

Part I: Matching

- | | | | | |
|-------------|-------------|--------------|--------------|--------------|
| 1. <u>J</u> | 5. <u>C</u> | 9. <u>T</u> | 13. <u>D</u> | 17. <u>H</u> |
| 2. <u>R</u> | 6. <u>S</u> | 10. <u>E</u> | 14. <u>I</u> | 18. <u>O</u> |
| 3. <u>L</u> | 7. <u>P</u> | 11. <u>M</u> | 15. <u>F</u> | 19. <u>A</u> |
| 4. <u>B</u> | 8. <u>N</u> | 12. <u>G</u> | 16. <u>Q</u> | 20. <u>K</u> |

Part II: Multiple Choice

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|--------------|--------------|--------------|--------------|--------------|
| 21. <u>D</u> | 27. <u>A</u> | 33. <u>D</u> | 39. <u>D</u> | 45. <u>C</u> |
| 22. <u>D</u> | 28. <u>A</u> | 34. <u>D</u> | 40. <u>B</u> | 46. <u>B</u> |
| 23. <u>C</u> | 29. <u>B</u> | 35. <u>B</u> | 41. <u>B</u> | |
| 24. <u>C</u> | 30. <u>D</u> | 36. <u>D</u> | 42. <u>B</u> | |
| 25. <u>B</u> | 31. <u>B</u> | 37. <u>C</u> | 43. <u>B</u> | |
| 26. <u>C</u> | 32. <u>D</u> | 38. <u>C</u> | 44. <u>A</u> | |

Part III: Free Response

47.a.

There is a distinct lack of craters

47.b.

They would not be strong enough

47.c.

Icy moons around giant planets are heated primarily through tidal interactions (friction). This can't be the case for Pluto, since there is no giant planet for it!

47.d.

2006

48.a.

Being "differentiated" means that the object has compositionally distinct layers at different depths. Based on this image, we could consider Ceres to be "differentiated".

48.b.

Ice, salts, and hydrated minerals

48.c.

Dawn observations cannot “see” below about 100 kilometers in depth, so it’s impossible to know when the middle layer transitions to the inner layer (the mantle)

49.a.

Nix and Hydra

49.b.

Eris

49.c.

2003 UB313 (Eris) is thought to be slightly bigger than Pluto. If Pluto were to remain a planet, then Eris should also be considered a planet, simply based on its size.

49.d.

2003 EL61

49.e.

Sedna has no known satellites. Gravitational interactions with a planet’s satellite(s) is the best way to determine mass.

49.f.

Its orbit is very inclined (relative to the ecliptic, which is where more searches for minor planets take place)

49.g.

Kuiper Belt Objects that are not in resonance with Neptune. “Cold” cubewanos are characterized by near-circular orbits and low inclinations and generally display only red colors, while “hot” cubewanos have orbits with higher eccentricities and larger inclinations and can be any color (blue to very red).

50.a.

2007 OR10

50.b.

2007

50.c.

33 times

50.d.

No, the variation in distance just means that the orbit is highly elliptical.

50.e.

Its moon (satellite)

50.f.

Hubble Space Telescope

50.g.

This object has a lot of methane frosts, which turn red when bombarded by sunlight and cosmic rays. The products are organic compounds called tholins.

51.a.

Saturn

51.b.

The Argonauts

51.c.

Cassini

51.d.

ISS-Narrow Angle

51.e.

It orbits in a retrograde direction, opposite from Saturn's major moons. Its overall density is inconsistent (much higher than expected) with Saturn's major moons as well.

51.f.

The figure shows that carbon dioxide is prevalent on Phoebe globally, although slightly more so in darker regions. This rules out the asteroid belt as a possible origin and suggests that a colder place, like the Kuiper Belt, is more likely.

51.g.

Brighter

52.a.

Moon

52.b.

Earth

52.c.

LRO (Lunar Reconnaissance Orbiter)

52.d.

Maria

52.e.

Silica (SiO_2)

52.f.

About 1/6 (0.165)

52.g.

Month

52.h.

Libration
