

1508

Tour of the Solar System

ASTR 1530

Spring 2008, Exam #1

February 14, 2008

Instructions: There are a total of 20 problems in this exam, worth 5 points each. Attempt as many problems as possible, write your answers on the question sheet, and turn it in at the end of the class. You should need to write no more than a few sentences to answer descriptive questions. Please note that this is not an open-book exam: no books, notes or laptops may be used.

Be sure to fill out your name below.

NAME:

81.5

(please print legibly)

[1] List the 8 major planets in our Solar System, in order of their increasing distance outward from the Sun.

Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune

[2] Pluto is no longer considered to be a major planet. State whether each of the following potential reasons for its change in status is true or false:

- (a) Pluto has a more eccentric orbit around the Sun than the major planets *true*
- (b) Pluto does not have a moon and therefore cannot be considered a planet *false*
- (c) Pluto does not have an atmosphere and therefore cannot be considered a planet *false*
- (d) Pluto is irregular in shape, like an asteroid, not rounded, like a planet *false*
- (e) Pluto is smaller than another body in orbit around the Sun beyond Neptune that is not considered a planet *true*

[3] Match up the surface features (a) – (d) with the bodies (i) – (iv) on which they are located:

- | | |
|---------------------------------------|----------------------|
| (a) The Caloris Basin <i>(iv)</i> | <i>(i)</i> The Earth |
| (b) Mare Imbrium <i>(iv)</i> | <i>(ii)</i> Mercury |
| (c) The Chicxulub Crater <i>(iii)</i> | <i>(iii)</i> Venus |
| (d) The Maxwell Mountains <i>(iv)</i> | <i>(iv)</i> The Moon |

[4] Match up the terms (a) – (e) with the correct description (i) – (v):

- | | |
|---------------------------------------|---|
| (a) Superior conjunction <i>(iii)</i> | <i>(i)</i> The Earth's orbital plane around the Sun |
| (b) Ecliptic <i>(i)</i> | <i>(ii)</i> The angle between the plane of a planet's orbit and that of the Earth |
| (c) Epicycle <i>(v)</i> | <i>(iii)</i> The point in an inferior planet's orbit at which it is farthest from Earth |
| (d) Inclination <i>(ii)</i> | <i>(iv)</i> Motion of an inferior planet across the face of the Sun |
| (e) Transit <i>(iv)</i> | <i>(v)</i> Apparent retrograde motion of a planet near opposition |

[5] Briefly explain the difference between a total solar eclipse and an annular solar eclipse.

A total solar eclipse occurs when the moon passes between the sun and the Earth at its closest point to earth in its orbit, completely blocking out all but the corona of the sun.

An annular solar eclipse occurs when the moon passes between the sun and the Earth at the farthest point in its orbit, leaving a ring of sunlight visible.

[6] Which of the following is the best time to observe Venus from the Earth?

[There may be more than one correct answer: check all that apply.]

- ☒ (i) Greatest Eastern Elongation
- ☒ (ii) Inferior Conjunction
- ☒ (iii) Greatest Western Elongation
- ☐ (iv) Superior Conjunction

[7] State whether each of the following statements is true or false:

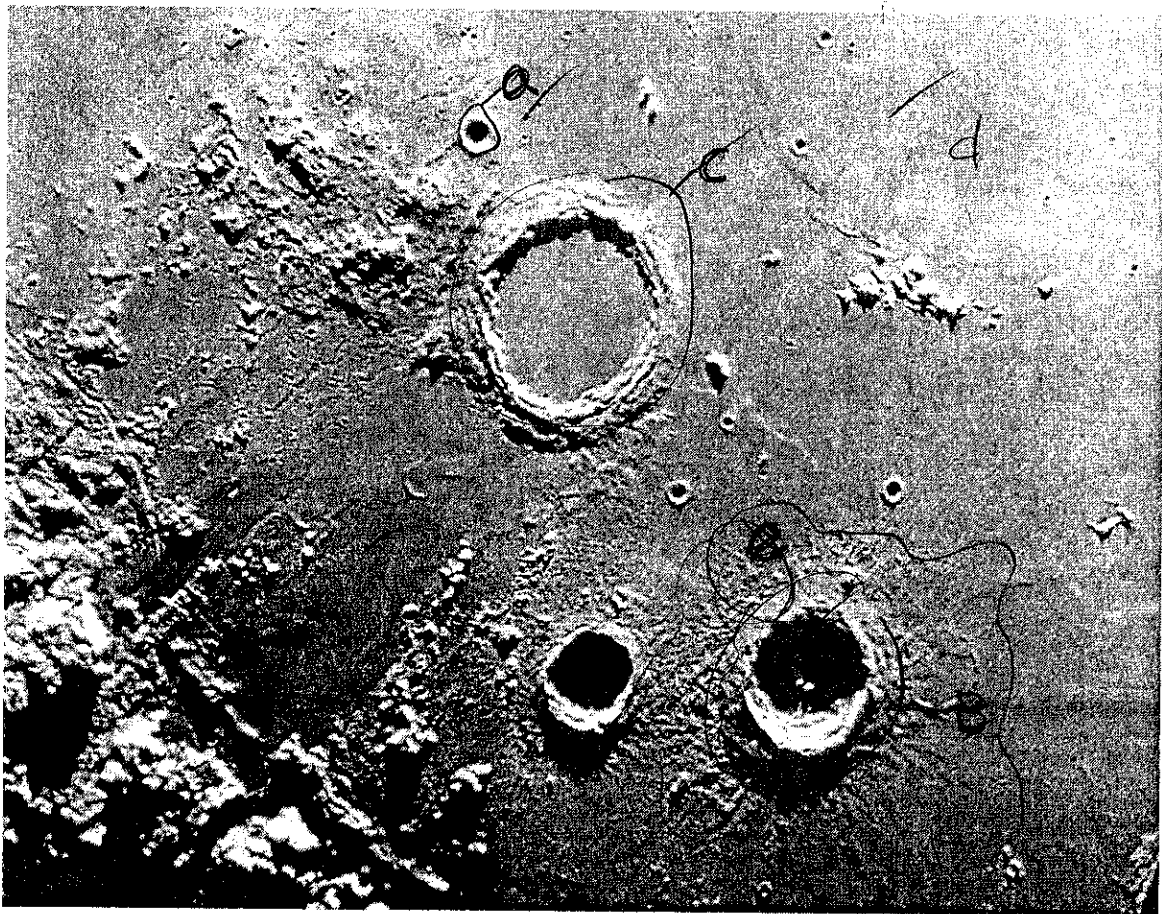
- (a) When Venus is at greatest eastern elongation it may be observed in the evening sky after sunset ~~false~~
- (b) When Mercury is at greatest eastern elongation it may be observed in the morning sky before sunrise ~~true~~
- (c) When Mars is at opposition it displays a fully illuminated disk as viewed from the Earth ~~true~~
- (d) There can never be an annular eclipse of the Moon ~~true~~
- (e) A transit of Mercury occurs when Mercury passes directly between the Earth and the Sun ~~true~~

[8] Briefly explain what is meant by "saturation cratering" of a planetary surface.

-5 When the entirety of the surface of a planet has an equal distribution of craters, the size and type of craters can be used to determine the rough geologic age of the planet's surface.

[9] Identify by labeling on the image of lunar cratered terrain below:

- (a) A simple impact crater
- (b) A complex impact crater
- (c) An impact crater that subsequently flooded with magma
- (d) A volcanic plain
- (e) Debris ejected by an impact that formed a crater

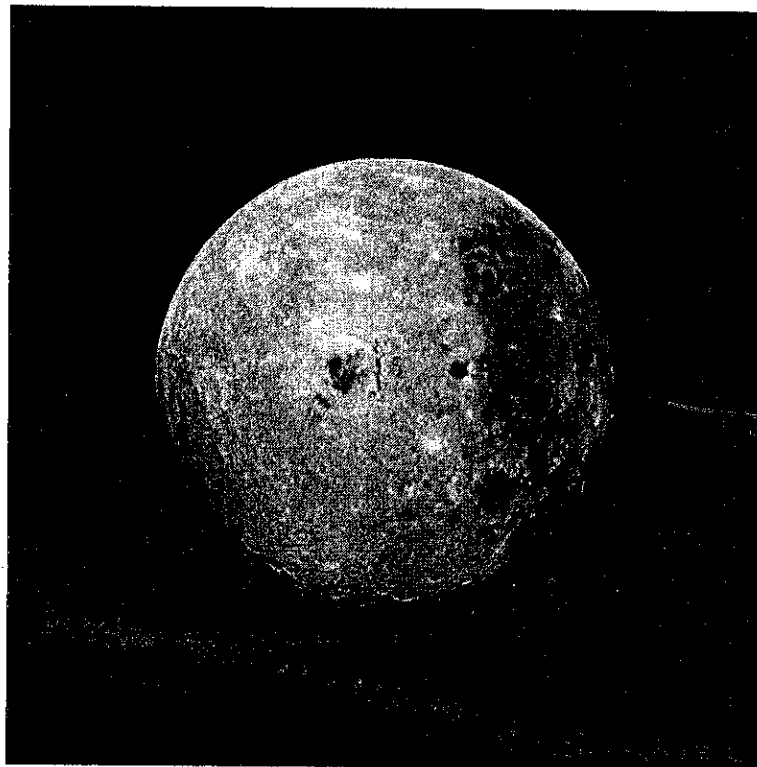


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[10] The Moon's highlands have an average crater density per unit surface area that is a factor of about 10 higher compared with the lunar plains ("mare"). Which of the following is the most likely explanation of this fact? (There is only one correct answer).

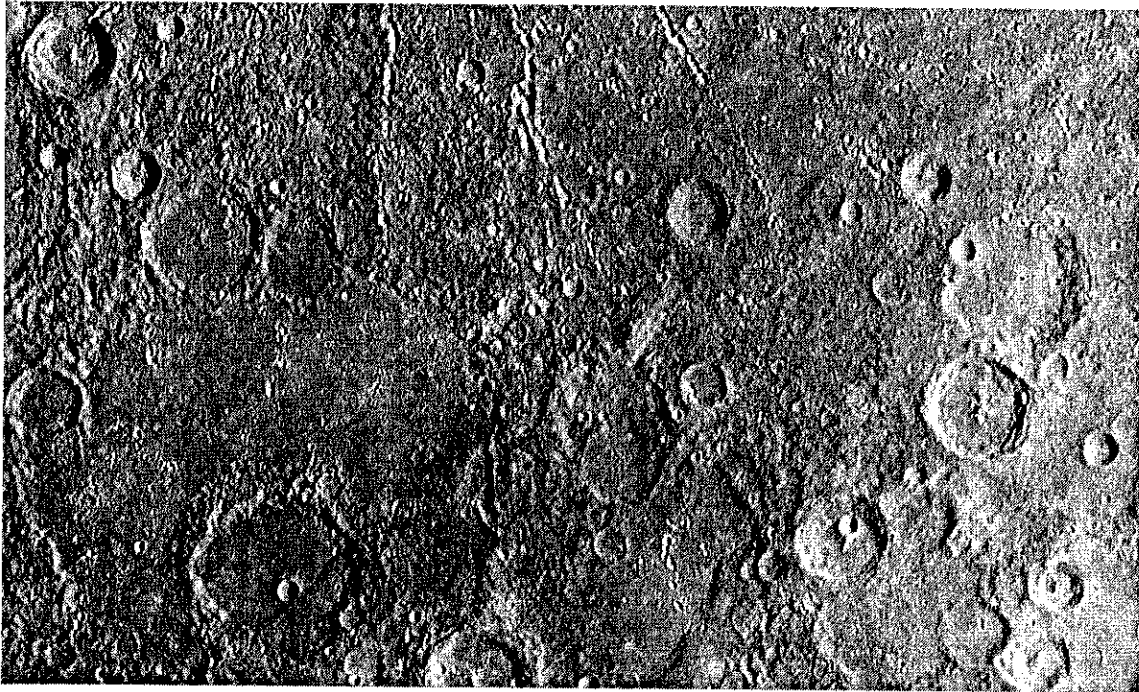
- (a) Because the plains are made of basalt, which is dense, they were impervious to impacts.
- ☒ (b) Volcanic activity destroyed most of the older craters on the plains.
- (c) Crater-forming impacts were more frequent on the highlands.

[11] The image of the Moon below, taken by the Galileo spacecraft, shows a different (side-on) view compared with what we see from Earth. Indicate by labeling the most probable direction of the Earth relative to the Moon on this image.



[12] The image of cratered terrain on Mercury below was taken by the Messenger Mission during a recent flyby. By studying the distribution of craters and their sizes, determine which of the following statements is most likely to be true:

- (a) The larger impacts mostly occurred early in Mercury's history; the more recent ones tend to be smaller.
- (b) The early impacts were generally small; the larger ones came later.
- (c) Small and large impacts occurred at about the same rate throughout the cratering process.



[13] It is generally agreed that Mercury must have a large core composed mostly of iron. Which of the following statements is the true reason for this conclusion? (There is only one correct answer).

- (i) Seismic data from NASA missions to Mercury indicate the presence of an iron core.
- (ii) Mercury has an iron-rich crust and therefore must also have an iron-rich core.
- (iii) Iron is the only abundant planetary material that is dense enough to explain Mercury's high average density.

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[14] A shield volcano is observed at a particular location on the Earth's surface. Which of the following statements is most likely to be true? (There is only one correct answer).

- (a) The region is close to a lateral fault
- ☒ (b) The region might be close to a rift zone, or it might be remote from any tectonic plate boundary
- (c) The region is close to a subduction zone

[15] A strato (cone-shaped) volcano is observed at a particular location on the Earth's surface. Which of the following statements is most likely to be true? (There is only one correct answer).

- (a) The region is close to a rift zone
- ☒ (b) The region is close to a subduction zone
- (c) The region is remote from any tectonic plate boundary

[16] Of the two major classes of volcano found on Earth (strato and shield), only one is found on Venus. Which one? What is the significance of this result?

~~Shield~~. This means that Venus doesn't really have any tectonic plates - not definitively, but it does have convection hot enough to melt through the crust enough to form shield volcanoes.

[17] Radar maps of the surface of Venus have demonstrated that the entire surface is uniformly cratered, with a density much less than the most highly cratered areas of the Moon. What can we deduce from this about the way Venus' crust has evolved?

It can be deduced that Venus has resurfaced itself fairly recently with respect to geologic time compared to when the moon was last volcanically active.

[18] If present-day Venus could be towed away from the Sun, to a distance similar to the distance of the Earth from the Sun, do you think it would become a suitable habitat for life? Explain your answer. (Assume that Venus and the Earth do not collide!)

No because there is little to no water left to speak of left on Venus. For life as we know and understand it, water is vital. If mass amounts of water suddenly found itself on a Venus now Earth's distance from the sun, then yes, it very likely could become a suitable habitat for life.

[19] On the Moon, craters above about 20 km in diameter are usually complex and those below 20 km are usually simple. Would you expect this "cross-over size" to be greater, smaller, or about the same on a more massive planet like Mercury?

(Assume that its surface is made of the same material). Explain your answer.

I would expect this "crossover size" to be perhaps a bit bigger on Mercury because it's larger and more dense, and thus has more gravitational pull back on the material shot upwards. ... more gravity, so smaller crossover size

[20] Between 1902 and 1929, Daniel Barringer, a mining engineer from Philadelphia, invested large sums of money on a project to mine within the Arizona Meteor Crater. He believed there to be rich and extensive mineral deposits from the original impactor buried below the surface, but none were ever found. Explain briefly why his investment was not a good one.

Because the crater was formed by a relatively small object that broke up upon impact and was deposited outside the crater, not in it.