

Name: \_\_\_\_\_

Astronomy

Time Allotted: 25 minutes

Key: (\*) = none, one, or more than one answer possible (e.g. Answer: A, D, and E)

1. Which of the following statements are true of planets in the Solar System? (\*)

- a) Venus and Uranus have retrograde revolution around the Sun
- b) Mercury is the densest terrestrial planet
- c) The highest winds in the solar system are believed to be on Jupiter
- d) Resonance with the orbits of Jupiter and Saturn result in the location of the asteroid belt between the two

2. Which of the following statements are true of moons of the Solar System? (\*)

- a) The moons of Mars are within its Roche limit
- b) Mercury's moon features extreme temperature contrasts
- c) All moons in the solar system have tenuous atmospheres due to their low mass
- d) Earth's moon has a heterogeneous interior

Homer the Astronomer tracks the movement of Mars from Earth, and notices that it suddenly appears to move backwards in the sky. The sidereal period of Mars is approximately 1.9 Earth years. Answer the following two questions based on these observations.

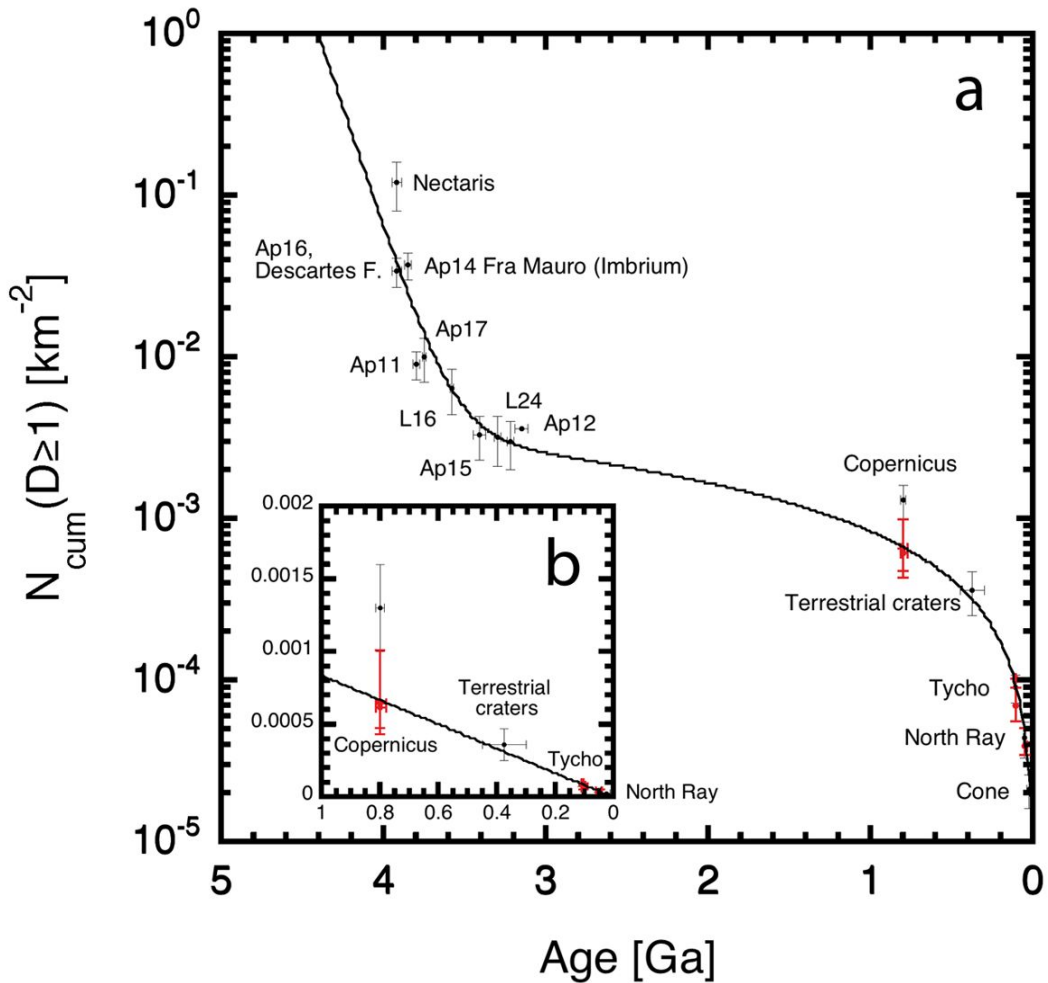
3. Which of the following is the best explanation?

- a) Mars actually moves in small epicycles that are occasionally amplified
- b) The relative position of the Sun causes "phases" that create this illusion
- c) Near conjunction, Mars appears to move backwards
- d) Near opposition, Mars appears to move backwards

4. Homer must wait approximately how many years before he sees the phenomenon again?

- a) Slightly less than one year
- b) Slightly more than one year
- c) Slightly less than two years
- d) Slightly more than two years

Using the figure below, answer the two questions that follow.



5. The diagram depicts information related to which celestial body?

- a) Earth
- b) Moon
- c) Venus
- d) Mars

6. Which of the following factors help to explain the shape of the overall curve in the figure? (\*)

- a) Larger impacts occurred more frequently billions of years ago.
- b) The formation of an atmosphere roughly 1 billion years ago.
- c) Erosion by micrometeorites and the solar wind.
- d) Greater volcanic activity later in the body's development.

7. The figure-eight shape that the sun traces out in the sky over a course of a year is the result of which of the following? (\*)

- a) Eccentricity of orbit
- b) Precession of axis
- c) Axial tilt
- d) Rotation about axis

Bellatrix, the third-brightest star in Orion has right ascension 5h 25m and declination  $+6^{\circ} 20'$ . Further, the local sidereal time is 18:00. Given this data, answer the following three questions.

8. To the nearest hour, how long will it take for Bellatrix to be at the highest relative position in the night sky?

- a) 5 hours
- b) 6 hours
- c) 7 hours
- d) 8 hours
- e) 10 hours
- f) 11 hours
- g) 12 hours
- h) 13 hours

9. The observer also happens to be located at latitude  $6^{\circ} 20' N$ . What is the altitude of Bellatrix if it is in its highest relative position in the night sky?

- a) 0 degrees
- b) 45 degrees
- c) 90 degrees
- d) 180 degrees
- e) Undefined

10. What is the azimuth of Bellatrix under these conditions? Use North as the baseline.

- a) 0 degrees
- b) 45 degrees
- c) 90 degrees
- d) 180 degrees
- e) Undefined

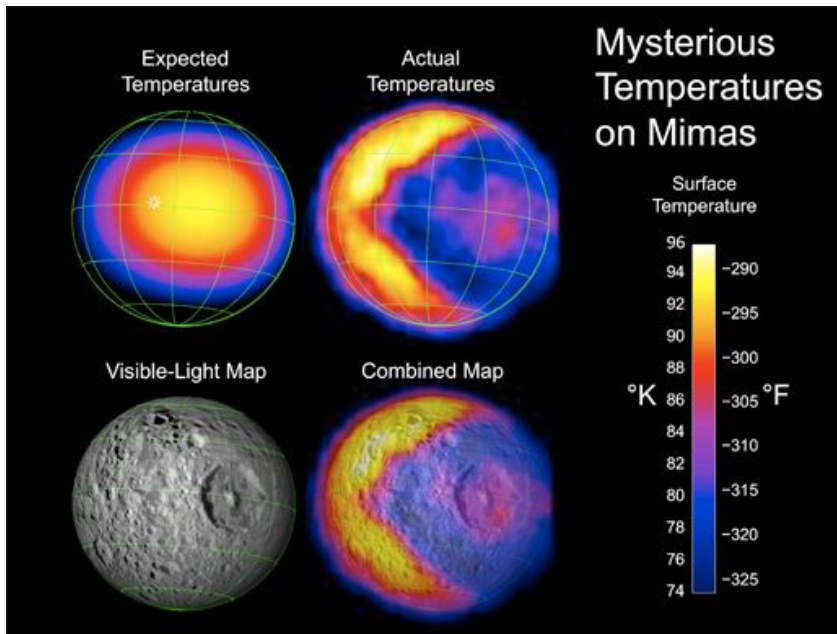
11. A mysterious new planet is discovered orbiting the Sun. High concentrations of metal oxides and silicates are discovered upon preliminary analysis. Which of the following statements are likely correct of this planet? (\*)

- a) The planet likely formed relatively early on in comparison to other planets
- b) The planet likely formed relatively later on in comparison to other planets
- c) The upper limit on its age is probably around 13.7 billion years
- d) The interior is probably differentiated due to radioactive decay and gravitational collapse

12. On October 14, the declination of the Sun was -8.5 degrees. At noon, an observer located at 29 degrees South calculates the angle the Sun makes from the zenith. To the nearest degree, what is this angle?

- a) 0 degrees
- b) 9 degrees
- c) 21 degrees
- d) 38 degrees
- e) 52 degrees
- f) 69 degrees
- g) 90 degrees

Consider the following thermal image of Mimas, a moon of Saturn. Further, the density of the planet is found to be  $1.15 \text{ g/cm}^3$ . Answer the following three questions based on the image.



13. Mimas is likely composed mostly of:

- a) Dry ice
- b) Water ice
- c) Silicates
- d) Metals and metal oxides

14. Which of the following is the best hypothesis for why the expected temperature distribution differs from what is actually observed?

- a) The moon is abnormally heated by Saturn
- b) Volcanic activity combined with irregular terrain
- c) Differences in thermal conductivity on the surface
- d) The prominent crater helps to shield from heating

15. The side opposite from the major crater is likely characterized by:

- a) Smooth, basaltic terrain
- b) Jumbled, fractured terrain
- c) Mountainous, volcanic terrain
- d) Extensive icy terrain

Consider the following data:

<i>Sea Level Temperature</i>	<i>Dew Point</i>	<i>Dry Adiabatic Lapse Rate</i>	<i>Wet Adiabatic Lapse Rate</i>	<i>Dew Point Lapse Rate</i>	<i>Environmental Lapse Rate</i>
34 degrees Celsius	22 degrees Celsius	10 degrees Celsius per kilometer	6 degrees Celsius per kilometer	2 degrees Celsius per kilometer	7 degrees Celsius per kilometer

16. At what minimum altitude will clouds begin to exhibit significant vertical development (hint: they must be convectively buoyant)?

- a) 1 km
- b) 1.5 km
- c) 2 km
- d) 2.5 km
- e) 3 km
- f) 3.5 km
- g) 4 km
- h) 4.5 km
- i) 5 km
- j) 5.5 km
- k) 6 km
- l) 6.5 km