

Solar System B

Michigan Region 8

March 24, 2018

Team Number _____

Team Name _____

Type (select one) _____ Varsity

_____ Junior Varsity

Student Name(s) _____

Directions

1. There is a separate answer sheet. Answers written elsewhere (e.g. on the test) will not be considered.
2. You may take the test apart, but please put it back together at the end.
3. This test is 100 points total. Questions are worth 1 point each unless otherwise specified.
4. The first two tiebreakers are the section scores for Part II (Moons) and Part I (Planets), in that order. Further tiebreakers are indicated as [T₁], [T₂], etc. Time is NOT a tiebreaker.
5. For any answers that have units, be sure to use the units that are specified in the question. Answers in other units will be marked wrong.

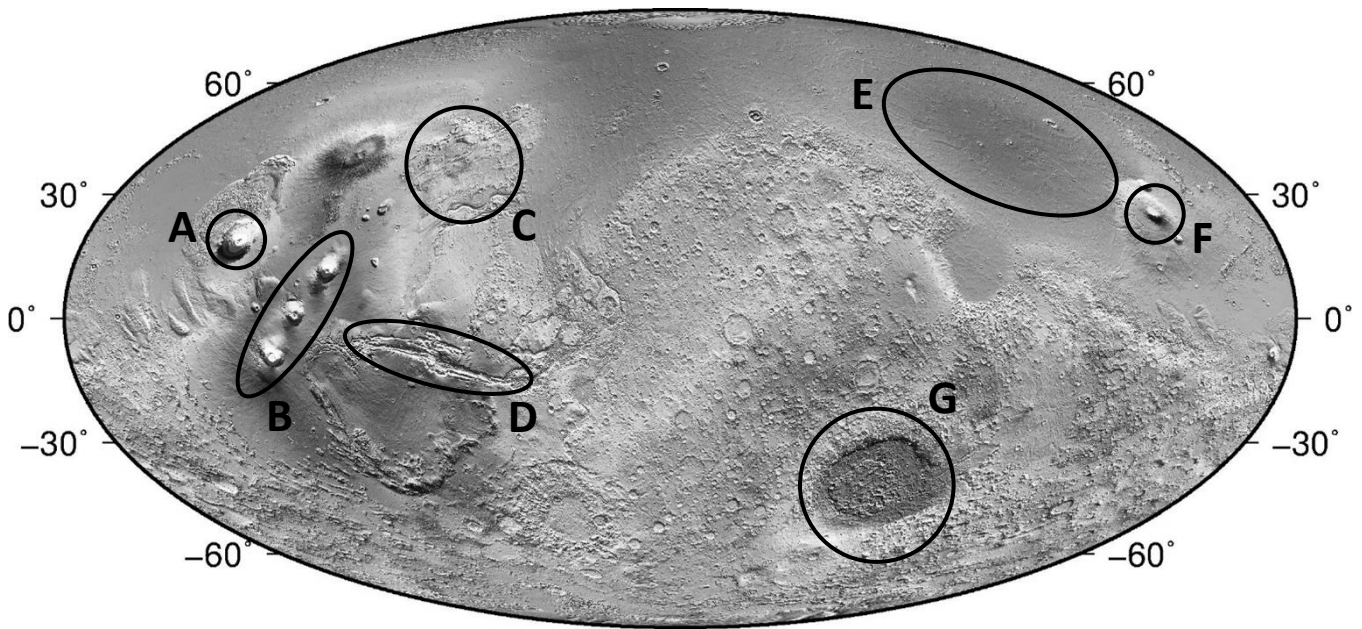
Bonus (+1)

In October 2017, a very elongated and chaotically tumbling “space object” was discovered by the Pan-STARRS telescope. What makes this object – named ‘Oumuamua (1I/2017 U1) – so special?

Part I: Planets (40 points)

1. [3 pts] What are the terrestrial planets (excluding Earth), in order from closest to the Sun to furthest?
2. Mercury's rotation period and its orbital period are linked. What is the ratio between the two?
3. Which mission (launched by NASA) extensively studied Mercury for over 10 years?
4. What is the name of the largest crater on Mercury?
5. [2 pts] What geologic feature is on the exact opposite side of the planet from this crater, and what is one theory for how it formed?
6. What is thought to be the cause of the many wrinkles and folds on Mercury's surface?
7. How can we tell that Mercury has been geologically inactive for a long time?
8. Mercury is the second-densest object in the solar system (second only to Earth). What about Mercury's core makes the planet so dense?
9. What is one theory for how such a dense planet formed?
10. Venus' atmosphere is primarily composed of what compound?
11. It is hard to study the surface of Venus because it has very opaque clouds. What compound are these clouds made of?
12. [T7] Why is Venus so hot?
13. What is the name of one of Venus' two "continents"?
14. Why are there no small impact craters found on Venus (even though there are several large ones)?
15. Why is it puzzling that Venus' surface is geologically young?
16. [2 pts] What is the sole erosion process on Venus, and why is there only this one process? (Choose from water, ice, wind, or gravity.)
17. Little is known about the internal structure of Venus, but it can be assumed to be fairly similar to the interior of which other planet?

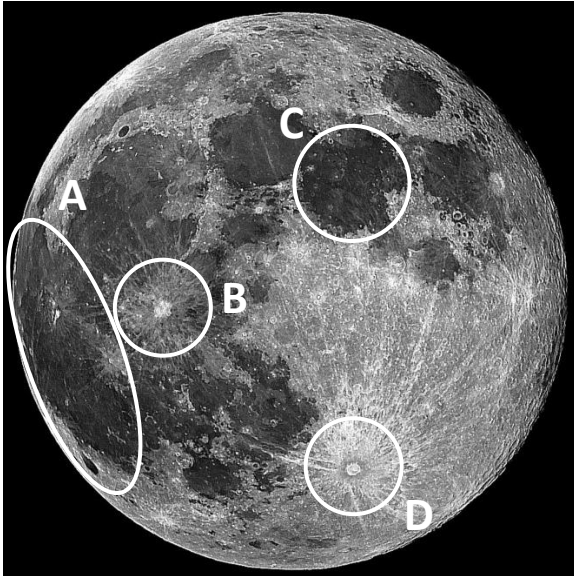
18. [7 pts] Identify the features of Mars labeled on the map below.



19. What massive geologic feature (not indicated on the map above) covers 40% of Mars' surface?
20. [2 pts] What are the general composition of the core and the mantle of Mars? (Choose from metallic, silicate, icy, watery, organic, or gaseous – and indicate which is which.)
21. What element in Mars' crust gives it its distinctive reddish color?
22. [2 pts] What distinguishes the geography of Mars' northern hemisphere from its southern hemisphere?
23. What traits of certain Martian minerals indicate that it must have once had liquid water?
24. [T2] What surface features of Mars indicate that it once had liquid water?
25. [T8] Where is most of the surface water on Mars now?
26. What is the name of the most recent rover mission on Mars?
27. [2 pts] This rover is exploring an area called Gale Crater. What types of geological processes are thought to have deposited and then eroded material from Gale Crater? (Choose from water, ice, wind, or gravity – and indicate which is which.)

Part II: Moons (35 points)

28. [4 pts] Identify the features of the Moon labeled on the image below.



29. This image shows the near side of the Moon. Why is only one face of the Moon ever visible from Earth?
30. The largest lunar crater is not visible because it's on the far side of the Moon. What is its name?
31. Why are the dark regions (such as features A and C) of the Moon dark?
32. [T1] Why are craters on the Moon so well-preserved?
33. What is the leading theory for the formation of the Moon?
34. What is one recent mission that found water on the Moon by crashing things into it (yes, there was more than one)?

35. Where is the Moon, in relation to the Sun and the Earth, during a solar eclipse?
36. In the far future, why will total solar eclipses stop happening?
37. [T6] Why is there not a solar eclipse (or a lunar eclipse) every single month?
38. [2 pts] What causes the difference between spring tides and neap tides?

39. [2 pts] What are the two main theories for the origin of Mars' moons?

40. The moons of Mars are composed primarily of rock rich in what element?
41. [2 pts] Which of Mars' moons appears to orbit backwards (as seen from the surface of Mars), and why does this happen?
42. This moon is slowly drifting closer to Mars. What will be its eventual fate?
43. One of the major geologic features of this moon is a single large impact crater. What is its name?
44. What is thought to have caused the many "grooves" that this moon has?
45. What is the name of the other, smaller moon of Mars?
46. Why is it unusual that this moon has significant amounts of regolith?
47. [T₁₀] What geologic feature, also found on Earth, does Io have a lot of?
48. What element is primarily responsible for the bright and varied colors of Io's surface?
49. [2 pts] What compound is Io's atmosphere primarily made of, and where does this come from?
50. Which mission was the first to discover the geologic activity of Io?
51. How can we tell that Io is still very geologically active?
52. [T₄] What causes Io to maintain this much geologic activity?
53. Io is part of what grouping of Jupiter's 4 largest moons?
54. [2 pts] What makes the composition of Io different from many other moons in the outer solar system? (Choose from metallic, silicate, icy, watery, organic, or gaseous – and indicate which is which.)

Part III: Asteroids (25 points)

55. Which mission (launched by NASA) previously studied the asteroid Vesta and is now studying the dwarf planet Ceres?
56. By itself, Ceres makes up what fraction of the total mass of the Asteroid Belt?
57. Recent analysis of the atmosphere of Ceres suggests that there could be an ocean of what substance beneath its surface?
58. [2 pts] Which two planets is the Asteroid Belt located between?
59. [2 pts] What are the inner and outer limits of the Asteroid Belt, in AU?

60. [2 pts] What phenomenon causes asteroids to be quickly ejected from certain orbits in the Asteroid Belt, and what is the name for these orbits that have very few asteroids?
61. What is thought to cause most Near-Earth Asteroids to end up near Earth?
62. What is one class of Near-Earth Asteroids whose orbits cross that of Earth?
63. Near-Earth Asteroids are considered good targets for collecting samples because... well, they're close by! What is one mission (past or future) designed to return samples from a Near-Earth Asteroid?
64. Some asteroids may share the same orbit as a planet, and are found at stable gravitational points called Lagrange points. What is the name for these asteroids?
65. In reality, these asteroids do not remain exactly at the Lagrange points, but instead orbit around them. What is the term for this motion?
66. What element makes up a large part of C-type asteroids?
67. C-type asteroids tend to have very low albedos. What is albedo?
68. What is the name of the largest C-type asteroid?
69. What chemical compounds distinguish S-type asteroids?
70. [T₃] S-type asteroids tend to dominate the inner asteroid belt. If an S-type asteroid is found at a distance of 2 AU, what is its orbital period, in years?
71. V-type asteroids come from the asteroid Vesta. What is the name of one of the large impact craters on Vesta that are thought to have produced these asteroids?
72. [T₅] Why is Vesta so important to learning about planet formation in our solar system?
73. [2 pts] Many M-type asteroids are made up of which two elements?
74. Which M-type asteroid was visited by the *Rosetta* mission (launched by ESA) in 2010?
75. [T₉] What is the most common type of asteroid? (Choose from C, S, V, or M.)