Course Description for Astronomy and Space Science

Course Title
Astronomy and Space Science

School
Deer Valley High School

District
Antioch Unified

City Antioch, CA

Department or Discipline
- ❑ History/Social Studies
- ❑ English/Language Arts
- ❑ Mathematics
- √ Laboratory Science
- ❑ Language other than English
- ❑ Visual & Performing Arts (for 2003)
- ❑ College Preparatory Elective:
  Subject Area: ___________________________

Name of School Contact Person
Jeffery Adkins

Title/Position
Science Dept. Chair/Instructor

Contact Information

Phone: 925 756 6711 x 6801

Fax: 925.754.8094

E-mail: jeffadkins@antioch.k12.ca.us

Grade Level(s) for which course is intended
10 -12

Length of Course
_ Semester √ Year _ Other

Unit Value
- ❑ 0.5 (half year equivalent)
- √ 1.0 (one year equivalent)
- ❑ 2.0 (two year equivalent)
- ❑ Other: _____________________________

Date of School Board Approval
1/12/00

Seeking "Honors" distinction?
___Yes √ No

Was this course previously approved by UC?
___Yes √ No
If so, in what year? ________ Under what course title? ___________________

Pre-Requisites

Co-Requisites
Concurrent enrollment in Geometry

Brief Course Description

Astronomy and Space Science is an interdisciplinary, integrated, year-long lab course in which students will learn about the earth, the solar system, stars, the galaxy and the universe. The astronomy section of the course will provide experiences in planetary science and astronomy, and the Space Science section will provide experiences about the technology and theory of space travel. Students will learn about rockets, remote sensing, orbital mechanics, space shuttle technology, the earth's place in the universe, constellations, lives and deaths of stars, and the latest astronomical research on new planet discoveries.
In Astronomy and Space Science students will be expected to bring together and exploit skills learned in Geometry class, 9th grade science, history class, English class, and fine arts (through drawings and presentations).

Context for Course (optional).

Departmental or Pathway Structure

Astronomy and Space Science is a supplemental course intended to meet the needs of students seeking an additional science lab credit but who would not normally enroll in an advanced physics or chemistry course. It is a laboratory-based class with many activities, which are described elsewhere in this document. The many physics topics covered in the course will reinforce and extend the basic concepts covered in our 9th grade physical science class. Many advanced physics and chemistry students may also choose to fill an elective slot with this course as well (as seems to be the case in the current year). This is described on our draft pathways page on the school web site, located at http://www.antioch.k12.ca.us/dvhs/departments/science/sciencecourses.html .

Another need being serviced by the class is the lack of earth science in the entire high school curriculum. As written our 9th grade science class has some earth science included in it, but as it falls at the end of the curriculum it is likely to get short shrift as the school year ends. Therefore this course has the additional purpose of increasing our students' exposure to earth sciences.

School restructuring plans

Two major school initiatives are integral parts of the plan for Astronomy and Space Science. First, the technology plan associated with our Digital High School proposal insists that technology be integrated into the curriculum. The Astronomy and Space Science course is highly technology-integrated, with lab computers used for data collection, simulation, research, data processing, image analysis, and collecting images from remotely controlled computerized telescopes. This directly addresses one of our ESLRs – to be a proficient user of technology. Second, the course implements several assessment initiatives, including an effort to use Total Quality Management techniques in classroom management and planning, and advanced multiple-choice and open response test item design to simultaneously address the school's application of standards in the classroom and statewide assessment program (STAR). The STAR test in particular has a major physical science and earth science component, and this course should extend and reinforce the limited work done in the 9th grade science class.

Core or supplemental

The course is supplemental for most students. If this course is the only science elective taken beyond the sophomore year, as may be the case with many students, the extensive work in basic physics needed should show many applications and extensions of the physics they studied in the 9th grade physical science class. This is detailed in the course outline.

Student/school/community needs

Aside from simple fulfillment of course requirements, we have found there is a tremendous interest and demand for the subject matter in the course. Several students said, in a beginning of the year interview, that they intend to pursue a career in astronomy, astrophysics, astronautics, or aerospace, and this course is a doorway for them into that realm. The reaction I have seen is really unprecedented in my 11 years of teaching. In our first year of implementation over 70 students enrolled (out of a student population of 3000). For others there is the prospect of having a science class focus on a topic they are interested in, instead of what is required or expected.

The school will be served by the course by having an example of technology integration with curriculum which in terms of technical skills required, is just short of a computer class itself. Other teachers in science and in other areas can look to the many examples of how word processing, databases, spreadsheets, drawings, simulations, internet access, computer based data collection and analysis, presentation software, and other technology is applied for ideas in their own classroom.

The community will also be served. Students are even now in the process of designing and constructing a portable planetarium, which will be used in the community (particularly elementary schools) for showings along with telescopes at night-time observing sessions. One of our initiatives will be to survey the community's light-pollution, and present a report to the city council regarding lighting ordinances.

History of Course Development (optional).

Who was involved in the course development? Did you consult with UC Admissions personnel or UC professors? If so, what was the nature of such consultation and what was the result? Was this course modeled after another course at another school? If so, is that course UC approved? How does the course being submitted differ from the course after which it was modeled? Has this course received any special recognitions, designations or awards? Has it been articulated to local community colleges or universities?

This course is based on another high school astronomy course I developed and taught in 1989-1991 at Henry Clay High School in Lexington, Kentucky. While teaching that course, also called Astronomy and Space Science, my students and I participated in several public star parties and outreach programs for elementary and middle schools. During the course of this class I was awarded the Kentucky Air Force Associations' Aerospace Educator of the Year award for my support of aerospace education in the Commonwealth of Kentucky. The course description and materials from the students were part of my application for that award.

For the current version, Cheryl Domenichelli (a colleague at DVHS) and I consulted together on the scope and course outline. We presented to the school board a dual course proposal for Astronomy and Space Science along with a second course, Astronomy and Earth Science, which she will teach beginning in the fall of 2001. (A separate UC application will be submitted for the Earth Science version, but it is largely the same as this one.)

Additional resources we used included the Hands On Universe curriculum developed by the Lawrence Hall of Science, which is a standards-based, hands-on (naturally) lab curriculum for high school astronomy classes, material used in my on-line college course for teachers "Astronomy and the WWW" sponsored by the Heritage Institute, Online (www.hol.edu).

COURSE CONTENT.

Directions: Using any format that meets your needs, please include the following course content information. Examples and notes are provided below. Complete sample course descriptions will be posted on the Internet beginning fall 2000.

A. Course goals and/or major student outcomes – approximately 3-5 broad goals

Demonstrate conceptual and technical understanding of earth's place in the universe—where it is, where it originated, and the relationship between planets and their suns.

Apply knowledge from mathematics, physics, and chemistry to the solution of questions related to planets, stars in all stages of development, and groups of stars from clusters to galaxies.

Understand the problems related to space travel and apply knowledge of mathematics, biology and physics to basic rocket science, telerobotics, and living in space.

Use the appropriate technological and conceptual tools to find solutions to scientific problems, especially scientifically designed experiments and situations requiring critical thinking.

Demonstrate mastery of all state science objectives related to astronomy and space science**.**

B. Course objectives – specific student learning objectives

Objectives are based on the 1999 Science Draft Standards. A customized relational database of the Draft Standards was used to generate this report. A blank indicates no science standard exists which directly matches the objective.

Students in Astronomy and Space Science will:

1	prepare written research reports showing his/her ability to apply the scientific method to solutions of problems.	Investigation and Experimentation:1.a Investigation and Experimentation:1.b Investigation and Experimentation:1.c Investigation and Experimentation:1.d Investigation and Experimentation:1.e Investigation and Experimentation:1.i Investigation and Experimentation:1.j Investigation and Experimentation:1.k Investigation and Experimentation:1.l Investigation and Experimentation:1.m Investigation and Experimentation:1.n
2	measure angles and use the properties of triangles to determine unknown sizes, distances and angles in astronomical problems.	Investigation and Experimentation:1.a Investigation and Experimentation:1.b Investigation and Experimentation:1.c Investigation and Experimentation:1.e Physics:1.m
3	use astronomical coordinate systems to locate objects on the sky or on a map.	Investigation and Experimentation:1.h

4	relate naked eye and telescopic observations to distinguish between various models of the solar system.	Investigation and Experimentation:1.n
5	Relate the appearance of the moon in its relative position in its orbit compared to the position of the sun.	Earth Science:1.b
6	explain the geometric arrangement, and make predictions of lunar and solar eclipses.	
7	name 20 constellations by sight in the real sky and in a planetarium	
8	name 20 stars by name in the real sky, on charts, and in a planetarium.	
9	visually identify major classes of objects in the sky (clusters, galaxies, nebulae, planets) based on first-hand observations.	Earth Science:2.d
10	explain the basis of our time measuring system and use the definitons in establishing longitude, sidereal time, and sky coordinates.	
11	explain how different models of the solar system successfully explain the visual observations of planet motion.	Investigation and Experimentation:1.n Investigation and Experimentation:1.g
12	detail the necessary observations that are needed to establish that the earth rotates and is not in the center of the solar system.	Investigation and Experimentation:1.d
14	explain retrograde motion using Ptolemy's and Copernicus' models.	Investigation and Experimentation:1.g Investigation and Experimentation:1.n
15	use basic observing instruments to map constellation shapes and take position measurements.	Investigation and Experimentation:1.a
16	measure the focal length of lenses and explain the basic design of several classes of telescopes, including aperture, f/ratio, "speed", and mount type.	Investigation and Experimentation:1.a
17	use basic principles of optics to understand convex lenses and concave mirror behavior in telescopes.	Investigation and Experimentation:1.a
18	compute the magnifying power of a telescope.	Investigation and Experimentation:1.a
19	compare the resolution of two telescopes.	Investigation and Experimentation:1.a
20	determine the characteristics of a commercially produced telescope by reading its advertising.	Investigation and Experimentation:1.a

21	determine the characteristics of a commercially produced telescope by reading its advertising.	Investigation and Experimentation:1.m
22	explain the historical context and the evolution of solar system models from Aristotle through Einstein, especially Ptolemy and Copernicus and Kepler.	Investigation and Experimentation:1.n
23	use Kepler's laws of planetary motion to describe the orbits and motions of planets around the sun.	Earth Science:1.g Physics:1.f
24	compare the structure and characteristics of planets in the solar system and orbiting other stars	Earth Science:1.a Earth Science:1.b Earth Science:1.c Earth Science:1.d Earth Science:1.f Earth Science:3.a Earth Science:3.b Earth Science:3.c Earth Science:3.d Earth Science:3.e Earth Science:3.f Investigation and Experimentation:1.n
25	derive Kepler's third law of planetary motion from Newton's Universal Law of Gravity and the definiton of centripetal force.	Earth Science:1.g Physics:1.a Physics:1.b Physics:1.c Physics:1.d Physics:1.f Physics:1.g Physics:1.m
26	describe the connection between the structure of an atom and the atomic spectra it produces in a plasma state.	Chemistry:1.j Physics:5.i
27	identify unknown gasses using spectroscopic analysis.	Chemistry:1.j Investigation and Experimentation:1.a Investigation and Experimentation:1.d Physics:5.i
28	classify stellar spectra by type using a categorization scheme.	Chemistry:1.j
29	relate stellar spectra to temperature and luminosity.	Earth Science:2.d Earth Science:2.f
30	explain how absorption spectra can be used to tell the composition of stars.	Earth Science:2.f

31	interpret measurements made by radio telescopes.	Investigation and Experimentation:1.h Physics:4.e
32	collect CCD images and analyze them using image-processing software.	Investigation and Experimentation:1.a
33	measure size, distance, and brightness using image processing techniques.	Investigation and Experimentation:1.e
34	describe the life cycle of a star.	Earth Science:2.c Earth Science:2.d Earth Science:2.e Earth Science:2.g
35	explain in detail the source of the sun' energy.	Chemistry:11.a Chemistry:11.b Chemistry:11.c Earth Science:1.e Earth Science:2.c Earth Science:2.f Earth Science:4.a Earth Science:4.b Earth Science:4.c
36	visually recognize the appearance of objects in each stage of the life cycle of a star.	Earth Science:2.d
37	observe through a telescope objects representing every stage of the life cycle of a star.	Earth Science:2.d
38	describe the observations of galaxies which led to the development of the Big Bang theory.	Earth Science:2.a Earth Science:2.b Earth Science:2.g Investigation and Experimentation:1.f
39	use the Doppler effect equation to determine the recessional velocities of galaxies.	Earth Science:2.g Physics:4.f
40	use the principle of lookback time and the Hubble law of expansion to determine the distances of extremely distant galaxies.	Earth Science:2.g
41	understand the basic principles of special and general relativity, especially how they apply to space travel and cosmology.	Investigation and Experimentation:1.i
42	state what each variable in the Drake equation stands for and how we estimate or measure it.	

43	use Newton’s laws of motion to solve motion problems and travel time problems for spacecraft.	Physics:1.a Physics:1.b Physics:1.c Physics:1.d Physics:1.e Physics:1.f Physics:1.g Physics:1.h Physics:1.i Physics:1.j
44	use conservation of energy and conservation of momentum to explain the motion of spacecraft in space, especially, the rocket princple.	Physics:2.a Physics:2.b Physics:2.c Physics:2.d Physics:2.e Physics:2.f
45	use Newton’s law of gravity to explain the nature of orbits.	Physics:1.e Physics:1.g
46	use basic orbital mechanics to predict distances, orbital periods, and orbital velocities.	Physics:1.f Physics:1.g
47	design a least-energy transfer orbit from one planet to another.	Physics:1.e Physics:1.f
48	use remote sensors to collect data.	Investigation and Experimentation:1.a
49	explain in detail the problems involved with remote and robotic exploration.	Investigation and Experimentation:1.a Investigation and Experimentation:1.b
50	understand the nature of digital information and how it is transmitted via radio.	Investigation and Experimentation:1.a
51	describe the evolution of spacecraft design from the early experiments to the present, and project possible future designs.	
52	describe the steps necessary to provide a long-term livable environment in space.	Biology/Life Sciences:6.f Biology/Life Sciences:9.a Biology/Life Sciences:9.b Biology/Life Sciences:9.e
53	plan a manned mission to Mars including the trip start and end times and dates, direction of travel, landing site, and mission parameters.	Investigation and Experimentation:1.h
54	participate in a large scale project intended to demonstrate mastery of one or	Investigation and Experimentation:1.m

	more astronomy and space science objectives.	

C. Course outline – A traditional course outline listing all topics and sub-topics, indicating both breadth and depth of coverage**.**

Astronomy and Space Science Course Outline

Items listed in *italics* are lab activities which require students to make independent measurements and draw conclusions from data. Activities, simulations, and other projects are listed for informational purposes but are not considered lab activities by the UC definition. Items marked with a footnote number are described in detail at the end of the table.

Content Area	**Lab or activity**
Astronomy	
Pre-Telescopic Astronomy	
Observing the Sun	Size of the Sun activity
Rising and Setting	
Seasonal Changes	Redshift simulation The Stonehenge Project
Telling Time by the Sun	Sundial project *Measuring the sun's degree per hour motion lab*
Observing the Moon	
Phases of the Moon	*Moon observing lab*
Tides	
Lunar and Solar Eclipses	Redshift investigation: searching for eclipses
Lunar mythology	Drawing the man in the moon activity; Drawing lunar craters art lesson
The Night Sky	
Constellations and Asterisms	Constellation Identification Practical Constellations Legends report
Star names	Star names Practical
Sidereal vs. Solar Time	*Measuring the length of a day lab*
Seasonal Changes	Planetarium activity
Fuzzy Things in the Sky	
Star Maps and Coordinate Systems	*Constellation Mapping Lab*
Planet Observations	
General Appearance	Planet observations
Inferior and Superior Planets	*Redshift simulation*
Retrograde Motion	
Comets, Meteors, Novae, and Aurorae	

Meteors and Shooting Stars	*Cratering lab*
Comets and other Portents of Doom	
Novae and Supernovae	*HOU Supernova Search Lab*
Aurorae (Borealis and Australis)	
Basic Astronomical Instrumentation	
Ancient Instruments	
Cross-Staff and Quadrant	*Cross Staff Lab* *Quadrant Lab* *Measuring the height of Mt. Diablo* *Parallax lab*
Sextant and Transit	
Telescopes	
Early Telescopic observations	
Lenses	*Lens Lab*[1]
Refracting Telescopes	*Build and Analyze Telescope Lab*
Magnification	
Resolution	
Mount Types	
Reflecting Telescopes	Analysis of telescope advertising activity
Newtonian	
Dobsonian	
Coude'	
Cassegrain	
Schmidt-Cassegrain	
Amateur Astronomers (guest speaker)	
Models of the Solar System	*Mock Trial: Heliocentric vs. Geocentric*
Geocentric Models	Dance of the Planets activity
Aristotle	
Ptolemy	
Hybrid Models	
Tycho Brahe	
Heliocentric Models	Synodic and Sidereal Activity
Hipparchus	
Copernicus	
Comparing Heliocentric and Geocentric Models	
The Birth of Astrophysics-Gravity and Orbits	
Kepler's Laws of Planetary Motion	
First Law of Planetary Motion	*Ellipse lab*
Second Law of Planetary Motion	Activity: Counting squares to verify the Second Law

Third Law of Planetary Motion	Redshift investigation: graphing periods and major axes of the planets Redshift simulation
Galileo and Halley and Newton	
Of Ramps and Pendula	
A Peculiar Comet Problem	
The Law of Gravity	
Circular Motion	
Centripetal and Centrifugal	*Centripetal Force Lab*[2]
Force required to move in a circle	
Kepler's Laws revisited	
Derivation of Kepler's Third Law	
Basic Orbital Mechanics	
Orbital Elements	Celestial Sphere review
Precession	Gyroscope activity
Advanced Astronomical Instrumentation	
Spectroscopy	
The structure of light	
The Electromagnetic spectrum	
Emission spectra	*Spectroscopy Lab*[3]
Absorption Spectra	Observation of stellar spectra activity
Photography	
Photosensitive Chemicals	*Photography lab?*
Basic Principles of Photography	
CCD photography (HOU units)	*HOU Introduction to Image Processing Lab*
Light detectors	
Radio astronomy	
Space-based astronomy	Hubble survey activity
Modern Astronomy and Astrophysics	
Lives and Deaths of Stars	
Star Brightnesses	*Distance vs. Brightness (Inverse r-square) lab*[3]
Weighing Stars	
Stellar Spectral Types	Classification of spectra activity
Blackbody radiation	Blackbody radiation simulation
Stefan-Boltzmann Law	
Wien's Law	
Stellar Hydrodynamics	*Fluid Pressure Lab?*
Source of the Sun's Energy	
` Nuclear Fusion	
Nucleosynthesis	
The H-R Diagram	*HR Diagram Lab*

Star Birth:	HOU Tour of the Universe activity Nighttime observing sessions
Dark Nebulae	
Emission Nebulae	
Star Lives	
Open Clusters	
Galactic Clusters	Location within the Milky Way activity
Galaxies	
Star Death	
White Dwarf/Black Dwarf	
Planetary Nebulae	
Neutron Stars	
Black Holes	
Supernovae	*HOU Supernova Lab (continues)*
Galaxies	
The Milky Way	Distribution of globular clusters activity
Other Galaxies	
Galaxy Classification	Galaxy classification activity
Superclusters and Sheets	
Exploding Galaxies	
Colliding Galaxies	
Energy Sources in the Universe	
Einstein's Theories and Black Holes	
Special Relativity	Special Relativity computer simulation
General Relativity	
Time and Gravity	
Cosmology	
The Shape of the Universe	
The Fate of the Universe	
The Doppler Effect	*Doppler Effect Lab*
Expansion of the Universe	Balloon Activity
The Big Bang Theory	
Life in the Universe	*Star Counting Lab*
The Drake Equation	
SETI (Guest Speaker)	
Science Fiction and Fact	Book Report
Space Science	
Newton's Laws and The Law of Gravity	
Newton's First Law	Air Track Demos
Newton's Second Law	*F=ma lab*[4]

Newton's Third Law	*Introductory Rocket Lab*
Conservation of Energy and Momentum	*Conservation of Momentum lab* *Conservation of Energy lab*
Newton's Law of Gravity	*Inverse r-squared lab*
Basic Rocket Principles	*Water Rocket lab* *Model Rocket lab* *Rocket Design lab*[5]
Orbital Mechanics for Spacecraft	
Energy in Orbital Systems	
Basic Orbit Parameters	
Low-Earth orbits	Observing Earth satellite activity
Geosynchronous orbits	
Interplanetary Spaceflight	
Remote Sensing and Robotics	
Basic Electronics	*Electricity lab*
Encoding and Transmitting Data	
Modern Planetary Science	
Comparative planetary geology	
Planet masses	*Jupiter Mass Lab*
Terrestrial vs. Gas Giant	
Cratering	*Cratering lab*
Water	Stream Table activity
Geology of other worlds	
Problems with Remote and Robotic Exploration	
History of Space Probes	
Living and Working in Space	
History of Space Flight	
Problems of Microgravity	*Microgravity lab*
Long Term Health Effects of the Space Environment	*Reduced-g physiology lab*
The Future of Humanity in Space	
Planning a Mission to Mars	Mission to Mars Project
High Frontier	
Special Projects (yearlong)	
Hands On Universe	Several different computer image processing labs,. Including some where students request images from a remote telescope. Include the supernova search project and the asteroid search project.
SETI @ home	
National Astronomy Day	
NASA SEEDS	An experiment where seeds

	transported by space shuttle are compared to those left on earth
NASA INSPIRE	A radio telescope lab mainly aimed at detecting space shuttle transmissions and observing patterns in electromagnetic phenomena of the atmosphere
NASA Radio JOVE	A radio telescope lab mainly aimed at observing the emissions from Jupiter
Planetarium	

Selected Lab Descriptions:

---

[1] Lens lab: In this lab students will analyze the characteristics of images formed by double-convex lenses as a function of image distance. They will place a lamp or candle near a double convex lens and **make observations of brightness, image size, image distance, orientation and nature as a function of object distance** on an observing form. After completing the observations students are asked **to seek out patterns in the data** that might help explain why lenses behave the way they do.

[2] Centripetal force lab: In the Centripetal Force Lab students will use a whirling mass on a string attached to a computer-based force sensor to determine the relationship between force, rotational velocity and radius of revolution. Through a series of carefully controlled experiments**, they will change every combination of two variables in the centripetal force equation while holding the others constant.** Then they will combine the resulting series of relationships into a single equation. **Students will be asked to develop the experimental design before collecting data.**

[3] Inverse r-square lab: In this lab, which is central to the study of light intensity and gravity, students will design and carry out an experiment **where the brightness of a fixed source of light is measured at ever-increasing distances using a computer-based light probe**. The resulting data table will lead to the conclusion that such effects behave according to an inverse-square law. Students will change the distance between the sensor and light source and record the brightness of the light, then graph the data.

[4] F=ma lab: Using a force sensor and an accelerometer connected to a computer**, students will accelerate a massive cart while simultaneously measuring the force and acceleration on the cart.** Graphing force vs. acceleration will reveal a linear relationship, the slope of which is equivalent to the mass of the cart. The mass of the cart used will be measured with a balance for comparison purposes. For space science this will be shown to be the accepted method of “weighing” an astronaut in a weightless environment.

[5] Rocket design lab : In this activity students will use the principles of Newton’s Laws as well as the concepts of Center of Pressure and Center of Gravity to design and construct a functional rocket model which will be flown in class. Using projectile motion theory, students will be asked to predict the altitude their rocket will reach when launched; then the rocket will be launched to confirm the prediction. **The design phase of this activity requires students to apply Newton’s laws and the concept of force equilibrium.**

D. Texts & supplemental instructional materials

Notes:

1. First list district-adopted core textbooks and core literature lists

At present there is not a district-adopted textbook. It is worth noting that there are no high-school astronomy textbooks currently on the market. The majority of high-school astronomy courses use an introductory college textbook as their text.

My students and I reviewed three textbooks, and one of them, **Discovering the Universe** by Neil Comins and William J. Kaufmann III, is currently being submitted to the District Curriculum Council for approval and purchase. Barring unforeseen difficulties we anticipate having this textbook for use during the current academic year.

In lieu of a textbook we originally decided to use a district-adopted piece of multimedia software, **Redshift** by Maris publishing, as our primary reference in class. Redshift is a sky simulator, which can depict the appearance of the sky from anywhere in the solar system, on any date, at any time and in any direction. It also contains an extensive astronomical dictionary, a large number of tutorial files (called “Guided tours”) intended to teach basic astronomical concepts, and an on-line repository of reference material linked to every visual image presented on the screen.

2. Follow with other readings, articles, reports, etc., indicating if materials will be used in part or in their entirety

In addition to the Redshift CD-ROM, we are using as a secondary reference the same list of astronomy-related links I used in my college-level online course for teachers, Astronomy and the WWW, sponsored by the Heritage Institute, Online (www.hol.edu). A copy of these links appears below:

Astronomy Links

http://members.home.net/jeffadkins/astronomy/gallery.htm	Mr. Adkins' Astro-Gallery. Not the greatest astro-gallery but it's *mine*.
http://users.aol.com/mdas101b/private/members.htm	The Mount Diablo Astronomical society hosts monthly star parties and a monthly lecture series on astronomy.HIGHLY recommended.
I. The Solar System	
http://www.seds.org/nineplanets/nineplanets/nineplanets.html	This is probably the best planet web site on the entire WWW (no kidding).
http://my.voyager.net/stargazer/solar_system.htm	A simpler planet page done by a college physics student.
http://www.bradley.edu/las/phy/solar_system.html	Presents a giant physical model of the solar system.
http://www.exploratorium.edu/ronh/solar_system/index.html	This Solar System Calculator will assist you in building a scale model of the solar system. Requires Javascript.

http://www.pgd.hawaii.edu/prpdc/vr/planetvr.html	See the surface of Mars and the Moon in virtual reality. Requires Quicktime VR (free, link on the page).
http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html	Good site for elementary school students.
http://www.marsacademy.com/	Everything you need to know about the Red Planet.
II. Comets, Asteroids, and Meteors	
http://encke.jpl.nasa.gov/	Emphasis on the opening page on debunking comet myths.
http://comets.amsmeteors.org/	Comets and Meteor Showers general topics.
http://www.skypub.com/comets/comets.html	SKY Online's Comet Page
III. Lives of the Stars	
http://www.twsu.edu/~obswww/lss.html	Life Story of a Star by Lake Afton Public Observatory.
http://nineplanets.org/twn/	The Web Nebulae, a photographic index of nebulae, by Bill Arnett, creator of the "Nineplanets" site.
http://www.ggw.org/asras/supernova.html	Listing of current supernovae.
IV. Exploring the Milky Way	
http://www.twsu.edu/~obswww/emw.html	General Milky Way Info from Lake Afton Public Observatory.
V. Black Holes	
http://physics7.berkeley.edu/BHfaq.html	Black Hole FAQ by Ted Bunn.
http://jean-luc.ncsa.uiuc.edu/Movies/	NCSA Relativity Group Movies--probably the most technical treatment on this list.
http://www.twsu.edu/~obswww/o34.html	Amazing Facts re: Black Holes from Lake Afton Public Observatory.
http://entropy.davidson.edu/WebTalks/Aapt_WC/BlackHole.htm	Virtual Trips to Black Holes and Neutron Stars.
http://cfa-www.harvard.edu/seuforum/explore/blackhole/blackhole.htm	Voyage to a Black Hole site, very slick presentation.
VI. Galaxies	
http://crux.astr.ua.edu/choosepic.html	Different Categories of Pictures categorized with button links.

http://www.telescope.org/btl/m4.html	A small gallery of galaxy types.
http://seds.lpl.arizona.edu/messier/galaxy.html	Galaxies tutorial from the venerable SEDS (Students for the Exploration and Development of Space) site.
http://zebu.uoregon.edu/movie.html	Colliding galaxy movies.
VII. Life in the Universe	
http://www.empire.net/~whatmoug/Extrasolar/extrasolar_visions.html	Extrasolar Visions
http://www.seti-inst.edu/	Welcome to the SETI Institute--this is the inheritor of the old NASA SETI program, now a nonprofit institute.
http://www.setiathome.berkeley.edu	This is the famous SETI @ home project that allows your computer to process radio telescope information as a screen saver.
VIII. Space Places	
http://www.yahoo.com/Science/Astronomy/Planetaria/	Yahoo - Science:Astronomy: Planetaria
http://www.yahoo.com/Science/Astronomy/Observatories/	Yahoo - Science:Astronomy: Observatories
http://www.skypub.com/astrodir/usa.html	S&T's Astro Directory - United States
http://www.cosc.org/visit/programs/teacher.asp	Chabot Astronomy Center in Oakland--a world-class astronomy education center (worth the trip!)
http://www.lhs.berkeley.edu/pass/AST300.html	This is an advertisement for a series of resources on using planetarium materials in the classroom.
IX. Observing the Night Sky	
http://www.skypub.com/whatsup/whatsup.html	SKY Online - What's Up?
http://www.skypub.com/backyard/backyard.html	SKY Online - Backyard Astronomy
http://www2.astronomy.com/astro/News/News.html	Astronomy Almanac
http://www.pa.msu.edu/abrams/diary.html	SKYWATCHER'S DIARY
http://www.wunderground.com/sky/index.asp	Input your ZIP code, and this site will display the stars at your location. Good beginner-level site.
http://www.analemma.com	The best site on the entire WWW for explaining the motion of the sun in the sky. Contains both conceptual and technical explanations.
X. Astronomy News	

http://antwrp.gsfc.nasa.gov/apod/astropix.html	Astronomy Picture of the Day
http://www.skypub.com/news/news.html	SKY Online -- Weekly News Bulletin
http://www.stsci.edu/pubinfo/Latest.html	Latest HST Release
http://www.chron.com/content/interactive/space/astronomy/	Houston Chronicle
http://www.nasa.gov/today/index.html	NASA Today
http://science.msfc.nasa.gov/news/subscribe.htm	NASA News Listserv
http://spacelink.nasa.gov/xh/express.html	Another astronomy related list server can be found at the following address:
XI. Software review	
http://www.siennasoft.com/eng/downloads.shtml	Free Starry Night Basic software (10 day free demo requires payment of a registration fee for permanent use)
http://www.skypub.com/resources/software/software.shtml	A listing of Sky Publishing's resources: free software in BASIC format, programs from shareware vendors, and advertising from publishers. Macintosh software is not listed here.
http://www.shareware.com/	A searchable site which yields many hits when you search for "astronomy" by operating system (Mac or Windows)
http://www.maris.com/kdgfolder/astronom/rs3/rs3home.htm	Link to Maris Software's Redshift 3 site, a commercial product for Macintosh and Windows (no free version). Redshift is a planetarium program which can put the user on any object in the solar system.
http://www.carinasoft.com/voyager.html	Links to Voyager II, a Mac-specific planetarium program which has been around since 1988.
http://www.seds.org/billa/astrosoftware.html	An excellent listing of vendors of astronomy software for many different computer platforms.
http://www.procyon-sys.com/	Link to Observer software that allows you to control your telescope by voice command.
XII. Astronomy Curriculum and Educational Resources for Developing Lesson Plans	
http://space.jpl.nasa.gov	Solar System Simulator: you input the parameters, it draws the pictures. Could be useful for simulated experiments.
http://hou.lbl.gov/howtojoin/	Hands-On Universe, a program of the Lawrence

	Hall of Science and NSF, attempting to build a nationwide collaboration of high school astronomy teachers. Stipends! Credits! Contacts!
http://www.aspsky.org/astro/teacher.html	The San Francisco area's project ASTRO for linking astronomers to teachers.
http://www.aspsky.org/education/tnl.html	The Universe in the Classroom, a free newsletter for educators, is available from the Astronomical Society of the Pacific.
http://mo-www.harvard.edu/MicroObservatory/Enroll/index.html	An exciting remote-control observatory site. Sign up to control and take photographs over the web.
XIII. General Astronomy	
http://www.snapnet.com/HVAG/resources/ca.html	Astronomy Groups, planetaria, and observatories in California.
http://members.aol.com/bemusabord/	Martz Observatory page, with a good list of astronomy links--scroll down.
http://www.seds.org/	Home Page for the Students for the Exploration and Development of Space, the host of several of the pages listed above.
http://www.zapme.com/net/class/science/astro.html	Astronomy links from ZAPME.com, an educational portal site. Long list of links.
XIV. Fun Stuff	
http://amazing-space.stsci.edu/	Astronomy Games using your browser.
http://kidsastronomy.about.com/kids/kidsastronomy/msub29.htm	KidsClick

We are also using a series of instructional workbooks produced by the Hands –On-Universe project (hou.lbl.gov) sponsored by the Lawrence Hall of Science. These books provide basic astronomy and physics instruction, and information about how to utilize the image processing software provided by the project for student use. This software takes actual images and analyzes them for size, brightness changes, image enhancment, and so on. The projects consider the size of mountains on the moon, the experimental detection of variable star brightnesses with the interfering variables of sky brightness and exposure time, locating supernovas, and many others. The program includes an opportunity for students to specify the settings used by a remotely controlled computerized telescope to collect new images for analysis. One such class has discovered a supernova in the past using these techniques.

E. **Instructional methods and/or strategies –** A general description of instructional methods including lecture, group work, readings, lab work, project-based learning, service-learning, library research, internet research, interviewing, videos, audiotapes, CD Rom, etc.

The primary methods of instruction for this course will consist of lab activities, lecture, and projects. Every major unit will use a lab utilizing data collection and analysis by the student as one of the core activities.

Lecture serves the purpose of unifying the disparate sources of information into a meaningful pattern. Projects show the application of principles learned as well as provide student motivation.

Secondary methods of instruction include computer simulation using the Redshift software program, the construction of models such as a sundial and functional model rocket, internet research, service learning (through the presentation of planetarium shows at elementary schools), the construction of instructional videos on astronomy topics, and daily class work and homework assignments.

F. Assessment methods and/or tools – A description of assessment methods, including exams, quizzes, papers, assignments, projects, participation, attendance, etc.

A wide variety of assessment techniques will be used in this course. The course management plan explains how grading will be done. A copy is attached.

Final exams are worth approximately 20% of the course; chapter tests are worth approximately 30%. The exact percentage varies depending on the amount of work done in each particular chapter. Weighting schemes are not used.

In particular, the following assessment techniques will be used:

- Multiple choice: Final exams and portions of chapter tests will be multiple choice questions based on the content for that chapter.

- Open response: Each chapter test will contain several questions which require students to show their work and which will be graded on a rubric.

- Culminating Projects: Each student is expected to complete a culminating project requiring significant effort and incorporating revision. Some of these are research projects, and some of them are presentations centered on astronomical topics. Projects will be scored using the science department Projects rubric. Department rubrics are still being revised but are based on ESLR's, the content standards and the demands of the statewide assessment program.

- Total Quality Management Program participation: Under the leadership of our superintendent, Dr. Lee Jenkins, my classes are conducting a total quality management process of using randomly selected questions from a cumulative list of 100 items to evaluate progress towards completion of the curriculum goals. Progress is charted over time and the feedback is used to adjust the class procedures. For my students these are participation grades.

- Lab reports: Some labs will be evaluated with quizzes, and some will be evaluated using a standard lab report format listing hypothesis, variables, equipment, procedures, data, and results. Lab reports will be scored using the Science Department rubric.

- Student Generated Assessments: Students will be taught the basic principles of assessment and be asked to contribute multiple-choice and open response items for test use on the theory that a student who understands how a test is written can take the test more effectively.

G. Assessment criteria – Indicate what criteria are used to assess student work. For example, has the school or department developed rubrics that define quality work? Until the State has published its Academic Performance Standards, what is being used to define quality?

Quality is being defined at least three different ways in my classroom. First, for lab reports and projects, the Department rubric will be used to evaluated the quality of student work, particularly at check points before the final evaluation. Department rubrics are being developed in conjunction with our WASC review and should be completed during this academic year.

We are also using rubrics as a part of evaluation of open response items and minor projects. These rubrics will be announced as the assignments are given. In general, these follow the format established by the New Standards project : papers are sorted into two categories, Needs Instruction and Ready for Revision, and further subdivided into other categories. Examples of student work are used to define the rubric, and the rubric is then shared as a reference for future work.

Finally, we are using Total Quality Management techniques in an attempt to gauge long-term progress towards a fixed and finite goal of mastery of a limited set of mostly knowledge level objectives.

For ordinary daily classroom work, a standard percentage scale of successful completion is used, with a 90% = A, 80% = B, 70% = C, and 60 % = D scale, as specified in the classroom management plan.

Classroom Management Plan for Mr. Jeff Adkins (2000-2001)
An expanded version of this document is located online at:
http://www.antioch.k12.ca.us/dvhs/departments/science/teachers/JA/index.htm

(Only the grading policy portion is presented here.)

Class Assignments
The kinds of class assignments, and the points they are worth, are listed here.
1. Worksheets/Puzzles/Daily in-class work (10-30 points)
2. Lab Worksheets (30 points)
3. Lab Reports (50 points)
4. Small Projects such as posters, models, short presentations (50 points)
5. Large Projects such as Science Fair, or other (100-200 points)
6. Quizzes (10-30 points)
7. Tests, Chapter level (100 points)
8. Final Exams (200 points)
9. Extra Credit assignments (10 points)
10. Participation grades (10 points)
11. Homework from book (1 point per problem)

Grading Policy
Grades in Mr. Adkins' classes are cumulative.Point values accumulate, or add up, all semester, increasing for each quarter and progress report grade.They include any makeup work that is completed and graded by report time. The ONLY way to get makeup work is to attend an amnesty day session (see below.)

Percentage grade = (Your point total ÷ Total points possible) x 100
In this class, > 100% = A+, 90% = A, 80% = B, 70 % = C, 60 % = D, and below 60 % is failing.

Other policies:

Incomplete Work or Assignments
Assignments which were not completed or were done sloppily or hurriedly will be given a zero, and amnestyday credit must be used to make up these assignments (see below).

There is NO ROUNDING of percentage grades.79.9999 = a "C".
The point totals reset to zero each semester, NOT each quarter.If you fail 1 1/2 quarters it is very difficult to pass the 2-quarter long semester. The grades issued are cumulative, not by reporting period.
If you fail the first quarter but pass the second quarter, you can still fail the semester if you do not make up the points you missed.
EXTRA CREDIT is the only way to compensate for having a bad day, unexcused absences, poor test grades, etc.
Students who transfer in from other schools: if you have a grade issued from that school it will be pro-rated for all your missing grades (as if you got that grade on all the assignments you missed).If you don't have a grade from the other school you MUST MAKE UP all the missing work or get an incomplete.
Students who transfer from another house: if you have a grade from the other teacher it will be pro-rated for all your missing grades.
No late work accepted, except on amnesty day.

Extra Credit
Extra credit is possible on any assignment. You are encouraged to consistently go above and beyond the call of duty on anything required for this class. However, there are a few conditions:

Extra credit cannot be earned if the assignment it is based on is not completed correctly.
Don't expect extra credit to raise your grade more than about 10% (a letter).
Extra credit assignments are offered to the entire class or not at all.
Extra credit can be earned on any assignment if you can find a way to exceed the standard expectations.
More is good, but Better is Best. Don't expect to get double credit for working twice as many problems.
There is, generally, no extra credit for typing as most assignments must be typed anyway.

Amnesty Day
Amnesty Day is held once per month. If you attend amnesty day, you get permission to turn in ONE late piece of work. You must attend an after school session that lasts about an hour, and do whatever is assigned during the hour. You might listen to a lecture, do a lab, or work on a short project. You will be given help for the current unit, on the assumption that when you didn't turn in work it was because you might be having difficulty with the class. You have to attend the whole session, and be on time and attentive during the work.
When Amnesty Day is over, you will get a little card which you fill out and have Mr. Adkins sign before leaving. The Amnesty Card does not take the place of the missing work. It gives you permission to turn in the missing work.

The best grade you can get on an assignment using Amnesty credit is a "C". This is to discourage you waiting to copy someone else's work using Amnesty credit. Amnesty credit cannot be used for major projects or tests or final exams. Only regular assignments, worksheets, homework, and small projects can be made up with Amnesty Credit.

Mr. Jeff Adkins dvhscience@home.com or jeffadkins@antioch.k12.ca.us 925 756 6711x6801