

Answer Key

Section A

True or False

- | | | | | |
|-------------|-------------|-------------|--------------|--------------|
| 1. <u>F</u> | 4. <u>F</u> | 7. <u>T</u> | 10. <u>T</u> | 13. <u>T</u> |
| 2. <u>F</u> | 5. <u>T</u> | 8. <u>F</u> | 11. <u>F</u> | 14. <u>T</u> |
| 3. <u>T</u> | 6. <u>F</u> | 9. <u>T</u> | 12. <u>T</u> | 15. <u>F</u> |

Fill-in-the-blank

- | | | | |
|-------------------|---------------------|---------------------|-------------------|
| 16. <u>Pluto</u> | 19. <u>The moon</u> | 22. <u>Trojans</u> | 25. <u>Phoebe</u> |
| 17. <u>Ceres</u> | 20. <u>Eris</u> | 23. <u>Haumea</u> | |
| 18. <u>Charon</u> | 21. <u>Mimas</u> | 24. <u>Makemake</u> | |

Section B

Multiple Choice

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|--------------|--------------|--------------|--------------|--------------|
| 26. <u>C</u> | 31. <u>C</u> | 36. <u>C</u> | 41. <u>B</u> | 46. <u>A</u> |
| 27. <u>B</u> | 32. <u>A</u> | 37. <u>A</u> | 42. <u>D</u> | 47. <u>A</u> |
| 28. <u>D</u> | 33. <u>D</u> | 38. <u>C</u> | 43. <u>C</u> | 48. <u>C</u> |
| 29. <u>C</u> | 34. <u>B</u> | 39. <u>E</u> | 44. <u>C</u> | 49. <u>B</u> |
| 30. <u>B</u> | 35. <u>B</u> | 40. <u>C</u> | 45. <u>A</u> | |

Section C

50. (a) 'Oumuamua
(b) Artist illustration
(c) It is an interstellar object (i.e. it is from outside our Solar System)
51. (a) Mimas
(b) Cassini
(c) Herschel
52. (a) Eris
(b) Dwarf Planet
(c) Dysnomia
(d) Astronomers can measure the period and separation of Eris and its moon and use that to estimate their masses using Kepler's Third Law.
53. (a) Phoebe
(b) Saturn
(c) The surface of Phoebe is likely bright and icy, but covered with a thin layer of dark material. When Phoebe gets hit by an object, it disturbs the dark material and exposes the ice underneath.
54. (a) A small mountain
(b) Image 11
(c) 4 km
(d) Kwanzaa Tholus is most likely older. Earlier in Ceres' history, it was likely similar in size to Ahuna Mons, but because ice isn't very strong, it's since degraded and become shorter.
55. (a) Haumea
(b) Increase
(c) Images 1 and 5
56. (a) Pluto
(b) New Horizons
(c) LORRI
(d) Tombaugh Regio
(e) New Horizons was travelling very, very quickly (about 14 km/s) when it reached Pluto. It would take an incredible amount of energy to slow it down enough to orbit around Pluto, which requires more fuel. More fuel means that the spacecraft becomes heavier, which means it would be launched from Earth at a lower speed and take far longer to reach Pluto. It wasn't cost-effective or reasonable considering our current technology.
57. (a) Mountain ranges
(b) Red
(c) The brown region is likely very old, especially compared to the surrounding region (Sputnik Planitia), which is nearly craterless.
58. (a) Makemake
(b) Kuiper Belt
(c) Blue (methane and higher mass hydrocarbons)

- (d) Irradiation of less massive hydrocarbons leads to the formation of more massive ones. Specifically, it causes rupture of a C–H bond in a shorter hydrocarbon (often methane, since it is the simplest alkane), creating a radical (in the case of methane, a CH_3 radical) . These radicals can react with each other to form more massive hydrocarbons. Processes like radiolysis or unimolecular decomposition can be used to produce more compounds.
59. (a) Hilda asteroids
(b) Trojans
(c) A Lagrange Point is a point in space at which a small body, under the gravitational influence of two large ones, will remain relatively still.
60. (a) Serenity Chasma
(b) Hydrogen bonding forces the water molecules into a hexagonal lattice that is less packed than liquid water. Note: the structure of ice isn't always hexagonal, and different types of ice can be more dense than liquid water. You can check these out on a phase diagram. However, I think going into the specific chemistry there would be beyond the scope of this event and for the purposes of this question, this explanation is enough.
(c) Possible answers include: the decay of radioactive elements and Charon's internal heating from when it was formed.
61. (a) Image 9
(b) Scattered Disk
(c) 20-24 hours
(d) (225088) 2007 OR₁₀ may be an ellipsoid (specifically, a MacLauri or Jacobi ellipsoid). Although scientists do not think this is true due to (225088) 2007 OR₁₀'s large size, this response would receive full credit for this part. Another possible answer is that the surface of (225088) 2007 OR₁₀ has large variations in albedo. This is what scientists think is most likely and would also receive full credit.
62. (a) The moon
(b) 20, 21, 22
(c) The object that created this crater hit the surface of the moon at a very low impact angle.