

Given (a.k.a. 'First') Name(s): \_\_\_\_\_ Family (a.k.a. 'Last') name: \_\_\_\_\_

**ON YOUR PARSCORE:** Write your name, and 'bubble' your student I.D. number, your test version, and answers. I will keep the Parscore forms. **MAKE SURE TO LOOK AT EVERY PAGE OF THE EXAM.**

**ON THIS TEST PACKET:** Write your name. Circle your multiple-choice answers on this packet. I will hand this packet back to you, and you'll keep it.  
You need to write your name on this packet to find out your grade.

## **ASTRONOMY 4 Exam 3**

## **PRACTICE VERSION**

### **True/False (3 pts. each)**

If the statement is fully true, bubble "A". If some or all of it is false, bubble "B".

1. The solar wind distorts the Earth's magnetosphere, giving it a long 'tail' that points away from the Sun.
2. Mercury's surface is hotter than Venus's because of the strong greenhouse effect in Mercury's atmosphere.
3. Mars's polar caps contain permanent deposits of water ice, because the polar regions of Mars are too cold for that type of ice to evaporate.
4. The rugged, light-colored lunar highlands are mostly made of a type of lava rock called basalt.
5. All of the dwarf planets are Trans-Neptunian Objects; none of them gets closer to the Sun than Neptune's orbit.

### **Matching (4 pts. each)**

Matching Set 1 (Q 6 - 8): For each question, choose the item from "a" through "e" that fits best. (Items from a-e can be used more than once.)

- a. Outflow channels
- b. Olympus Mons
- c. Valles Marineris

- d. Opposition
- e. Valley networks

6. Large Martian volcano
7. Martian landforms that suggest rapid, large-scale outpourings of water from water-bearing rock layers
8. Relative positioning of Earth and Mars that allows for the best telescopic observations of Mars
9. Martian landforms that suggest rainfall or snowmelt on early Mars

**Multiple Choice (General Knowledge) 5 pts. each**

Choose the ONE best answer, and 'bubble' it on your Parscore form.

10. The part of the Bay Area around Foothill and De Anza Colleges has earthquake faults which, if they slip and break the ground surface, could push one part of the Earth's crust over another. This is similar to what sort of feature that we see on another planetary body?
- The lobate scarps on Mercury.
  - Valleys formed by crustal stretching, like the Valles Marineris on Mars.
  - The circular coronae on Venus
  - High-standing portions of the crust, like the lunar highlands.
11. Which of these is a correct example of a difference between our Moon and most of the moons in the outer solar system?
- Our Moon is a captured asteroid, unlike their moons, which formed by giant impacts with the parent planets.
  - The Earth's Moon is much older than any of the other moons, having formed billions of years before the rest of the solar system.
  - Our Moon orbits the Earth much faster than they orbit their planets, because the Earth is so much more massive than the outer planets.
  - Most of those moons contain a lot of ice, but our Moon doesn't.
12. Which of the following is a good description of a type of surface feature on Venus, which is similar to a type of surface feature produced by plate tectonics on Earth?
- Venus shows folded mountain ranges, such as the Maxwell Mountains. These are somewhat similar to the folded mountains of Earth, which are produced in places where plates move toward each other.
  - Venus has large areas of flat plains, which appear to have been produced by vast outpourings of lava that flooded the plains.
  - There are circular features on Venus called 'coronae' that are almost identical to the circular coronae on Earth. These circular features on Earth are one of the main features made by plate-tectonic processes.
  - Venus has impact craters scattered randomly over its surface, which is also a sign of plate tectonics on the Earth.
13. Which of these statements about the Apollo missions to the Moon is most accurate?
- Twelve astronauts walked on the Moon between 1969 and 1972, and the last mission had a geologist on the crew.
  - Apollo 11 was the only successful mission to the Moon, and the program was cancelled after this victory in the 'space race'.
  - Although two dozen astronauts (on 7 missions) orbited the Moon and studied it from only 60 miles away, only one crew ever walked on the surface.
  - The first Moon landing might have happened before the end of the 1960s but the U.S. waited until after the Vietnam War was over before sending astronauts there in the mid-1970s.
14. Which of these best explains why the surface of Mars is so much colder than the surface of the Earth?
- Mars's surface reflects too much of the Sun's energy back into space.
  - Mars's thin atmosphere can't produce much of a greenhouse effect.
  - Some of the sunlight that would otherwise reach Mars is partially blocked by the asteroid belt.
  - Mars is closer to the Sun than the Earth.

15. Nearly every impact crater in the solar system is round, such as on the Moon, Mars, and Mercury. Why is this?
- When an impacting body hits the target object, it creates a rapidly expanding shock wave that is spherical in shape.
  - The asteroids that hit the inner planets were round, because they had suffered many small collisions with other asteroids.
  - The gravity of the 'target' object (such as the Moon or Mercury) pulls the 'impactor' vertically downwards toward its surface, so the 'impactors' never hit at an angle.
  - After astronauts brought back lunar samples, scientists realized the so-called 'impact' craters were actually round volcanic craters.
16. In 1877, Mars was at opposition as seen from the Earth, and the Italian astronomer Schiaparelli described seeing 'canali' (singular: 'canale') on its surface. This wasn't translated into other languages (such as English) correctly. What was the result?
- The study of Mars was set back for many years, because Schiaparelli hadn't seen evidence of ongoing volcanic activity.
  - People thought he meant 'canals', which would imply that there are intelligent, canal-building Martians on the surface.
  - Astronomers reading translations of his report thought he meant that the surface of Mars is broken into large, channel-like valleys and ridges due to the fracturing of its crust.
  - Other astronomers were highly impressed with the resolving power of his telescope, and basically left the study of Mars entirely up to him for decades.
17. Which of these parts of the Earth is the part that generates its magnetic field?
- The Earth's inner core
  - The Earth's lithosphere
  - The Earth's mantle
  - The Earth's outer core
18. Let's say that a friend of yours says they would like to be part of a human-spaceflight mission to Venus. Why might you be skeptical of their dream of being the first person on the surface of Venus?
- The extremely high pressure and temperature at the surface of Venus would make it exceedingly difficult to protect a person from being crushed and fried at the same time.
  - Venus's great distance from the Sun makes it extremely cold, and it would be hard to survive those surface conditions.
  - Venus is so far from the Earth, compared to other planets, that the trip would take much too long to be practical.
  - The thick atmosphere would make it very hard to land safely on the surface of Venus.

**Multiple Choice (Deeper Thought) 8 pts. each**

Choose the ONE best answer, and 'bubble' it on your Parscore form.

19. Astronomers have found that our solar system is not the only one in the Milky Way galaxy. They sometimes find evidence of "debris disks" in these solar systems, leftovers from the process of solar-system formation. If they found an icy debris disk at the outer edge of a solar system, it would be like which of the following parts of our solar system?
- The zone of inner planets
  - The belt of Trans-Neptunian Objects
  - The zone of outer planets
  - The asteroid belt
20. Some people who advocate for spaceflight funding claim that "If the dinosaurs had had a space program, they might still be around!". What do they probably mean by this:
- Dinosaurs could not breathe oxygen, and so they might have used resources (from asteroids) to soak up the growing amount of poisonous oxygen that built up in the Earth's atmosphere about 65 million years ago.
  - If the dinosaurs had been intelligent enough to fly in space, they might have found wormholes in spacetime that would allow them to jump into the future and avoid their (formerly) inevitable extinction.
  - With a sufficiently advanced space program, they might have been able to deflect the asteroid that hit the Earth 65 million years ago. This asteroid darkened the sky with dust and smoke and crashed the ecosystem they lived in.
  - The Earth has gotten much closer to the Sun since the time of the dinosaurs, making our climate much hotter than it was in their time. With spaceflight technology, they could have escaped to Mars, where it's almost as cold as Earth once during the age of dinosaurs.
21. One can find deep canyons on both the Earth and Mars, such as the Earth's Grand Canyon and Mars's Valles Marineris. What is something that's fundamentally different about these two canyons?
- The Valles Marineris is a much younger feature than the Grand Canyon. The Grand Canyon is older than most of the geological features on Mars.
  - Unlike the Valles Marineris, the Grand Canyon is basically a large rift or crack on the side of a huge volcanic bulge.
  - The Grand Canyon was carved by flowing water, whereas the Valles Marineris was the result of faulting, which was due to stretching of the crust.
  - The two canyons are nearly identical in appearance and geological history - there really isn't a significant difference between them.
22. If you were on Mars, you'd notice that the atmospheric pressure decreases noticeably during the winter. Which of the following is the most likely explanation?
- The intense magnetic field of Mars changes as Mars goes around the Sun, and can compress the atmosphere more (or less) at certain times of year.
  - It is a result of Mars's strong greenhouse effect, since Mars has a much thicker atmosphere than Earth or Venus.
  - Each year, when one hemisphere or another experiences winter, it triggers massive water flow in the outflow channels and valley networks, and this rapidly-moving water sets up strong currents in the atmosphere.
  - Some of Mars's atmosphere freezes out onto each polar cap during the winter, reducing the total amount of atmospheric gas for a while.

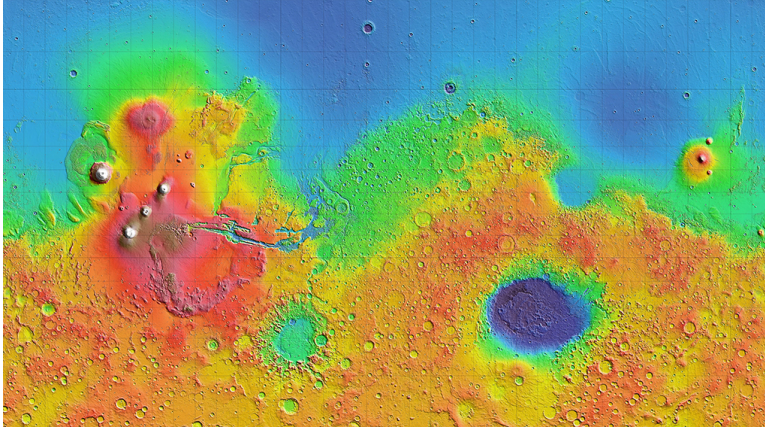
**Extra-Credit Multiple Choice (9 pts.)**

If you want to try either of these, choose the ONE best answer, and 'bubble' it on your Parscore form.

23. (Extra Credit) (9 pts.) (Extra Credit, 9 pts) The Earth's oceans would have an average depth of 3,000 meters if you spread them over the whole surface. The Earth's radius is  $6.4 \times 10^6$  meters. The radius of Mercury is  $2.4 \times 10^6$  meters. If Mercury had an ocean all over its surface, and it was 3,000m deep everywhere, how much water would Mercury have, compared to the Earth?
- a. About 14 times as much water as the Earth has
  - b. About 1/20th of the amount of water the Earth has
  - c. About 1/100th of the amount of water the Earth has
  - d. About 1/7th of the amount of water Earth has
  - e. About 10 times as much water as the Earth has

## Slide Section

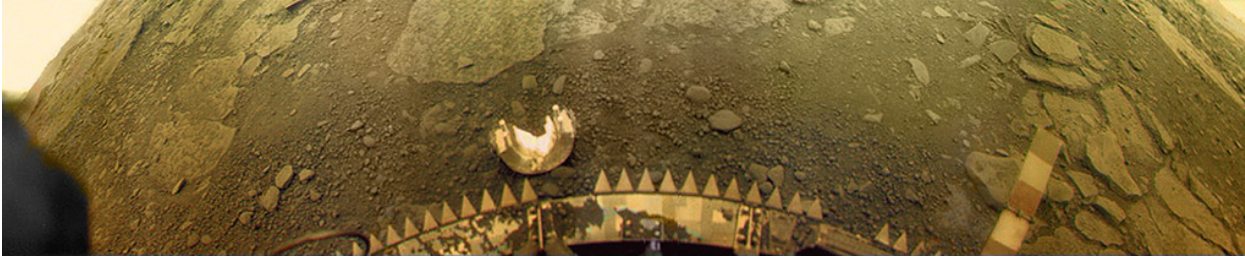
For each slide: Q1 = 3pts, Q2,3 = 6pts each, Q4 = 8 pts.



Q 24-27

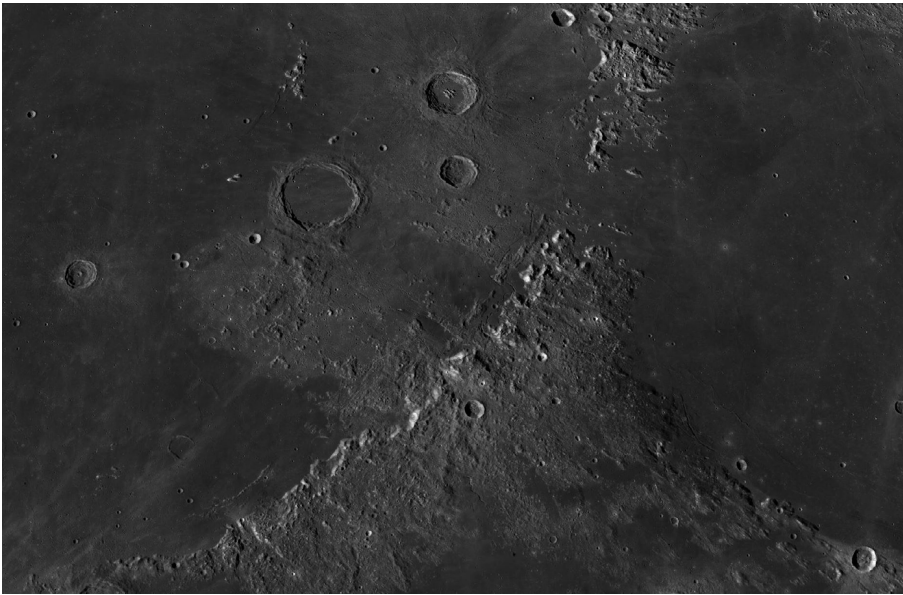
This is a global elevation map. Blue colors are low areas, while the red and white areas are the highest. Green and orange are in between.

24. (T/F) On this global map of the surface of a planetary body, we can see that some parts of the surface are probably much older than other parts of the surface.
25. This global elevation map shows the surface of which planetary body?
- Earth
  - Venus
  - Mars
  - Mercury
26. The left-hand half of this image shows an area of high elevation, with four prominent mountains on it. Which of the following is the best description of this high-standing region?
- It is a large impact basin, formed by an asteroid impact that nearly shattered this planetary body.
  - It is an accumulation of sedimentary rock layers, and was first climbed by the Spirit rover in the early 2000s.
  - The four prominent "mountains" are actually the last four asteroids to hit this planetary body, and they can still be seen embedded in the body's surface.
  - It is the Tharsis bulge, with four large shield volcanoes on it.
27. Looking at this map, we can see that the northern part of this planetary body looks different from the southern part. How might this be interpreted in a way that could be favorable for life having existed here in the past?
- Because there are so many craters on the northern part of this body's surface, we should look for life on the southern part, which has experienced far fewer impacts.
  - The southern area has clearly experienced a heavy impact bombardment, and the heat from such impacts is the most important factor in the origin of life.
  - The flat, low-lying northern plains might be sedimentary rocks deposited in an ocean, which might have harbored life.
  - Actually, the best place to look for life would be in the prominent dark-blue area in the southeastern (lower-right) part of the map, since that particular spot has clearly never experienced any impacts.



Q 28-31

28. (T/F) The orangish-colored light that we see illuminating this planetary surface is due to the fact that the planet orbits a star that's not our Sun - it's a red giant star in the constellation Scorpius.
29. Even though we don't know the exact types or ages of rocks in this picture, why would it be reasonable to guess that they are volcanic rocks less than 0.5 - 1.0 billion years old?
  - a. Planetary bodies like this one, and like the Earth, only have volcanic rocks on their surfaces.
  - b. This isn't actually correct, and it's almost certain that this image shows rocks many billions of years old.
  - c. All planetary surfaces in our solar system are that young.
  - d. This planet appears to have been volcanically resurfaced during that time frame.
30. This is the only picture transmitted by this particular space probe; it stopped working shortly after taking this picture and making a few other measurements. This was expected. What is the most likely reason for this?
  - a. Soon after this robotic spacecraft landed, astronauts landed here and deactivated the probe.
  - b. No robotic spacecraft has ever been built that could operate on the surface of another planetary body for more than a few hours.
  - c. The intense heat and pressure at this planet's surface were too much for the probe's systems.
  - d. The intense cold at the surface of this planetary body caused the probe's batteries to fail after a short time.
31. This picture was taken by a robotic space probe that didn't carry any people. If you were on the surface of this planetary body, what would you be likely to notice about the gravity here?
  - a. Since this is a terrestrial planet that's as big as a gas-giant like Jupiter, the gravitational force here would be extremely large, and you'd have a very hard time standing up.
  - b. It would be very similar to the gravity at the Earth's surface, since this planet has a similar mass and size to the Earth.
  - c. The gravitational force here would be much weaker than at the Earth's surface, since this planetary body is much smaller than the Earth.
  - d. It would feel like there's no gravity here, since you're outside the Earth's gravitational field.

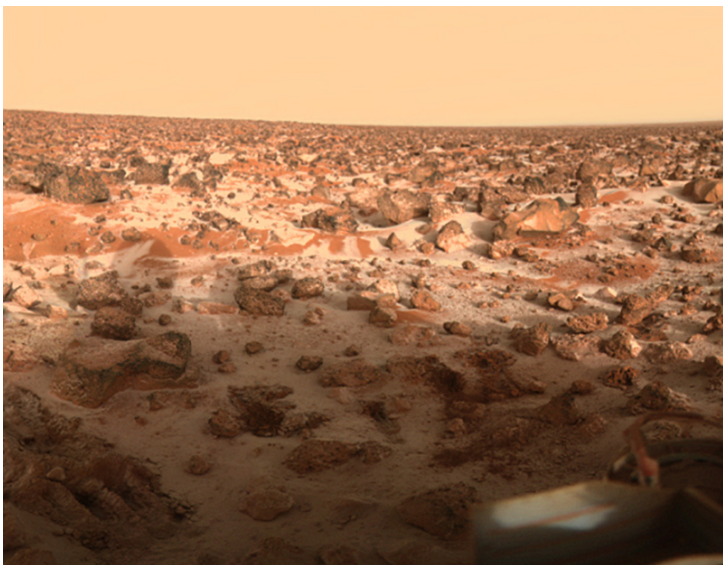


Q 32-35

This image shows an area a few hundred miles across, on the southeastern edge of a circular feature called Mare Imbrium.

32. (T/F) All of the crater-forming impacts onto this part of the Moon's surface occurred before the large impact that formed Mare Imbrium.
33. Why doesn't the Earth's surface have the large number of craters that the Moon's surface does?
  - a. The crust of the Earth is much stronger than the crusts of other planetary bodies, so it can resist impacts from asteroids and meteoroids.
  - b. Weathering, plate tectonics, and other geologic processes tend to destroy craters (on Earth) shortly after they form.
  - c. The strong gravity of the Moon deflects most of the asteroids that would otherwise hit the Earth.
  - d. The Earth formed long after the Moon did, so it hasn't had as much time to accumulate craters.
34. What sort of material forms the smooth plains that we see in this image?
  - a. Thick layers of sediment that were deposited when Mare Imbrium was filled with water.
  - b. A common type of volcanic rock called basalt.
  - c. A light-colored rock called anorthosite
  - d. A layer of dust, into which some of the early uncrewed probes sank shortly after they landed.
35. In the upper-left part of the image, we see several large craters within the circular border of Mare Imbrium. Which of the following best describes the history of this part of the Moon?
  - a. These craters all formed before the Imbrium impact occurred.
  - b. The craters formed before Mare Imbrium was created by a giant volcanic eruption.
  - c. A very large impact carved out Mare Imbrium, and then these craters formed at later times.
  - d. These craters - along with the Mare Imbrium basin - must have formed from the same cluster of incoming asteroids.





Q 36-39

36. (T/F) If you were an astronaut here on Mars, your best bet for getting a good look at the Earth would be during an opposition.
37. Underneath the white layer, we see reddish-brown soil and reddish-brown colors on some of the rock surfaces. Why does Mars's surface have this reddish color?
  - a. Although this area is barren and lifeless today, the color of the soil was changed by vegetation, such as exists on other parts of Mars.
  - b. Mineral grains in the soil and rocks reacted with oxygen, back when Mars had free oxygen in its environment.
  - c. The strong magnetic field of Mars has caused changes in the atomic structures of the minerals in Mars's rocks and soil.
  - d. Mars has been bombarded by meteorites that were blasted off of Mercury by giant impacts, causing Mars to have the same red color as Mercury.
38. What is the white layer that we see in this image?
  - a. A layer of dust that formed when mineral grains (in the rocks and soil) were exposed to oxygen and "rusted".
  - b. A thin layer of water-ice frost
  - c. A layer of bacteria, fungi, and other micro-organisms that were discovered by the Viking landers.
  - d. A layer of frozen carbon dioxide
39. The dark rocks here are probably a common type of volcanic rock called basalt. Which of the following would NOT be another good place to find basalt?
  - a. The Earth's ocean floors
  - b. The highland areas of the Moon
  - c. The lunar maria
  - d. The smooth, low-lying parts of the Moon's surface

1. T
2. F
3. T
4. F
5. F
6. B
7. A
8. D
9. E
10. A
11. D
12. A
13. A

14. B
15. A
16. B
17. D
18. A
19. B
20. C
21. C
22. D
23. D
24. T
25. C
26. D

27. C
28. F
29. D
30. C
31. B
32. F
33. B
34. B
35. C
36. ~~F~~ F
37. B
38. B
39. B