

# Solar System B

UT Regional 2018



*Exploring the World of Science*

**Competitors:** \_\_\_\_\_

**School Name:** \_\_\_\_\_

**Team Number:** \_\_\_\_\_

This test contains 5 parts, worth 150 points in total. As always, you'll have 50 minutes to complete the test. You may separate the pages; be sure to put your team number at the top of every page. You may use two letter-sized notes sheets. Good Luck, Have Fun! And always remember: The Eyes of Texas Are Upon You!

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|         |    |    |    |    |    |    |       |
|---------|----|----|----|----|----|----|-------|
| Page:   | 1  | 2  | 3  | 4  | 5  | 7  | Total |
| Points: | 45 | 15 | 15 | 25 | 25 | 25 | 150   |
| Score:  |    |    |    |    |    |    |       |

# 1 Matching

3 points each. Each choice might be used 0, 1, or more times. This section will be used for tiebreakers.

|          |              |          |               |          |                |
|----------|--------------|----------|---------------|----------|----------------|
| <b>A</b> | Nitrogen     | <b>B</b> | Mercury       | <b>C</b> | MESSENGER      |
| <b>D</b> | Protoplanets | <b>E</b> | Phobos        | <b>F</b> | Ethane         |
| <b>G</b> | Titan        | <b>H</b> | Saturn        | <b>I</b> | Carbon Dioxide |
| <b>J</b> | Venus        | <b>K</b> | Deimos        | <b>L</b> | Callisto       |
| <b>M</b> | Cassini      | <b>N</b> | Planetesimals | <b>O</b> | Voyager 2      |
| <b>P</b> | Mars         | <b>Q</b> | Pluto         | <b>R</b> | Planets        |
| <b>S</b> | Planetoids   | <b>T</b> | Miranda       | <b>U</b> | Oxygen         |
| <b>V</b> | Potassium    | <b>W</b> | Ceres         | <b>X</b> | The moon       |

1. \_\_\_\_\_ Planets are thought to form when these coalesce.
2. \_\_\_\_\_ The main chemical component of the Martian atmosphere.
3. \_\_\_\_\_ This moon is a Galilean moon.
4. \_\_\_\_\_ This body is located in the asteroid belt.
5. \_\_\_\_\_ The planet most similar in size to the Earth.
6. \_\_\_\_\_ This body features a plateau called Lakshmi Planum.
7. \_\_\_\_\_ This spacecraft is the only one to have orbited Mercury for observation.
8. \_\_\_\_\_ A component of lunar KREEP.
9. \_\_\_\_\_ This body has the most cratered surface in the solar system.
10. \_\_\_\_\_ This body's features are named after people and places from *Gulliver's Travels*.
11. \_\_\_\_\_ The precession of this planet's orbit was explained by general relativity.
12. \_\_\_\_\_ Planetary embryos which are large enough to have undergone internal melting.
13. \_\_\_\_\_ This planet has a surface atmospheric density nearly 100 times that of Earth.
14. \_\_\_\_\_ This planet has an axial tilt of 25.2 degrees (the most similar to Earth's).
15. \_\_\_\_\_ This body features craters named *Swift* and *Voltaire*.

## 2 Multiple Choice

General solar system astronomy, 3 points each.

16. Which of these is NOT valid evidence for the Giant Impact Hypothesis?
  - A. The isotope ratios of lunar and terrestrial rock are identical.
  - B. The Moon is approximately the same size as the Great Atlantic Basin.
  - C. The spin of the Earth is aligned with the revolution of the Moon.
  - D. The Moon has lower density than the Earth.
  
17. The Earth reaches perihelion
  - A. Monthly
  - B. Twice a year
  - C. Annually
  - D. Once every 138 years
  
18. The shape of a planetary orbit can always be mathematically defined by a/an
  - A. Sphere
  - B. Circle
  - C. Oval
  - D. Ellipse
  
19. Which of these is NOT a moon of Jupiter?
  - A. Miranda
  - B. Callisto
  - C. Ganymede
  - D. Europa
  
20. Ceres is considered a dwarf planet because
  - A. It has not undergone planetary differentiation.
  - B. It has not cleared its orbital neighborhood.
  - C. It has not been rounded by its own gravity.
  - D. It undergoes thermonuclear fusion.

21. Which of these is true about the formation of the Solar System?
- A. The sun formed about 4.6 million years ago.
  - B. The terrestrial planets were much larger than they are now.
  - C. The sun was one of the first stars in the universe.
  - D. The Earth formed about 4.6 billion years ago.
22. Venus is unique among terrestrial planets for its
- A. Retrograde revolution
  - B. Retrograde rotation
  - C. Prograde revolution
  - D. Prograde rotation
23. Jupiter's Great Red Spot is best described as a giant
- A. Crater
  - B. Moon
  - C. Aurora
  - D. Hurricane
24. A comet's tail always points
- A. Opposite the direction of the comet's motion
  - B. In the same direction of the comet's motion
  - C. Away from the sun
  - D. Towards the sun
25. Which of the following protects us from the solar wind?
- A. The ozone layer
  - B. Clouds and other dense atmospheric structures
  - C. The magnetosphere
  - D. The greenhouse effect

### 3 Short Answer

26. (25 points) Planetary differentiation is an important process in the geologic lifespan of planets.

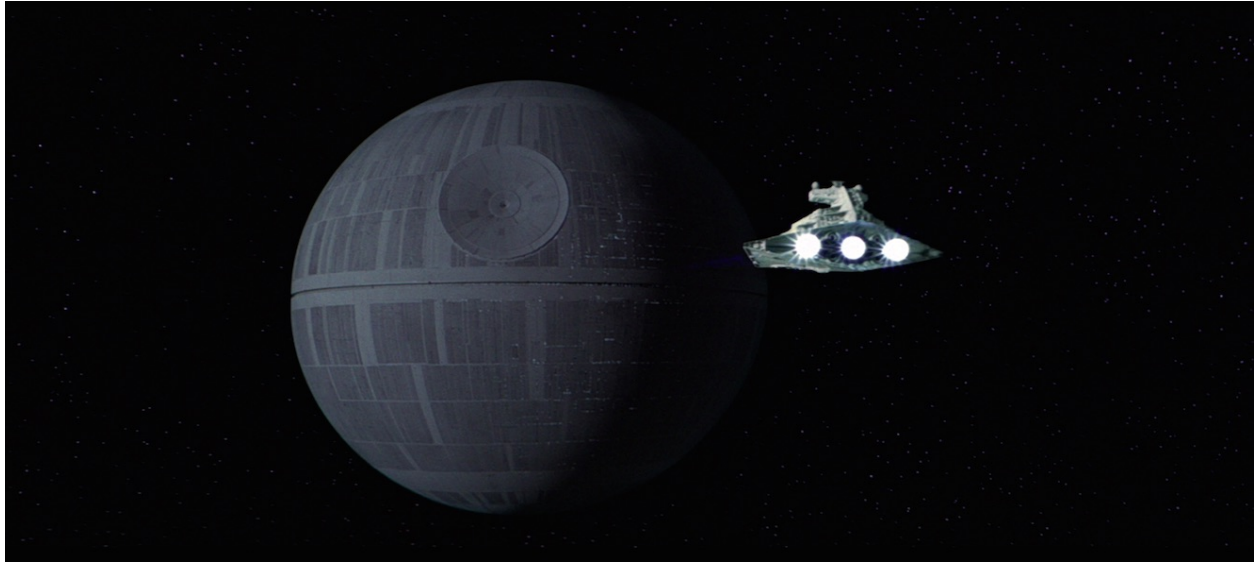
(a) (5 points) What is planetary differentiation?

(b) (5 points) Give an example of a planet (other than Earth) that has undergone differentiation, and a moon that has undergone differentiation.

(c) (5 points) Explain why many terrestrial planets have iron-nickel cores.

(d) (5 points) Explain why asteroids and other such objects typically are not differentiated.

(e) (5 points) When did Earth begin to differentiate? When did it stop differentiating?

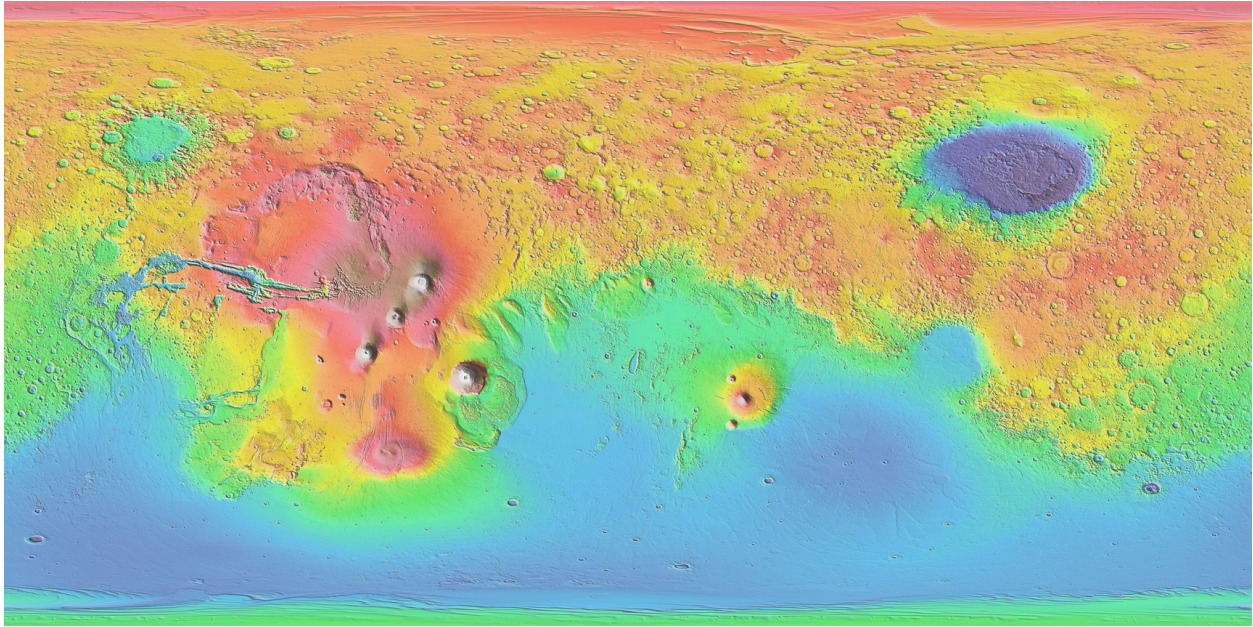


27. (25 points) *“That’s no moon... it’s a space station!”* –Obi-wan Kenobi
- (a) (5 points) The Death Star was a giant, spherical, planet-destroying space station built by the evil Empire. Its center was a hollow chamber which housed the main reactor. Which moon in our solar system was once hypothesized by scientists to be hollow?
- (b) (5 points) Suppose that the Death Star had half the surface area of Pluto, and one-tenth the mass. What is the density of the Death Star in terms of Pluto’s density? You are not required to compute the decimal answer; an expression is fine. Show work for full credit.



## 4 Interpretive Task

The image below is an elevation map of the Martian terrain.



28. (12 points) Label the following features using their numbers:

- |                     |                    |                             |
|---------------------|--------------------|-----------------------------|
| 1. Olympus Mons     | 5. Tharsis Montes  | 9. Schiaparelli crater      |
| 2. South Pole       | 6. Huygens crater  | 10. <i>Pathfinder</i> site  |
| 3. Valles Marineris | 7. Argyre Planitia | 11. <i>Opportunity</i> site |
| 4. Hellas Planitia  | 8. Elysium Mons    | 12. <i>Curiosity</i> site   |

29. (13 points) In this image, one hemisphere is mostly orange, while the other is mostly blue. What does this say about the geology of Mars? Explain the two most likely hypotheses for this geologic anomaly.