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Science Fairs

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School Science Fairs

I. Overview and Rationale

School science fairs usually take the form of an assembly of student groups across many classes each setting up table exhibits, which demonstrate practical and important scientific principles. This activity is usually set out as a two-step process. First, teachers work with older students in reviewing scientific concepts in several areas. At primary school level, these may be Grade 6 children while at lower secondary school level, it may include students in Grades 8 or 9. Students and their teachers carry out this review intensively through real scientific investigation involving observations, recording, formulation of hypotheses, and testing. Students are formed into groups where each is assigned a number of tasks in a particular topical area. These areas may include the following:

- Light and Colors
- Sound
- Pressure and Convection
- Magnetism

The role of the teacher assists students in carrying out the task work, which leads to conclusions that summarize basic scientific principles (e.g., sound can be conveyed by solids, liquids, and gases; white light is comprised of the colors of the spectrum; etc.). Student groups can then present their findings to each other, taking questions from their peers in turn. Teachers may assist student groups during the questioning process. Following the conclusion of this stage of knowledge acquisition, student groups may organize a large science fair for younger children who observe demonstrations of experiments and receive accompanying explanations from their older peers. Younger children should also have the opportunity to ask their own questions and participating in experiments as much as possible. The larger science fair may occur on a Technical Day or a special day reserved by the school for this purpose.

Science fairs are useful devices for allowing many students to assimilate a great deal of practical science understanding in a very short period of time. In this sense, science fairs have many practical advantages. First, they allow independent inquiry by students into different scientific concepts. This occurs in a way where students learn through the scientific process (e.g., observation, formulation of hypotheses, recording, etc.). Learning in this way helps to build critical thinking skills rather than the mere acquisition of isolated scientific facts and figures, as they are often prone to do in their regular classrooms. Another important advantage refers to the aspect of older students explaining the science they have learned to other, younger students. This not only helps to further increase the total amount of learning occurring but also to reinforce the understanding for the students who are providing the explanations. In addition, children are more likely to ask questions of their older peers and get more lucid explanations, thereby making the overall learning process more child-friendly.

II. Objectives

- Students are able to independently carry out experimentation in specific topical areas leading to acquisition of basic scientific principles.
- Students are able to replicate their experiments for their peers with lucid explanations of the principles that the experiment exemplifies.
- Students are able to provide explanations of what they have learned to their peers.
- Students are able to organize free-standing exhibitions for younger children that demonstrate the scientific principles that they have learned.

III. Time

- Initial Instruction of Students: 3 - 4 Hours
- School-wide science fair: 1 School Day (4 hours)

IV. Materials

For Initial Instruction of Students:
- *Stationery for Recording and Explanations:* Poster paper, marker pens, tape
- *Homemade Science Kits:* Kit 1- Experiments with Light; Kit 2 - Experiments with Sound; Kit 3 - Experiments with Pressure and Convection; Kit 4 - Experiments with Magnetism
- *Materials for experiments:* thermometers, glasses, hot water, salt, spoons, plastic bottles, color dye, magnets, mirrors, color marker pens, stationery materials, etc.

For Science Fair
- A large open space such as a classroom
- Tables and posters to set up exhibitions
- Materials identified in Homemade Science Kits.

V. Procedure

A. Organizational Preparation
- Organize students into groups of 5 or 6 in a large classroom. If more than one class is involved, it may be necessary to increase the number of topical areas. Ideally, there should be 5 or 6 groups per classroom.
- One topical area may be assigned to two student groups at a time, as necessary. Thus, a teacher may have each of three groups working on a different topic while two other groups work on the same topic. This is because only 4 science kits have been prepared for this module. Teachers may also develop their own modules at their own discretion.
- On one table in the room, set out all the materials that will be needed in order to perform the experiments described in the science kits. Group the materials by the topical areas provided.

B. Establishing Set/Ice Breaker
- Begin the program by informing students that they will be learning about science in a new way. This new way is based on what scientists do when they make science. What might you imagine that scientists do when they discover scientific principles; that is, what skills do they use when they work? Try to brain storm a list such as the one below:
    - Observing
    - Measuring
    - Stating hypotheses
    - Experimenting
    - Making conclusions
    - Recording information
- Main Point: In order to learn these process skills, it is necessary that we actually practice them ourselves when learning science.
- Ice Breaker: Before starting the program, do a game with students that sets the stage for thinking critically. This might be a brain twister question, assembling a puzzle, or some other activity. If available, use a puzzle assembly kit in which the

group that assembles the pieces first gets to keep the puzzle. An example is provided below:

Instructions: Assemble the puzzle pieces shown to the left into a square. Do this as a group.

C. Using Science Process Skills

- The purpose of the present session is to demonstrate specific science process skills in a concrete context. First, begin by passing out a sheet of poster paper and a crayon to each group and asking them to make a chart like the one below.

What you did	What you observed	What did you conclude

- Now, you are ready to conduct an experiment. Each group should select a participant to record the experiment in the chart; the other participants should assist in doing the experiment.

- *First experiment: Solutions and Temperature*

  - Begin by passing out 3 glasses to each group. Then, place an equal amount of hot water in each glass. The participants should note that the source of the hot water is the same (indicating that the temperature is equal at the beginning of the experiment)
  - Next, ask participants to put one large tablespoon of salt in the first glass, two table spoons in the second glass and to leave the third glass as pure water.
  - Now, ask participants to measure the temperature of each glass of water.
  - Record the results in the chart according to each heading provided earlier: An example is provided below.
  - At this point, make sure that participants are only writing in the first two columns of the chart.
  - When all the steps in the experiment have been completed, write down your conclusions in the last column of the chart.

What you did	What you observed	What did you conclude
♦ Placed an equal amount of water in each glass from the same source ♦ Placed one tablespoon of salt in the first glass, two in the second, and none in the third. ♦ Measured the temperature of the water in each glass	♦ The more salt in the water, the lower the temperature seems to drop.	♦ Placing a substance in solution lowers the temperature of the solution (in an equal proportion to the substance).

- When the experiment is completed, ask participants to present their charts. Compare and discuss. Be sure to identify what process skills were demonstrated in this experiment (e.g., recording, observing, measuring, etc.) as well as what the overall conclusions in the experiment were.

D. Group Work by Topical Area

- When students understand the manner in which they are to work, assign topical areas to each group. These topical areas are the same as those stated earlier: Light and Colors; Sound; Pressure and Convection; and Magnetism. If possible, give students some choice in the topics.
- When students have received/chosen their topics, pass out science kits to each group as well as pieces of poster materials for making charts, which record their activities.
- Distribute science kit documentation to each group asking each to carry out all the experiments indicated. Be sure that each group has a clear division of labor so it is clear who is doing what. All students should be involved in the activities conducted. If there is not enough for everyone to do something simultaneously, then students should take turns in performing the different experiments. Be sure this is clear to all groups before starting.
- Monitor and assist the work of student groups as necessary.
- Allow about 90 to 120 minutes for students to complete all their activities.

E. Group Presentations

- When the student groups have completed their experiments, ask each to come to the front of the room with their materials and demonstrate each. Each group should provide a summary of what they did, observed, and concluded for each experiment. If time permits, participants may actually demonstrate the experiment for the other groups to observe.
- Allow the other student groups to put questions to the presenting group. The teacher may assist in providing explanations but allow the presenting groups to begin the process of giving an answer.

SCIENCE KIT 1: Light and Colors

<u>Experiment 1</u>: Water Prism

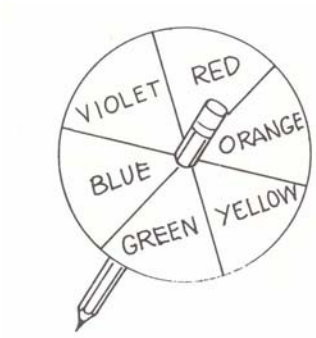
Purpose: To use water to separate light into its separate colors

Materials:
Flashlight
Carton paper
Masking tape
Scissors
Sheet of white paper
Chair or table
Glass of water

Procedure:

- Cut a circle from the heavy carton paper to cover the end of the flashlight.
- Cut a very thin slit across the circle, stopping about 1 cm from the edge.
- Tape the paper circle to the front of the flashlight.
- Place the galss of water on the edge of the chair or table.
- Ask a friend to hold the whit paper near the floor at the edge of the chair or table.
- If possible, darken the room and hold the flashlight at an angle to the surface of the water.
- Change the angle of the flashlight and ask your friend to vary the position of the white paper until you see some colors.
- Record the results observed and make your conclusion.

<u>Experiment 2</u>: Mixing Colors (A)



Purpose: To demonstrate how light waves blend to produce white light.

Materials:
Carton paper
Scissors
Pencil with an eraser at the top
Ruler
Marking pens or water colors for painting

Procedure:

- Cut a 10 cm circle from the carton paper.
- Divide the circle in 6 equal sections.
- Color the sections in this order: red, orange, yellow, blue, green and violet.
- Punch the pencil through the center of the circle, leaving about half of the pencil on each side.
- Place the point of the pencil on a flat surface and quickly spin the top of the pencil.
- Record the results observed and make your conclusion.

<u>Experiment 3</u>: Mixing Colors (B)

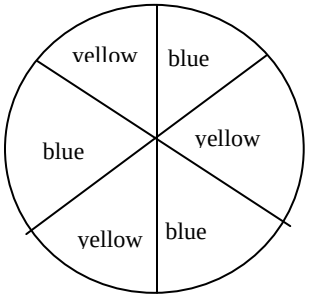
Purpose: To demonstrate how light waves blend to produce different colors.

Materials: Carton paper
Scissors
Pencil with an eraser at the top
Ruler
Marking pens or water colors for painting

Procedure:

- Repeat the procedure above but in this case make three circles. Do not color in the parts of the circle yet.
- Color in the parts of the circle using only two colors as follows:
  Circle 1: Yellow and Blue
  Circle 2: Red and Yellow
  Circle 3: Brown and Violet
- Alternate the colors as you fill in the parts of the circle.
- Punch the pencil through the center of the circle, leaving about half of the pencil on each side.
- Place the point of the pencil on a flat surface and quickly spin the top of the pencil.
- Record the results observed and make your conclusion.

Example:



SCIENCE KIT 2: Sound

<u>Experiment 1</u>: Magnifying Sounds

Purpose: To demonstrate the effect of solids on the speed of sound

Materials: Clear plastic drinking glass
Rubber band

Procedure:

- Stretch the rubber band around the glass so that the glass is bisected at the top and the bottom
- Hold the bottom of the glass against your ear.
- Gently strum the stretched rubber band.
- Record the results observed and make your conclusion.

<u>Experiment 2</u>: Singing Glasses

Purpose: To demonstrate how frequency affects the pitch of sound.

Materials: 6 glasses of equal size
Water
Metal spoon

Procedure:

- Pour different amounts of water into each glass.
- Arrange each glass from the fullest to the least full.
- Gently tap each bottle with the metal spoon
- Record the results observed and make your conclusion.

<u>Experiment 3</u>: Using a Spoon as a Bell

Purpose: To demonstrate how it is possible to change the pitch of sound.

Materials: Metal spoon
Scissors
Kite string (75 cm)

Procedure:

- Tie the handle of the spoon in the center of the string.
- Wrap the ends of the string around your index fingers. Be sure that both strings are the same length.
- Place the tips of your index fingers in each ear.
- Lean over so that the spoon hangs freely and tap the spoon against the side of a table.
- Shorten the strings by wrapping more of the string around your fingers. Again, keep the strings the same length.
- Lean over again and tap the hanging spoon against the side of the table.
- Record the results observed and make your conclusion.

SCIENCE KIT 3: Pressure and Convection

Experiment 1: Crushing the Bottle

Purpose: To demonstrate the direction of air pressure

Materials: An empty plastic bottle
Bottle cap
Hot water

Procedure:
- Take the plastic bottle and uncap it.
- Next, take a little bit of hot water and place it inside the bottle. Swish the hot water around and then pour it out.
- Then, quickly recap the bottle and place it in the center of the table.
- Observe what happens.
- Record the results observed and make your conclusion.

Experiment 2: The Characteristics of Hot and Cold Water

Purpose: To demonstrate the movement of hot and cold materials

Materials: 4 glass water bottles of equal size (not more than 1 liter in size each)
2 liters of hot water
2 liters of cold water
A packet of food coloring
2 square sheets of paper about 5 cm x 5 cm

Procedure:
- Fill 2 bottles with cold water and the other two with hot water. Make sure each bottle is filled to the top.
- Take the food color packet and place some coloring powder in one bottle of hot water and some more in one bottle of cold water.
- Next, place the sheet of paper over the two remaining bottles with no coloring in them.
- Take the bottles with no coloring and place them on the top of the two bottles with coloring. The cold water bottle should go over the hot water bottle and the hot water bottle should go over cold water bottle. Be careful when you do this so that the water does not flow out.
- When each bottle is balanced on top of the other, gently remove the piece of paper separating the pair of bottles. Watch what happens.
- Record the results observed and make your conclusion.

Experiment 3: The Candle and Cigarette

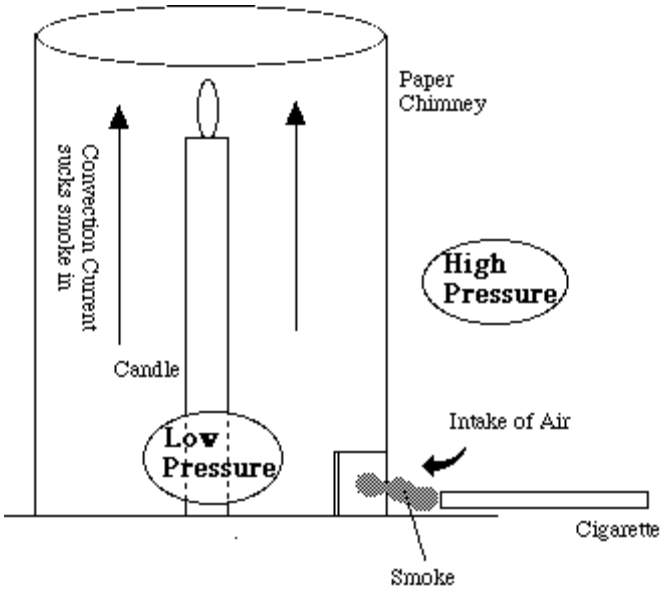
Purpose: To demonstrate how pressure and convection produce wind

Materials: One sheet of photocopy paper
Masking tape
Short candle
Cigarette or incense stick

Box of matches
Scissors

Procedure:

- Take a piece of roneo paper and tape the ends together.
- Next, cut a low door in the bottom of the funnel that you have made with the paper about 2 cm high.
- Light the candle and place it securely on the table.
- Next, take the paper funnel and place it around the candle.
- Take the cigarette and light it until it is emiting smoke.
- Place the cigarette near the little opening that you have cut at the bottom of the funnel.
- Record the results observed and make your conclusion.



SCIENCE KIT 4: Magnetism

Experiment 1: The Behavior of Magnetic Poles

Purpose: To demonstrate what will happen to magnets based on the position of their poles.

Materials: 2 or 3 magnets of the same shape (it is best to paint similar poles all the same color)

Procedure:
- Place the magnets with the colored side up on a table.
- Push one of the magnets towards the other magnets.
- Observe what happens.
- Next, turn one of the magnets over and do the same thing.
- Record the results observed and make your conclusion.

Experiment 2: The Strength of Magnetism

Purpose: To determine the strength of a magnet

Materials: Box of paper clips
Magnets
Masking tape

Procedure:
- Tape a magnet onto the edge of a table so that part of the magnet is hanging over the edge.
- Place a paper clip onto the edge of the magnet.
- Add more paper clips one at a time to the first clip until the clips pull loose from the magnet and fall.
- Repeat this experiment again by adding another magnet on top of the one that is taped to the table.
- Record the results observed and make your conclusion.

Experiment 3: Floating Needle

Purpose: To show how a compass works.

Materials: A needle
Small piece of Styrofoam
Bowl of water
Magnet
Compass

Procedure:
- Take a needle and run across the magnet several times. This will magnetize the needle.
- Next, take the needle and stick it though the piece of Styrofoam
- Place the Styrofoam and needle into the bowl of water.
- Check to see which way the needle is pointing.
- Compare this with the direction of the pointer in the compass.
- Record the results observed and make your conclusion