH1113, is a 3-credit hour course designed for the non-science major covering the scientific method of discovery and its application to the fields of geology, astronomy, chemistry, meteorology, the environment and physics. It is often, but not required, accompanied by a laboratory course, PH1122, structured to illustrate and reinforce lecture topics.

The course competencies and objectives are stated in the departmental syllabus and are assessed through departmental examinations. Additionally, two independent tests, *Beyond the Solar System* (BSS) prepared by the Smithsonian Institution and the *Thermal Concept Evaluation* featured in the professional journal, The Physics Teacher, are used in assessing student competency.

**Survey of Physical Science Results**

Spring 2007:

* Midterm exams were administered to 22 students with a group average of 93%, ranging from 49% to 98%.
* Final exam was administered to 22 students resulting in an average of 66.5% and scores ranging from 31% to 85%.
* Two independent assessment exams were also administered; **Beyond the Solar System** © Smithsonian Institution, given after the astronomy unit, and an abbreviated version of the assessment test **Introductory Thermal Concept Evaluation** (*The Physics Teacher, November 2001)*. The results are as follows:

Fall 2007:

* Midterms and finals were administered to 16 students.
* Midterm exams had an average of 84% with a range from 65% to 97%.
* The final exam had an average of 66.5% with a low score of 24% and a high of 96%.
* One independent assessment exam, **Beyond the Solar System** © Smithsonian Institution was given after the astronomy unit. The results are as follows:

Fall 2008:

* 14 students were administered midterm exams and the final
* Group average on the midterms was 86%; for the final 85%.
* High score on midterms was 96% and low was 66%; for final the high was 100% and low 41%
* One independent assessment exams was administered, **Introductory Thermal Concept Evaluation** (*The Physics Teacher, November 2001)*. The results are as follows:

Fall 2009:

* The midterm exams and final was administered to 17 students.
* Average on the midterms was 88%. The average for the final was 70%.
* The midterm scores ranged from 40% to 99%. The final exam scores ranged from 38% to 100%.
* Thermal Concept Evaluation, in its entirety, was adopted for the assessment tool. This test was administered as the pre-test and post-test for Survey of Physical Science.
* Pre-test average was 29% and post-test was 24.85%
* High score on the pre-test was 65.38% and the post-test was 50%. The low scores were 11.54% for the pre-test and 0% on the post-test.

Most Frequently Missed Questions (more than 50%)

|  |  |  |  |
| --- | --- | --- | --- |
| **Spring 2007** | **Fall 2007** | **Fall 2008** | **Fall 2009** |
| Beyond the Solar System   * Sun was an average star * Stars are light-years distance from Earth * Atmosphere obscures images from outer space * Elements hydrogen and helium formed shortly after the big bang were uniformly distributed * Solar system was formed from the remnants of other stars | Beyond the Solar System   * Sun is light-minutes distance from earth * Atmosphere obscures images from outer space\* * Relative distances of planets, stars, galaxies from earth * Elements hydrogen and Helium formed shortly after the big bang were uniformly distributed\* * Solar System contains remnants of other stars\* * Elements Iron, Carbon, Oxygen were formed in stars | Beyond the Solar System   * Not administered | Beyond the Solar System   * Not administered |
| Introductory Thermal Concept Evaluation   * Concept of latent heat for phase changes * Applied pressure effects boiling points \* * Direction of heat flow \* * Temperature differences effect heat flow rate \* * Concept of a lowest possible temperature \* | Introductory Thermal Concept Evaluation   * not administered | Introductory Thermal Concept Evaluation   * Applied pressure effects boiling points \* * Direction of heat flow \* * Temperature differences effect heat flow rate \* * Concept of a lowest possible temperature \* | Introductory Thermal Concept Evaluation   * Most likely temperature of ice in freezer * Ice-water equilibrium temperature * Rate of heat conduction as a function of temperature * Concept of thermal equilibrium * Applied pressure effects boiling points \* * Direction of heat flow \* * Temperature differences effect heat flow rate \* * Concept of a lowest possible temperature \* |

\* indicates topic was missed in multiple semesters

To address concerns, students were encouraged to utilize the study guides for the mid-term exams and the final. Demonstrations and science videos were introduced to illustrate concepts and to increase student interest, although improvements have not coincided with these changes. The Thermal Concept Evaluation, which is currently being used as a pre and post- test assessment, has only been given in other colleges to College or General Physics students. This exam will be phased-out. The pre-requisite of intermediate algebra appears to be adequate mathematical preparation for most topics covered in the course and coincides with the pre-requisites at the transfer institutions.

**Improvement for the 2010-2011 Academic Year**

More detailed study guides will be developed to assist students in preparing for examinations. More homework /quizzes will be developed of a conceptual nature to give students more practice in applying physical concepts to a slightly different situation.

A departmental pre-test will be developed (covering more specific topics) and administered during the first week of class, and then be followed by a departmental post-test given at the end of the semester to track particular topics of difficulty. Further research into the literature has indicated the Thermal Concept Evaluation, although non-mathematical, is not generally used by the physics community in physical science courses. The department will continue to research assessment practices. Beyond the Solar System will return as an independent assessment. The test makes use of specific facts, which will be emphasized in class, as well as allowing data to be tracked and evaluated to identify strengths and weaknesses.

***Teaching strategy/improvement***

* Review other physical science textbooks
* Review physical science computer software
* Partition class-time with varying learning activities

***Increasing enrollment strategy***

It is felt that admission or guidance counselors may not be aware of physical science classes, so contact will be made with the counselors to help increase enrollment. Also, the scheduled class times may not be desirable for students, so an effort will be made to re-schedule class times.