

Methods for Organizing an Informal Science Learning Collection

Sherry Hsi & Holly Fait
Center for Learning & Teaching
The Exploratorium

- **NSF National Science Digital Library**
- **2003-2005, Collections Track**
- **PIs, Sherry Hsi & Robert Semper**
- **Collaborators: Prof. Alice Agogino**
SMETE.org
- **Building upon IMLS Museums Online:
EDAM – Exploratorium Digital Assets
Management project**

Multiple approaches

Survey existing
metadata
standards

Review K12
and science
digital libraries

Survey existing
taxonomies in
science textbooks

Literature
review

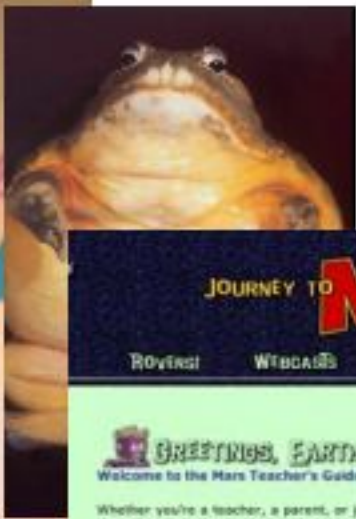
Review & select
Exploratorium
digital resources

Teacher DL
study



Metadata fields

Review resources

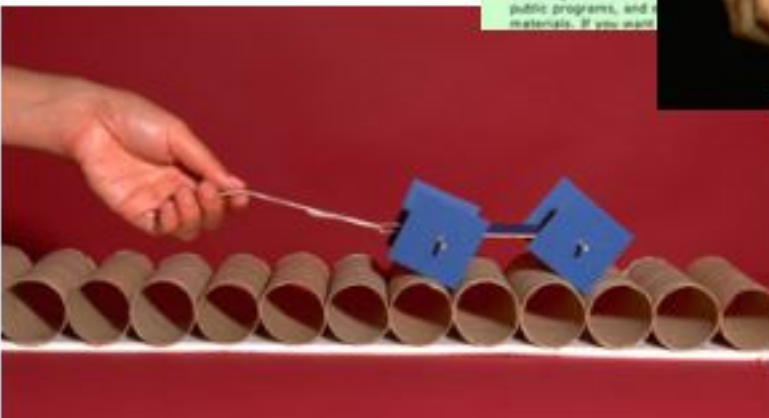


JOURNEY TO MARS
ROVERS | WEBCASTS | TEACHERS | LINKS

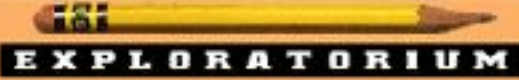
GREETINGS, EARTHINGS!
Welcome to the Mars Teacher's Guide!

Whether you're a teacher, a parent, or just a curious enthusiast, the collections of activities on these pages will help you delve into an exploration of Mars. We've collected sets of resources grouped around three topics: the search for life on Mars, the Martian environment, and the Mars Rover itself. You'll find student body, and guide materials address.

Each page has a central home or in a classroom page has links to other explorations, Webcasts traveling distance of public programs, and materials. If you want



- Field trip pathways
- Hands-on “Snacks”
- Inquiry-based Professional Development Materials
- Digital images of art, science, perception
- Iron Science Teacher webcasts
- Cow-eye dissections
- Science articles
- Online exhibitions

SNACKS  **SNACKS**

Blue Sky

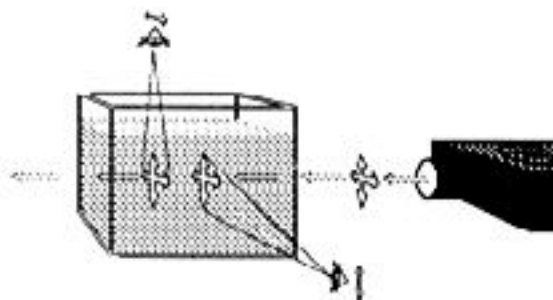
Now you can explain why the sky is blue and the sunset is red

- **Materials**
- **Assembly**
- **To do and notice**
- **What's going on?**



The sun produces white light, which is made up of light of all colors: red, orange, yellow, green, blue, indigo, violet. Light is a wave, and each of these colors corresponds to a different frequency, and therefore wavelength, of light. The colors in the rainbow spectrum are arranged according to their frequency: violet, indigo, and blue light have a higher frequency than red, orange, and yellow light.

When the white light from the sun shines through the earth's atmosphere, it collides with gas molecules. These molecules scatter the light. The shorter the wavelength of light, the more it is scattered by the atmosphere. Because it has a shorter wavelength, blue light is scattered ten times more than red light.





THUMBNAIL:

RESOURCE TITLE: Soap Film Painting Exhibit jpg.

RECORD NAME/URL: 1187-058.jpg

SHORT DESCRIPTION: Soap Film Painting Exhibit showing rainbow colors

FULL (ASSET) DESCRIPTION: A rod lifts from a trough filled with bubble blow carrying a thin film of liquid up with it. The colors on the membrane shift with time

TEACHER DESCRIPTION: A soap film is a soapy water sandwich, with two outside layers of soap molecules forming boundaries around a layer of soapy water. When light waves strike the front surface of the bubble film, about 40% of the light is reflected. The remainder of the light is transmitted to the back surface of the film, where more of the light is reflected back to your eyes. The light waves from the two surfaces combine and interfere both constructively and destructively. The soap film pulled between two supports gradually drains down. As it does so the thickness of the membrane changes and the colors of the membrane change in a regular pattern.

TEACHING TIPS: Compare the color pattern of this vertical soap film with the pattern of bubble spheres and hemispheres. Note the improved quality of color appearance against a dark background.

GRADE LEVELS: elementary, middle, high, post-secondary

EDUCATIONAL RESOURCE TYPE: image, museum exhibit

CA STANDARD NUMBERS:

1.4.a,1.4.b,1.4.c,1.4.e,2.1.a,2.1.b,2.1.c,2.4.a,2.4.c,2.4.d,2.4.g,3.2.c,3.2.d,3.5.e
4.6.a,4.6.c,4.6.d,4.6.f,5.6.b,5.6.c,5.6.d,5.6.e,5.6.g,5.6.h,6.7.a,6.7.c,6.7.d,6.7.e,7.6.c,7.6.e,7/6/f,7
/6/g,7.7.c,7.7.d,8.4.a,8.6.c,8.8.c,8.8.d,8.9.a,8.9.b,8.9.c,PH.4.c,PH.4.e,PH.4.f,

TEACHING TOPICS: Bubble blow, bubble liquid, soap, detergent, glycerin, bubble brew, soap solutions, soap chemistry, bubble chemistry, water chemistry, macromolecules, hydrophobic molecules, hydrophilic molecules, micelle, minimal distance, surface tension, bubbles in nature, bubble configurations, bubble cluster, bubble foam, bubble colors, wave length, light interference, front surface reflection, back surface reflection, wave cancellation, soap film thickness, bubble print, bubble prism, bubble rainbow, bubble age, liquid rainbows, bubble pressure, breaking bubble, bursting bubble, speed of bubble bursting

CURRICULAR AREA: Physical Sciences: Light & Optics

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Metadata in Cumulus

Cumulus File Edit View Category Collection Asset Window Help Special

26 of 2184 Categories | 6 of 10002 Records | Unsorted | Educator View

All	Categories	Keywords	Sources
<ul style="list-style-type: none"> edam <ul style="list-style-type: none"> 3Categories 3Keywords 3Sources By Asset Resource Type By Audience By Collection By Conceptual Area By Event/Exhibition By Exhibit Name By Phenomena By Place By Program By Subject By Year Master Created Clusters Curricular Area <ul style="list-style-type: none"> Curricular Area-Earth & Space Science <ul style="list-style-type: none"> Curricular Area-Earth & Space Science-Stars & Galaxies Curricular Area-Physical Sciences <ul style="list-style-type: none"> Curricular Area-Physical Sciences-Electricity & Magnetism Curricular Area-Physical Sciences-Interactions of Matter Curricular Area-Physical Sciences-Light & Optics Curricular Area-Physical Sciences-Measurement Curricular Area-Physical Sciences-Vibration & Waves In progress 			

soap_bubbles-cbk.pdf	3587-029.jpg	bubbles_hoops.mov
Soap Bubbles Cookbook R...	Exploratorium in a Bubble	Bubl...
soap_bubbles.jpg	mag_bub-200max.pdf	bubl...
Soap Bubbles Line Drawing	Bubble Magazine	Idea...

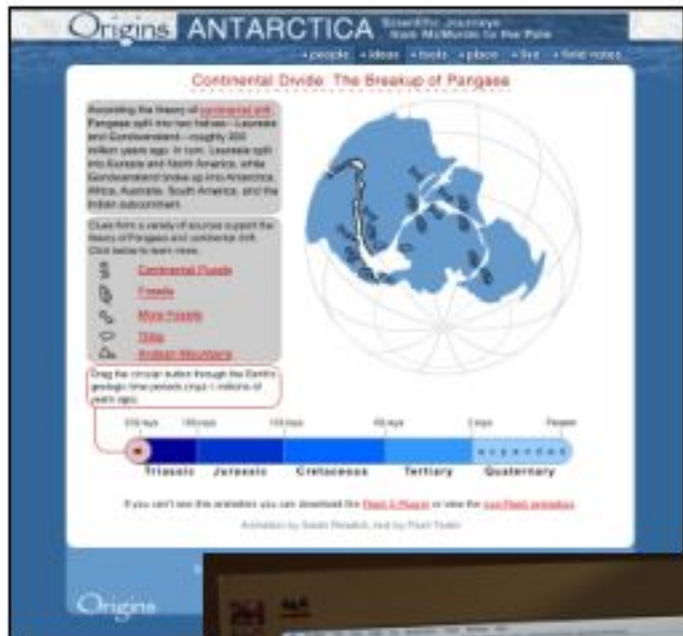
Information for Asset "mag_bub-200max.pdf" of "edam"

Field Name	Field Content			
Record Name	mag_bsb-200max.pdf			
Thumbnail				
Resource Title	Bubble Magazine			
Uniform Exhibit Name				
Asset Reference	<table border="1"> <tr> <td>Mac OS</td> <td>Unix</td> <td>Windows</td> </tr> </table> 192.174.2.2/assets/ITd/0001/magazines/mag_bub-200max.pdf	Mac OS	Unix	Windows
Mac OS	Unix	Windows		
Short Description				
Full Description	An illustrated summary of the physics, chemistry and math of bubbles. Meet the people who study and make bubbles of every shape, size and material.			
Teacher Description	A quick read of the essential background information on teaching the science of bubbles: an introduction to bubbles; bubble people, sticky water, surface tension, bubble shapes, soap chemistry, bubble colors, boiling and bubble chambers, bread and bubbles, bubbles in solids and fizz.			

- **Image**
- **Video/audio**
- **Activity**
- **Article**
- **Web interactive**
- **Web exhibition**
- **Museum exhibit**
- **Professional development materials**

Three part study focusing on in-service middle school science teachers who use the internet

- Part 1: Background questionnaire
- Part 2 & 3: Think-aloud web-based search tasks
 - Resource location task
 - Lesson supplement task
 - Record keywords, comments, successful completion



- Participants are given off-line digital copies of Exploratorium resources
- Find the resource using the search tool at www.exploratorium.edu
- Participants videotaped
- Keyword search recorded



- **Describe in detail a recent one-day lesson**
 - Grade level, topic, field
 - Resources referenced
 - Standards referenced
- **Search for online digital resources to supplement or improve that lesson**
 - Discuss resources as they are discovered

<p>SEARCHING</p>	<ul style="list-style-type: none"> •Attention to Titles •“Searching by” vs. “Sorting by” •Advanced Searching
<p>INTERFACE</p>	<ul style="list-style-type: none"> •Data presentation •Resource pruning
<p>ARCHI- TECTURE</p>	<ul style="list-style-type: none"> •Resource definitions vary •Consistency
<p>RESOURCES</p>	<ul style="list-style-type: none"> •Educator desires unclear •No unified voice •Different needs for different experience levels

- **No single model of teacher search and use**
- **Reaching consensus around taxonomies**
 - Curricular areas vs. conceptual area vs. phenomena
 - Educational resource types
- **Establishing controlled vocabularies**
 - Informal learning resources with formal audiences
- **Curatorial and editorial process**
 - Ensuring high quality metadata with value
 - Large quantity of resources to select from
 - Different voices for written descriptions of assets
 - Single authorship: Capturing teaching tips useful for broad educator audience



**Exploratorium Online
Digital Library**

<http://www.exploratorium.edu/nsdl>

nsdl@exploratorium.edu

- **Field study of science teachers and educators (Spring 2004)**
- **Define user requirements for digital library (Summer 2004)**
- **Develop metadata and indices for digital exhibit-based science resources (on-going)**
- **Build Exploratorium Online digital library at www.exploratorium.edu/library**
- **Large-scale testing of library interface (Spring 2005)**
- **Establish interoperability with the NSDL (Summer 2005)**

- **Identify, select, and catalog digital assets drawn from the Exploratorium's 650 interactive exhibits**
- **With SMETE.ORG, establish digital library interoperability mechanisms to enable dissemination of item-level metadata to NSDL portals**
- **Create guidelines for cataloging digital exhibit-based science resources in established metadata element set standards that capture the unique museum quality and pedagogical value of Exploratorium digital assets**
- **Evaluate and refine the usability, accessibility, and applicability of the digital library with educator audiences**