

What's Up! April 2022 Quiz (Planets and their Satellites) **Answers**

by John Rowland

Two notes about the quiz

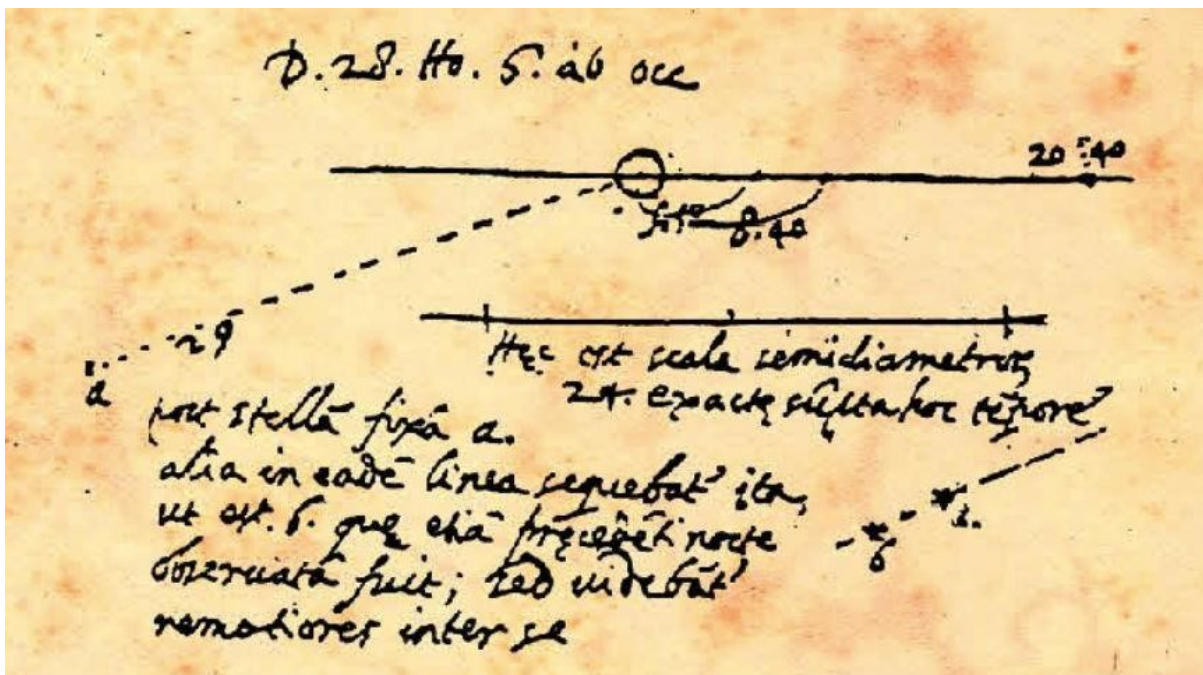
Some of the questions in this quiz take the form of presenting four correct statements and one incorrect one. This seems to be a preferred and positive way to help people learn about the topic rather than presenting four incorrect and one correct statement. I hope you agree.

1. What is the total number of natural satellites around all the planets in the solar system (including Pluto but excluding any other dwarf planets)?

- a) 32
- b) 37
- c) 183
- d) 207
- e) 212

Mercury – 0, Venus – 0, Earth – 1, Mars – 2, Jupiter – 80, Saturn – 83, Uranus – 27, Neptune – 14, Pluto – 5. Total 212.

2. There is evidence that on 28th December 1612, Galileo recorded what he thought was a fixed star during his observations of the Jovian satellites. This is from his Sidereus Nuncius.



In fact, the “star” was:

- a) The planet Uranus.
- b) **The planet Neptune.**
- c) The asteroid Ceres.
- d) The asteroid Pallas.
- e) The asteroid Juno.

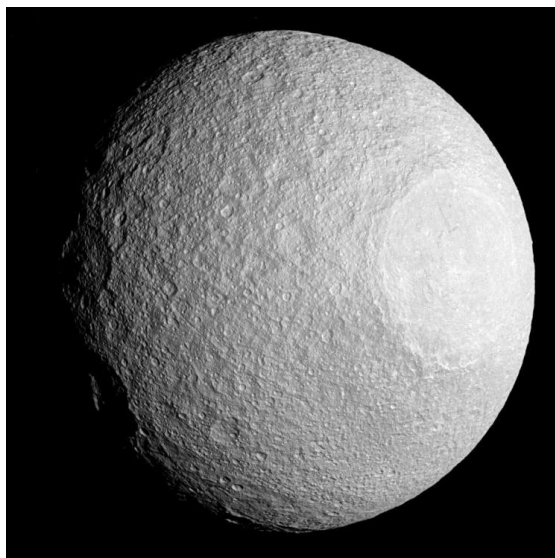
It was Neptune. Galileo saw it without realising it was a planet, 233 years before its confirmed discovery.

3. Earth is not the only planet to experience total solar eclipses caused by its moon. Which of the following statements is not correct?

- a) **Phobos can cause total solar eclipses visible from the Surface of Mars.**
- b) All four of Jupiter's Galilean moons can cause total solar eclipses that could be seen from Jupiter's surface (if it had one!).
- c) Seven of Saturn's moons can create total solar eclipses that could be seen from Saturn's "surface" (again, if it had one).
- d) Although the orbital plane of Uranus's moons is almost at right angles to the ecliptic, twelve of its satellites could cause total solar eclipses visible from its "surface".
- e) Charon can cause total solar eclipses on Pluto in batches, for a few years every 120 years.

The incorrect answer is a). To create a *total* solar eclipse, the angular diameter of the satellite (as seen from the planet's surface) must be equal to or greater than the angular diameter of the Sun. In every case except a), that is the case. Phobos isn't quite large enough to completely hide the Sun so would only cause annular eclipses.

4. What is the name of this satellite?



- a) Rhea
- b) Dione
- c) Tethys**
- d) Enceladus
- e) Mimas

It's Tethys. Could easily be mistaken for Mimas as both have a very large circular crater.

5. In this question regarding surface gravity, this is always quoted for the equator of the body, and take the surface gravity of a gas giant to be the gravity at the 1 bar pressure level in the atmosphere. The question is, which pair of bodies have the same surface gravity?

- a) Saturn and Neptune
- b) The Moon and Pluto
- c) The Earth and Saturn
- d) Venus and Uranus**
- e) Jupiter and Mercury

It's d). The surface gravities (in m/s/s) are: Mercury 3.70, Venus 8.87, Earth 9.80, Mars 3.72, Jupiter 24.92, Saturn 10.44, Uranus 8.87, Neptune 11.15, Pluto 0.58, The Moon 1.62. Notice – not surprisingly – that Mercury and Mars also have virtually identical surface gravities.

6. WARNING: This is a tough question and not for the faint-hearted! No idea? Just guess.

Mercury is an elusive planet because it is never far from the Sun in the sky. To make matters worse, its orbit is more elliptical than any other planet, and its angular distance from the Sun at greatest eastern or western elongation (GEE or GWE) can vary between 17.9° and 27.8° . Clearly, the most favourable time to observe it is when the greatest elongation is at its maximum and the ecliptic is oriented at right angles to the horizon, thereby putting the planet as high as possible at sunset or sunrise (whichever is applicable – GWE for observing before sunrise and GEE for observing after sunset). Unfortunately, these occasions are relatively rare and you need to be at the most favourable latitude. By the way, Mercury's aphelion (the point on its orbit when it is furthest from the Sun) occurs when a line from the Sun although Mercury points to the constellation of Scorpio. Which of the following set of circumstances is the most favourable?

- a) From about latitude 40°N for an August GEE.
- b) From about latitude 25°N for an April GWE.
- c) From near the equator for any greatest elongation on any date.
- d) From about latitude 25°S for an April GWE.
- e) From about latitude 40°S for an August GWE.

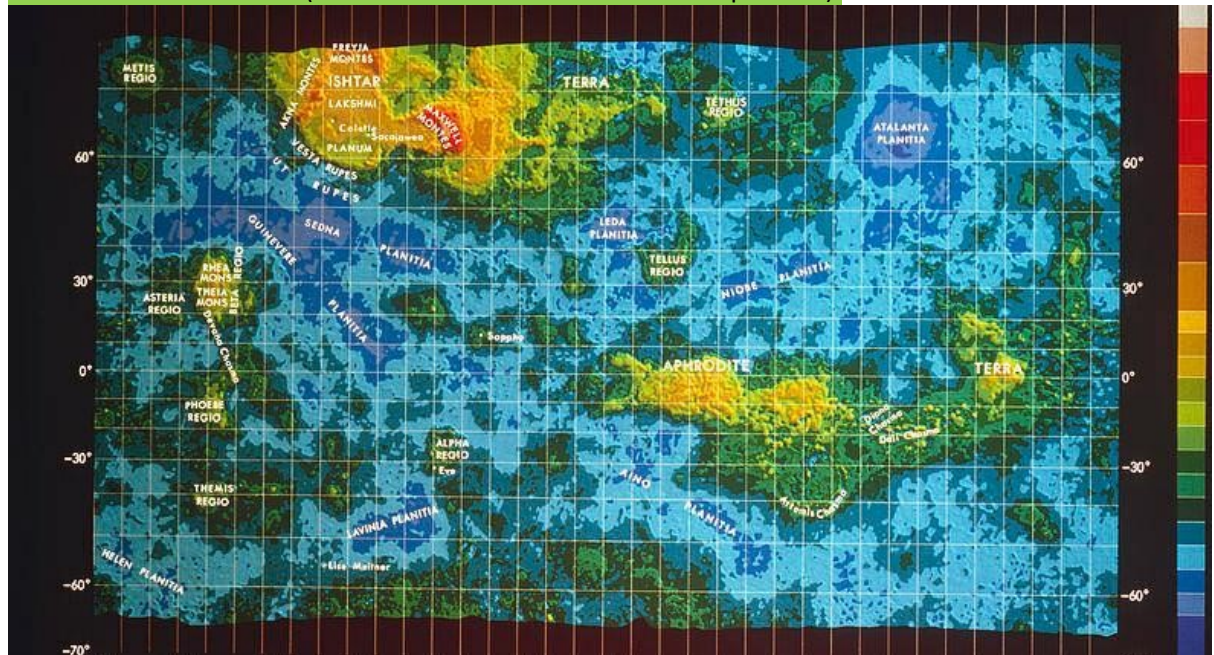
This question is best tackled with the aid of a diagram. Please look [here](#), and scroll down a bit to the orbits diagram. This correctly shows Mercury's orbit, with its aphelion lined up with where the Earth is in June. You can see that if Mercury was at aphelion when the Earth was in its August or April position, Mercury would be seen a good 27° away from the Sun. It would be to the left of the Sun on an August evening and to the right of the Sun on an April morning. Under both circumstances however, the ecliptic is angled southwards from the Sun's position. One would have to move to a latitude south of the equator to get the ecliptic to rise vertically upwards from the sunset or sunrise position. In fact, the best latitude is in the region of $20\text{--}25^\circ\text{S}$. You can therefore eliminate a) and b) because they are both north of the equator. You can also eliminate c) because though it is very favourable, it cannot be better than observing from 25°S . And e) is no good because not only is it too far south, it's a GWE not a GEE. So the answer is d).

(If you have a planetarium program, enter the details for the April 3rd 2026 GWE and see how you have to move to about 24°S to see Mercury straight up from the Sun at sunrise. This is in fact the most perfect GWE for 25 years.)

7. Which of the following statements about Venus is not correct?

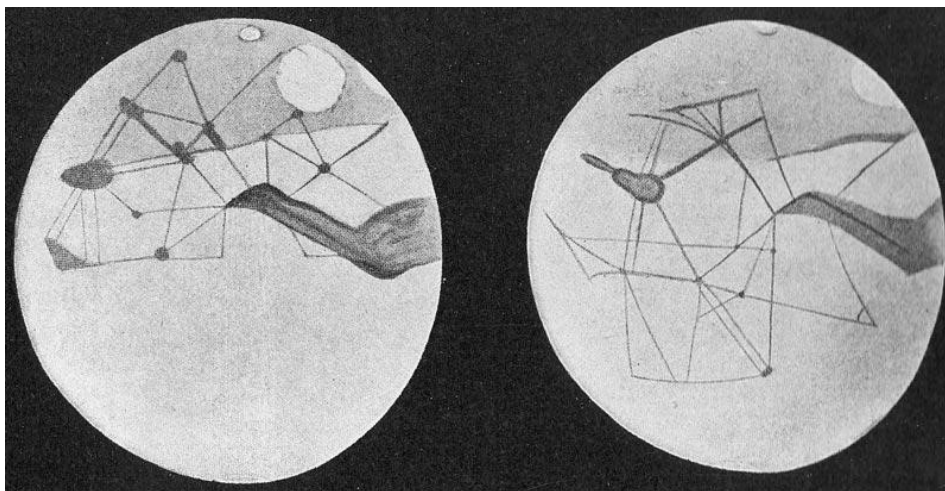
- a) Venus takes longer to rotate once on its axis than it takes to revolve once around the Sun.
- b) Venus has an atmosphere consisting of over 96% carbon dioxide and an atmospheric pressure 92 times the sea level pressure on Earth.
- c) Venus's mean surface temperature is 464°C , which is even hotter than the sun-facing side of Mercury.
- d) Venus has some surface features with radial and concentric fractures resembling spider webs, known as arachnoids.

- e) The prime meridian of Venus is now defined as passing through the central peak of the crater Ariadne on Leda Planitia (seen on the colour coded radar map below).



It's e) that's incorrect. The prime meridian does indeed pass through the crater Ariadne but this crater is not on Leda Planitia. It is on Sedna Planitia (in the upper left quarter of the image).

8. Which of the following statements about Mars is not correct?



- a) The drawings of Mars above were made by Giovanni Schiaparelli in 1877, who named the lines canali (the Italian for "channels"), which was mis-translated as "canals". These canals have since been revealed as an optical illusion.
- b) Much of the surface of Mars is covered with finely grained iron(III) oxide dust (basically rust), which accounts for its reddish appearance.
- c) Mars has the highest volcano in the solar system, Olympus Mons, 13.6 miles high.
- d) Mars has an enormous canyon system, the Valles Marineris, 2,500 miles long, 120 miles wide and up to 4.3 miles deep. (In comparison, the Grand Canyon on Earth is 277 miles long and 1.2 miles deep.)
- e) The polar caps of Mars consist primarily (70%) of water ice. If the ice from the south polar cap melted, it would be enough to cover the entire surface of the planet to a depth of 11 metres.

The drawings above were not made by Schiaparelli. They were made by Percival Lowell so it's a) that's not correct. Apart from that however, the rest of a) is correct.

9. Which of the following statements about Jupiter is not correct?

- a) According to one formation theory, at an early stage in Jupiter's life it orbited the Sun at only 1.5 AU and caused the destruction of super-Earths orbiting closer to the Sun.
- b) Jupiter is thought to have a very diffuse core, perhaps out to 40% of the planet's radius. Above this is mainly metallic hydrogen overlaid with molecular hydrogen.
- c) The visible outer layer of Jupiter comprises at least two decks of clouds of ammonia, about 300 miles deep.
- d) Lightning hundreds of times more powerful than on Earth has been seen in Jupiter's atmosphere.
- e) Jupiter has a magnetic field 14 times stronger than Earth's, making it the strongest in the solar system.

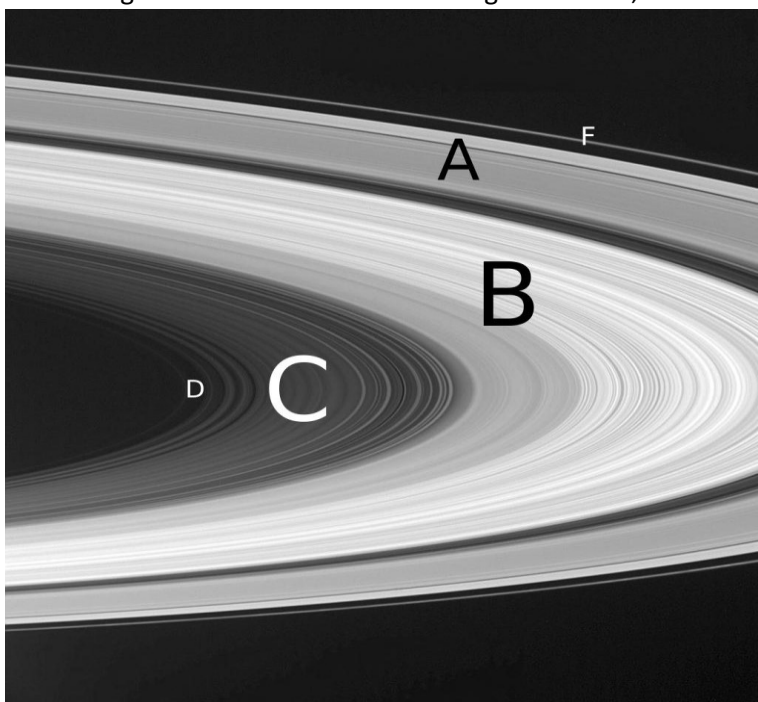
It's c) that is not correct. The depth of these ammonia cloud layers is more like 30 miles, not 300.

10. Which of the following statements about Jupiter's moons is not correct?

- a) For every four orbits that Io makes, Europa makes two and Ganymede makes one. This is an example of a Laplace resonance.
- b) Tidal flexing heats Io, Europa and Ganymede by friction and is to a large degree responsible for the volcanic activity of Io and the tectonically active surface of Europa.
- c) Ganymede's surface has a high albedo (reflectivity) attributed to the fact that 50-90% of its surface comprises solid carbon dioxide (dry ice).
- d) A popular hypothesis is that Europa has a water ocean beneath its surface, which may harbour extraterrestrial life.
- e) The surface of Callisto is the oldest and most heavily cratered in the solar system.

It's c) again that is not correct. In fact 50-90% of the surface of Ganymede is water ice, not dry ice.

11. Saturn must surely be the most majestic and beautiful object in the solar system. Here are some fascinating facts about Saturn and its rings. However, one so-called fact is incorrect. Which one is it?



Source: Cassini-Huygens/NASA

- a) The image above shows the major subdivisions of Saturn's ring system. The C ring was named the "Crepe Ring" by William Lassell in the 1800's.
- b) The main rings are typically only 9 metres thick but in some places contain vertical formations of bumps and ridges up to 3 Km high.
- c) There is an extremely faint but massive ring called the Phoebe ring that if it could be seen from Earth, would be the size of two full moons.
- d) The Cassini division is kept clear of material by the action of the shepherd moons Prometheus and Pandora.
- e) The moon Enceladus is mostly covered in fresh, clean ice, and has cryovolcanic geysers spurting about 200 Kg per second of water vapour, salt and ice from its south polar region, supplying most of the material making up Saturn's E ring.

It's d) that is incorrect. Far from being clear of material, the Cassini division is populated by numerous ringlets of material similar to that in the C ring. Prometheus and Pandora are indeed shepherd moons but influence the F ring. It is Mimas that maintains the Huygens Gap within the Cassini division through gravitational resonance with its particles rather than the shepherding effect.

12. And finally, a hotch-potch of statements about Uranus and Neptune, one of which is false. Which one is false?

- a) Wind speeds in the atmosphere of Uranus can reach 560 mph.
- b) Due to its extraordinary axial tilt (of 98°), when Uranus is at or near its equinox, one pole faces the Sun continuously whilst the other pole is in continuous darkness.
- c) The lowest recorded atmospheric temperature of Uranus was 49°K (-224°C), making it colder than Neptune and the coldest planet in the solar system.
- d) Neptune has the strongest sustained winds of any planet in the solar system, with recorded speeds of up to 1,300 mph.
- e) There have been cyclonic storms observed on Neptune, similar to Jupiter's Great Red Spot but darker, and below the bright cloud features often observed.

It's b) that's wrong. It should read, "... when Uranus is at or near its solstice ...". Not equinox.