

National Science Olympiad

Solar System 2019 (Division B)

January 2019

Do not open the test packet until instructed by the event supervisor. Ensure that you have all 13 pages of the test packet including the 24 images at the end. You are encouraged to use the backs of the test sheets as scratch paper. Only answers recorded on the exam sheet will be graded. Mark only one answer for multiple choice questions. All questions are of equal value. There are questions with “Tiebreak” keyword will be used to break a tie among teams. Good luck!.

Team Number: _____

Team Name: _____

Student Names: _____

1. (10 points) What distinguishes a dwarf planet from other planets in the solar system?
 - ☐ Spherical in shape
 - ☐ Size
 - ☐ In orbit around a star, but is not itself a satellite
 - ☐ All of the above
2. (10 points) List three other dwarf planets that are about the same small size as Pluto?
3. (10 points) Identify Pluto from the image set?
4. (10 points) Which mission took the most recent optical image?
 - ☐ LUCY
 - ☐ DAWN
 - ☐ New Horizon
 - ☐ CASSINI
5. (10 points) What is the only dwarf planet located in the inner solar system? [**Tiebreaker**]
6. (10 points) Which mission took the most recent optical image?
 - ☐ LUCY
 - ☐ DAWN
 - ☐ New Horizon
 - ☐ CASSINI
7. (10 points) Identify this dwarf planet from the image set?
8. (10 points) The Diagram showing a possible internal structure of a dwarf planet is shown in Figure 4, identify distinct internal layers?
9. (10 points) Identify dwarf planet Makemake from the image set?
10. (10 points) Identify this dwarf planet Eris from the image set?
11. (10 points) What is the name of the moon belonging to Eris?
12. (10 points) identify the dwarf planet which closest resembles the Haumea from the image set?
13. (10 points) Identify Earth's moon from the image set?
14. (10 points) Following questions are related to earth-moon tidal lock [**Tiebreaker**]

- (a) (7 points) Explain why Earth and Moon are tidally-locked?
- (b) (3 points) What is the far side of the moon?
15. (10 points) Origin of the moon [**Tiebreaker**]
- (a) (8 points) Describe the leading theory of the Moon's origin?
- (b) (2 points) How old is the Moon?
- ☐ about 4.5 billion years
 - ☐ about 45 billion years
 - ☐ about 1 billion years
 - ☐ about 0.5 billion years
16. (10 points) List distinct internal layers of the Earth's Moon?
17. (10 points) Identify the moon Charon from the image set?
18. (10 points) Charon is orbiting which object?
19. (10 points) Identify the moon Mimas from the image set?
20. (10 points) Identify the moon Phoebe from the image set?
21. (10 points) What is a minor planet? [**Tiebreaker**]
22. (10 points) List Minor planets?
23. (10 points) Are dwarf planets same as minor planets?
- ☐ Yes
 - ☐ No
 - ☐ They are same

24. (10 points) Identify three broad composition classes of asteroids? [**Tiebreaker**]
25. (10 points) What solar system object helped to create the Asteroid Belt
- ☐ Sun
 - ☐ Jupiter
 - ☐ Mars
 - ☐ None of the above
26. (10 points) How asteroids can be knocked out of the asteroid belt?
- ☐ Jupiter's gravity
 - ☐ Close encounters with Mars
 - ☐ All of the above
27. (10 points) What is a trans-Neptunian object (TNO)? [**Tiebreaker**]
28. (10 points) Identify two large groups within TNO? [**Tiebreaker**]
29. (10 points) What is a Centaurs?
- ☐ comet-like in composition
 - ☐ Asteroid-like in size
 - ☐ A dwarf planet
 - ☐ First and second are correct
30. (10 points) Identify 'Oumuamua from the image set?
31. (10 points) What is the significance of 'Oumuamua object? [**Tiebreaker**]
32. (10 points) Is 'Oumuamua comet or asteroid Explain based on observations? [**Tiebreaker**]

33. (10 points) Explain how remote sensing instrument works?
- ☐ They record characteristics of objects at a distance
 - ☐ They record characteristics of objects by using its sample
 - ☐ None of the above
34. (10 points) Identify the remote sensing instrument shown in image set?
35. (10 points) Classify spectroscopic instruments into three main categories? [**Tiebreaker**]
36. (10 points) Identify the remote sensing instrument shown in Figure 5
- ☐ Radar imaging/Altimetry
 - ☐ Electrostatic Analyzer
 - ☐ Imaging or optical Instrument
 - ☐ None of the above
37. (10 points) Identify the DAWN spacecraft from the image set?
38. (10 points) DAWN related questions
- (a) (8 points) What is the goal of the DAWN mission?
 - (b) (2 points) What is the current status of DAWN spacecraft?
 - ☐ Still on mission
 - ☐ Gone silent
 - ☐ Destroyed
 - ☐ Extended mission
39. (10 points) Identify the Voyager 2 spacecraft from the image set?
40. (10 points) Where is Voyager 2 spacecraft?
- ☐ Still inside the solar system
 - ☐ Entered interstellar space
 - ☐ Gone silent
 - ☐ Destroyed
41. (10 points) Identify the LUCY spacecraft from the image set?
42. (10 points) LUCY mission related
- (a) (6 points) What is the goal of the LUCY mission?
 - (b) (2 points) What is the current status of the mission?
 - ☐ In Development
 - ☐ In mission
 - ☐ In extended mission
 - ☐ In design
 - (c) (2 points) What was/is the launch date?

- ☐ October 2022
 - ☐ October 2021
 - ☐ October 2012
 - ☐ October 2001
43. (10 points) Identify the CASSINI spacecraft from the image set?
44. (10 points) Identify the Huygens probe from the image set?
45. (10 points) CASSINI mission related
- (a) (5 points) What is the goal of the CASSINI mission?
 - (b) (5 points) What is the mission of the Huygens probe?
 - ☐ Parachuted to the surface of Saturn's moon, Enceladus
 - ☐ Parachuted to the surface of Saturn's moon, Titan
 - ☐ Free-fall to the surface of Saturn's moon, Enceladus
 - ☐ Parachuted to the surface of Saturn's moon, Janus
46. (10 points) Identify the New Horizons spacecraft from the image set?
47. (10 points) Recently New Horizons spacecraft flew past and took imagery of the most distant solar system object in history. What is it? [**Tiebreaker**]
48. (10 points) New Horizons mission related [**Tiebreaker**]
- (a) (5 points) What is the goal of the New Horizons mission?
 - (b) (5 points) What is the current status of the New Horizons mission?
 - ☐ Gone silent
 - ☐ Completed
 - ☐ Successful - Extended Mission in Progress
 - ☐ Still completing the main mission
49. (10 points) Kepler's Laws
- (a) (8 points) The orbit of a hypothetical planet is shown in Figure 11 which shows the area of the orbital plane swept during a unit time T. The sun is shown in the yellow circle. what is the relation between area (A) swept during these unit time intervals (T)?
 - (b) (2 points) What happens to the speed of the planet as it approaches closer to the sun from far side?
50. (10 points) The semi-major axis of the orbit of this hypothetical planet is 4.642 AU where AU is the astronomical unit. Find the orbital period of the hypothetical planet in years you can use the plot shown in Figure 12?
- ☐ 100 years
 - ☐ 1 year
 - ☐ 10 year
 - ☐ 1000 years

51. (10 points) Tides
- (a) (5 points) What causes tides?
 - ☐ To a greater extent by the moon
 - ☐ To a lesser extent by the sun
 - ☐ All of the above
 - (b) (5 points) Identify two types of tides from Figure 20
52. (10 points) Lunar eclipse [**Tiebreaker**]
- (a) (5 points) The Moon passes through two distinct parts of Earth's shadow during a lunar eclipse. What are they called?
 - (b) (5 points) Explain their differences?
53. (10 points) Identify two distinct parts of the earth's shadow in the Figure 14 [**Tiebreaker**]
54. (10 points) Lunar eclipses [**Tiebreaker**]
- (a) (5 points) How lunar eclipses occur?
 - (b) (5 points) why don't eclipses happen once a month?
55. (10 points) Identify moon phases from top to bottom in Figure 24 [**Tiebreaker**]
56. (10 points) Solar eclipses
- (a) (2 points) How solar eclipses occur?
 - (b) (4 points) At what moon phase a solar eclipse can occur?
 - (c) (4 points) List three types of solar eclipse

2019 National Science Olympiad B Division Solar System Event Image Set

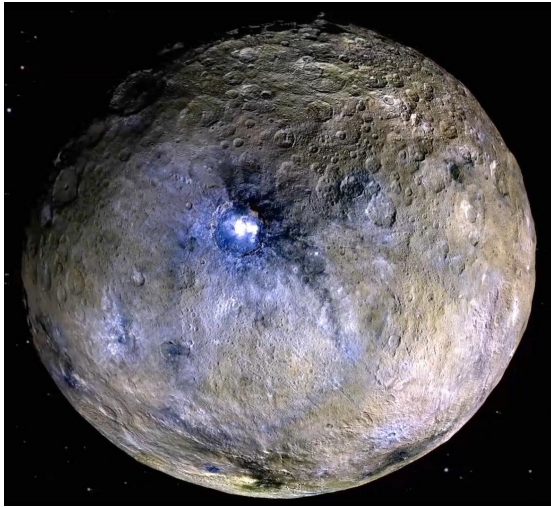


Figure 1:



Figure 3:

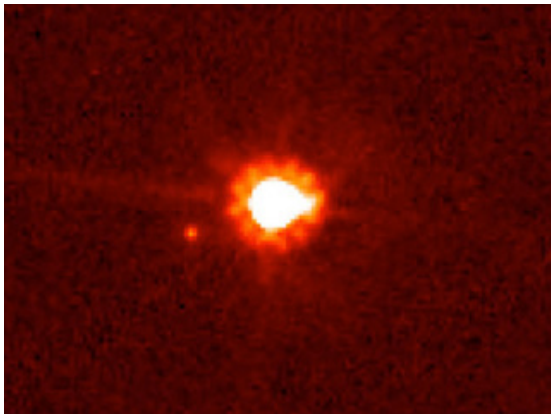


Figure 2:

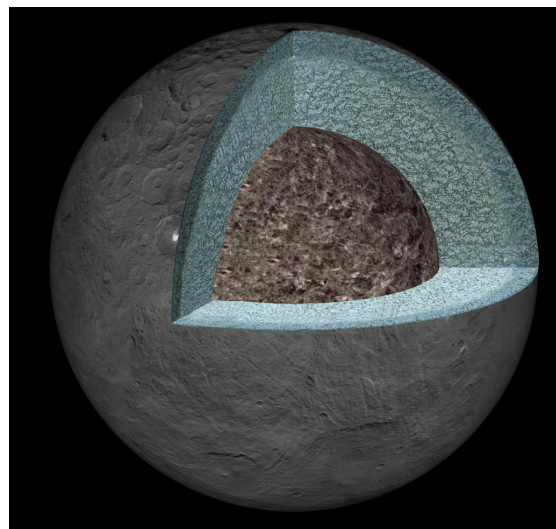


Figure 4:

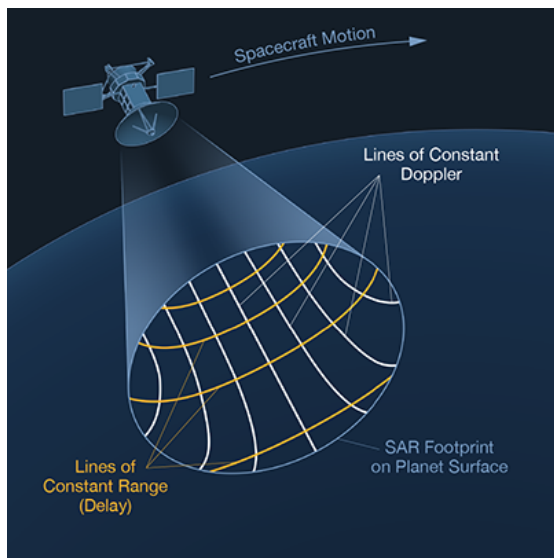


Figure 5:

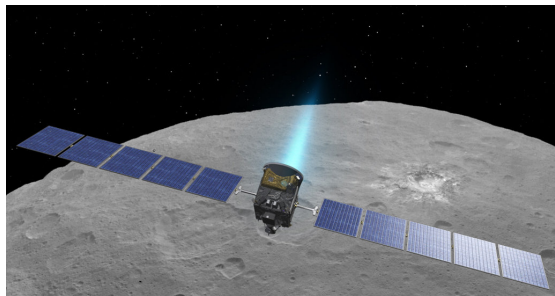


Figure 6:



Figure 7:

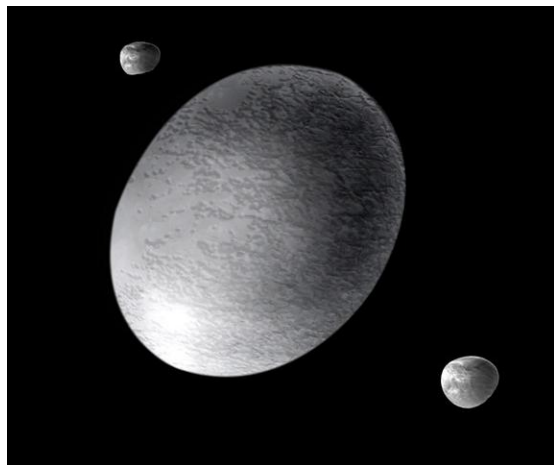


Figure 8:

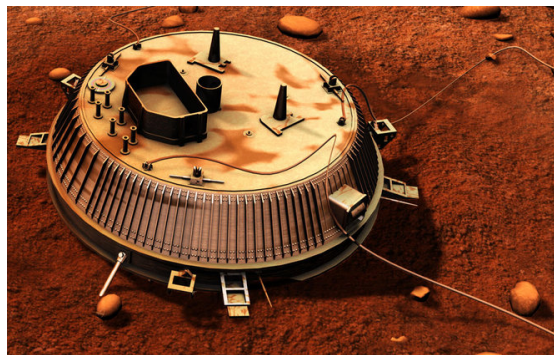


Figure 9:



Figure 10:

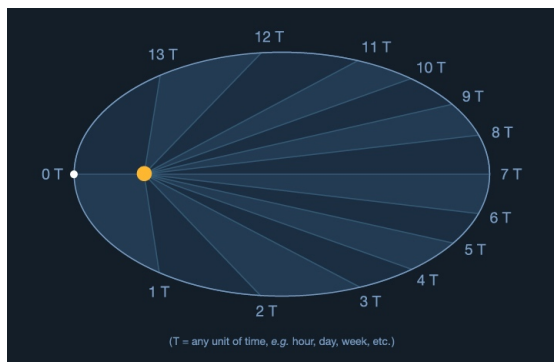


Figure 11:



Figure 14:

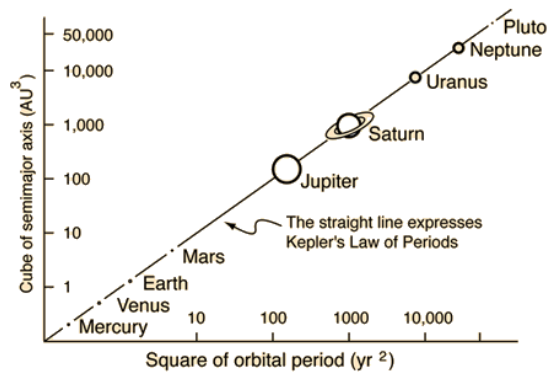


Figure 12:

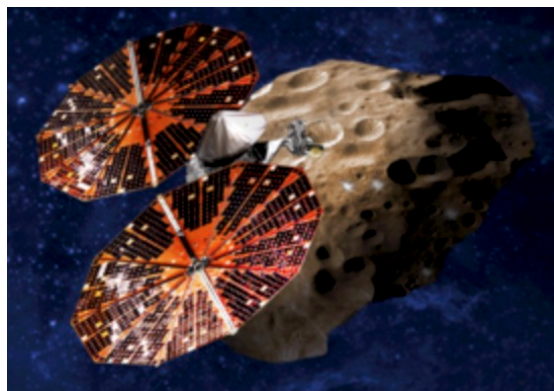


Figure 13:



Figure 15:

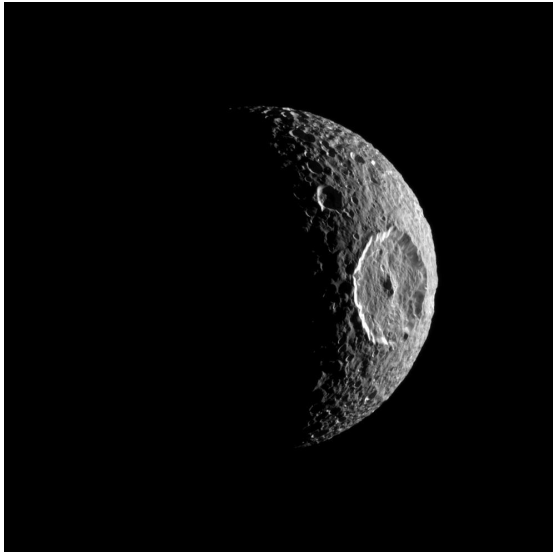


Figure 16:

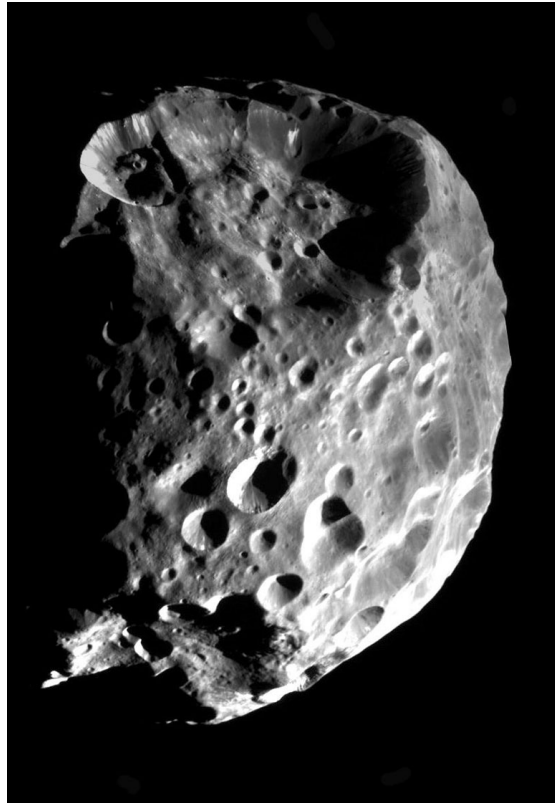


Figure 18:

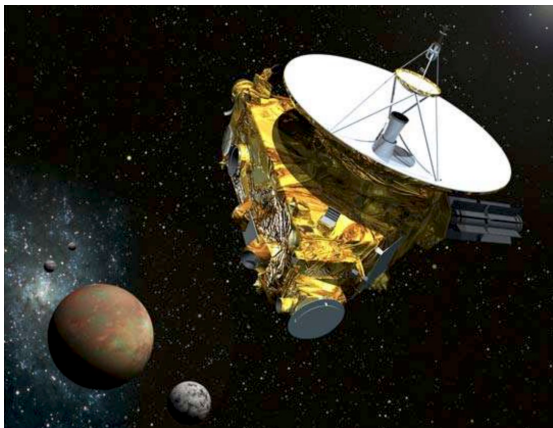


Figure 17:



Figure 19:

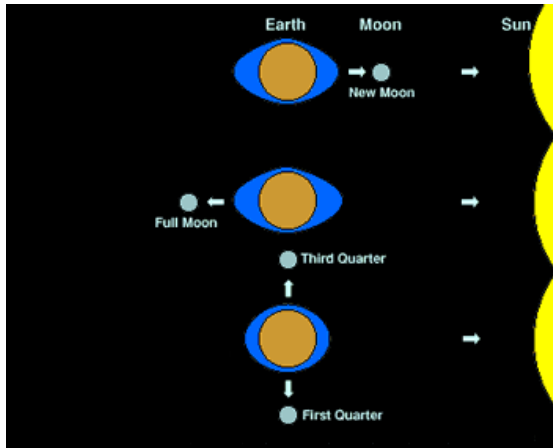


Figure 20:

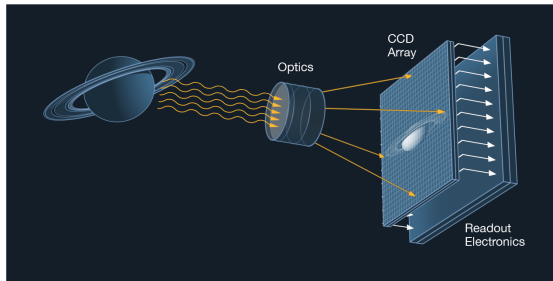


Figure 21:

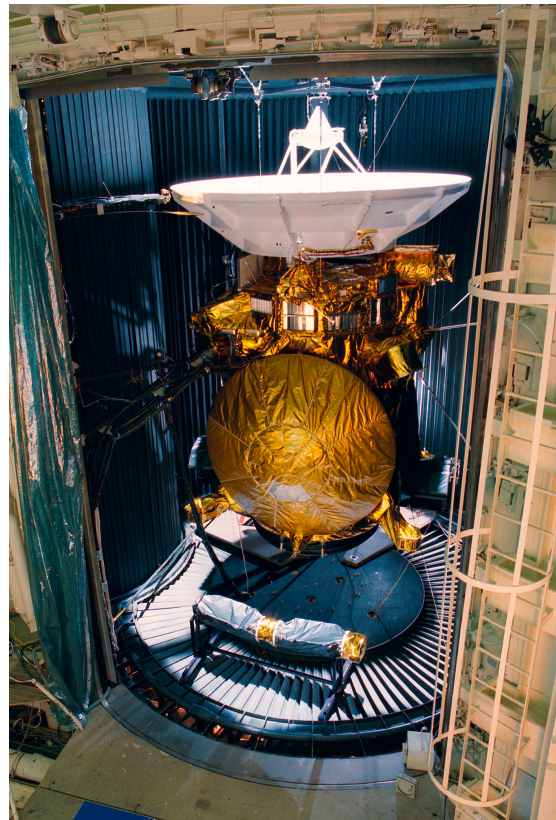


Figure 23:

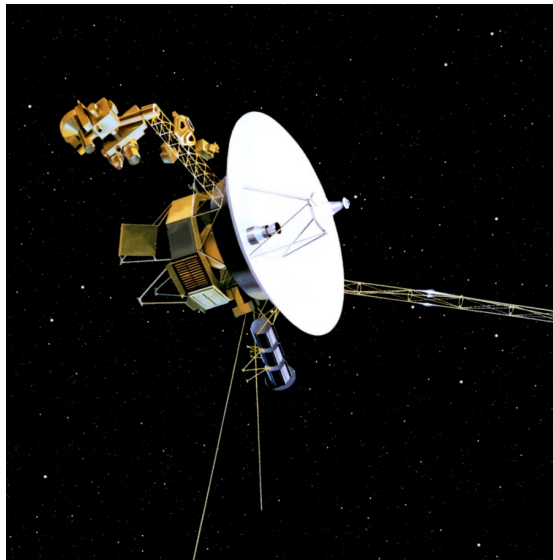


Figure 22:



Figure 24: