

FIRE IN THE SKY: TEACHER GUIDE

Subject: Earth Science

Grade Level: Middle School

Last Updated: September 6, 2008

Case Summary

A Near-Earth Object (NEO) has recently been sighted and is on a path to possibly collide with the Earth. NASA has sent an urgent letter to an expert space research team asking for their help in determining the effects of a collision and the ability of other planets in our solar system to support life. The research team needs to provide the President of the United States with information on the effects of the event and a plan so that the President can address the American public.

Credits

This case was written by Elizabeth Sheehan (PhD student, Psychology, Emory University, Atlanta, GA) and Antione L. Ford (teacher, Bethune Middle School, Decatur, GA) fellows of the Emory University PRISM program (<http://www.prism.emory.edu>). Authors may be contacted at elewis2@emory.edu

The NASA seal was adopted from <http://www.hq.nasa.gov/office/nsp/>

The Presidential seal was adopted from <http://www.ssa.gov>

The student evaluation sheet in the student materials is from:

DeLoney, D. Y. (2006). *Out of breath*. Retrieved October 03, 2006 from Emory University, CASES Online Web site: http://www.cse.emory.edu/cases/casedisplay.cfm?case_id=543

Learning Objectives

Upon completing the case students will be able to:

1. Differentiate between types of “Near-Earth objects”, including: comets, asteroids, and meteors.
2. Define mass extinction.
3. Describe past theories of mass extinction created by an object colliding with the Earth.
4. Identify other planets in the solar system and their characteristics.
5. Distinguish between inner and outer planets.
6. Prepare a 5 minute organized presentation on both “Near-Earth objects” and the solar system.
7. Create a travel guide of the solar system which include the planets and other objects.

Georgia Performance Standards

S6CSI. Students will explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works. (NSES Content Standard A)

S6CS9. Students will investigate the features of the process of scientific inquiry. (NSES Content Standard A)

S6E1. Students will explore current scientific views of the universe and how those views evolved. (NSES Content Standard D)

c. Compare and contrast the planets in terms of

- Size relative to the Earth
- Surface and atmospheric features
- Relative distance from the sun
- Ability to support life

f. Describe the characteristics of comets, asteroids, and meteors.

Assessment

At the end of scene 1, students turned in their box charts in addition to giving a 5 minute power-point presentation. Their presentation included the description of NEO's and the possibilities of mass extinction. They were graded on content, preparedness, clarity, and presentation style.

At the end of scene 2, students turned in a model of the solar system, including the sun, the planets, and the comet. Students also created a travel guide or brochure of the solar system that included the planets and other objects.

A rubric handed out to the students for grading is attached in the *Student Materials*.

Implementation Strategy

Students worked in small groups of 4 or 5 for this case. Two facilitators were present and roving the room as the students worked. Each scene of the case was read aloud as a class and then students broke into pre-assigned small groups to work on the box charts and research.

The following implementation strategy was used:

Day 1 (1 hour 50 minute class)	<ul style="list-style-type: none"> • Scene 1 introduced (10 minutes) • Box charts created (20 minutes) • LI assigned (5 minutes) • Independent research will begin (45 minutes)
Day 2 (1 hour 50 minute class)	<ul style="list-style-type: none"> • Independent research continued (45 minutes) • Report back on learning issues within the group (15 Minutes) • Prepare ppt. presentation (50 minutes)
Day 3 (50 minute class)	<ul style="list-style-type: none"> • Finish power-point presentations (50 minutes)
Day 4 (1 hour 50 minute class)	<ul style="list-style-type: none"> • Group Presentations (45 minutes) • Show Movie Clips from <i>Deep Impact</i> (10

	<i>minutes)</i> <ul style="list-style-type: none"> • Scene 2 will be introduced (10 minutes) • Box charts created and LI assigned (45 minutes) Independent research
Day 5 (1 hour 50 minute class)	<ul style="list-style-type: none"> • Independent research (45 minutes) • Create model of solar system and work on travel guides (60 minutes)
Day 6 (50 minute class)	<ul style="list-style-type: none"> • Work on model and travel guides (50 minutes)
Day 7 (1 hour 50 minutes)	<ul style="list-style-type: none"> • Finish models and travel guides • Present models and travel guides

Case Notes

What went well:

1. Students divided their learning issues and were excited about their research. Students also discovered other learning issues that were relevant that we didn't consider. Students even located other comets and asteroids that cross earth's orbit and come close to impact.
2. Students created some very good power-point presentations. There were great visuals, pictures, and examples within the power-point files. Most students were professionally dressed for the occasion as if they were really in a boardroom in the White House.
3. The media specialist created excellent websites for the students to conduct their research. They found excellent resources on near earth objects and mass extinction for the students. This included a website with animations that illustrates how close specific asteroids and comets come to impacting the earth. It showed all near earth objects and the dates in which they cross earth's orbit.

What Could Change:

1. When discussing the products of this case, it should be emphasized that these are professional presentations. This would cut down on a lot of the laughing and giggling and playing around during presentations. Professionalism should be included in the rubric in order for students to take these presentations more serious.
2. Presentations should not be robotic. During some of the presentations, students simply recited answers to the learning issues and read straight from the power-point. It should be emphasized that presentations should be a formal discussion of their research.
3. Enough time should be allotted for the students to do necessary research to complete the products of scene 2. Some groups didn't complete their travel brochure and research on the other planets ability to sustain life.

Facilitator Guide:

Facilitator Questions for Scene 1:

1. What are the different types of NEO's?
2. What is mass extinction?
3. Has a mass extinction occurred in the past?
4. How large would an NEO need to be to result in mass extinction?
5. What could be the effects of a NEO colliding with Earth? On land? On water?

Facilitator Questions for Scene 2:

1. What types of visual aids could you provide during the address?
2. Are there other planets that could support life? Which ones are they?
3. What modifications would be required for the planet to support life?
4. How are these planets similar to or different than Earth?

Scene 1: Here is a sample box chart. The items in **bold** text were provided for the students to get them started.

Facts	Hypotheses
<ul style="list-style-type: none"> • A NEO could impact the earth • This letter is from President Bush • President Bush didn't take Earth Science in school • We have to prepare a power point presentation for a committee • We have been chosen to do the research 	Empty space for hypotheses
Learning Issues	Questions

<ul style="list-style-type: none"> • What are NEO's? • What is NASA? • What are the possible results of an impact of a NEO on earth? 	
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Scene 2: Here is a sample box chart. The items in **bold** text were provided for the students to get them started.

Facts	Hypotheses
<ul style="list-style-type: none"> • The orbit of the comet 8P/Tuttle has changed • Yo Momma So contacted us immediately • This letter is from NASA • It is possible that it may result in mass extinction, totally annihilating all forms of life • There is a 90% chance that the Tuttle comet is now on a path to collide with the Earth on January 26, 2008 • The implications of the collision are unclear • The President needs to inform the American public of the crisis and a plan for relocation in two days 	
Learning Issues	

Questions

- What is mass extinction?
- Has mass extinction occurred before?
If so, when and what happened?
- What is the 8P/Tuttle comet?
- What is the orbit of comets?
- **How could the orbit of a comet change?**
- What is the international space station?
- **What planets can and cannot support life? Explain why they can or cannot support life.**

Resources

Exline, J. D., Pasachoff, J. M., Simons, B. B., Vogel, C. G., Wellnitz, T. R. (2001). *Science Explorer: Earth Science*. Needham: Prentice Hall.