

**Answer all questions in the space provided. If you have any questions, raise your hand.
100 points possible. NO CALCULATORS OR ANY ELECTRONIC DEVICES.**

1 (2 pts) The **semi-major axis** of an elliptical orbit can also be thought of as the:

- (a) speed of the orbit
- (b) shape of the orbit
- (c) amount of “flatness” of the orbit
- (d) average distance of the orbit

2 (2 pts) If you were in a dark room with an object that emits light **ONLY** in the ultraviolet part of the spectrum, how would this object appear to your eyes?

- (a) very bright and blue
- (b) very dark and blue
- (c) very bright and red
- (d) very dark and red
- (e) invisible

3 (2 pts) Pristine Highland Rock (Anorthosite) formed when:

- (a) The original crust of the Moon cooled
- (b) The surface of the Moon was shattered and melted by an impact
- (c) The surface of the Moon melted and flowed across the Moon
- (d) The surface of the Moon was impacted into a powder

4 (2 pts) The main reason that the crater density in the lunar mare is less than the crater density in the highlands is because:

- (a) the highlands have not suffered as much erosion over time.
- (b) cratering is a random process, and the mare just have fewer craters.
- (c) the mare were formed by different materials than the highlands.
- (d) the mare were formed at a later time than the highlands.
- (e) the mare were formed by volcanic activity.

5 (2 pts) What is the best evidence we have that shows that the Earth was extensively cratered 4 billion years ago.

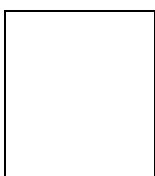
- (a) There are lots of craters on old Earth surfaces.
- (b) There are no dinosaurs on the Earth today.
- (c) Old surfaces of the Earth are littered with meteorites.
- (d) We have determined the ages of the lunar highlands.
- (e) There is no evidence of cratering on the early Earth.

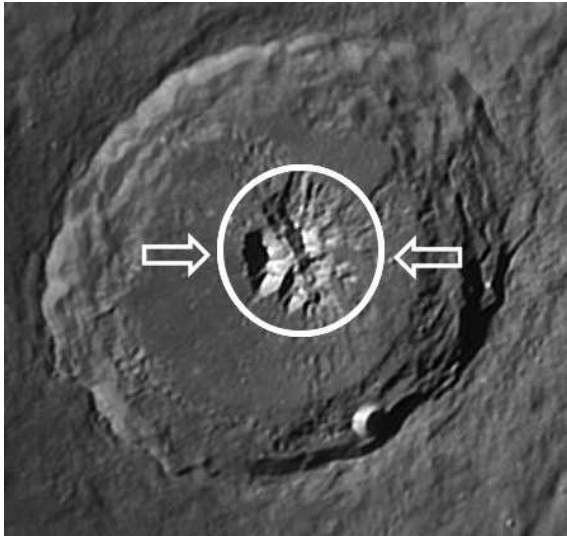


6 (8 pts) Give two (2) reasons why crater counting would be a really poor way to determine the difference in ages between the various Hawaiian islands.

7 (8 pts) Liquid water existed on the **surface** of Mars in the past. What was different about the conditions on the surface of Mars in the past as compared to now?

8 (2 pts) The density of **water** is _____





On the left is an image of a **complex crater** on the Moon.

9 (2 pts) Identify the feature marked in the center of the crater.

10 (6 pts) Explain how the feature marked in the center was formed.

11 (8 pts) Explain why samples from this marked feature would be **older** than samples collected outside the crater rim.

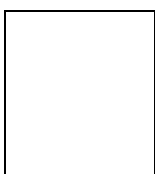
12 (2 pts) It is determined that samples collected at the **rim** of this crater came from a depth of about **10 km**. What is the diameter of this complex crater?



13 (8 pts) Explain how two worlds made of the exact same materials, but with very different **masses**, can have the same surface gravity.

14 (8 pts) Explain how two worlds made of the exact same materials, and with the same **surface gravity**, can have very different atmospheric surface pressures.

15 (2 pts) The density of **rock** is about _____



16 (8 pts) Explain why the volcanic activity on Venus lasted longer than the volcanic activity on Mars.

17 (8 pts) The impactor that killed the dinosaurs was *very, very small* compared to the size of the Earth. Explain why this event was so destructive to life over the entire surface of the Earth.

18 (2 pts) The density of **iron** is about _____



For each of the following surfaces, tell me: **(1)** the most likely rock type found on the surface **(2)** the most probable age of the surface (I want a number with units), **(3)** How the age of the surface was determined, and **(4)** what processes are modifying the surface TODAY.



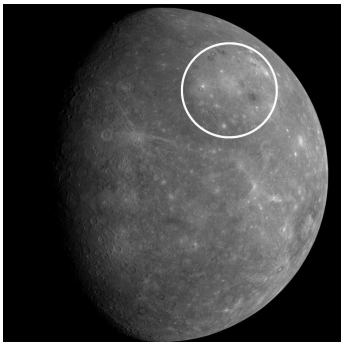
19 (8 pts) Earth - Big Island of Hawaii

Sample Type: _____

Surface Age: _____

How surface age was determined:

Processes modifying surface today:



20 (8 pts) Mercury - Caloris Impact Basin

Sample Type: _____

Surface Age: _____

How surface age was determined:

Processes modifying surface today:

