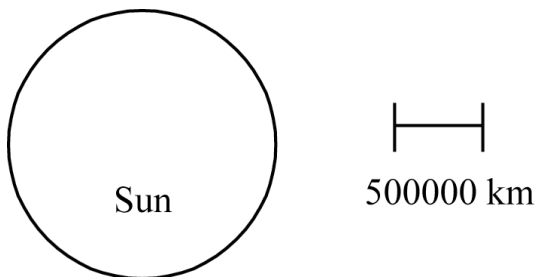


Astronomy 104 PRACTICE Mid-Term #1
Solutions
Spring Semester 2009

You really don't want to look at these solutions until you have attempted the practice mid-term exam, since the mid-term exam questions will be different than on the practice exam, "memorizing" these solutions is somewhat worthless.

Multiple Choice Questions Solution Key: Correct answers in **bold face** text.

1. A light-year is
 - a. the average distance between the Earth and the Sun
 - b. the time it takes light to travel 9.5×10^{12} kilometers
 - c. **a distance, not a time.**
 - d. the average size of a galaxy.
2. The majority of the volume of our galaxy, the Milky Way, is occupied by
 - a. the planets.
 - b. the Sun.
 - c. stars.
 - d. other galaxies.
 - e. **empty space.**
3. The average distance to Moon (from Earth) is approximately 382,500,000 meters. This would be written in scientific notation as
 - a. 382.5 thousand kilometers.
 - b. **3.825×10^8 meters**
 - c. 3.825×10^{10} meters.
 - d. 3.825×10^9 meters
 - e. 3.825 million meters.



4. Based on the diagram above, the diameter of the Sun is about
 - a. 150 km
 - b. **1,500,000 km**
 - c. 150,000,000 km
 - d. 1.5×10^9 km

5. Why do astronomers use units like “Astronomical Units” and “Light Years” instead of kilometers or miles when discussing distances?
 - a. **Because it allows us to represent astronomical distances with relatively manageable numbers.**
 - b. Because they don’t like metric units.
 - c. Because it makes conversions between units easy.
 - d. All of the above.
 - e. None of the above.
6. In a geocentric theory for the solar system the object at the center of the solar system is
 - a. the sun.
 - b. **the earth.**
7. 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 _____.
 - a. East to West; celestial equator
 - b. East to West; ecliptic
 - c. West to East; celestial equator
 - d. **West to East; ecliptic**
8. In the heliocentric model, the motion of the Sun across the sky over the course of a year is due to
 - a. The rotation of the Earth on its axis.
 - b. The tilt of the Earth’s axis.
 - c. **The revolution of the Earth about the Sun.**
 - d. The precession of the Earth’s axis of rotation.

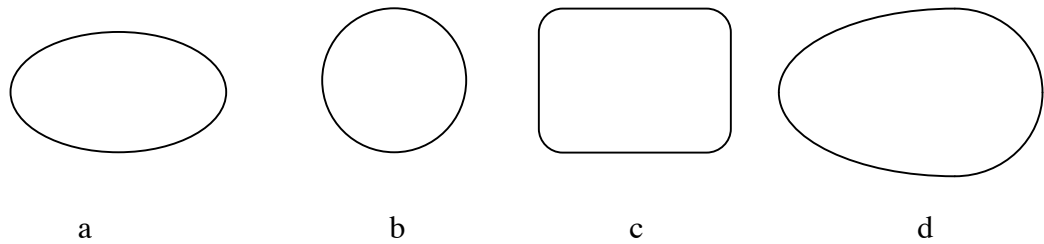


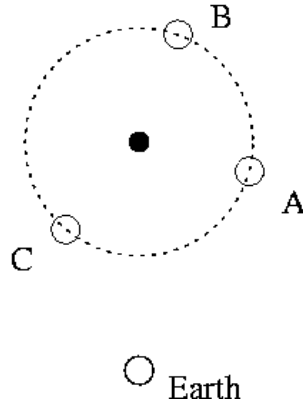
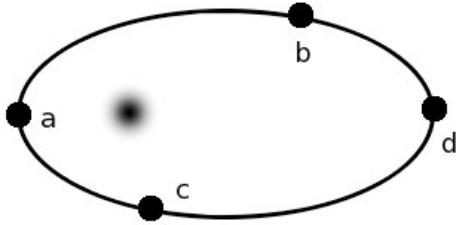
Figure for question 10.

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?
The answer is a.
11. Which of the shapes above most closely resembles the orbits of most planets in our solar system?
The answer is b. The actual eccentricity of most planetary orbits in our solar system is extremely small.
12. An idea is scientific if it
- Can be tested by experiment**
 - Is more simple than other ideas
 - Definitely correct
13. 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
14. 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.
- e. None of the Above

15. 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
16. According to Kepler's First Law, planets move on orbits around the sun that are
- Circles
 - Hyperbolas
 - Ovals
 - Ellipses**
17. 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.
18. 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.**
19. Imagine looking at a triple star system, in which two small stars orbit around a much larger star. One of the small stars, A, is close to the large star, and the other small star, B, is far from the large star. Star A takes _____ time to go around the large star compared to star B.
- more
 - the same
 - less**
20. The observation that Planets with a shorter period than Earth are closer to the Sun than Earth is a consequence of which of Kepler's laws?
- First law
 - Second law
 - Third law**
21. Which of Galileo's observations conclusively indicates that planets go around the Sun, not the Earth
- Moons of Jupiter
 - Phases of Venus**
 - Sunspots
 - The Milky Way is composed of stars

22. Consider the orbit shown below. At what point in the orbit is the star moving fastest?

The answer is a.



23. Copernicus revived the idea that
- the Sun goes around the Earth.
 - the Earth goes around the Sun.**

24. 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.

25. Which of the following was **not** an observation that Galileo made?
- Venus goes through phases
 - Jupiter has moons.
 - Planets move in elliptical orbits**
 - There are many faint stars in the sky that you can not see without a telescope.

26. The picture above shows the Earth, the Sun, and the orbit of the planet Mercury. At which of the points will Mercury appear almost full (i.e. almost all of Mercury's face would be lit up)?
- A
 - B
 - C

Discussion Questions Solutions for PRACTICE Mid-Term #1:

These solutions are very brief and just meant to point you in the right direction, we would likely expect you to be a bit more thorough in your explanations.

- 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.

In the heliocentric theory, the Earth goes around the Sun once a year. For this reason, the stars we see “behind the sun” will change during the year such that the Sun will appear to move a big circle around the sky during a year.

- D2.** 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.

Since the planets closer to the Sun move faster, Earth moves “past” outer planets like Mars and Jupiter during the year, resulting in a period when Mars and Jupiter appear to move retrograde relative to the stars.

- D3.** Explain in your own words what makes scientific theories different than other “ideas”.

A scientific theory is not “merely an idea,” instead it is an idea that makes clear predictions of what to expect in a given situation and has been repeatedly tested to verify those predictions are accurate.

- D4.** Give an example of an idea that is not scientific although it tries to explain something about the universe around us. Why is it not a scientific idea?

This question is fairly open to interpretation, but for example, the idea that an omnipotent God placed the planets in their orbits and set them up to move is an explanation for the current distribution of planets in the solar system and their motion. It is however not scientific because of two reasons I can think of: (a) it is impossible to disprove. For an idea to be scientific it must be possible to disprove it. Only if it stands up to tests that could disprove it can it be considered a well-supported scientific theory. The second reason (b) is because it makes no predictions that differ from a model in which the solar system formed “naturally” into its current configuration. What would be different about the solar system in a supernatural versus natural model? If there is nothing different, then there are no predictions made that can distinguish the two models, so the model is not scientific.

D5. Describe Galileo's observations of Venus and explain their significance in understanding the solar system.

Galileo's discovery of the phases of Venus, and more importantly that Venus had a "full Venus" phase, were not explainable by a theory where the planets orbited the Earth, but were clearly explainable by a theory where the planets orbited the Sun. Specifically, the theory that had the planets orbiting the Earth proposed Venus moved in a circle between the Earth and Sun... you can't get a "full Venus" phase unless Venus can move to the opposite side of the Sun as the Earth.