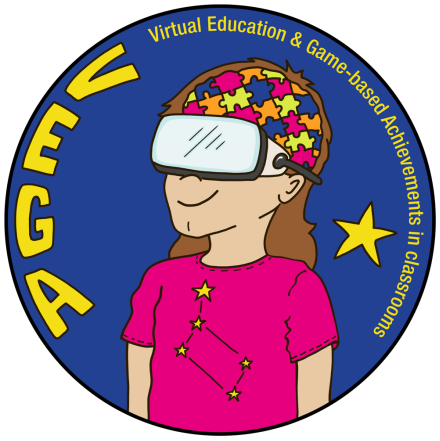
Erasmus+



Deep-dive into Orbits and Pluto! – VEGA Teaching Scenario

Topic: Orbits and the Curious case of Pluto

Subject(s): Science / Physics

Age / Grade: 6th grade and up

Short description of the game in this scenario:

Universe Sandbox is an interactive sandbox gravity simulator video game and educational software. Using Universe Sandbox, users can see the effects of gravity on objects in the university-run scale simulations of the Solar System, various galaxies, or other simulations, while at the same time interacting and maintaining control over gravity, time, and other objects in the universe.

Introduction to the Scenario

This scenario is lesson 2 on gravity and how it determines celestial body interaction in space. Why are orbits formed and how do different Newtonian laws come into play? The lesson utilizes Universe Sandbox 2. What actually makes up a planet? What do we call planets and which celestial objects deserve the right to be called a ’planet’? In this lesson, the students get to compare planets and categorize them. We focus on Pluto and why do we call Pluto a dwarf planet nowadays.

Please open the computers after the theory section for better concentration.

Learning outcomes:

The students are able to:

- Understand the newtonian laws
- Understand how newtonian laws and planet movement is connected
- what actually is a planet by definition
- Experiment with gravity and run tests on it

A selection of learning outcomes from the Finnish Curriculum

- M1 arouse and maintain the student's interest in the environment and the teaching of environmental science and help the student to realize that all subject areas in environmental science are important for him
- M2 guide and encourage the student to set goals for their studies and to work long-term to achieve them and to analyze their knowledge in environmental science
- M3 support the student to develop environmental awareness and to act and influence in their immediate environment and in different contexts to promote sustainable development and to appreciate the importance of sustainable development for themselves and the world

- M4 encourage the student to formulate questions on different subject areas and to use them as a starting point for investigations and other activities
- M5 help the student to plan and carry out small investigations, make observations and measurements in diverse learning environments with the help of different senses and investigation and measurement tools
- M6 help the student to see the connection between cause and effect, draw conclusions based on the results and per center their results and research in different ways
- M13 guide the student to understand, use and create different models with the help of which one can interpret and explain man, the environment and related phenomena
- M15 guide the student to investigate nature , identify organisms and habitats, think ecologically and help the student to understand human structure, life functions and development

Formative assessment

Number of students: Duration (estimated time/number of lessons):

- 25 students
- 2 lessons á 45 min

Prerequisites (necessary materials and online resources):

- Please see the powerpoint and make sure the game works (Universe sandbox 2)

Before the program begins (preparatory work for teacher):

- Please make sure the game works on the computers and that you have the powerpoint available

The main part of the scenario (number of lessons):

Part one (one lesson 1 x 45 min)

Please open the powerpoint provided.

Theory phase: 15 minutes (follow the powerpoint presentation)

Discuss the topic and see the instructions on how to open the right simulation from the saved simulations. Please see presenter notes for more specific information for the teacher. Open the game after the instructions have been checked. Instructions are on the slide show just after the 'play phase'.

Play phase: 20 minutes (please allow sufficient time for experiments)

Each group/pair should have notation devices with them to answer each task on a separate document. Faster students can move forward quicker and experiment with the bonus tasks provided on the final task slide. It is a good idea to once in a while check that all students have taken notes.

Debriefing: 10 minutes

Please discuss the topics provided on the slides. Presenter notes will provide the answer to the questions if needed. Feel free to have a free discussion with the students. They might also have interesting ideas on how to utilize the game in school

Part two (one lesson 1 x 45 min)

Please open the powerpoint provided.

Theory phase: 15 minutes (follow the powerpoint presentation)

Theory phase: Discuss the topics on the powerpoint slides. The game will automatically open showing the solar system when you move to the play phase. Please see presenter notes for more specific information for the teacher.

Open the game after you have completed the theory phase discussions.

Play phase: 20 minutes (please allow sufficient time for experiments)

Each group/pair should have notation devices with them to answer each task on a separate document. It is a good idea to once in a while check that all students have taken notes.

Debriefing: 10 minutes

Please discuss the topics provided on the slides. Presenter notes will provide the answer to the questions if needed. Feel free to have a free discussion with the students. They might also have interesting ideas on how to utilize the game in school.

ASSESSMENT

Student evaluation rubric				
Knowledge content	1	2	3	4
Information recall	Student can't recall information covered in game	Student can recall some information covered in game	Student can recall most information covered in game	Student can recall all the information from the game well
Transfer	Student can't connect the information in game to information on books or in other medias	Student can transfer some information from the game to other medias	Student can transfer majority of information from the game to other medias	Student can connect the information in game very well to contents in other medias
Skills	1	2	3	4
Problem-solving	Student did not try to solve problems in game / during activity	Student was somewhat active in solving problems during the activity	Student worked rather actively on solving problems during class.	Student worked very actively on solving problems during class
Collaboration	Student was not able / willing to collaborate with others.	Student participated, but was not particularly active in collaboration.	Student was actively collaborating while working.	Student was very actively collaborating while working.
Creativity	Student did not actively consider / provide creative solutions to tasks or challenges	Student provided some creative ideas and solutions during the activity	Student actively considered / provided creative solutions to tasks or challenges	Student very actively considered/provided creative solutions to tasks or challenges
	1	2	3	4
Exercise completion	Student was not able to complete the tasks in the game	Student was able to complete some of the tasks in the game	Student was able to complete most of the tasks in the game	Student was able to complete all (or nearly all) tasks in the game
Engagement	Student was not engaged during the class	Student was slightly engaged during the class	Student was engaged during the class	Student was very engaged during the class

For students - more for evaluating the game itself. Most useful when experimenting

Student self-assessment rubric (includes game/scenario assessment)				
	1	2	3	4
Clear goals	I didn't understand what I was supposed to do in the game.	I somewhat understood what I was supposed to do in the game.	I knew what to do in the game.	I knew exactly what to do in the game.
Challenge level	The game was so hard that I felt frustrated.	My skill and game's difficulty were in balance.	The game didn't provide me with too much challenge.	I felt bored, the game was too easy.
Feedback	The game didn't provide me any feedback	The game provided me some feedback	The game provided me a lot of feedback	The game provided all the feedback I needed.
Concentration	I wasn't able to concentrate on the game.	I was able to somewhat concentrate on the game.	I was able to almost fully concentrate while playing.	I was able to fully concentrate while playing.
Completion	I wasn't able to complete the tasks in the game.	I was able to complete some tasks in the game.	I was able to complete almost all tasks in the game.	I was able to complete all the tasks in the game.
Learning	I didn't learn anything.	I did learn something from the game.	I feel that I learned quite a few things from the game.	I feel that I learned a lot from the game.
Fun	I didn't like playing the game.	I had some fun playing the game.	Playing the game was fun.	Playing the game was a lot of fun.