

Astronomy 102 Mid-Term #1 Study Guide

Fall Semester 2009

The midterm covers Chapters 1-4, but not all topics from each chapter are on the test. The detailed list below was what you should know how to do. A practice exam is attached. We should warn you we expect the practice exam will take about 75 minutes. The actual midterm will be a bit shorter, since you will only be allowed about 50 minutes for it.

Objective (what you should be able to do on the test)	Reading from the textbook
List some of the objects in the solar system.	1.1, 1.2, 1.3
Describe one way of organizing those objects according to their properties-rocky planets close to sun, gas giants farther away.	7.1, 7.2
Describe the relative sizes of objects in the solar system.	7.1, 7.2
Explain what makes an idea a scientific idea.	3.4
Describe annual and daily motion of sun and stars.	3.2 and planetarium lab
Describe Ptolemy's geocentric model of the solar system.	3.2, 3.3
Describe Copernicus' heliocentric model of the solar system.	3.3
Evaluate a geocentric model in terms of the predictions it makes and whether they are verified.	3.4
List the assumptions that ancient Greeks made in constructing their model of the solar system.	3.3
Describe Copernicus' heliocentric model of the solar system.	3.3
Describe how the motion of planets differs from other objects in the sky.	2.4
Explain why retrograde motion occurs in Copernicus' model of the solar system.	2.4
Describe Galileo's observations (we will not discuss all of them in detail, but you should be able to list all of the observations described in pages 75-77 of the book)	3.3
Explain how Galileo's observations support a heliocentric model.	3.3
Use Kepler's First Law to identify the shape of the orbit of a planet.	3.3
Use Kepler's second law to deduce how much of its time an object spends on each part of its orbit.	3.3
Use Kepler's third law to deduce the period of a new asteroid (or other object) given its distance from the sun.	3.3
Use Kepler's third law to deduce the distance from the Sun of a new asteroid (or other object) given its orbital period.	3.3
Explain that Kepler's Laws were based solely on observation with no understanding of why they were correct.	3.3

Objective (what you should be able to do on the test)	Reading from the textbook
Correctly predict the motion of two falling objects dropped near the Earth's surface.	4.1 and 4.5
Discuss the importance of Newton's work in understanding the solar system.	4.4
Identify whether acceleration is occurring given a description of a physical situation	4.2

Astronomy 102 PRACTICE Mid-Term #1

Fall Semester 2009

[NOTE: This practice mid-term will take longer than the actual mid-term as it will have more questions.]

DO NOT OPEN THIS EXAM UNTIL TOLD TO DO SO BY INSTRUCTOR.

Exam Rules:

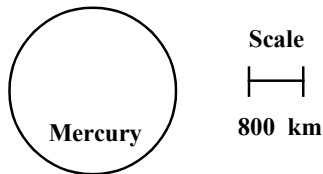
- a. Exam will start at the beginning of your lecture period and must be turned in 50 minutes after the exam begins. The exam is scheduled to be about 45 minutes long, but you will be given 50 minutes to finish.
- b. **Exam is Closed Book and Closed Notes.**
- c. **Cell phones must be off and out of sight (not even “vibrate”).**
- d. **No electronic devices allowed with exception of a calculator except at discretion of instructor.**
- e. I expect everyone to be honorable and not copy answers from someone else's exam. I consider it a personal insult for you to cheat and thus cheating will be dealt with by giving the cheater an “F” for the entire course.

Exam Hints:

- a. If you have trouble with a problem, skip it and go to the next one, come back to it later.
- b. Don't be afraid to raise your hand and ask a question of the instructor if you have a problem with interpreting a question.

Multiple Choice Questions:

- The average distance between the Earth to the Sun is
 - 1 light year
 - 1 Astronomical Unit
 - 1 million kilometers
 - 1 million miles
 - 1 billion kilometers
- The majority of the volume of the solar system is occupied by
 - The planets.
 - The Sun
 - The planets and moons.
 - The Sun, planets, and moons.
 - empty space.
- The average distance to Moon (from Earth) is approximately 382,500,000 meters. This would be written in scientific notation as
 - 382.5 thousand kilometers.
 - 3.825×10^8 meters
 - 3.825×10^{10} meters.
 - 3.825×10^9 meters
 - 3.825 million meters.
- Why do astronomers use units like “Astronomical Units” and “Light Years” instead of kilometers or miles when discussing distances?
 - Because it allows us to represent astronomical distances with relatively manageable numbers.
 - Because they don’t like metric units.
 - Because it makes conversions between units easy.
 - All of the above.
 - None of the above.
- In a geocentric theory for the solar system the object at the center of the solar system is
 - the sun.
 - the earth.
- Choose the words that most accurately fill in this sentence: Over the course of the year, the Sun moves from _____ along a path in the sky called the _____.
 - East to West; celestial equator
 - East to West; ecliptic
 - West to East; celestial equator
 - West to East; ecliptic



- Based on the diagram above, what is the diameter of Mercury?
 - about 240 km
 - about 2400 km
 - about 24,000 km
 - about 240,000 km
 - about 2.4×10^6 km
- In the heliocentric model, the motion of the Sun across the sky over the course of a year is due to
 - The rotation of the Earth on its axis.
 - The tilt of the Earth’s axis.
 - The revolution of the Earth about the Sun.
 - The precession of the Earth’s axis of rotation.

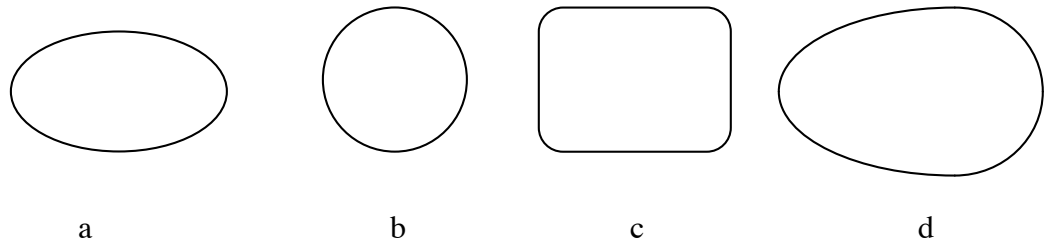
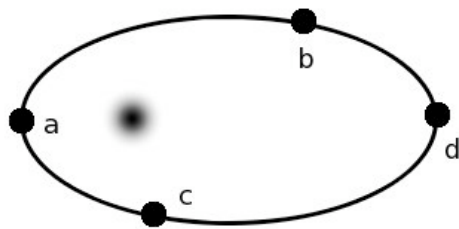


Figure for question 10.

9. To the naked eye, planets are different than stars because planets
- appear to be round discs, stars are just points.
 - move in the sky from night to night
 - are different colors than stars.
10. Which of the shapes above is an ellipse with non-zero eccentricity?
11. On a day when the phase of the moon is first quarter, a lunar eclipse (in which the moon passes through the Earth's shadow)
- Will definitely **NOT** happen.
 - Will happen once every few years.
 - Will definitely happen.
12. The 3rd Quarter moon was on Monday, Sep. 22. What will the moon look like a week from today (about Sep. 30)?
- It will be a crescent moon (less than half the face lit).
 - It will be a first quarter moon (exactly half the face lit).
 - It will be a gibbous moon (more than half the face lit)
 - It will be a full moon.
 - Can not be determined from the information given in the problem.
13. During a total solar eclipse, when then moon's shadow touches the Earth,
- the phase must be full moon.
 - the moon may appear to be a coppery red color.
 - The phase must be a new moon.
 - The phase must be a first quarter moon.
 - All of the above
14. During a full moon, the moon and the Sun are
- in about the same place on the sky (both set at the same time)
 - about 90 degrees apart (as the sun is setting, the moon is overhead)
 - on opposite sides of the sky (as the sun is setting the moon is rising)
15. An idea is a scientific idea if it
- Can be tested by experiment
 - Is more simple than other ideas
 - Definitely correct

16. Which of the following is **NOT** consistent with the major hallmarks of science?
- Scientific explanations should be based solely on natural causes.
 - A scientific model must make testable predictions.
 - Science consists of proven theories that are understood to be true explanations of reality.
 - Science progresses through the creation and testing of models that explain observation as simply as possible.
 - None of the Above
17. Which of the following statements about scientific theories is **NOT** true?
- A theory must make predictions that can be checked by observation or experiment.
 - A theory cannot be taken seriously by scientists if it contradicts other theories developed by scientists over the past several hundred years.
 - A theory can never be proved beyond all doubt; we can only hope to collect more and more evidence that might support it.
 - If even a single new fact is discovered that contradicts what we expect according to a particular theory, then the theory must be revised or discarded.
 - A theory is a model designed to explain a number of observed facts.
18. In the geocentric theory for describing the solar system, epicycles were necessary to explain
- why the sun moves across the sky over the course of a year
 - why the stars rise and set every day
 - why the planets sometimes move in retrograde motion
 - why the planets move across the sky over the course of a year
19. According to Kepler's First Law, planets move on orbits around the sun that are
- Circles
 - Hyperbolas
 - Ovals
 - Ellipses
20. Kepler's second law, which states that as a planet moves around its orbit it sweeps out equal areas in equal times, means that
- a planet's period does not depend on the eccentricity of its orbit.
 - planets that are farther from the Sun move at slower average speeds than nearer planets.
 - a planet travels faster when it is nearer to the Sun and slower when it is farther from the Sun.
 - the period of a planet does not depend on its mass.
 - planets have circular orbits.

21. Kepler's third law, $P^2 = ka^3$ (where k is a constant) means that
- all planetary orbits with the same average distance from the Sun (semimajor axis) have the same period.
 - planets that are farther from the Sun move at slower average speeds than nearer planets.
 - the period of a planet does not depend on its mass.
 - a planet's period does not depend on the eccentricity of its orbit.
 - All of the above are correct.
22. Which of the following statements describes the motion of objects dropped near the surface of the Earth, ignoring air resistance?
- Heavier objects always fall faster than lighter objects.
 - Lighter objects always fall faster than heavier objects.
 - Heavy and light objects both fall at the same rate.
23. The observation that planets with a shorter period than Earth are closer to the Sun than Earth is a reflection of which of Kepler's laws?
- First law
 - Second law
 - Third law
24. Which of Galileo's observations conclusively eliminates a geocentric model?
- Mountains on the moon
 - Phases of Venus
 - Sunspots
 - The Milky Way is composed of stars
25. Copernicus revived the idea that
- the Sun goes around the Earth.
 - the Earth goes around the Sun.
26. Copernicus' model of the solar system did not gain immediate acceptance in part because it
- could not explain retrograde motion.
 - did not predict planetary positions better than Ptolemy's model.
 - could not explain the daily motion of stars.
27. The terrestrial planets, which are composed primarily of rock, are located
- Some in the inner solar system, some in the outer.
 - In the outer solar system (far from the sun).
 - In the inner solar system (close to the sun).
28. Consider the orbit shown below. At what point in the orbit is the planet moving fastest?



29. According to the modern heliocentric understanding of the solar system, the Sun is _____ of the orbit of a planet like Mars.
- at the center
 - outside
 - off-center, at one focus

30. A GPS satellite orbits the Earth in a much higher orbit than the International Space Station. The time it takes the GPS satellite to orbit the Earth is _____ the time it takes the International Space Station.
- the same as
 - less than
 - more than
31. In the scale model of the solar system you constructed in lab the sun was a tennis ball 0.065 meters across and the Earth was about 5 meters from the Sun. If you made a different model in which the Sun was the size of a soccer ball 0.25 meters across then the Earth would be _____ meters from the Sun.
- more than 5
 - about 5
 - less than 5
32. Which of the following is an example in which you are traveling at constant speed but not at constant velocity?
- driving backward at exactly 50 km/hr
 - rolling freely down a hill in a cart, traveling in a straight line
 - driving around in a circle at exactly 100 km/hr
 - jumping up and down, with a period of exactly 60 hops per minute
 - None of the above
33. Which of the following is an example in which of an object has a velocity but no acceleration?
- A car driving around in a circular racetrack at exactly 200 km/hr.
 - A person jumping up and down, with a period of exactly 60 hops per minute.
 - A student pushes off on a sled and slides down a snowy hill, traveling in a straight line and speeding up as they go down the hill.
 - A car is driving at exactly 50 km/hr when the driver places the car in neutral and lets it come to a stop.
 - None of the above
34. The planets never travel in a straight line as they orbit the Sun. According to Newton's second law of motion, this must mean that:
- a force is acting on the planets.
 - the planets will eventually fall into the Sun.
 - the planets are always accelerating.
 - the planets have angular momentum.
 - the planets have gravity.
35. The fact that the Voyager 2 space probe continues to move out of the solar system, even though its rockets have no fuel, is an example of
- the universal law of gravitation.
 - Newton's first law of motion.
 - Newton's second law of motion.
 - Newton's third law of motion.
 - none of the above

**Discussion Questions for
PRACTICE Mid-Term #1:
(Turn this section in with “computer graded” sheet)**

On the actual mid-term exam, there will be three short answer questions of which you must answer two for full credit. If you answer all three, your best two answers will be used in determining your score.

Answer the questions below as fully and clearly as you can. You will be graded both on clarity (using full sentences that make sense) and on completeness and correctness.

- D1.** Why, in the heliocentric theory for the solar system, does the position of the sun appear to change over the course of a year? Feel free to include a diagram as *part of* your explanation, if you wish; a diagram is not necessary.
- D2.** Describe what you would see if you were standing on the surface of the Moon looking at the Earth during a Full Moon.
- D3.** How is the complicated motion of planets in the sky (a.k.a. retrograde motion) explained in terms of a heliocentric theory of the solar system.
- D4.** Explain in your own words what makes scientific theories different than other “ideas”.
- D5.** Describe Galileo’s observations of Venus and explain their significance in understanding the solar system.
- D6.** According to Newton’s third law, if a semi-trailer truck hits a little car, the force the truck exerts on the car is equal to the force the car exerts on the truck. Why is it that in such a collision that the car ends up much more damaged?