Approved: 2/24/99
Date

MINUTES OF THE SENATE EDUCATION COMMITTEE.

The meeting was called to order by Chairperson Senator Barbara Lawrence at 9:00 a.m. on February 11, 1999 in Room 313-S of the Capitol.

All members were present except:

Committee staff present: Avis Swartzman - Revisor
Ben Barrett - Legislative Research
Jackie Breymeyer - Committee Secretary

Conferees appearing before the committee: Mr. Terry Smith, consultant, Jason Project

Others attending: See Attached List

The Joint House and Senate Committees met for the purpose of hearing Mr. Terry Smith on the Jason Project. The mission of the Jason Project Foundation for Education is to engage students in science and technology, and to motivate and provide professional development for their teachers through the use of advanced telecommunications.

Mr. Smith, who was introduced by Representative Morrisson, told of the inception of the program and how it came about.

In 1986, after Dr. Robert Ballard had been to the ocean's depths and viewed the Titanic, received letters from students all over the world. He wanted some way he could engage these enthusiastic young people to share in scientific exploits. Three years later that opportunity became a reality as thousands of students shared in the first Jason Project in the Mediterranean Sea. This was Dr. Ballard's dream as the students could actually interact through a live satellite broadcast. This was made possible through a unique partnership of private industry, scientific research facilities, museums and government and educational organizations.

This supplemental science education program with integrated components is keyed to the national content standards for science and geography. (Attachment 1)

Mr. Smith showed a seven-minute video that highlighted the many facets of the project. He then introduced Elsie Revard, a former middle school classroom teacher, who travels throughout the country "training the trainers" for the project. Ms. Revard demonstrated an exercise entitled, "Leaf Litter Activity" (Attachment 2) .

Chairman Tanner adjourned the Senate committee to meet its commitments.

SENATE EDUCATION COMMITTEE GUEST LIST

DATE: 2-11-99

NAME	REPRESENTING
Barbara J. White	Kansas Exemplary Educators Network
Carolyn Muehring	KS - Exemplary Educators Network
Karen Newberry	Mid America Nazarene University
Alicia Hawkins	Washburn Nursing School
Darwell Felton	Washburn Nursing School
Dr. Lisa Cassilly	KSNA - Fort Hays State University
Kurt Leis	Bethel College Nursing School
Christina Friedrich	Bethel College Nsg.
Liberty Friesen	Bethel College Nursing
Crystal G Cook	Butler County Comm. College, KSNA
Yolanda Voyles	Butler County Community College NS
Kate Claassen	Butler CCC Nsg. student
Marilyn Odell-Gillespie	USD 210 / High Plains Educational Cooperative
James J. Blair	Safety Education Service Co.
Janie Gillett	Mary Grimes School of Nursing Neosho County Community College
Earlene Lewis	Mary Grimes School of Nursing Neosho County Community College
Debbie Logan	Mary Grimes School of Nursing Neosho County Community College
Manelia Stephenson	Hugoton Middle / High School USD 210 Hugoton KS
Robert Poor	USD 289 - Wellsville KS

SENATE EDUCATION COMMITTEE GUEST LIST

DATE: 2-11-99

NAME	REPRESENTING
Gary L Ray	USD 395 LaCrosse
Wesley Henken	USD 395 La Crosse
Lorraine Ryan	U.S.D 395 La Crosse
GAIL L. KENNEDY	SRS
Val DeFever	State Bd of Ed.
Steve Adams	KSDE
Katharine Weickert	USA
Sherry Nelson	KTOY
Sue Wilson	USD260 Regional KTOY99
Phil Larson	USD 419
Dean R. Bayle	USD 419
Daryl Tegtje	USD 423
Rick Kehbiel	USD 423
H. Keith Doering	USD 423
Bill Dennis	USD 423
Eloise Kyrks	USD 443
Sharol Little	"
Marie Reeves	USD 443
Roger Teichen	Senator Huelskamp Office

SENATE EDUCATION COMMITTEE GUEST LIST

DATE: 2-11-99

NAME	REPRESENTING
MARK DESETTI	KNEA
Craig Grant	KNEA
John Klaassen	USD 206
Bev Murray	Rep. Pottorff
Bruce Nicholson	USD 266
Gary George	USD 233
David Miles	Associated Press
Flora Bishop	KEEN
Cheryl Adrian	KEEN
Kathleen Williams	Lawrence USD497
Leni Salkind	Lawrence USD497
AUSTIN TURNEY	" USD497
Dan Carlson USD 400	USD 400 Lindsborg
Leona Vajek USD 397	Post Springs
Kim Mitchell USD428	Great Bend USD 425
Mary Keng	Great Bend USD 428
Jean Cavanaugh	" " " "
Judy Smith	CWA
Stan Hoffman	CWA

SENATE EDUCATION COMMITTEE GUEST LIST

DATE: 2-11-99

NAME	REPRESENTING
Peggy Karmann	Butler County Community College KSNA Nursing Student
Kimberly Jones	Butler County Community College Nursing Student
Kristin Holderman	Butler County Comm. College Nursing Student
Laura Hamlin	Butler Co. Comm. College - Instructor (KSNA)
Steve Herrox	Seward Co. Comm. College (KSNA)
Steve Schuler	USD # 473, Chapman
Karen Hardin	Butler Co. Comm. College Nursing
Joanie Doolittle	Butler Co. Comm. College KSNA
Rachel Enloe	Kansas Ass. of Nursing Students Pittsburg State University
Natalie Fiser	Bethel College N. Newton, Ks - Student nurse
Greg Rasmussen	KSDE
Eldon L. Mahnkey	Wichita Public Schools / KASE Board Member
Monte Kay Yoho	Johnson County Comm. College
Mindy Myrick	Hilary Grimes School of Nsg: Olathe, Ks
Richard Goodbarn	USD #495 - Larned KS
Jon Apley	USD # 495 - Larned, KS.

In 1986, Dr. Robert Ballard, president of the Institute for Exploration, gazed into the murky darkness at the hull of the R.M.S. Titanic and asked himself, "Why only me?"

JASON PROJECT

Three years later in 1989, through a unique partnership of private industry, scientific research facilities, museums, government and educational organizations, thousands of students joined Dr. Ballard live via satellite broadcast on the first JASON Project in the Mediterranean Sea. Dr. Ballard's dream to take students with him on real research projects and to engage them in interactive substantive exchanges with researchers had become reality!

Each year, the JASON Project traverses the globe using cutting edge communications and educational technology to excite and engage students in science and to motivate and provide professional development for their teachers.

From oceans to rainforests, fr polar regions to volcanoes, t JASON Project explores Planet Earth to answer the questions:

1. What are the Earth's physical systems?

2. How do these systems affect life on Earth?

3. What technologies do we use to study these systems and why?

Join the JASON Project for a year-long multi-media interdisciplinary program based on the National Science and Geography Standards for students and teachers in grades 5-8. Integrating video programming, satellite transmissions, classroom instruction, and online activities, the JASON Project's award winning curriculum guides teachers and students through a hands-on inquiry based learning experience that culminates with two weeks of live telepresence broadcasts from JASON's expedition site each year.

Participation Options:

There are a number of ways for a school to join and take part in the activities of the JASON Project. The JASON Foundation for Education is working to create Statewide and Regional as well as new PIN Sites to sponsor participating schools. If you do not have access to either a local SWN/Regional or a PINS, you can sign up as an At-large member of the JASON Project.

Pricing for At-large members starts at $400 for a JASON program unit. A unit consists of one set of program materials that can be shared among as many as 5 teachers and 150 students. 1-5 Units may be purchased for $400 per unit, purchases of 6-14 Units are available at $350 per unit and purchases of 15-29 Units are available at $300 per unit. For larger purchases, please contact Diana Lee Crew at 303-316-8800 or at diana@jason.org.

- **Curriculum:** JASON staff works with project researchers to identify key learning areas and to create hands-on activities that explain and complement the wide range of activities covered in the program. The curriculum is keyed to national science standards, national geography standards and educational goals.

- **Online Activity and Resource Center:** Throughout the year, JASON Project participating students and teachers can check the award winning JASON website (**www.jasonproject.org**) for interactive and teacher-directed activities, discussion groups, chat sessions, Ask-An-Expert, additional curricular models and more.

  Minimum technical requirements for participating in JASON online activities are: a 486 PC running Windows 3.1, Windows 95 or Windows NT or a MAC Power PC or 68k Processor with Open Transport1.1 and MAC TCP 2.0.6; 16 MB of RAM and 15 MB free hard drive space; 28.8 KPS modem; Netscape Navigator 3.0 or MS Internet Explorer 3.0; Shockwave, Adobe Acrobat Reader, and ICHAT plug-ins.

- **Video Programming:** Each year, a series of video programs are produced to complement and enhance the curriculum. The programs air over an encrypted KU Band satellite and are available on videotape for those who cannot receive the satellite broadcasts.

  A. **Prologue Video**: Packaged with the curriculum, this video offers a substantive overview and visual kick-off for the year's studies.

The JASON Foundation For Education 395 Totten Pond Road Waltham, Massachusetts 02451
PH: (888) 527-6600 FX: (802) 352-9873 Website: www.jasonproject.org

Senate Education
2-11-99
Attachment 1

B. **Expedition Updates:** A series of four fifteen-minute videos to give students and teachers a visual and entertaining enhancement to help bring to life specific segments of the curriculum.

C. **Expedition Science Spotlights:** Designed for classroom viewing during the live broadcasts, these six 15 minute segments will explore specific aspects of the expedition's field research in more depth.

D. **Highlights Video:** This one-hour video will be produced from the expedition broadcasts to provide members of JASON with a review of the expedition and a wrap-up to the year's activities.

The JASON Project Expedition Broadcasts:

Each year in the early spring, Dr. Ballard leads a team of researchers, students and teacher "Argonauts" on a two-week expedition to explore the year's curriculum in a field setting. A state-of-the-art satellite broadcast facility is setup on location to link the expedition team to JASON participants live. Expedition broadcasts will air Monday-Saturday (week 1) and Monday- Friday (week 2) during the expedition. Broadcasts last one hour and are transmitted at 10 a.m., 11:30 a.m., 1:00 p.m., 2:30 p.m. and 4:00 p.m. EST.

PIN Sites & Interactive Telepresence: Over the past 10 years, the JASON Project has forged a partnership with leading museums, research institutions, school districts and Universities to create a unique link between a student's classroom study and the field research of an expedition. Through state-of-the-art broadcast and communications technology these Primary Interactive Network Sites (PINS) offer a spectacular 3-screen "telepresence" for unparalleled visual involvement with the subject matter, as well as opportunities for students to directly interact with the expedition team during the live broadcasts.

In addition to providing the crowning experience for JASON Project participants, PINS host professional development ***workshops*** for participating JASON teachers and sponsor participating students and teachers for selection as an Argonaut to accompany the JASON Project on its live broadcast expedition. Presently there are about 33 PINS around the U.S. with additional sites in Monterrey, Mexico, the UK and Bermuda. Check our website **www.jasonproject.org** for more information on a PINS near your school.

Benefits of Participating through a Primary Interactive Network Site (PINS):

- Attend live three-screen broadcasts, as opposed to single screen broadcast or video viewing
- Students have *the* opportunity to interact and submit questions directly to *the Live Expedition site*
- Participating in JASON through PINS may reduce both training costs and per student fee
- PINS provide value-added activities, such as Guest Experts, exhibits and demonstrations

Classroom Viewing: Not all JASON Project members can get to a PINS to view an interactive telepresence broadcast, but if your school has a KU Band digital satellite dish to receive educational programming and a General Instruments DSR 4200 V digital receiver, the live broadcasts can be viewed right in your own classroom. You may also receive the programs through the Dish Network, by Echostar. Contact the JASON Foundation for more details. *A Highlights Program is available on videotape for those who cannot receive satellite broadcasts.*

Professional Development Workshops:

National Educators' Conference: Sponsored each fall in Milwaukee, WI by the JASON Foundation, the NEC features a complete walk-through of the current year's JASON Project curriculum, online and video components. The registration fee is approximately $200. For more information, contact **Caroline Joyce at (414)-227-3365.**
Regional Conferences: In conjunction with the National Science Teacher's Association's three regional conferences, the JASON Foundation will be on-site to offer professional development and program training to educators participating in the JASON Project. *Sites may also contract with the Foundation for Training.*
Online and Video-Conferencing: Workshops will be offered through Video Conferencing and Online Sessions.
PINS Training Sessions: PINS host a number of professional development seminars for their participating teachers. Some sessions may be open to teachers participating in JASON independently.
More information on Professional Development training sessions: www.jasonproject.org

Questions on participating?: Contact Sarah Welcome at (888) 527-6600 or sarah@jason.org

JASON XI (School Year 1999-2000): 'Going to Extremes'
Preliminary Abstract

Why do we risk life and limb to explore the unknown, and how do we develop the technologies that allow us to overcome our physical limitations in these hostile environments?

Human nature inspires us to explore. We posses a unique blend of curiosity, creativity, and innovation, which leads us on a never-ending journey to learn more about the Universe and our place in it. As modern-day explorers, we continue our quest to understand these complex systems, to better understand life in the oceans, and continue our search for life on other planets.

JASON XI 'Going to Extremes' looks at sea and space through the eyes of modern-day explorers. We will compare NOAA's Aquarius Underwater Laboratory (Florida Keys) and NASA's International Space Station as research platforms that enable humans to go beyond their physical limitations to explore the unknown.

We will be exploring these extremes through the following thematic questions:

1. What are the Earth's dynamic systems?
2. How do these systems support life on Earth?
3. What technologies do we use to study the Earth-Space system and why?

Where are we going and why?

JASON XI : "Going to Extremes" will take us into the ocean and into space to explore the spirit of discovery and the technology for achieving it. Our main venues will be the ocean and space research and exploration, in conjunction with the Aquarius Underwater Laboratory, the Johnson Space Center and the International Space Station.

Join the JASON XI Research Team as we look at:

1. The technology we develop to explore - the design, engineering and maintenance of the Aquarius Underwater Laboratory and the International Space Station.

2. The training we undergo to explore - astronaut and aquanaut preparation, survival and the effects on the human body.

3. Why we explore space/ocean research and discovery, as well as the history and spirit of exploration.

For more information please call (888) 527-6600, or visit our website at www.jasonproject.org

The JASON Foundation For Education 395 Totten Pond Road Waltham, Massachusetts 02451
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JASON FOUNDATION FOR EDUCATION
JASON PROJECT XI: "Going to Extremes"
At-Large Particpant Registration Form

Please complete the form below to enroll in the JASON Project as an At-Large Participant.

School or District Name: _____
School Contact: _____
Title of Contact Person: _____
Phone: (___)-___-_____ Ext:_____ Fax: _____ E-mail: _____
Mailing Address: _____
Mailing Address: _____
City: _____ State: _____ Zip: _____ Country:_____

How did you learn about The Jason Foundation for Education?_____
Have you checked our website for a PINS near you? You are choosing not to participate through a PINS for the following reason: _____

The JASON Instructional Unit:

A JASON Program Unit consists of the following materials and content:

Materials	Date Available	# Shipped per Unit
Curriculum	Fall, 1999	1
Prologue Video	Fall, 1999	1
Online Registration	Fall, 1999	Up to 5

Broadcast Programming	Broadcast Date	Video Available
Winter Updates	February, 2000	February, 2000
Live Expedition Broadcast	March, 2000	Available only as part of Highlights video
Science Spotlights	March, 2000	April, 2000
Highlights Broadcast Video	April, 2000	April, 2000

Unit Pricing Calculation
Each JASON unit allows as many as 5 teachers and 150 students. **1 unit = 5 teachers = 150 students**
Please provide the number of teachers and students you intend to serve: Teachers:_____ Students:_____

Prices per unit:

1-5 units	6-14 units	15-29 units
$400 per unit	$350 per unit	$300 per unit

Number of Units _____ **X $** _____ **per unit = $** _____

Extra Curriculum and Videos

The Foundation will only sell up to 4 additional curriculum and videos per unit ordered.

Quantity	JASON X Materials	Unit Price	Total
	Curriculum & Poster	$30.00	
	Expedition Prologue Video	$29.00	
	Expedition Updates Video	$29.00	
	Science Spotlights Video	$29.00	
	Expedition Highlights Video	$29.00	
		TOTAL	$

Broadcast Programming

e JASON Project classroom and online activities will be supplemented with live and taped video broadcasts throughout ear. Presently this programming is available via these two satellite broadcast options.

KU Band Satellite	This is an encrypted signal transmitted via satellite **SBS6/Transponder 15.** You may receive all 53 live expedition telecasts. Indicate which equipment you have to receive the signal below. • Digital KU Band Satellite Dish and LNB ..... ☐Yes ☐ No • General Instruments DSR 4200 V or B Digital Receiver ..... ☐Yes ☐ No
Echostar Dish Network	This system allows you to receive the broadcast on a dbs system. Currently about one broadcast per day will be transmitted. You may purchase a one dish system which allows you access to JASON for about $430, plus installation. Or you may purchase a two dish solution, which also provides additional educational programming, for approximately $ $550 plus installation. Please refer to the separate flyer on Echostar systems.

If you have the necessary satellite equipment, you will need to point your KU Band dish to this locale for each telecast. Exact coordinates will be provided to the designated contact below.

Contact:			Title:		
Phone:		Ext:		Fax:	
E-mail:					

To order equipment which will provide access to the broadcasts, please refer to the Equipment Order Form.

Professional Development Training:

In order to participate in the JASON Project, you should attend a JASON Training Program. Currently these programs are available at Primary Interactive Network Sites, at the JASON National Educator's Conference in September, at NSTA Regional Conferences , through a combined Video-Conference and/or Online Course, or school districts may choose to bring a JASON training team to their district at a cost of $3,000 per day.

- Listing of current training sessions are available at www.jasonproject.org
- The registration fee for the JASON National Educator's Conference is $200 per person. Please indicate here if you would like registration information sent to you. ____ Yes ____No
- The cost of two JASON trainers on-site for one day is $3,000, plus travel expenses. Please indicate if you would like to have the JASON Foundation for Education conduct your training. ____Yes ____No

Note: School Districts purchasing more than 100 units will be provided with on-site training.

Please indicate how and when you plan to receive training: _____

Payment Summary:

Total $ for JASON Units	$
Total $ for Extra Curriculum & Videos	$
Total $ Amount for Order	$

- ____ Enclosed is our Check/ Purchase Order *(please circle one)* #_____ for $ _____

Please make all checks and Purchase Orders payable to The JASON Foundation for Education

Leaf Litter Activity

In this exercise, you'll collect, observe, and classify leaves to examine physical patterns and characteristics in your local ecosystem. By sharing your data with other schools online, you may discover a relationship between leaf shape margins and mean annual temperature.

Focus *questions*

What characteristics do you use to classify your leaves?

What distributions and patterns did you see in the plant species of your local environment?

What processes might create physical patterns and characteristics in species and ecosystems?

Exercise 4.4.1

Materials

Pencils and paper

Copies of Master A, Smooth and Toothed Leaves

Collecting bag

Procedure

1. Review the definitions of morphology, physiognomy, and leaf margin.
2. Hike around a field trip site and observe the different leaves, branches, and bark textures. Discuss the different characteristics of the tree species in your local ecosystem. Formulate hypotheses as to why plant species may have developed such different characteristics.
3. Collect about 15 fallen leaves (from as many species as possible) from different areas of the school yard/field trip site and bring them back to the classroom. Collect as many species as possible. The correlation between temperature and leaf shape decreases with fewer than 20 species and should not be used with fewer than 12 species.
4. Separate your leaves into "species" by classifying the leaves according to their characteristics. Describe or draw the characteristics you used to determine the number of species in your lawn bag. This type of classification identifies species by their morphology and separates the leaves into "morphospecies." Morphospecies may or may not be the same as real species. For assistance, you may want to look in a field guide to plants in your region.
5. After separating tree species, count how many species have toothed leaves and how many have smooth leaves. Record this leaf margin information on your paper.
6. Share all individual data to generate a classroom count of the total number of smooth and toothed leaves collected by the class.
7. Plug your individual data and the total classroom data about the number of smooth and toothed leaves into the following formula:

   leaf-estimated mean annual temperature (in degrees Celcius) = 30.6P + 1.14

   where P is the proportion of smooth margined species relative to the total number species collected. For example, if 100 species were collected and 60 had smooth margins, P would equal 0.6. As a class, discuss the number and proportions of the smooth and toothed margins collected. Talk about why the characteristics of smooth margins and those of toothed margins might be beneficial and/or harmful in your local ecosystem. Why do you think that species in tropical rainforests are almost all smooth margined with drip tips, whereas temperate deciduous forest species have more toothed margins? Come up with some hypotheses about adaptation and why a greater proportion of smooth margins should match with a higher mean annual temperature.
8. Map the results from the formula of your individual data and the classroom data on **Master A**. How did the classroom results of smooth to toothed leaves formula compare to the map of world temperature shown on **Master A**? What do these results tell you about your local climate?

For Further Exploration

Share your results with the world via the Internet at **www.jasonproject.org.**

Senate Education
2-11-99
Attachment 2

Smooth and Toothed Leaves

Smooth Margins

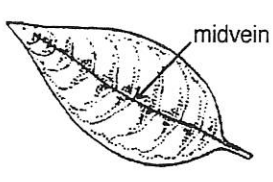
The leaf margin forms a smooth line or arc without noticeable pointed projections or indentations. A smooth margined leaf may be lobed, but NOT toothed.

Note: Many lobed leaves are smooth margined. Lobes are projections that indent more than 1/4 of the distance from the midvein.

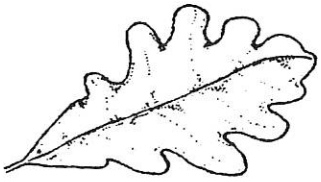
Toothed Margins

The leaf margin has pointed projections, which are indented less than 1/4 of the distance to the midvein.

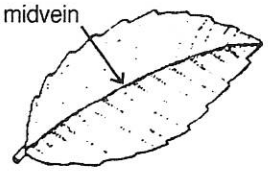
NOTE: If there is one tooth of any size, the leaf is toothed.



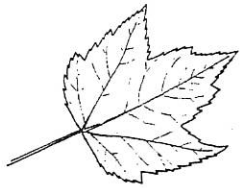
Smooth, unlobed



Smooth, lobed



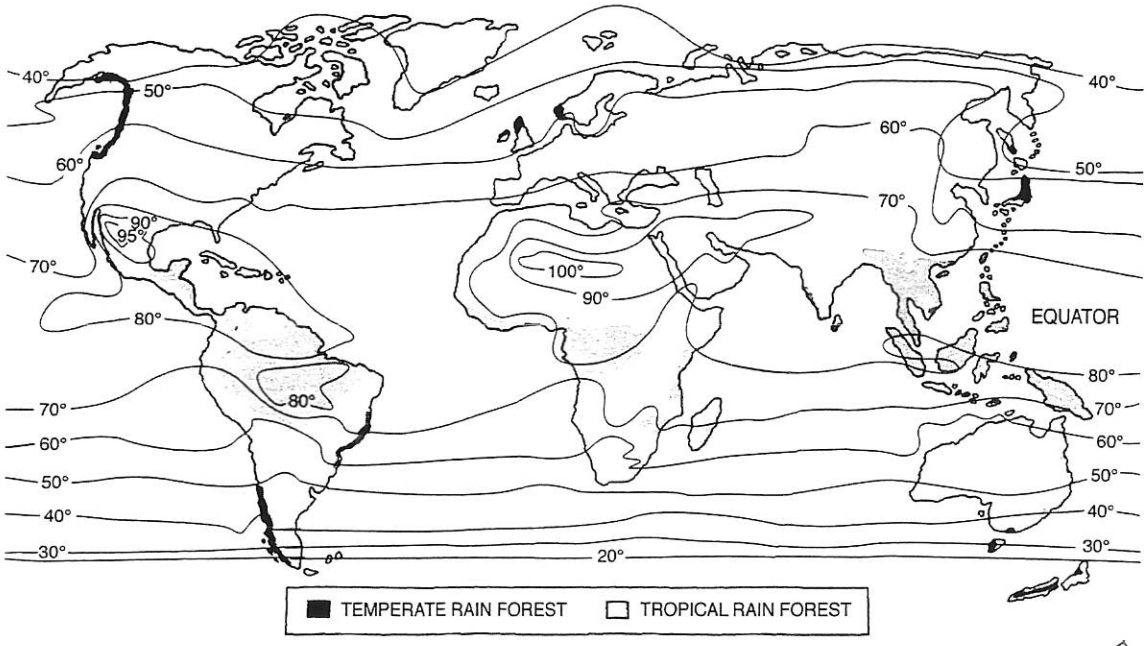
Toothed, unlobed



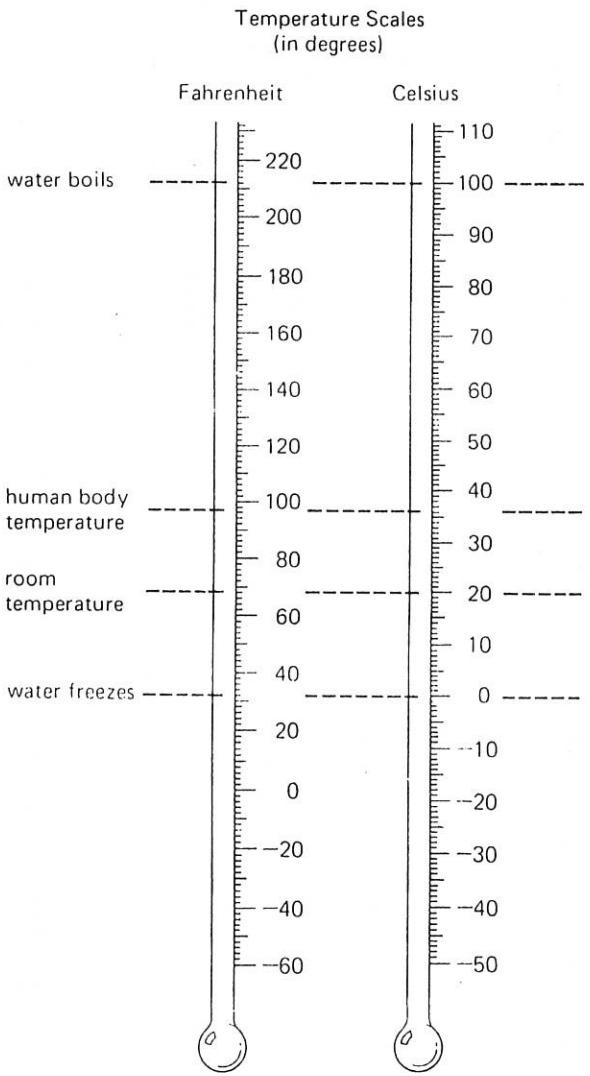
Toothed, lobed

Collector	Number of Leaf Species Collected			P*	Leaf-Estimated Mean Annual Temperature**
	Total	Smooth	Toothed		
Your Name					
Class Total					

* P is the proportion of smooth leave species relative to the total number of species collected.
** Leaf-estimated mean annual temperature = 30.6P + 1.14



2-2



Leaf Litter Formula Worksheet

Your Name: _____

Date: _____

Location of leaves collected: _____

Formula for Leaf-Estimated Mean Annual Temperature in Celsius

Number of smooth leaf species: ( )

_____ x 30.6 + 1.14 = _____ °C

Number of total leaf species: ( )

Formula to convert Celsius to Fahrenheit

$$\frac{\text{\_\_\_\_ °C} \times 9}{5} + 32 = \text{\_\_\_\_ °F}$$

Contributed by Dee McLellan, Minnesota Jason Mentor Teacher

Exercise 4.4.1
LEAF LITTER ACTIVITY



Time Required

30 minutes or more to collect leaf samples; 1 hour for in-class activities.

Additional Preparation

Bookmark **www.jasonproject.org** before the activity.

Teacher Take Note!

Conduct your leaf litter study along with your Local Field Investigation (Investigation 3.2) or in as natural an area as possible. Before collecting leaves, emphasize that students should collect leaves from woody tree species, shrubs, and/or vines, not herbaceous plants. To avoid collecting leaves from introduced species (i.e., exotic or non-native species) which are not natural parts of the ecosystem you are observing, you may want to collect leaf samples from areas far from roads, gardens, and cultivated areas like school yards. Before collecting leaf samples, you should also help students to identify local plants that should avoided and not touched, such as poison ivy or poison oak.

After you have finished this activity, share your results with other JASON classrooms around the world via the Internet at **www.jasonproject.org**.

Internet sites:

Denver Museum of Natural History:
http://www.dkonline.com/preview/sitepreview/private/express/museums/denver.html

Global Change Master Directory:
http://gcmd.nasa.gov/

International Organization of Paleobotany:
http://ibs.uel.ac.uk/palaeo/

Paleobotanist Peter Wilf's Home Page:
http://www.sas.upenn.edu/~pwilf/

The PaleoNet Pages:
http://www.ucmp.berkeley.edu/Paleonet/

University of California (Berkeley) Museum of Paleontology: **http://www.ucmp.berkeley.edu**

K-3 9-12

Adaptations

Students can make a bar graph to determine the relative abundance of leaves with smooth and toothed margins. During your classroom discussion, list the climatic factors that could affect diversity, like climate, moisture, and location.

Ask younger students to only compile the data together and not individually (i.e., only do steps 6 and 7 as a group for total classroom data).

Exercise 4.4.2
TRACE FOSSIL ACTIVITY


Time Required

15 to 30 minutes to create the experiment design; 30 minutes to perform the experiment (not including the time it takes for the plaster of Paris to dry); 15 to 30 minutes to discuss and interpret results.

Teacher Take Note!

Each group needs to decide what to test in its experiment. Students will probably need guidance. The two combinations of dry sand and damp sand, and damp mud and damp sand will probably work the best. Two groups can do the same experiment; they can compare their results at the end. Or, one group can use the same conditions as another, but use a different animal. In other words, be careful to control your variables by only testing one variable at a time. For example, advise them against using damp mud and dry sand. In this case, they wouldn't be able to decide whether the fidelity of preservation of the traces was due to dampness or to grain size.

Answers to Questions

Paleontologists use trace fossils to learn about past environments and animals. Most distinct, recognizable traces for heavier animals will probably be produced in damp sand, because the dampness increases the cohesion of the sediment. For very light animals, however, the best trace might be produced in dry, fine sand or possibly damp mud. In general, the deeper the trace, the heavier the animal. Traces might not be preserved in damp sand if the animal is not heavy enough.

2-4

Teacher preparation

K-3 9-12

Adaptations

To make this activity easier, inanimate objects such as leafs, twigs, or large seeds could be pressed into the sediment, leaving impressions. Although the impression of an inanimate object is not a trace fossil (it does not record behavior), the results yield information about fidelity of preservation of shape in different grain sizes or moisture contents; such results do not yield information on weight.

To make this activity more difficult, ask students to measure the lengths and weights of their animals.

Then ask student groups to pool this information and summarize it on two graphs. In graph one, the students could plot the distance between footprint traces against the length of the animal; in graph 2, they could plot depth of animal footprint traces against weight. Both of these graphs should show a positive correlation between the variables. Discuss how paleontologists could use this information to learn about extinct animals, like dinosaurs.

INVESTIGATION 4.4 ALL ACTIVITIES

National Education Standards	Exercise		
Science as Inquiry: Content Standard A • Students should learn about scientific inquiry and develop the abilities necessary to perform it.	Trace Fossil		
Life Science: Content Standard C • Students should develop an understanding of the structure and function of living systems, populations and ecosystems, and the diversity and adaptations of organisms.	Leaf Litter Activity		
Physical Science: Content Standard B Earth and Space Science: Content Standard D • Students should develop an understanding about properties and changes in matter, motions and forces, the structure of the earth system, and earth's history (as learned from studying fossils).	Both Exercises		
Performance Indicator: Leaf Litter	**Novice**	**Apprentice**	**Researcher**
Identifies and characterizes different leaf species by their physical characteristics.			
Explains the distribution and patterns of ecosystems, as exemplified by being able to discuss the types of plants (smooth leaved verses toothed leaved) associated with climate regions on earth (rainforest locations as an example).			
Analyzes physical patterns in terms of the processes that create them; can construct and analyze climate graphs for selected places and suggest reasons for similarities and difference in climate.			
Performance Indicator: Trace Fossil	**Novice**	**Apprentice**	**Researcher**
Effectively communicates ideas.			
Uses scientific vocabulary.			
Creates an experiment design and modifies the design (as needed) to successfully test for one variable.			
Supports ideas and conclusions with appropriate evidence.			
Logically organizes and present scientific information.			

2-5