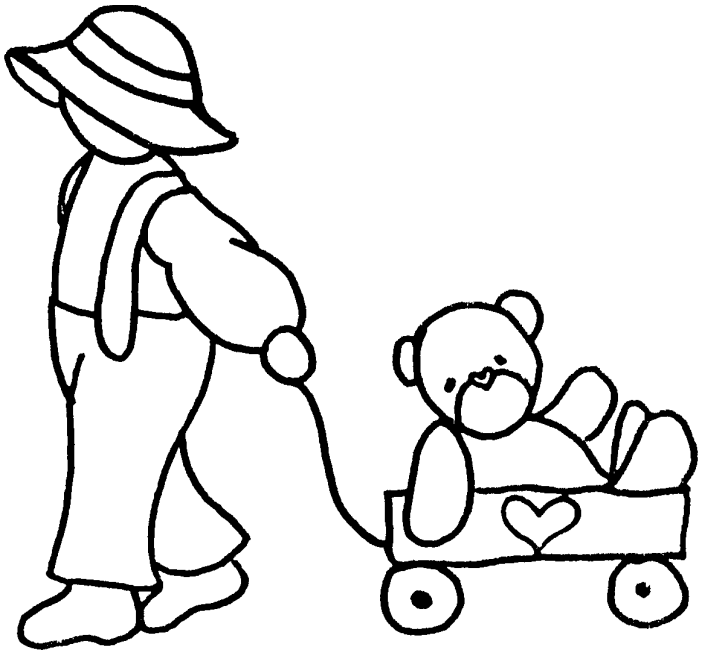
Applied Science

Our Technological World

SIXTH GRADE

SCIENCE AND MATH



3 WEEKS
LESSON PLANS AND
ACTIVITIES

APPLIED SCIENCE
OVERVIEW OF SIXTH GRADE

SCIENCE AND MATH

WEEK 1.
PRE: *Investigating critical thinking.*
LAB: *Exploring topology of a closed surface.*
POST: *Exploring how math and science are related.*
WEEK 2.
PRE: *Exploring how mathematical sequences are found in nature.*
LAB: *Exploring design.*
POST: *Designing an experiment.*
WEEK 3.
PRE: *Discussing how fibers become fibers.*
LAB: *Comparing and contrasting different fibers.*
POST: *Investigating fibers present in your home.*

PHYSICS

WEEK 4.
PRE: *Investigating matter and its interactions.*
LAB: *Exploring the nature of motion.*
POST: *Exploring the different laws of motion.*
WEEK 5.
PRE: *Exploring the motion of fluids.*
LAB: *Observing and recording motion of fluids.*
POST: *Investigating fluids in motion.*

TECHNOLOGY

WEEK 6.
PRE: *Investigating Bernoulli's principle.*
LAB: *Experimenting with different types of gliders.*
POST: *Exploring forces that affect gliders.*
WEEK 7.
PRE: *Exploring how design can overcome friction.*
LAB: *Investigating aerodynamic design.*
POST: *Comparing rockets and airplanes.*

BUILT ENVIRONMENT

WEEK 8.
PRE: *Exploring living requirements in space.*
LAB: *Observing toys in space.*
POST: *Designing a space station*
.

APPLIED SCIENCE - SCIENCE AND MATH (6A)

PRE LAB

Students determine scientific method.

OBJECTIVES:

1. Exploring lab procedure.
2. Investigating critical thinking.

VOCABULARY:

critical thinking
hypothesis
science
scientific methods

MATERIALS:

worksheet
examples of beakers, microscope, and other lab equipment
The Dinosaur is the Biggest Animal that Every Lived by S. Simon.

BACKGROUND:

If this is the first science class of the new school year, have students discuss their impressions of science. Students' knowledge of science should be good if they have used the Integrating Science, Math, and Technology program throughout elementary school. If starting this program for the first time, or only in the second year, students may have difficulty with some of the activities. We suggest you start with some of the fourth or fifth grade Science and Math activities.

Science is a built up accumulation of content and process. However, if students have not been exposed to content, they cannot make connections to truly understand the scientific method. "Light bulbs" should begin turning on if students have been prepared to understand that math and science are the foundation of our society.

PROCEDURE:

1. Discuss your particular lab procedures. Stress safety when using any item in the lab. If a lab is not available, make sure students know the rules of your classroom.

2. Introduce students to a science lab by showing them beakers, flasks, or any other science equipment. See if they remember what the items are used for. Students should be cautious and careful when using equipment. Scientific equipment is used for investigation.

3. Examples from *The Dinosaur is the Biggest Animal that Ever Lived* will help overcome some of the misconceptions of science. If students have gone through the entire I. Science MaTe program, many of these misconceptions have been corrected.

4. Go over scientific methods with the students by using the enclosed lab sheet. Remember, there is usually more than one way to answer a question. This can be a homework assignment followed by discussion of students answers.

5. Suggested answers:

Question 1. What effects do different colored lights have on plant growth? Key points: Students should remember to have a control so they can compare their experiment with a plant that is not part of the experiment. They might design an experiment to evaluate the effect of colored lights. Students may use different colored lights but they must use the same type of plant.

Question 2. How do you tell if two rocks are the same? Key points: Scientist could describe the minerals in the rocks and compare the minerals to see if they are the same. They also might test the rocks to see if they have other similar properties like density or color.

Question 3. Does smoking cigarettes cause lung cancer in humans? Key points: This is a hard one. A scientist cannot force humans to smoke and then see if they die. However, they can study the health of people who smoke and don't smoke. Scientists then see if there is a higher percentage of death due to cancer over a 20 year period by recording which percentage died due to cancer. A scientist also may look at county medical records. They study the information related to causes of death of people and then calculate the percentage due to cancer.

APPLIED SCIENCE - SCIENCE AND MATH (6A) PRE LAB

WHAT IS THE SCIENTIFIC METHOD?

In the following situations, propose a possible question a scientist can answer to solve the problem. Be specific.

1. A scientist wants to establish how color effects plants. Design an experiment that will help the scientist find out.

_____

_____

_____

_____

2. A scientist wants to establish if two rocks are the same. What can that scientist do to find out if they are the same?

_____

_____

_____

_____

3. A scientist wants to establish if people who smoke cigarettes have more deaths due to lung cancer then people who do not smoke. How can that scientist find out?

_____

_____

_____

_____

APPLIED SCIENCE - SCIENCE AND MATH (6A)

LAB

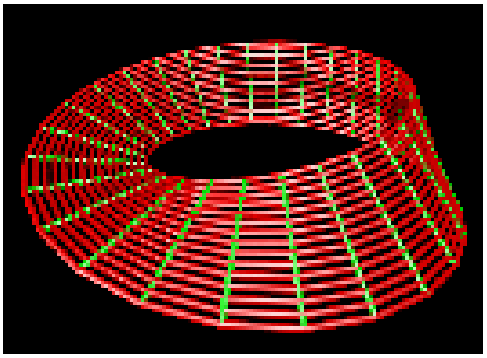
Students use tangles to explore topology.

OBJECTIVES:

1. Investigating the relationship of mathematics and science.
2. Exploring the topology of a closed surface.

VOCABULARY:

geometry
mathematics
ring
surface
topology



MATERIALS:

Applied Science - Science and Math (6A) or tangles

BACKGROUND:

Children love to play with different shaped blocks and build structures. The inherent beauty of these three-dimensional objects is somehow lost when mathematics turns to paper and pencil arithmetic. Keep in mind that because a child is not good in arithmetic computation, doesn't mean the child cannot conceptualize higher mathematical skills.

The least needed skill in science is computational skill because addition, subtraction, multiplication, and division are easily obtainable by a calculator. This doesn't mean these parts of mathematics are not important, they just are not the door that opens children's minds to higher mathematics. This activity exposes students to a different field of mathematics that is more abstract and has more direct relationship to science.

Mathematics also relates to nature. Emphasize that the importance of mathematical relationships helps determine patterns in nature. We give students the skills to measure straight objects, but most objects are curved. Even a straight line must curve sometimes. (If we were a flat Earth a line could be straight, but a continuous line will eventually curve!) Mathematics is almost mystical because the results are sometimes not easily explained.

PROCEDURE:

1. This activity has more questions than answers and is like a mathematical puzzle. If geometrically based puzzles are available, include them with this lab.

2. This lab also tries to show mathematics as a subject that can be fun as well as

complicated. Topology is a branch of mathematics that relates the points of an object that can be distorted. A lump of clay is a collection of points that can be squeezed without changing topologically. Shape and size are unimportant, but the connectivity of a figure is. This is very different from the strict measurements we usually require of students. Remember that the Earth, Solar System, and Universe are all somehow connected but the points keep changing in space. Topology simply is the study of closed curves. Just think of it, a sphere and a potato are topologically equivalent!

3. In the module, there are sets of "tangles." When closed, a tangle is a good example of how a closed surface can make many shapes. These shapes are topologically related. Follow the worksheet and have students work out the problems. Remember the key objective is for students to relate to curves and discover how difficult it is to describe and quantitate curves.

4. **ANSWERS:**

1. Students should make 3 shapes that are topologically related. Notice that although the circumference of the closed curve remains the same, the area inside changes constantly. Have students use 16 segments for this activity and trace the curves on the worksheet. Use the larger tangle to show unique shapes to the entire class.

2. Students are asked to see if they can make a knot from the closed curve of 16 segments. They cannot. They are then asked to make a knot by unsnapping just one link. If students have difficulty with this, have them think of the tangle as a shoe lace and then ask them to make a knot. Have the students compare a knot with a closed curve. They will notice that the knot interweaves where the closed curve does not.

3. Keeping the tangles closed, have students make a coil. This will require them to "wrap" the curves.

4. Students are asked if the curved surface can be made flat if they unsnap one of the links on the tangle. Yes, they can, if they make the tangle in a undulating wave pattern. Students are then asked if they can measure the curves with a ruler. The answer is no, curves are difficult to measure and have to be determined by a mathematical relationship that includes using the constant pi (determining the circumference of a circle).

5. Students are asked to make as many circles from the tangles of 16 curves. They will find that they can make 4 (4 curves make one circle). Give them instructions of how to find the circumference of the outside circle and the inside circle. Measure the diameter and multiply by pi or 3.14. The circles are 2.5 cm on the outside and 1.5 on the inside. The circumference is 2.5 times 3.14 (7.85) and 1.5 times 3.14 (4.71). An easy way to refer to the circumference is 2.5 pi and 1.5 pi. Now, can the students determine the length of the tangle. Yes. Some of the students may figure there are 4 complete circles. That means the outside total circumference is 4 times 2.5 pi and inside circumference is 4 times 1.5 pi. The answer for the total length of the outside is 10 pi or 31.4 cm and the inside is 6 pi or 18.84 cm.

6. Remember, this activity is to help students realize that mathematics is a tool to model the real world. The higher the math they take (and the better the teacher) the more exciting math becomes. It is part of our life, whether we like it or not!

APPLIED SCIENCE - SCIENCE AND MATH (6A)

PROBLEM: Can the length of a curved surface be determined?
PREDICTION:_____
PROCEDURE:

MATERIALS: 1 tangle per student

EXERCISE 1. In the space below, make 3 shapes that are topologically related using 16 snaps from a Tangle. Trace the area inside. If you think you have a "neat" shape, show your teacher before you change the shape.

EXERCISE 2. See if you can make a knot from the closed curve of 16 segments. Draw the difference between a knot and a closed curve.

EXERCISE 3. Keeping the tangles closed, make a coil. Show your instructor and have them check this item to verify you completed this exercise.
_____

EXERCISE 4. Can you make a curved surface flat? You may unsnap one of the links on the tangle. Show your instructor to verify.
_____

EXERCISE 5. How many complete circles can you make from the 16 curved snaps?_____ If the diameter of the circle (in cm) is multiplied by pi or 3.14, you can determine the circumference of the circle. Can you determine the outer length of the entire curved surface? Can you determine the inner length of the entire tangle? Use the space below and try to compute the length of a curved surface.

CONCLUSIONS:
_____

APPLIED SCIENCE - SCIENCE AND MATH (6A)

POST LAB

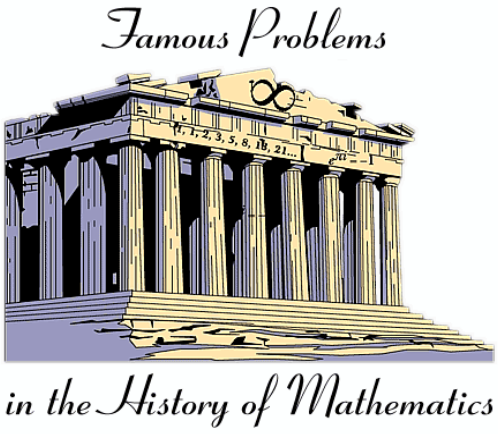
Student use the Internet to find out about fields of mathematics.

OBJECTIVES:

1. Investigating the early history of mathematics.
2. Exploring how math and science are related.

VOCABULARY:

algebra
arithmetic
calculus
geometry
mathematics
trigonometry



MATERIALS:

worksheet
Internet

BACKGROUND:

The history of science and math are interrelated. The people who shaped science are also important in mathematics. As in science, the early history of mathematics is sketchy. We know that the lunar and solar cycles were counted by the Babylonians and Egyptians in an organized fashion. Early Indian mathematicians are credited with many astronomical observations as well as the beginning of algebra. The use of decimals and numbers with 9 figures and a zero are also attributed to the Indians. Their work spread to the Arabic nations, where the term Arabic numbers (compared to Roman numerals) first emerged.

The Chinese are credited with the inventions of spills and abacus, which are both counting machines. Multiplications tables were used at least from the 6th century BC. Chinese mathematics were used for the solutions of practical problems in engineering and business. Although the Chinese had advanced algebra, western scholars seemingly were ignorant of much of this work.

Starting in the 6th century BC, Greek mathematicians documented many discoveries in geometry. The Greeks' conception of numbers as the elements of all things and of the heavens, made mathematical relationships a respected field of study. The philosophy of Pythagoras, Plato and Aristotle reflected the almost "god-like" respect the Greeks gave to the interrelationship of numbers with the universe.

Mathematics is a tool of science, but understanding why mathematical formulas

work is a science all by itself. This activity should be used as a homework assignment or library search. A good dictionary is also helpful.

PROCEDURE:

1. The internet has many great sites on mathematics. In order to complete the worksheet have students do a search on different mathematics sites. Use the "key" mathematical term to start the search.

2. **ANSWERS:**

Algebra deals with general statements of relations, utilizing letters and other symbols to represent different values. Used in science to develop formulas to find an unknown.

Geometry deals with deduction of properties, measurements, and relationships of points, lines, angles, and figures in space. It includes many different disciplines that try to describe the world. Used in science to observe and describe.

Euclidean geometry deals with a flat world that states that parallel lines are always parallel and never intersect. Euclidean geometry is our way of measuring on Earth. Used in science to observe and describe things on Earth.

Riemannian Geometry deals with a spherical world that says parallel lines will intersect. This takes into consideration, the Universe may be a closed surface. Used in science to observe and describe throughout the Universe.

Trigonometry deals with the relationship between angles and sides. Used in science to help determine where the location of certain events are, like earthquakes, planets, stars, and many other things that we cannot directly measure.

Calculus refers to a large branch in mathematics that can solve many ways to measure (like volume or area) using complicated surfaces. It is used in most branches of science to derive answers that cannot be measured directly.

APPLIED SCIENCE - SCIENCE AND MATH (6A) POST

Define each of the following branches of mathematics. From the definition, try to determine how that mathematical branch may be used in science. Give an example if you cannot think of a general name. Use the example.

DEFINE	HOW USED IN SCIENCE
1. Arithmetic - computation of figures	counting how many times something occurs in an experiment
2. Algebra	
3. Geometry	
4. Euclidean Geometry	
5. Riemannian Geometry	
6. Trigonometry	
7. Calculus	

APPLIED SCIENCE - SCIENCE AND MATH (6B)

PRE LAB

Students determine Fibonacci sequences.

OBJECTIVES:

1. Exploring how mathematical sequences are found in nature.
2. Investigating the Fibonacci Sequence.

VOCABULARY:

mathematicians
sequence
series

MATERIALS:

worksheet

BACKGROUND:

Scientists and mathematicians are always looking for connections in math and science. They collect and analyze data to see if a pattern emerges. If a mathematical model of an experiment can be created, it usually reveals that a scientist has discovered something.

An example of a sequence that has many natural counterparts is the Fibonacci Sequence. This number series was named for Leonard Fibonacci (1180-1228). He discovered a sequence that is based on the idea that each term in it is the sum of the two preceding numbers. For example, the following is the Fibonacci Sequence: 1,1,2,3,5,8,13,21,34,55,89,144 which is derived from 1, 1, 2=(1+1), 3=(1+2), 5=(2+3), 8=(3+5), 13=(5+8).

The Fibonacci Sequence was found to be extremely important in the scientific field of genetics. The Fibonacci Sequence is found to measure the fraction of a turn between successive leaves on the stalk of a plant: 1/2 for grasses, 1/3 for sedges, 2/5 for the apple and cherry, 3/8 for plantain, and 5/13 for the leek. There are also many other examples from genetics.

PROCEDURE:

1. Ask students what "naturally" means. They may reply "something that grows without the aid of humans." Then ask if nature designs itself mathematically. Students should think back on some of the previous years in science and remember that natural objects usually have a mathematical pattern.

2. The worksheet has a few examples of Fibonacci sequences for the students to work out. See if the students can make their own. You may also do a search on the Internet on Fibonacci, and you will be surprised how many links there are.

3. ANSWERS:

A. 1,1,2,3,5,8,13,21,34,55,89,144
B. 2,4,6,8,10,12,14,16,18,20
C. 1,3,5,7,9,11,13,15,17,19
D. 1,2,4,7,11,16,22,29,37
(Add 1 to the first number, add 2 to the second number, add 3 to the third number, etc)
E. 1,6,11,16,21,26,31,36,41
F. 1,4,9,16,25,36,49,64,81
[Each number is squared (times by itself)]
G. 1,1/2,1/4,1/8,1/16,1/32,1/64,1/128
(Each number is equal to 1/2 o the preceding number)
H. 100,95,90,85,80,75,70,65

APPLIED SCIENCE - SCIENCE AND MATH (6B) PRE

FIBONACCI SEQUENCE

Can you figure out the next 5 numbers of the Fibonacci sequence?

A. 1, 1, 2, 2, 3, 5, 8, 13, _____, _____, _____, _____, _____

Here are some other sequences. Can you figure out the next 5 numbers in each sequence? Have fun!

B. 2, 4, 6, 8, 10, _____, _____, _____, _____, _____

C. 1, 3, 5, 7, 9, _____, _____, _____, _____, _____

D. 1, 2, 4, 7, _____, _____, _____, _____, _____

E. 1, 6, 11, 16, _____, _____, _____, _____, _____

F. 1, 4, 9, 16, _____, _____, _____, _____, _____

G. 1, 1/2, 1/4, _____, _____, _____, _____, _____

H. 100, 95, 90, _____, _____, _____, _____, _____

H. What's the difference between the first five sequences and the last 2 sequences?

_____
_____

APPLIED SCIENCE - SCIENCE AND MATH (6B)

LAB

Students scientifically design an art project.

OBJECTIVES:

1. Exploring design.
2. Comparing science and art.

VOCABULARY:

art
design
science

MATERIALS:

Applied Science - Science And Math (6B) or
perler beads and guides
iron (optional)

BACKGROUND:

Both artists and scientists have to think about their goal. An artist has a vision of the end product. A scientist also needs a goal for a research project. Although the product of both an artist and a scientist are different, the thought processes are very similar. The great artists of the world made sketch after sketch before they actually produced their art. Many students are not aware that even people with talent have to work to make that talent a reality. No matter how talented a person is, developing a masterpiece takes thought and conviction.

Design is a word used to mean composition, style or decoration. Composition is the framework of relationship in a thing, considered analytically in isolation from the parts and from the whole. Both artist and scientist have to consider if their project can fit into an overall scheme.

PROCEDURE:

1. In this lab, students will design art before they create it. On the lab sheet they will have to think about how many colors they want, how many pieces they will require, and generally what the design will look like. As students progress from the design created on paper to the actual perler beads, they may decide it is not what they wanted. In experiments, as in design, it is acceptable to change the course of the project if the original design was flawed.

2. Perler beads are placed one by one on a pegboard. When the design is complete, heat-seal paper is placed over the design and it is ironed by an adult helper. The beads fuse together quickly on what will become the backside of the design. When it has cooled completely, the design is removed from the pegboard. The pegboard is reusable, and the iron paper can be used many times before it must be discarded. If you want to save the perler beads, do not fuse the beads. It depends on budget if you want to use this as a consumable or not. Use the design and idea book for students to get ideas. Stress that great ideas and designs usually built up from a previous knowledge. Looking for ideas is not cheating.

3. Students have 5 different shapes of pegboards, the heart, star, circle, square, and hexagon. More designs are possible on the square than on any other shape. You may want to give the design phase as a homework assignment. Creativity needs time also. Science and art are related.

APPLIED SCIENCE - SCIENCE AND MATH (6B)

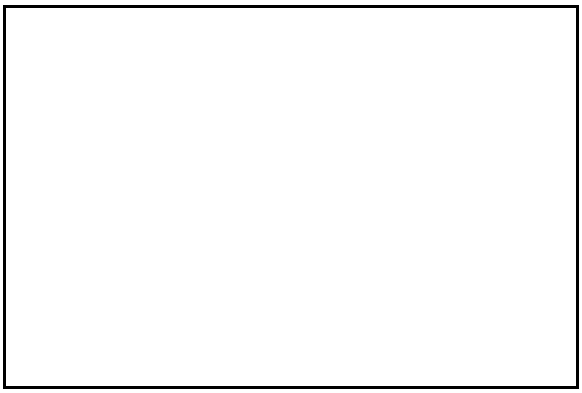
PROBLEM: How is science and art related?

PREDICTION: _____

PROCEDURE:

MATERIALS: perler beads, templates

Draw a picture of your pattern and the design. Make sure you have used the correct amount of pegs that are on your pegboard. This helps determine how many beads you will need.



On the graph below, record how many beads you will need of each color. Then count out the number of perler beads and start your project. Your teacher will give you instructions.

COLOR	NUMBER OF BEADS

CONCLUSIONS: As you were designing your art work, did you see any relationship with science? Explain.

_____

_____

_____

APPLIED SCIENCE - SCIENCE AND MATH (6B)

POST LAB

Students design a science project.

OBJECTIVE:

1. Designing an experiment.
2. Comparing research and development with the scientific method.

VOCABULARY:

hypothesis
procedure
research and development
scientific method

MATERIALS:

worksheet

BACKGROUND:

Students should recognize that scientific experiments don't just "happen." A scientist first has to learn about a subject and then find a problem that needs to be solved from that subject. The scientific method requires a scientist to think about the subject before they experiment.

The key point of this post lab is for students to realize that designing an experiment is fun, but it can also be frustrating. Sometimes experiments just don't work! However, when an experiment doesn't work, you have also learned something. Either something was wrong with the design of the experiment or the answer was not an option for that experiment. This is information that a scientist can build on. Science today is mainly accomplished by what is termed "research and development" or R and D. This refers to laboratories, either government or industry, that follow certain paths. With each new piece of information, they might redirect their experiment. In other words, the project develops and the end product may be usable or not. Research and development is a way to get more creative ideas.

Science is part play, part serious, but mainly taking results and continuing to seek an answer. This process of reasoning and logic is important in other parts of a student's life.

PROCEDURE:

1. This worksheet can be a homework assignment. If students have been in a rigorous science program this assignment will not be difficult, because they can refer to

many of the previous labs that they may have completed. However, if their science background is poor, they may have difficulty. You then may want to do the assignment as a class project.

2. Make sure that students know that they can consult a library, a scientist, or they can even write a letter to a company that they may be interested in. Many students may pick subjects that they cannot formulate an experiment from. You may ask them to try again.

3. This assignment should be saved especially if your school requires a science fair project.

APPLIED SCIENCE - SCIENCE AND MATH (6B)

DESIGNING AN EXPERIMENT

ANSWER THE FOLLOWING QUESTIONS:

1. What subject do I want to learn more about? Are there any subjects that I have always wanted to know the answer?

_____
_____

2. How do I find information about the subject?

_____

3. Where would I go to learn more information?

_____
_____
_____

4. How can I design an experiment about this subject? Can I propose a hypothesis on the subject?

_____

5. Can I compare and contrast this to other things? If so, what?

_____

6. What is the goal of this project?

_____

7. Where do I get materials for the experiment?

_____

8. How do I record the data?

_____

9. How do I present the data, so other people can understand what I did?

_____

APPLIED SCIENCE - SCIENCE AND MATH (6C)

PRE LAB

Students research fibers.

OBJECTIVES:

1. Identifying fibers.
2. Discussing how fibers become fabric.

VOCABULARY:

fibers
hypothesis
investigate

MATERIALS:

books on fibers and fabric
Internet

BACKGROUND:

Individual fibers have unique characteristics. Cotton is a flat ribbon that looks twisted. Linen looks jointed like bamboo. Wool looks like scaly corkscrews. Silk has double strands; rayon is smooth glass-like rods; nylon is smooth clear rods; and polyester is rod shaped like nylon but not as clear.

Most paper is made by pressing and flattening fibers by forcing them to "stick" together. Remember most fabrics or cloth fibers are interlocked by weaving, knitting, or crocheting. Felt is a cloth made by pressing together, but it is not used to make clothes. Paper is usually made up of vegetable fibers that are laid down on a fine screen from a water suspension and then are pressed together through the action of heat, moisture, chemicals, and pressure. Other natural fibers are used as well as synthetic or mixed fibers.

In lab the students will be observing different fibers so they can identify them. Then in the post lab, students will look at the fibers in the lint they have from home. Some of your students will hopefully make the connection that investigators use fibers many times to identify criminals. After this unit the students will be able to understand why. Fibers are unique and can be traced from a criminal to the crime.

PROCEDURE:

1. In the upcoming labs, students are going to investigate fibers. This unit is an example to show students how to research and conduct an experiment. As part of any scientific investigation students need to realize that books hold valuable information. They

have learned about fabrics by looking, but most of their knowledge is limited. (Like most of ours!) Books and the Internet can help extend this knowledge.

2. Have students "research" about one fabric to learn more about how to use reference materials. You might go over the procedure on using references, what an index is, and how to ask for help. If your school has a library this is a good opportunity to investigate what types of books the library has.

3. In lab their research will help them to distinguish the different types of fibers. Below is a general idea of what students should have concluded.

4. It would be helpful if students wrote a report on different types of paper. They can look in an encyclopedia or the Internet for information. Some possible suggestions are: papyrus, rice paper, wax paper, cardboard, tracing paper, history of paper, or even fibers in forensic science.

APPLIED SCIENCE -SCIENCE AND MATH 6C

LAB

Students use a microscope to look at fabric and their fibers.

OBJECTIVES:

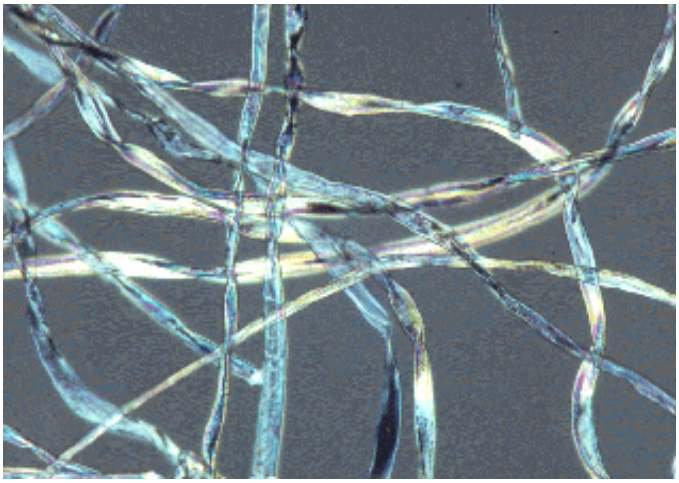
1. Comparing and contrasting different fibers.
2. Recording observations.

VOCABULARY:

fabric
fiber
synthetic

MATERIALS:

fabric
Swift GH microscope



Cotton fibers

BACKGROUND:

Introduce this lab by telling students that all their clothing is made of fibers which are thin, thread-like pieces of plant, animal or man-made (synthetic). The principle use of fibers is in the manufacture of textiles, stuffing for mattresses or upholstery, brushes, and paper. Fibers can be broadly classified as coming from plant, animals or manufactured by humans.

Draw the following chart on the board to illustrate some fiber or fabric types and where they come from.

TYPE	PLANT	ANIMAL	SYNTHETIC
cotton	X		
wool		X	
polyester			X
nylon			X
jute	X		
angora		X	

Fabrics are made by interconnecting or joining of fibers by the process of weaving,

knitting, or felting (like paper). Fibers are sometimes combined or mixed to make varieties of fabric. For example, a shirt label that reads "75% cotton, 25% wool" means that each strand of thread or yard of fabric there is 3/4 cotton fiber blended with 1/4 wool fiber.

In Forensic Science the study of fibers helps to locate who may have been at a crime scene. Detectives may find hair fibers from humans and analyze it for DNA or other properties that can help find a suspect. Minute fibers from a rug can be found on people's clothing, which can be traced to a carpet in a house or car.

PROCEDURE:

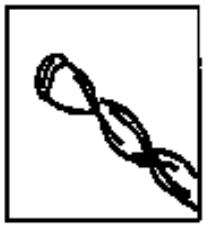
1. Students should look at several samples of different fabric and see how the fibers are woven together. Students should observe the fabric and record what they see under the microscope.

2. This exercise is not only an introduction to investigating science, but also for students to learn about different fibers. Emphasize with students that scientists have to learn about different subjects by observing and recording information before they can actually formulate a question about that subject. Refer students to the "Guide to Fibers" to help identify the fibers.

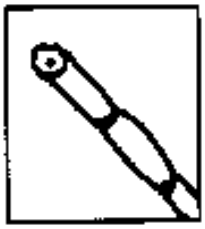
3. You can easily add on to this lab by having students identify what kind of fabric they are wearing. You may want to make a list of the different types of clothes students have on and try to “group them.” Most of their clothes will probably be cotton and polyester blend. You may want to point out that fabrics made from silk or rayon are usually expensive.

GUIDE TO FIBERS

PLANT FIBERS

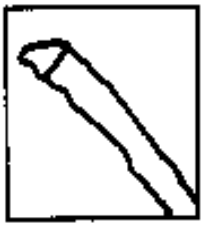


COTTON is derived from a cotton plant. The fibers appear as flat ribbons under the microscope that are slightly twisted. The fabric that cotton produces is soft, absorbs water, and wrinkles easily. Cotton is a fabric that is light and cool.

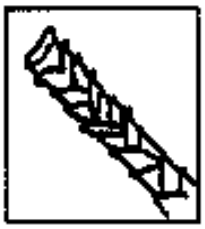


LINEN is derived from the stems of flax plants. Fibers are jointed, looks like a miniature bamboo. The fiber is shiny, strong, gets softer with use, absorbs water, and wrinkles easily. Linen gets softer with use and considered a cool fabric for warmer climate.

ANIMAL FIBERS

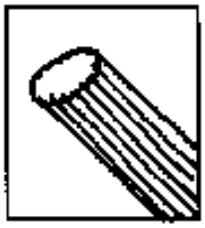


SILK is from the cocoons of silkworms. The fiber is double strands, smooth, and shiny. The fabric is lightweight but can keep its wearer warm.



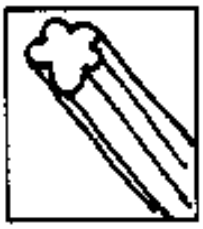
WOOL is from a sheep. Under the microscope it looks like scaly corkscrews. The fiber is stretchable, long lasting, doesn't wrinkle and springs back into shape. Wool easily absorbs water, and soft. Wool fabric is known for its ability to "breathe" keeping wearers warm in the winter and somewhat cool in warmer weather Wool picks up static electricity easily when rubbed.

SYNTHETIC FIBERS

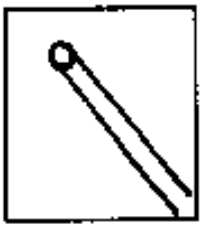


RAYON is made from wood. The fibers are smooth and glass-like rods, which is easily stretchable. Rayon doesn't wrinkle, is soft and absorbent.

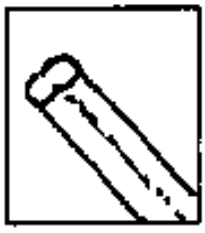
SYNTHETIC FIBERS



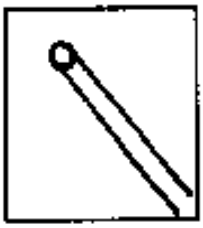
ACETATE is a created from wood. Under the microscope there are grooves that run the length of the fibers. Acetate is soft, smooth, and will melt under a hot iron. It does not absorb water. The fabric is cool.



NYLON is derived from coal. The fibers under the microscope are smooth and clear rods. Nylon is shiny, tough, stretchable and melts under a hot iron. The fibers are nonabsorbent, quick drying, and doesn't wrinkle. The fabric is cool but clammy.



ACRYLIC is made from petroleum. Under the microscope the fiber is dog-bone shaped with apparent cut ends. The fabric is lightweight, warm, and quick drying.



POLYESTER is derived from petroleum. Under the microscope the rod shaped fiber looks like nylon but is not clear. The fiber does not wrinkle, is silk-like, strong, and absorbent.

APPLIED SCIENCES-SCIENCE AND MATH (6C)

PROBLEM: Do different fabrics have different characteristics?
PREDICTION:_____

PROCEDURE:

MATERIALS: pieces of different fabric; Guide to Fibers

Look at the different fabrics under the microscope and draw a single fiber.

FABRIC NAME	CLOTH WEAVE (DRAW OR DESCRIBE)	SINGLE FIBER (DRAW)

CONCLUSION: List some of the characteristics of fabrics.

_____

_____

APPLIED SCIENCE - SCIENCE AND MATH (6C)

POST LAB

Students make paper.

OBJECTIVE:

1. Investigating fibers present in your home.
2. Constructing paper from lint.

VOCABULARY:

fiber
forensic
lint
paper

MATERIALS:

2 types of lint (each the size of 3 cotton balls)
small mixing bowl
2 cups of water
a fork
100 ml of liquid laundry starch
a two-five 30 cm square of wire screening
a newspaper section of several sheets
a rolling pin
Swift GH microscope

BACKGROUND:

Identifying fibers can be helpful to determine where the fabric came from. This is part of forensic science that can help determine where a fiber may have originated from. In this activity the students will learn about how paper is made, but they will also be able to identify the fibers that their household has. Encourage students to bring lint from home so they can make paper from their own fibers. You may want students to make the paper at home and then bring it in. This is a messy activity, but fun!

Discuss the process of paper-making, emphasizing that most paper is crushed together, and not woven like a fabric. You may want to list the many paper products the students use everyday. For instance, writing paper, toilet paper, paper towels, cardboard, newspaper, paper plates, and many more. This activity discusses how to make paper. Follow the directions below. Each student can make their own piece of paper.

PROCEDURE:

1. Put lint in a bowl. Cover the lint with water. Beat the mixture with a fork and fingers. Try to mix the lint and water as evenly as possible. Then add the laundry starch and stir.

2. Do this quickly, before the lint settles.

3. Dip one end of the wire screen into the water. Slip the screen flat under the water's surface. Then lift it out of the water, keeping it flat. Allow most of the water to drain through. It should be covered with an even layer of lint. If it isn't, slip it back under the water's surface after stirring the mixture in the bowl with your hand. Try again.

4. The layer of lint fibers will become your paper. Put the screen, fiber side up, on three or four sheets of folded newspaper. Cover it with a few more sheets of folded newspaper. Roll the pile with the rolling pin. You are squeezing the water out. Gently peel off the top layers of the newspaper. Your sheet of lint paper should be sticking to it. Let it dry. Peel the newspaper off after it dries. You now have a piece of paper. (Actually it looks more like cardboard.)

5. Go over the lab procedure carefully with students. Stress that the lint must be evenly mixed and the importance of draining off the water as much as possible before placing the screen with the lint between the newspaper layers. After the students look at the paper under the microscope, see if they can identify different types of fibers. Remember if a household has cats or dogs their hair will be incorporated into the paper.