Directions: Take this passage on your own (pacing is approximately 13 minutes for the passage and all questions). Then, review our videos on Evidence Based Reading Skills and we'll discuss all the strategies to use in order to crack questions like these.

This passage is adapted from Katherine Brown, "Astronomers Find First Evidence of Possible Moon Outside Our Solar System" 2018 by the National Aeronautics and Space Administration (NASA).

Using NASA's Hubble and Kepler space telescopes, astronomers have uncovered tantalizing evidence of what could be the first discovery of a moon orbiting a planet outside our solar system.

This moon candidate, which is 8,000 light-years from Earth in the Cygnus constellation, orbits a gas-giant planet that, in turn, orbits a star called Kepler-1625. Researchers caution that the moon hypothesis is tentative and must be confirmed by follow-up Hubble observations.

"This intriguing finding shows how NASA's missions work together to uncover incredible mysteries in our cosmos," said Thomas Zurbuchen, associate administrator of NASA's Science Mission Directorate at Headquarters, Washington. "If confirmed, this finding could completely shake up our understanding of how moons are formed and what they can be made of."

Since moons outside our solar system – known as exomoons – cannot be imaged directly, their presence is inferred when they pass in front of a star, momentarily dimming its light. Such an event is called a transit, and has been used to detect many of the exoplanets cataloged to date.

However, exomoons are harder to detect than exoplanets because they are smaller than their companion planet, and so their transit signal is weaker when plotted on a light curve that measures the duration of the planet crossing and the amount of momentary dimming.

Exomoons also shift position with each transit because the moon is orbiting the planet.

In search of exomoons, Alex Teachey and David Kipping, astronomers at Columbia University in New York, analyzed data from 284 Kepler-discovered planets that were in comparatively wide orbits, longer than 30 days, around their host star. The researchers found one instance in planet Kepler-1625b, of a transit signature with intriguing **anomalies**, suggesting the presence of a moon.

"We saw little deviations and wobbles in the light curve that caught our attention," Kipping said.

Based upon their findings, the team spent 40 hours making observations with Hubble to study the planet intensively – also using the transit method – obtaining more precise data on the dips of light. Scientists monitored the planet before and during its 19-hour transit across the **face** of the star. After the transit ended, Hubble detected a second, and much smaller, decrease in the star's brightness approximately 3.5 hours later. This small decrease is consistent with a gravitationally-bound moon trailing the planet, much like a dog following after its owner. Unfortunately, the scheduled Hubble observations ended before the complete transit of the candidate moon could be measured and its existence confirmed.

In addition to this dip in light, Hubble provided supporting evidence for the moon hypothesis by finding the planet transit occurring more than an hour earlier than predicted. This is consistent with a planet and moon orbiting a common center of gravity that would cause the planet to wobble from its predicted location, much the way Earth wobbles as our Moon orbits it.

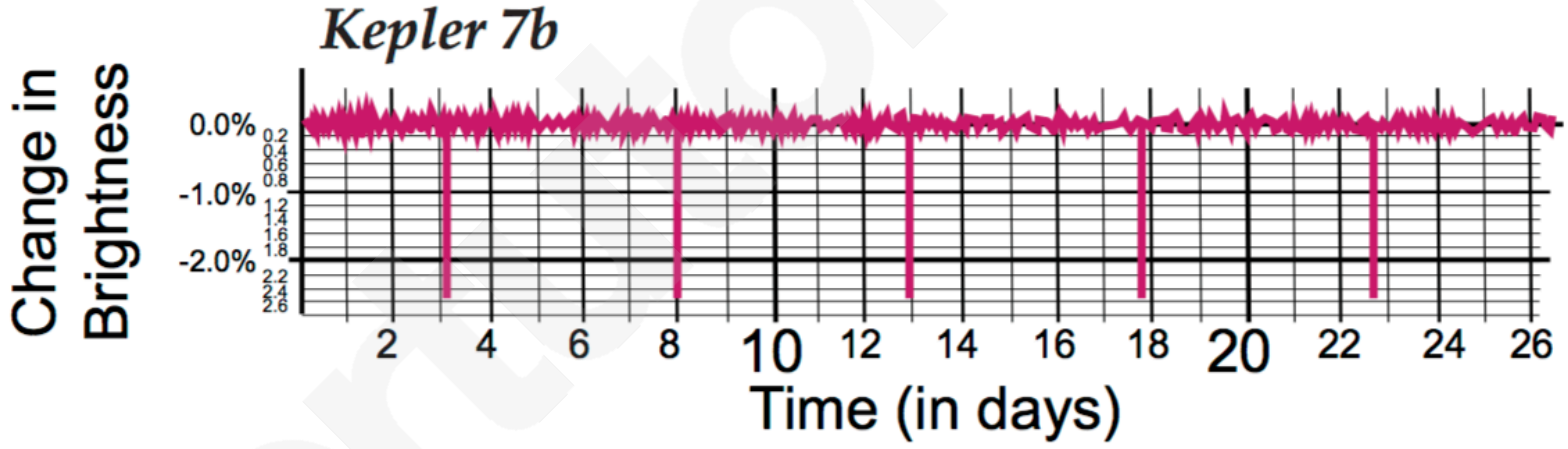
The researchers note the planetary wobble could be caused by the gravitational pull of a hypothetical second planet in the system, rather than a moon. While Kepler

has not detected a second planet in the system, it could be that the planet is there, but not detectable using Kepler's techniques.

Future searches for exomoons, in general, will target Jupiter-size planets that are farther from their star than Earth is from the Sun. The ideal candidate planets hosting moons are in wide orbits, with long and infrequent transit times. In this search, a moon would have been among the easiest to detect because of its large size. Currently, there are just a handful of such planets in the Kepler database. Whether future observations confirm the existence of the Kepler-1625b moon, NASA's James Webb Space Telescope will be used to find candidate moons around other planets, with much greater detail than Kepler.

"We can expect to see really tiny moons with Webb," Teachey said.

The graph below depicts the change in brightness of a star during transits of a Kepler discovered exoplanet over time.



Credits: NASA/ESA/L. Hustak, Graph: NASA/JPL Education – Exploring Exoplanets with Kepler. NASA does not endorse and is not affiliated with Supertutor Media Inc.

1. The main purpose of the passage is to

   A) Describe an exomoon and observations that cast doubt on its accepted classification
   B) Elaborate on a transit and how it is used to identify exoplanets and exomoons
   C) Explain models used to understand data from telescopes in our galaxy
   D) Detail a recent astronomical finding that supports a particular hypothesis

2. Which choice provides the best evidence for the claim that scientists believe further data should be collected on Kepler-1625?

A) Lines 7-9 (“Researchers... observations.”)
B) Lines 14-16 (“If confirmed...of.”)
C) Lines 48-50 (”Unfortunately... measured”)
D) Lines 70-72 (“NASA’s James Webb Space Telescope... Kepler.”)

3. Based on the passage, which of the following provides the strongest indication that a Kepler planet may have an exomoon?

A) It possesses a comparatively wide orbit
B) It is nearer to its star than Earth is to its sun
C) Its transit time is easily measured
D) Its star appears to momentarily dim

4. Which of the following provides the best evidence for the answer to the previous question?

A) Lines 17-20 (“Since...light. “)
B) Lines 30-34 (“In search...star.”)
C) Lines 37-38 (“We saw...said.”)
D) Lines 64-67 (“Future...times.”)

5. As used in line 5, “candidate” most nearly means:

A) applicant
B) nominee
C) prospect
D) imitator

6. The main purpose of the analogy of the dog (line 48) is to

A) suggest a sense of loyalty
B) dramatize a rare occurrence
C) articulate a widely held belief
D) clarify a pattern of behavior

7. According to the passage, which statement could explain why Hubble observed planet Kepler-1625b's transit earlier than predicted?

A) An unseen planet in the solar system influenced Kepler-1625b with its gravitational pull.
B) Kepler-1625b and its moon lack a common center of gravity, causing a shift in the planet's positioning.
C) The earth wobbles as its moon orbits it, compromising observational accuracy.
D) The wide orbit of Kepler-1625b prevented its completion of a full orbit cycle.

8. Which choice provides the best evidence for the previous question?

A) Lines 30-35 ("In search...Kepler-1625b")
B) Lines 51-52 ("In addition...predicted")
C) Lines 55-58 ("This is...orbits it")
D) Lines 59-63 ("The researchers...techniques")

9. As presented in the passage, Teachy and Kipping's research primarily relied on which type of evidence?

A) Historical data
B) Expert testimony
C) Random sampling
D) Telescopic observations

10. Based on the graph and the description of a transit in the passage, the time it takes for Kepler 7b to make a complete orbit would most likely be approximately

A) 26 days
B) 7 days
C) 5 days
D) 3 days

11. Based on the passage and the graph, how would Teachy and Kipping regard Kepler 7b's potential to host an exomoon?

A) Probable, as its periodic changes in brightness could indicate the presence of an exomoon.
B) Possible, as its orbit is shorter than 30 days.
C) Unlikely, as its transit data do not exhibit variations indicative of exomoons.
D) Uncertain, as its planetary mass is not significant enough to make its moon visible in a transit

Answer Key:

1. D
2. A
3. D
4. A
5. C
6. D
7. A
8. D
9. D
10. C
11. C