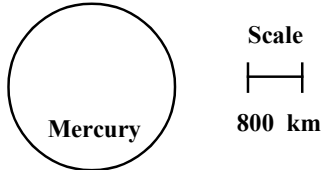


Astronomy 102 PRACTICE Mid-Term #1 Solutions

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.

- 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.
- Based on the diagram above, what is the diameter of Mercury?

The diagram shows a circle representing Mercury. To its right is a scale bar consisting of a horizontal line with vertical end caps. Above the scale bar is the word "Scale" and below it is the text "800 km".

 - about 240 km
 - about 2400 km**
 - about 24,000 km
 - about 240,000 km
 - about 2.4×10^6 km
- 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 of 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**
- 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.

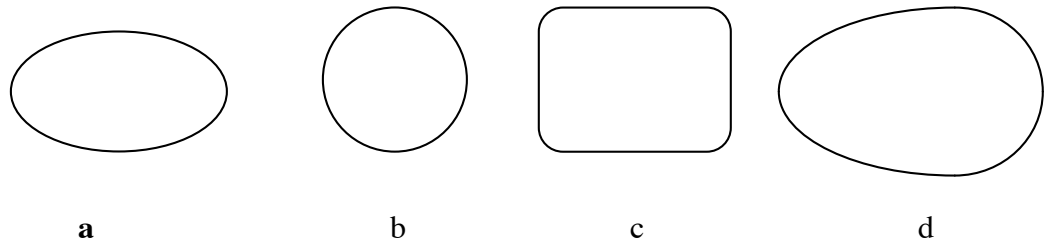
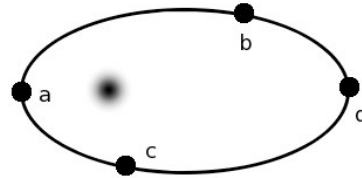


Figure for question 10.

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?
(“a” is correct answer)
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 next 3rd Quarter moon will be this coming Thursday, Oct. 4. What will the moon look like a week from today (about Oct. 7)?
- 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 consequence of which of Kepler's laws?
- First law
 - Second law
 - Third law**
24. Which of Galileo's observations conclusively eliminates a geocentric model?
- Moons of Jupiter
 - 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?



(The correct answer is "a", you should be able to state why this is the case!)

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 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 complete in your explanations. You may use drawings in your answers, but they must be accompanied by words.

D1.Why, in the heliocentric theory for the solar system, does the position of the sun in the sky, relative to the stars, 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.Describe what you would see if you were standing on the surface of the Moon looking at the Earth during a Full Moon.

You would see the Earth completely in darkness, a “new earth”. You would also see the Sun in the background, behind the Earth.

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.

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.

D4.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.

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.

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?

Recall Newton's 2nd Law which related force to mass and acceleration:

$$F = ma$$

If the two forces here are equal, that doesn't mean the accelerations are equal. Since the truck is a lot more massive than the car, the same force applied to it will result in a much smaller acceleration than when that force is applied to the car. That is why the car ends up a lot more damaged than the truck.