CORE CURRICULUM COMPONENT APPLICATION
Sam Houston State University

Revised October, 2012

PART I – Course Information

Course Type
☒ Existing/Restructured
☐ New Course Proposed Fall 2013
If new, have you submitted a Form B to the SHSU Curriculum Committee? ☐ Yes ☐ No

Course Prefix & Number: PHYS1312/PHYS1112

Texas Common Course Number (TCCN Matrix): PHYS1303/PHYS1103

Course Title: Stars and Galaxies

Course Catalog Description (Copy and paste from online catalog for existing courses):
The study of the universe beyond the solar system. Topics include the nature of stars, stellar evolution, galaxies, quasars, cosmology, the universe as a whole, and theories about the origin and fate of the universe. Along the way, students will be introduced to tools astronomers use to determine such properties as temperatures, compositions, motions, masses, and evolution of astronomical objects. This laboratory will introduce students to the tools and techniques used by ancient and modern astronomers to determine the nature of stars, galaxies, the interstellar medium, and the universe as a whole.

Course Prerequisites: none

Available Online?
☒ Yes, currently developed in online delivery mode
☐ Anticipated development in online delivery mode (Semester, Year:)
☐ No

Number of Sections to be Offered per Academic Year: 10

Estimated Enrollment per Section: 60

Course Level (freshman, sophomore): freshman

Designated Contact Person (for follow-up communication purposes): Dr. C. Renee James

E-Mail Address: phy_crj@shsu.edu

Phone: (936)294-4888

Approvals

Department Chair: _____ Signature 10/8/12 Date

Academic Dean: _____ Signature 10/15/12 Date

Submit completed, signed form to Core Curriculum Committee - Box 2478 or Fax 4-1271

PART II – THECB Foundational Component Areas

See Appendix for full description of each component area.

Select Component Area: III. Life and Physical Sciences

In one paragraph, describe how the proposed course will fulfill the core and skill objectives of the component area: The proposed course is one that has been taught as a fundamental science course since humanity laid the foundation of science. The behavior of the universe beyond the solar system will be explored through direct observation, interpretation of observations, and understanding of the empirical and physical laws that have been codified over the centuries.Following researched educational paradigms, instructors will introduce the class to a number of activities that have been shown to foster critical thinking and teamwork.Both individuals and teams will be required to communicate their understanding of the material through various means, both in the laboratory setting and the more traditional classroom setting. Given that mathematics is the language of science, students will also be required to hone their numerical and quantitative reasoning skills.

PART III – Course Objectives & Student Learning Outcomes (SLO)

Insert the applicable course objectives stated as student learning outcomes (e.g., Students completing the course will be able to...) that support the core component area objectives. Please reference the component rubric for additional information on core component area objectives.

Objective/SLO 1: Students completing the course will be able to describe, explain and predict natural phenomena using the scientific method.

How will the objective be addressed (including strategies and techniques)?
Students will be introduced to the concept of scientific modeling of observations through simple, commonly experienced phenomena, such as star colors and brigthness, and be asked to create conceptual models to explain these phenomena. Given that scientific models make testable predictions, students will see how models are supported or discarded based on their abilities to predict accurately. For instance, if a star's spectrum is more like a light bulb's than like a discharge tubes, then the mechanism behind its color must be more like that of a light bulb, and this sort of logical progression should be an integral part of the class. Further explorations into the properties of stars (details of their spectra, distances, luminosities, masses) and the laws that govern them will lead to more robust scientific modeling that includes application of mathematics. Finally, extrapolation of our understanding of stars and galaxies to selected current topics (e.g., dark energy and the accelerating universe) will demonstrate to students the limitations of our modern scientific models.

Describe how the objective will be assessed: Assessments include, but are not limited to, personal response questions within the context of the lecture and/or lab class, embedded exam questions that require the student to apply their understanding to real situations or that present

hypothetical scenarios (e.g. "If an atom had the following energy levels, which transition would emit blue light?"), embedded questions that require the student to apply the laws of nature to new or hypothetical scenarios (e.g. "Two stars display the following spectra. Which star is hotter/denser/more luminous?"), homework and/or laboratory exercises where students must demonstrate the ability to describe, explain, and predict, research-supported learning tools such as Lecture Tutorials (Prather et al) and Ranking Tasks, as well as other activities developed and tested by faculty.

Objective/SLO 2: Students completing this course will understand the interactions among natural phenomena.

How will the objective be addressed (including strategies and techniques)?
Within a stars and galaxies class, there are multiple interactions that can be explored, including gravitational, electromagnetic, and a detailed understanding of the interaction between light an matter.,These concepts are reinforced through a combination of straight lecture, homework exercises and/or in-class activities (e.g. professor-developed activities, published Lecture Tutorials, Ranking Tasks), covering such aspects of stars and galaxies as Newton's Law of Universal Gravitation, Kepler's Laws, atomic physics and the absorption and emission of light by atoms, and more detailed laboratory exercises (e.g., using simulated data to understand the observable effects of various binary star interactions).

Describe how the objective will be assessed: Research-based methods of assessment for understanding interactions among natural phenomena will be employed. These include embedded exam questions where students are asked to apply their understanding to both real scenarios and hypothetical scenarios (e.g., determining the light absorbed or emitted by atoms with different energy level structures, or determining the properties of a binary star system based on their understanding of their mutual gravitational attraction). Other direct assessments include Lecture Tutorials (either published or professor-created), Ranking Tasks (either published or professor-created), in-class activities, laboratory exercises and summative reports, and/or homework questions requiring students to demonstrate their understanding of the interactions.

Objective/SLO 3: Students completing this course will understand the implications of scientific principles on the physical world and on human experiences.

How will the objective be addressed (including strategies and techniques)?
The laws of physics (gravity, orbital mechanics, the interaction of light with matter, the variables that allow the Sun to be an ideal star around which life can form, the evolution of the universe in general that allowed for the presence of matter, fusion, etc.) govern everything we do, so the implications are innumerable. Practical aspects of these physical laws include recognizing how a star's mass is directly responsible for both its luminosity, lifetime, and continuously habitable zone, understanding how the interaction of the light and matter allows us to "see" in the dark and to infer properties of objects (e.g. how your digital temple thermometer uses Wien's Law to find your peak wavelength and then computes your temperature).. Because of the scope of the course, the examples are almost limitless, and different professors will likely choose to highlight different examples of this learning outcome, depending on their personal expertise.

Describe how the objective will be assessed: Personal response questions and/or embedded exam questions that allow students to demonstrate their understanding of the implications of scientific principles are the most immediately direct assessment of this learning outcome. For instance, to divine whether a student understands how the mass of a star affects its lifetime and

peak wavelength and ultimate mode of death, one could create a hypothetical scenario and ask students to determine which of an array of stars might have a life-supporting planet like Earth. Open-ended laboratory explorations (e.g., one that employs the Sloan Digital Sky Survey database that allow students to determine for themselves properties of stars and/or galaxies), homework or team discussion questions asking, for instance, the range of influence of a supernova, along with in-class activities (e.g. published and professor-created Lecture Tutorials, and/or published and professor-created Ranking Tasks),

Objective/SLO 4: N/A

How will the objective be addressed (including strategies and techniques)?
N/A

Describe how the objective will be assessed: N/A

Objective/SLO 5: N/A

How will the objective be addressed (including strategies and techniques)?
N/A

Describe how the objective will be assessed: N/A

PART IV – THECB Skill Objectives

Address each of the THECB skill objectives required within the component area. Explain how the skill is addressed, including specific strategies to address the skill(s). *Address ALL skill objectives associated with the selected Component Area. (See Appendix)*

1. **Critical Thinking Skills**: to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information

How will the skill be addressed (including specific strategies, activities, and techniques)?
Critical thinking is practically the foundation of science. Students will make personal observations and be presented with astronomical data and the development of the laws of physics, and they will have to determine what conclusions can validly be drawn. At innumerable times throughout history, there have been competing scientific models to explain phenomena, but later observations require modifications. Students will explore through in-class activities, homework assignments, and laboratory investigations how new observations support or oppose scientific models, and thus more fully understand the nature of science.

2. **Communication Skills**: to include effective development, interpretation and expression of ideas through written, oral and visual communication

How will the skill be addressed (including specific strategies, activities, and techniques)?
Within the context of lecture and lab, students will have many opportunities to communicate their ideas. Lecture tutorials, ranking tasks, and other in-class activities require written communication as well as visual communication (e.g., diagrams must be drawn by students to indicate, for example, where a star with particular properties will fall on an HR Diagram, but students are also required to explain their reasoning for placing the star on the diagram as they do; diagrams and physical models must also be created and described verbally or in writing to explain blackbody curves, the fusion layers of a star at various points during its evolution, etc.). Students must also be receivers of visual communication, developing the ability to interpret diagrams and graphs. In lab and some lectures, teamwork is appropriate, so students must also communicate orally with other members of their teams. Personal response (also called think-pair-share) questions can be employed, and these also require oral communication as students attempt to justify their answers to their peers. Laboratory group work requires a high level of oral communication as groups attempt to discover and explain the underlying laws and concepts. Writing is then required by each individual to convey understanding to the instructor. Homework sets may have free-response questions where students express their understanding in writing, as well.

3. Empirical and Quantitative Skills: to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions

How will the skill be addressed (including specific strategies, activities, and techniques)?
Mathematics is the language of science, and a course on stars and galaxies is no exception. The relationships between distance and parallax, redshift and distance, and luminosity, temperature and size, are easily presented in this language, which is used most extensively within the context of labs, where students have more time to wrestle with the manipulation of equations. However, there are many mathematical relationships that can be explored in lecture via published lecture-tutorials that guide students through the physical laws, ranking tasks, which require the application of mathematical thinking to a variety of situations, in-class published or professor-developed activities that allow students to personally explore relationships between observables (e.g. that the distance to an object is inversely proportional to the parallax angle, or that the apparent brightness is directly proportional to luminosity, but inversely related to the square of the distance) . More involved laboratory activities include activities where students explore the empirical relationships between, for example, color, temperature, and peak wavelength.

4. Teamwork: to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal

How will the skill be addressed (including specific strategies, activities, and techniques)?
The most intensive teamwork will occur during the laboratory hours for the class, when students will work in groups of 4 or 5 to explore the problem for the week (or, in the case of the constellation observation lab, during the duration of the semester). Students will have to look at data, interpret data, cooperate to carry out specific tasks, discuss and prepare results, discuss what conclusions can be drawn, etc. They will also have to coordinate efforts outside of class to complete a long-term observing lab and a guided research question lab. In the lecture setting, teamwork will be employed on a less regular basis as students wrestle with in-class activities that are designed to reinforce concepts in class. These activities may include Lecture Tutorials, Ranking Tasks, personal-response questions, and professor-developed exercises, depending on the personality of the professor.

5. **Personal Responsibility**: to include the ability to connect choices, actions and consequences to ethical decision-making

How will the skill be addressed (including specific strategies, activities, and techniques)?
N/A

6. **Social Responsibility**: to include intercultural competence, knowledge of civic responsibility, and the ability to engage effectively in regional, national, and global communities

How will the skill be addressed (including specific strategies, activities, and techniques)?
N/A

PART V – SHSU Core Curriculum Committee Requirements

1. Using a 15-week class schedule, identify the topics to be covered during each week of the semester. Provide sufficient detail to allow readers to understand the scope and sequence of topics covered.

Week 1	Introduction to Light (no lab)
Week 2	Determining properties of objects from their light (no lab)
Week 3	Stellar Properties (Intro to Light Lab)
Week 4	Stellar Properties (Parallax and the First Rung of the Cosmic Distance Ladder Lab)
Week 5	Stellar Properties (Inverse.Square Law of Light Lab)
Week 6	Stellar Properties (Stellar Magnitudes and the Cosmic Brightness Scale Lab)
Week 7	Stellar Properties (Classification and Interpretation of Stellar Spectra Lab)
Week 8	Star Formation (Determining Stellar Properties from Eclipsing Binaries)
Week 9	Stellar Evolution (no lab)
Week 10	Stellar Remnants (Pleiades - Main Sequence Fitting and Determining the Ages of Star Clusters Lab)
Week 11	Stellar Remnants (Using Cepheid Variables to Determine Cosmic Distances Lab)
Week 12	Milky Way (Hubble's Galactic Observations Lab)
Week 13	Galaxies (Guided Research Question Lab)
Week 14	Galaxies (no lab)
Week 15	Cosmology (no lab)

2. Attachments (Syllabus Required)

Syllabus Attached? ☒ Yes ☐ No

Other Attached? ☒ Yes ☐ No If yes, specify: Addendum statement and examples of various assessment methods discussed in the body of this application.

Appendix: THECB Component Area Descriptions and Skill Requirements

I. Communication (Courses in this category focus on developing ideas and expressing them clearly, considering the effect of the message, fostering understanding, and building the skills needed to communicate persuasively. Courses involve the command of oral, aural, written, and visual literacy skills that enable people to exchange messages appropriate to the subject, occasion, and audience.)

II. Mathematics (Courses in this category focus on quantitative literacy in logic, patterns, and relationships. Courses involve the understanding of key mathematical concepts and the application of appropriate quantitative tools to everyday experience.)

III. Life and Physical Sciences (Courses in this category focus on describing, explaining, and predicting natural phenomena using the scientific method. Courses involve the understanding of interactions among natural phenomena and the implications of scientific principles on the physical world and on human experiences.)

IV. Language, Philosophy, and Culture (Courses in this category focus on how ideas, values, beliefs, and other aspects of culture express and affect human experience. Courses involve the exploration of ideas that foster aesthetic and intellectual creation in order to understand the human condition across cultures.)

V. Creative Arts (Courses in this category focus on the appreciation and analysis of creative artifacts and works of the human imagination. Courses involve the synthesis and interpretation of artistic expression and enable critical, creative, and innovative communication about works of art.)

VI. American History (Courses in this category focus on the consideration of past events and ideas relative to the United States, with the option of including Texas History for a portion of this component area. Courses involve the interaction among individuals, communities, states, the nation, and the world, considering how these interactions have contributed to the development of the United States and its global role.)

VII. Government/ Political Science (Courses in this category focus on consideration of the Constitution of the United States and the constitutions of the states, with special emphasis on that of Texas. Courses involve the analysis of governmental institutions, political behavior, civic engagement, and their political and philosophical foundations.)

VIII. Social and Behavioral Sciences (Courses in this category focus on the application of empirical and scientific methods that contribute to the understanding of what makes us human.
Courses involve the exploration of behavior and interactions among individuals, groups, institutions, and events, examining their impact on the individual, society, and culture.)

Required Skill Objectives

Foundational Component Areas	Skill Objectives					
	Critical Thinking	Communication	Empirical & Quantitative	Team Work	Social Responsibility	Personal Responsibility
Communication	✓	✓		✓		✓
Mathematics	✓	✓	✓			
Life and Physical Sciences	✓	✓	✓	✓		
Language, Philosophy & Culture	✓	✓			✓	✓
Creative Arts	✓	✓		✓	✓	
American History	✓	✓			✓	✓
Government/Political Science	✓	✓			✓	✓
Social and Behavioral Sciences	✓	✓	✓		✓	

Submit completed, signed form to Core Curriculum Committee - Box 2478 or Fax 4-1271

PHYS 1312/1112 – Stars and Galaxies/Lab

Fall 2012

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Telephone: (936) 294-3266
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Office Hours: by appt
Facebook Group: https://www.facebook.com/groups/SHSUAstronomy/

Introduction:

PHYS 1312/an introductory lecture course in astronomy for non-science students. It is exclusively a lecture course, although it will include some demonstrations of various kinds as well as participation activities in order to clarify the material. The material from which the lectures are drawn is described later on in this syllabus. The most important rules and information about this course are given below.

Students are required to enroll in PHYS 1112, Stars and Galaxies Lab, concurrently with this course. The lab course is designed to allow you to apply some of the astronomical techniques and concepts discussed in PHYS 1312. To help you prepare for lab, a series of pre-lab questions are included in the lab manual. You should answer these questions using your lecture notes from PHYS 1312, your textbook, or reputable websites on the internet.

Goals:

While the main objective of this course is to cover most of the areas of modern astronomy at an elementary level using only the most basic mathematics, along the way we will also address a number of other goals, such as:

1. Focusing on *describing, explaining, and predicting natural phenomena* using the scientific method.
2. *Understanding the interactions among natural phenomena.*
3. Understanding the *implications of scientific principles on the physical world and on human experiences.*
4. Developing a deeper knowledge of astronomy and be able *to effectively communicate* this understanding to others.
5. Increasing an appreciation of astronomy and the advances made in the field.
6. Understanding how advances in astronomy apply to the real world.
7. Understanding the scientific process and be able to observe facts scientifically and critically evaluate them.
8. Learning to work cooperatively with others in a group setting in order to communicate ideas and knowledge while working towards a common group goal.

9. Strengthening communication and reasoning skills that are valuable in any profession.
10. Instilling a joy of science and having fun in the process!

As we discuss the material in this course, we will approach astronomy within the framework of the scientific method: observation, explanation and prediction. While we will cover a wide variety of topics, we will focus on answering the following questions:

1. What are some of the basic physical laws of the Universe, and how do they apply to astronomy?
2. How does the size of our solar system compare to that of our Galaxy? the Universe? How do the sizes of various objects compare?
3. How do celestial objects form and evolve over time?
4. What limitations to observations exist and how do they produce a selection effect within our data?

Texts and Topics:

All of the information which you need to learn for this course is contained in the online lessons and covered in class. If you would like to use a text as a supplemental resource, then the text which has been recommended for this course is **Stars and Galaxies**, 7th edition, by Chaisson & McMillan. The contents of this text most closely match the content of the lessons, although there are some topics that may not be covered in the text.

The laboratory manual for this course is available at all university bookstores. In addition, a scientific calculator is strongly recommended.

Determination of Grade:

Participation	10%
Homework	10%
Quizzes	10%
Exams	20%
Laboratory	25%
Final Exam	25%
Total	**100%**

Description of Assignments:

Participation: Participation credit is based in part on in-class questions, which may be answered using a Personal Response Systems (PRS, or "clickers"), multi-colored "voting" cards, or other method the professor chooses. Full participation in answering the in-class questions will result in full credit for that day.

In addition, part of your participation grade will be determined based upon your participation in lecture activities. These activities have been developed to improve critical thinking skills, such as creative thinking, inquiry, analysis of information, and so on. They are also designed to promote communication skills as you analyze charts, graphs and 3-dimensional visualizations, communicate your thoughts and ideas with class members, and record your answers for discussion. The activities will occur almost every class period at random points throughout class. You will be graded based on your attempt of the problem, not necessarily on the correctness of your answer.

In some classes you will be working on activities that, while not collected, will greatly assist you in understanding the material. A FIRM UNDERSTANDING OF THESE ACTIVITIES WILL BE ESSENTIAL TO A GOOD GRADE IN THE COURSE. You are required to collaborate with others in class, discussing problems and sharing ideas. Ultimately, though, when you are asked to answer questions, you must do so **in your own words**. You will be responsible for your own understanding of the material. Questions on the group assignments will be incorporated into the exams.

Homework: There will be periodic homework assignments throughout the semester; their dates are listed on the course schedule. These assignments are designed to assist you in reviewing the material as it is covered in class.

In some cases, the homework assignments will be submitted online. In these cases, it is not uncommon for technical errors to occur periodically. It is your responsibility to make sure your answers have been submitted correctly and before the deadline. No extensions or make-ups will be given for any reason.

Quizzes: Periodically throughout the semester, quizzes will be administered either in class or online. The quizzes will cover basic information from the reading material and lesson notes.

Exams: There will be a number exams during the semester; their dates are listed on the schedule. Each exam will cover new material presented since the previous exam (the topics will be announced in class). While not cumulative, sometimes material from later chapters relies on your knowledge of earlier material.

Make sure you are present for the exams (the dates are listed in the class schedule). NO MAKE-EXAMS ARE ALLOWED, unless 1) you notify me BEFORE the exam and 2) it is for a university-excused reason. If you miss one exam (and follow the rules above), then you may

take a make-up exam. If you miss more than one exam, you will automatically fail the course. Regardless, only University excused absences are allowed.

If you know that you will miss an exam beforehand, you must notify me before the exam. Any make-up exam will consist solely of questions requiring written, short answers. All make-up exams will take place within one week of the normal exam. It is your responsibility to schedule a make-up time with me. Failure to do so will result in a zero for that exam.

I encourage all students to take their exams at the scheduled times. Students are required to notify me on or before the exam date in the case of unexpected events, such as a serious medical or family emergency or legitimate unavoidable conflicts related to university business. Students can request make-up exams only if they missed the regular exams for the above reasons. When doing so, you must include your complete schedule (dates and times of all classes) so I can schedule your make-up exam as soon as possible. Requests for make-up exams will be approved by me based on merit. If notification is given after the exam, then it is my discretion to decide whether or not to offer a make-up exam.

Laboratory: The lab component of your grade will be subdivided into the following parts:

Quizzes:	21%
Post-lab Questions:	21%
Lab reports:	42%
Observatory:	16%

Quizzes: A brief (5-10 question) multiple-choice quiz will be given at the beginning of each lab period. The quiz will cover the pre-lab questions that are contained in each lab. It is essential that you complete the pre-lab questions before coming to class.

Post-lab Questions: At the end of every lab, before leaving, you will turn in your answers to the post-lab questions found at the end of every lab. Answers should be written on a separate, full sheet of paper in complete sentences. Make sure you include your name, email address, section and the title of the lab on each submission. Make sure your handwriting is legible. Credit will not be given for illegible work.

Lab Reports: Students will be assigned to groups the first week of class, and it is within your group that lab assignments will be completed. Each week you will perform a series of activities with your group members with whom you will discuss the main concepts of the lab, and manipulate and analyze numerical data and/or observable facts in order to arrive at informed conclusions. You are then required to synthesize the information and summarize your findings in a lab report. Each member of your group is required to submit an individual and unique lab report. Copying of information is strictly forbidden and will result in a failing grade. Please refer to the "Lab Report Guide" posted on the course website for instructions regarding your lab reports.

Lab reports are due at the beginning of the lab period. Late work will not be accepted.

Observatory: Students are expected to attend the SHSU Observatory at least one night during the semester to complete the observatory assignment in the lab manual. Students must keep in mind that, due to the fact that the observatory is outside, its availability is subject to the weather. If the observatory is not available on a given night, students are expected to try again until they are able to attend the observatory. Conflicts in schedule are NOT an excuse for failing to complete this assignment. A schedule of available observatory nights will be posted on the course website.

Final Exam: The final will be held during the final exam week (see course schedule for exact time). The final exam is worth 25% and will cover the entire semester. There will be no make-up for the final exam, so make sure that you do not miss it. Missing the final exam will result in an automatic failing grade for the course.

Any grade discrepancies for any assignment or test must be brought to my attention within a week after the assignment deadline or after receiving your score. Otherwise, no grade changes will be considered.

Where to Get Help:

1. *Professor Miller:* I have office hours posted on the course website, please make the most of them and attend often to have any of your questions answered. You may also ask questions by email (although discussions of homework or exam problems are usually best done in person). If you do email me, or anyone else in regards to this course, please include the following information in your emails: Your name, your student number, the course name and the section for which you are registered. I will be able to more easily help you if you include all of this in your email.

2. *Services for Students Disabilities:* (http://www.shsu.edu/~counsel/sswd.html).

It is the policy of Sam Houston State University that individuals otherwise qualified shall not be excluded, solely by reason of their disability, from participation in any academic program of the university. Further, they shall not be denied the benefits of these programs nor shall they be subjected to discrimination. Students with disabilities that might affect their academic performance are expected to visit with the Office of Services for Students with Disabilities located in the Counseling Center. They should then make arrangements with their individual instructors so that appropriate strategies can be considered and helpful procedures can be developed to ensure that participation and achievement opportunities are not impaired.

SHSU adheres to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations for students with disabilities. If you have a disability that may affect adversely your work in this class, then I encourage you to register with the SHSU Counseling Center and to talk with me about how I can best help you. All disclosures of disabilities will be kept strictly confidential. NOTE: No accommodation can be made until you register with the Counseling Center. For a complete listing of the university policy, see:

http://www.shsu.edu/~vaf_www/aps/811006.pdf

ABSENCES:

As adults, you are expected to be responsible for your own actions. While there is no penalty for missing class, understand that by missing class you miss out on the opportunity to earn participation points for the day, or worse, may miss a quiz or exam. There will not be any opportunity to make up these missed points, so it is in your best interest to attend regularly. Attendance records will be kept on a daily basis. While absences will not be penalized, in the case of borderline grades, your attendance record will be taken into account.

If you are late to class or need to leave early, please be respectful of the fact that class is in session. Please enter or exit quietly without disruption. If at all possible, in these situations please use the door in the back of the room.

STUDENT ABSENCES ON RELIGIOUS HOLY DAYS POLICY:

Section 51.911(b) of the Texas Education Code requires that an institution of higher education excuse a student from attending classes or other required activities, including examinations, for the observance of a religious holy day, including travel for that purpose. Section 51.911 (a) (2) defines a religious holy day as: "a holy day observed by a religion whose places of worship are exempt from property taxation under Section 11.20…." A student whose absence is excused under this subsection may not be penalized for that absence and shall be allowed to take an examination or complete an assignment from which the student is excused within a reasonable time after the absence.

University policy 861001 provides the procedures to be followed by the student and instructor. A student desiring to absent himself/herself from a scheduled class in order to observe (a) religious holy day(s) shall present to each instructor involved a written statement concerning the religious holy day(s). The instructor will complete a form notifying the student of a reasonable timeframe in which the missed assignments and/or examinations are to be completed. For a complete listing of the university policy, see:

http://www.shsu.edu/~vaf_www/aps/documents/861001.pdf

CELL PHONE POLICY:

There are a number of reasons why students may need to have their cell phone on during the class. The sound on your cell phone should be turned off, and it should be set on silent/vibrate. Most calls can wait until class is over. In the case of an emergency, please quickly and quietly step out into the hallway to take your call. Excessive disruptions due to cell phone usage will result in these privileges being revoked, and will reflect poorly on you during peer evaluations. Cell phones must be turned off during all quizzes and exams.

There will be times when you will be asked to use your cell phone for research purposes. At this time cell phone use is encouraged! Otherwise, your cell phone use should be placed out of sight if possible. Students found texting during class will have their cell phone privileges revoked.

VISITORS IN THE CLASSROOM:

Only registered students may attend class. Exceptions can be made on a case-by-case basis by the professor. In all cases, visitors must not present a disruption to the class by their attendance. Students wishing to audit a class must apply to do so through the Registrar's Office.

ACADEMIC DISHONESTY:

Cheating in any form will not be tolerated. Students are encouraged to work together on activities and homework, but collaboration is different than cheating. Collaboration involves the sharing of ideas, while cheating involves the wholesale use of one person's ideas without the other person's contribution to the work.

In general, the academic dishonesty policy is as follows: The first time a student is accused of cheating, he or she will earn a grade of zero on the assignment. Any future evidence of cheating will result in a failing grade in the course and the student will be reported to the Dean of Students for an official reprimand.

All students are expected to engage in all academic pursuits in a manner that is above reproach. Students are expected to maintain honesty and integrity in the academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. The University and its official representatives may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including but not limited to, cheating on an examination or other academic work which is to be submitted, plagiarism, collusion and the abuse of resource materials. For a complete listing of the university policy, see:

http://www.shsu.edu/administrative/faculty/sectionb.html#dishonesty

Definitions of various forms of cheating are listed below.

CHEATING

Cheating is the unauthorized use of information and study guides in any academic exercise. The methods of cheating are varied and well-known. Cheating includes:

1. Copying from others during an examination.

2. Sharing answers for a take-home examination.

3. Using illegal notes during an examination.

4. Taking an examination for another student.

5. Asking or allowing another student to take an examination for you.

6. Tampering with an examination after it has been corrected, then returning it for more credit than deserved.

7. Submitting substantial portions of the same academic work for credit in more than one course, without consulting with the second instructor (and the first instructor if the courses are concurrent at Penn State).

8. Preparing answers or writing notes in a blue book before an examination.

9. Allowing others to do the research and writing of an assigned paper (for example, using the services of a commercial term paper company).

PLAGIARISM

Plagiarism is academic theft. It refers to the use of another's ideas or words without proper attribution or credit. An author's work is his/her property and should be respected by documentation. Credit must be given:

1. For every direct quotation.

2. When a work is paraphrased or summarized in whole or in part in your own words.

3. For information which is not common knowledge. (It appears in several sources about the subject).

COLLUSION

Any student who knowingly or intentionally helps another student to perform any of the above acts of cheating or plagiarism is subject to discipline for academic dishonesty. There is no distinction between those who cheat and plagiarize and those who willingly allow it to occur.

ADDENDUM TO PHYS 1312/1112 PROPOSAL

In the field of Astronomy Education Research, there has emerged a suite of research-based learning and assessment tools, as described in the NASA Center for Astronomy Education website: http://astronomy101.jpl.nasa.gov/. These tools include 1) personal response questions/think-pair-share/peer instruction questions, 2) Lecture Tutorials in Introductory Astonomy (3rd Edition, by Prather, Slater, Adams, Brissenden; there is also a suite of unpublished ranking tasks within the CAE website, and several "home-grown" activities developed and tested by SHSU faculty), 3) Astronomy Ranking Tasks (originally developed by Kevin Lee at the University of Nebraska at Lincoln).

Examples of each of these tools are attached.

While it is impossible to gauge the precise personality of everyone who will ultimately teach PHYS 1311/1111 and PHYS 1312/1112, it is expected that each faculty member will incorporate *some subset* of these tools as he/she sees most fit. For instance, not all tenured and tenure track faculty incorporate personal response questions in direct assessments, but those that don't incorporate other, research-supported assessment tools that gauge the same learning outcomes.

Thus within the body of the learning outcome assessment descriptions above, you will frequently find language such as "the class will employ research-supported instructional tools, such as personal response questions, Lecture Tutorials, Ranking Tasks, and/or other instructor-developed activities." *All assessments used will be valid research-supported instruments developed with Bloom's Taxonomy of Educational Objectives in mind.* However, it is impossible to state categorically that every section every semester taught by every instructor for the next decade will use Lecture Tutorials or that they will all use Ranking Tasks. They will use the subset of this suite of research-based tools that best mesh with their personalities. This uncertainty reduces our list to an "and/or" list, rather than an "and" list, but each of these tools has been shown by astronomy education researchers to result in learning gains by students.

The only assessment for each student learning outcome that *must* be common across every section is that of embedded exam questions.

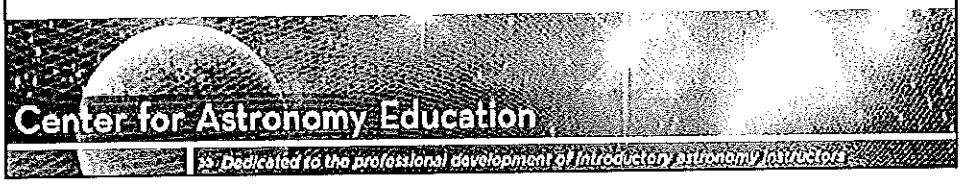
A Short note about Instructional Strategies

Think-Pair-Share:
A questioning in the classroom technique that makes use of a combination of conceptually challenging multiple choice questions, along with systematic classroom feedback designed to increase student-to-student discourse and provide data on students' learning for both you and them.

Crouch, C. H. & Mazur, E. 2001, "Peer Instruction: Ten Years of Experience and Results," *American Journal of Physics*, 69(9), 970, 2001

Development and Application of a Situated Apprenticeship Approach to Professional Development of Astronomy Instructors, Prather, E. E., and Brissenden, G. The Astronomy Education Review, 7(2), 2008

Clickers as Data Gathering Tools and Students' Attitudes, Motivations, and Beliefs on Their Use in this Application, Prather, E. E., Brissenden, G., The Astronomy Education Review, 8 (1), 2009 .



You look to the west at 10am and see the moon on the horizon. What is the phase of the moon that will be high in the sky in three weeks?

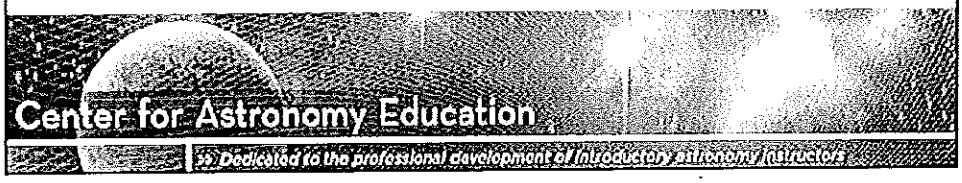
A. Waning Gibbous

B. Waxing crescent

C. New

D.Waxing Gibbous

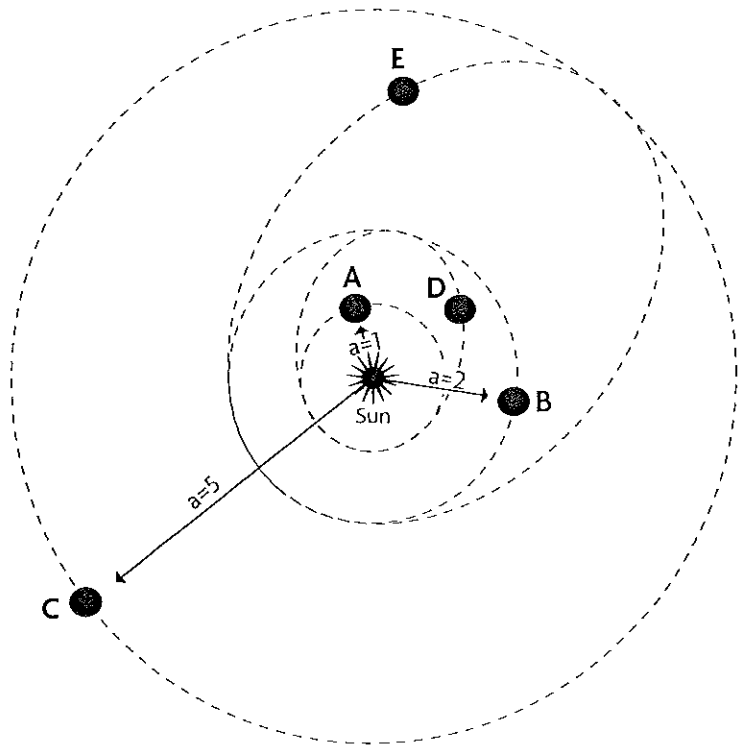
E. Waning Crescent



Astronomy Ranking Task:
Kepler's Laws - Orbital Motion

Exercise #3

Description: The figure below shows a star and five orbiting planets (A – E). Note that planets A, B and C are in perfectly circular orbits. In contrast, planets D and E have more elliptical orbits. Note that the closest and farthest distances for the elliptical orbits of planets D and E happen to match the orbital distances of planets A, B, and C as shown in the figure.



Ranking Instructions: Rank the orbital period (from longest to shortest) of the planets.

Ranking Order: Longest 1 ___ 2 ____ 3 ____ 4 ____ 5 ____ Shortest

Or, the orbital periods of the planets would all be the same. _____ (indicate with check mark).

Carefully explain your reasoning for ranking this way:

_____

_____

_____

_____

INTRODUCTION

Prerequisite Knowledge

- A basic familiarity how Kepler's Second Law describes the motion of an orbiting object in terms of equal areas in equal times
- A fundamental understanding of how the motion of an orbiting object changes as it orbits a central star based on Kepler's Second Law

Goals

- Be able to reason about and describe the entire motion of a planet's orbit based on the area swept out by the planets and the time it takes for that motion to occur.
- Practice estimation and analytical reasoning skills.

Pre-activity Question

1. Kepler's second law says "a line joining a planet and the Sun sweeps out equal areas in equal amounts of time." Which of the following statements means nearly the same thing?
   a. Planets move farther in each unit of time when they are closer to the Sun.
   b. Planets move equal distances throughout their orbit of the Sun.
   c. Planets move the same speed at all points during their orbit of the Sun.
   d. Planets move slowest when they are moving away from the Sun.
   e. Planets move fastest when they are moving toward the Sun.

TUTORIAL GUIDE

1) **[Yes]** Since the planet is in a perfectly circular orbit, and the distance between the lettered positions looks the same, the area swept out by the planet between each of the lettered positions would be the same. So, since the time intervals between each of the letters positions is also the same—one month—it obeys Kepler's second law: equal areas swept out in equal amount of time.

2) **[Staying the same]** Since the planet is moving the same distance in the same time it must be traveling at the same speed the entire time.

4) **[possible correct answers C-H or D-I] There are many choices that could be offered which should be considered correct provided they identify a distance traveled which is greater than the distance between locations A and B.**

   Students may struggle with deciding which letters to choose since there are several options. In addition, some students struggle with understanding what is meant by "swept-out-area." If students are stuck here, it can be helpful to ask them if they

were going to carpet (or paint) a new area with the same size as the triangle they made between Positions A and B, which two of the points between C and I would use the same amount of carpet.

5) **[Equal to]** The lettered positions identified in answer 4 were chosen because the area swept out between them would be about the same as the area swept out between A and B. And since we are told that the planet obeys Kepler's second law—equal areas in equal times—the time interval must be equal.

6) **[Question 4]**

7) **[Question 4]** Since the planet traveled a greater distance for the motion identified in Question 4 than it did in Question 3, and both motions took place in the same amount of time, the planet had to be moving faster during the interval identified in Question 4.

   Some students struggle with making the connection that if the planet travels a greater distance in the same amount of time it must be traveling with a greater speed.

8) **[No]**

9) **[Fastest: G; Slowest: A]** Since the time intervals between the lettered positions is the same, and the distance traveled in that time interval is greatest at Position G and smallest at Position A, it must be moving fastest at Position G and slowest at Position A.

10) **[Increasing]** Since the time intervals between each of the lettered positions is the same, and the distance between Positions D and E is greater than the distance between Positions D and C, the speed of the planet must be increasing.

11) The closer a planet is to its companion star the faster it moves, and the further away it is the slower it moves.

12) **[A]** Orbit A is a circle, and Earth's eccentricity is nearly zero, and since orbits with an eccentricity of zero are "perfectly circular," Orbit A must be the one that most closely matches Earth's orbits. Orbits B and C are not circles.

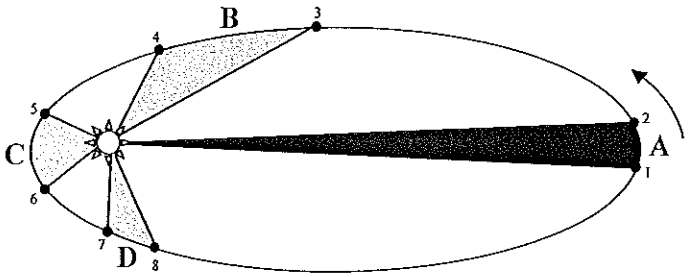
    Many students have the misconception that Earth's orbit is highly elliptical.

13) **[Largest: Pluto; Smallest: Venus]**

14) Earth's orbital speed wouldn't change very much throughout the year because its orbit is nearly a perfect circle, so it wouldn't change its distance from the Sun very much. And, since we found it Question 11 that the closer a planet is to its star it moves faster, and the further away it is it moves slower, Earth would have to change its distance from the Sun to change its speed.

ADDITIONAL QUESTIONS

The planet in the orbit shown in the drawing at right obeys Kepler's Laws. Use this drawing to answer the next four questions.



1. According to Kepler's Second Law, during which one of the portion of the planets orbit "B", "C", or "D", would the planet take the same amount of time as it took for the portion of the orbit identified with letter "A"? If you think all the portions of the orbit take the same amount of time, answer "E". **[B is the correct answer]**

2. During which part of the planet's orbit (A, B, C, or D) would the planet move with the greatest speed? **[C is the correct answer]**

3. During how many portions of the planet's orbit (A, B, C and D) would the planet be speeding up the entire time?

   a. **Only during one of the portions shown.**
   b. During two of the portions shown.
   c. During three of the portions shown.
   d. During four of the portions shown.
   e. None of the above.

4. During which of the portions of the planet's orbit would the planet experience an increase in speed for at least a moment?
   a. Only during one of the portions shown.
   b. During two of the portions shown.
   c. **During three of the portions shown.**
   d. During four of the portions shown.
   e. None of the above.