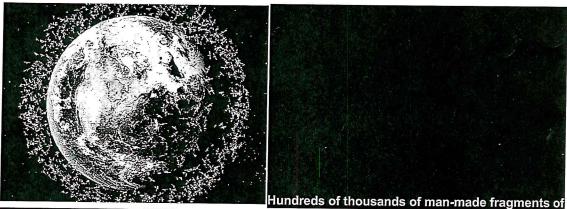
A Forgotten Piece of Space Junk is Headed for Earth

The object could be a lost piece of a rocket dating back to the Apollo missions



debris orbit around the Earth, as depicted here in an illustration of the cosmic mess. (Science Photo Library/Corbis)

By **Danny Lewis**

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In just a few weeks, a forgotten piece of space junk will re-enter the Earth's atmosphere above the Indian Ocean. Astronomers initially detected the object two years ago, but they're still unsure what it actually is.

After more than 60 years of flinging rockets, space stations and satellites into orbit, the sky has gotten pretty crowded. While Earth's orbit isn't quite as cluttered <u>as in the future envisioned in "WALL-E,"</u> there is still plenty of debris left over from old satellites and space launches littering the sky.

Known as '<u>space junk</u>,' this debris is often found in low orbit around Earth and is tracked by several space agencies, including the European Space Agency, NASA and the U.S. military.

What's curious about this new piece of space junk is how recently it was discovered and how odd its orbit is. According to the ESA, the mysterious object, called WT1190F, was first detected in 2013 by scientists at the Catalina Sky Survey, a project that scans the sky for near-Earth objects like asteroids and comets.

Unlike most space junk, WT1190F has an elliptical orbit that takes it deep into space. At its furthest point from Earth, the object is about twice as far as the distance between the Earth and the Moon, <u>Traci Watson writes for Nature News</u>.

Judging by its trajectory, scientists believe that it is just a few meters wide, not very dense and could be hollow. This data suggests that the space junk could be a part of an old rocket, panels from a past moon mission, or some other "lost piece of space history that's come back to haunt us," Harvard astrophysicist <u>Jonathan McDowell tells Watson</u>.

The object will re-enter the Earth's atmosphere above the Indian Ocean on November 13th. But there's no need to worry: WT1190F is tiny, cosmically speaking.

While most of it will probably burn up as it re-enters the atmosphere near the Sri Lankan coast, astronomers are excited for the rare chance to watch how WT1190F acts as it rockets through the sky.

Most funding and attention goes towards tracking space debris in low-Earth orbit, as it can interfere with communications satellites. Much less is known about objects in far-flung orbits like WT1190F, which is why it went for so long without being detected. Now that the object is on its way here, astronomers will get to test out a new set of tracking systems designed to detect and analyze debris with erratic orbits like this one, Alissa Walker reports for *Gizmodo*.

In the meantime, get ready for some spectacular shots of WT1190F plummeting back to Earth. While it may not be on track to cause any damage, the piece of junk should burn brightly enough to be visible during the day.

Read more:

http://www.smithsonianmag.com/smart-news/forgotten-piece-space-junk-headed-earth-180957072/#m7W2oy0Fj4eQAhoa.99

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PHASES OF THE MOON MODEL



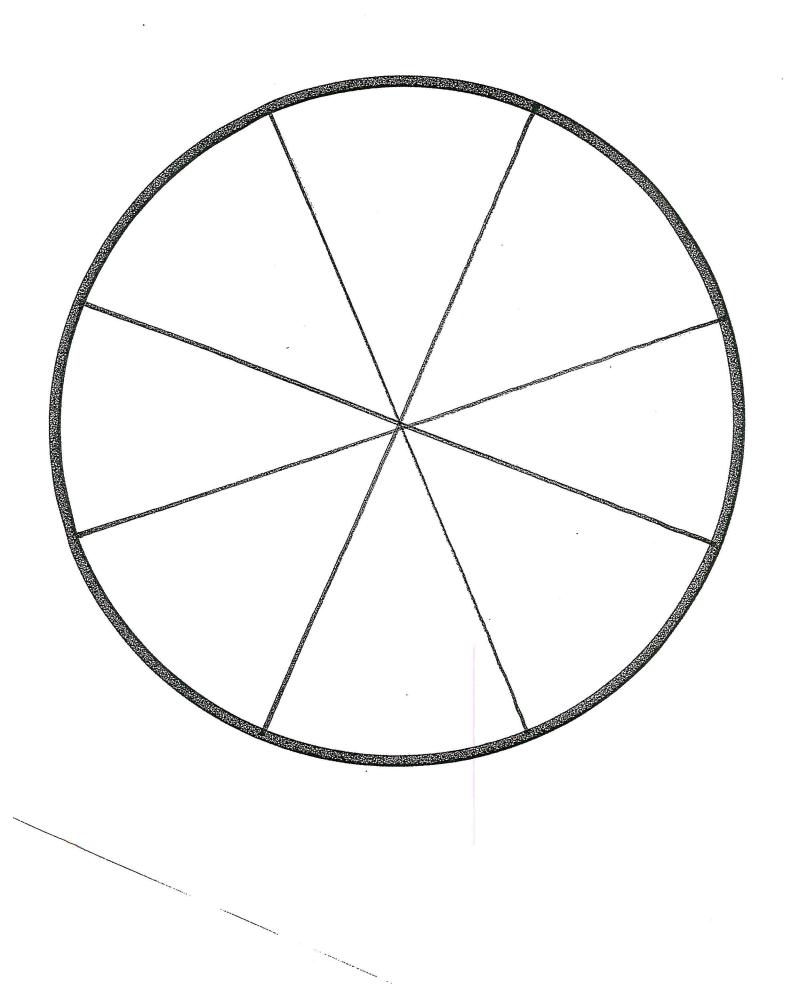
You must include:

- 1. The sun and Earth (label them)
- 2. The moon in the following phases, (label them):
 - a.new moon
 - b. full moon
 - c. waxing crescent
 - d.waning crescent
 - e.first quarter
 - f. third quarter
 - g. waxing gibbous
 - h.waning gibbous
- 3. For each phase, label the degrees from the new moon
- 4. For each phase, indicate how many days from the new moon it is in its cycle

10 pts for the sun and Earth and 5pts for each phase with all the information required.

Due: no later than Wednesday, Dec 20th.

This project must be neat, complete and you must hand in this rubric with the assignment in order to receive a 100%.



Identify the Phases of the Moon

<u>Waxing Crescent</u> - when we can see only a sliver of the moon's disk (*righ*t-hand side).

<u>Full Moon</u> - when the moon's disk is light because the Earth is between the sun and the moon

Gibbous Waxing - when we can see roughly three-quarters of the moon's disk (the right side of the moon is lit). First Quarter - can see one-half of the moon's disk (at First Quarter, you see the right half of the moon lit [this one-quarter of the entire moon's surface]).

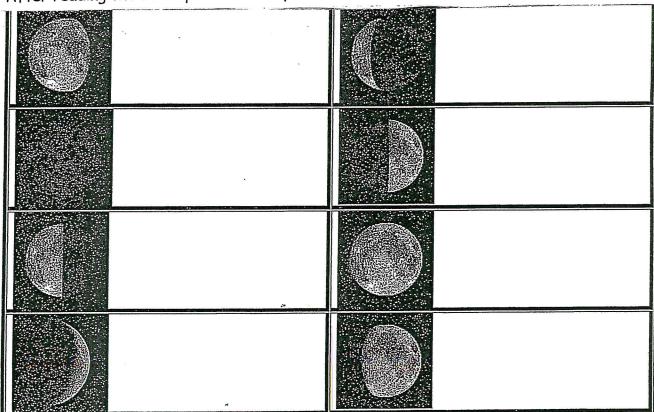
New Moon - when the moon's disk is dark (and invisible to us) because the moon is between the sun and the Earth

Last/3rd Quarter - can see one-half of the moon's disk (at Last/3rd Quarter, you see the left half of the moon lit [this one-quarter of the entire moon's surface]).

Gibbous Waning - when we can see roughly three-quarters of the moon's disk (the left side of the moon is lit).

Waning Crescent – when we can see only a sliver of the moon's disk (left-hand side).

Now, on the other side: After reading the description of each phase, write the name of the phase by its picture.



Name:	
Period:	
Date: _	

Anchor Phenomena: Swinging a Ball on a String Focus Question: How does a ball travelling around on a string model orbital motion?

Construct a model and written explanation to explain the phenomena. Provide an example to clarify your explanation/model.

REFINE Your Thinking	ninking	
Source	Notes	How does this help me understand the phenomena?
Team Members Initial Anchor Phenomena Models & Explanations		
Anchor Text (info) What is Orbit?		
Anchor Text (pop) A forgotten piece of space junk is headed for Earth		
Task To Electric Magnetic // V180 USCS		

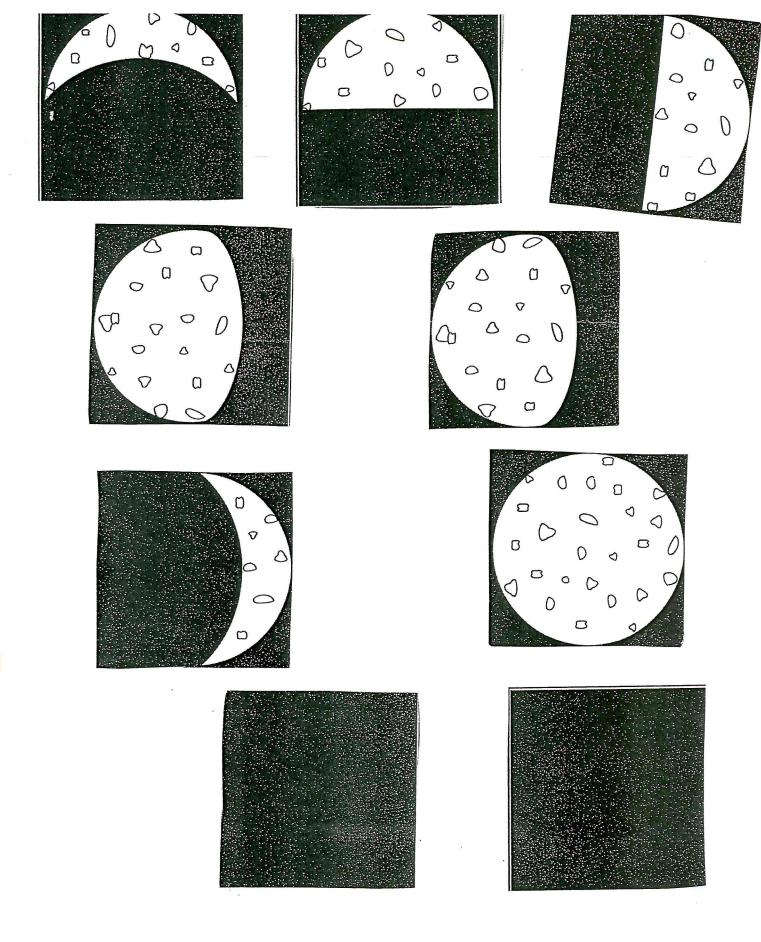
Adapted from: San Lorenzo Unified School District 8.2.U 1



Period: _

_ Date: _

REVISED explanation/model. Describe how thinking with your thought partners or examining other sources helped you make meaning of [concept] and in developing a



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Name:	-	
	Moon Phases	
New Moon	Waxing Crescent	First Quarter
Waxing Gibbou	ıs Full Moon	Waning Gibbous
Last Quarter	Waning Crescent	New Moon
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What Factors Affect Gravity?

A skydiver would be surprised if she jumped out of a plane and did not fall. We are so used to objects falling that we may not have thought about why they fall. One person who thought about it was Sir Isaac Newton. He concluded that a force acts to pull objects straight down toward the center of Earth. Gravity is a force that pulls objects toward each other.

Universal Gravitation Newton realized that gravity acts everywhere in the universe, not just on Earth. It is the force that makes the skydivers in Figure 2 fall to the ground. It is the force that keeps the moon orbiting around Earth. It is the force that keeps all the planets in our solar system orbiting around the sun.

What Newton realized is now called the law of universal gravitation. The law of universal gravitation states that the force of gravity acts between all objects in the universe that have mass. This means that any two objects in the universe that have mass attract each other. You are attracted not only to Earth but also to

the moon, the other planets in the solar system, and all the objects around you. Earth and the objects around you are attracted to you as well. However, you do not notice the attraction among small objects because these forces are extremely small compared to the force of Earth's attraction.



FIGURE 2

Observing Gravity

Newton published his work on gravity in 1687.

Observe What observations might you make today that would lead you to the same conclusions about gravity? Write down your ideas below.

Identify Supporting
Evidence Underline the factors that determine how strong the gravitational force is between two objects.

exists between any two objects in the universe. However, you don't see your pencil fly toward the wall the way you see it fall toward Earth. That's because the gravitational force between some objects is stronger than the force between others. You observe only the effects of the strongest gravitational forces. Two factors affect the gravitational attraction between objects: mass and distance. Mass is a measure of the amount of matter in an object. The SI unit of mass is the kilogram.

The more mass an object has, the greater the gravitational force between it and other objects. Earth's gravitational force on nearby objects is strong because the mass of Earth is so large. The more massive planets in Figure 3 interact with a greater gravitational force than the less massive planets. Gravitational force also depends on the distance between the objects' centers. As distance increases, gravitational force decreases. That's why Earth can exert a visible gravitational force on a pencil in your room and not on a pencil on the moon.

FIGURE 3Gravitational Attraction

Gravitational attraction depends on two factors: mass and distance. Suppose there was a solar system that looked like this.

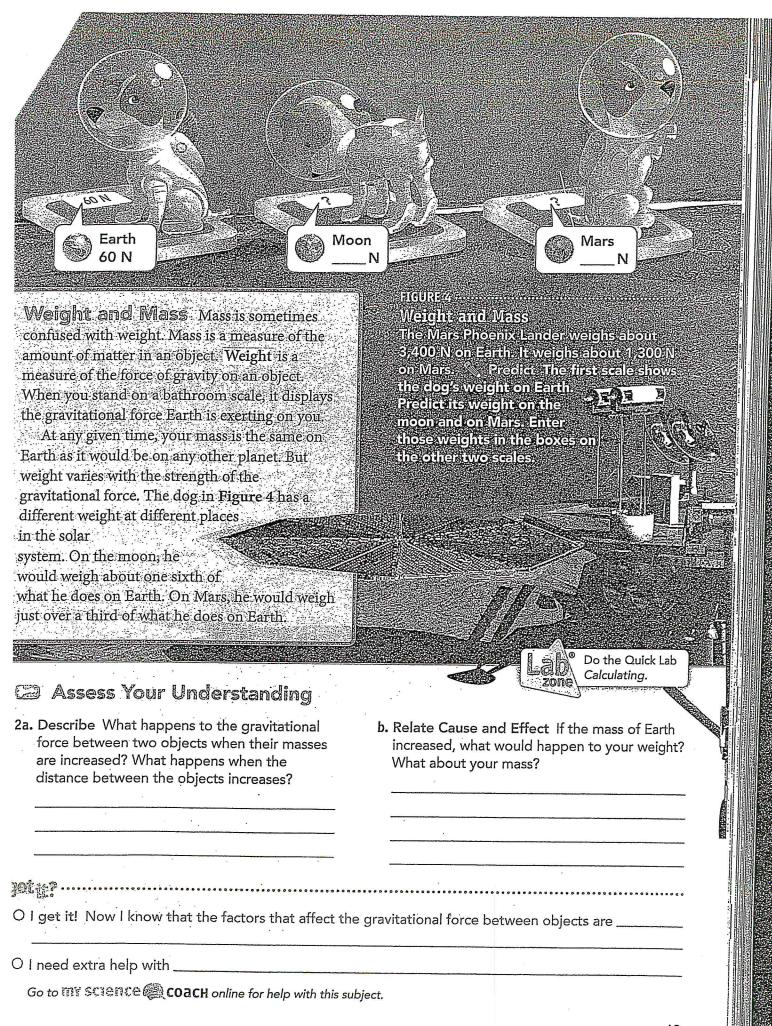
Interpret Diagrams Use the diagram below to compare the gravitational force between different planets and their sun. Assume all planets are made of the same material, so bigger planets have more mass.

Circle the object in the outermost orbit that experiences the greatest gravitational pull from the sun.

Planet B's force arrow from the sun's gravitational pull should be (longer/shorter) than the arrow from Planet A.

Draw what a planet would look like if it was the same distance from the sun as Planet C but experienced a smaller

gravitational pull from the sun.



Satellites in orbit around Earth continuously fall toward larth, but because Earth is curved they travel around it. In other vords, a satellite is a falling object that keeps missing the ground! It alls around Earth rather than onto it. Once it has entered a stable rbit, a satellite does not need fuel. It continues to move ahead due o its inertia. At the same time, gravity continuously changes the atellite's direction. Most satellites are launched at a speed of about 7,900 m/s. That's more than 17,000 miles per hour!

Centripetal Force Many manufactured satellites orbit Earth in an almost circular path. Recall that an object traveling in a circle is accelerating because it constantly changes direction. If an object is accelerating, a force must be acting on it. A force that causes an object to move in a circular path is a centripetal force (sen TRIP ih tul). The word centripetal means "center-seeking." Centripetal forces always point toward the center of the circle an object is moving in. If you could turn off a centripetal force, inertia would cause the object to fly off in a straight line. For example, the string of a yo-yo being swung in a circle provides a centripetal force. Cutting the string would cut off the centripetal force, and



Identify What is creating the centripetal force in each situation below?

- A tetherball swinging around a pole
- Mars orbiting around the sun
- A child standing on a merrygo-round



Orbiting Earth.

Assess Your Understanding

the yo-yo would fly off in a

straight line.

1a. Identify What is the force that causes objects to move in circles?

b. Predict If Earth's gravity could be turned off, what would happen to satellites that are currently in orbit? Explain your reasoning.

O I get it! Now I know that satellites stay in orbit

O I need extra help with _____

Go to MY SCIENCE COACH online for help with this subject.