

# Astronomy Program Assessment Report

## Part I - Assessment SUMMARY (2006-2007)

### A. Program/Discipline Mission Statement

The mission of the Astronomy department is to support ACC's goal of being a world class learning centered institution, facilitate student learning and meet the needs of ACC's students. The purpose of the Department of Astronomy is to provide educational services in the areas of astronomy for the residents of Arapahoe and Douglas counties and surrounding areas. The department takes a learner centered approach. The courses support transfer requirements for science and non-science students. The department is committed to quality education in the area of astronomy, incorporating the most current astronomy technology and educational methods.

### B. Intended Outcomes

1. Demonstrate mastery of competencies identified by the competency-based syllabus for that specific course (see Appendix).
2. Acquire the ability to analyze data and suggest answers or solutions to scientific problems.
3. Use appropriate technology and lab equipment such as calculators and/or computers.
4. Apply the logic, thinking and application of the scientific method to topics in astronomy and be able to apply these principles to "real life" problems.
5. Demonstrate the ability to read and write about scientific literature that is relevant and appropriate to a specific course.

### B. Benchmarks for 2006-2007

The benchmark for 2006-2007 was that the scores will meet or exceed the 2005-2006 scores on the Astronomy Assessment Test, the Kepler's Law Lab and the Scientific Method Lab. Note: the benchmarks for individual question scores on the Astronomy Assessment Test has been removed since it was overly specific and too narrow. In tabular form:

Benchmarks for 2006-2007

Assessment Tool or Item	Current Score	Benchmarked Score
Astronomy Assessment Test	17.5	17.9
Kepler's Law Lab	23.1	22.0
Scientific Method lab	18.8	17.6

## D. Assessment Results

### 1. Historical Context

The Astronomy Assessment Test is derived from several sources and inspired, in part, by The Astronomy Diagnostic Test ( See <http://solar.physics.montana.edu/aae/adt/> for details). The Kepler's Law Lab was developed by the Astronomy Department to ensure student learning on the topic of Kepler's Laws and to facilitate the assessment process at ACC. Its implementation in previous semesters has actually resulted in measurable improvement in the knowledge and understanding of Kepler's Laws by astronomy students at ACC. The Scientific Method Lab is a recent addition and, like the Kepler's Laws lab, was written especially for this purpose. All three of these instruments have utility in the assessment process. Copies of these tools are available on request.

### 2. Current Year Data Results

The results of these assessments for 2006-2007 are listed in the accompanying table. These are the raw scores on these tests and labs. Since the grading of the Kepler's Law Lab and the Scientific Method Lab is strenuous and time-consuming, a random representative sample of these quizzes was selected for evaluation. There is a column for percentages of the max score.

Assessment Tool	Sample Size	Average score	Possible max score	Average as a percent
Astronomy Assessment Test	194	17.5	30	58%
Kepler's Law	54	23.1	24	96%
Scientific Method	58	18.8	20	94%

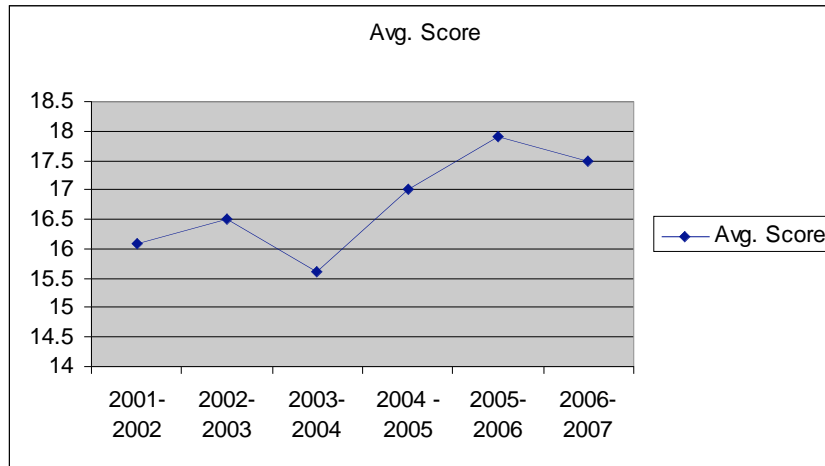
### 3. Analysis

#### Astronomy Assessment Test

The accompanying table lists the results of the Astronomy Assessment Test. Scores are listed for 2001 through 2006. For 2002 and 2003 the test was administered as both a pre and a post test. It is currently administered only at the end of the semester and those scores are the ones being compared.

Date	2001-2002	2002-2003	2003-2004	2004 - 2005	2005-2006	2006-2007

Avg. Score	16.1	16.5	15.6	17.0	17.9	17.5
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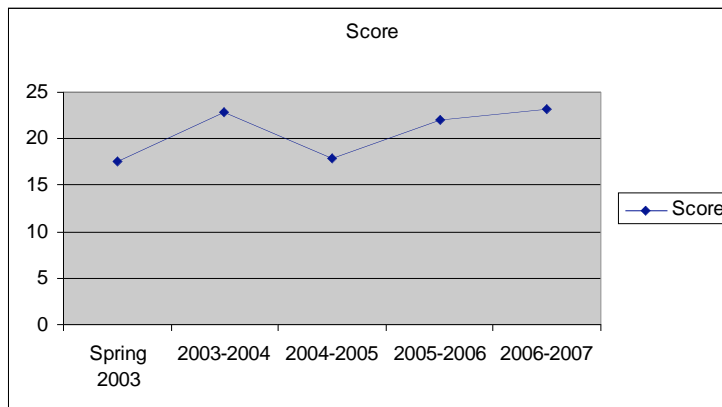


There was a slight decrease in the scores this year. The average score of 17.5 is below the benchmark of 17.9 for this vehicle and even lower than last year's average. However, this is still considerably better than the scores of a few years ago as indicated in the graph.

Kepler's Law Lab

SCORES (raw data)

Year	Spring 2003	2003-2004	2004-2005	2005-2006	2006-2007
Score	17.5	22.9	17.9	22.0	23.1

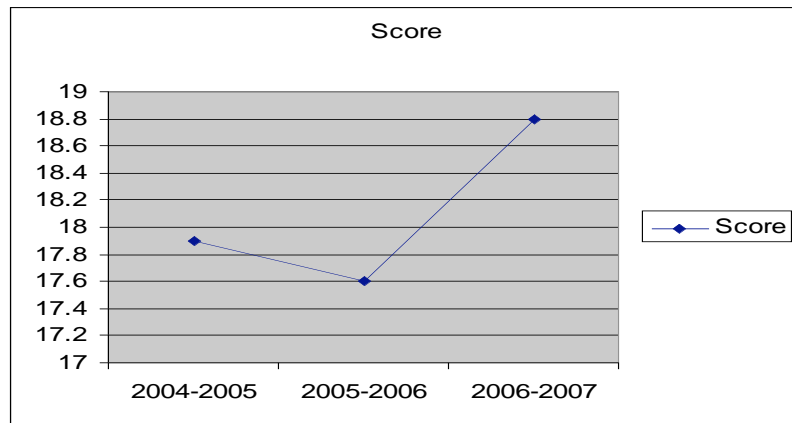


The 2006-2007 average score on the Kepler's Law Lab was 23.1. This represents a success in meeting and exceeding the benchmark of 22.0.

We can see a trend indicating marginal improvement on the vehicle and the overall percentage score of 96% on this assessment indicates a very high level of understanding of Kepler's laws by our students.

### Scientific Method Lab

Year	2004-2005	2005-2006	2006-2007
Score	17.9	17.6	18.8



The Scientific Method Lab is designed to ascertain whether students have a good comprehension of the Scientific Method. This year's result of 18.8 exceeds the benchmark of 17.6. This score translates to 94% which is a clear indication that our students' understanding of the Scientific Method seems to be very good.

### **E. Use of Results**

The results of the Kepler's Laws and Scientific Method Labs are, we think, very good. This indicates that we have been able to focus our efforts on these specific outcomes. However, we see a lot of room for improvement on the Astronomy Assessment Test. A score of 17.5 equates to 58 %. This test is designed to cover many broad topics that are covered in AST101 and it should not be easy. However, it is desirable that ACC Astronomy students exhibit greater mastery across the board with improved scores on this test. For 2007-2008 we will benchmark an improvement on that exam and see if we can produce an overall increase in the score.

The astronomy department will continue to use the Astronomy Assessment Test, Kepler's Law Lab and Scientific Method Lab to assess student performance in Astronomy classes at ACC, though we anticipate no substantial improvement in the latter two vehicles. With those two, we

are simply content to hold our own and not drop substantially. We would like to see an improvement in the Astronomy Assessment test because there is a lot of room for growth there. A score of 17.5 out of 30 indicates a consistent but fairly low level of the understanding of a wide variety of astronomical concepts by our students. We want to pin down the scores on Kepler's laws and the Scientific method while improving comprehension across the board.

These results and the resulting ambitions will be shared with all Instructors who teach Astronomy at ACC. We will send out an email as follows:

Dear Astronomy Instructor,

Attached is the ACC Astronomy Assessment result and plan for next year. It shows that we seem to be doing a good job teaching the Scientific Method and Kepler's laws, two of the most important topics we cover in AST101. You will also notice that the scores on the ACC Astronomy Assessment test dropped slightly last year. This is not a significant problem but we would appreciate any attention you can give to this matter.

You have all received a copy of the ACC Astronomy Assessment test and you will be asked to administer it at the end of the semester. You know it covers a wide variety of astronomical concepts that are consistent with Colorado's Learning Outcomes for AST101. We do not want you to "teach to the test". However, we would ask that you make sure to cover the material on the test in adequate fashion in your classes. This is, of course, consistent with the State required outcomes for AST101. Hopefully, we will measure an improvement on the scores this year.

Thank you for your continued efforts to give ACC students the best possible education.

## **Part II – Assessment Plan (2007-2008)**

### **A. Intended Outcomes:**

These outcomes are essentially identical to the previous years but the specific relationship to General Education outcomes has been clearly identified.

1. Demonstrate mastery of competencies identified by the competency-based syllabus for that specific course (see Appendix).
2. Demonstrate the ability to analyze data and suggest answers or solutions to scientific problems. (Gen. Ed.: Quantitative Reasoning )
3. Use appropriate technology and lab equipment such as calculators and/or computers. (Gen. Ed.: Use of Technology)
4. Apply the logic, thinking and application of the scientific method to topics in astronomy and be able to apply these principles to "real life" problems. (Gen. Ed.: Critical Thinking)

5. Demonstrate the ability to read and write about scientific literature that is relevant and appropriate to a specific course.

### **B. Identify Assessment Procedures/Methods**

For 2007-2008 these specific learning outcomes will be assessed by administering The ACC Astronomy Assessment Test and assigning a Kepler's Laws Lab as well as the Scientific Method Lab for a large percentage of ACC Astronomy 101 students.

Learning Outcome	ACC Astronomy Assessment Test question numbers	Kepler's Law Lab question numbers	Scientific Method Lab question numbers
1	1 through 30	1, 2, 3.e,f	A. B. C. D.
2	18,19,21,22,26,27	3.a,b,c,d	
3		3.a,b,c,d	D. (part 1)
4	1,4,28		B. C. D (part 2)
5	1 through 30	4,5	A. B. C. D (part 2)

### **C. Benchmarks for 2007-2008**

The benchmark for this period is that the scores will exceed the 2006-2007 scores on the Astronomy Assessment Test by 5%. There will be no reduction of more than 5% on the Kepler's Law Lab and the Scientific Method Lab.

In tabular form:

Benchmarks for 2007-2008

Assessment Tool	Current Score	Benchmarked Score
Astronomy Assessment Test	17.5	19.0
Kepler's Law Lab	23.1	21.9
Scientific Method lab	18.8	17.8

## APPENDIX - AST101 Learning Outcomes and Topical Outline

This class addresses the following learning outcomes:

1. Define each of the related vocabulary words.
2. Recognize the appropriate symbols used.
3. State the concepts introduced.
4. Distinguish between different concepts within a topic.
5. Interpret tables or graphs.
6. Collect and organize data in a systematic manner.
7. Present data by construction of charts and graphs.
8. Evaluate the relevancy of data.
9. Write a formal report.
10. Set up and solve problems using geometry, algebra and trigonometry.
11. Apply concepts to new situations.

### OUTLINE

#### I. History of Astronomy

- A. Astronomy vs. Astrology
- B. Pre-Copernican
- C. Copernicus, Galileo, Brahe, Kepler, and Newton

#### II. The Observed Night Sky

- A. The Motions of the Moon and Sun
- B. The Motion of the Visible Planets
- C. The Celestial Sphere
- D. The Calendar and the Seasons

#### III. Observing Instruments

- A. Geometrical Optics
- B. Refracting Telescopes
- C. Reflecting Telescopes
- D. Space Telescopes
- E. Introduction to Light

#### IV. The Solar System

- A. Structure
- B. Properties
- C. Cosmogony

#### V. The Moon

- A. Origin of the Moon

- B. The structure of the Moon
- C. The Apollo Findings

#### VI. The Planets

- A. Interior Structure
- B. Surface Features
- C. Atmospheres
- D. Satellites and Rings

#### VII. Minor Bodies of the Solar System

- A. Comets
- B. Asteroids
- C. Meteoroids

#### VIII. Life in the Universe

- A. Origin of Life
- B. The Search for Extraterrestrial Life

