Physics Lesson Plan: How far and fast does it travel?

Getaway Special Team 2010

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Lesson Plan – Physics

Unit Theme: Distance, Velocity, and Acceleration
Lesson Title: How far and fast does it travel?
Grade Level: 10th-12th

Subject Area: Science
Number of Learners: Entire class
Time Needed: 30-45 minutes

Curriculum
Standard I: Students will understand how to measure, calculate, and describe the motion of an object in terms of position, time, velocity, and acceleration.
Objective 1: Describe the motion of an object in terms of position, time, and velocity.
Objective 2: Analyze the motion of an object in terms of velocity, time, and acceleration.

Materials Needed
- Distance, velocity, and acceleration graphs (below)
- AIAA Journal GAS Paper
- Microgravity Boiling on 2001 Experiment
- Microgravity and Gravity Boiling of 2010 Experiment Videos
  - Microgravity Link: http://www.youtube.com/watch?v=b9PnK58m0tE
  - Gravity Link: http://www.youtube.com/watch?v=Z-N1j-8tR3s
- GAS Team Summer 2010 NASA Experience Video
  - Link: http://www.youtube.com/watch?v=7xQp8LWcqoE

Learning Objectives
Students will be able to correctly draw the distance, velocity, and acceleration graph of a departing bubble from the 2001 microgravity boiling experiment. They will better understand how research is performed.

Background Knowledge
Teachers must know how to explain distance, velocity, and acceleration properly and be able to correctly draw the graphs of each.

Instructional Procedure
Begin the lesson by asking the students if they think research is fun. Not many hands will go up and this is expected. Next ask them how they think research is performed. Explain to them that is can be fun and they students can research whatever they are interested in whether it is plants, animals, medicine, or boiling bubbles. Emphasize the opportunity of hands-on research in higher education settings. Next discuss with them the opportunity some USU students had to do research on their own. Then explain to them that basic physics concepts played a large part in the research.

Show the video of the 2001 microgravity boiling experiment. Then assign groups for the students to work in and hand out the graphs. Explain to them that you are going to have them fill in each graph for the bubble. In the video it is the video departing horizontally in the top right corner. Allow the video to loop while the students fill out the graphs. Monitor the students’ progress, keep them on task, and answer any questions that arise.
Bring the discussion back together and on the board draw the three graphs in the following order: distance, velocity, and acceleration. Ask or assign a student to come up and fill out the distance graph first and explain how they got their answer. Repeat for velocity and acceleration graphs. With the video still looping show the students how the distance graph was obtained and that it covered a lot of distance at first and then slowed down to a stop. Do the same with velocity and acceleration. Point out the negative acceleration graphs and ask the students why it was negative. Explain to them that it is because the bubble is slowing down and it has a negative velocity.

Next show the students the correct answer from the AIAA paper (page six). Then briefly run through the journal article and explain to the students that this paper was compiled by undergraduate research students. Emphasize that they can have the same opportunities if they would like.

Ask them why they think boiling in space would be useful. Bring out the usefulness of heat management systems and using it as a source of cooling. This potentially provides assistance for further space exploration. Explain to them that students at USU were wondering its usefulness and explain about the project. Show the students the boiling cube and pass it around. Next show them video footage of the 2010 experiment. Show them boiling in gravity first and ask them which way the bubbles are going. Then show them boiling in microgravity and ask them where those bubbles are going.

Boiling on Earth:
http://www.youtube.com/watch?v=Z-N1j-8tR3s

Boiling in Microgravity:
http://www.youtube.com/watch?v=h9PnK58m0tE

Finally show them the video of the NASA summer of 2010 experience video. Talk about the research performed, what we have learned, and what we continue to hope to learn.
http://www.youtube.com/watch?v=7xQp8LWcgoE

Wrap up with a few experiences from the trip and promote college and the opportunities you can have. Go Aggies! End with questions.

Assessment
The students drew the distance, velocity, and acceleration graphs correctly. They also used correctly terminology when they were explaining the principles. Students understand gravity’s impact by proper explanations when asked questions during the discussion.

Extensions
The students could create their own scale and actually calculate the distance, velocity, and acceleration rather than drawing a general graph.