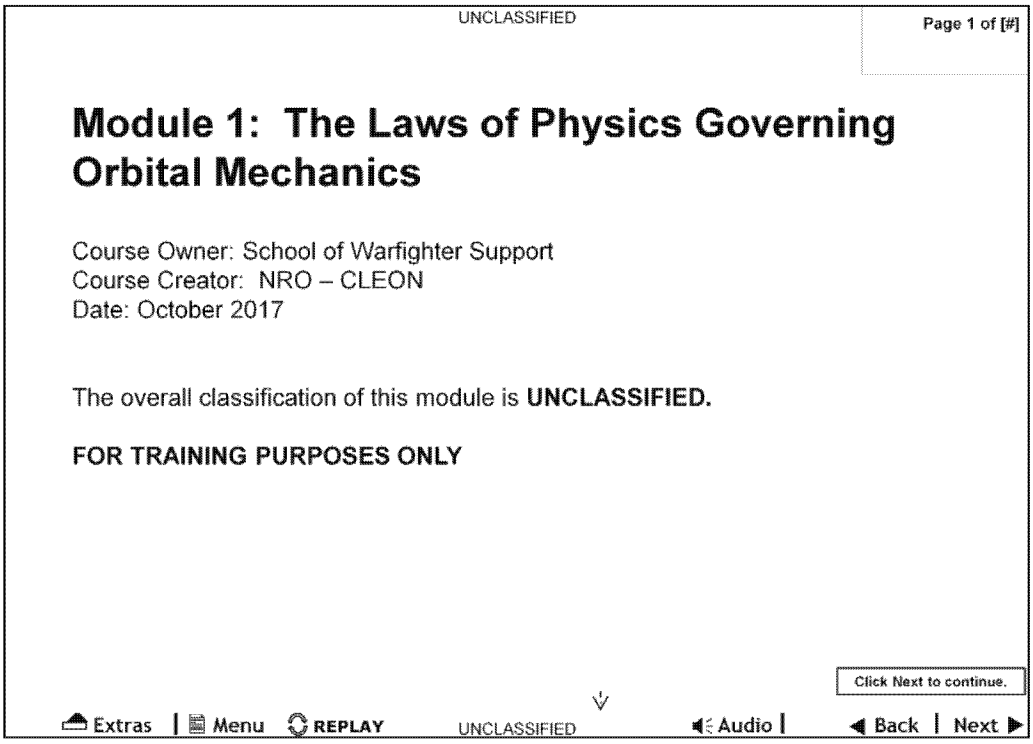


Purpose of screen: Classification/Splash page gives overall classification of entire module
Objective: [Objective to which this slide corresponds]
Sources: [Where did the content for this page originate?]

DEVELOPER NOTES:

User Instruction: Click Next.

Media Elements:

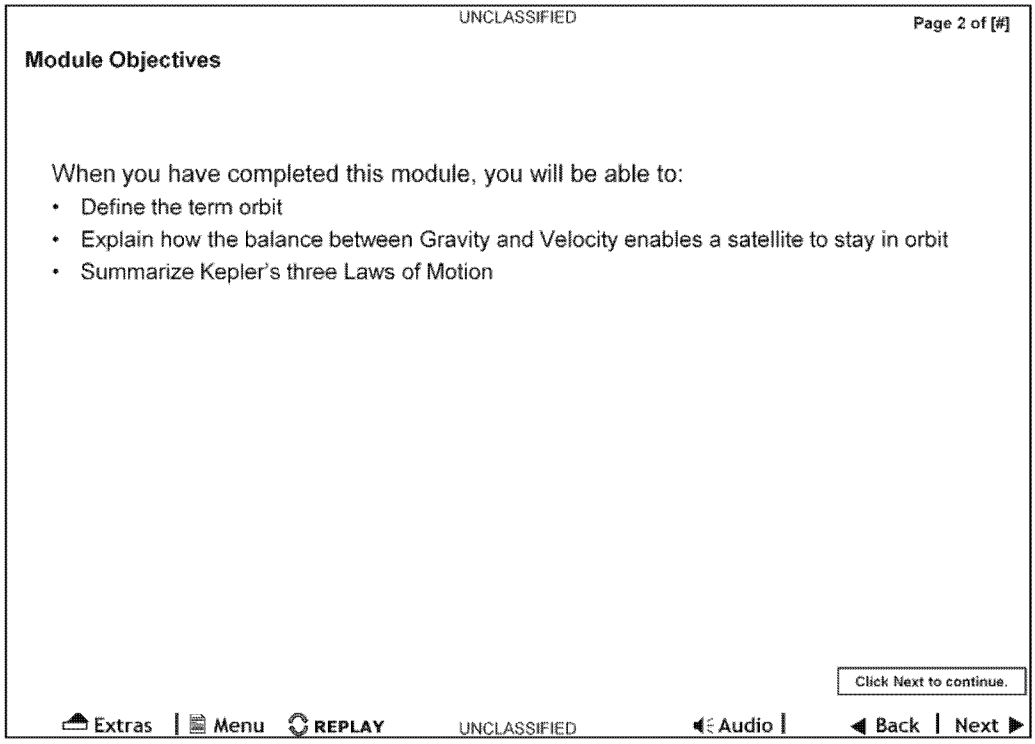
- None

AUDIO TEXT

The overall classification of this module is Unclassified.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: This page lists the Objectives of the module.
Objective: n/a
Sources: n/a

DEVELOPER NOTES:

User Instruction: Click Next.

Media Elements:

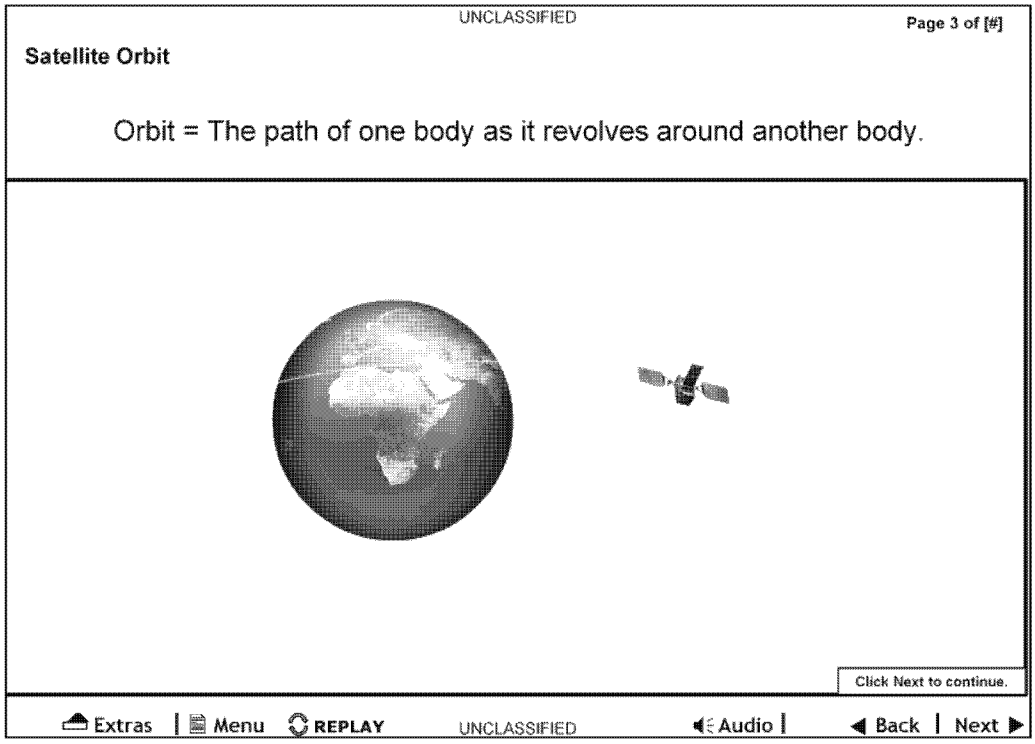
- None

AUDIO TEXT

The goal of this module is to explain how and why a satellite stays in orbit.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Introduce the term orbit

Objective: Define the term orbit

Sources: multiple

DEVELOPER NOTES:

User Instruction: Click Next.

Media Elements:

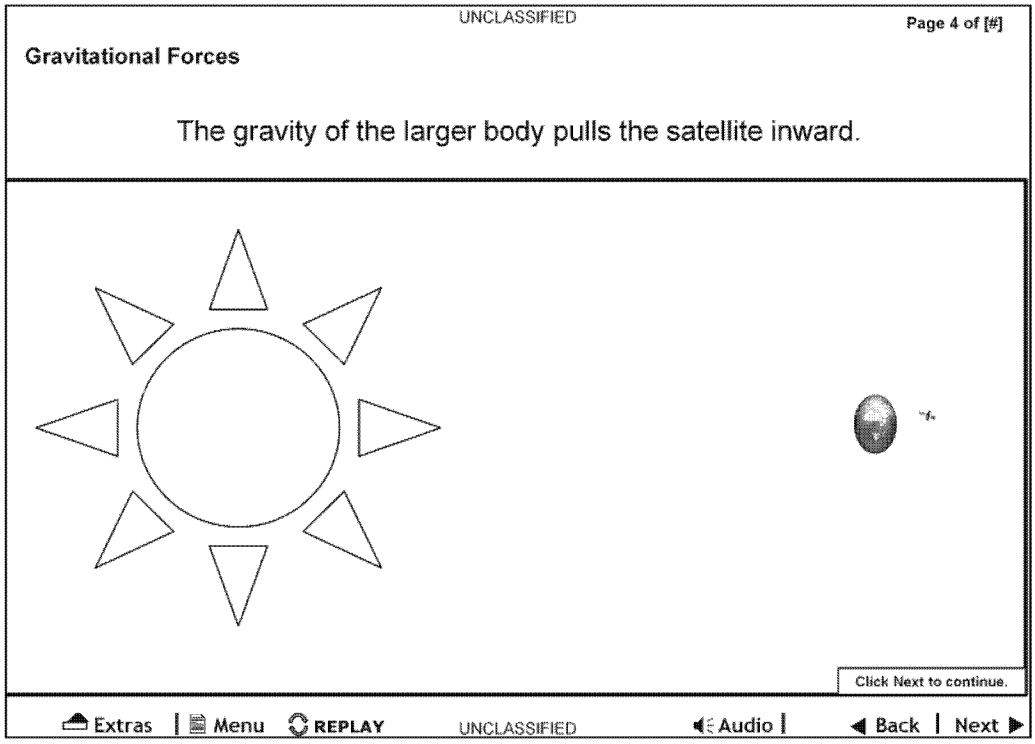
- Create animation of satellite revolving around earth.

AUDIO TEXT

An orbit is the curved path of a celestial body or spacecraft as it travels around a star, planet, or moon under the influence of gravity. During this course, we will specifically be concerned with man-made satellites revolving around the earth. Each complete orbit of a satellite is called a revolution, or "rev."

Acronyms & Glossary of Terms:

Orbit = The path of one body as it revolves around another body.



Purpose of screen: Explain how gravity affects an orbiting body

Objective: Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

Sources: SME

DEVELOPER NOTES:

User Instruction: Click Next.

Media Elements:

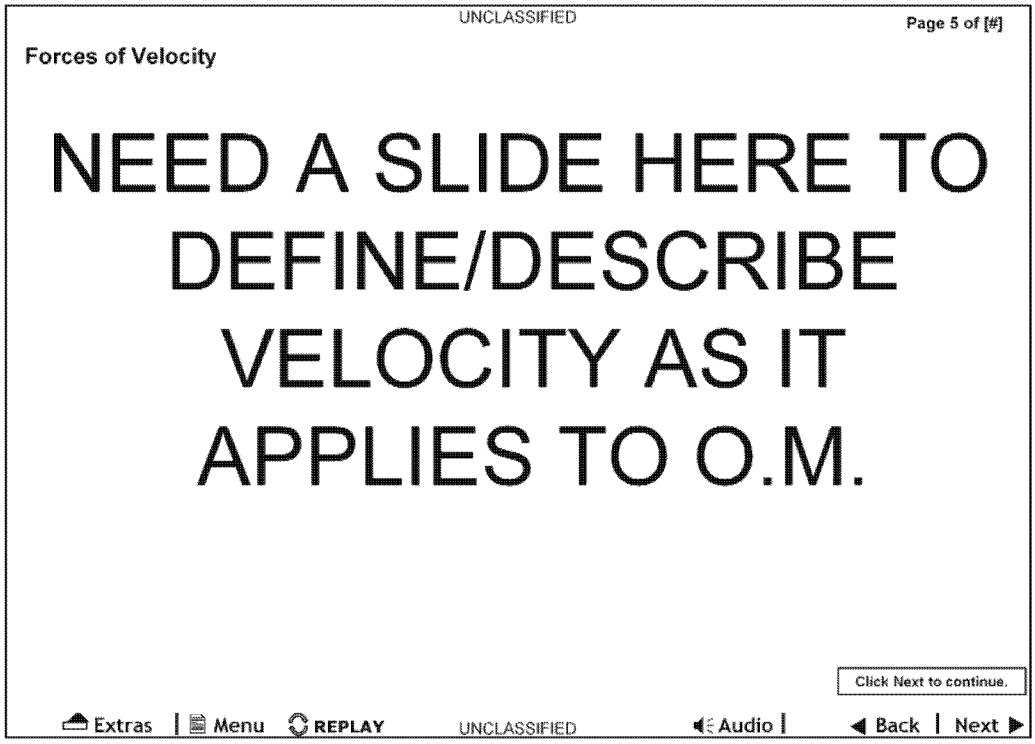
- Might be able to animate the earth rotating around sun while the satellite rotates around earth but if not a still picture will get the point across.

AUDIO TEXT

The planets in our solar system orbit the Sun, and similarly man-made satellites orbit the earth. In both scenarios, the mass of the central body is overwhelmingly larger than the mass of the orbiting object. This creates gravitational forces that draw the orbiting object toward the central body.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain how velocity affects an orbiting body

Objective: Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

Sources: SME

DEVELOPER NOTES:

User Instruction: Click Next.

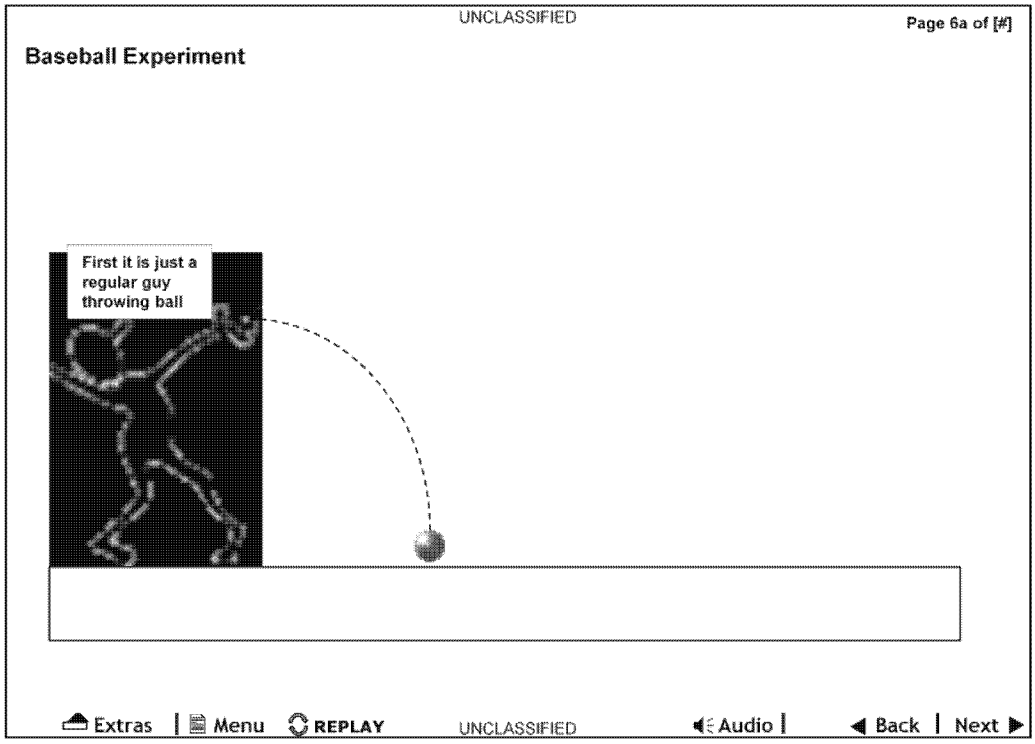
Media Elements:

- sdfasdfasdf

AUDIO TEXT

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain how velocity affects an orbiting body

Objective: Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements:

a. Still picture: A regular guy throws the baseball

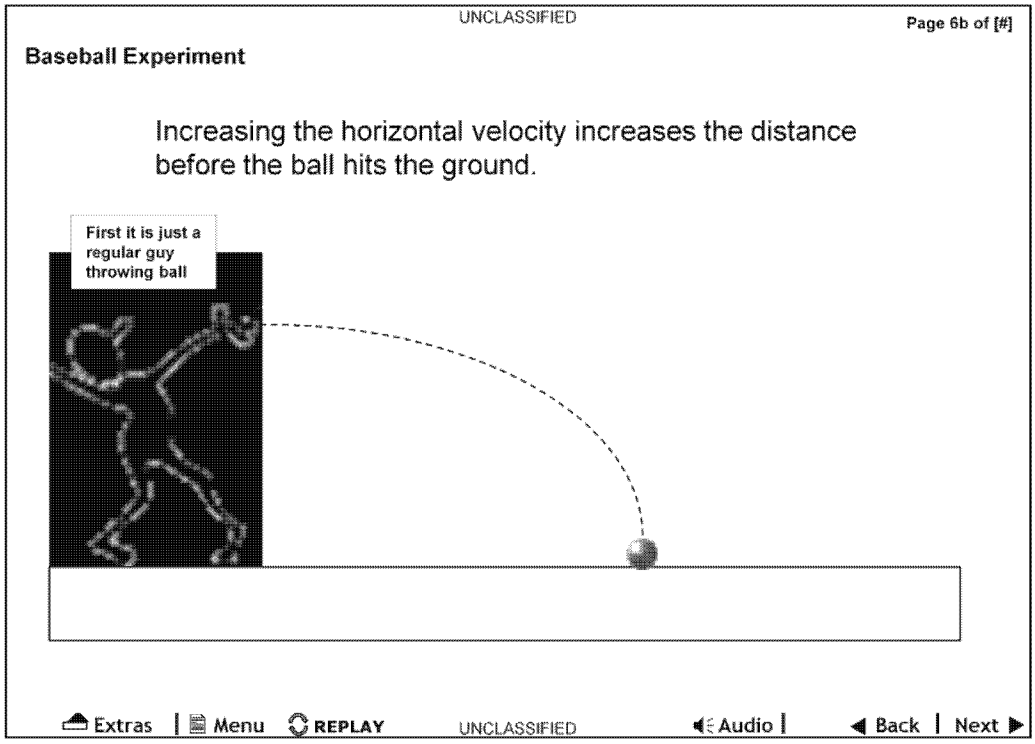
AUDIO TEXT

So, let's consider a common example of those two forces, gravity and velocity, at work.

If you were to throw a baseball, it will go some distance before it falls to the ground. Why does it fall? Because gravity is pulling it towards the center of the earth.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain how velocity affects an orbiting body

Objective: Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements:

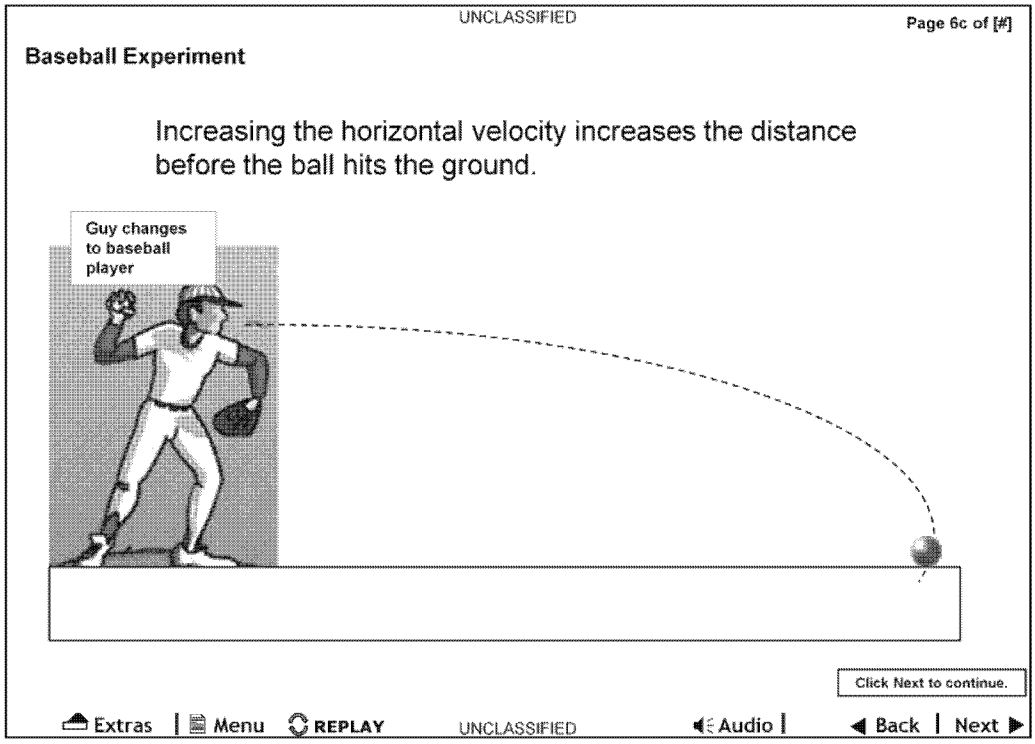
b. Still picture: Same regular guy throws the ball further this time. Text box is added.

AUDIO TEXT

If you throw it faster, it's going to go farther, but gravity is still going to pull it down.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain how velocity affects an orbiting body

Objective: Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

Sources: SME

DEVELOPER NOTES:

User Instruction: Click Next.

Media Elements:

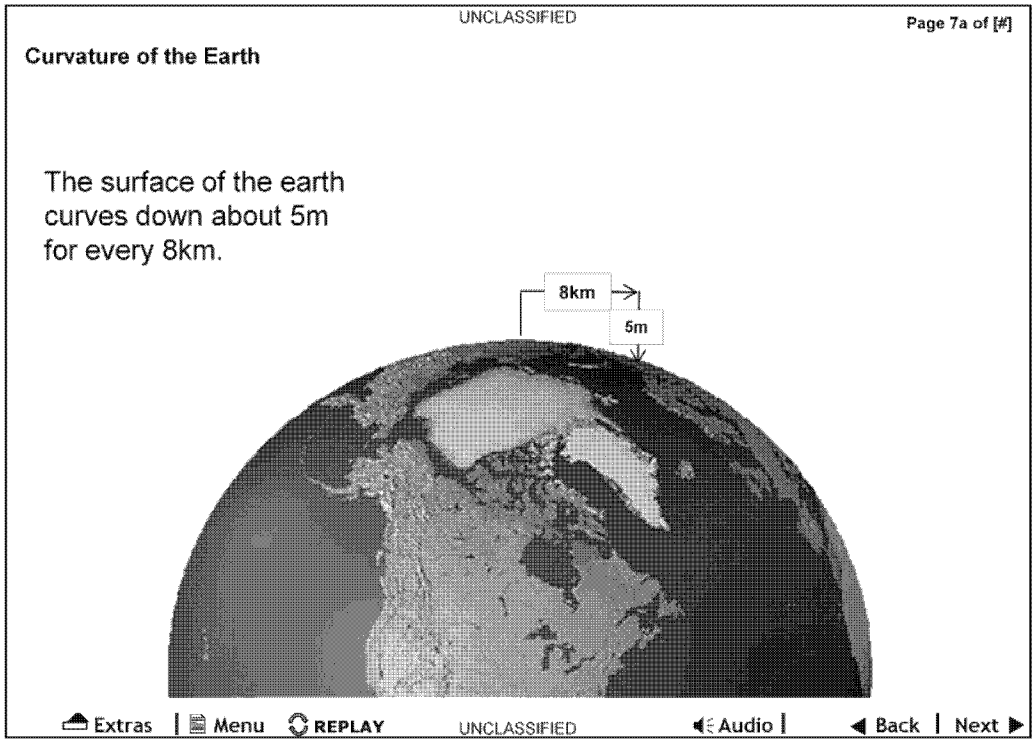
c. Still picture: Guy changes to a baseball player and throws ball much further.

AUDIO TEXT

If a professional baseball player throws that same ball, say at 100 miles per hour, it's going to go a lot farther, but it's still going to come to the ground eventually. This seems intuitive when viewed from our "flat earth" perspective, but the earth's surface curves.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain how curvature of the earth affects an orbiting body

Objective: Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements:

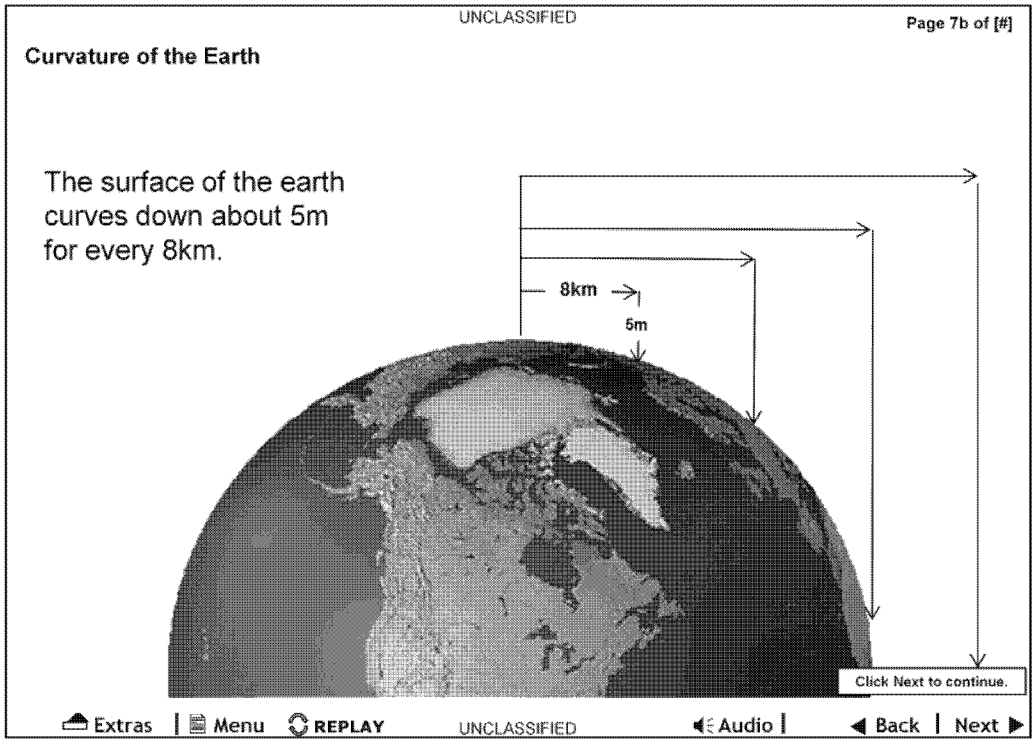
a. Still picture: Picture changes to northern part of earth with first set of arrows and labels.

AUDIO TEXT

In fact, the surface of the earth curves down about 5 meters for every 8 kilometers that you travel.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain how curvature of the earth affects an orbiting body

Objective: Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

Sources: SME

DEVELOPER NOTES:

User Instruction: Click Next.

Media Elements:

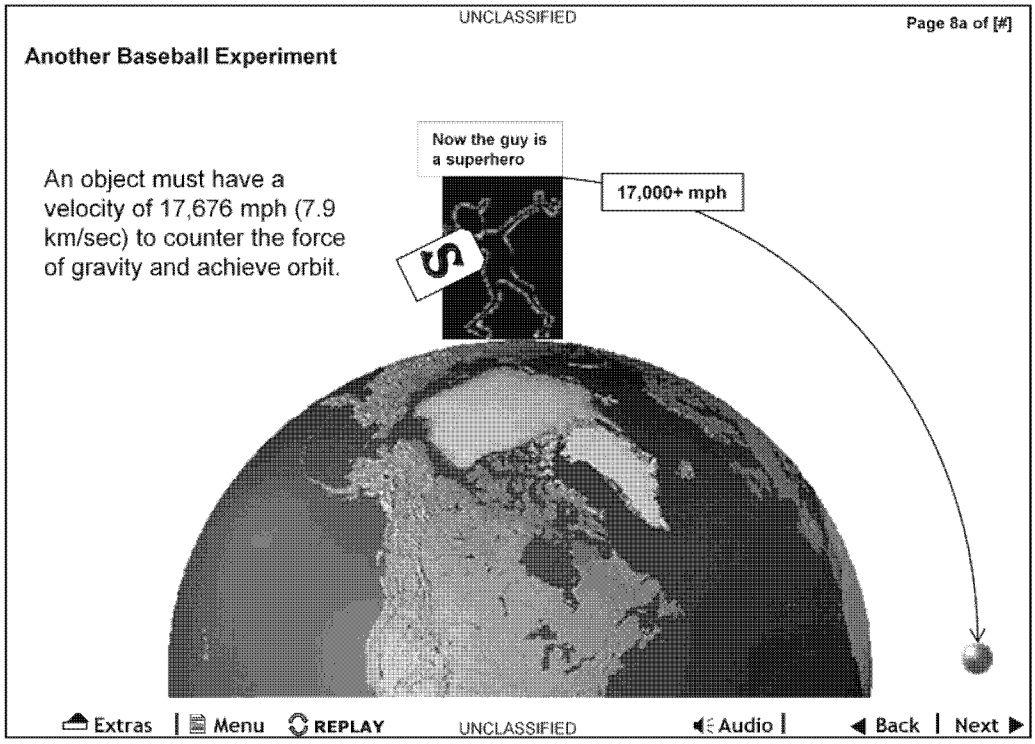
b. Still picture: Additional sets of arrows cascade in to the right

AUDIO TEXT

This means that the ball would have to go a huge distance, at a very high velocity, in order to clear the earth's surface and make it into orbit.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain how velocity affects an orbiting body

Objective: Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements:

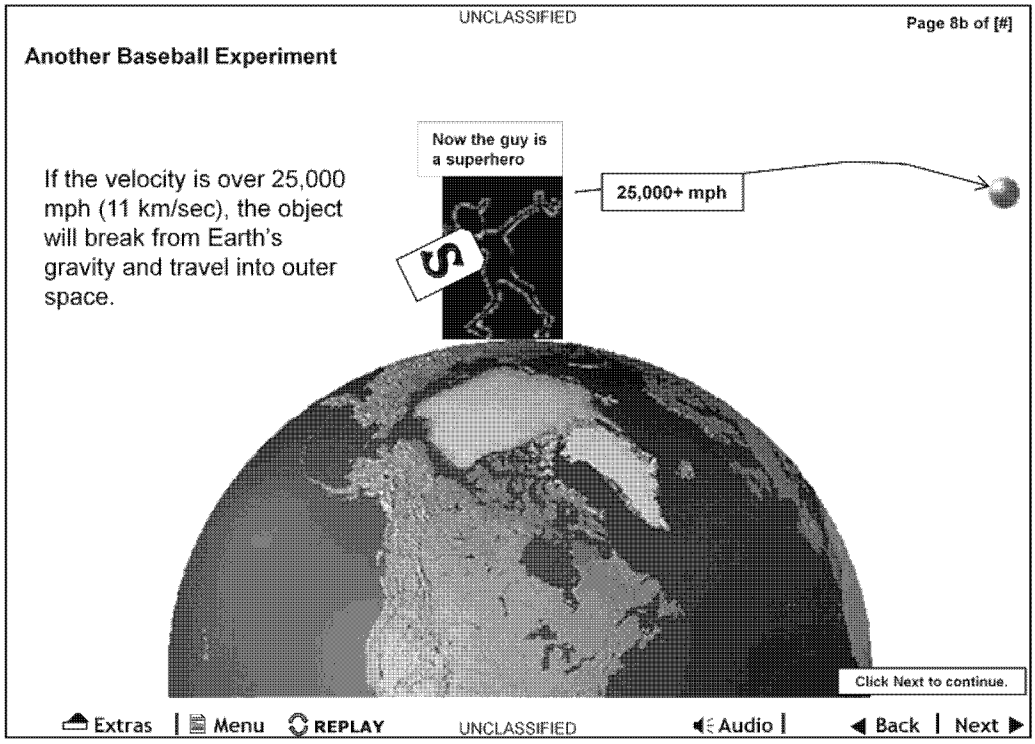
a. Still picture: Now a superhero throws the ball.

AUDIO TEXT

Returning to our baseball example, it would take a superhero to reach that distance and overcome the force of gravity! The ball would need to travel at over 17,000 miles per hour.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain how velocity affects an orbiting body

Objective: Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

Sources: SME

DEVELOPER NOTES:

User Instruction: Click Next.

Media Elements:

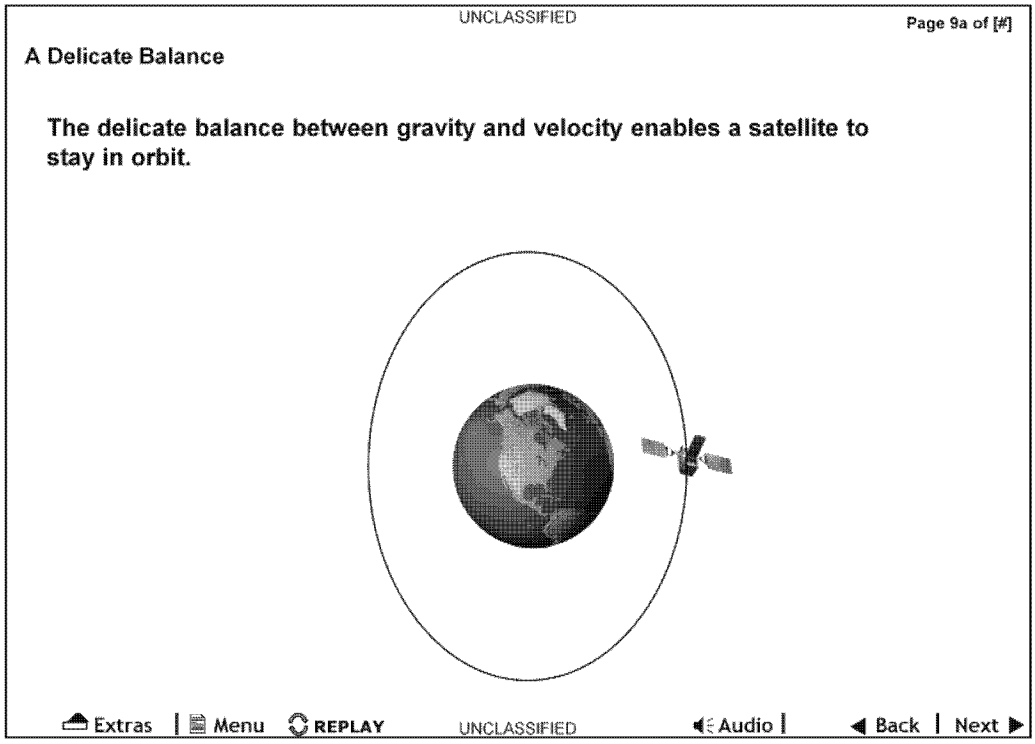
b. Still picture: Superhero throws the ball out into space

AUDIO TEXT

If our superhero throws the ball even faster, say over 25,000 mph, it will go out of the earth's gravitational pull and into the solar system, like a deep space probe.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain balance between Gravity and Velocity

Objective: Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements:

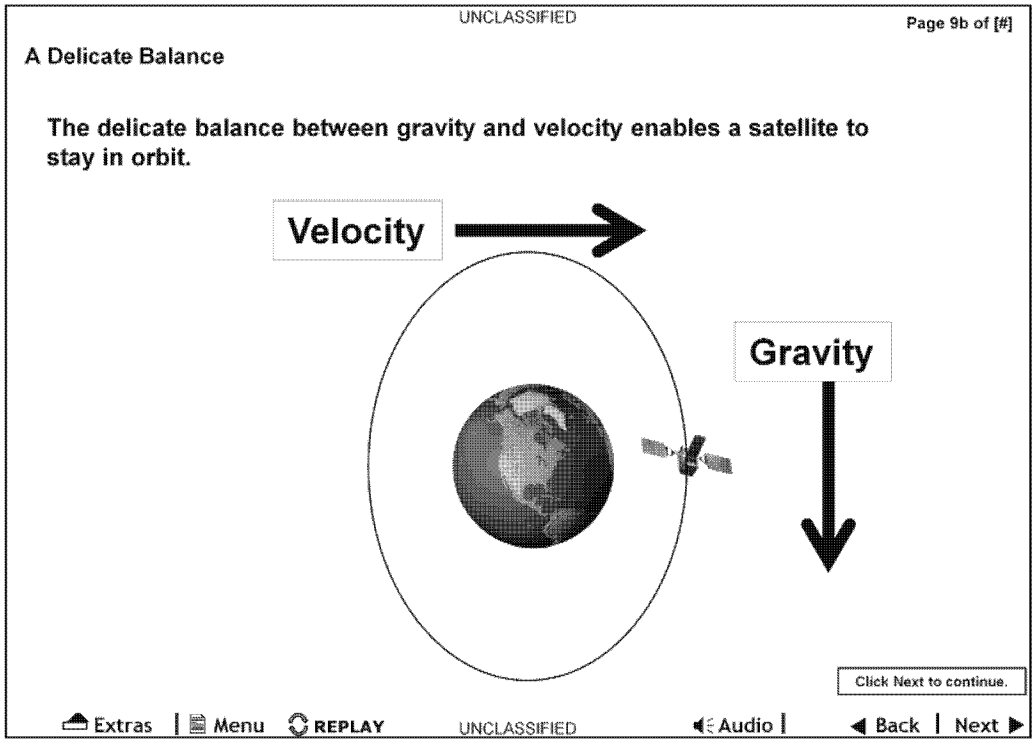
a. Animation of satellite rotating the earth.

AUDIO TEXT

A satellite in orbit is literally falling around the Earth, but, because of its horizontal velocity, it never impacts the ground. Of course we use rockets, not super heroes, to "throw" satellites into orbit.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain balance between Gravity and Velocity

Objective: Explain how the balance between Gravity and Velocity enables a satellite to stay in orbit

Sources: SME

DEVELOPER NOTES:

User Instruction: Click Next.

Media Elements:

b. Add Velocity and Gravity arrows in synch w/ narration.

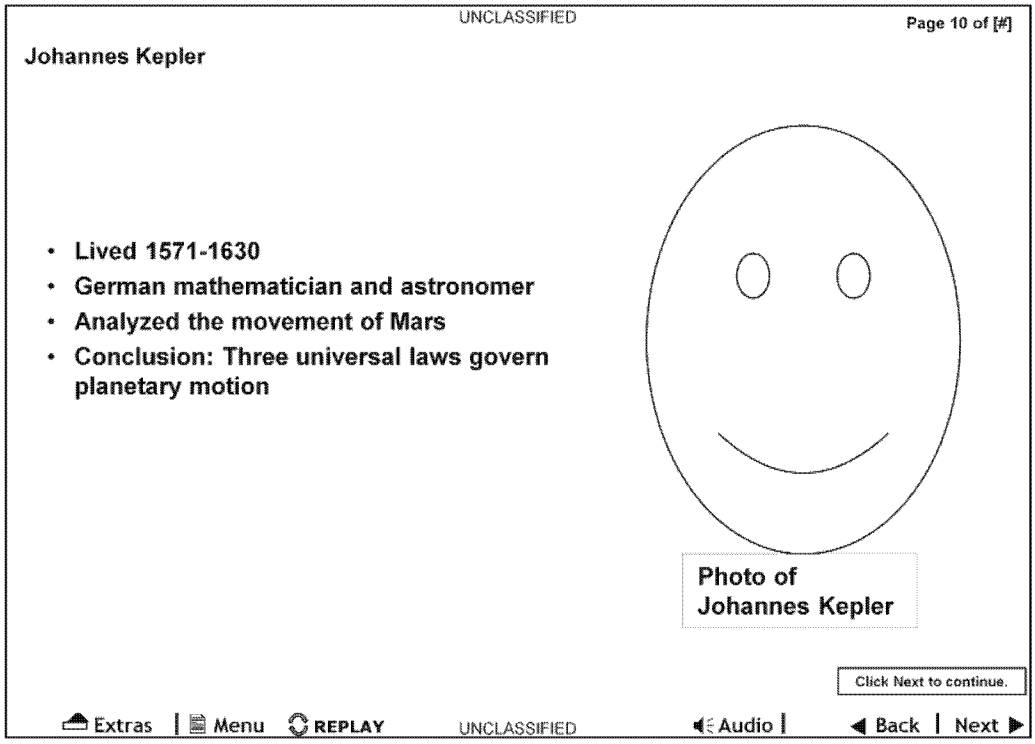
AUDIO TEXT

Then, the satellite stays in orbit from a combination of the velocity it was launched with and the pull of gravity towards the center of the earth. Earth's gravity pulls the satellite towards the earth while the satellite's velocity moves it away.

A precise balance between gravity and velocity keeps a satellite in orbit. Too little velocity and the satellite falls back to Earth; too much velocity and it leaves the Earth for deep space, never to return.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Introduce Kepler and his 3 laws

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction: Click Next.

Media Elements: Photo of Kepler

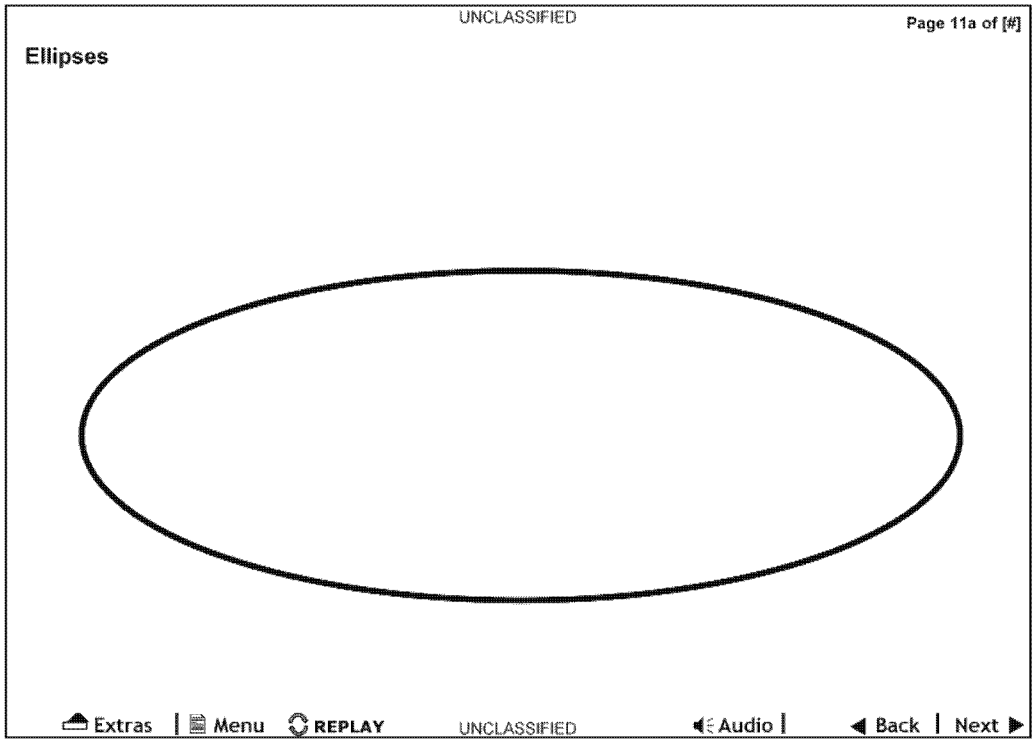
AUDIO TEXT

Johannes Kepler was a German mathematician and astronomer. He analyzed observations of the movement of Mars, as recorded by his mentor Tycho Brahe. From this analysis, he concluded that there are three laws that govern the movements of all planets. Not coincidentally, these laws also apply to the motion of satellites as they orbit Earth.

All scientific concepts come with rules, and orbits are no exception. The physics of orbits are necessarily math heavy; however, it is not necessary to memorize the equations in order to understand the concepts.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define ellipse
Objective: Summarize Kepler's three Laws of Motion
Sources: SME

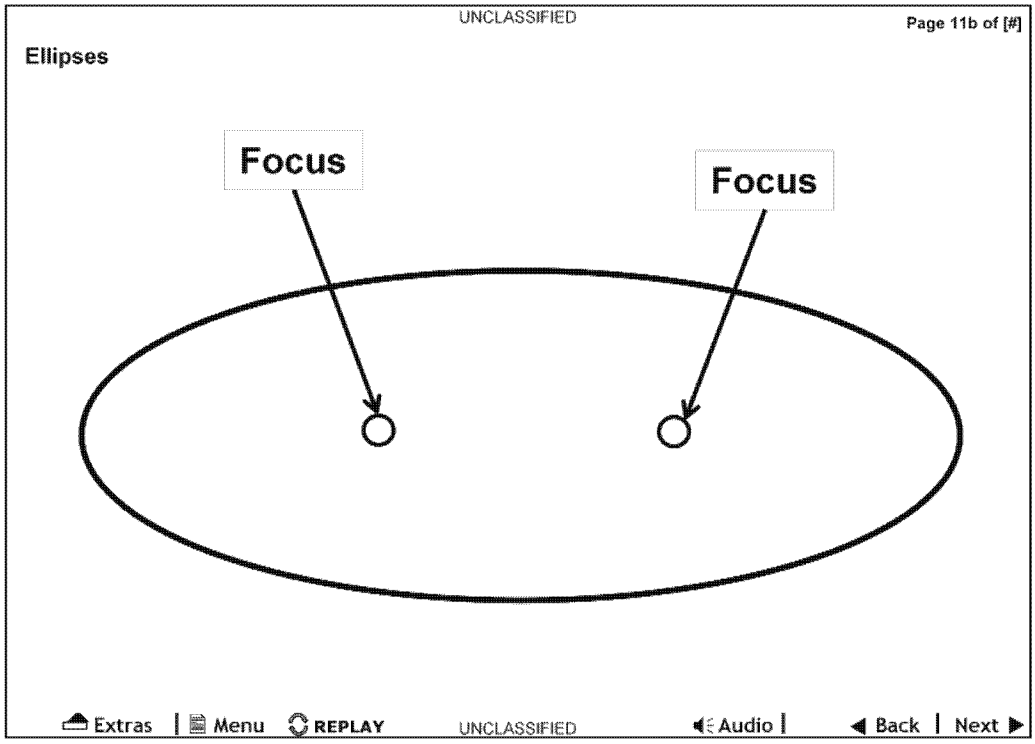
DEVELOPER NOTES:
User Instruction:

Media Elements: a quickly changing build of an ellipse and foci:
a. oval only

AUDIO TEXT

Before we dive into Kepler's laws, we need to define the term ellipse. Simply put, an ellipse is an oval.

Acronyms & Glossary of Terms:
[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define ellipse
Objective: Summarize Kepler's three Laws of Motion
Sources: SME

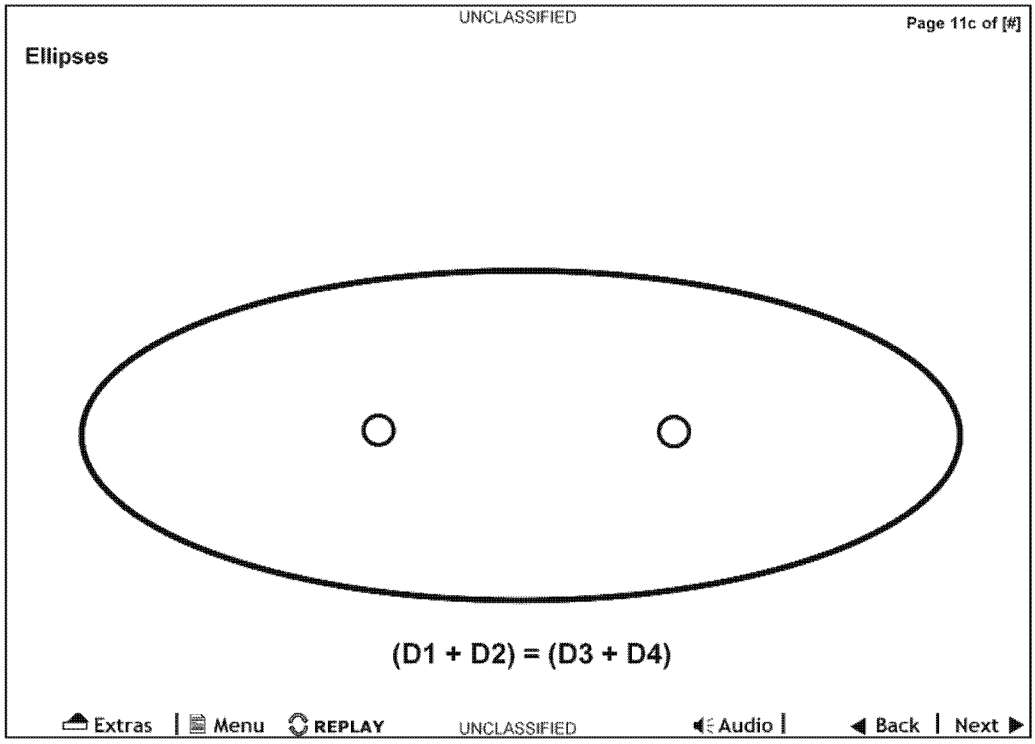
DEVELOPER NOTES:
User Instruction:

Media Elements: a quickly changing build of an ellipse and foci:
b. first add foci and labels' then add formula

AUDIO TEXT

All ellipses have two points called foci. The location of each focus is determined by a formula.

Acronyms & Glossary of Terms:
[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define ellipse

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: a quickly changing build of an ellipse and foci:

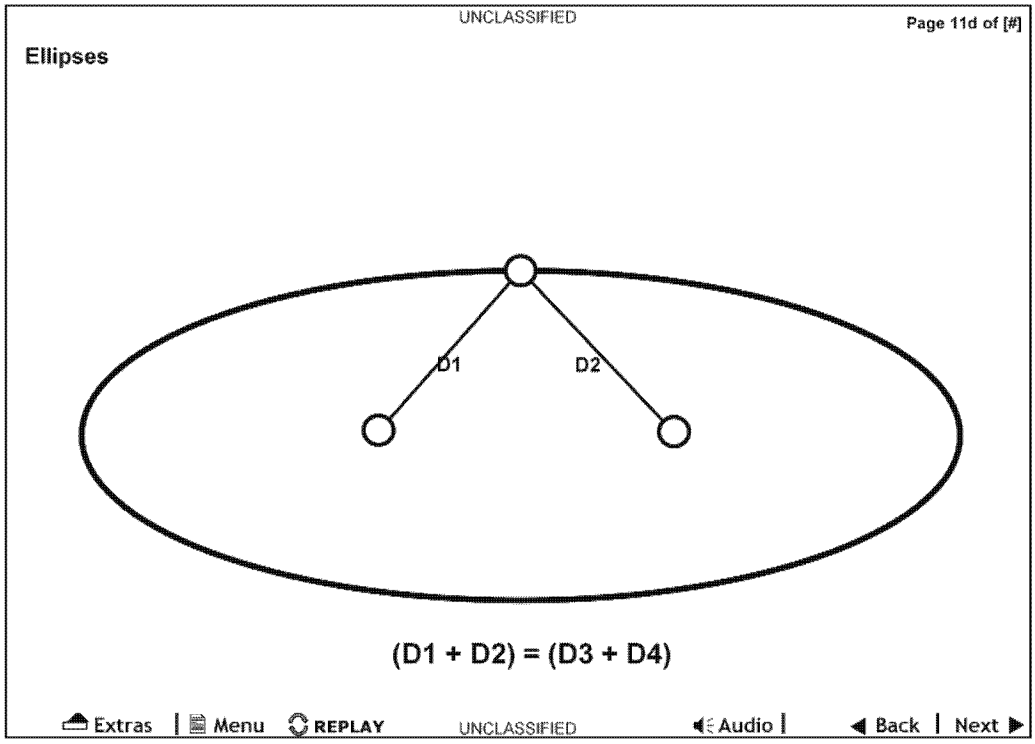
c. Add formula

AUDIO TEXT

In this formula, D equals distance.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define ellipse

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: a quickly changing build of an ellipse and foci:

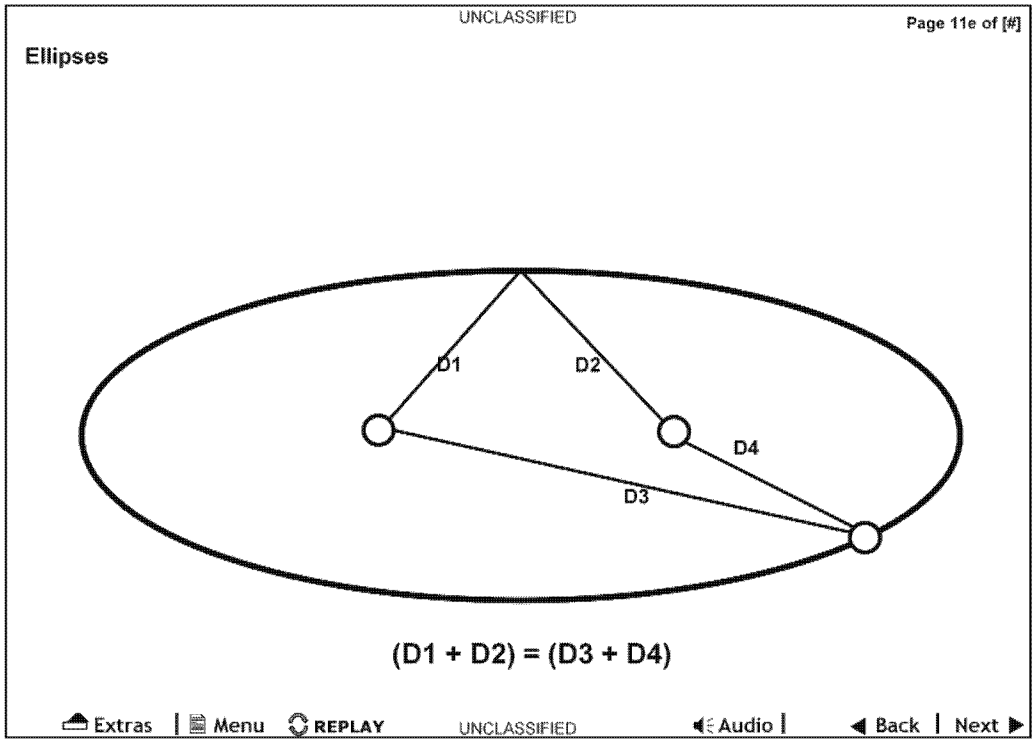
d. Add purple point, then lines, and then labels D1 and D2 (in synch w/ naration)

AUDIO TEXT

We start by measuring the distance from any point around the ellipse to each of the foci. Those are D1 and D2.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define ellipse

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: a quickly changing build of an ellipse and foci:

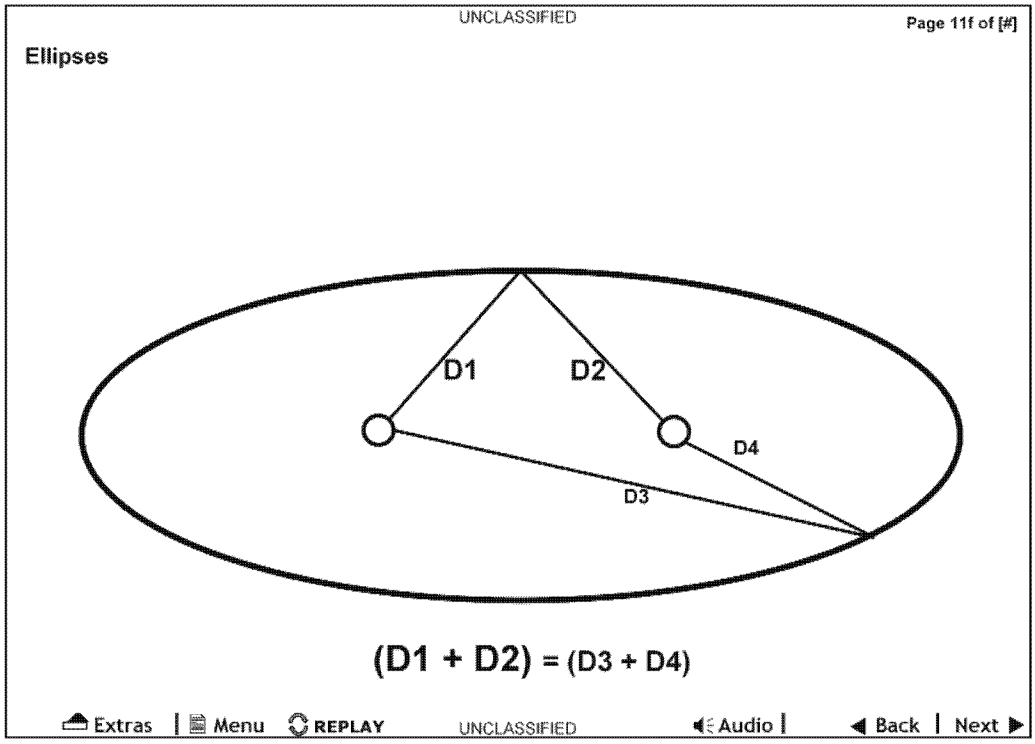
e. move purple point, then add lines and then labels D3 and D4 (in synch w/ narration)

AUDIO TEXT

Next, measure from both foci to any other point anywhere around the ellipse. Those are D3 and D4.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define ellipse

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: a quickly changing build of an ellipse and foci:

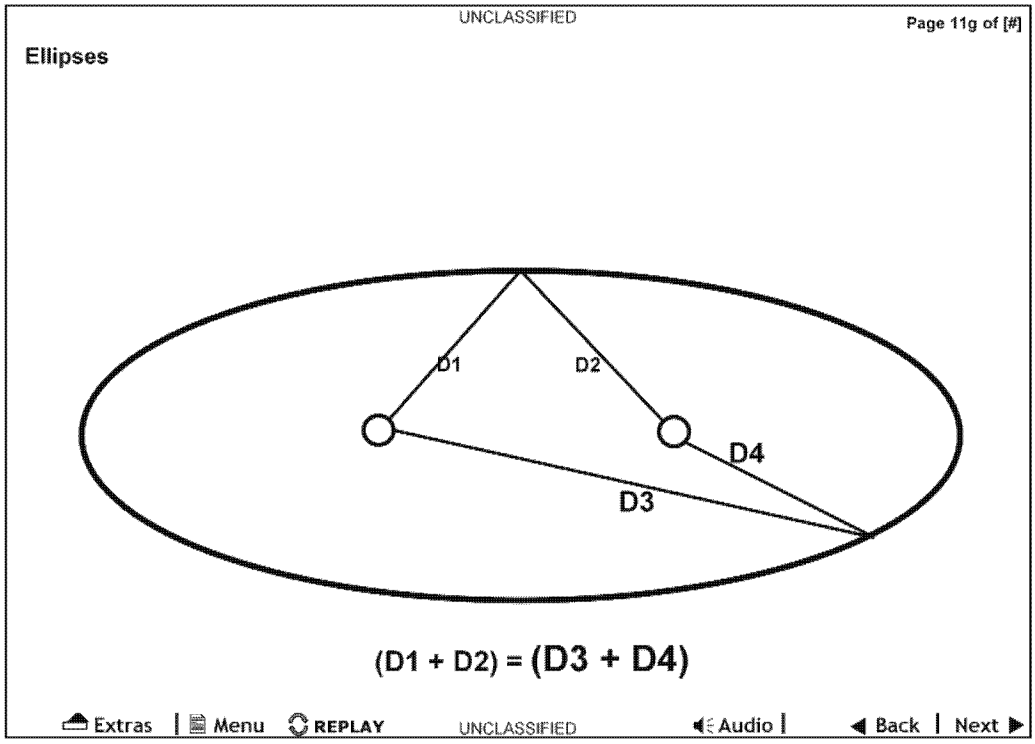
f. remove purple point; first (D1 + D2) gets highlighted (red/bold maybe?) in the formula along with the D1 and D2 lines.

AUDIO TEXT

The sum of D1 and D2 . . .

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define ellipse

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: a quickly changing build of an ellipse and foci:

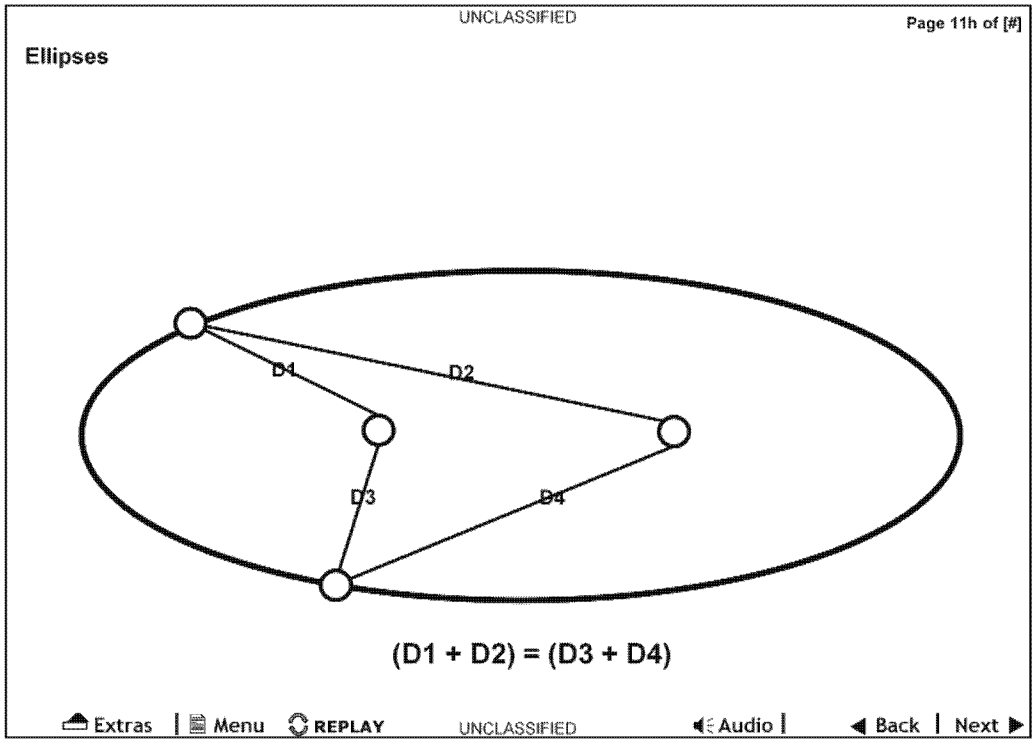
g. Then (D3 + D4) in formula gets highlighted along with D3 and D4 lines.

AUDIO TEXT

. . . will always equal the sum of D3 and D4.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define ellipse
Objective: Summarize Kepler's three Laws of Motion
Sources: SME

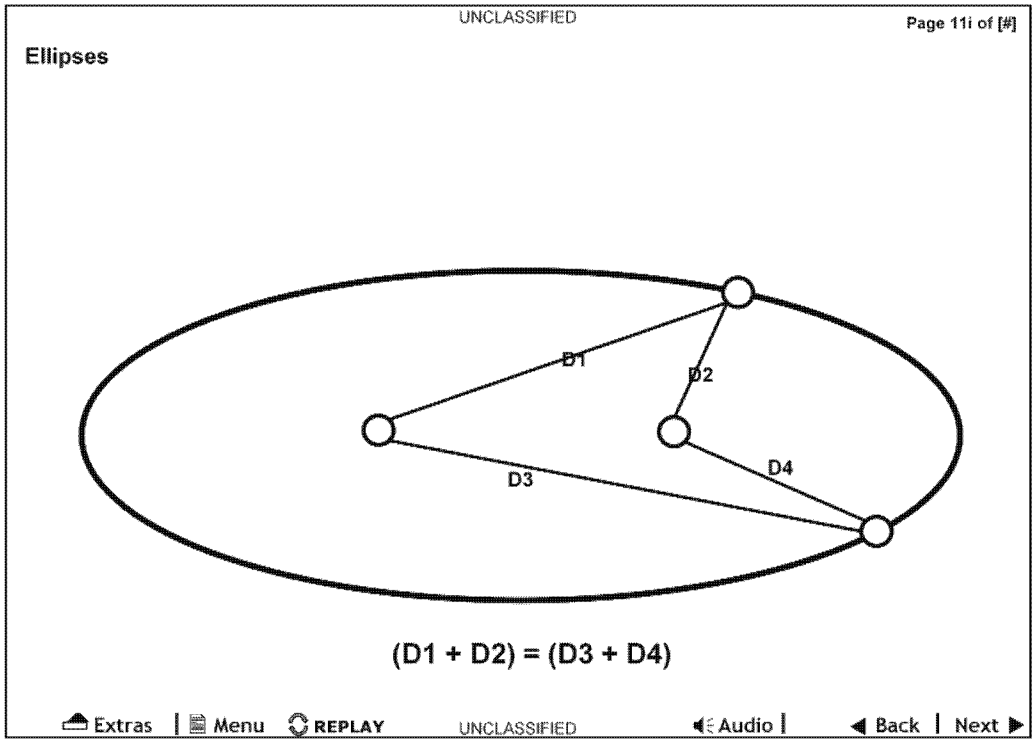
DEVELOPER NOTES:
User Instruction:

Media Elements: a quickly changing build of an ellipse and foci:
h. relocate all of the lines and the 2 purple points

AUDIO TEXT

It doesn't matter which two points on the ellipse you choose.

Acronyms & Glossary of Terms:
[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define ellipse

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: a quickly changing build of an ellipse and foci:

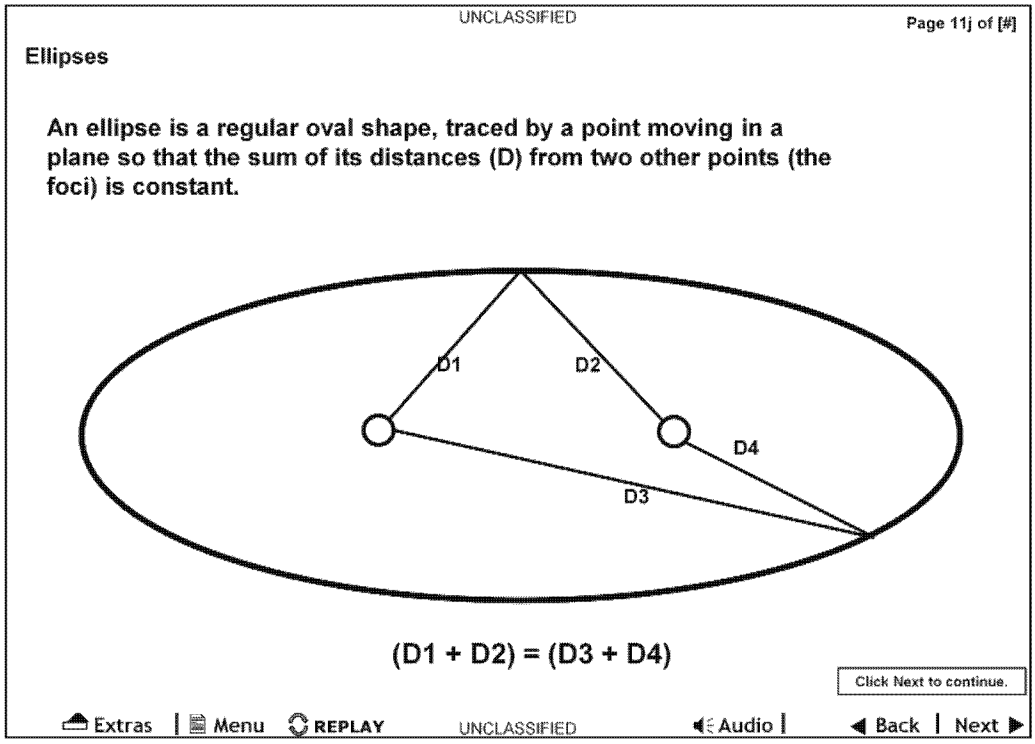
i. relocate all of the lines and the 2 purple points AGAIN

AUDIO TEXT

D1 plus D2 will always equal D3 plus D4.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define ellipse

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction: Click Next

Media Elements: a quickly changing build of an ellipse and foci:

j. Back to same graphic as 11e; add text box.

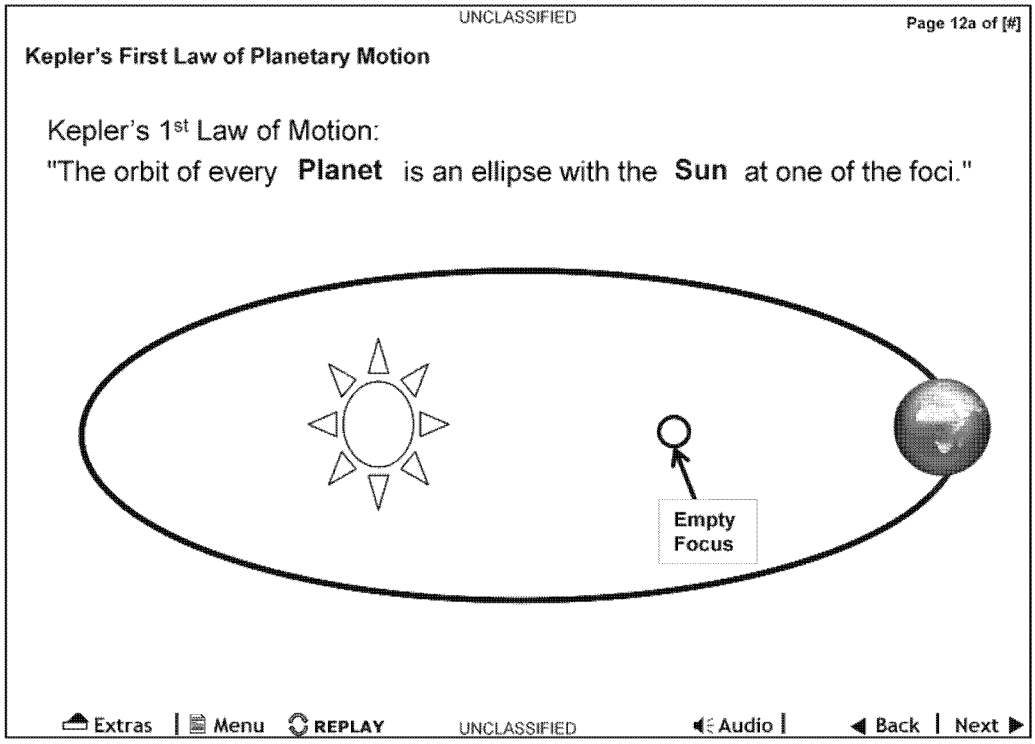
AUDIO TEXT

So, to get more technical, an ellipse is a regular oval shape, whereby the sum of the distances from any point to both of the foci is constant no matter where on the oval the point is located.

All this really means is that the location of the foci determine the size and shape of the oval. This is important in understanding Kepler's three laws.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Kepler's first law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: a build of an ellipse with changing objects orbiting around it

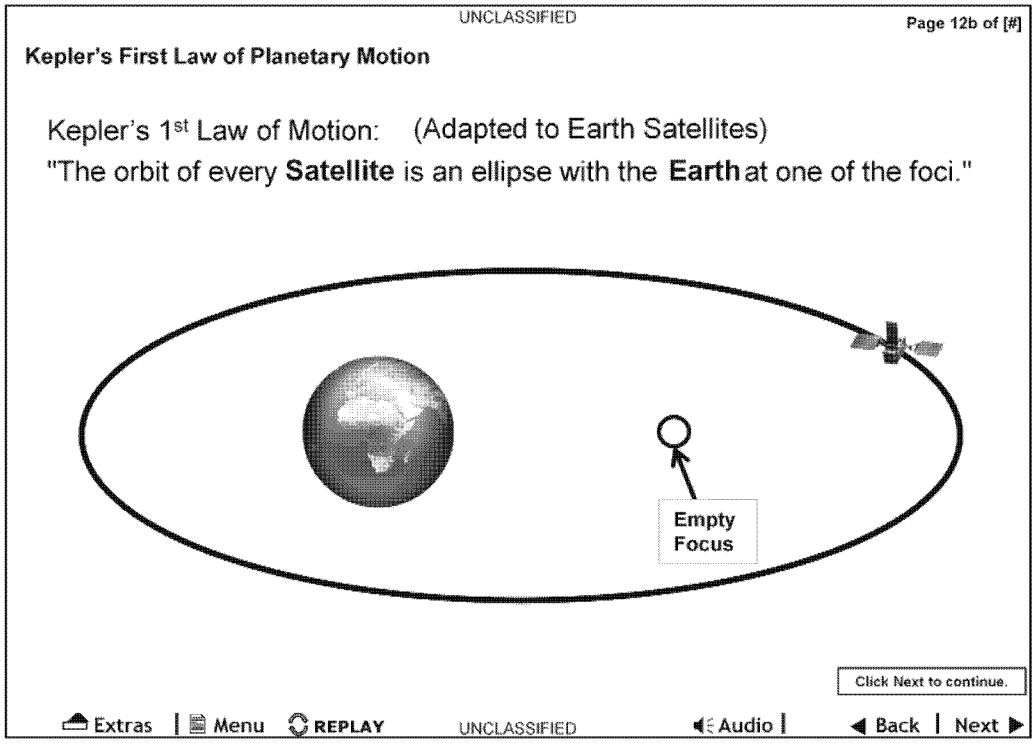
a. Opens w/ earth in orbit around sun

AUDIO TEXT

Kepler's First law of Planetary Motion states that "The orbit of every planet is an ellipse with the Sun at one of the foci." In this scenario, the second focus of the ellipse is empty.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Kepler's first law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction: Click Next

Media Elements: a build of an ellipse with changing objects orbiting around it

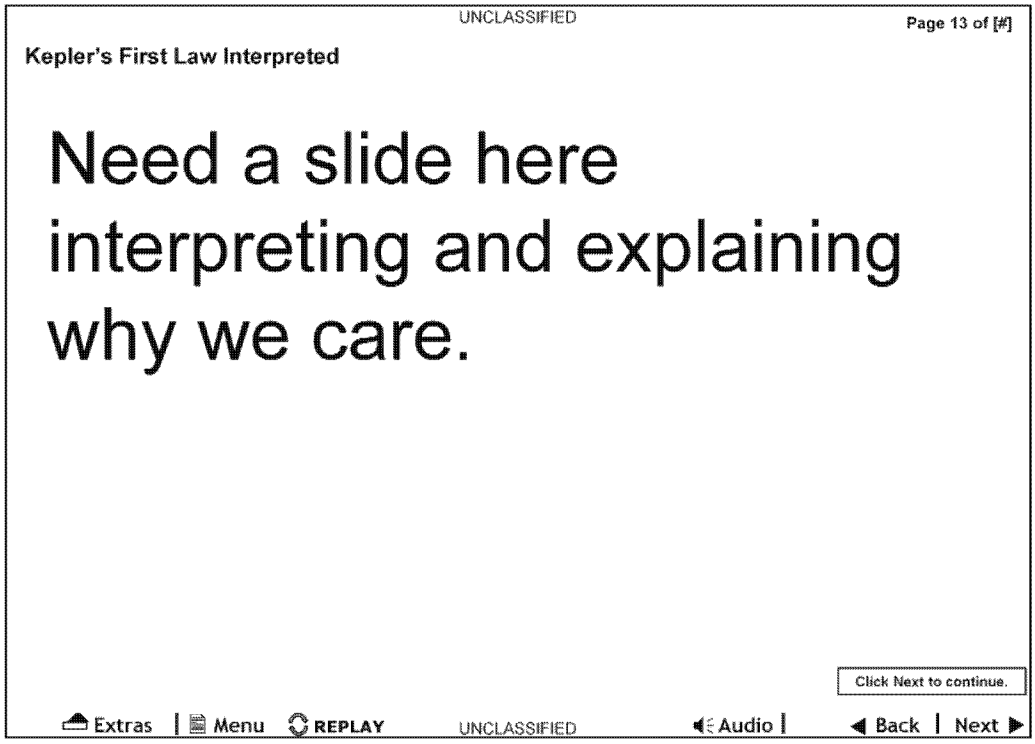
b. Text at top changes; now a satellite is orbiting around earth

AUDIO TEXT

This can easily be adapted to earth-orbiting satellites. Now the Earth is one of the foci.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



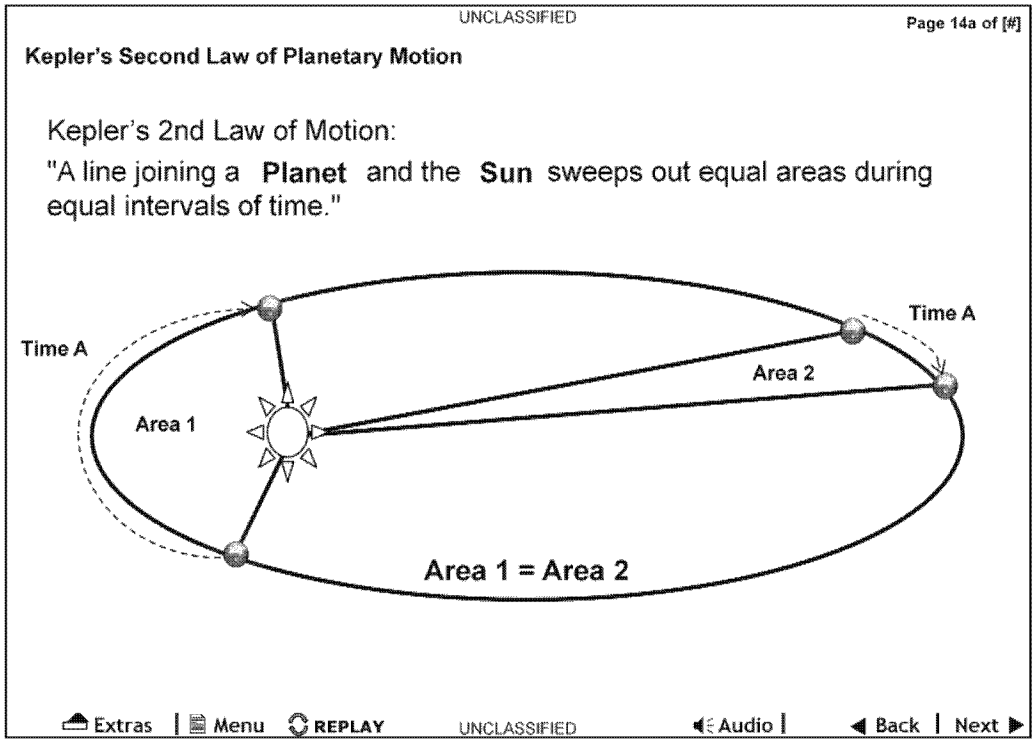
Purpose of screen: explain Kepler's first law of motion
Objective: Summarize Kepler's three Laws of Motion
Sources: SME

DEVELOPER NOTES:
User Instruction: Click Next

Media Elements: asdfasdf
asdfasdfasdf

AUDIO TEXT
asdfasfsdf

Acronyms & Glossary of Terms:
[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Kepler's 2nd law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: a build of an ellipse with changing objects orbiting around it

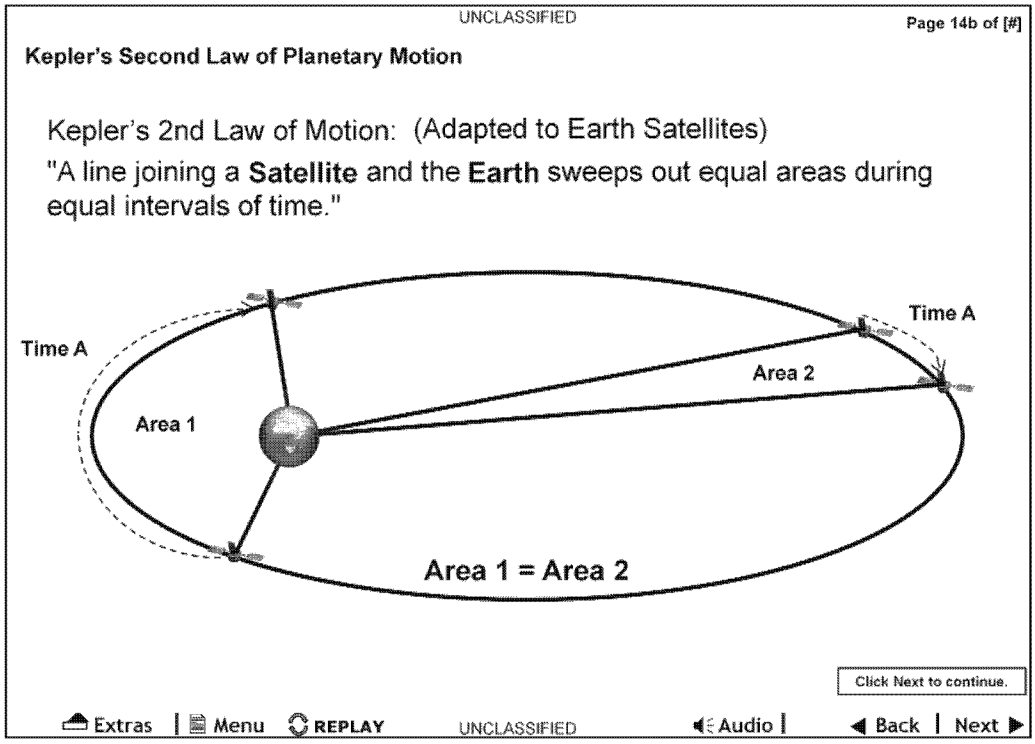
a. Opens w/ earth in orbit around sun

AUDIO TEXT

Kepler's Second Law of Planetary Motion states that "A line joining a planet and the Sun sweeps out equal areas during equal intervals of time."

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Kepler's 2nd law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction: Click Next

Media Elements: a build of an ellipse with changing objects orbiting around it

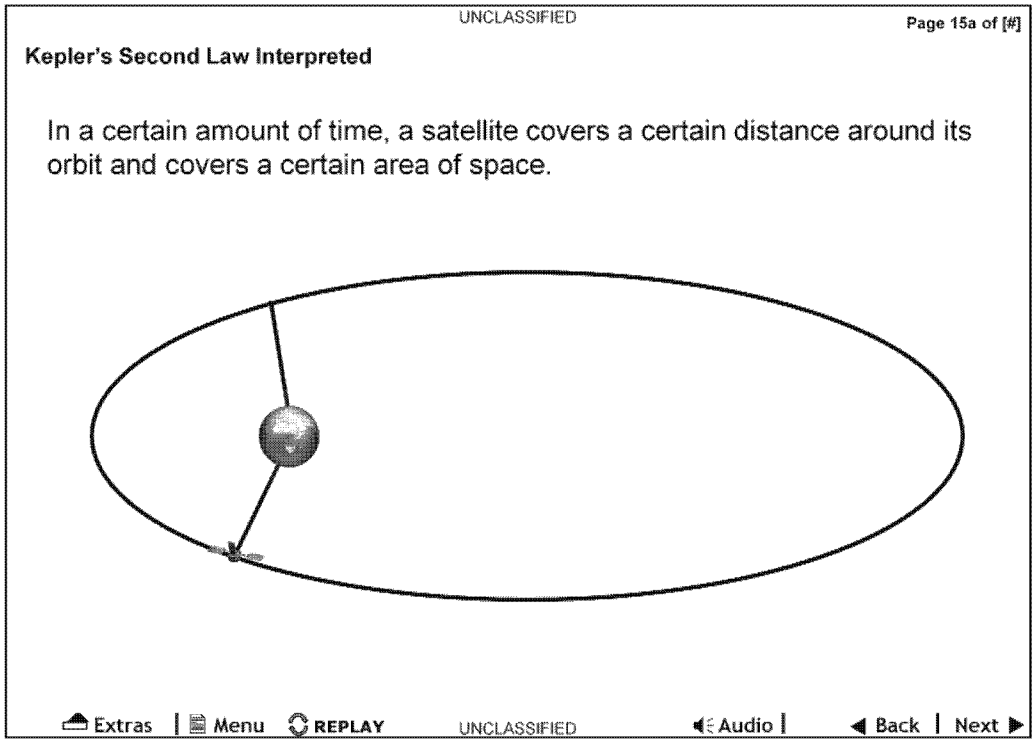
b. Text at top changes; now a satellite is orbiting around earth

AUDIO TEXT

Again, this can readily be applied to man-made satellites orbiting the earth.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Kepler's 2ndlaw of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

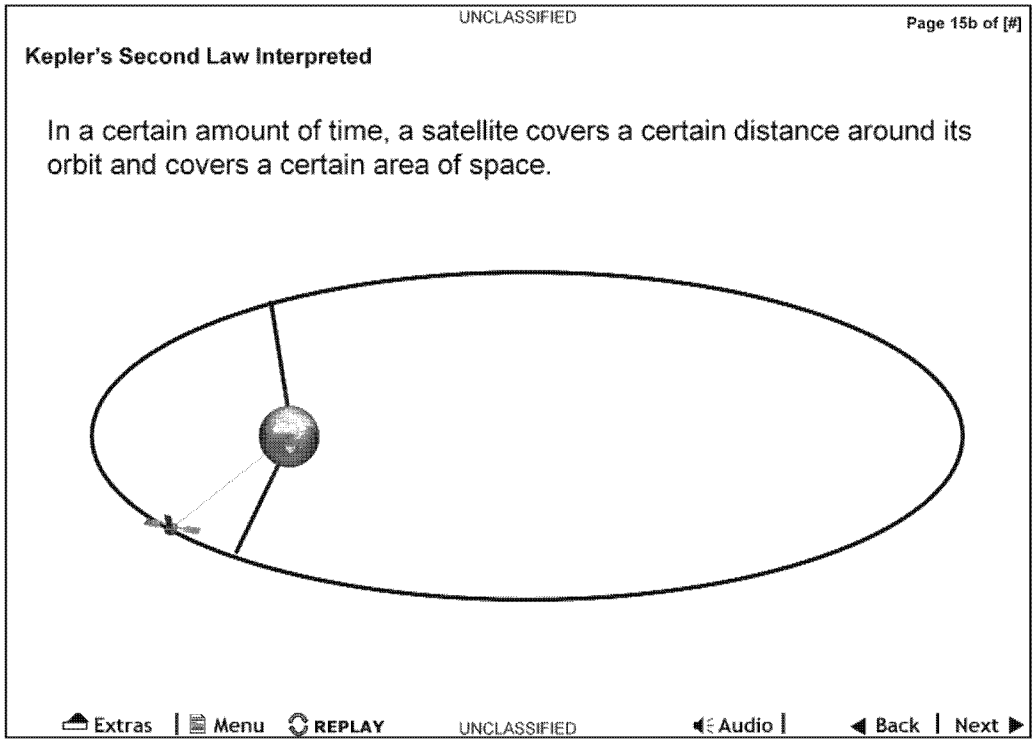
Media Elements: Animation of satellite on left moving from first point around to 2nd point. The "area" builds with it. Finally the labels and green arrow appear.

AUDIO TEXT

But what does it mean? If the satellite on the left were to travel for a particular interval of time, say one hour, it would "sweep out" a particular area of space.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Kepler's 2ndlaw of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

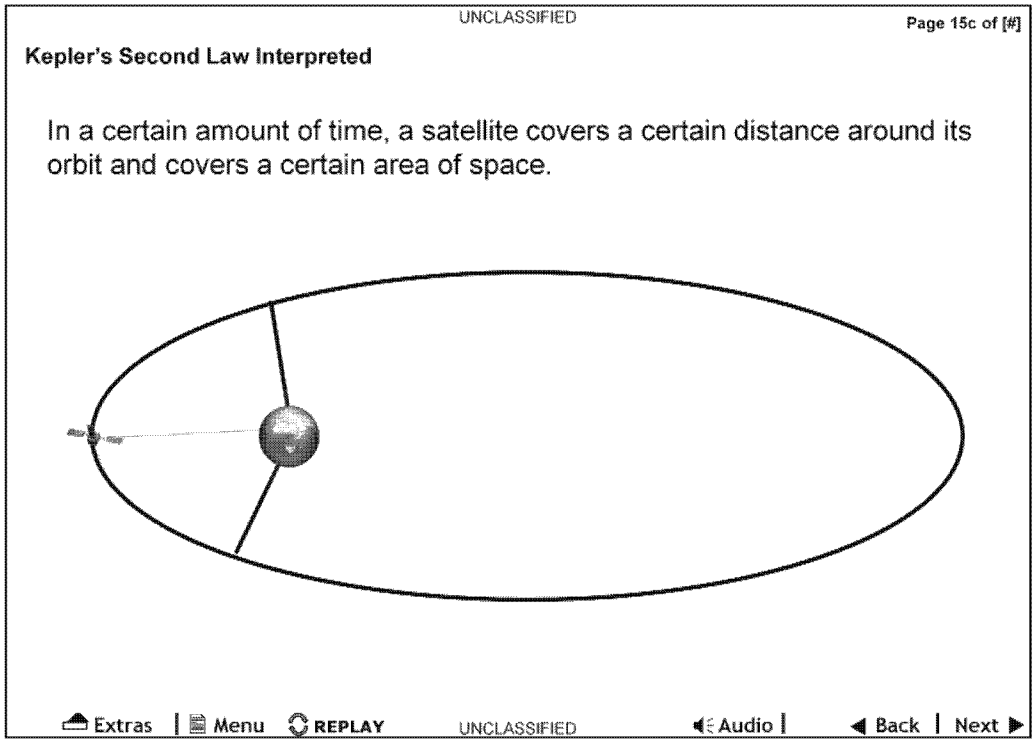
Media Elements: Animation of satellite on left moving from first point around to 2nd point. The "area" builds with it. Finally the labels and green arrow appear.

AUDIO TEXT

But what does it mean? If the satellite on the left were to travel for a particular interval of time, say one hour, it would "sweep out" a particular area of space.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Kepler's 2ndlaw of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

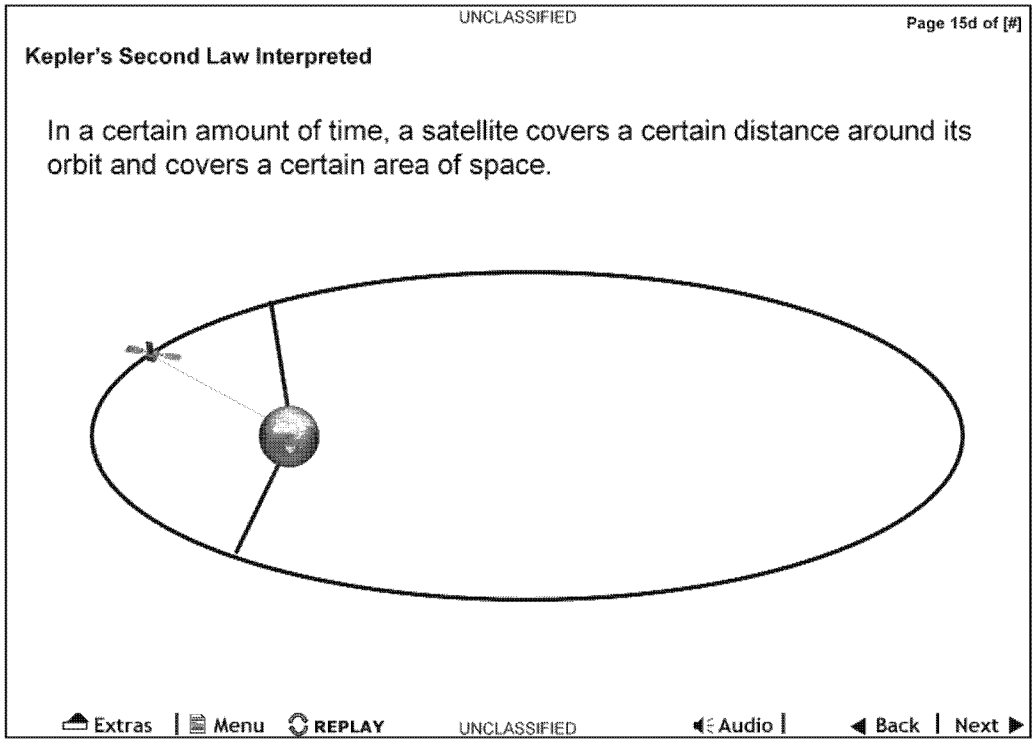
Media Elements: Animation of satellite on left moving from first point around to 2nd point. The "area" builds with it. Finally the labels and green arrow appear.

AUDIO TEXT

But what does it mean? If the satellite on the left were to travel for a particular interval of time, say one hour, it would "sweep out" a particular area of space.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Kepler's 2ndlaw of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

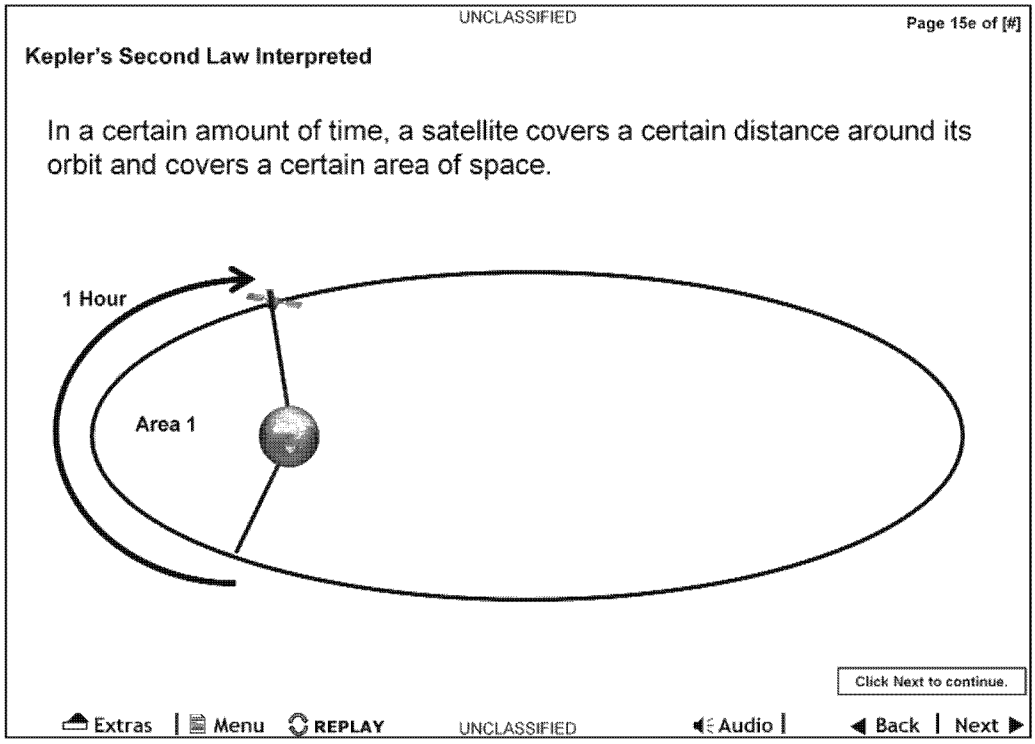
Media Elements: Animation of satellite on left moving from first point around to 2nd point. The "area" builds with it. Finally the labels and green arrow appear.

AUDIO TEXT

But what does it mean? If the satellite on the left were to travel for a particular interval of time, say one hour, it would "sweep out" a particular area of space.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Kepler's 2nd law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

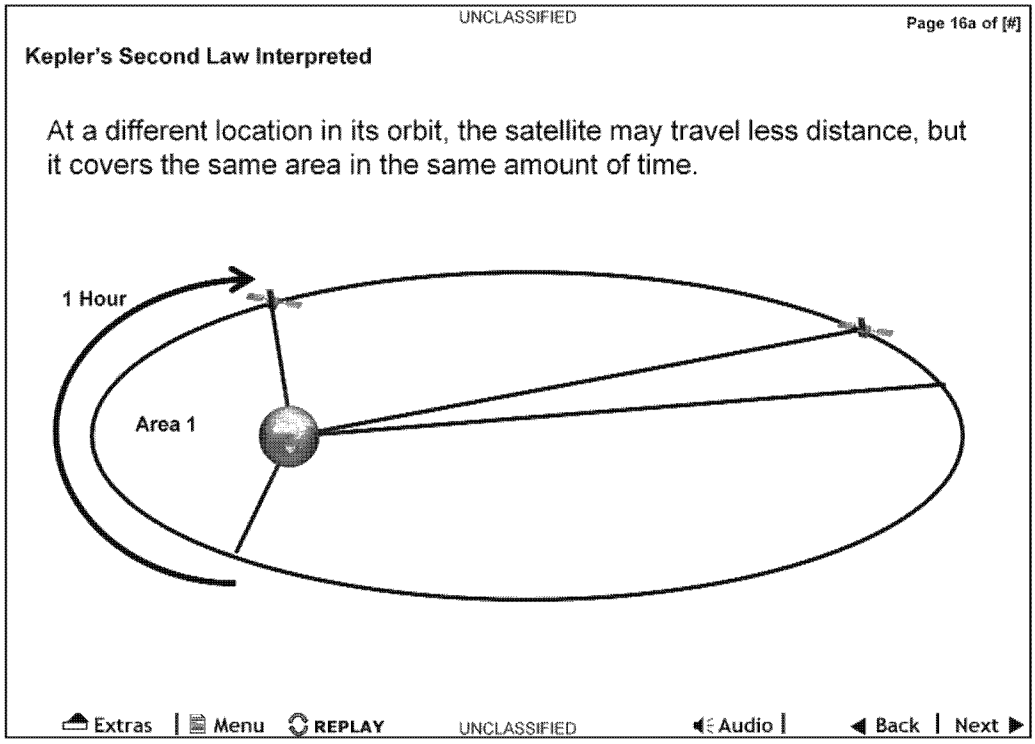
Media Elements: Animation of satellite on left moving from first point around to 2nd point. The "area" builds with it. Finally the labels and green arrow appear.

AUDIO TEXT

But what does it mean? If the satellite on the left were to travel for a particular interval of time, say one hour, it would "sweep out" a particular area of space.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's 2nd law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

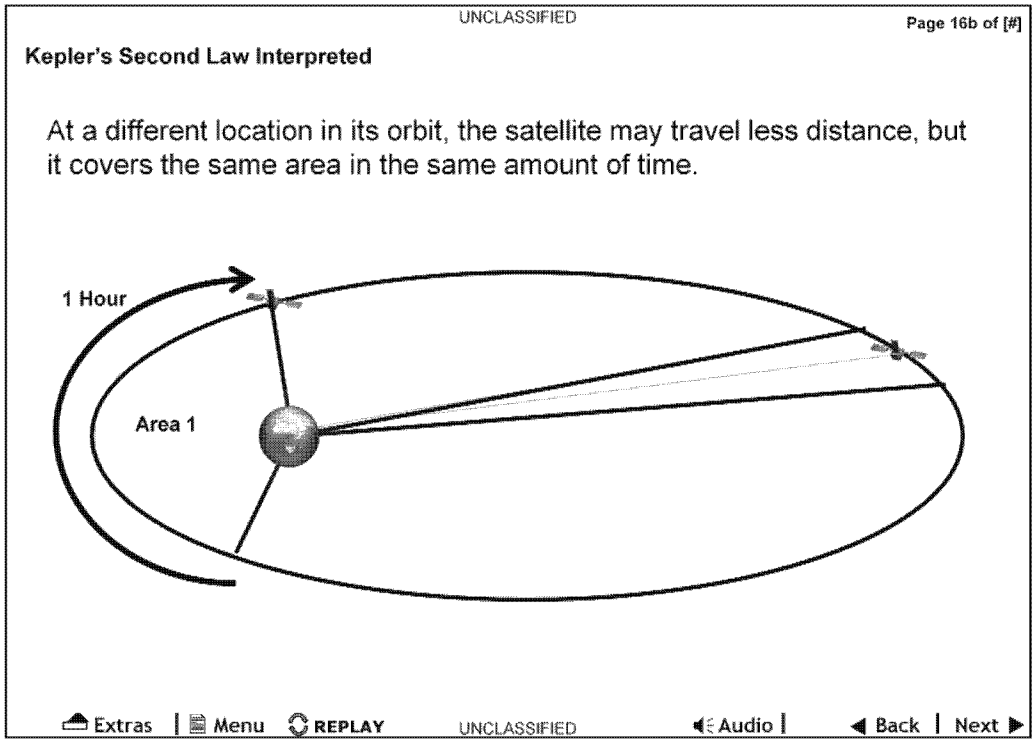
Media Elements: Animation of satellite on right moving from first point around to 2nd point. The "area" builds with it. Finally the labels and green arrow appear.

AUDIO TEXT

Later, the same satellite is in a different portion of its orbit, further away from the earth. In the same time period, it travels a much shorter distance. However, the area of space that it "sweeps out" is equal to that of the first area.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's 2nd law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

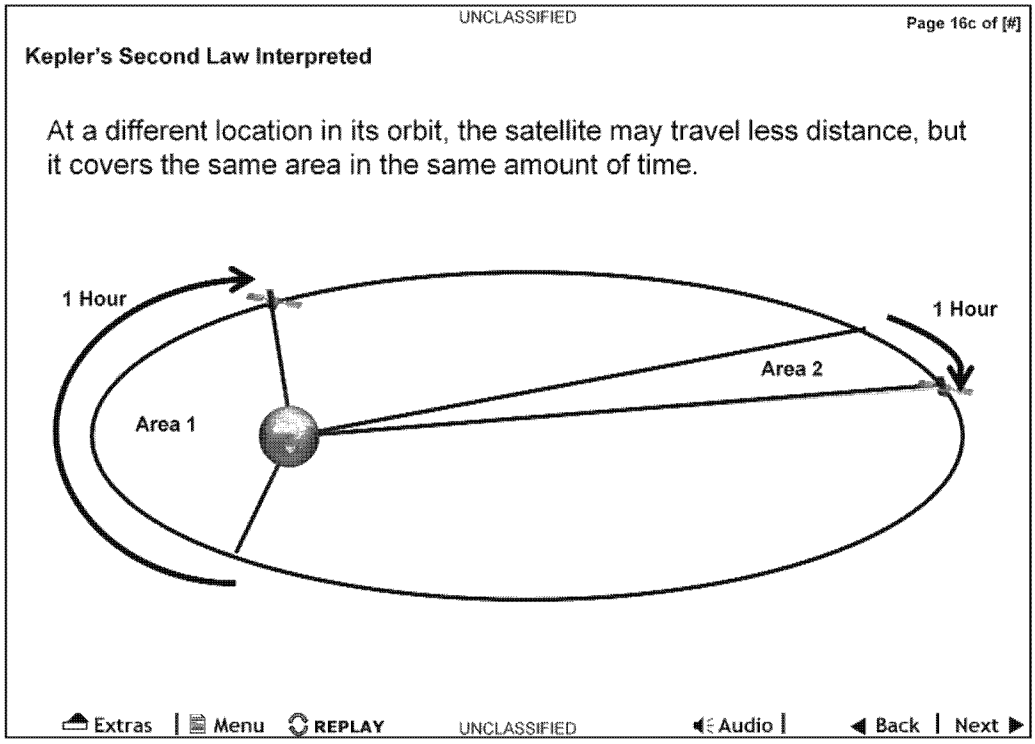
Media Elements: Animation of satellite on left moving from first point around to 2nd point. The "area" builds with it. Finally the labels appear.

AUDIO TEXT

Later, the same satellite is in a different portion of its orbit, further away from the earth. In the same time period, it travels a much shorter distance. However, the area of space that it "sweeps out" is equal to that of the first area.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's 2nd law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

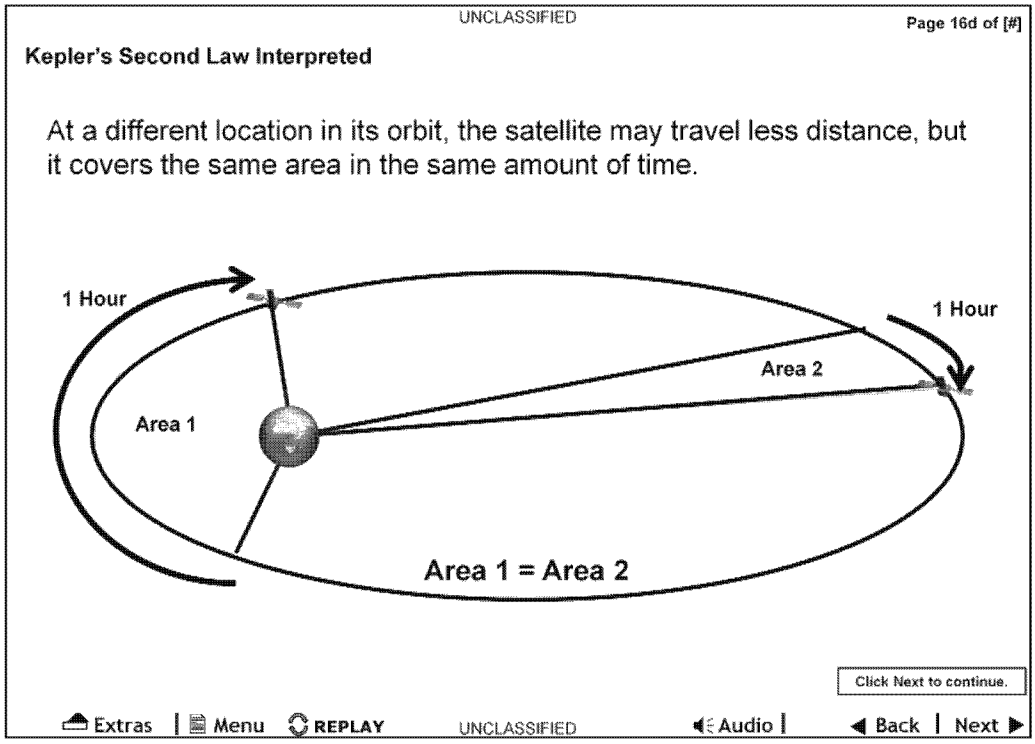
Media Elements: Animation of satellite on left moving from first point around to 2nd point. The "area" builds with it. Finally the labels appear.

AUDIO TEXT

Later, the same satellite is in a different portion of its orbit, further away from the earth. In the same time period, it travels a much shorter distance. However, the area of space that it "sweeps out" is equal to that of the first area.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's 2nd law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

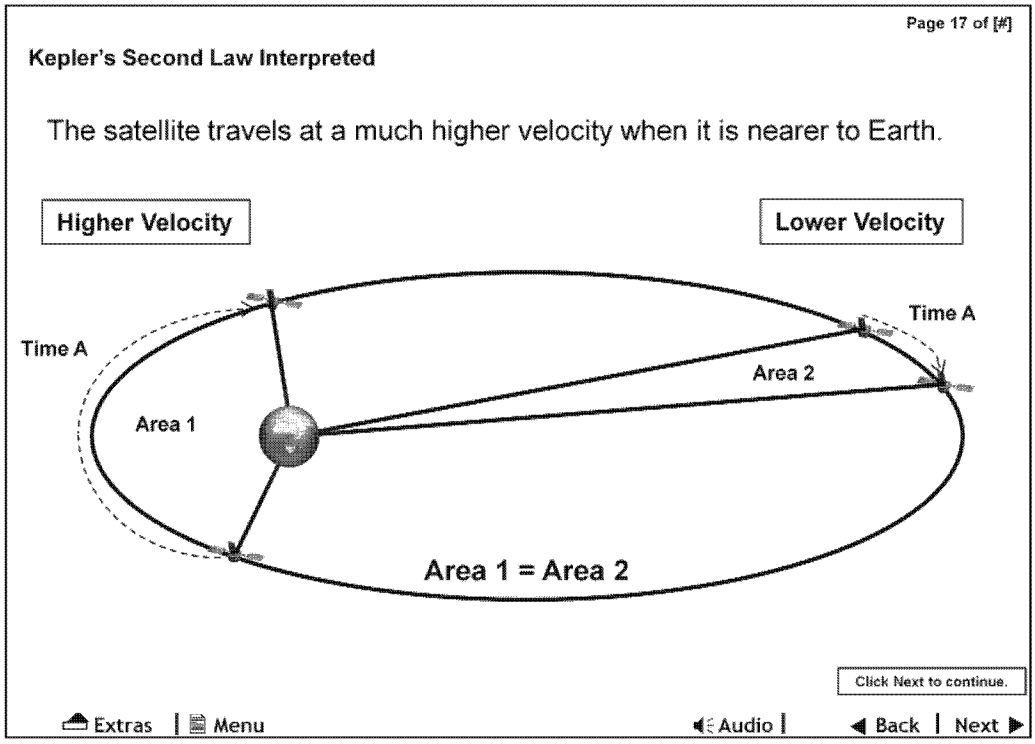
Media Elements: Animation of satellite on left moving from first point around to 2nd point. The "area" builds with it. Finally the labels appear.

AUDIO TEXT

Later, the same satellite is in a different portion of its orbit, further away from the earth. In the same time period, it travels a much shorter distance. However, the area of space that it "sweeps out" is equal to that of the first area.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's 2nd law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction: Click Next

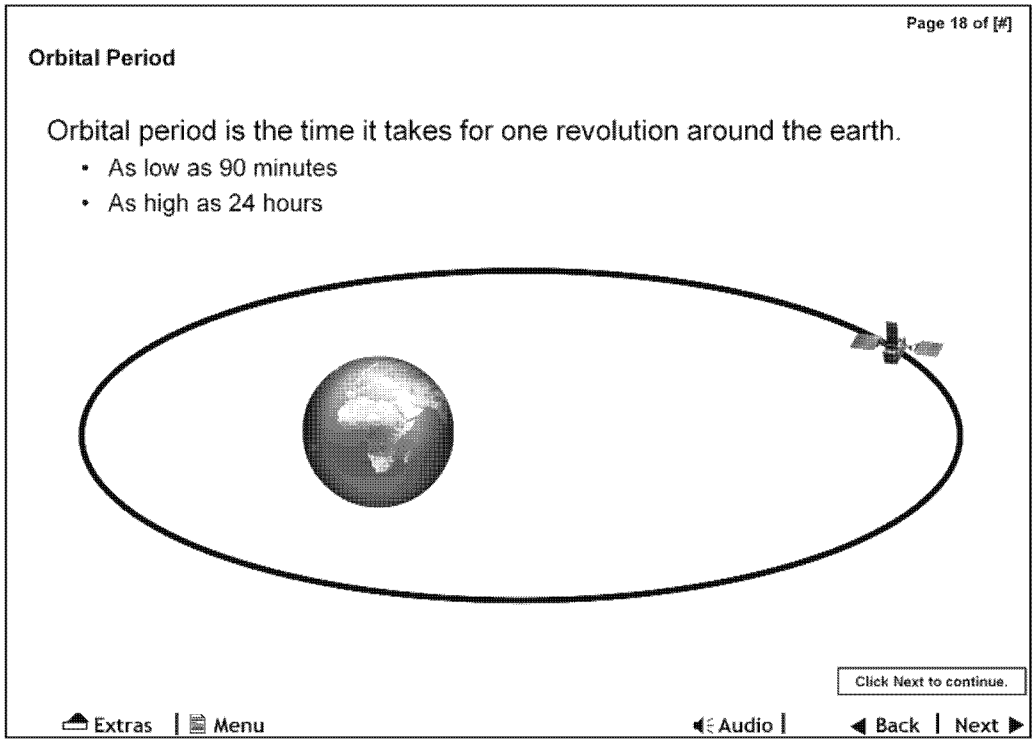
Media Elements: Back to same still graphic as page 14b. Add Higher Velocity and Lower Velocity labels in synch w/ narration.

AUDIO TEXT

The takeaway for Kepler's second law is that an orbiting satellite travels much faster when it is close to the Earth than when it is further away. This allows the satellite to "sweep out" equal areas although it is covering different distances at different times.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Orbital Period

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction: Click Next

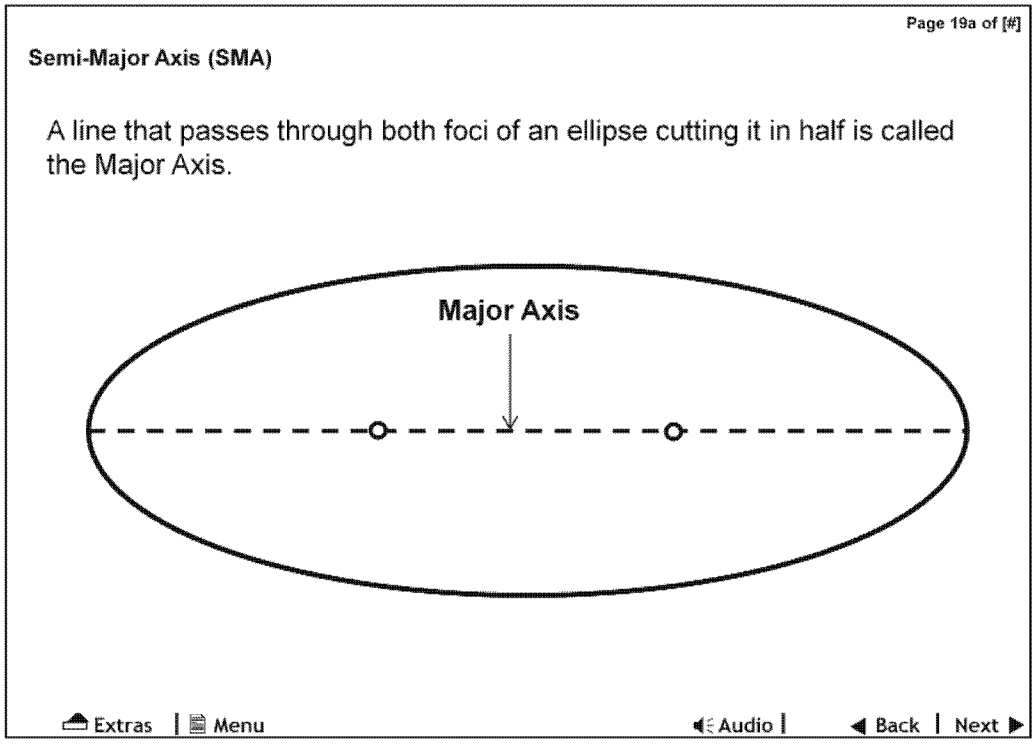
Media Elements: animation of satellite going around Earth

AUDIO TEXT

Before we move on to Kepler's Third law, we need to define some more terms. Orbital period is the time it takes for a satellite to make one revolution around the earth. The orbital period determines how many revolutions the satellite will complete each day. Additionally, orbital period has a direct effect on the amount of time that the satellite has access to any given target. This is referred to as dwell time.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Semi-Major Axis

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

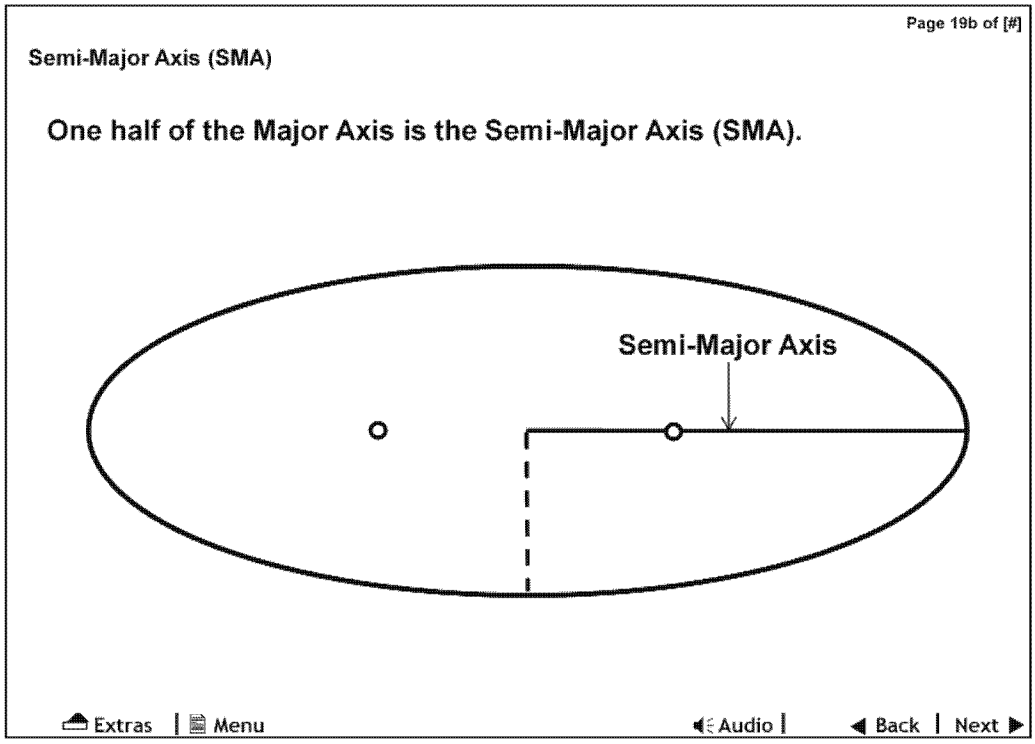
Media Elements: Build of ellipse with varying lines and labels

AUDIO TEXT

The overall length of an ellipse is referred to as the Major Axis.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Semi-Major Axis

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

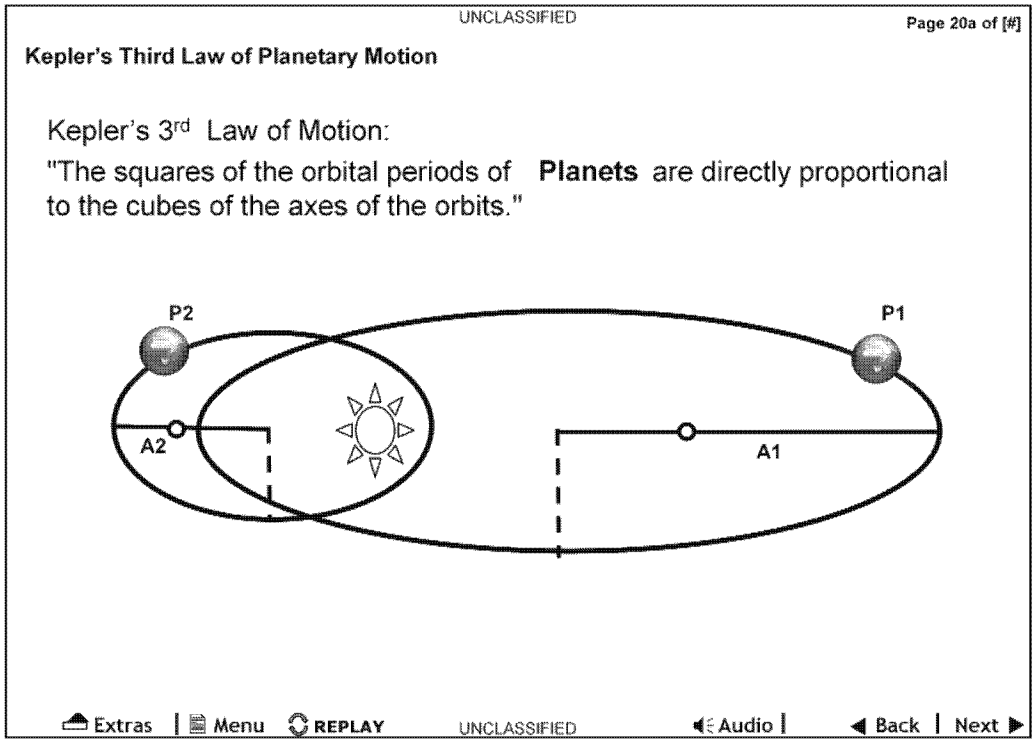
Media Elements: Build of ellipse with varying lines and labels

AUDIO TEXT

Half of the Major Axis is the Semi-Major Axis. The semi-major axis determines the size of the orbit. The bigger the semi-major axis, and the corresponding orbit, the longer the orbital period.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: a build of an ellipse with changing objects orbiting around it

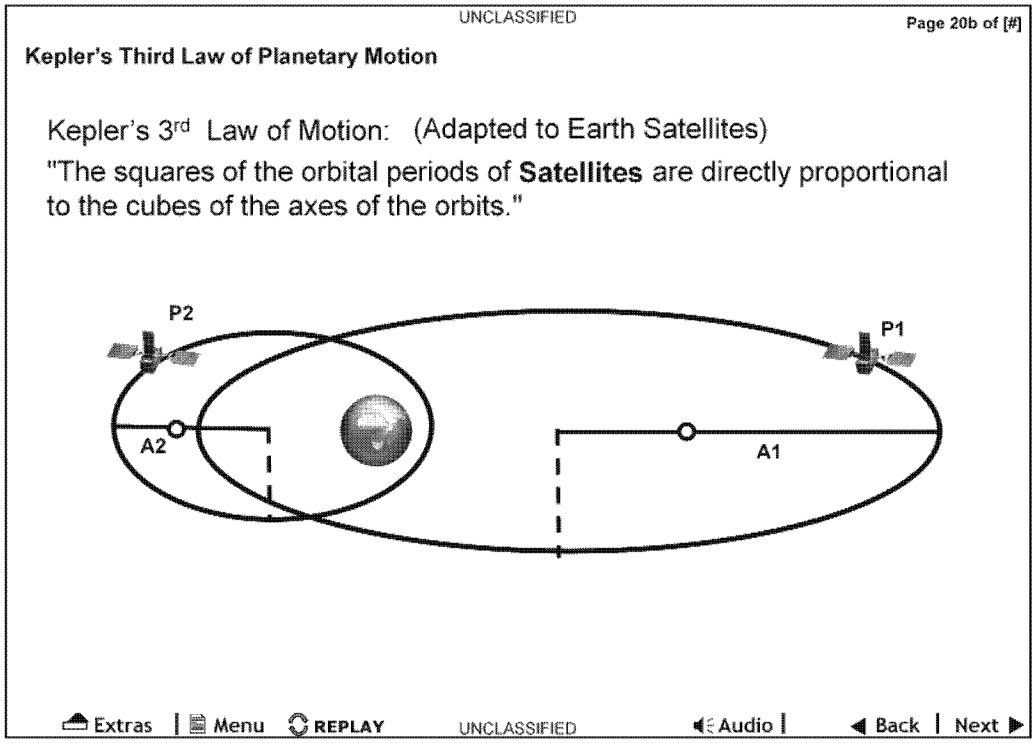
a. Opens w/ earth in orbit around sun in 2 different ellipses (orbits)

AUDIO TEXT

Kepler's third Law of Planetary Motion states that "The squares of the orbital periods of planets are directly proportional to the cubes of the axes of the orbits."

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Define Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: a build of an ellipse with changing objects orbiting around it

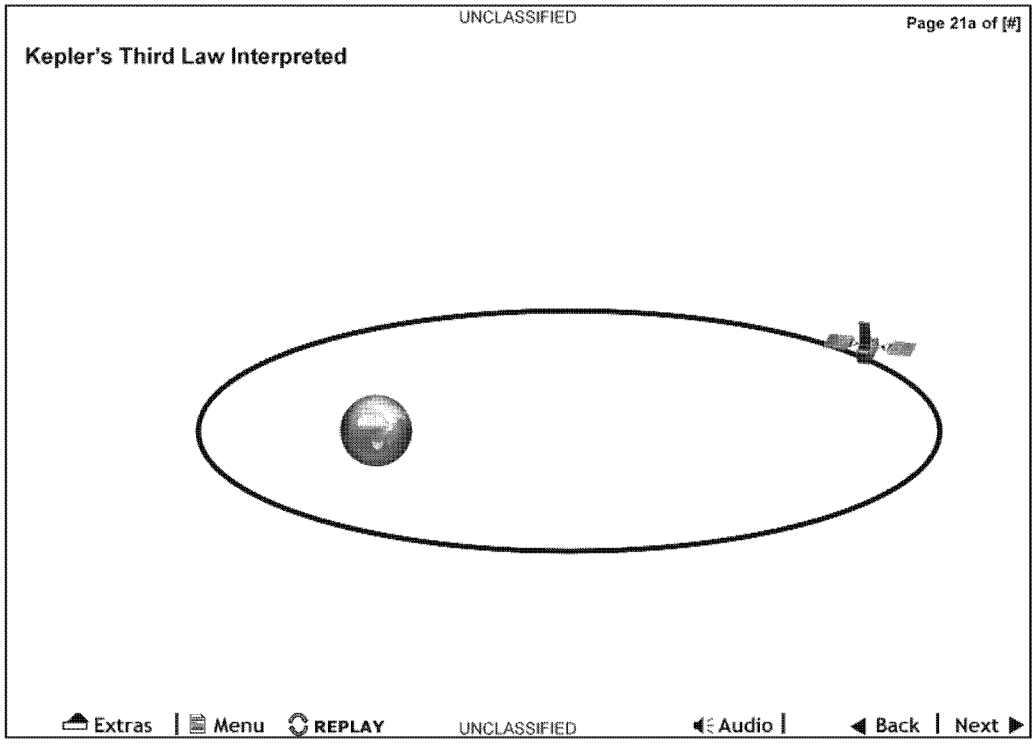
b. Now satellites are in orbit around earth in 2 different ellipses (orbits)

AUDIO TEXT

Once again, we can adapt this to Earth-orbiting satellites. But what does it mean?

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: build of various objects in various orbits w/ labels as shown and in synch w/ narration

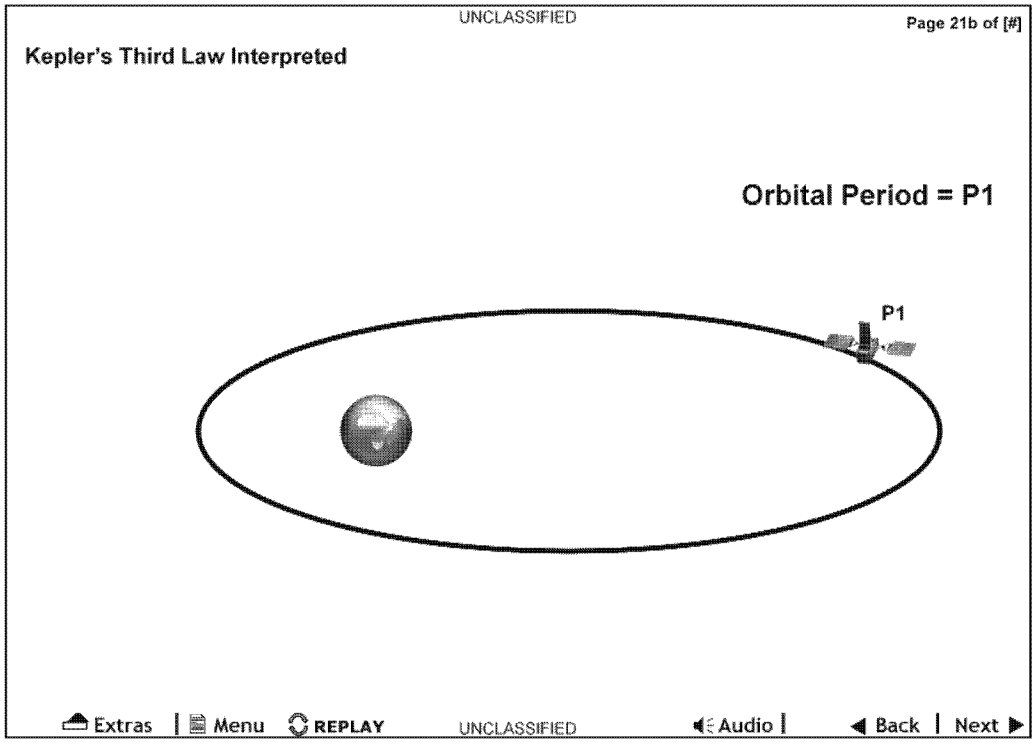
a. single satellite in orbit

AUDIO TEXT

Let's break that down into smaller chunks so that we can explain it.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: build of various objects in various orbits w/ labels as shown and in synch w/ narration

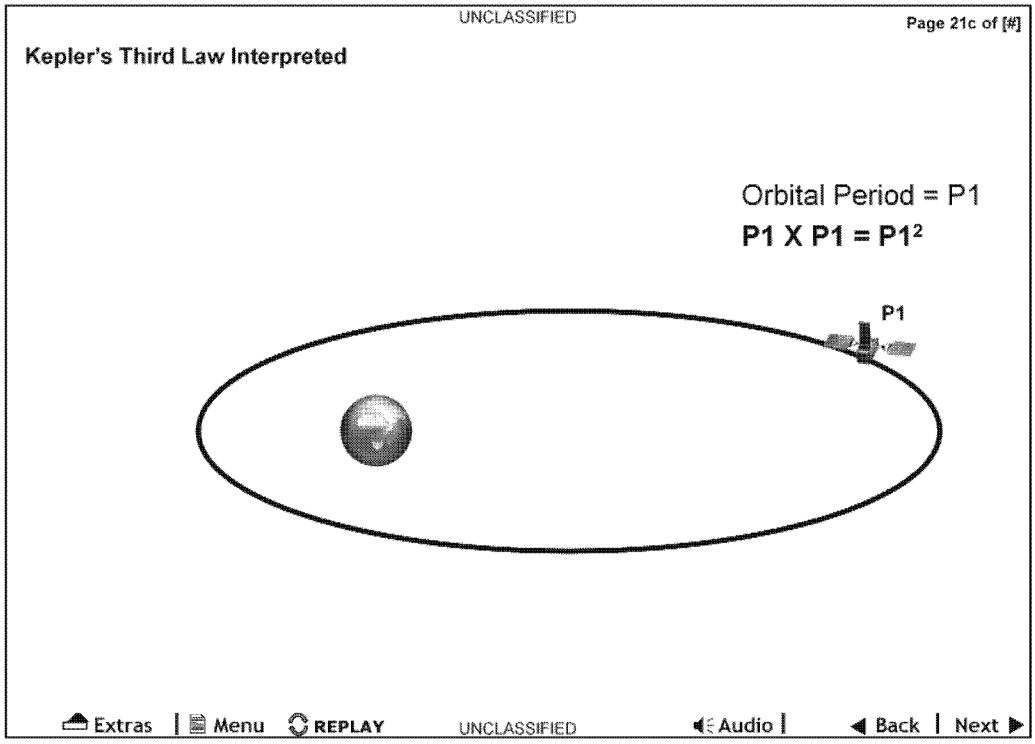
b. Add big red and little orange P1 labels

AUDIO TEXT

Remember, the Orbital Period is the length of time it takes for the satellite to make one revolution. Let's label that P1.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: build of various objects in various orbits w/ labels as shown and in synch w/ narration

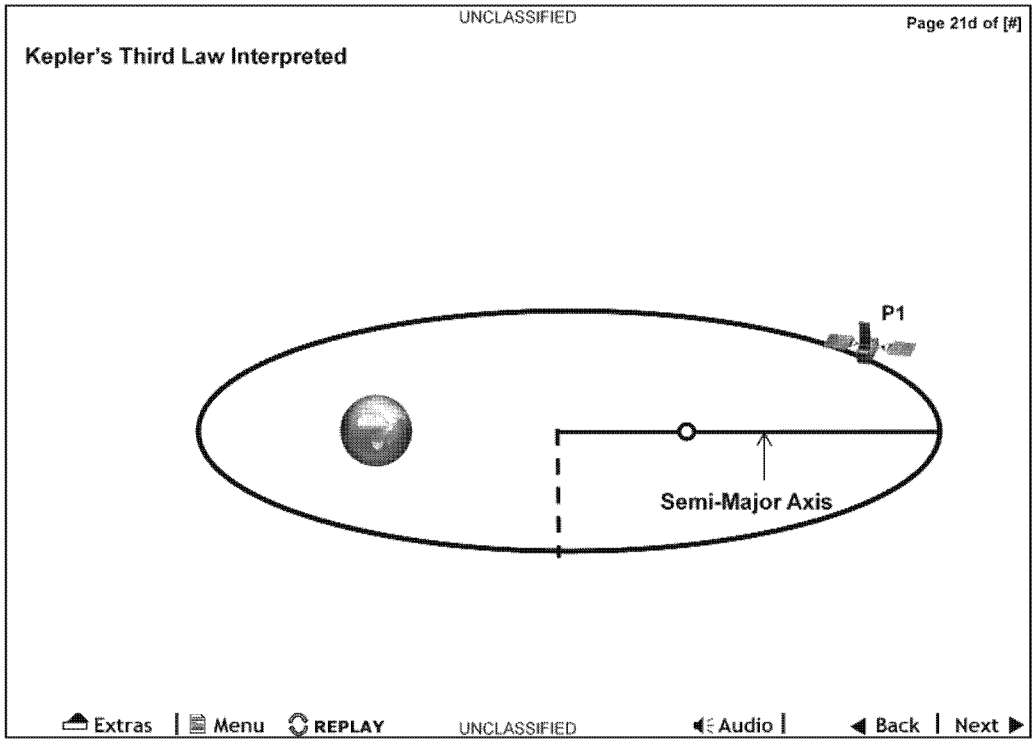
c. Add big red formula

AUDIO TEXT

If you were to multiply it by itself, you have P1 squared. Now we have Kepler's "square of the orbital period."

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: build of various objects in various orbits w/ labels as shown and in synch w/ narration

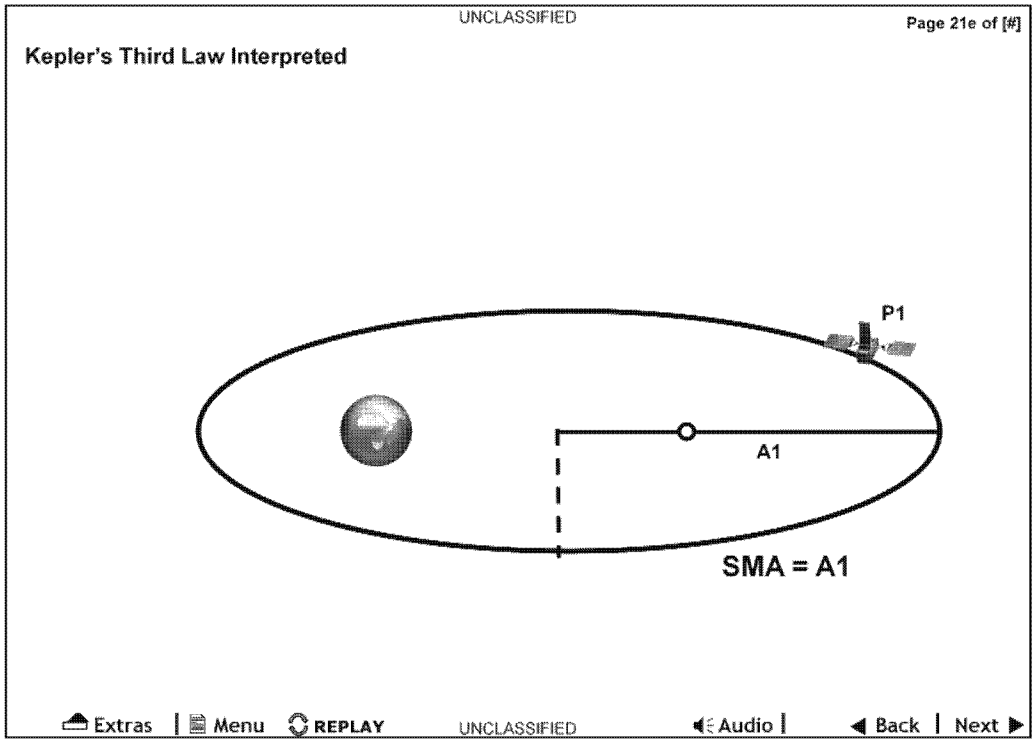
d. Remove upper labels and add label for SMA

AUDIO TEXT

Also remember, the Semi-Major Axis is half of the length of the ellipse.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: build of various objects in various orbits w/ labels as shown and in synch w/ narration

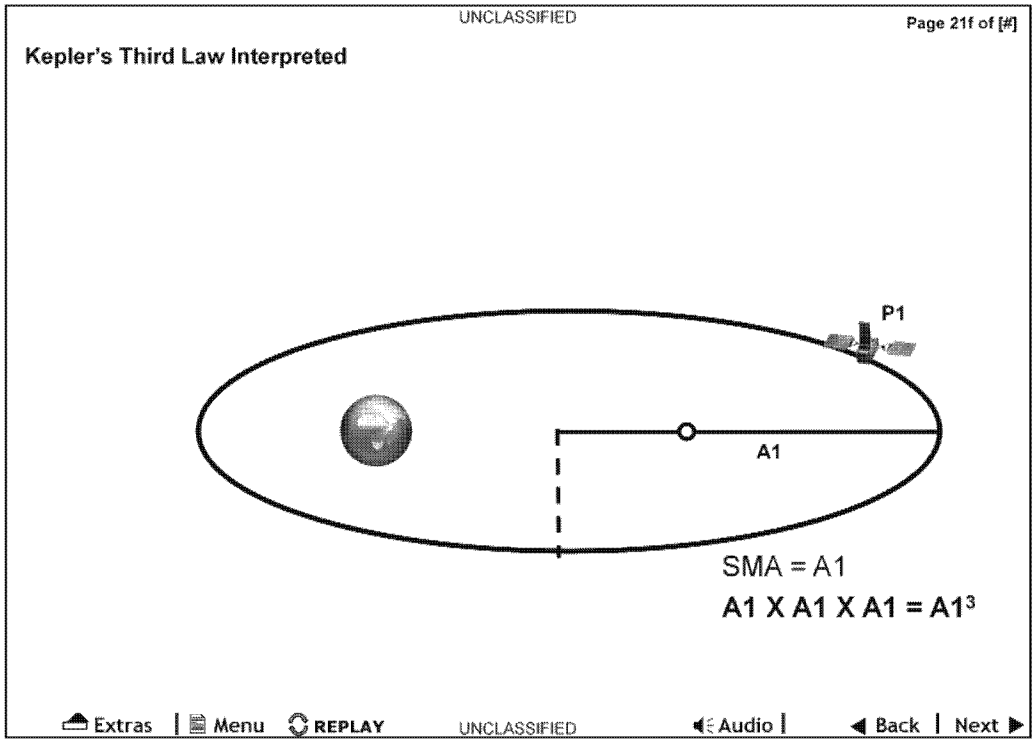
e. Remove SMA label. Add big red and little orange A1 labels.

AUDIO TEXT

We will label that A1.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: build of various objects in various orbits w/ labels as shown and in synch w/ narration

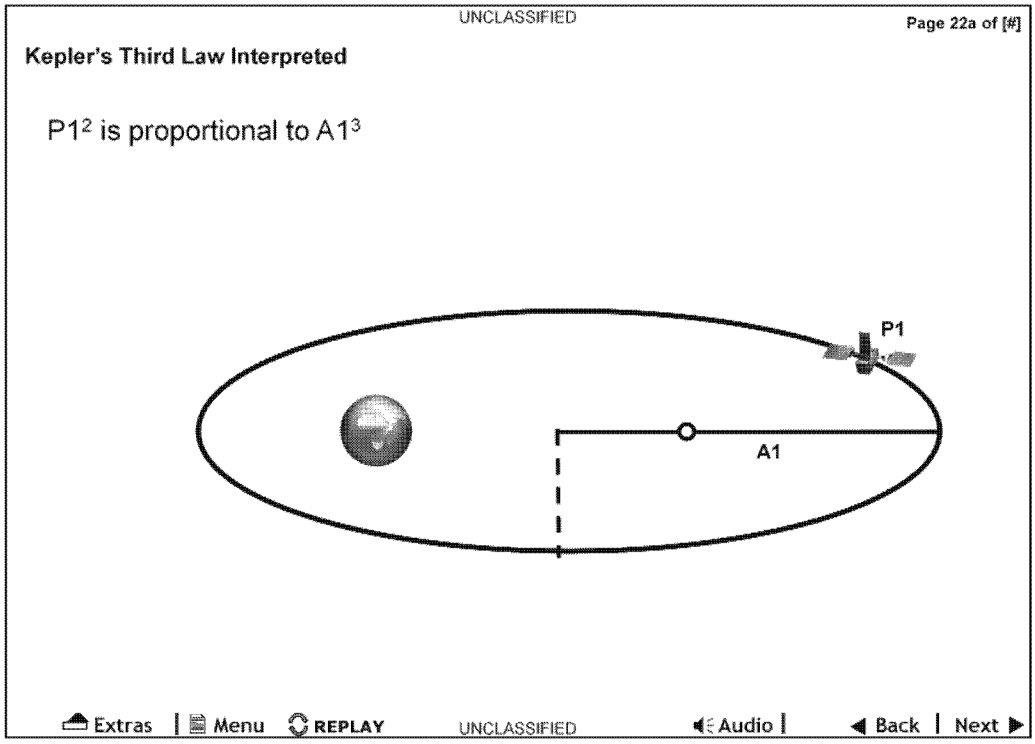
f. Add big red formula

AUDIO TEXT

If you were to multiply it by itself and then by itself once again, that is A1 cubed. Now, we have identified Kepler's "cube of the axis of the orbits."

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: build of various objects in various orbits w/ labels, text boxes, and formulas as shown and in synch w/ narration

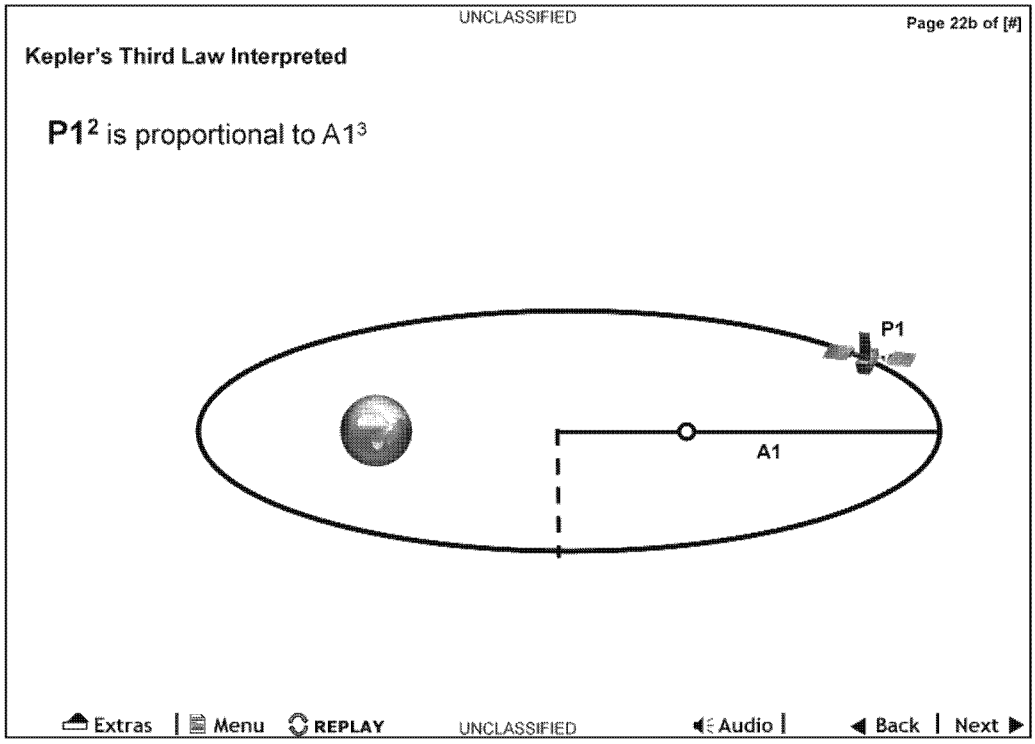
a. larger orbit

AUDIO TEXT

So, let's put all of those pieces together now into one complete thought.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: build of various objects in various orbits w/ labels, text boxes, and formulas as shown and in synch w/ narration

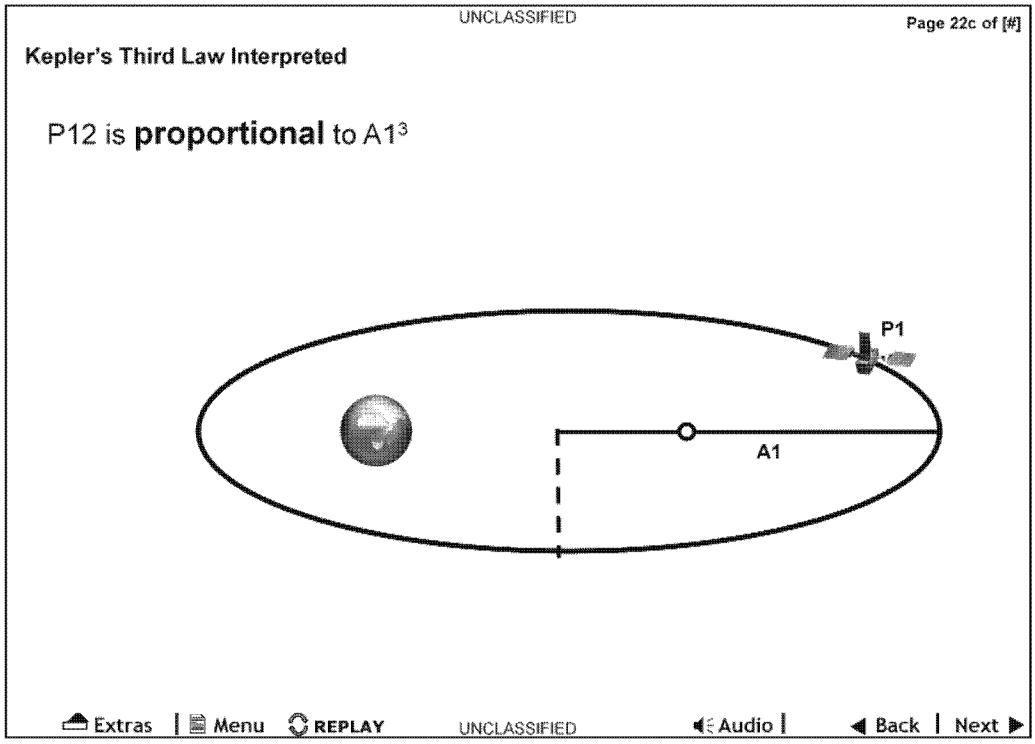
b. Bold $P1^2$

AUDIO TEXT

In simple terms, Kepler's third law states that the **square of the orbital period** of a satellite has a proportional relationship to the cube of the Semi-Major Axis.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: build of various objects in various orbits w/ labels, text boxes, and formulas as shown and in synch w/ narration

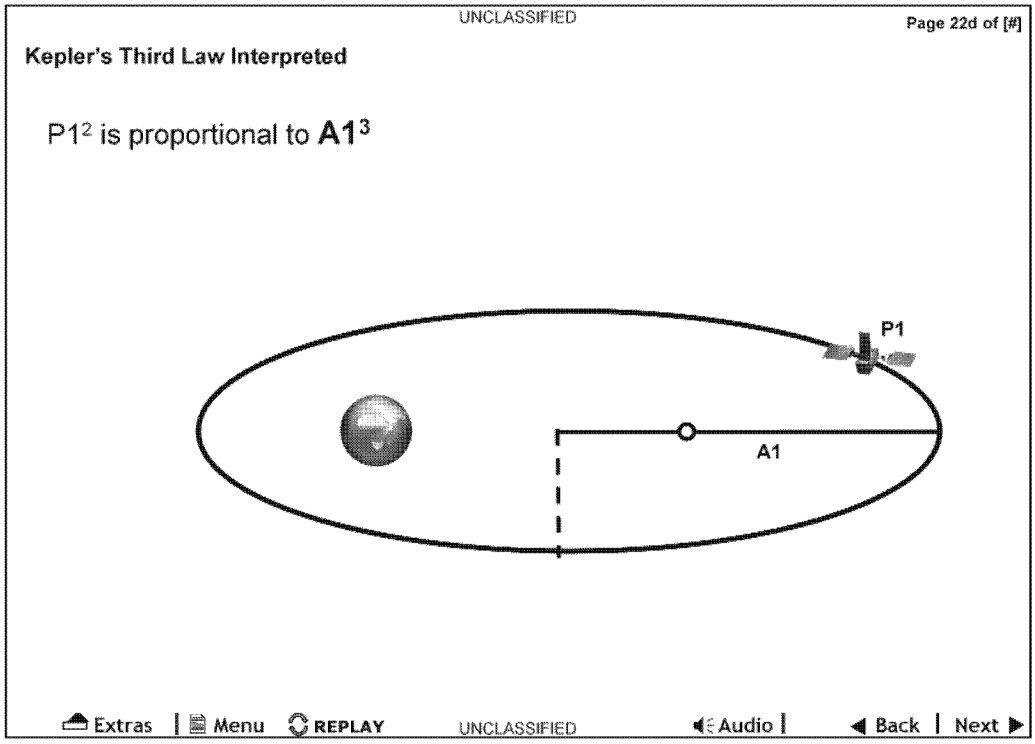
c. Bold proportional

AUDIO TEXT

In simple terms, Kepler's third law states that the square of the orbital period of a satellite has a **proportional relationship** to the cube of the Semi-Major Axis.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: build of various objects in various orbits w/ labels, text boxes, and formulas as shown and in synch w/ narration

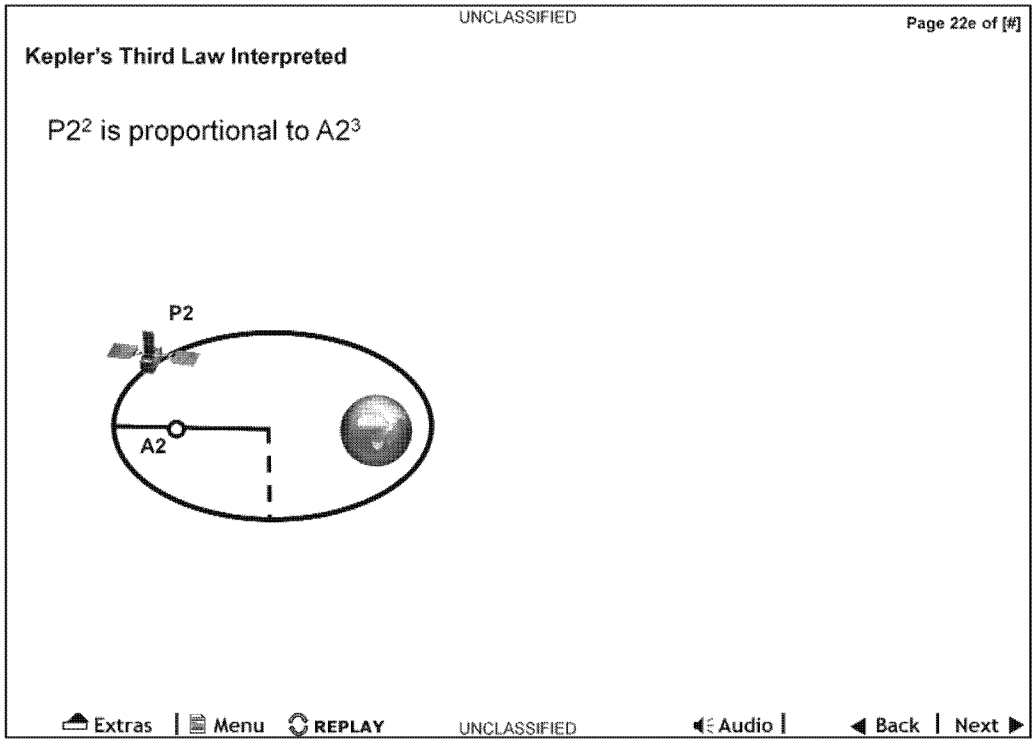
d. Bold $A1^3$

AUDIO TEXT

In simple terms, Kepler's third law states that the square of the orbital period of a satellite has a proportional relationship to the **cube of the Semi-Major Axis.**

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: build of various objects in various orbits w/ labels, text boxes, and formulas as shown and in synch w/ narration

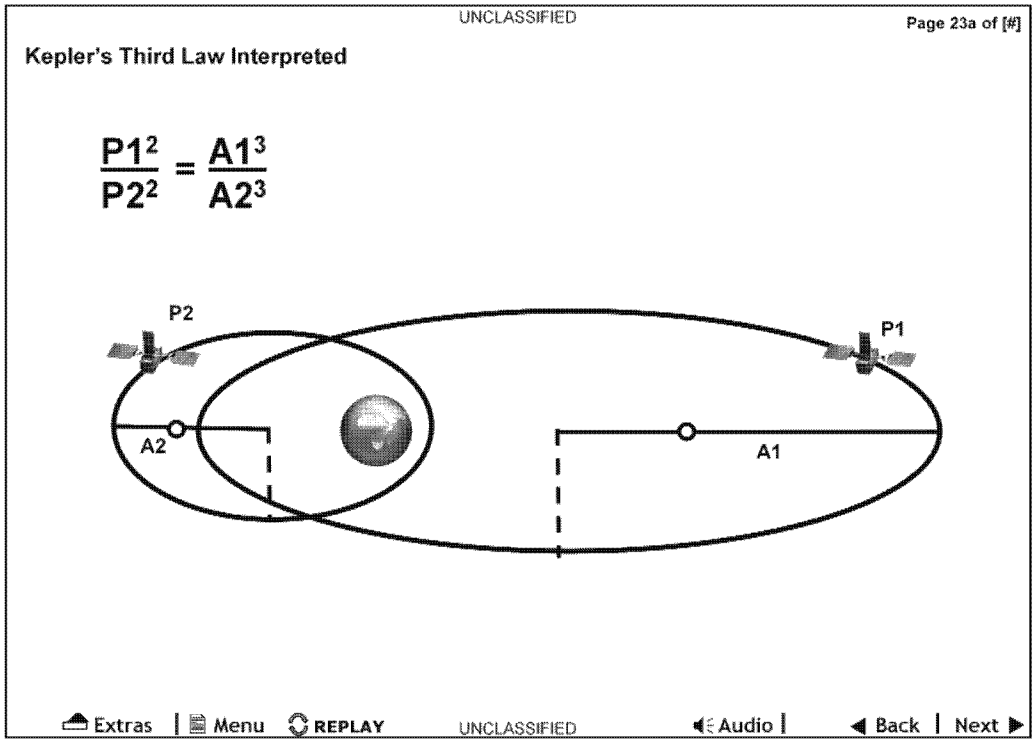
e. Changes to small ellipse and new formula

AUDIO TEXT

This rule applies no matter the size of the orbit. The same proportional relationship is always maintained.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

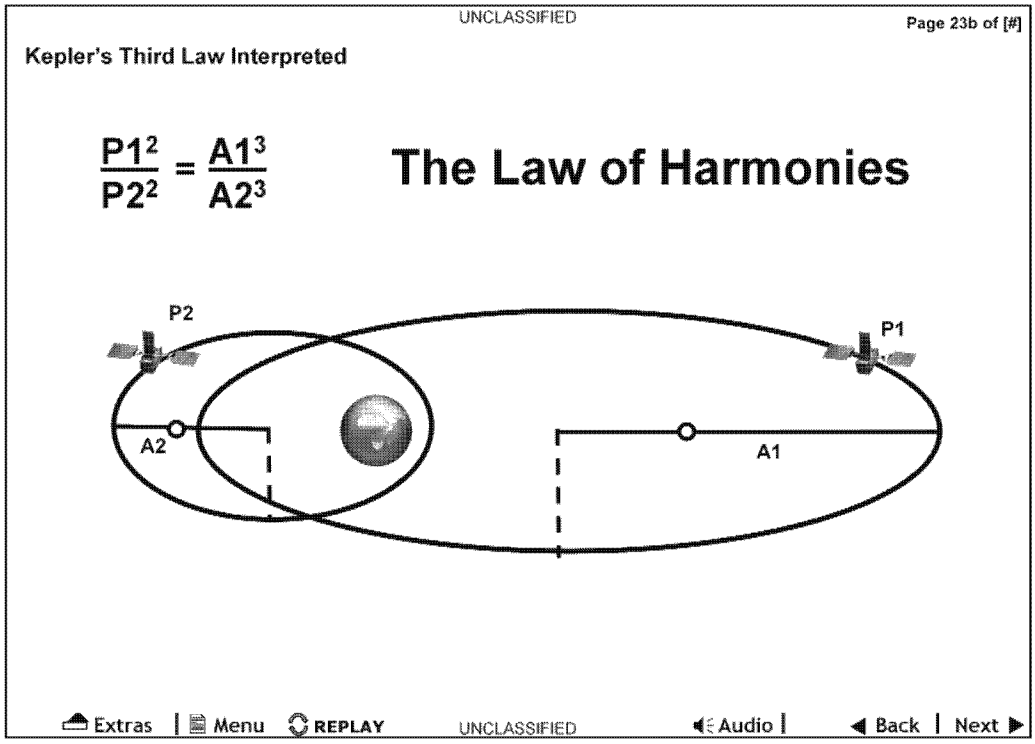
Media Elements: Back to same graphic from 20b. Add formula at top

AUDIO TEXT

Kepler described this relationship using a complex formula.

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]



Purpose of screen: Explain Kepler's third law of motion

Objective: Summarize Kepler's three Laws of Motion

Sources: SME

DEVELOPER NOTES:

User Instruction:

Media Elements: Back to same graphic from 20b. Add formula at top

b. Add text box.

AUDIO TEXT

Since this law applies to all orbits, planetary or man-made, Kepler referred to his 3rd law as "The Law of Harmonies."

Acronyms & Glossary of Terms:

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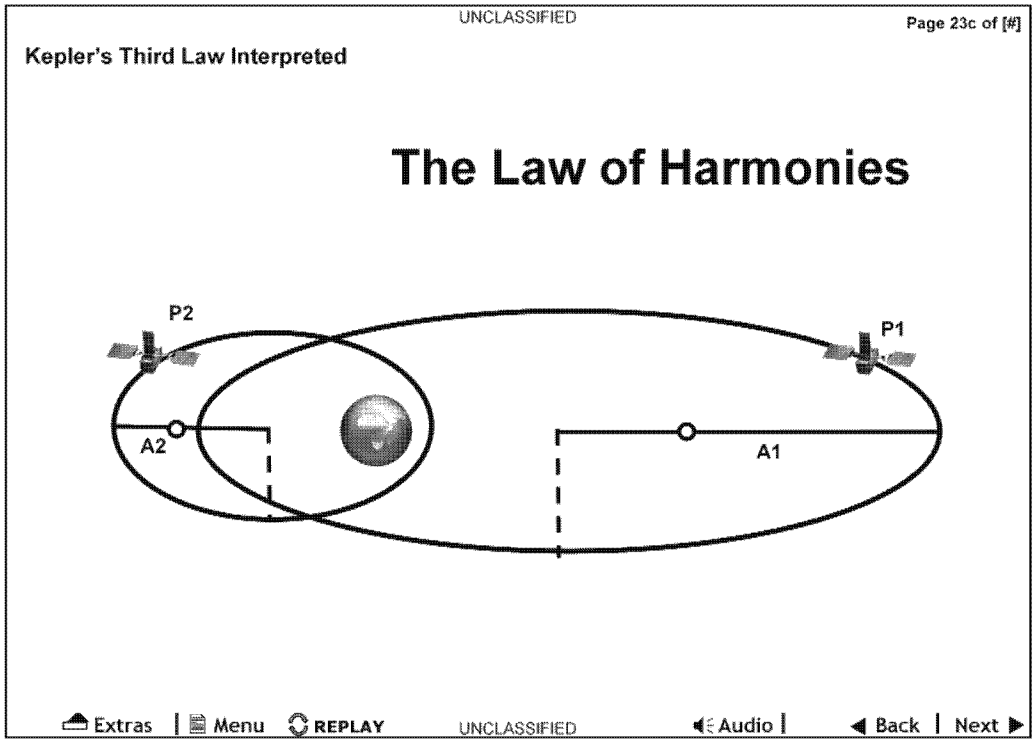

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AUDIO TEXT

So what the Law of Harmonies mean to us humans trying to launch satellites into orbit?

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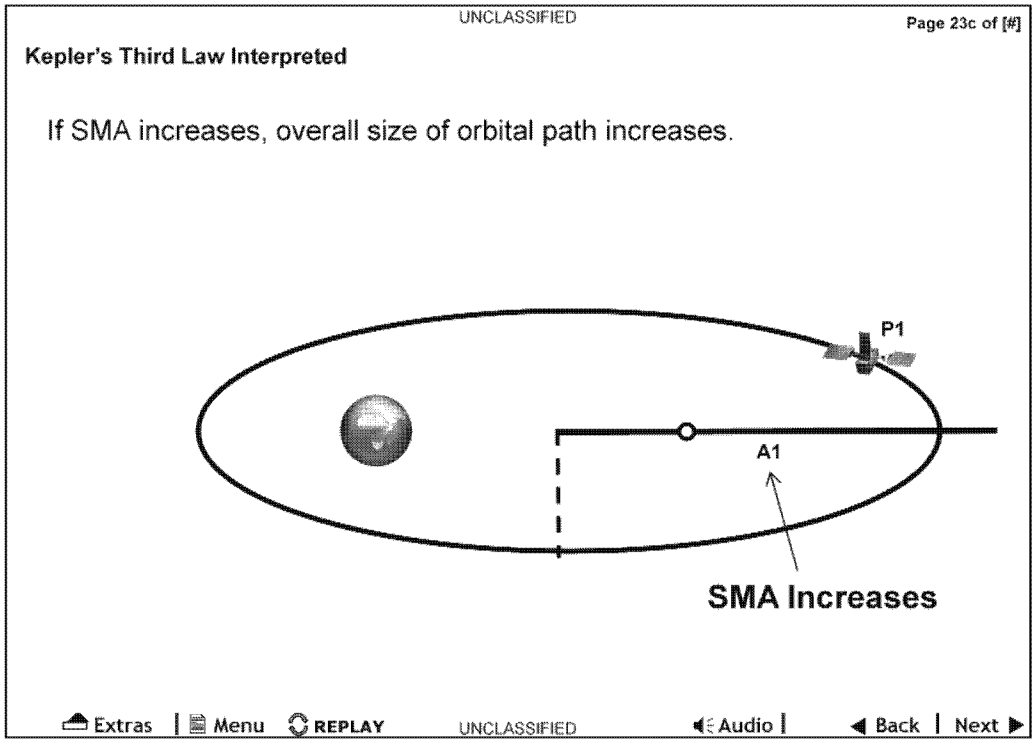

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AUDIO TEXT

If the semi-major axis increases, the overall orbital path must increase. This causes the orbital period to increase. If the orbital period increases, the velocity of the satellite decreases. So, the key takeaway for Kepler's Third Law is that satellites in smaller orbits travel faster than satellites in larger orbits. This happens because the further away from Earth a satellite gets, the lower the gravitational pull and the lower the velocity required to counter that pull.

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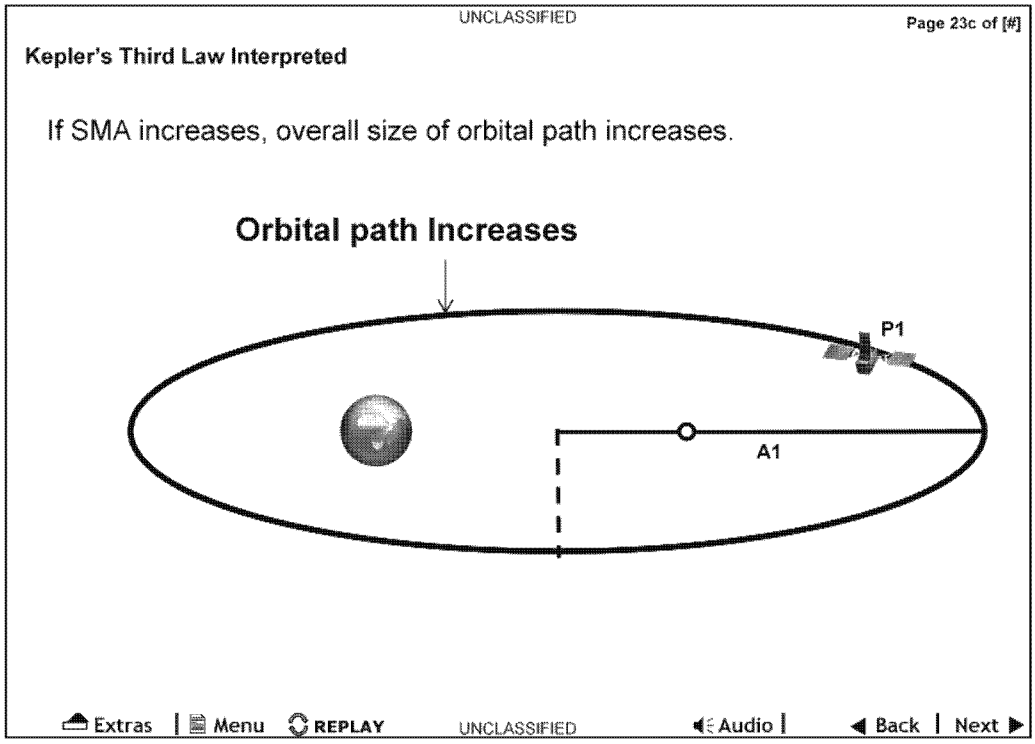

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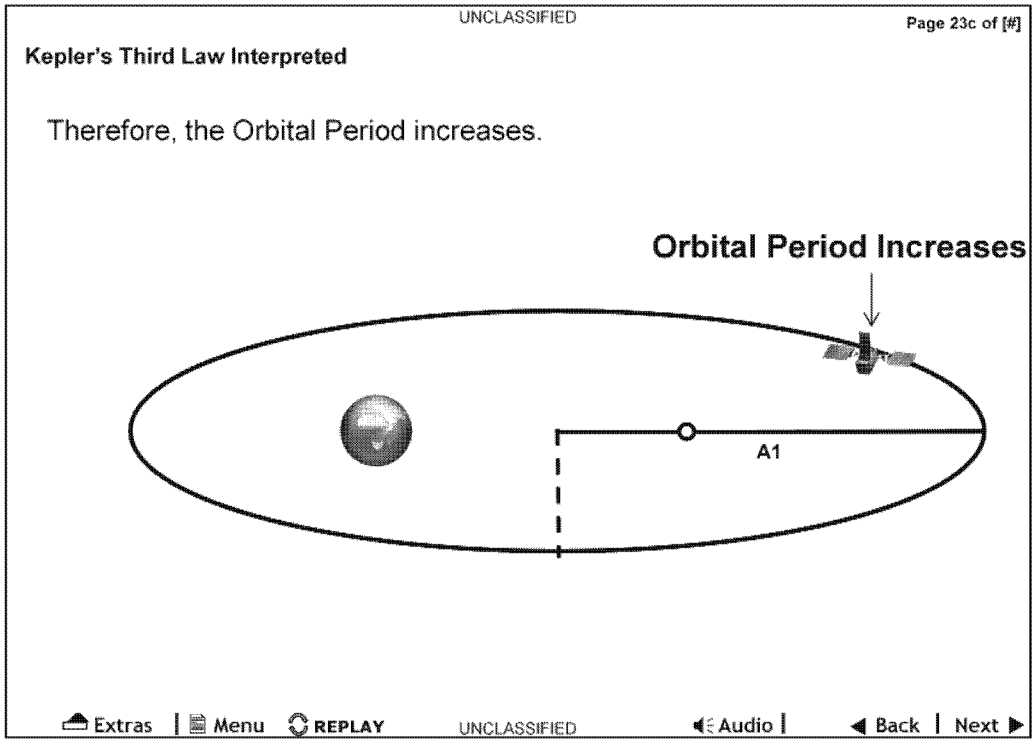

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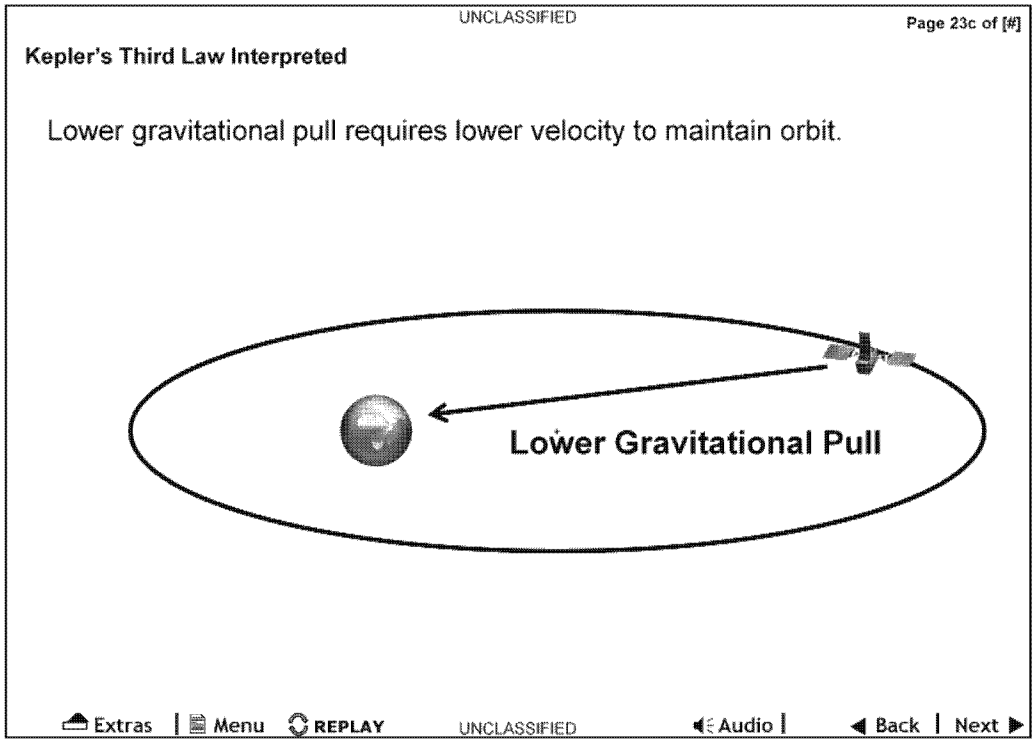

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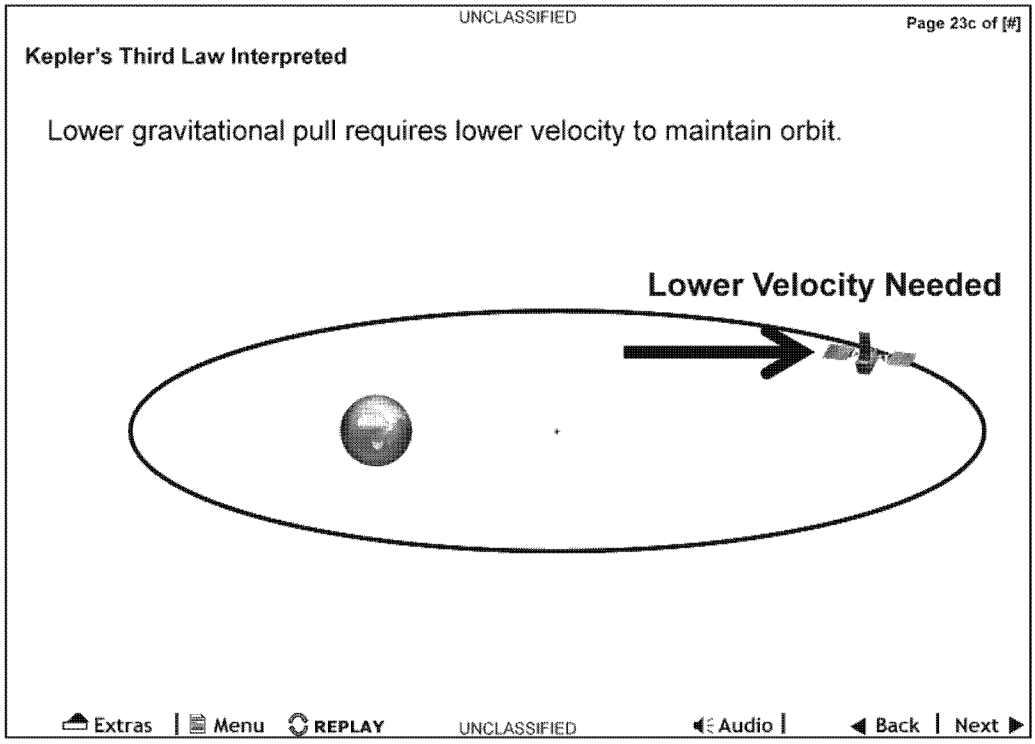

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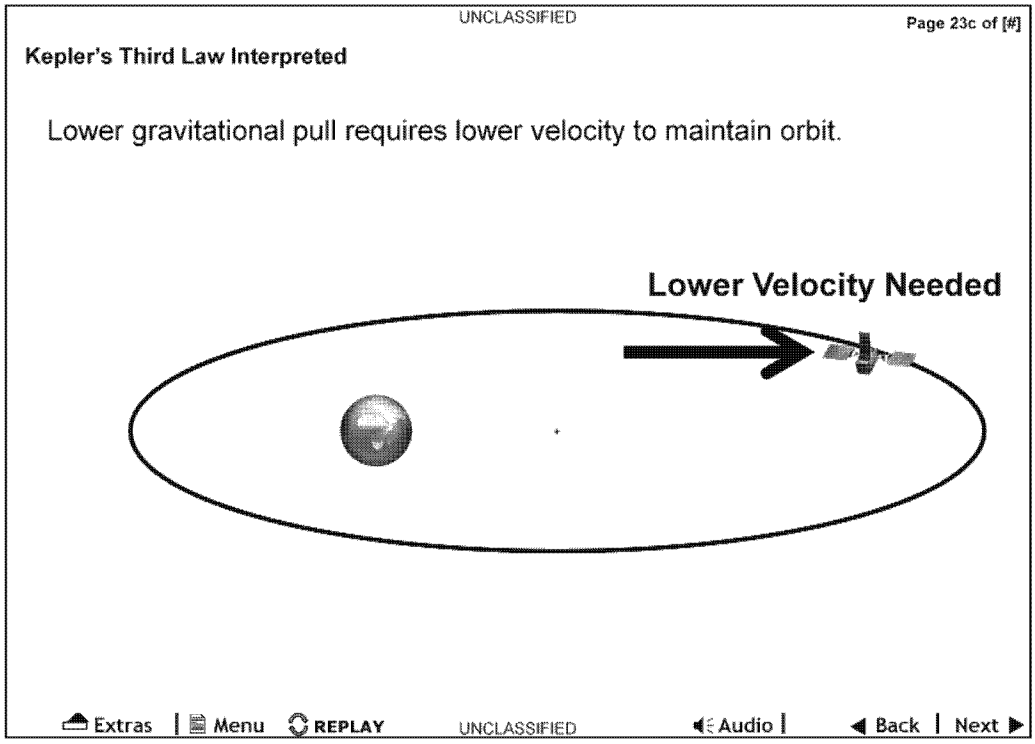

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AUDIO TEXT

Back to the delicate balance of Vel and Gravity.

Acronyms & Glossary of Terms:

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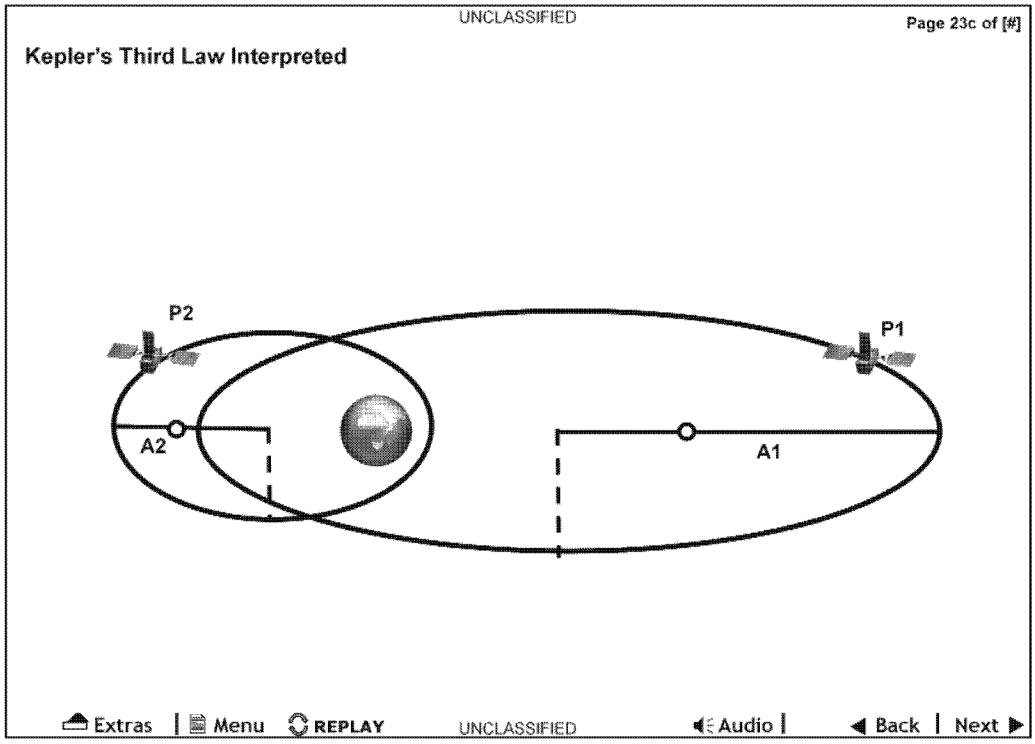

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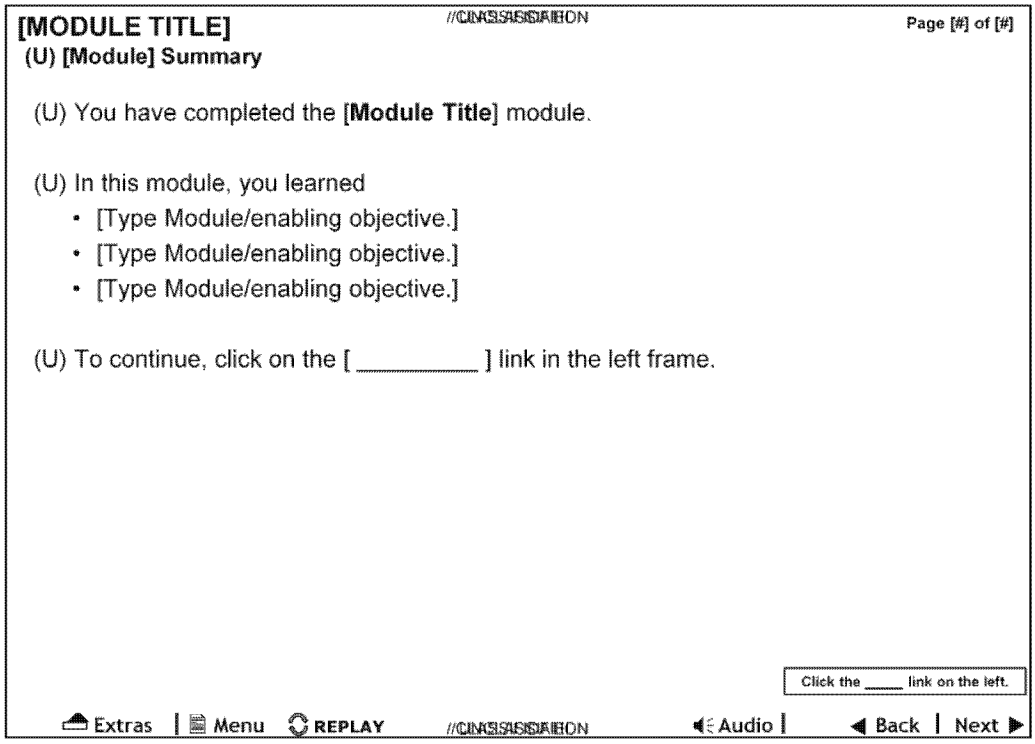

Purpose of screen: Summarized and closes the module.
Objective: [Objective to which this slide corresponds]
Sources: [Where did the content for this page originate?]

DEVELOPER NOTES:

User Instruction: To continue. Click on the [ ] link in the left frame.

Media Elements:

- None

AUDIO TEXT

//CLASSIFICATION

[(U) Type audio script here.]

[(U) Be sure to begin each paragraph with the proper portion-marking and fill in the header/footer.]

//CLASSIFICATION

Acronyms & Glossary of Terms:

[List any acronyms and terms/definitions that need to go into the glossary.]

Defining the term orbit
Gravity and Velocity
What keeps a satellite in orbit?