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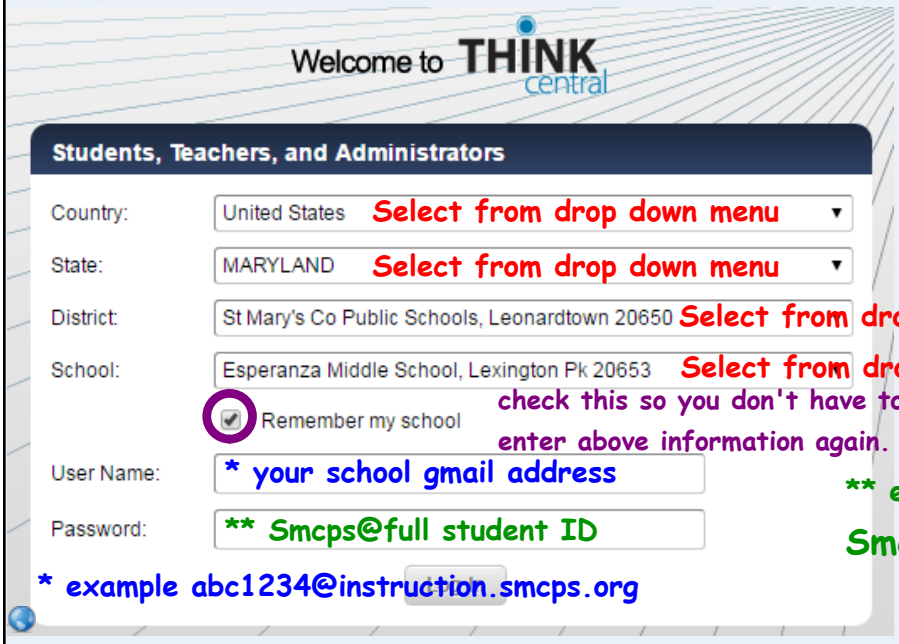


Oct 17-2:47 PM

Disciplinary Core Ideas

Disciplinary Core Ideas

ESS1.A: The Universe and Its Stars
- Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1)
- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2)

ESS1.B: Earth and the Solar System
- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3)
- This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)
- The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)

Plan of the Day:

0) OVERDUE: Expanding Universe Quick Lab. Then, place your Expanding Universe Quick Lab in the WHITE MORNING BIN on the black cart next to the student table. Make sure your FIRST & LAST NAME and your CLASS (12A, 36A, 78A, 12B, 36B or 78B) are on your handout.

Go over Writing and QuickLabs

1) Once I return the the following graded PRODUCT assignments,

CHOOSE and ANSWER Question 10 (pg 119) OR Question 17 (pg 123) and Orbital Ellipses Quick Lab, we will go over writing expectations.

2) FINISH READING Unit 3 Earth-Sun-Moon System, Lesson 1, Earth's Days, Years, and Seasons pages 140-149.

Nov 3-12:59 PM

#10, Actual Question:

10 Research Astronomer Clyde Tombaugh discovered Pluto in 1930. Research why Tombaugh was searching beyond Neptune for "Planet X" and how he discovered Pluto.

Paragraph 1 Paragraph 2

The HIGHLIGHTED information (various colors) includes quotes students *should have used* or *paraphrased* in their responses to the question. These quotes come from the parts of the readings I had identified by placing a "red box" to draw student attention to the information relevant to the questions asked.

Nov 9-6:32 AM

2) Finding the long sought Planet X was Tombaugh's primary assignment at Lowell. Percival Lowell, who had founded the observatory – and who gained fame for his notion of canals on the planet Mars – had also searched for a Planet X. It remained a priority even after Lowell's death in 1916. Tombaugh was hired to continue Lowell's search. He discovered Pluto a year later, on February 18, 1930.

Clyde Tombaugh using a device to 'blink plates,' that is, to click back and forth between two images of the same patch of sky, taken on two different nights. On those two images, the distant background stars would not appear to move, but closer objects would move from one night to another. Comparing thousands of images, Tombaugh discovered Pluto. Image via Lowell Observatory.

Why were astronomers led to search for a Planet X in the first place? What started the search that ultimately resulted in Pluto's discovery?

At the beginning of the 19th century, astronomers believed something was gravitationally disturbing the orbit of the 7th planet, Uranus. At the time, Uranus was the outermost known planet. The astronomers concluded another planet must exist beyond Uranus, and the location of Neptune was mathematically predicted. Not long afterwards, in 1846, Neptune was found, based on these predictions. But the orbit of Neptune had unexplained irregularities, too. And so astronomers believed there was an unknown planet – a Planet X – beyond Neptune.

The search for it led to Pluto's discovery. Very soon after the discovery of Pluto, astronomers realized is too tiny to have caused the supposed irregularities in Neptune's orbit. And later the irregularities were explained away by other means. In 2006, the International Astronomical Union changed the status of Pluto from one of nine major planets in our solar system to dwarf planet. There are now numerous bodies in the outer solar system.

Nov 9-6:32 AM

1) Clyde William Tombaugh (/ˈtɒmbɔː/; February 4, 1906 – January 17, 1997) was an American astronomer. He discovered Pluto in 1930, the first object to be discovered in what would later be identified as the Kuiper belt. At the time of discovery, Pluto was considered a planet but was later reclassified as a dwarf planet. Tombaugh also discovered many asteroids. He also called for the serious scientific research of unidentified flying objects, or UFOs.

While a young researcher working for the Lowell Observatory in Flagstaff, Arizona, Tombaugh was given the job to perform a systematic search for a trans-Neptunian planet (also called Planet X), which had been predicted by Percival Lowell and William Pickering.

Tombaugh used the observatory's 13inch astrograph to take photographs of the same section of sky several nights apart. He then used a blink comparator to compare the different images. When he shifted between the two images, a moving object, such as a planet, would appear to jump from one position to another, while the more distant objects such as stars would appear stationary. Tombaugh noticed such a moving object in his search, near the place predicted by Lowell, and subsequent observations showed it to have an orbit beyond that of Neptune. This ruled out classification as an asteroid, and they decided this was the ninth planet that Lowell had predicted. The discovery was made on Tuesday, February 18, 1930,[7] using images taken the previous month.[13] The name "Pluto" was suggested by Venetia Burney, then an 11year old English schoolgirl, who died in April 2009, having lived to see the reclassification of Pluto as a dwarf planet. It won out over numerous other suggestions because it was the name of the Roman god of the underworld, who was able to render himself invisible, and because Percival Lowell's initials PL formed the first 2 letters. The name Pluto was officially adopted on May 1, 1930.

Nov 9-6:32 AM

APPROACH - Restate the question as part of your claim:

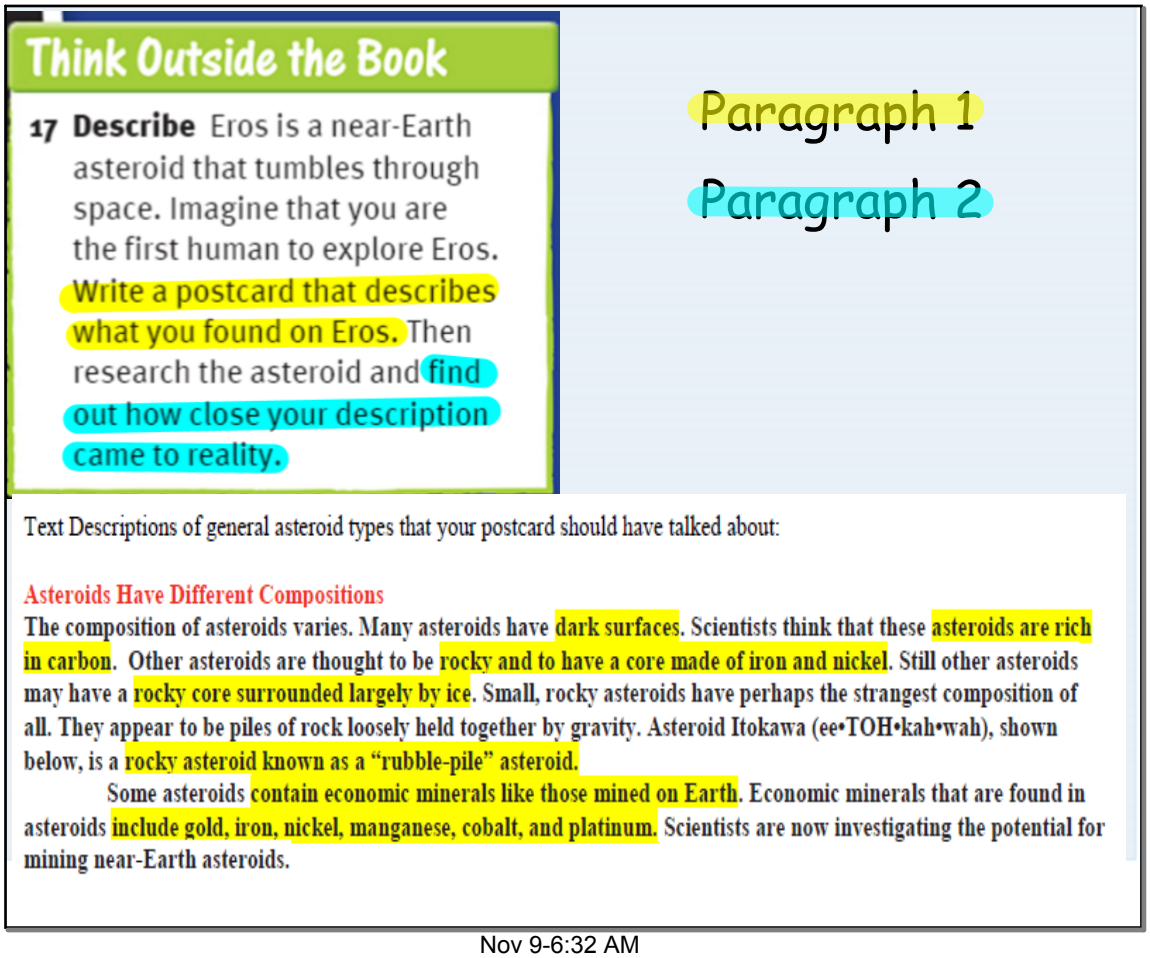
Paragraph 1:

Tombaugh was searching beyond Neptune for Planet X for a number of reasons. Then continue, listing the reasons starting with the MOST IMPORTANT one.

Paragraph 2:

Tombaugh performed a systematic search for a trans-Neptune planet. Then continue, describing the steps he took.

Nov 9-3:25 PM



Nov 9-6:32 AM

APPROACH - Start your postcard with a claim:

Paragraph 1:

WOW! Eros is an interesting asteroid with lots of cool stuff! Then continue, listing the materials that make up Eros that you thought you might find based on the passage in the text.

Paragraph 2 possibilities:

I described Eros PERFECTLY! or I was TOTALLY OFF TARGET in my postcard from Eros! or I was partly right in my description of Eros. SAY SO! Then continue, describing what you astronomers actually know about Eros from your readings as support.

Nov 9-3:32 PM

1) The target of the NEAR mission is 433 Eros, the first discovered near-Earth asteroid (NEA) and the second-largest. Eros also is one of the most elongated asteroids, a potato-shaped body with estimated dimensions of 20.5 by 8 by 8 miles (33 by 13 by 13 kilometers). Its size qualifies Eros as one of only three NEAs with diameters above 6 miles (10 kilometers).

There is no air and no evidence of water on Eros. Daytime temperature is about 100 deg. C (212 deg. F), while at night it plunges to -150 deg. C (-238 deg. F). Gravity on Eros is very weak but sufficient to hold a spacecraft in orbit.

Eros is one of the S-type (silicaceous) asteroids, the most common type in the inner asteroid belt and the subject of debate over their relationship to meteorites. Galileo's flyby observations of Gaspra and Ida (both of which are S-types) did not provide the answer, largely because remotely sensed spectral data cannot accurately determine the relative abundances of key elements. This is a major goal of the NEAR mission to Eros.

Nov 9-6:32 AM

2) 433 Eros is an S-type near Earth asteroid approximately 34.4×11.2×11.2 kilometres (21.4×7.0×7.0 mi) in size, the second largest near Earth asteroid after 1036 Ganymed. It was discovered in 1898 and was the first near Earth asteroid discovered. It was the first asteroid orbited by an Earth probe (in 2000). It belongs to the Amor group.

Surface gravity depends on the distance from a spot on the surface to the center of a body's mass. Eros's surface gravity varies greatly because Eros is not a sphere but an elongated peanut-shaped (or potato or shoe shaped) object. The daytime temperature on Eros can reach about 100 °C (373 K) at perihelion. Nighttime measurements fall near −150 °C (123 K). Eros's density is 2.67 g/cm3, about the same as the density of Earth's crust. It rotates once every 5.27 hours.

Data from the Near Earth Asteroid Rendezvous spacecraft collected on Eros in December 1998 suggests that it could contain 20,000 billion kilograms of aluminum and similar amounts of metals that are rare on Earth, such as gold and platinum.[15]

Nov 9-6:32 AM

Name:_____ Partner:_____ Class:_____

QUICK LAB DIRECTED INQUIRY

Orbital Ellipses

In this lab, you will make models of planetary orbits. Johannes Kepler revolutionized astronomy when he proved that planetary orbits are ellipses, not perfect circles. His first law of planetary motion states that planetary orbits are ellipses (ovals) that have the sun as one focus and an empty point in space as the other focus.

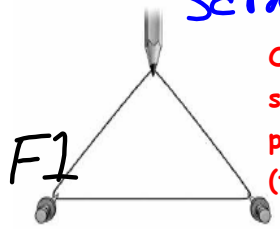
OBJECTIVE
- Describe the orbits of planets.

MATERIALS
For each student
- metric ruler
- paper
- pencil
- 2 pieces of corrugated cardboard, approx. 27 cm × 21 cm
- safety goggles
- strong thread or fine string
- thumbtacks or

PROCEDURE

1. Place the **paper** on top of the **cardboard**. Insert one **thumbtack** through the paper and the cardboard, near the center of the piece of paper. Use the **metric ruler** to measure a location 2 cm from the thumbtack. Insert a second thumbtack at this location. The two thumbtacks will be the *foci* (singular, *focus*) of your ellipse.
2. Tie the ends of the **thread** so that the thread forms a circle. Loop the thread around the thumbtacks and **pencil**, as shown in the illustration below. Hold the pencil vertically with its point touching the paper.

3 drawing (3 pts)



One pin ALWAYS stays in its original place. Label it F1 (focus 1)

3. Pull the string so that it is tight, and use the pencil to trace an ellipse around the foci. Label this ellipse "Ellipse A."

Name _____ Class _____ Date _____

4. Move **one** of the thumbtacks so that the distance between the foci is 4 cm. Predict how the shape of the ellipse will change.

more elliptical (oval)
bigger or smaller
less elliptical (oval)

1pt

5. Trace the new ellipse, and label it "Ellipse B."
6. A) Describe how changing the distance between the foci affected the shape of the ellipse.

The ellipse got smaller + more oval.

1pt

B) Was your prediction correct?

Yes or no

Sep 30-3:12 PM

Name _____ Class _____ Date _____

7. A) Describe how you would change this setup to create a perfect circle. Change the setup and test your ideas. Label this ellipse "Ellipse C."

Eliminate one push pin.

1pt

B) Were your ideas correct?

Yes

1pt

8. *Eccentricity* is a measure of how much the shape of an ellipse differs from the shape of a perfect circle.

The eccentricity of an ellipse is equal to the distance between its foci divided by the maximum width of the ellipse.

Calculate the eccentricity of each of your ellipses, and record it below.

1 Ellipse A $\frac{2}{7} = 0.29$

1 Ellipse B $\frac{4}{5} = 0.8$

1 Ellipse C $\frac{0}{9} = \emptyset$

Name _____ Class _____ Date _____

9. Earth's orbit has an eccentricity of about 0.01. Pluto's orbit has an eccentricity of about 0.24, and the orbit of Halley's comet has an eccentricity of about 0.96. Which of the ellipses you drew most closely matches each of these orbits?

1pt Ellipse A ≅ Pluto

1pt Ellipse B ≅ H.C.

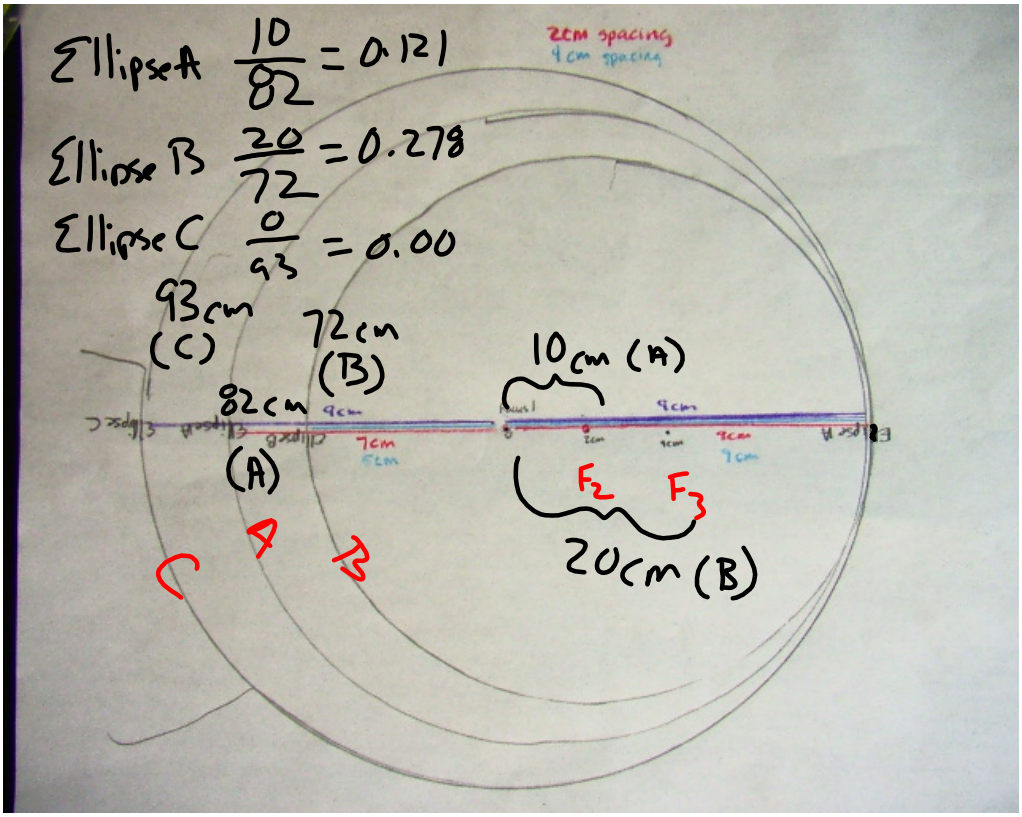
1pt Ellipse C ≅ Earth

10. The sun is at one focus of Earth's orbit. If Earth's orbit has a very small eccentricity, where is the other focus of Earth's orbit? Explain your answer.

Think about what the first push pin represents in terms of "focus." That should help you think about what the second push pin represents.

5pt If Earth has a very small eccentricity, then the other focus must be very close to the first. The only way to get a circle is to have one focus. Two foci close together gets you nearly a circle.

Sep 30-3:12 PM


Ellipse A 10/82 = 0.121
Ellipse B 20/72 = 0.278
Ellipse C 0/93 = 0.00
2cm spacing
4cm spacing
93cm (C)
72cm (B)
82cm (A)
10cm (A)
9cm
7cm
5cm
F2
F3
20cm (B)
C
A
B

Oct 18-7:54 AM