“Teaching is an art, not a science.”

True?  False?
The main goals for the workshop are: Teachers will

• Use PhET simulations for class activities
• Use the guidelines for inquiry approach provided by the PhET team in the activities
• Share their activities on the PhET educators’ database
• Share their experiences during the workshop
• Try Clickers
PhET Workshop Series
2006-2007
At EHS

Who are we?
Handouts for Series

Guidelines
Moving Man worksheet showing alignment
Activity design
How We Learn
CCK worksheet with 2 types of lessons (assigned as homework)
Writing learning goals
Carl W.’s article “Minimize your Mistakes”
Masses and Springs worksheet with 2 types of lessons
Notecard for reflecting
Take home about research
Bloom’s revised
King before and after
Dubson article
Chem ed article
Scientific Abilities (just the ability to design page)
Chapter 6 summary from Mayer
1. How many years have you taught?

A. 0-3  B. 4-8  C. 8-15  D. 16 or more
2. How many years have you taught your subject?
A. 0-3  B. 4-8  C. 8-15  D. 16 or more
Getting $500

• Attend and collaborate at meetings
• Design lessons for your classes using the simulations & the research ideas
• Use the lessons
• Reflect on the experience
• Publish your lessons in the Educators’ database for PhET.
http://phet.colorado.edu

Funding

NSF

Hewlett Foundation

Kavli Foundation

University of Colorado

Alfred Nobel
Tonight’s Goals

• Explore some PhET simulations
• Think about how you could use them in class
• Explore the guidelines for inquiry approach provided by the PhET team
• Chose a simulation to use this next month
• Pick a partner for this month
3. My experience with the PhET simulations is
   A. I just heard about them from the flyer
   B. I have been to the web site and played with some of the simulations
   C. I have used one in my course
   D. I have used several in my course
Simulations - Research based

Motion
Work, Energy & Power
Sound & Waves
Heat & Thermo
Electricity, Magnets & Circuits
Light & Radiation
Quantum Phenomena
Chemistry
Math Tools
Cutting Edge Research

Energy

Heat & Thermo

Electricity

Math
Learning Goals

Initial Design

Interviews

Redesign

Research Base

Classroom Use

 β

Interviews

Final Design
Investigate the PhET website

On your note card:

1. Record how long it takes you to open a simulation
2. Record how many Quantum sims there are without talking to anyone else
4. How much control do you have over your curriculum?
A. I follow a school curriculum with few modifications
B. I am part of a team of teachers who agree on the curriculum
C. I write my curriculum using some district guidelines
D. I write my curriculum
Dinner break

Be ready to work again at 5:25
5. How would you describe your understanding of Inquiry Based Teaching (IBT)?

A. I have been to an in-service where IBT was covered for about an hour.

B. I have been to several in-services about IBT.

C. I have read several books or articles about the IBT.

D. I have been to several in-services and read several books/articles about the IBT.
6. How would you describe your experience with inquiry based teaching?
A. I have not used inquiry based lessons.
B. I try to have an inquiry based lesson once a year.
C. I use inquiry based lessons a couple of times a semester.
D. I use inquiry based lessons frequently.
Inquiry Guidelines

Research Based

✓ Specific learning goals
✓ Students reason and make sense
✓ Connect to students’ knowledge
✓ Connects to students’ real world experiences
✓ Collaborative activities
✓ Minimal directions
✓ Students self-check understanding
Comparing Activity Design

Make the man start at -5 meter mark, move with constant speed to the 2 meter mark and then accelerates to the 8 meter mark.

A. Sketch the position, velocity and acceleration graphs that you see.
B. How do the three graphs relate?

Sketch what you think the graphs will look like for this story that Jill told:

“Bobby was talking to me on his cell phone standing by his car. The phone signal was poor, so he walked toward his house trying to get a better signal and then stood still so we could talk.”

A. Explain why each part of your graph makes sense.
B. Test your ideas using the simulation
Writing an activity

• Find a partner that agrees to try the same sim this month.
• Decide which guidelines you want to meet
• Discuss if you are going to write individual activities or collaborate on one.
• Decide how you will communicate to reflect on how well the lesson meets the guidelines.
• Meet in large group at 6:20
7. If I want to have my students use computers

A. I have to expect them to do the work at home
B. I need to plan three weeks ahead to sign up for a computer lab
C. I can usually get the computer lab within a short time
D. I have computers in my classroom
8. If I need to have something loaded on the students’ computers like Flash or Java

A. I need to fill out a request form three weeks in advance
B. I ask the tech to do it and she does it within a week
C. I have to make time to load it myself
D. I give up because it is too much trouble at my school to have anything loaded.
What’s next?

• Sept 17 4:00-6:30
• Be prepared to share your experience using a simulation and the guidelines
• Bring lesson plan and student directions in separate digital documents
Welcome

1. Get name tag and clicker
2. Fill out and turn in: W-9 & Scope of Work forms
3. Explore the Teaching Ideas pages, make a login, and enter your activity
4. Record the number of Quantum sims
5. Play with sims
The main goals for the workshop are: teachers will use

1. PhET simulations for class activities
2. The guidelines for inquiry approach provided by the PhET team in the activities
3. Concept questions to check for learning after the activity
4. Share their activities on the PhET educators’ database
5. Share their experiences during the workshop
6. Try clickers
9. The best way to describe my use of the activity I worked on is:
A. I won’t be able to use it this year
B. I haven’t used it yet, but I will in the near future
C. I used it with one class
D. I used it with more than one class
10. I thought that the simulation was ______ USEFUL for helping my students meet their learning goals

A. very
B. somewhat
C. barely
D. not at all
E. I didn’t use a simulation
11. I thought that the simulation was _______ ENJOYABLE for helping my students meet their learning goals
   A. very
   B. somewhat
   C. barely
   D. not at all
   E. I didn’t use a simulation
12. Next year,

A. I will use the activity with little revision
B. I won’t use this activity again, but I’ll use the sim in a different activity
C. I won’t use this activity again, and I won’t use the sim again
D. I will use the activity with significant revision
13. This activity fit into my unit plan

A. As part of the introduction to a new topic
B. After a lab or homework lesson to reinforce a concept
C. To introduce and develop a concept fully
D. To review before an evaluation
E. As part of the test
14. The students participated in the activity
A. With equipment as part of a lab
B. Instead of using equipment
C. In a group discussion where the simulation was only demonstrated
D. I didn’t use a sim
Reflection on use of sim

Talk about your activity

• Which guidelines did you apply?
• How you used the sim
• How using the simulation affected student learning
Work on Circuit Construction Kit guideline handout in pairs
Dinner break
Be back to room at 5:20
Learning goal writing

The learning goals need to:

• Be specific
• Use action verbs that can be measured
• Challenge the students to learn something from the sim
Writing an activity

• Find a partner that agrees to work on same guidelines or similar
• Discuss if you are going to write individual activities or collaborate on one.
• Use design sheet
• Meet in large group at 6:25
Homework

• Post activity to the PhET Teaching Ideas
• Write a new activity
• Oct 15 4:00-6:30 Be prepared to share your experience using a simulation and the guidelines
Warm-up

• The Physics teacher article
CCK homework discussion

- Share answers
- Reviewing note card:
  
  How does this activity rate?
PhET Workshop 3

- Reflect on writing activities
- Explore some PhET simulations: Forces 1D and Masses & Springs
- Chose a simulation to use this next month
- Work on designing an activity
Reflection on use of sim

Talk about your activity
• Which guidelines did you apply?
• How you used the sim
• How using the simulation affected student learning
Features of simulations

Forces 1D
- Sliders, dragging and typing for values
- Playback features
- Variety of graphs: minimize, zoom, select what to view
- Advanced features

Masses and Springs
- Less complex
- Slider controls with no units
- Game-like: determine the unknowns; find PE reference line
How does the simulation design effect your lesson?
Writing another activity

• Pick a partner who wants to use the same sim
• Chose the guidelines that you are going to focus on
• Work until 6:20
Getting $500

• Attend and collaborate at meetings
• Design lessons for your classes using the simulations & the research ideas
• Use the lessons
• Reflect on the experience
• Publish your lessons in the Educators’ database for PhET
PhET Workshop 4

Share activities
Digital Science Library presentation
Reflect on lessons using the guidelines
Explore some PhET simulations
Chose a simulation and guidelines to work on tonight
Warm-up

Discuss in small groups the Masses and Springs homework
Share use of sim

Talk about your activity
• Which guidelines did you apply?
• How you used the sim
• How using the simulation affected student learning
National Digital Science Library

- nsdl.org/
- **NSDL** is the Nation's online library for education and research in Science, Technology, Engineering, Mathematics.
- NSDL was established by the National Science Foundation (NSF) in 2000 as an online library which directs users to exemplary resources for science, technology, engineering, and mathematics (STEM) education and research.
Reflect on Activity

- Exchange lessons
- Make suggestions in writing in regards to align the lesson
- Discuss ideas
Homework

Continue to work on lessons
Enter your lessons in the database!!
Robert Payo
Education & Outreach Specialist
National Science Digital Library
According to the 2006 Speak Up Survey:
Where do students learn about new technologies?

a) From their teachers
b) From their parents
c) From their peers
d) On their own

http://www.tomorrow.org/speakup/
The 2006 Project Tomorrow Speak Up Survey polled students on their interest in science. At what grade level did student interest begin to drop off?

a) 3rd grade  
b) 6th grade  
c) 9th grade  
d) 12th grade

http://www.tomorrow.org/speakup/
What is the biggest barrier keeping you from using technology in your teaching?
Digital libraries can help!
Welcome to comPADRE!

The comPADRE Pathway, a part of the National Science Digital Library, is a growing network of educational resource collections supporting teachers and students in Physics and Astronomy. As a user, you may explore collections designed to meet your specific needs and help build the network by recommending resources, commenting on resources, and starting or joining discussions. To recommend a web resource, log into the Physical Sciences Resource Center and select the Submit Resources link.

You may use the user selector above to go to collections of physics materials targeted at you, whether you are a K-12 teacher, college faculty member, student, education researcher, or someone generally interested in Physics and Astronomy.

Or if you would like to learn more about ComPADRE, its events, collections, and partnerships, please choose an option below.

- Collections
- Partnerships
- Workshops and Conferences
  - Calendar
  - Hosted Events
- Community News
- Staff
- Technology
- Become a Collaborator
- Contact Us

Partnerships

ComPADRE is working with multiple groups interested in facilitating physics educators. New partnerships with the Astrophysics Data System and the Science Education Resource Center are designed to provide educational context to ComPADRE linked materials.

- Adopt-a-Physicist
- APS Education Service
- MERLOT
- NSDL
- Physlets/Open Source Physics
Welcome to the Physics Front!

The Physics Front provides high quality resources for the teaching of physics and physical sciences courses.

You may search or browse the Physics Front in order to find materials appropriate for your physics classes. Additionally, registering will allow you to share your experiences using materials.

The Physics Front is a free service provided by the American Association of Physics Teachers in partnership with the NSF/NSDL.

In 1918, Dr. Lise Meitner, together with Otto Hahn, discovered the radioactive element protactinium (element 91). In December 1933, Lise provided the physical explanation of results obtained by Otto Hahn and Fritz Strassmann in their chemical experiments. Her contributions helped lead to the discovery of nuclear fission and to our understanding of the fundamental structures of nature.

Featured Resources

High School Self Assessments
Dynamics: Forces and Motion

This topic is broken into units to help in formulating cohesive, effective lessons. Clicking on each unit title below will display appropriate activities, lesson plans, or labs.

Unit materials are a subset of all possible materials available for this topic, selected especially with the new physics teacher in mind. You may instead browse all materials for this topic here.

Physics First Dynamics: Forces and Motion Units

A branch of mechanics that deals with forces and their relation primarily to motion but also sometimes to the equilibrium of bodies. Units are not listed in a prescribed order.

- Newton's First Law & Inertia (3)
- Newton's Second Law & Net Force (6)
- Newton's Third Law (1)
- Applications of Newton's Laws (6)
- The Universal Law of Gravitation (2)
- Frictional Forces (4)
- Force Diagrams (3)
- Rotational Motion (6)
- Special Collections (1)
Dynamics: Forces and Motion

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Physics First Dynamics: Forces and Motion Units

A branch of mechanics that deals with forces and their relation primarily to motion but also sometimes to the equilibrium of bodies. Units are not listed in a prescribed order.

- **Newton’s First Law & Inertia (3)**

  Lesson Plans:

  - **How to find out coefficients of friction through an inclined plane**
    
    This inquiry-based lesson plan shows beginning students how to collect experimental data and calculate corresponding coefficients of friction. ([Open Website](#))

  Activities:

  - **PhET: Masses & Springs**
    
    This fun and realistic simulation helps students gain an understanding of force and motion, springs, and friction. Students manipulate spring constant, mass, and damping. ([Open Website](#))

  - **Inertia Games**
    
    This collection of applets explores the physics of force and momentum through simulations of a spaceship moving through space. By rotating the spaceship and firing the engines, the user can navigate the ship around simple obstacles. ([Open Website](#))

- **Newton’s Second Law & Net Force (6)**

- **Newton’s Third Law (1)**
How to find out coefficients of friction through an inclined plane

written by Youning Wang

This website provides teachers with activities allowing students to understand how to determine a coefficient of friction via an inclined plane. The page also includes a brief background and information on how the activity should be used to promote teamwork.

http://www.scienceteacherprogram.org/physics/wang03.html

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Levels</th>
<th>Resource Types</th>
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</thead>
<tbody>
<tr>
<td>Classical Mechanics</td>
<td>- High School</td>
<td>- Activity</td>
</tr>
<tr>
<td>- Applications of Newton’s</td>
<td>- Middle School</td>
<td>- Laboratory</td>
</tr>
<tr>
<td>Laws</td>
<td>- Lower Undergraduate</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Appropriate Courses</th>
<th>Categories</th>
<th>Intended Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Physics First</td>
<td>- Lesson Plan</td>
<td>- New teachers</td>
</tr>
<tr>
<td>- Conceptual Physics</td>
<td>- Laboratory</td>
<td>- Teachers</td>
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<tr>
<td>- Algebra-based Physics</td>
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<td></td>
</tr>
<tr>
<td>- AP Physics</td>
<td></td>
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</tbody>
</table>

| Intended User: Teacher    |
| Cost: Does not have an associated cost. |
| Restriction: Copyright 2003: Copyright, Youning Wang |
| Format: text/html |
| Record Creator: Metadata instance created Jul 29, 2004 by Stephanie Tchatchoua |
| Last Record Update: Feb 01, 2005 by Bruce Mason |
Summer Research Program for Science Teachers

How to find out coefficients of friction through an inclined plane
A Practical Method To Measure Coefficients For Frictional Force

Youning Wang
Murry Bergtraum HS, Manhattan
August 2003

Subject: Physics.
Time Allocation: Thirty-five minutes.

Performance Objectives
Applying the skills of teamwork, students work cooperatively to find out coefficients of friction for surfaces of metal on wood and metal on metal. After completing this class activity, students should be able to:
1. understand that a coefficient of friction could be determined via an inclined plane;
2. collect experimental data and calculate the corresponding results of coefficient;
3. compare the values of coefficient generated from different pairs of surfaces.

Components for Cooperative Learning
1. Team size: four students.
2. Assignment to team: If there are thirty-two students in the class, teacher will assign a number to each student starting from 1 to 8. Next, all the "one"'s will make up a team, all the "two"'s will make up another team, all the "three"'s will make up the third team, and so forth. Teacher will also ensure that the students are equally distributed among the teams depending on their talents.
3. Roles in each team:
   Messenger ---- reading the class instructions to direct this activity;
   Handler ---- to pick up and return all class activity materials for his/ her team;
   Operator ---- following the given procedure to carry out the experimental trials;
   Recorder ---- to record the observation results and to calculate the related data.
4. Positive interdependence: This class activity should be done cooperatively. Thus, every team member must be assigned a role to make a positive contribution for the completion of the class activity. Each team should fill in the data sheet for the results of this activity; its team members should agree with the team observations and should be able to explain the results.
5. Individual accountability: While doing this activity, each team member is expected to write down the common observations for the experiment. Furthermore, every student must be able to explain the purpose of the class activity. Teacher may call individuals to come to the board and to present their results.
6. Expected behaviors and monitoring: Teacher will expect to see all team members
Welcome!
Did you know that we have added 100 new resources and 10 new lesson plans to our Life and Physical Sciences collections? They are fully integrated into the Teachers' Domain Library, but you can see them all in one place by clicking here. And make sure to go to My Profile to sign up to receive alerts about new features, content, and free stuff through our monthly newsletter.

Teachers’ Domain is now linked to shop.wgbh.org. Look for the ‘Media Available for Purchase’ link on select resource pages. Every purchase supports more great programs like NOVA, Evolution, and American Experience. For a limited time (through 11/30/11), Teachers’ Domain users get back-to-school savings of 15% off any order on shop.wgbh.org by entering the code DOWNSPO during checkout.

Resource Highlight

In this video from Curious George, children build boats out of everyday materials and then predict and observe whether the boats sink or float.

http://www.teachersdomain.org
Subject: Engineering

Explore the wide world of engineering with innovative multimedia resources from NOVA, Building Big, ZOOM, NASA, and more. From the air bag and hydrogen car to radio waves and DNA, you will find new ways to illustrate engineering concepts and inspire your students.

For more engineering ideas and classroom activities, check out Design Squad, a new reality show that takes eight teenagers into fun, competitive engineering challenges.

Resource Highlight

Firth of Forth Cantilever Bridge
Type: QuickTime Video

This video segment from Building Big: "Bridges" demonstrates the basic design of a cantilever bridge by looking at Scotland's Firth of Forth Railway Bridge.

Permitted use: Download and Share

Engineering Design

- Applying the Design Process (81 resources)
- History and Impact of Technology (49)
- Innovation and Invention (25)
- The Design Process (22)
- What Is Engineering? (8)

See all resources and lesson plans

Materials and Tools

- Materials (33 resources)
- Tools (16)

See all resources and lesson plans

Systems and Technologies

- Biotechnologies (24 resources)
- Communication and Information Technologies (12)
- Construction Technologies (50)
- Energy and Power Technologies (25)
- Manufacturing Technologies (4)
- Transportation Technologies (23)

See all resources and lesson plans
### Subtopic: Innovation and Invention

25 out of 25 resources are within your selected grade band.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Grade Level</th>
<th>Media Type</th>
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</thead>
<tbody>
<tr>
<td><strong>Air Bag Design</strong></td>
<td>3-12</td>
<td>QuickTime Video</td>
</tr>
<tr>
<td>Using automobile crash test footage, this video segment adapted from NOVA shows some of the challenges in designing the air bag.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Air Power: Making a Hovercraft</strong></td>
<td>K-8</td>
<td>QuickTime Video</td>
</tr>
<tr>
<td>In this video segment adapted from ZOOM, cast members make their own hovercraft and demonstrate how the air leaking out of a balloon can make a plastic plate hover above a table.</td>
<td></td>
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</tr>
<tr>
<td><strong>Ask an Engineer</strong></td>
<td>3-12</td>
<td>QuickTime Video</td>
</tr>
<tr>
<td>Explore some of the wonders of modern engineering in this video from the Sciencenter in Ithaca, New York. Hear a diverse selection of engineers explain how things work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Design Inspired by Nature</strong></td>
<td>3-12</td>
<td>Flash Image</td>
</tr>
<tr>
<td>In this stills collage produced for Teachers Domain, see several examples of everyday inventions that were either inspired by nature or are similar in form and function to plants or animals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Engineering Career Options</strong></td>
<td>3-12</td>
<td>Flash Image</td>
</tr>
<tr>
<td>It's a profession that can take you from the depths of the ocean to the far reaches of outer space, from within the microscopic structures of the human cell to the top of the tallest skyscrapers. In this stills collage adapted from The American Society for Engineering Education, learn about some of the most popular engineering fields.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Forgotten Inventors</strong></td>
<td>3-12</td>
<td>HTML Interactive</td>
</tr>
<tr>
<td>This illustrated feature from the American Experience Web site highlights the frequently forgotten inventors of several useful, innovative technologies.</td>
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</tr>
<tr>
<td><strong>Global Warming: The Hydrogen Car</strong></td>
<td>3-12</td>
<td>QuickTime Video</td>
</tr>
<tr>
<td>Is the hydrogen car the answer to global warming? This video segment adapted from NOVA/Frontline looks at the pros and cons of this developing technology.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hoover Dam and Hydroelectric Power</strong></td>
<td>3-12</td>
<td>QuickTime Video</td>
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</tbody>
</table>
Resource: To Survive at High Velocity

Racecar teams look to reduce the time it takes their cars to complete a circuit. They focus most of their efforts on improving what's called cornering speed, because it's in the corners where cars must reduce speed, that precious time is lost. Using a mix of practice lap and actual race footage, this video segment, adapted from NOVA, highlights the forces at work on a racecar as it travels around a track.

Background Essay

Speed is the rate at which something moves. Fast-moving objects have high speeds, slow-moving ones have low speeds, and objects with no movement have zero speed. Velocity, on the other hand, is speed in a particular direction. Velocity is what's called a vector quantity, which is any quantity -- velocity, force, acceleration, torque -- that has both magnitude and direction. Racecar teams are most interested in improving average speed around a track. Because all cars can move quickly along the straight sections of a track, racecar designers modify a car so that it performs best especially when cornering.

Designers take into account the forces that act upon the car as it moves around the track. Downforce keeps a car stuck to the road by increasing friction and stability, while drag is the air resistance that slows a car. Maximizing downforce and minimizing drag are the primary

Topics Covered:

- Motions and Forces
- Engineering Design

Professional Development Courses

Using This Resource:

- Teaching Elementary Physical Science
- Teaching High School Physical Science
- Building Understanding

Source: NOVA: "Fast Cars"
Racecar teams look to reduce the time it takes their cars to complete a circuit. They focus most of their efforts on improving what’s called cornering speed, because it’s in the corners, where cars must reduce speed, that precious time is lost. Using a mix of practice lap and actual race footage, this video segment, adapted from NOVA, highlights the forces at work on a racecar as it travels around a track.

Topics Covered:
- Motions and Forces
- Engineering Design

Professional Development Courses
Using This Resource:
- Teaching Elementary Physical Science
- Teaching High School Physical Science
- Building Understanding

Source: NOVA: “Fast Cars”

Produced for Teachers’ Domain by:

Collection Developed for Teachers’ Domain by:

Collection Funded by:

National Science Education Standards (NRC, 1995)

US.NSES.5-8.sci.A
CONTENT STANDARD A:

MOTIONS AND FORCES
US.NSES.5-8.sci.B.2
- The motion of an object can be described by its position, direction of motion, and speed. That motion can be measured and represented on a graph. [See Content Standard D (grades 5-8)]
- An object that is not being subjected to a force will continue to move at a constant speed and in a straight line.

US.NSES.5-8.sci.B.1
CONTENT STANDARD B: Physical Science

US.NSES.5-8.sci.B.2
- MOTIONS AND FORCES
US.NSES.5-8.sci.B.2.a
- MOTIONS AND FORCES
US.NSES.5-8.sci.B.2.b

US.NSES.5-8.sci.A
- ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY
US.NSES.5-8.sci.A.1
- UNDERSTANDINGS ABOUT SCIENTIFIC INQUIRY
US.NSES.5-8.sci.A.2
- UNDERSTANDINGS ABOUT SCIENTIFIC INQUIRY

The National Science Digital Library

http://nsdl.org
The Book of Phyz: Momentum
This item is a chapter from "The Book of Phyz," an educator's guide to teaching introductory high school physics. It features easily understood content support in the fundamentals of momentum, the rel...
Keywords: Physics, Science, Classical Mechanics, Linear Momentum, conservation of momentum, momentum
Format: PDF, Text/html
http://homepage.mac.com/phyzman/phyz/BOP/1-05COM/
View all related information

A Java Game Using Linear Momentum
Game Using Linear.. => Learning Resource: A Java Game Using Linear Momentum Comments (0) Reviews (0) Save to Workspace Title: A Java Game Using Linear Momentum Download URL: http://a java gain...
Keywords: momentum
Format: Text/html
http://www.engineeringpathway.com/view.html?id=E91CD6C...
View all related information

Conservation of Energy and Momentum
NASAscience 9-12 Lesson: Conservation Of Energy And Momentum (Teacher Sheets) Conservation Of Energy And Momentum Teacher Sheet(s) Objective: To predict the relationship between energy and velocity....
Keywords: Physics, Science, Classical Mechanics, Linear Momentum, Work Energy, conservation of energy, conservation of momentum, energy, momentum
Format: Text/html
http://nasaexplorers.com/show_912_teacher_st.php?id=0391...
View all related information

Collisions and Momentum Conservation Lab
The purpose of this lab is to investigate the conservation of linear momentum and energy in one dimensional collisions.
Keywords: Physics/Mechanics/Energy Momentum
Format: Text/html
NSDL Pathways

ChemEdDLib: Chemistry
High School to Graduate
Led by the American Chemical Society (ACS) and the Journal of Chemical Education (JCE) (http://chemed.chem.wisc.edu)

ComPADRE: Physics & Astronomy
High School to Graduate
Led by the American Association of Physics Teachers
http://compadre.org

Math Gateway: Mathematics
Undergraduate
Led by the Mathematical Association of America
http://mathgateway.maa.org

BiosciEdNet (BEN): Biological Science
High School to Graduate
Led by the American Association for the Advancement of Science
http://www.biosciencednet.org

CSERD: Computational Science
K-12 to Graduate
Led by the Shodor Education Foundation, Inc.
http://www.shodor.org/refdesk

AMSER: Applied Math & Science
Community Colleges
Led by Internet Scout Project, University of Wisconsin
http://amser.org

NSDPortal: Science & Math
Middle School
Led by the Digital Library Projects at Ohio State University
http://msteacher.org

Teachers' Domain: Life, Earth, Space, & Physical Science
K-12
Led by WGBH
http://teachersdomain.org

MatDL: Materials Science
Undergraduate to Graduate
Led by Kent State University
http://matdl.org

NSDL Engineering Pathway
K-12 to Graduate
Led by UC Berkeley, University of Colorado
http://engineeringpathway.org/ep

NSDL welcomes the Science and Math Informal Learning Educators (SME) Pathway (Fall 2007), led by the University of California at Berkeley’s Lawrence Hall of Science in partnership with the Exploratorium, the New York Hall of Science, Science Museum of Minnesota, Children’s Museum of Houston, and the Association of Science and Technology Centers (ASTC).
emergent properties

heat energy

In solids, the atoms or molecules are closely locked in position and can only vibrate. In liquids, they have higher energy, are more loosely connected, and can slide past one another; some molecules may get enough energy to escape into a gas. In gases, the atoms or molecules have still more energy and are free of one another except during occasional collisions.

Grade range: 6-8

9-12

An enormous variety of biological, chemical, and physical phenomena can be explained by changes in the arrangement and motion of atoms and molecules.

A system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts.

6-8

Atoms and molecules are perpetually in motion. Increased temperature means greater average energy of motion. Most substances expand when heated.

Most substances exist as a solid, liquid, or gas depend on temperature.

The Electromagnetic Spectrum: Waves of Energy


In this lesson, students will (1) understand that the sun energy is transferred to Earth by electromagnetic waves, which are transverse waves, (2) understand that there are eight main types of electromagnetic waves, classified on the electromagnetic spectrum according to their wavelengths, and (3) understand how each of the types of electromagnetic radiation is used or found in our everyday lives.

Energy of Motion


The Energy of Motion unit begins with mechanical energy and its two simplest forms: kinetic and potential energy. Next, the concept that energy can change forms is introduced, with examples of kinetic and potential energy interrelationships. Using the example of a waterwheel, the concepts of work and power are examined. Conservation of momentum and collisions are explored, with analogies to popular...
NSDL Web Seminar Series
Which is not related to a hotspot? Stamp your answer

Iceland

Yellowstone

Hawaii

Mt. St. Helens
Tuesday, November 13th:

Studying Genomes: From the Lab to the Classroom

Dr. Rob DeSalle,
Author and Curator in the Sackler Institute for Comparative Genomics,
American Museum of Natural History

http://nsdl.org
Robert Payo
NSDL Education & Outreach Specialist
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THANK YOU!
February Workshop 07-08
Before/After lessons

1. Which is which?
2. How did Karen change her lesson to improve alignment with guidelines?
Workshops Recap

Explore PhET simulations
Discuss science ed research
Discuss and share PhET uses
Reflect on lessons using guidelines
POST LESSONS
Variety of Uses

- Labs
- Lecture
- Homework
- Extension opportunities
- Application test questions
Simulation Extends Lab Concepts

- **Qualitative lab**: Use the motion probe to graph position and velocity of some motion, also make motions to fit given graphs.

- **Quantitative lab**: Use Moving man to accurately interpret and draw position, velocity and acceleration graphs for common situations and explain reasoning.
Simulation Extends Lab Concepts

Vernier Labpro

Moving Man
Enables Inquiry Labs

Energy Skate Park

• Multiple variables, but easily isolated
• Easy to repeat experiments
• Variables beyond classroom
• Multiple representations
• Relates to students experiences
Concept tests

The pie graph shows the energy of the Skater, where could she be on the track?

A

B

C

D

E

PE

KE

A

B

C

D

E

House

Mountains
Demonstration in Slow Motion
Demo Scientific Model

Electrostatics – Traditional balloon demos
- Charge transfer, Coulomb attraction, Polarization

Simple, but effective
Replace Expensive Equipment

Challenge: Use the simulation to see how the design of a lens effects how it works.
Writing and Reflection Handouts

Guidelines
Activity design
How We Learn
Writing learning goals
Reflecting note card
Bloom’s Revised

How could this information be used?
Share use of sim

Talk about your activity

• Which guidelines did you apply?
• How you used the sim
• How using the simulation affected student learning
Reflect on Activity

• Exchange lessons
• Make suggestions in writing in regards to align the lesson
• Discuss ideas
Homework

Continue to work on lessons
Enter your lessons in the database!!
March Workshop

• Read Dubson Article
• How do his ideas fit with our goals to have inquiry based lessons?
Organize handouts

• Research
• Tools for Writing
• Examples of writing
Writing and Reflection Handouts

Guidelines
Activity design
How We Learn
Writing learning goals
Reflecting note card
Database Reflection

- Entering lessons
- Editing lessons
- Browsing
- Downloading
Share use of sim

Talk about your activity

• Which guidelines did you apply?
• How you used the sim
• How using the simulation affected student learning
Reflect on Activity

• Exchange lessons
• Make suggestions in writing in regards to align the lesson
• Discuss ideas
Dinner
Workshops Recap

Explore PhET simulations
Discuss science ed research
Discuss and share PhET uses
Reflect on lessons using guidelines
POST LESSONS
Homework

Read Chem Ed article
Continue to work on lessons
Enter your lessons in the database!!
Warmup

1. Discuss Chem Ed article
2. Enter “comments” into Teaching idea Database
April Workshop topics

• Scientific Thinking and skills
• Add Database comments
• Share activities for reflection
Koch’s presentation

- Linda surveyed students about their understanding of thermodynamics and the gas laws
- Gas laws can interfere with understanding Laws of Thermodynamics
- Girls seem to want to make sense more and boys look for an equation
Example - of what revealed by interview studies.

Radio waves. Initial startup.

Experts - really like.

Students -- Watch without interacting. Don’t like. Misinterpret.
Start with curve view, manually move electron. Very different result. Later move to full field view, manipulate, like, and understand. Correctly interpret.
Why starting this way works so much better?

Matches research on learning.
• Cognitive demand. *Novices don’t know what to focus on.* Treat everything equally important. Much more than short-term working memory can handle, overwhelming

• Construction of understanding.

Other important features:
Visual model—electrons in transmitting and receiving antennas, display of waves

Interactivity
Scientific Abilities-Etkina

- [http://paer.rutgers.edu/scientificabilities/](http://paer.rutgers.edu/scientificabilities/)
- the ability to represent information in multiple ways
- the ability to use scientific equipment to conduct experimental investigations and to gather pertinent data to investigate phenomena, to test hypotheses, or to solve practical problems
- the ability to collect and represent data in order to find patterns, and to ask questions
- the ability to devise multiple explanations for the patterns and to modify them in light of new data
- the ability to evaluate the design and the results of an experiment or a solution to a problem
Homework

- Use sims and post (fix any that are not complete from March)
- Add comments to some activities
- Prepare a 5-8 minute presentation on one of your activities or anything about using the sims that you would like to share. Bring a handout or slide show
- Complete evaluation