The Everyday Science Sourcebook

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Revised 2nd Edition

Ideas for Teaching in the Primary and Middle Years

Hawker Brownlow
EDUCATION

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Entry Section

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Features of This Sourcebook

This sourcebook is a thesaurus. In contrast to a dictionary or encyclopedia, which format content alphabetically, a thesaurus is a reference work that arranges its content according to conceptual similarities. Its purpose is to enable readers to find specific ideas and to see how the ideas relate to other ideas.

As a thesaurus of science concepts, this book provides easy access to science activities that teach science concepts that correspond to national standards. And it does much more because of the way the science content is organised.

Organisation: Science Content

The Entry section of this book comprises a number of interlocking science content groupings organised by numerical code system. Entries are arranged in broad science categories to match the Standards. These are subdivided into topics, subtopics, and specific activities, all related to the content being taught.

Broad Science Content Categories

Six broad content categories are used to provide a framework for the Entry section—the main body of this book. Each of the content categories is coded by numerals in a decimal system.

100–199: Inorganic Matter

Matter, one of the two great divisions studied by scientists, includes all the materials that occupy space in the world around us. The scientist subdivides the materials into two kinds: inorganic and organic. Inorganic matter is the subdivision that comprises all nonliving materials (e.g., the rocks and minerals above and below the surface of the Earth). This content category includes such directly observable aspects as the physical and chemical properties of matter and the changes in the states of matter (i.e., solid, liquid, gas).

200–299: Organic Matter

The other subdivision of matter studied by scientists is organic matter. Organic matter is found in all living materials (e.g., the various forms of plants and animals). This content category contains entries that pertain to the directly observable physical and

chemical properties of living organisms, their growth and response to environmental conditions, and the interrelationships among them.

300–399: Energy

Energy is the second great division studied by scientists. Energy means the ability to do work. This content category includes entries that pertain to the various forms of energy such as light, sound, and heat.

400–499: Inference Models

In scientific terms, a model is a theory that describes or explains a phenomenon that cannot be directly observed (e.g., atomic structures, the solar system). This fourth category contains entries that serve to explain phenomena and pertain to ideas derived through indirect means.

500–599: Technology and Engineering

Technology is the blend of science and invention that aims to increase productivity by rearranging the environment and producing goods. As such, technology is sometimes called *applied science* or *engineering*. This category contains entries pertaining to inventions (e.g., simple machines) developed from the application of scientific principles that, in turn, can be used to further understand basic scientific laws and principles.

600–699: Instructional Apparatus, Materials, and Systems

This sixth category contains entries dealing with the preparation of various materials useful in teaching science that have wide application throughout the content categories. This category includes such topics as techniques for cutting and bending of glass to making certain apparatus and construction plans for the construction of measuring devices (e.g., balance and spring scales).

The content numbering system is presented in the Table of Contents.
100 ← Inorganic Matter
200 ← Organic Matter
300 ← Energy
400 ← Inference Models
500 ← Technology and Engineering
600 ← Instructional Apparatus, Materials, and Systems

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Topics

Each of the six broad science categories is divided into specialized topics. For example, the category *100 Inorganic Matter* is subdivided into six topics that are coded by the second numeral in the series of three numerals.

100 Inorganic Matter
- **11**0 ← Solids
- **12**0 ← Liquids
- **13**0 ← Gases
- **14**0 ← Earth Science
- **15**0 ← Oceans
- **16**0 ← Weather

Subtopics

Within the topical categories, scientific knowledge is subdivided into four subtopics.

1. Characteristics: This subtopic contains knowledge that relates to the characteristics or attributes of objects (e.g., size, shape, color, texture, and so on). Generally, this knowledge is descriptive of physical properties of objects.
2. Interactions: This second subtopic contains interactive knowledge. Such knowledge describes causes and effects between and among objects.
3. Theory: The third subtopic contains knowledge that is speculative (e.g., theories and explanations for observed phenomena).
4. Applications: The final subtopic contains activities that are applications of knowledge.

These subtopics are identified by the third numeral in the series of three.

300 Energy
- **34**0 Heat
  - **341** ← Characteristics
  - **342** ← Interactions
  - **343** ← Theory
  - **344** ← Applications

Knowledge of Characteristics

When we observe, compare, or organise our observations and then describe the results, we make statements such as "insects have three body parts and six legs," "sea water is salty," and "leaves are green." Observing, comparing, and organising processes always produce information that is largely organisational in character. Objects are described for specific attributes that define them as members of a particular class or function: Fish have fins (class), birds have feathers (class), the flower is the part of the plant where seeds develop (function), and machines are devices that make work easier (function).

110 Solids

111 Characteristics

Generalization I. Solid is one of three states of matter.

> *Contributing Idea.* Solids melt into liquids; liquids freeze into solids.

Observing melting and freezing (solid ↔ liquid). Caution: The procedure of melting solder or lead should be demonstrated by the teacher and not done by the students. With guidance and appropriate safety precautions, students can see solder or lead (fish weight) melt in a tin can held with pliers. After letting students describe what happens in each case, you might tell them that whenever a solid changes to a liquid, it is said to be melting. When each pan is removed from the heat and placed in a bowl of ice water, students will see the liquid change back to a solid. Tell them that this change is called freezing, even though the substance might not feel cold to the touch. You might want to demonstrate that some organic solids can also melt and freeze: a piece of paraffin; a cube of sugar; a pat of butter or margarine. **01 Aa Bb**

Determining the melting point of different solids. Students can harden some olive oil in a jar by placing it in a refrigerator for one day. When hard, set the jar of oil in a sunny place. As the oil starts to melt, tip the jar so that the students can take the oil's temperature. Have them record the melting point, then follow the same procedure using margarine, butter, lard, ice, and ice cream. The different materials can be seriated by their melting points. **02 Ce Da**

Observing changes of state: ice (solid ↔ liquid). Have students watch ice cubes melt in dishes placed in different parts of the classroom. After seeing which melts fastest, students should try to explain why (usually the cause is heat). Challenge the students to bring a solid ice cube to school from home. (They will have to be inventive to keep it from melting.) Discuss factors that contributed to those that were brought successfully to school. Next, challenge students to devise ways to make ice cubes that are spherical, hollow, or various other shapes. They might discover that the shape (i.e., amount of surface area) influences the rate at which each melts. For controlled comparisons, differently shaped ice of equal volumes can be made by pouring equal amounts of water into paper cups with flat bottoms and pointed bottoms, various candy cups, cookie molds, round lids or covers, or tall cylinders. Set the frozen shapes on dishes in the same locations to keep temperature conditions the same. Students can record and compare the time it takes each to melt. **03 Aa Gb**

Generalization II. Solids have identifiable characteristics.

> *Contributing Idea A.* Our senses can be used to identify solids.

Seeing and describing some characteristics of some solids. The visual properties of objects that can be selected and **04 Aa Ba Ca**

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controlled in instructional situations are size, shape, color, and pattern. Although students might begin with grossly different objects, fine discriminations can be later used to sharpen perceptual awareness. Fine discriminations might involve examination of closely matching lengths of sticks, serrations or venation of leaves, complex designs, or shades or tones of colors.

a. *Clue Given*: Show students a leaf. Have them find a matching leaf (on the basis of shape) from a collection of differently shaped leaves.

b. *Clue Given*: Buttons, coins, or other small objects can be glued to heavy cardboard. Ask students to find the two objects that are alike. Finer discriminations among the objects can be developed by selecting ones that are more closely alike.

c. *Clue Given:* String beads (identical in size and color but different in shape) on a string. Every time you string a bead, have a student string a matching one.

d. *Clue Not Given:* Prepare a collection of polished, colored stones of similar size (include two stones that are identical in color). Ask students to find the two that look the same on the basis of color.

e. *Clue Not Given:* Prepare a set of objects that vary in size but that are the same in shape and color. Have students match identical objects by size.

Feeling and describing some characteristics of some solids. Tactile properties have the greatest range of instructional possibilities. Materials can be selected to emphasize such aspects as size, shape, or textures (e.g., roughness, stickiness, softness, sharpness, etc.). 05 Ab Ba Ca

a. *Clue Given:* Prepare about eight squares of sandpaper, identical in size, but different in grade (i.e., roughness). Place the squares in a Feely Box (see Figure 111.05). Give students another square that matches the roughness of those in the box. Ask them to find the matching square. For finer discriminations, you might try using different grades of emery paper.

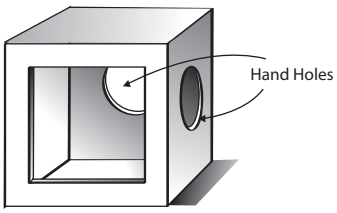

Figure 111.05

b. *Clue Not Given:* Place about six wooden dowels of equal length but of different diameters within a Feely Box. Include two dowels of identical diameters. Have students use their sense of touch to locate the two that feel the most alike.

Hearing some characteristics of some solids. Sounds produced by certain solid objects are sometimes a characteristic of that object. The primary auditory properties are pitch, intensity, and rhythm. 06 Ac Ba Ca

- **a.** *Clue Given:* Have students listen as you play a single note on a musical instrument. Ask them to identify a matching note from a number of notes played in a series.
- **b.** *Clue Given:* Using a pencil, tap simple rhythms on a desk. After students listen to the rhythms with their eyes closed, have them use pencils to repeat the rhythm that you tapped.
- **c.** *Clue Not Given:* Before playing a series of seven notes on a musical instrument, ask students to listen and record the numbers of the two notes among the seven that sound alike. (You might have to repeat the series several times.)
- **d.** *Clue Not Given:* Record various household sounds. As students listen to the recording, let them describe the characteristics of each sound before identifying the object that makes the sound (e.g., ticking clock, turning egg beater, vacuum cleaner, washing machine).

Smelling some characteristics of some solids. Our sense of smell is not as acute as that of many other animals, and smells are generally described by naming a potential source of the smell (e.g., It smells like a skunk; It has a mint smell). 07 Ad

- **a.** *Clue Given:* Place six to eight bars of differently scented soaps into different containers. The bars should be identical in size and shape, and wrapped so that they cannot be distinguished on the basis of color. Place one more bar matching one of the scents in another container and ask students to find, by smelling, the matching container within the set.
- **b.** *Clue Not Given:* Wrap differently scented candles that are identical in size and shape. Place six to eight into boxes or cans. Add one additional box containing a candle that matches one of the others on the basis of its smell. Mix the boxes and ask students to find the two that smell alike.

Tasting some characteristics of some solids. Generally our sense of taste is influenced by our sense of smell. Other than the basic tastes of sweet, sour, bitter, and salty, flavors become complex combinations interwoven with our sense of smell. **Caution: Tasting unknown materials can be dangerous. Warn students against this practice, and let them discuss reasons for the caution.** 08 Ae Ba Ca

- **a.** *Clue Given:* Give each student his or her own set of four small cups containing salt water, sugar water,

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