

Solar System

School: _____

Team Number: _____

Names: _____

#5 is the Tiebreaker Question. However, your score on that question will count to your overall score, so it will not just be used to break ties. If the score on #5 is the same, then #4 will be the second tiebreaker, followed by #7.

Score: _____/90

1. Kepler's Laws (7 points)
 - a. What is Kepler's First Law of Planetary Motion?
 - b. Would a planet orbiting the Sun be travelling faster at perihelion or aphelion? Justify your answer with Kepler's Second Law of Planetary Motion.
 - c. If a planet's closest distance to the Sun is 1.00 AU, and its furthest distance from the sun is 9.00 AU, what would its orbital period be?
 - d. You observe a binary system with a period of 32 years and an average separation of 16 AU. Star A is 12 AU away from the center of mass, and Star B is 4 AU away from the center of mass. What is the total mass of this system, and what are the individual masses of Star A and Star B? Give your answer in solar masses.

2. Eclipses (10 points)
 - a. What color is the moon during a lunar eclipse and why?
 - b. Why isn't there an eclipse at every new moon and at every full moon?
 - c. What would astronauts on the moon observe while people on Earth were seeing a total lunar eclipse?
 - d. If Earth had no atmosphere, how would a lunar eclipse look different?
 - e. During a total solar eclipse, the [photosphere, chromosphere, corona, and prominences] (Select all that apply.) become(s) more visible because the _____ is covered.
 - f. What is an annular solar eclipse and what causes it?

3. Mercury (9 points)
 - a. What formation is depicted in Image A?
 - b. What spacecraft took this photograph?
 - c. Explain the cause of the deep cracks in this formation's central lava plains.
 - d. What formation is the arrow pointing at in Image B?
 - e. Explain how your answer to 3d formed.
 - f. Mercury has a larger metallic core and a larger proportion of dense metals than predicted. Explain the most probable explanation for this.
 - g. How did the intercrater plains form?
 - h. How did the smooth plains form?

4. The Moon (13 points)
 - a. What formation does Image C show?
 - b. When and how did this form?
 - c. What is the name for the dividing line between daylight and darkness on the moon?
 - d. The moon is tidally locked with the Earth. What does this mean?
 - e. Name and describe the widely accepted theory of the formation of the moon.
 - f. Explain where each of the following hypotheses fail to describe the formation of the moon:

- i. The Fission Hypothesis: The moon broke from a rapidly spinning young Earth.
 - ii. The Condensation Hypothesis: Earth and its moon condensed from the same cloud of matter in the solar nebula.
 - iii. The Capture Hypothesis: The moon formed elsewhere in the solar nebula and was later captured by Earth.
- g. The moon contains a lot of breccias—large grained, angular fragments bound together by heat. What does this suggest?
5. Comparing and Contrasting Mercury and the Moon (6 points) (Tiebreaker Question)
- a. Refer to Image A and C again. List one reason why they are similar, and one reason why they are different.
 - b. What is the **main** reason that the surface evolution of the both the moon and Mercury has essentially come to a stop, but the Earth's surface evolution continues?
 - c. Why does the moon not possess the formation present in Image B (question 3d)?
6. Venus (12 points)
- a. What are the two most abundant gases in Venus's atmosphere?
 - b. What are the clouds in Venus primarily composed of? How did that compound end up forming clouds?
 - c. What formation (include the specific name) is depicted in Image D?
 - d. What spacecraft took this photograph?
 - e. Why do you see lighter colors covering darker colors in Image D?
 - f. Name and describe the formation the arrows point to in Image E.
 - g. How did the formations in Image E form?
 - h. Volcanoes on Venus are shield volcanoes—wide, low-profile cones produced by relatively runny lava. On Earth, these volcanoes are associated with hotspots. What does this suggest about Venus's crust?
 - i. Image F is a computer generated image of which volcano on Venus?
 - j. Although images of Venus usually appear orange, the surface of Venus is not actually orange. What color would the rock be if you looked at it with your own eyes?
7. Mars (19 points)
- a. What is the primary component of Mars's atmosphere?
 - b. Why is Mars's atmosphere so thin?
 - c. What is the name of the formation is shown in Image G, and why is it special?
 - d. Where is Image G located on Mars?
 - e. The volcanoes on Mars are generally much larger than the ones on Earth. Why can volcanoes grow so much larger on Mars than on Earth?
 - f. The volcano depicted in Image G has not collapsed inward yet. What does this suggest about Mars's crust?

- g. The history of Mars can be described in three periods. Name and describe them.
 - h. Identify the formation in Image H.
 - i. What is this formation primarily composed of?
 - j. Identify the formation in Image I.
 - k. What is this formation primarily composed of?
 - l. Which of the two is Mars's primary source of water?
 - m. Why don't long-term liquid water deposits (rivers, lakes, oceans, etc.) exist on the surface of Mars?
8. Deimos and Phobos (4 points)
- a. Which of Mars's moons is larger?
 - b. Explain how Mars acquired Deimos and Phobos.
 - c. Why are Deimos and Phobos nonspherical?
 - d. Why aren't Deimos or Phobos volcanically active?
9. Io (3 points)
- a. Io is so far from the Sun, yet it is geologically active. What causes this?
 - b. Why are no impact craters visible on Io?
 - c. Why does Io appear yellowish-orange?
10. Asteroid Belt (7 points)
- a. Name the largest object in the Asteroid Belt.
 - b. What is Ceres' core most likely made of? The mantle?
 - c. Vesta is described as a protoplanet that was most likely prevented from growing larger due to Jupiter's gravity. What is special about Vesta's internal structure compared to most other asteroids?
 - d. What are Kirkwood Gaps and what are they caused by?
 - e. Name the space probe launched by NASA in 2007 to study Vesta and Ceres.