Life Science
Worksheet

GRADE LEVEL: Fourth

Topic: Organization of Living Things

Grade Level Standard: 4-1 Examine organization of living things.

Grade Level Benchmark: 1. Classify familiar organisms on the basis of observable physical characteristics. (III.2.E.2)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How can observable characteristics help us classify living things?*** 1. Compare and contrast flowering and non-flowering plants.	www.kidspiration.com Sorting all Sorts-AIMS http://www.aims.edu.org/aimscatalog/
Process Skills: Observing, Classifying	

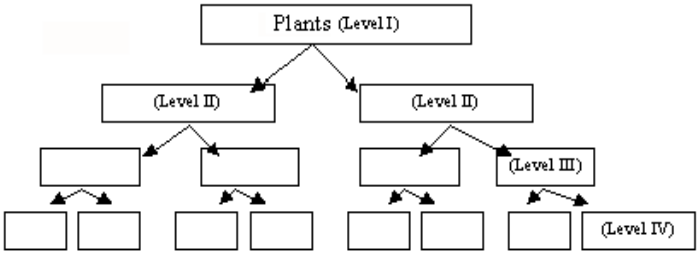
New Vocabulary: Plant parts: roots, leaves, stems, flowers, flowering, non-flowering

Assessment
Grade 4

ORGANIZATION OF LIVING THINGS

Classroom Assessment Example SCI.III.2.E.2
(Compare and contrast familiar organisms on the basis of observable physical characteristics)

Post plant characteristics (flowering, non-flowering, above ground, below ground). Have students brainstorm a list of plants for each category. Students should then choose two of the categories. Challenge each student to consider the similarities and differences among the plants in the categories he or she has chosen and to create one more division for each category based on personal observation. Each student will then design a graphic organizer (see graphic organizer in resources) that begins with plants (Level I) and is divided into two of the posted categories (Level II). From there, the student will divide each of the two chosen categories once more based on personal observation (Level III). The graphic organizer is then completed by adding the names of the plants from the original brainstormed list (Level IV).



(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.III.2.E.2

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of characteristics	Completes Level II by choosing two of the posted characteristics (Level III is omitted).	Completes Level II by choosing two of the posted characteristics; creates two sub-divisions for one of those characteristics (part of Level III).	Completes Level II by choosing two of the posted characteristics; creates two sub-divisions for two of those characteristics (all of Level III).	Completes Level II by choosing two of the posted characteristics; creates more than two sub-divisions for each of those characteristics (Level III).
Completeness of plants	Lists all of the plants from the brainstormed list that fit the characteristics (Level IV).	Lists all of the plants from the brainstormed list that fit the new divisions (Level IV).	Lists all of the plants from the brainstormed list that fit the new divisions (Level IV).	Lists all or more plants that fit the new division (Level IV).

Life Science
Worksheet

GRADE LEVEL: Fourth

Topic: Organization of Living Things

Grade Level Standard: 4-1 Examine organization of living things.

Grade Level Benchmark: 2. Describe life cycles of familiar organisms. (III.2.E.3)

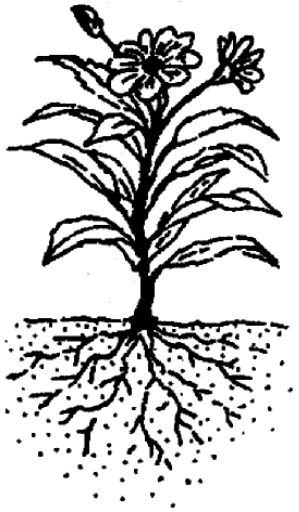
Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How do plants change as they grow?*** 1. Plant seeds. Make a routine to observe and care for the plants daily.	www.aims.edu.org/aimscatalog/ Life Cycle Series (CTP) Life Story Series (Troll)
Process Skills: Observing, Inferring, Predicting	

New Vocabulary: seed, plant, flower, fruit

Name _____

MAKING MODELS

1. Make a plant model from the materials.
2. Tape your plant model below.
3. Cut out the labels.
4. Label the parts of your plant.



root	stem	flower	fruit	seed	leaf

Assessment
Grade 4
ORGANIZATION OF LIVING THINGS

Classroom Assessment Example SCI.III.2.E.3
(Describe the life cycle of familiar organisms.)

Students will complete a panel drawing (comic strip) showing the life cycle stages of a plant. Each panel should correspond to one stage in the plant's life cycle. Drawings must include speech bubbles explaining the stage and what is happening to the plant. (Example: bean)

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.III.2.E.3

Criteria	Apprentice	Basic	Meets	Exceeds
Correctness of order	Draws at least one life cycle stage.	Draws at least two life cycle stages in order.	Draws all life cycle stages in order.	Draws all life cycle stages in order and includes proper habitat -or- Expands on one or more of the life cycle stages.
Completeness of explanation	Writes life cycle stage explanation for one drawing.	Writes life cycle stage explanations for drawings.	Writes life cycle stage explanations for drawings.	Writes a detailed life cycle stage explanation for each drawing. Includes explanation of organisms' habitats.

Life Science
Worksheet

GRADE LEVEL: Fourth

Topic: Organization of Living Things

Grade Level Standard: 4-1 Examine organization of living things.

Grade Level Benchmark: 3. Compare and contrast food, energy, and environmental needs of selected organisms. (III.2.E.4)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How do the life requirements for a plant and animal compare?*** 1. Make a Venn Diagram for plants, animals, or both. 2. Have the students draw and color a food chain with their own examples.	http://wwww.scienceexplosion.indiegroup.com
Process Skills: Observing, Classifying	

New Vocabulary: air, water, minerals, space, habitat, sunlight, food, germinating

Assessment
Grade 4

ORGANIZATION OF LIVING THINGS

Classroom Assessment Example SCI.III.2.E.4
(Compare and contrast food, energy, and environmental needs of selected organisms.)

Students will create a graphic organizer displaying the following information for a selected animal or plant: food, air, water, sunlight, habitat, and food source. Using this information, students will construct a labeled three-dimensional model (diorama) that shows the life requirements of their animal.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.III.2.E.4

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of graphic organizer	Shows two of the life requirements for their animal or plant.	Shows three of the life requirements accurately for their animal or plant.	Shows four of the life requirements accurately for their animal or plant. Shows food source accurately.	Shows all of the life requirements for their animal or plant. Shows food source accurately.
Construction of animal life requirements	Constructs two of the life requirements in the diorama.	Constructs three of the life requirements in the diorama.	Constructs four of the life requirements in the diorama.	Constructs five or more of the life requirements in the diorama.

Life Science
Worksheet

GRADE LEVEL: Fourth

Topic: Organization of Living Things

Grade Level Standard: 4-1 Examine organization of living things.

Grade Level Benchmark: 4. Explain functions of selected seed plant parts. (III.2.E.5)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***What are the functions of seed plant parts?*** 1. Have students label and identify functions of plants and seed parts at different stages of growth.	www.fmi.org/coolscience/ "Salad Nutrition Chart" www.kidsgardening.com
Process Skills: Observing, Classifying	

New Vocabulary: plant parts, roots, seeds, stems, leaves, flowers, fruit, edible, inedible

Assessment
Grade 4

ORGANIZATION OF LIVING THINGS

Classroom Assessment Example SCI.III.2.E.5
(Compare and contrast food, energy, and environmental needs of selected organisms.)

Students will create a graphic organizer displaying the following information for a selected plant: food, air, water, sunlight, and food source. Using this information, students will construct a labeled three-dimensional model (diorama) that shows the life requirements of their plant

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.III.2.E.5

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of plant parts	Creates salad containing two or three plant parts.	Creates salad containing four or five plant parts.	Creates salad containing all plant parts.	Creates salad containing more than one of each of the plant parts.
Identification of plant parts	Identifies two or three plant parts.	Identifies four or five plant parts.	Identifies six plant parts.	Identifies six plant parts.
Functions of plant parts	Identifies a function of two or three plant parts.	Identifies a function of four or five plant parts.	Identifies a function of six plant parts.	Identifies more than one of the functions of the six plant parts.

Life Science
Worksheet

GRADE LEVEL: Fourth

Topic: Heredity

Grade Level Standard: 4-2 Investigate inherited characteristics.

Grade Level Benchmark: 1. Give evidence that characteristics are passed from parents to young. (III.3.E.1)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***What physical characteristics are shared between a young living thing and it's parents?*** 1. a. Identify that a puppy looks like a dog. b. Identify that a kitten looks like a cat. c. Identify that saplings look like trees. d. Identify that seedlings look like plants. 2. "Unique U" ★ ★ Activity is attached	
Process Skills: Observing, Classifying	

New Vocabulary: heredity, leaf shape, flower structure, hair and feather color, eye color, mature, immature

UNIQUE U

TOPIC AREA

Observation and classification.

INTRODUCTORY STATEMENT

The students are to sort themselves according to their attributes (sex, hair color, type of clothing, etc.) until each student is in a group by himself/herself. In search for a solution, students will learn a great deal about attributes that make them the same and different from everyone else in the class.

MATH SKILLS

a. Logical Thinking
b. Sorting
c. Problem Solving

SCIENCE PROCESSES

a. Observing
b. Classifying
c. Recording Data

MATERIALS

Student Worksheets
Overhead projector and screen

KEY QUESTION

"What attributes make you a unique and special person?"

BACKGROUND INFORMATION

The students will be looking for attributes relevant to particular members of a group. They will choose from among these attributes to discover a category into which to place themselves. They will use a tree diagram which has two branches at every separation point.

MANAGEMENT SUGGESTIONS

1. Estimated time: one 45 minute class period

PROCEDURE

1. When students come to a consensus on an attribute, the teacher will record this attribute on the overhead transparency. This will be done for each decision.
2. Starting with the whole class, the students will decide how to divide themselves into two groups based on one attribute.
3. The groups will move to opposite sides of the room.
4. Each of these groups will divide itself into two groups based on one attribute which need not be the same for each group. These will separate themselves into four places in the classroom.
5. This process will continue until each person is by himself or herself.

6. As soon as any student is by himself or herself, the student returns to his or her seat and traces his or her own particular attributes on the sorting tree. See the sample copy for these examples: Mary Jane is a student, a girl with long hair, and she is tall; Bobby is a student, a boy with short hair, and he is short.
7. A typical procedure might be as follows:

    Teacher: "What is one way you can sort yourselves into two groups?"
    Students: "Boys and girls." (Students do so.)
    Teacher: "Can you divide each group again?"
    Students: "Long hair and short hair." (Students divide again.)
    Teacher: "How many groups are there now?"
    Students: "Four."

WHAT THE STUDENTS WILL DO

1. Students will sort themselves according to various attributes of their choosing.
2. Each student will trace his or her own attributes on a tree diagram.

DISCUSSION

1. Which attributes are the most general? (Those on the left side of the tree diagram.)
2. Which attributes are the most specific? (Those on the right side of the tree diagram.)
3. Which attributes made you a special and unique person in this classroom? (Answers will vary.)

EXTENSION

1. Sort buttons using the following attributes: 2 hole or 4 hole; round or straight; big or little; brown or not brown; etc. Other attributes may be selected by students.
2. Sort leaves by having students collect leaves. Use attributes such as; needles or whole leaves; branched or unbranched leaves; rough or smooth edged leaves; fine or coarse veined leaves; heart shaped or arrowhead shaped leaves; etc.
3. Classify animals by listing different kinds of animals on the overhead and having students sort the animals according to physical attributes.

Unique U

Unique U

GIRL

Blue Eyes

Light Hair

Dark Hair

Other Eye Color

Light Hair

Dark Hair

BOY

Blue Eyes

Light Hair

Dark Hair

Other Eye Color

Light Hair

Dark Hair

Assessment
Grade 4

HEREDITY

Classroom Assessment Example SCI.III.3.E.1
(Give evidence that characteristics are passed from parents to young.)

Students may use one set of the parent/offspring picture cards created for the Instructional Example (link to SCI.III.3.E.1) or brainstorm a set of parent/offspring organisms to create a Venn diagram. The diagram will illustrate the similarities and differences of the organism pictured on the cards or brainstormed.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.III.3.E.1

Criteria	Apprentice	Basic	Meets	Exceeds
Identification of common characteristics	Identifies up to one of the shared characteristics.	Identifies two of the shared characteristics.	Identifies three of the shared characteristics.	Identifies four or more of th shared characteristics. - or - Identifies indistinct characteristics that may make a positive link questionable.
Completeness of Venn diagram	Constructs a Venn diagram with data missing from one or more sections.	Constructs a Venn diagram with data in all three sections; some data may be inaccurate.	Constructs a Venn diagram with complete and accurate data.	Constructs a Venn diagram and another graphic organizer with complete and accurate data.

Physical Science
Worksheet

GRADE LEVEL: Fourth

Topic: Matter and Energy

Grade Level Standard: 4-3 Examine matter and energy

Grade Level Benchmark: 1. Classify common objects and substances according to observable attributes/properties. (IV.1.E.1)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How are given objects alike and different?***	
1. Teacher will play, "Guess the Attribute" game. Separate the students by attributes (hair/eye color, or students with glasses). Students guess the attribute.	Video: Scientific Face and Fun: Everything is something (matter) VH01483
2. Sherlock Combs the Yard ★	AIMS
★Activity is attached	
Process Skills: Communicating, Observing, Classifying	

New Vocabulary: Texture: rough, smooth; Flexibility: rigid, stiff, firm, flexible, strong; Smell: pleasant, unpleasant; States of matter: solid, liquid, gas; Magnetic properties: attract, repel, push, pull; Size: length, width, height, attribute, property, characteristics, hardness, sink, float; Color: common color words; Shapes: common shapes; Weight: heavy, light, heavier, lighter

Name _____

Sherlock Combs the Yard

1. Your team has 10 minutes to collect at least 4 objects with a common attribute. Read the attribute label on the bag but keep it a secret from other teams. Go outside, collect, and record.

My team's attribute is: _____.

Our team collected: _____

_____

2. Return to the room and display your objects but keep the attribute a secret. Study objects collected by other teams and predict the attribute each team used.

TEAM	PREDICTION	ACTUAL
A		
B		
C		
D		
E		
F		
G		
H		
I		
J		
K		
L		
M		
N		

3. Which groups have a similar attribute ?

Prediction	Actual
A and ____	A and ____
B and ____	B and ____
C and ____	C and ____
D and ____	D and ____
E and ____	E and ____
F and ____	F and ____
G and ____	G and ____

BAG LABELS : SHERLOCK COMBS THE YARD

TEAM A	TEAM M	COLLECT: Things that are Green	COLLECT: Things that are Green
TEAM B	TEAM K	COLLECT: Seeds	COLLECT: Seeds
TEAM C	TEAM N	COLLECT: Things that are Square	COLLECT: Things that are Square
TEAM D	TEAM H	COLLECT: Things that are Pointed	COLLECT: Things that are Pointed
TEAM E	TEAM I	COLLECT: Things that are Shiny	COLLECT: Things that are Shiny
TEAM F	TEAM L	COLLECT: Things that are Rough	COLLECT: Things that are Rough
TEAM G	TEAM J	COLLECT: Things that Float	COLLECT: Things that Float

How are These Alike?

I picked up these things outside.
They are alike in at least one way.

Draw a picture of your collection in the bag.

Name:

These things are all _____.

Assessment
Grade 4

MATTER AND ENERGY

Classroom Assessment Example SCI.IV.1.E.1
(Classify common objects and substances according to observable attributes/properties.)

Given a selection of objects, each student will sort the items using the objects' physical characteristics. After the student has sorted the items, he or she will organize the information by either creating an original graphic organizer or using the table given below:

Object	Color	Shape	Texture	Size

The student will choose two objects from the table and describe how the two objects are alike and different.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.IV.1.E.1

Criteria	Apprentice	Basic	Meets	Exceeds
Accuracy of Identification	Identifies one to two characteristics correctly.	Identifies three characteristics correctly.	Identifies four characteristics correctly.	Identifies five characteristics correctly.
Accuracy of summary	Compares and contrasts using one to two characteristics.	Compares and contrasts using three characteristics.	Compares and contrasts using four characteristics.	Compares and contrasts using five characteristics.

Physical Science
Worksheet

GRADE LEVEL: Fourth

Topic: Matter and Energy

Grade Level Standard: 4-3 Examine matter and energy.

Grade Level Benchmark: 2. Identify properties of materials which make them useful. (IV.1.E.2)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***What materials would you use to construct a familiar object (eggs, backpack, model airplane, rain coat)?*** 1. Identify and list the useful properties of rubber, cotton, glass, plastic, wool, and metal. 2. Students will compare, analyze, and discuss useful characteristics of different materials to make a familiar object. Students will then work with a partner to construct their own object out of the useful materials. For example, make a raincoat out of plastic bags.	MASER Project http://www.svsu.edu/mathsci-enter/Maser%20Science/MASER.html/ Hewitt, Sally. "Solid, Liquid or Gas." Usbourne, 1998
Process Skills: Comparing, Classifying	

New Vocabulary: unbreakable, waterproof, lightweight, conducts electricity, conducts heat, magnetic attraction, buoyancy, flexibility, hardness, transparency, clear

Assessment
Grade 4

MATTER AND ENERGY

Classroom Assessment Example SCI.IV.1.E.2
(Identify properties of materials that make them useful.)

Students will hold a public auction. They will auction common items with useful properties. The teacher will give the students objects such as a pencil, jacket, mirror, umbrella, paper plate, flashlight, refrigerator magnet, electrical wire, etc. Students may work with partners to share ideas.

Taking turns role-playing an auctioneer, each student will describe his or her item in terms of its properties, what it is used for, and the usefulness or benefits of its properties. Each student's goal will be to convince the class that his or her item is the most useful. The rest of the class will be able to "bid" on each item. After the auction, the class should discuss whether the items selling for the highest prices were also the most useful. What other characteristics might have influenced the students' bids?

After completing the auction, students may create a classroom book of "Silly and Not So Useful Products." Students will draw their products on sheets of paper. Instead of including the useful properties, they should change the properties to make them less useful. Examples may include an umbrella made from a screen, a mirror made from cardboard, a pan made from paper, etc.

After putting their pages into a book, students may share their class book with other classes, identifying the inappropriate properties. The class book may be put in the media center for others to enjoy.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.IV.1.E.2

Criteria	Apprentice	Basic	Meets	Exceeds
Description of object	Describes one useful property of the object.	Describes two useful properties of the object.	Describes three useful properties of the object.	Describes four or more useful properties and suggests another.
Accuracy of sketch	Sketches an object that reflects no useless properties.	Sketches an object that reflects at least one useless property.	Sketches an object that reflects at least two useless properties.	Sketches an object with great detail and three useless properties.

Physical Science
Worksheet

GRADE LEVEL: Fourth

Topic: Matter and Energy

Grade Level Standard: 4-3 Examine matter and energy.

Grade Level Benchmark: 3. Identify forms of energy associated with common phenomena. (IV.1.E.3)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***What forms of energy do you encounter in a given day?*** 1. Using the list of energy forms (heat, light, food, motion, electricity, sound), students will use tally marks to record how many times in one day they observe energy being used. ★ ★ Activity is attached	"Energy Hunt" MASER Project http://www.svsu.edu/mathsci-Center/MASER%20Science/Maser.html/ Harolw, Rosie "Energy and Power." King Fisher 1995
Process Skills: Observing, Recording data, Classifying	

New Vocabulary: energy, light, heat, sound, food energy, electricity, energy of motion

ENERGY HUNT

Using the lists of energy forms, students will collect and tally the number of times they observe energy being used in a one-day period at home. Students will determine the best forms of energy for a specific job, such as moving a car, drying clothing, playing the radio, playing ball, or staying warm. Students may either give oral explanations to their group(s) or defend their positions in writing.

OBJECT	heat	light	food	motion	electricity	sound

The class will select one common form of energy and investigate its source by visiting a power plant, researching on the Internet, or inviting a power plant employee into the classroom to present and answer questions to connect this to the real world. Presenters such as dieticians, doctors, or nurses can also be invited to explain other forms of energy.

Assessment
Grade 4

MATTER AND ENERGY

Classroom Assessment Example SCI.IV.1.E.3
(Identify forms of energy associated with common phenomena.)

The teacher will present the following scenario:

The school district has asked us to do our part in helping to conserve energy. Our task is to identify different forms of energy and ways we can help conserve them.

Each student will go on an "energy hunt" around the school to find examples of the different forms of energy.

Suggested list of energy forms:

- Heat energy (e.g., solar, heating units, cooking, etc.)
- Light energy (e.g., solar, lighting, aquarium bulbs, etc.)
- Sound energy (e.g., music room, cafeteria, gym class, traffic)
- Food energy (e.g., cafeteria, aquarium, guinea pig cage, etc.)
- Energy of motion (e.g., custodian, gym class, etc.)
- Electrical energy (e.g., classroom lighting, aquarium bulbs, computers, etc.)

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.IV.1.E.3

Criteria	Apprentice	Basic	Meets	Exceeds
Accuracy of identification	Identifies one to two forms of energy correctly.	Identifies three to four forms of energy correctly.	Identifies five forms of energy correctly.	Identifies six forms of energy correctly. - or - Identifies six forms of energy and a way in which the energy could be conserved.

Physical Science
Worksheet

GRADE LEVEL: Fourth

Topic: Matter and Energy

Grade Level Standard: 4-3 Examine matter and energy.

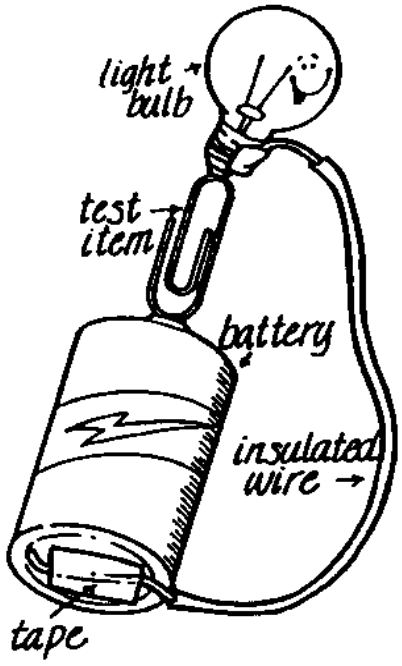
Grade Level Benchmark: 4. Construct simple, useful electrical circuits. (IV.1.E.4)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How do you build an electrical circuit?*** 1. Build an electrical circuit. 2. Conductor or Insulator ★ ★Activity is attached	"Simple Electrical Circuits Matter and Energy" MASER Project http://www.svsu.edu/mathsci-center/Maser%20Science/psmat.html Adamczyk, Peter, "Electricity and Magnetism." Usbourne, 1999.
Process Skills: Observing, Communicating, Developing a model	

New Vocabulary: batteries, bulbs, bells, motors, wires, electrical switches, complete loop

Electrical Engineer _____

Conductor or Insulator?



A **conductor** is any item that allows electrons to flow freely through it. The light bulb should light.

An **insulator** is any item that does not allow electrons to flow easily through it. The bulb will not light.

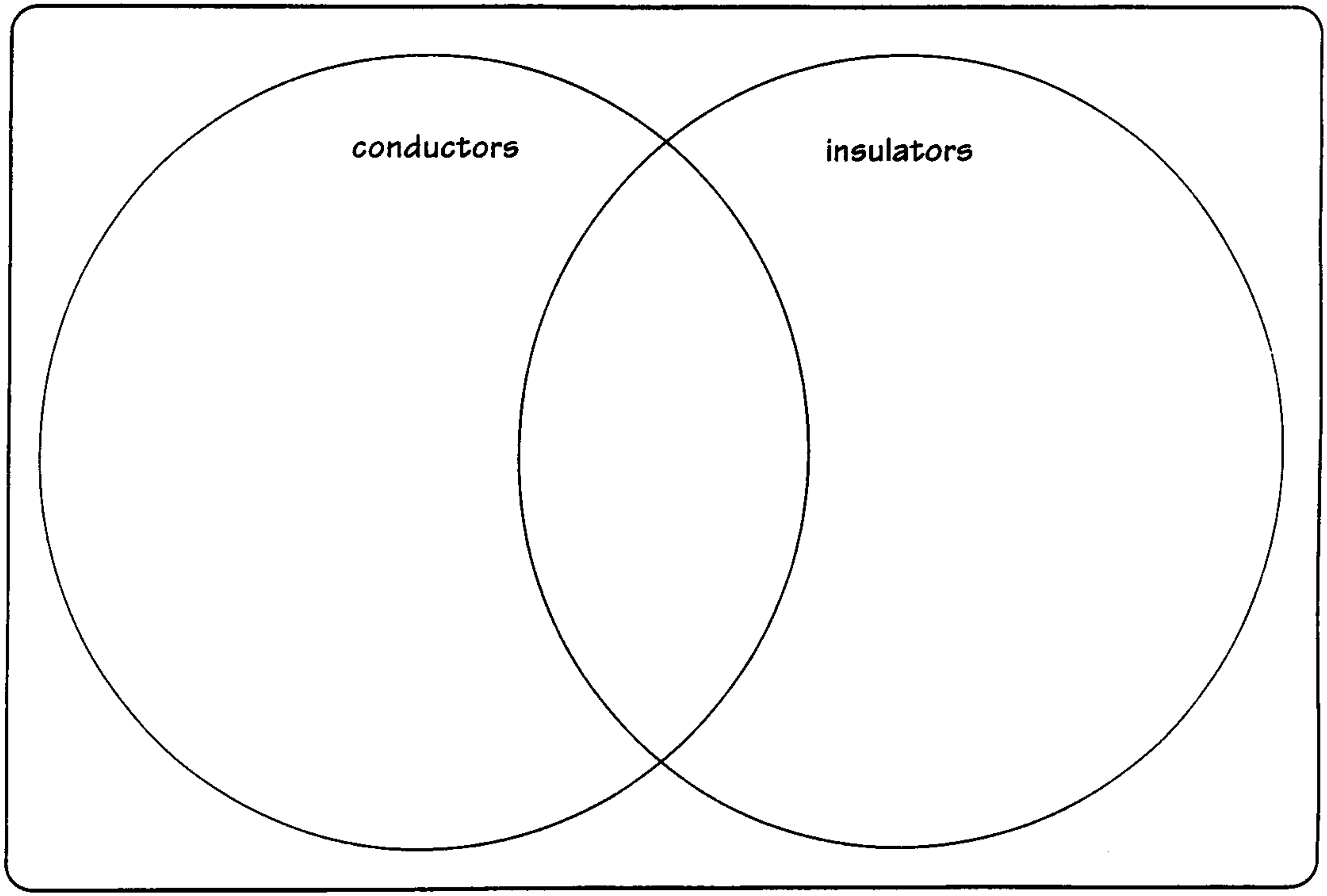
Tape the wire to the bottom of the cell. Wrap the wire around the metal side of the bulb. Tape it securely in place.

Test each item. Record your findings in the table below.

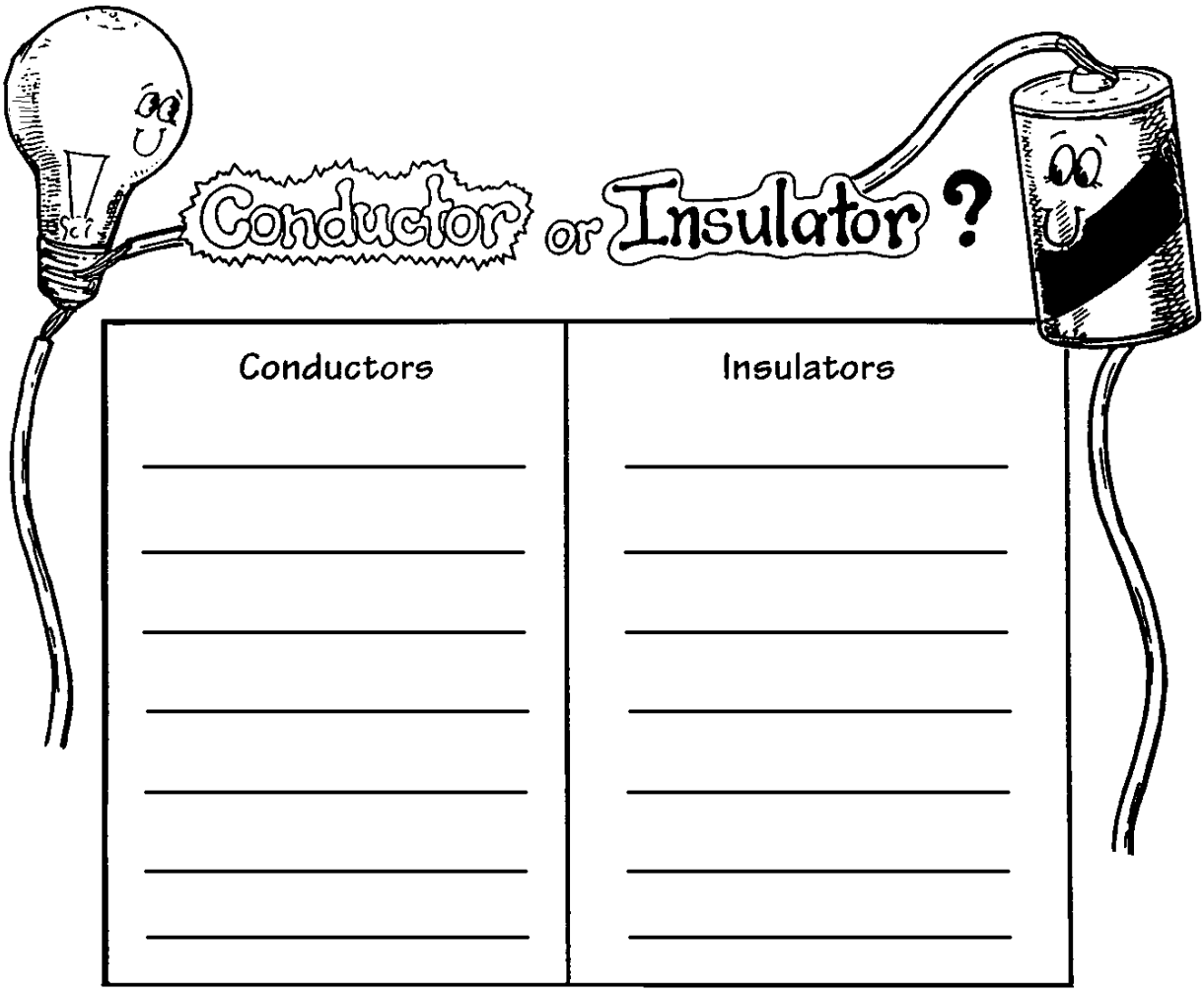
Item	Prediction	Conductor	Insulator
paper clip			
tape			
pencil			
string			
ruler			

Electrical Engineer ____________________

Conductor or Insulator?



Electrical Engineer _____



Conductors	Insulators
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

How are the conductors alike? _____

_____

How are the insulators alike? _____

_____

Conclusion: _____

_____

_____

Assessment
Grade 4

MATTER AND ENERGY

Classroom Assessment Example SCI.IV.1.E.4
(Construct simple, useful electrical circuits.)

Each student will create a useful electrical circuit using any of the following items: battery, wire, aluminum foil, masking tape, socket, bulb, bell, paperclip, or brad.

(No rubric needed; this is a pass/fail activity.)

Scoring of Classroom Assessment Example SCI.IV.1.E.4

Student successfully creates or fails to create a complete electrical circuit.

Physical Science
Worksheet

GRADE LEVEL: Fourth

Topic: Matter and Energy

Grade Level Standard: 4-3 Examine matter and energy.

Grade Level Benchmark: 5. Describe possible electrical hazards to be avoided at home and at school. (IV.1.E.5)

Learning Activity(s)/Facts/Information	**Resources**
<u>Central Question</u>: ***What are electrical hazards at home and school?***	
1. Students will draw common electrical hazards and share their illustrations with the rest of the class.	"Follow Safety Cat and Learn." MASER Project
2. Students will write and perform skits depicting various hazards of electricity.	
3. The teacher will invite an electrician, an appliance repairperson, or electrical inspector to the classroom for a presentation directed toward: – Safety consideration – Tools of the trade – The education and training needed – Local items of interest	
Process Skills: Communicating, Observing, Classifying	

New Vocabulary: shock, wall outlet, hazards

Assessment
Grade 4

MATTER AND ENERGY

Classroom Assessment Example SCI.IV.1.E.5
(Describe possible electrical hazards to be avoided at home and at school.)

Students will work in pairs to design posters with illustrations emphasizing one or more of the electrical safety rules learned in class. Students need to label their posters with the appropriate rules or create slogans that best reflect their safety rules.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.IV.1.E.5

Criteria	Apprentice	Basic	Meets	Exceeds
Appropriateness of safety rules	Attempts to label the poster with a safety rule.	Labels the poster with a safety rule that is either inappropriate, inaccurate, or unclear.	Labels the poster with an appropriate safety rule.	Labels the poster with an appropriate safety rule and a slogan.
Accuracy of illustration	Designs an illustration that does not match safety rule.	Designs one illustration that matches safety rule.	Designs two illustrations that match safety rule.	Designs three illustrations that match safety rule.

Physical Science
Worksheet

GRADE LEVEL: Fourth

Topic: Changes in Matter

Grade Level Standard: 4-4 Discover changes in matter.

Grade Level Benchmark: 1. Describe common physical changes in matter– dissolving, evaporating. (IV.2.E.1)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***What happens to matter when there is a physical change?*** 1. Make snowballs. 2. Break glass. 3. Crumble cookies. 4. Make clay models. 5. Dissolve sugar into water.	http://www.brainpop.com/ Hewitt, Sally. "Solid, Liquid, or Gas?" Children's Press, 1997. "Brain Pop-States of Matter." MASER Project
Process Skills: Observing, Predicting, Developing a model, Inferring	

New Vocabulary: solid, liquid, gas, bending, tearing, breaking, heating, cooling

Assessment
Grade 4

CHANGES IN MATTER

Classroom Assessment Example SCI.IV.2.E.1
(Describe common physical changes in matter—dissolving, evaporating.)

The teacher will prepare the following models, either real or through pictures:

Items	Sample changes and processes
• Whole cookie to cookie crumbs • Clay ball to clay sculpture • Ice cube to liquid water • Glass full of water to same size glass with little water • Glass of water and powdered drink mix to dissolving glass of water with powder mixed in the water	• Change in size, shape • Change in size, shape • Change in size, shape, melting – solid to liquid • Change in size • Change in color

Students will describe the physical changes that have occurred and name the processes that caused the change.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.IV.2.E.1

Criteria	Apprentice	Basic	Meets	Exceeds
Correctness of description	Incorrectly describes what happened.	Correctly describes what happened.	Correctly describes what happened.	Correctly describes what happened.
Accuracy of identification	Incorrectly identifies the physical change, and does not state that the changed object is made of the same material as the original object.	Incorrectly identifies the physical change, and does not state that the changed object is made of the same material as the original object.	Correctly identifies the physical change, but does not state that the changed object is made of the same material as the original object.	Correctly identifies the physical change, and states that the changed object is made of the same material as the original object.

Physical Science
Worksheet

GRADE LEVEL: Fourth

Topic: Changes in Matter

Grade Level Standard: 4-4 Discover changes in matter.

Grade Level Benchmark: 2. Prepare mixtures and separate them into their component parts. (IV.2.E.2)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***What are the different strategies for separating mixtures?*** 1. The teacher prepares a variety of solutions and mixtures using water, sugar, dirt, sand, gravel, leaves, iron fillings, salt, etc. Ask "What is the best way to separate each solution?" Student groups will chose a method, try it, and evaluate their success.	Cobb, Vicki. "Science Experiments You Can Eat." Harper, 1994
Process Skills: Communicating, Observing, Predicting, Inferring, Recording data	

New Vocabulary: dissolving, soluble, substances, evaporation, funnel, filter, mixture, solution, sieves, solar, still

Assessment
Grade 4

CHANGES IN MATTER

Classroom Assessment Example SCI.IV.2.E.2
(Prepare mixtures and separate them into their component parts.)

The teacher will prepare a variety of solutions and mixtures using water, salt, sugar, dirt, sand, gravel, leaves, iron filings, etc. Students will be asked to answer the question, "What is the best way to separate each mixture/solution?" Small groups will choose the appropriate method and tools to separate each solution or mixture. Students will use their chosen tools to separate the mixtures and solutions. They will evaluate the effectiveness of their choices of methods and tools.

Each student will record each mixture/solution, the chosen tools, and the chosen method of separation in his or her science journal. Each student will write conclusions that evaluate the effectiveness of the chosen tools and the chosen methods. The groups will present their evaluations to an audience.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.IV.2.E.2

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of data table	Creates incomplete data table.	Creates incomplete data table.	Creates incomplete data table.	Creates complete data table.
Accuracy of evaluations	Provides many inaccurate evaluations.	Provides some inaccurate evaluations.	Provides a few inaccurate evaluations.	Provides accurate evaluations.

Physical Science
Worksheet

GRADE LEVEL: Fourth

Topic: Waves and Vibrations

Grade Level Standard: 4-5 Investigate waves and vibrations.

Grade Level Benchmark: 1. Use prisms and filters with light sources to produce various colors of light. (IV.4.E.3)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***What colors are produced when manipulating a prism with light?***	
1. Students experiment with prisms, filters, and light sources to produce various colors of light.	Nankivell, Sally. "Science Experiments with Light." Watts, 2000.
Process Skills: Observing, Predicting, Experimenting, Inferring	

New Vocabulary: prisms, color filters, colored lights,

Assessment
Grade 4

WAVES AND VIBRATIONS

Classroom Assessment Example SCI.IV.4.E.3
(Use prisms and filters with light sources to produce various colors of light.)

Each student will use his or her knowledge of light to write a paragraph explaining why water appears to be shades of blue, why the sky looks blue, or why we see rainbows.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.IV.4.E.3

Criteria	Apprentice	Basic	Meets	Exceeds
Correctness of explanation	Provides incorrect explanation with no details.	Provides correct explanation with few details.	Provides correct explanation with some details.	Provides correct explanation with many details.

Physical Science
Worksheet

GRADE LEVEL: Fourth

Topic: Waves and Vibrations

Grade Level Standard: 4-5 Investigate waves and vibrations.

Grade Level Benchmark: 2. Explain how shadows are made. (IV.4.E.4)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How can we create a shadow?*** 1. Let students make hand shadows on the wall. 2. Go outside, look for shadows and what made them.	Jacobs, Frank. "Fun with Hand Shadows." Dover, 1996
Process Skills: Observing, Predicting	

New Vocabulary: shadow, sunlight, light bulbs, projectors, blocked path surface, object

Assessment
Grade 4

WAVES AND VIBRATIONS

Classroom Assessment Example SCI.IV.4.E.4
(Explain how shadows are made.)

On a sunny day, students will trace the shadow of an object placed between the Sun and the tracing paper. Each student will write a paragraph that accurately explains how he or she created the shadow. The paragraph will include appropriate terms: a light source, straight lines for light energy, a blocked path, an object and a shadow.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.IV.4.E.4

Criteria	Apprentice	Basic	Meets	Exceeds
Accuracy of explanation	Provides inaccurate explanation with many misconceptions and no detail.	Gives accurate explanation with one misconception and a few details.	Gives accurate explanation with no misconceptions and some details.	Gives accurate explanation with no misconceptions and many details.
Use of terms	Uses correctly one or no terms.	Uses correctly two or three terms.	Uses correctly four terms.	Uses correctly all five terms.

Earth/Space Science
Worksheet

GRADE LEVEL: Fourth

Topic: Solar System, Galaxy, and Universe

Grade Level Standard: 4-6 Distinguish between sun, moon, and earth.

Grade Level Benchmark: 1. Compare and contrast characteristics of the sun, moon, and earth. (V.4.E.1)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How are the sun, moon, and earth alike and different?*** 1. Students will work in groups to create a three-sided mobile that contains the characteristics of the sun on one side, moon on the other, and Earth on the third. Students will use books to do their own research. 2. Positions and Phases (Diagram) a. Diagram position of sun for a 24 hour period. b. Diagram phases of the moon for a month. c. Diagram earth position for a year.	Cole, Joanna. "Magic School Bus-Lost In the Solar System." Scholastic, 1990.
Process Skills: Observing, Researching, Classifying, Interpreting data, Developing models	

New Vocabulary: planet, star, sphere, space, solar system, larger/smaller, closer/farther, heat, light

Assessment
Grade 4

SOLAR SYSTEM, GALAXY, AND UNIVERSE

Classroom Assessment Example SCI.V.4.E.1
(Compare and contrast characteristics of the sun, moon, and earth.)

Students will use the information from their notes to complete a Venn diagram that compares and contrasts the sun, moon, and Earth.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example V.4.E.1

Criteria	Apprentice	Basic	Meets	Exceeds
Correctness of similarities (of sun, moon, and Earth)	Few similarities are correct.	Some similarities are correct.	Many similarities are correct.	All similarities are correct.
Correctness of differences (of sun, moon, and Earth)	Few differences are correct.	Some differences are correct.	Many differences are correct.	All differences are correct.
Correctness of labels	Few labels are correct.	Some labels are correct.	Many labels are correct.	All labels are correct.

Earth/Space Science
Worksheet

GRADE LEVEL: Fourth

Topic: Solar System, Galaxy, and Universe

Grade Level Standard: 4-6 Distinguish between sun, moon, and earth.

Grade Level Benchmark: 2. Describe the motion of the earth around the sun, and the moon around the earth. (V.4.E.2)

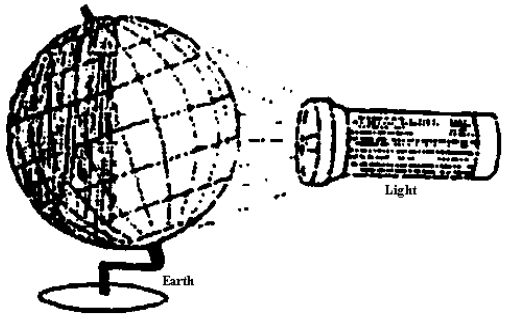
Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How does the moon move around the Earth?*** 1. Have the students break up into groups and make their own Earth-moon model. 2. Day and Night activities. ★ ★ Activity is attached	Fowler, Allan. "So That's How the Moon Changes Shape!" Children's Press, 1991.
Process Skills: Developing models	

New Vocabulary: spin, orbit, length of day, night-time, month, year, movement of the moon, calendar, revolve, revolution

WHAT MAKES DAY AND NIGHT?

PROBLEM

What makes day and night?



MATERIALS

Globe (earth)
Flashlight or base light or lamp
Scotch tape
Paper

PROCEDURE

1. Darken the room.
2. Have one child shine the flashlight on the globe. The flashlight represents the sun; the globe, the earth.
3. Ask the children what causes night; what causes day.
4. Cut a piece of paper and scotch-tape it on the globe to represent your city so the children can see where they live.
5. Rotate the globe and show what happens to their city as the earth rotates.
6. Ask how long it takes for the earth to rotate once. If you make it clear to them where the sun is shining to start with, they may be able to figure out for themselves that the earth rotates once a day. Have them work with the globe and flashlight to gain additional understanding.

RESULT

The children will learn that the earth rotates once each day. This causes night in part of the world while it is day is some other parts.

SUPPLEMENTAL INFORMATION

The rotation of the earth, not the movement of the sun, causes day and night.

THOUGHT QUESTIONS

1. Can you figure out if the earth rotates from east to west or west to east?
2. Why during some times of the year are days longer than nights and at other times nights longer than days?
3. How do we know the axis of the earth tilts in relation to the sun?

TAKEN FROM

Science Activities for Elementary Children, Nelson, L. W .and Lorbeer, G.C, Wm. C. Brown Publishers, Dobuque, Iowa, 1984.

EARTH AND SPACE

Earth's Rotation
Daytime vs. Nighttime

IDEAS TO BE DEVELOPED

1. Only one-half of the surface of a spherical object can be illuminated by direct radiation at any given time. Since only one-half of the earth's surface is illuminated by sunlight at any given time, the earth must be spherical in shape.
2. The earth rotates on its axis once every 24 hours. This period of time is called ONE DAY.
3. As the earth rotates, the part of its surface which faces the sun experiences "daytime"; the surface facing away form the sun experiences "nighttime".

MATERIALS

Shadow detector and peg
Two rubber bands
8 1/2" x 11" white paper
Volleyball
Globe
Watch/clock

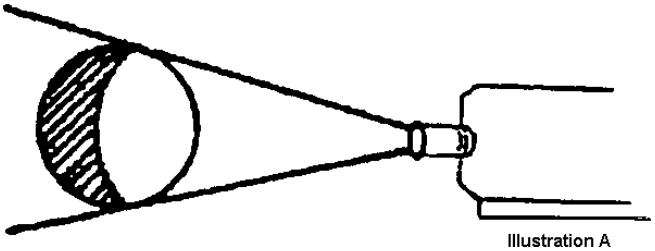


Illustration A

INVESTIGATIONS

A. The Shape of the Earth

Darken the room. Hold a book, edgewise, in the beam of light cast by the slide projector. Have the students observe that both sides of the book can be illuminated at the same time.

Hold a volleyball in the beam of light. Have the students observe that only on-half of the surface of the ball can be illuminated at a time.

Ask the students to tell why the entire surface of the ball does not receive light from the beam.

B. The Rotation of the Earth

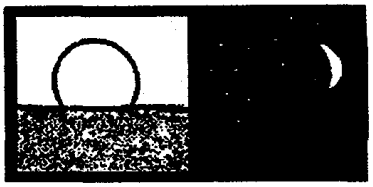
At a time when the sun is shining, have the students set up the shadow board outdoors. Place a piece of white paper on the board. Push the peg through the paper and into the hole in the board. Place a rubber band around each end of the board to hold the paper in place. Set the board on a level surface in a sunny location, as shown.

Mark the position of the shadow by making a dot in the middle of the shadow's thickness. Wait ten minutes. Again, make a dot in the middle of the shadow's thickness. Repeat after ten more minutes.

Name _____

Date _____

Day and Night
Student Sheet



Draw a picture showing the Earth and the sun. Write “day” on the part of the Earth that is in daytime. Use your pencil to color the part of the Earth that is in the nighttime.

Answer these questions. Share your answers with a partner to see if you both agree.

1. What causes day and night to happen?

   _____

   _____

2. Is it daytime for the whole Earth at the same time?

   _____

   _____

3. How long does it take the Earth to turn around once?

   _____

   _____

4. What do we call the turning of the Earth?

   _____

   _____

Assessment
Grade 4

SOLAR SYSTEM, GALAXY, AND UNIVERSE

Classroom Assessment Example SCI.V.4.E.2
(Describe the motion of the Earth around the Sun and the Moon around the Earth.)

Students will draw and label a diagram of the path of the moon as it moves around the Earth. Student must include a title for the diagram.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example V.4.E.2

Criteria	Apprentice	Basic	Meets	Exceeds
Correctness of moon's orbit	Draws moon's orbit incorrectly.	Draws moon's orbit correctly.	Draws moon's orbit correctly, and includes Earth's orbit around the sun.	Draws moon's orbit correctly, and includes Earth's orbit around the sun.
Completeness of labels	None/few labels or title for diagram.	Some labels or title for diagram.	Many labels or title for diagram.	All labels or title for diagram.

Science Process
Worksheet

GRADE LEVEL: Fourth

Topic: Science Processes

Grade Level Standard: 4-7 Construct an experiment using the scientific processes.

Grade Level Benchmark: 1. Use the scientific processes to construct meaning. (I.1.E.1-6)

Learning Activity(s)/Facts/Information	**Resources**
Central Questions: 1. ***How do scientists ask questions that help them learn about the world?*** 2. ***How do scientists figure out answers to their questions by investigating the world?*** 3. ***How do scientists learn about the world from books and other sources of information?*** 4. ***How do scientists communicate their findings to other scientists and the rest of society?*** 5. ***How do scientists reconstruct knowledge that they have partially forgotten?*** ★ Plant seeds from Organization of Living Things (4-1) Benchmark 2	
Process Skills: Observing, Predicting, Classifying	

New Vocabulary:

PRODUCTS OF SCIENCE

The process of science generates certain products which also can be arranged in an hierarchy of increasing complexity. These products include scientific terms, facts, concepts, principles, laws, theories, models, and applications.

SCIENTIFIC TERM

A word or words that scientists use to name an entity, object, event, time period, classification category, organism, or part of an organism. Terms are used for communication and would not normally include names given to concepts, laws, models, or theories.

SCIENTIFIC FACT

An observation, measurement, logical conclusion from other facts, or summary statement, which is concerned with some natural phenomenon, event, or property of a substance, which, through an operationally defined process or procedure, can be replicated independently, and which, through such replication, has achieved consensus in the relevant scientific profession. Facts include things such as the speed of light or properties of materials like boiling points, freezing points, or size.

SCIENTIFIC CONCEPT

A regularly occurring natural phenomenon, property, or characteristic of matter which is observable or detectable in many different contexts, and which is represented by a word(s) and often by a mathematical symbol(s) is called a scientific concept. When a scientific concept is fundamental to other concepts and is used extensively in creating such other concepts in nature, like length (or distance), mass, electric charge, and time. Most scientific concepts are derived, that is, defined in terms of basic or other scientific concepts. When a derived scientific concept is in the form of an equation, it is a mathematical definition, not a natural relationship (e.g., destiny, speed, velocity acceleration).

SCIENTIFIC PRINCIPLE

A generalization or summary in the form of a statement or mathematical for when expression, a set of observations of, or measurements for, a variable representing a concept shows a regular dependence on one or more other variables representing other concepts. A principle of science is an expression of generalizations that are significant but are not at the level, in terms of broad applicability or generalizability, to be a scientific law.

EMPIRICAL LAW

An empirical law is a generalization of a relationship that has been established between or more concepts through observation or measurement, but which relies on no theory or model for its expression or understanding. Such laws have important application and are of great importance as cornerstones for theories or models. Examples include Snell's law of refraction, Kepler's Laws, and evolution (but not the theory of natural selection).

SCIENTIFIC THEORY

An ordinary-language or mathematical statement created or designed by scientists to account for one or more kinds of observations, measurements, principles, or empirical laws, when this statement makes one or more additional predictions not implied directly by anyone of such components. When such prediction or predictions are subsequently observed, detected, or measured, the theory begins to gain acceptance among scientists. It is possible to create alternative theories, and scientists generally accept those theories which are the simplest or most comprehensive and general in their accommodation to empirical law and predictive capability (e.g., atomic theory, kinetic molecular theory, theory of natural selection, theory of plate tectonics, quantum theory). Theories which can account only for existing laws make no new predictions, or at least do not have greater simplicity or economy of description when offered as alternatives to accepted theories, are of little value and therefore, generally do not displace existing theories.

SCIENTIFIC MODEL

A representation, usually visual but sometimes mathematical or in words, used to aid in the description or understanding of a scientific phenomenon, theory, law, physical entity, organism, or part of an organism (e.g., wave model, particle model, model of electric current, "Greenhouse" model of the Earth and atmosphere).

UNIVERSAL LAW

A law of science that has been established through repeated unsuccessful attempts to deny it by all possible means and which therefore, is believed to have applicability throughout the universe. There are few such laws, and they are basic to all of the sciences (e.g., Law of Universal Gravitation, Coulomb's Law, Law of Conservation of Energy, Law of Conservation of Momentum).

APPLICATION OF SCIENCE

Utilization of the results of observations, measurements, empirical laws, or predictions from theories to design or explain the working of some human-made functional device or phenomenon produced by living beings and not otherwise occurring in the natural world. (Some such applications depend on several laws or theories, and historically many have been devised without the humans involved having prior knowledge of those theories or laws.) Applications would include engineering and technology and the utilization of science in making decisions on issues that have scientific basis, for example, the relative radiation damage possible from human-made sources as compared with natural radiation.

PROCESS OF SCIENCE

The scientific endeavor involves continually examining phenomena and assessing whether current explanations adequately encompass those phenomena. The conclusions that scientists draw never should assume a dogmatic character as science necessarily is tentative. Authorities do not determine or create scientific knowledge, but rather scientists describe what nature defines and originates.

Those engaged in the scientific endeavor use and rely on certain processes. The processes can be arranged in an hierarchy of increasing complexity–observing, classifying, measuring, interpreting data, inferring, communicating, controlling variables, developing models and theories, hypothesizing, and predicting–but the process scientists use usually do not and need not "happen" in this order.

OBSERVING
Examining or monitoring the change of a system closely and intently through direct sense perception and noticing and recording aspects not usually apparent on casual scrutiny.

CLASSIFYING
Systematic grouping of objects or systems into categories based on shared characteristics established by observation.

MEASURING
Using instruments to determine quantitative aspects or properties of objects, systems, or phenomena under observation. This includes the monitoring of temporal changes of size, shape, position, and other properties or manifestations.

INTERPRETING DATA
Translating or elucidating in intelligible and familiar language the significance or meaning of data and observations.

INFERRING
Reasoning, deducing, or drawing conclusions from given facts or from evidence such as that provided by observation, classification, or measurement.

COMMUNICATING
Conveying information, insight, explanation, results of observation or inference or measurement to others. This might include the use of verbal, pictorial, graphic, or symbolic modes of presentation, invoked separately or in combination as might prove most effective.

CONTROLLING VARIABLES
Holding all variables constant except one whose influence is being investigated in order to establish whether or not there exists an unambiguous cause and effect relationship.

DEVELOPING MODELS AND THEORIES

Created from evidence drawn from observation, classification, or measurement, a model is a mental picture or representative physical system of a phenomenon (e.g., a current in an electric circuit) or real physical system (e.g., the solar system). The mental picture or representative system then is used to help rationalize the observed phenomenon or real system and to predict effects and changes other than those that entered into construction of the model. Creating a theory goes beyond the mental picture or representative model and attempts to include other generalizations like empirical laws. Theories often are expressed in mathematical terms and utilize models in their description (e.g., kinetic theory of an ideal gas, which could utilize a model of particles in a box).

HYPOTHESIZING

Attempts to state simultaneously all reasonable or logical explanations for a reliable set of observations–stated so that each explanation may be tested and, based upon the results of those tests, denied. Although math can prove by induction, science cannot. In science, one can only prove that something is not true. Accumulated evidence also can be used to corroborate hypotheses, but science remains mainly tentative.

PREDICTING

Foretelling or forecasting outcomes to be expected when changes are imposed on (or are occurring in) a system. Such forecasts are made not as random guesses or vague prophecies, but involve, in scientific context, logical inferences and deductions based (1) on natural laws or principles or models or theories known to govern the behavior of the system under consideration or (2) on extensions of empirical data applicable to the system. (Such reasoning is usually described as "hypothetico-deductive.")

Source: The National Science Teachers Association

Science Process
Worksheet

GRADE LEVEL: Fourth

Topic: Science Processes

Grade Level Standard: 4-8 Reflect on an experiment using the scientific processes.

Grade Level Benchmark: 1. Use scientific processes to reflect on meaning. (II.1.E.1-4)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***Do dark colors absorb the heat better than light colors?*** Heat and Color ★ 1. Observing – Observe difference of two different colors (black, white) of paper that have been placed in the sun. Is there a difference in the temperature. 2. Classifying – Place several different colored pieces of paper in the sun. Classify them in rank order by amount of heat. 3. Measuring – Measure temperature of water with thermometers. 4. Communicating – Explain results of experiment verbally or graphing. 5. Developing models and theories – Take temperature of water and record on a graph. Students will observe that dark colors absorb heat faster than light colors.	AIMS
Process Skills: Observing, Predicting, Classifying	

New Vocabulary:

Heat and Color

I. Topic Area

Physical Science—Heat—Absorption of Heat by Colors

II. Introductory Statement

Students will observe that dark colors absorb heat faster than light colors.

III. Math Skills

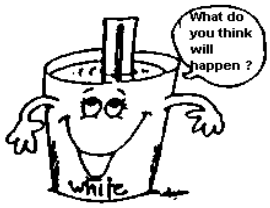
Measuring
Comparing
Graphing
Problem solving
Timing

Science Processes

Observing
Communicating
Collecting/Recording data
Drawing conclusions
Interpreting data

IV. Materials

Two white styrofoam cups
Black paint
Two thermometers
Water



V. Key Question

Do dark colors absorb the heat better than light colors?

VI. Instructional Information

Black or dark colors absorb the light and change it to heat. Light colors act as reflectors and bounce light off. Light that is absorbed is changed to heat energy. Temperature is the measure of heat energy. The black cups will collect more light energy so that the water temperature inside will rise faster than the water temperature inside the white cups.

VII. Management Suggestions

1. Paint the outside of one Styrofoam cup black. (The cup could be covered with black construction paper.)
2. Coffee cans can be used, but one can should be covered with black paper and one with white paper.
3. Teachers: before printing student sheet, mark the degrees in Celsius or Fahrenheit.

VIII. Procedure

I. Place two pieces of construction paper, one piece black and one white, in the sun. After a short period let the students feel each piece of paper. Is there a difference in the temperature of the papers? Ask the students why they think the two pieces have different temperatures.

2. Ask the students why it is beneficial to wear light colored clothes in the summer and darker colors in the winter .

3. Take two styrofoam cups. Paint the outside of one of the cups black (or cover with black paper). Leave the other one white. Coffee cans can be used. Cover one with black paper and the other one with white paper.
4. Pour equal amounts or tap water into both cups.
5. Put a thermometer in each cup. Take the temperature or the water in both cups. Record on the worksheet.
6. Put the cups outside in the sunshine for 30 minutes.
7. Take the temperature of the water in each cup again. Record on the worksheet.
8. Leave the cups in the sun for another 30 minutes: again read the temperature and record.

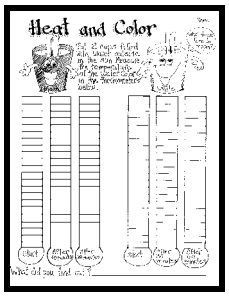
IX. Discussion Questions

I. What is the difference in the temperatures of the two cups?

2. Ask the students if they can explain what happened? (Black or dark colors absorb the light energy from the sun and it is changed to heat. Light colors act as reflectors and bounce light off.)
3. What would happen if the cups had been placed outside in the shade?
4. Would the temperature be different if another color had been used on the cup (green for example)? or if the outside of the cup was covered with aluminum foil?
5. What if you covered the tops of the cups with plastic wrap or a piece or cardboard?

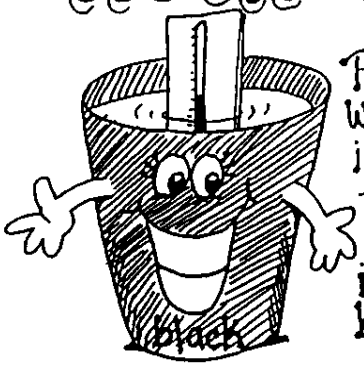
X. Extension

I. Cut squares from 6 to 8 different colors of construction paper. Be sure to include one that is black and one that is white. Put the squares of construction paper in the sun. Leave for 5 minutes, then let the students feel the papers to see if there is a temperature difference. Now place a thermometer under each square of paper and leave for five minutes. Then read the thermometer. Is there a difference in the temperature? Which color registered the highest temperature? Which color the lowest temperature?

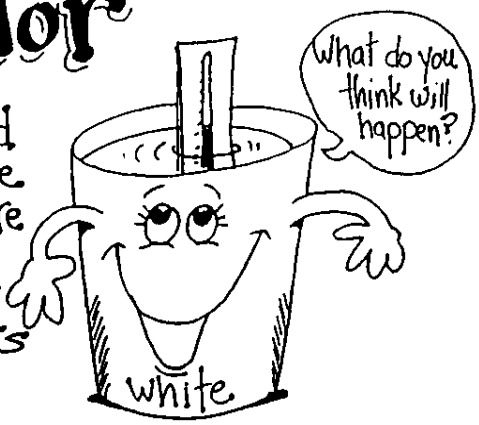


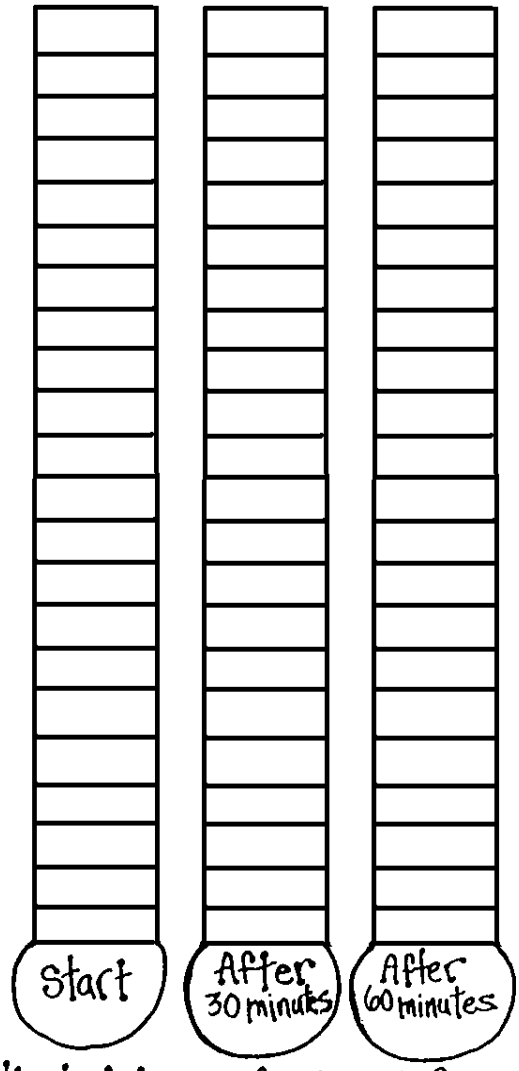
Name _____

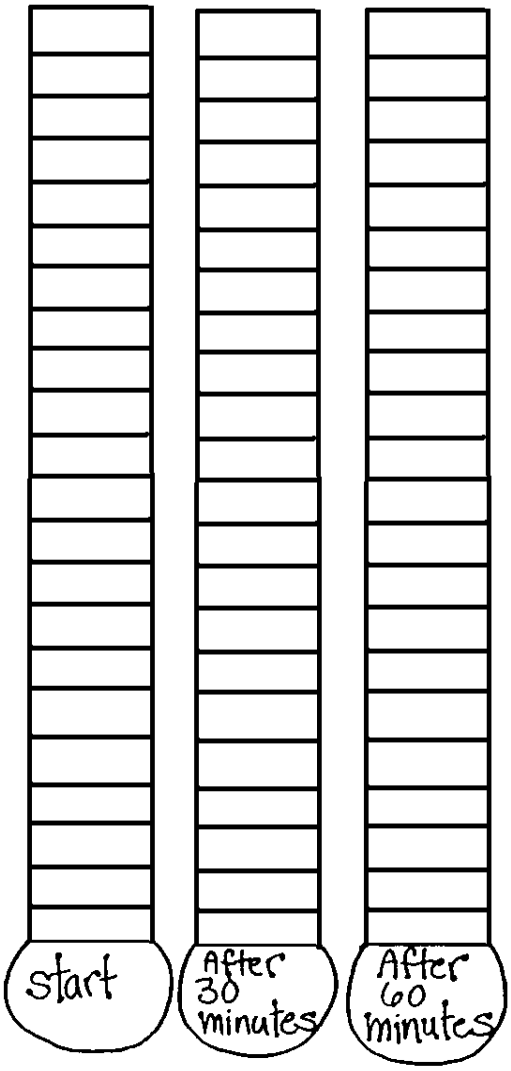
Heat and Color



Put 2 cups filled with water outside in the sun. Measure the temperature of the water. Color in the thermometers below.







What did you find out? _____

Science Process Worksheet

GRADE LEVEL: Fourth

Topic: Science Processes

Grade Level Standard: 4-9 Apply the scientific method.

Grade Level Benchmark: 1. Use the scientific method to conduct an experiment.

Learning Activity(s)/Facts/Information	**Resources**
1. Have students complete Lab Reports outlined in the Scientific Method. • Topic • Hypothesis • Materials • Procedure • Results • Conclusion	
Process Skills:	

New Vocabulary:

Name _____

HYPOTHESIZING

1. **Question**: How does the size of a sponge affect the amount of water it will hold? Your hypothesis (educated guess):

   _____

   _____

2. Place the 2 cm X 2 cm sponge on the construction paper.
   - Fill the graduated cylinder with water to the 250-ml mark.
   - Pour water 10 ml at a time evenly over the sponge. Each time, lift the sponge. When the paper is wet, stop pouring.
   - Subtract the amount of water left in the cylinder from 250 to find out how much water saturated the sponge.
   - Record this number in the chart below.
   - Refill the graduated cylinder.

3. Repeat with the remaining three sponges.

Sponge Size 250 ml - _____ (water level after saturating sponge) = ____ ml

2 cm X 2 cm		
3 cm X 3 cm		
4 cm X 4 cm		
5 cm X 5 cm		

4. Did your investigation support your hypothesis? _____

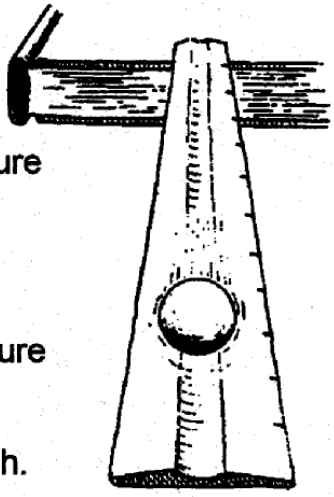
5. Explain. _____

   _____

   _____

Name _____

CONTROLLING VARIABLES



1. Make a ramp by setting the ruler on top of one of the books or blocks.
2. Roll the marble from the top of the ramp and measure the distance it travels from the end of the ramp.
3. Record the distance in the chart below.
4. Add another book and roll the marble again. Measure the distance it travels from the end of the ramp.
5. Repeat this procedure until the ramp is 6 books high.

Height of the Ramp	Distance marble travels from end of ramp in centimeters
1 book	
2 books	
3 books	
4 books	
5 books	
6 books	

6. Which variable did you change?

_____

7. Which variable responded to the change (what did you measure)?

_____

8. What variables were kept constant?

_____

Name _____

COMMUNICATING

Read the ingredients listed on the product label. List the ingredients in order and the amount of each ingredient (if given) in the chart below. (Ingredients on product labels are listed from most to least abundance.)

Name of Product _____

Ingredient	Amount of Ingredient (if given)

List everything you learned about this product from the label.

_____

_____

_____

Name _____

OBSERVING

1. Use your eyes, ears, hands, and nose to observe the shell.
2. Describe the color of the shell. _____

   _____
3. Describe the shape of the shell. _____

   _____
4. Describe the size of the shell. _____

   _____
5. Describe the texture of the shell. _____

   _____
6. Describe the sound of the shell. _____

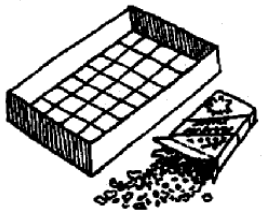
   _____
7. Describe the odor of the shell. _____

   _____
8. Draw and color of picture of the shell in the box below.

Name _____

ESTIMATING

1. Use the grid in the box and/or the containers to estimate the number of raisins in the box of cereal. (Do not count every raisin.) Use the box below to do your calculations.



2. Record your estimate of the number of raisins in the box. _____

3. Describe what you did to estimate the number of raisins in the box.

_____

_____

_____

_____

Technology
Worksheet

GRADE LEVEL: Fourth

Topic: Technology

Grade Level Standard: 4-10 Choose and use appropriate technology.

Grade Level Benchmark: 1. Assess and choose appropriate technology in a scientific investigation/experiment.

Learning Activity(s)/Facts/Information	**Resources**
1. Virtual field trip. 2. Research work. 3. PowerPoint presentations (Hyperstudio) 4. Create documents. 5. Virtual disections. 6. Science Fair	
Process Skills:	

New Vocabulary:

Gender/Equity
Worksheet

GRADE LEVEL: Fourth

Topic: Gender/Equity

Grade Level Standard: 4-11 Consider the contributions of diverse groups to science.

Grade Level Benchmark: 1. Develop an awareness of contributions made to science by people of diverse backgrounds and cultures. (II.1.E.5)

Learning Activity(s)/Facts/Information	**Resources**
1. Biographies — explore contributions by diverse groups to science. 2. Students use multimedia to locate information on gender and race involved in cell, heredity, matter and energy, changes in matter, and solar system, galaxy and universe. 3. Role play one of the famous people. 4. View a video of one of the famous people. 5. Make a bulletin board or poster of one of the famous people.	Internet
Process Skills: Observing, Communicating, Interpreting, Inferring	

New Vocabulary:

Benjamin Banneker (1737-1806)

ASTRONOMER, INVENTOR, WRITER AND MATHEMATICIAN

Benjamin Banneker was born in November of 1731 in Baltimore County, Maryland. His father, Robert, was a freed Negro slave who took his wife's surname at the time of their marriage because he did not have one of his own. Benjamin's mother was the daughter of an indentured English woman and a freed Negro slave. It was this maternal grandmother who was able to establish a small tobacco farm and purchase two slaves. She then gave them their freedom and married one of the two — Banneker. He is said to have been an African prince.

Benjamin's father purchased a 100-acre farm with his savings and built a log cabin home. Benjamin was raised and spent most of his years here. Grandmother taught him to read and write using the Bible, and he also attended the local school.

Benjamin had a healthy appetite for reading, but books were scarce. So, he taught himself literature, history, and mathematics during the hours following his workday on the farm. He excelled in math, and enjoyed collecting and creating mathematical puzzles. He eventually took over his parent's farm and was excellent at this, too.

One day, a traveling salesman showed Benjamin a pocket watch. He had never seen such a thing and was so fascinated by it that the salesman gave it to him. Its gears and wheels struck Banneker as a mathematical challenge. He went on to design and build the first all-wood striking clock ever built in the United States. It kept perfect time for some 40 years.

In 1771, the five Ellicott brothers purchased a tract of land adjacent to the Banneker farm. The Ellicotts were working toward developing the area into a successful center for wheat and flour milling, complete with saw mills, flour mills, an iron foundry and a general store. One of the Ellicott brothers had a son, George, who was interested in science. Benjamin enjoyed the friendship of his neighbors, especially George because of their common interest in science. Banneker taught himself astronomy using textbooks George loaned him, and the pair used the mills as an observatory.

Banneker even learned to project lunar and solar eclipses, and to calculate an ephemeris (a table giving the predicted positions of solar bodies over a period of time). Even though the ephemeris he developed for a 1791 almanac was not included in that volume, Banneker continued his self-education, learning to use astronomical instruments and other types of surveying equipment.

During that same year, U.S. President George Washington appointed Major Andrew

Ellicott, a cousin of George, to survey the Federal Territory (now Washington, D.C.) because it was the site of the new national capital. The Major needed someone competent to serve as his assistant and to use scientific equipment. He met Banneker on a visit to the Mills. After a few hints from George, Major Ellicott enlisted Banneker as his scientific assistant until such time as the Major's brothers could join him. At that time, Banneker returned to his farm and continued his astronomical observations.

With the help of George Ellicott and the Pennsylvania and Maryland abolition societies, his ephemerides were finally published in 1792 as a part of a series of almanacs that carried Banneker's name. In fact, the almanacs were such a success that he took up calculations for future publications full time.

Prior to its publication, Banneker had sent a copy of his ephemeris to Thomas Jefferson, who was then the Secretary of State. Jefferson was so impressed with Banneker's work that he forwarded it to the Academie des Sciences in Paris, along with a letter in which Banneker urged the abolition of Negro slavery .The Academie did not have a chance to act on this body of work because the French Revolution began. But, Banneker and Jefferson began corresponding, and some of these letters were included in future almanacs.

Just short of his 75th birthday, Benjamin Banneker died. During his burial, Banneker's house caught fire and burned to the ground, destroying all its contents - including the wooden clock, his books and his writings. Fortunately. however, all the books and instruments which had been loaned to him by George Ellicott had just been returned.

Among these articles was found a book of entries of accounts and astronomical notes. Also, his astronomical journal, which contained the original collection of calculations for each of Banneker's ephemerides, a selection of borrowed scientific works, some of his creative writings, the original manuscript of his first almanac of 1792, and a few personal letters.

Banneker's scientific works have been examined, and modern scientists confirm that he was an extremely accomplished mathematician. His ephemerides rank highly among others compiled by leading scientists of the same time period. And, he was living proof that all men are created equal. As Senator James McHenry said of Banneker: "I consider this Negro as a fresh proof that the powers of the mind are disconnected with the color of the skin."

References

The Life of Benjamin Banneker. Silvio Bedini. Scribner, New York, 1971.

Memoir of Benjamin Banneker. John H.B. Latrobe. Printed by John D. Toy, Baltimore, 1845.

LIFE SCIENCE: HEREDITY

James E. Bowman, Jr. (1923-)

RESEARCHED GENETIC VARIATIONS AND DISORDERS

Dr. James Bowman is noted not only as a scientist who has studied genetic characteristics of African populations, but also as someone who used his findings to debunk popular myths about the supremacy of one race over another.

Born in Washington, DC, in the early 1920's, James Bowman received his bachelor's degree from Howard University in 1943 and went on to Howard Medical School to earn an M.D. (medical doctor) degree. An internship at Freedmen's Hospital followed before Dr. Bowman left the nation's capital to complete a pathology residency at St. Luke's Hospital in Chicago, Illinois.

His research career has dealt mainly with genetic variations and disorders common among the many African populations. Dr. Bowman studied these variations and traced their migrations, not only within the continent of Africa, but throughout the world. He also analyzed issues of pigmentation, hemoglobinopathies (diseases of the red blood cells), lactose intolerance, malaria (a major killer in Africa), hypertension and diabetes, among others.

This research found that genetic disorders vary from population to population. For example, sickle-cell anemia is more prominent in Africans and African-Americans than in Europeans and European-Americans. On the other hand, African-Americans are less prone to disorders like PKt, cystic fibrosis and Tay-Sachs disease.

But, Dr. Bowman has not limited his interests strictly to science. He has also addressed the legal and ethical questions that follow genetic research. At different times throughout history, genetic research has been misused—when it was used as "evidence" to support theories of white supremacy over Jews, Africans and other ethnic groups, for instance. Some organizations have taken any number of valid genetic characteristics among ethnic groups, and then interpreted the data to fit their own beliefs.

Where these misuses have occurred and could have shaped public policy and laws, and determined how national resources were used, Dr. Bowman came forward to speak out. He influenced changes in legislation and policy which deal with sickle-cell traits and diseases. And, Dr. James E. Bowman, Jr., has made a significant contribution to fairness and equality for all ethnic groups by helping others understand what genetic research findings really mean.

References

Distribution and Evolution of Hemoglobin and Globin Loci. J. E. Bowman ed. New York: Elsevier/North Holland 1983.