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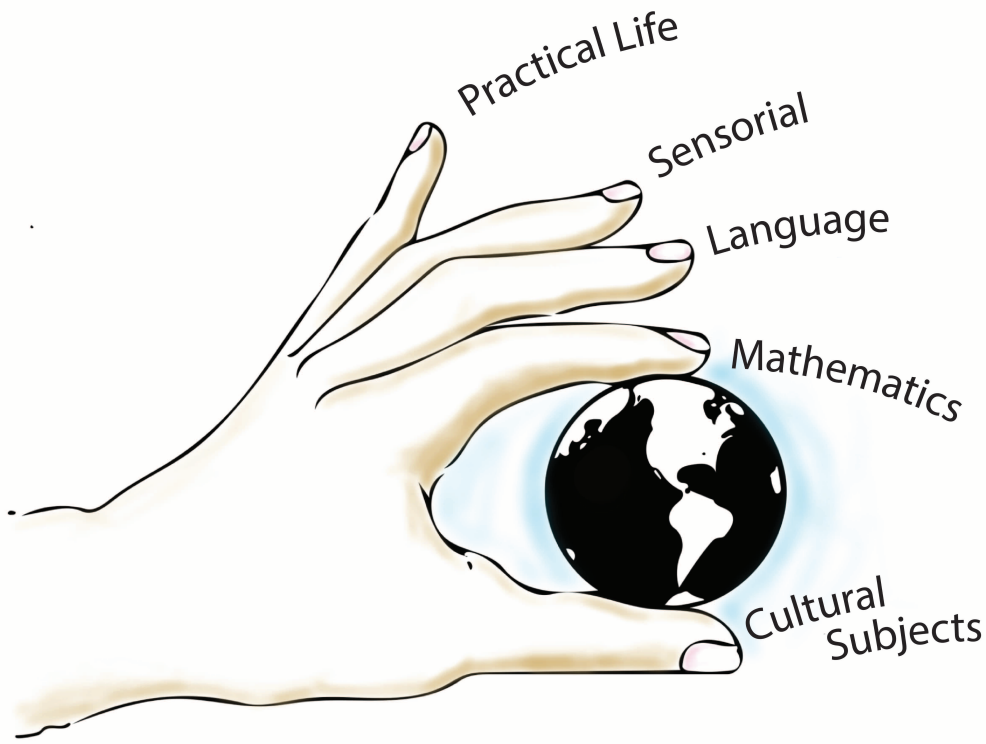

Biology

Early Childhood

Teacher Manual

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MEI, Inc Biology Early Childhood

General Biology

Botany

Instructions for Preparing Biology Materials

Zoology

Botany

GENERAL BIOLOGY

Classification of Living Organisms

Purposes:

To present an overview of the system of classification
To learn about Linnaeus and the development of the classification system
To introduce the five kingdoms of life
To provide a means for learning the characteristics of each kingdom
To present examples of each kingdom
To develop appreciation and understanding of the classifications of life
To emphasize the interrelationship of all living matter
To improve observation skills
To develop appropriate vocabulary

Preliminary Exercises:

Work with color tablets
Observation of live specimens
Exercises for reading phonograms (for classification work with cards)

Materials:

Live specimens of as many organisms as possible, not all at the same time
Separate color-coded containers for each of the five kingdoms with pictures of these organisms:
Prokaryotae bacteria (color-coded gray)
Protoctista nucleated algae, flagellated water molds, slime molds, protozoa (color-coded light blue)
Fungi eukaryotes that form spores and lack flaggellum (color-coded tan)
Plantae plants (color-coded green)
Animalia animals (color-coded white)
Container of drawings of organisms from each of the five kingdoms mounted on cream and having a colored dot on the back in the top right corner to indicate the kingdom; color-coded heading cards with names of kingdoms
Cream container labeled Five Kingdoms containing a color-coded control strip, labels and mute cards to represent each of the Five Kingdoms
Cream container of definition cards and control booklet for the Five Kingdoms
Cream colored container with accordion-folded control strip and separate cream cards for classification vocabulary (kingdom, phylum, class, order, family, genus, species)
Cream colored booklet about Linnaeus and his work

Procedure for Pictures:

1. Invite a child to the lesson once the preliminary exercises have been done and place one container of pictures on the table on your non-dominant side.
2. Remove one picture at a time, place it in front of the child and say the name of the kingdom and the organism. Move the picture to the left center of the table. Continue naming the pictures, placing them in a row from left to right.
3. Have the child replace the pictures in the container. Stand, replace chair, thank the child and say that any pictures may be chosen and that you will give the name.

Procedure for Sorting:

1. Invite a child who can read phonograms to the lesson once pictures for the five kingdoms have been introduced. Place the container of drawings mounted on cream in front of the child who is seated on your dominant side.
2. Have the child place the colored heading cards horizontally near the top edge of the table. Tell the child to sort the pictures vertically under the appropriate headings, checking placement by referring to colored dots on reverse.
3. Leave as soon as it is apparent that the procedure is understood.

Procedure for Sequence of the Five Kingdoms

1. Invite a child to the lesson and lay out the control strip in the center of the table. The child is seated on your dominant side.
2. Have the child match and place the mute cards beneath the control strip and, if able to read, place labels on the mute cards.
3. Show child how to refold the control strip.
4. Place materials in container, stand, replace chair.
5. Return materials to shelf, thank the child and say that these materials may be chosen.

Procedure for Classification Vocabulary:

1. Invite a child to the lesson and place the container of classification materials for vocabulary on a table near the front.
2. Tell the child to lay out the control vertically near the center of the table, then to place the separate cards appropriately beside the control.

Control of Error:

Color code for each kingdom
Colored dot on back of pictures mounted on cream
Relative sizes of separate cards to show hierarchy of classification system
Control card for classification

Observations:

Arrangement of cards
Return of pictures to packets
Handling of materials
Child's reaction to error
Length of work time and number of repetition
Length of period of contemplation
Degree of interest and concentration

Variations:

Teach the names of the organisms in the pictures by the three-period lesson.
Invite the child to arrange the classification cards without referral to the control.
Invite the child to place definition cards with the Five Kingdoms control strip, using the booklet for control of error.
Invite the child to read the booklet about Linnaeus.

Vocabulary:

names of specimens pictured on cards kingdom phylum class order family genus species Prokaryotae Protoctista Fungi Plantae Animalia Linnaeus

Pictures for Selected Phyla of the Animal Kingdom

Purposes:

To provide examples of animals from each of the selected phyla
To aid perception of similarities and differences within each phylum and among phyla
To further establish a sense of order
To improve observational skills
To develop appropriate vocabulary

Preliminary Exercises:

Observation of live specimens of as many of the phyla as possible

Materials:

Color-coded containers with six pictures each, mounted on the color given in “Information on the Selected Phyla of the Animal Kingdom”
Cream container of pictures like those above, two from each phyla, but mounted on cream with a colored dot in the top right corner of the back to indicate the phylum; color-coded heading cards with names of the selected phyla on appropriate color
Note: These heading cards are mounted on 8 1/2" by 2" in the appropriate color.

Procedure:

1. Invite a child to the lesson, choose any color-coded container with pictures mounted on the appropriate color and place on a table on your non-dominant side with the child seated on your dominant side.
2. Name the phylum of the packet chosen. Remove one picture at a time, naming each specimen and giving pertinent information from the backs of the cards. Invite the child to examine each picture, then lay on the table in a row.
3. Replace pictures in packet. Thank child and say the picture packets may be chosen
4. Stand, replace chair and return packet to shelf.

Control of Error:

Color code for each phylum

Observations:

Handling of materials
Return of pictures to packets
Child’s reaction to error
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration

Variations:

Invite the child to sort the cream-mounted pictures of each selected phyla under the appropriate color-coded heading cards, referring to the colored dot on the back of each card if necessary.

Vocabulary:

names of specimens in packets

Porifera (po-rif'-uh-ruh) 10,000 species (light blue)

Pori means small opening. There are many cells, bearing numerous small pores which are openings to canals. The skeletons are spongy fibers or glassy spicules.

Examples: sponges, Venus flower basket

Cnidaria (ni-dar'e-uh) 10,000 species (light orange)

The body and digestive cavity are combined. There are many cells in two layers; simple tissues are present and body parts have radial symmetry.

Examples: hydra, jellyfish, coral

Platyhelminthes (plat-e-hel'min-thez) 15,000 species (light green)

The flat, ribbon-like body is bilaterally symmetrical with digestive, nervous, excretory, and reproductive systems usually present. They may be parasitic or free living.

Examples: planarian, fluke, tapeworm

Nematoda (nem-uh-tod'uh) 80,000 species (pink)

These round, unsegmented worms have cylindrical bodies tapering at each end. They may be free living or parasitic.

Examples: vinegar eel, pinworm, hookworm, filaria worm

Brachiopoda (brak'e-uh-pawd-uh) 30,000 species (light yellow)

Shell-bearing forms resemble mollusks in appearance but are very unlike them otherwise. The bivalve shell is attached to the substratum by a stalk called the peduncle.There is bilateral symmetry at right angles to valves of shell. This is one of the oldest phyla.

Example: lingula

Mollusca (maw-lus'kuh) 110,000 species (orange)

Soft sac bodies contain organ systems. There is a muscular foot and a mantle that usually secretes shell.

Examples: Clam, snail, slug, whelk, squid, octopus

Annelida (an'el-id-uh) 8,800 species (gray)

Bodies are tubular and have true segmentation. The digestive tract is a tube with anterior mouth and posterior anus. There is a body cavity and organ systems are complete.

Examples: earthworm, clam worm, leech

Arthropoda (ar'thrah-pahd-ah) 500,000+ species (yellow)

Exoskeleton usually contains chitin. There is bilateral symmetry with distinct body regions, segmentation, jointed appendages and a high degree of specialization.

Examples: lobster, crayfish, spider, centipede, insect

Echinodermata (ih-ky'nuh-der-mat-ah) 6,000 species (lavender)

Characteristics are radial symmetry, limy skeletal parts, tube feet, and the outer surface covered with spines.

Examples: starfish, sea urchin, sea cucumber

Chordata (kor-da'-tuh) 45,000 species (beige)

The notable characteristics are: a notochord, a dorsal tubular nerve cord, and/or paired gill clefts.

Examples: lamprey, shark, perch, frog, snake, sparrow, man

Selected Phyla of the Animal Kingdom

Purposes:

To develop awareness of the major phyla of the animal kingdom
To develop appreciation and understanding of the classifications of animals
To emphasize the interrelationship of all living matter
To improve observation skills
To develop appropriate vocabulary

Preliminary Exercises:

Activities which involve sorting by color, size, and shape
Color tablet matching
Observation of live specimens
Work with picture cards from Classification of Living Organisms and pictures representing the selected phyla
Practice with phonogram materials

Materials:

Cream container labeled Selected Phyla of Animal Kingdom with a control strip and mute cards having drawings to represent selected phyla of the animal kingdom, with separate labels
Cream container of definition cards, color-coded according to the color scheme previously given and cream colored control booklet

Procedure:

1. Invite a child to the lesson and lay out the control strip in the center of the table. The child is seated on your dominant side.
2. Have the child match and place the mute cards beneath the control strip and, if able to read, place labels on the mute cards.
3. Show child how to refold the control strip.
4. Place materials in container, stand, replace chair.
5. Return materials to shelf, thank the child and say that these materials may be chosen.

Procedure for Definition Cards

1. Once it is observed that the child who can read has used the mute cards, controls and labels, invite the use of definition cards to be matched with drawings, using the control booklet

Control of Error:

Color coding of cards and labels
Control strip

Observations:

Handling of materials
Arrangement of materials
Child's reaction to error
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration

Variations

Teach names of phyla by the three-period lesson unless the child can read.
Invite the child to arrange mute cards without reference to the control strip until layout is complete.
Once pictures can be identified without reference to control, invite the child to trace the drawings.

Vocabulary:

phyla phylum Porifera Cnidaria Platyhelminthes Nematoda Brachiopoda Mollusca Annelida Arthropoda Echinodermata Chordata

Parts of Animals of Selected Phyla of the Animal Kingdom

Purposes:

To aid perception of similarities and differences of principal parts of animals representing selected phyla of animal kingdom
To establish awareness of parts of animals and their functions
To improve observational skills
To develop appropriate vocabulary

Preliminary Exercises:

Use of Selected Phyla of Animal Kingdom pictures
Practice with controls and definitions of the Selected Phyla of the Animal Kingdom.

Materials:

Containers with control and mute cards with separate labels for parts of each selected phylum of animal kingdom, color-coded according to color scheme given before
Containers with definition cards mounted on appropriate colors for each part represented and a control booklet for parats of each selected phyla

Procedure:

1. Invite a child to lesson and place any container of pictures of parts of animals on the table.
2. Invite the child to lay out control cards, place matching mute cards below the appropriate control cards and, if reading, place labels on the mute cards.
3. Once it is apparent that the procedure is understood, say that any of the containers for parts of animals may be chosen and leave the table to observe unobtrusively.

Note: By now, the child knows to return materials to the container and to replace them on the shelf.

Procedure for comparison of body parts among the phyla:

1. Invite the child who has used the parts of animals materials to bring any two sets of controls for animal parts to a table.
2. Have the child lay out one set of controls, then by reading the labels on the contoll cards, to place the corresponding parts cards below the previoously placed set.
3. Once it is apparent that the procedure is understood, say that any of the containers for parts of animals may be chosen for comparison and leave the table to observe unobtrusively.

Control of Error:

Control cards

Observations:

Handling of materials
Matching of control and mute cards
Labeling of mute cards by child who reads
Child's reaction to error
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration

Variations:

Using the three-period lesson, teach names of body parts to those who cannot read.
Once the names of body parts are known, invite the child to trace drawings.
Invite child to use control booklet and match definition cards to drawings in each phyla.
Invite the use of the materials without referring to controls until layout is complete.

Vocabulary:

names of body parts of animals in each phylum terms used in definition booklets

Life Cycles of Selected Phyla of the Animal Kingdom

Purposes:

- To provide information about the sequence of life in each of the selected phyla of animal kingdom
- To aid understanding and appreciation of the developmental process of life
- To further develop a sense of order
- To improve observational skills
- To develop appropriate vocabulary

Preliminary Exercises:

- Observation of various animals during their life cycle processes when possible
- Use of materials for Selected Phyla of Animal Kingdom
- Work with parts of animals materials

Materials:

- White control time line for the life cycle of a typical organism in each phylum with labeled outline drawings in the color scheme previously used
- Ten mute white time lines
- Containers of separate drawings (one drawing per card) with separate labels for each mute card, mounted on color appropriate for each phylum, color-coded as above
- Containers with information cards and control booklets in the color appropiate for each phylum
- Note: The scale for each time line for the life cycles of animals should be the same so that a comparison is possible regarding the length of time required for the life cycles.

Procedure:

1. Invite a child to the lesson, choose any control time line and unroll on the floor. Have the child unroll the corresponding mute time line below the control time line.
2. Select the container of pictures appropriate for the time line, remove pictures, keeping them in a stack in front of the child. Have the child place each on the mute time line in locations as indicated on the control.
3. Labels may be placed under pictures on mute time line if child can read phonograms.
4. Have the child return pictures and labels to container, then roll up time lines beginning at right ends.
5. After materials are returned to the shelf, tell the child any set of time lines of selected phyla of the animal kingdom may be chosen.

Control of Error:

- Control time line
- Color code

Observations:

- Handling of materials
- Placement of pictures on mute time line

Placement of labels
Child's reaction to error
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration

Variations:

By the three-period lesson, teach terms used in life cycles to those who cannot read.
Invite the tracing of drawings once the child knows the terms used in life cycles.
Invite the child to match information cards with drawings, using the control booklet to check the work.

Vocabulary:

names of stages within life cycles

Separate Pictures for Classes of Phylum Chordata

Purposes:

To provide examples of animals from each of the seven classes of phylum Chordata
To aid perception of similarities and differences within each class in phylum Chordata
To develop an appreciation of order in classification
To improve observational skills
To develop appropriate vocabulary

Preliminary Exercises:

Work with Selected Phyla of Animal Kingdom
Work with pictures for each selected phyla of animal kingdom
Use of picture cards for sorting into proper phyla

Materials:

Separate color-coded containers of about six pictures for each of the seven classes, with pictures of these organisms:

Cyclostomata (si-kluh-stow'-muh tuh) (color-coded yellow)
jawless fish lacking scales and having round suction cup mouths, such as lampreys, slime eels

Chondrichthyes (kawn-drik'-theez) (color-coded gray)
fish which have cartilaginous skeletons, such as sharks and skates

Osteichthyes (aws-tee-ik'-theez) (color-coded dark blue)
bony fish with scales, such as perch

Amphibia (am-fi b'ee-uh) (color-coded orange)
animals lacking scales which spend part of their life cycle in water, respiring through gills and respiring through skin, lungs or mouth lining on land, such as frogs, toads and salamanders

Reptilia (rep-til'e-uh) (color-coded dark tan)
animals which breathe through lungs and have dry skin covered with scales, such as turtles, snakes, lizards and crocodiles

Aves (a'veez) (color-coded light blue)
birds which have scaly skin with feathers, generally have wings for flying, and lack teeth, such as chickens, robins, and cardinals

Mammalia (muh-may'-lee-uh) (color-coded red)
animals which develop from fertilized eggs usually inside the female who secretes milk to nourish the young, which have hair-covered skin at some stage of life, and complex teeth, such as cows, humans, and dogs

Note: Due to the difficulty in obtaining appropriate pictures for some classes in the quantity desired , all of the various orders within each class may not necessarily be represented.

Pictures of animals of each class mounted on cream with a colored dot on the back in the top right corner to indicate class; heading cards, each with a label mounted on 8 1/2" by 2" in appropriate color for each class

Label for each phylum Chordata on appropriate color

Introductory Procedure:

1. Invite a child to the lesson and place any container representing one of the classes of phylum Chordata on the table.
2. Ask the child to remove the pictures, and give the name of the class that the pictures represent as well as names of the specific animals. Give pertinent information from the backs of the cards.
3. Have the child replace pictures in the container, stand, replace chair, then return container to shelf. Tell the child that any of the containers may chosen for examination.

Sorting Procedure:

1. Invite the child who is familiar with the introductory pictures of classes of phylum Chordata to bring the pictures mounted on cream colored backgrounds and the colored labels to a table.
2. Have the child lay out the labels horizontally near the middle of the table, then examine each picture before placing it verticallybelow the appropriate label.
3. Tell the child that the colored dot on the reverse of the pictures may be used to check placement

Control of Error:

Color code for each class

Observations:

Handling of materials
Return of pictures to container
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration
Child's reaction to error

Vocabulary:

names of animals depicted in the pictures classes of animals depicted

Phylum Chordata

Purposes:

To provide examples of the seven classes of phylum Chordata
To aid perception of similarities and differences of classes of animals in phylum Chordata
To develop an appreciation of order in classification
To improve observational skills
To develop appropriate vocabulary

Preliminary Exercises:

Use of Selected Phyla of Animal Kingdom pictures
Work with picture cards for sorting into appropriate phyla
Use of pictures of classes in phylum Chordata

Materials:

Beige container labeled phylum Chordata containing a control strip, color-coded labels and mute cards to represent the seven classes of phylum Chordata, color-coded as given previously for pictures of classes of phylum Chordata
Beige container with definition cards and control booklets with labeled drawings on the left pages, definitions on the right pages

Procedure:

1. Invite a child to the lesson and lay out the control strip in the center of a table.
2. Have the child match and place the mute cards beneath the control strip and place labels on the mute cards if able to read phonograms.
3. Show the child how to refold the control strip and place materials in container.
4. Stand, replace chair, return materials to shelf, and say that the material for classes of phylum Chordata may be chosen.

Control of Error:

Control strip
Color coding of cards and labels

Observations:

Handling of cards and control
Placement of mute cards and labels if child is able to read
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration
Child's reaction to error

Variations:

By the three-period lesson, teach names of classes to those who cannot read.
Invite the child to arrange mute cards without referral to control strip until layout is complete.
Invite the child who can read to match definition cards with drawings, referring to the control booklet.
After the child knows the names of the classes, invite the tracing of drawings.

Vocabulary:

class Cyclostomata Chondrichthyes Osteichthyes Amphibia Reptilia Aves Mammalia

Parts of Animals of Classes in Phylum Chordata

Purposes:

To aid perception of similarities and differences of animals representing the classes of phylum Chordata
To develop an appreciation of order in classification
To improve observational skills
To develop appropriate vocabulary

Preliminary Exercises:

Work with Selected Phyla of Animal Kingdom materials
Use of separate picture containers of selected phyla of animal kingdom
Work with phylum Chordata definitions
Use of separate picture containers for classes of phylum Chordata

Materials:

Containers of control and mute cards with separate labels for parts of animals in each class of phylum Chordata, color-coded according to previous color scheme
Containers of definition cards for parts of each animal, color-coded appropriately according to previous color scheme
Control booklets with drawings and definitions for parts of animals in each class of phylum Chordata
If possible, body parts puzzles with controls for as many classes as available

Procedure:

1. Invite a child to the lesson and place a container with parts of an animal from any class on the table.
2. Have the child lay out control cards, place matching mute cards below, and, if reading, place labels on the mute cards.
3. Say that any of the containers with parts of animals from any class may be chosen. Leave the table and observe unobtrusively.

Procedure for comparison of body parts among the classes in phylum Chordata:

1. Invite the child who has used the body parts materials to bring any two sets of controls for body parts to a table.
2. Have the child lay out one set of controls, then by reading the labels on the contoll cards, to place the corresponding parts cards below the previoously placed set.
3. Once it is apparent that the procedure is understood, say that any of the containers for body parts of classes may be chosen for comparison and leave the table to observe unobtrusively.

Control of Error:

Control cards
Color code

Observations:

- Handling of materials
- Placement of controls, mute cards and labels
- Child's reaction to error
- Length of work time and number of repetitions
- Length of period of contemplation
- Degree of interest and concentration

Variations:

- For those who cannot read phonograms, use the three-period lesson to teach names of body parts of animals in classes of phylum Chordata.
- Invite the child to lay out the mute cards and labels without referring to the controls except to check completed work.
- Invite the child to use puzzles with controls for parts of animals in any class.
- Invite the child to match definition cards with drawings, using the control booklet to check the work.
- Invite the child who has learned the names of body parts in any class to trace drawings.

Vocabulary:

- names of body parts of each class

Life Cycles of the Phylum Chordata

Purposes:

To provide information about the sequence of life in each class of phylum Chordata
To aid understanding and appreciation of the developmental process of life
To develop an appreciation of order in classification
To improve observational skills
To develop appropriate vocabulary

Preliminary Exercises:

Work with Selected Phyla of Animal Kingdom and pictures
Observation of various animals during their life cycle processes when possible
Use of materials for Parts of Animals

Materials:

Seven beige life cycle control time lines with labeled outline drawings in the color scheme stated for each class in phylum Chordata
Seven mute beige time lines
For each mute time line, a container of separate drawings (one drawing per card), with separate labels color-coded as above
Containers with information cards and control booklets with labeled drawings on the left pages and information on the right pages in the color appropiate for each class
Note: The scale (one inch equals one day) is the same for all time lines for the life cycles of animals so that a comparison can be made regarding the length of time required for each life cycle.

Procedure:

1. Invite a child to the lesson and choose any life cycle control and mute time lines. Take appropriate container of drawings and labels to a table or floor mat..
2. Ask the child to unroll the control with the mute time line below it on a table or on the floor.
3. Have the child remove drawings from container and place on the mute time line in proper locations by referring to the control.
4. If the child can read phonograms, invite the placement of labels under cards on mute time line.
5. Ask the child to return drawings and labels to the container and to roll up the time lines beginning at right ends.
6. Have the child return materials to shelf and say that any of the life cycle time lines may be chosen.

Control of Error:

Control time line
Color code for each class used to outline and mount drawings

Observations:

Handling of materials

Placement of drawings and labels on mute time line
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration
Child's reaction to error

Variations:

By the three-period lesson, teach names of stages of various life cycles to the child who cannot read phonograms.
Once names of the stages of life cycles are known, the child may trace drawings.
Invite the child to match information cards with drawings, using the control booklet to check the work.

Vocabulary:

names of stages within life cycles

External Parts of the Human Body, Phylum Chordata, Class Mammalia

Purposes:

To provide a means for learning the names and functions of external parts of the body
To develop an appreciation of the complex functions of the human body
To provide the basis for the study of Human Physiology
To improve observational skills
To develop appropriate vocabulary

Preliminary Exercises:

Work with materials for Selected Phyla of Animal Kingdom
Use of separate picture containers of selected phyla of animal kingdom
Work with materials for phylum Chordata
Use of separate picture containers for the classes of phylum Chordata

Materials:

Container of control and mute cards with separate labels for each major external part of the human body (head, trunk, arm, hand, leg, foot), mounted on red
Containers of control and mute cards with parts of the human body's trunk, arm, hand, leg, foot and head, each mounted on red; labels for each part

Procedure:

1. Invite a child to the lesson and place the container for the major external parts of the human body on the table.
2. Have the child lay out control cards and match with appropriate mute cards placed below. If able to read phonograms, invite child to place labels on the mute cards.
3. Leave and observe unobtrusively.

Control of Error:

Control cards

Observations:

Handling of materials
Matching of control and mute cards
Placement of labels on mute cards by child who reads
Child's reaction to error
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration

Variations:

For the child who cannot read phonograms, use the three-period lesson to teach names of major human body parts as well as the parts of each part.
Invite child to place labels on body parts mute cards without referral to the control until finished.
Invite the child who knows the names of body parts to trace drawings.
Invite the child to compare the parts of the human body with parts of the bodies of animals from other classes
Invite the child to use the control and mute cards with labels for parts of body parts

Vocabulary:

names of body parts names of parts of body parts

BOTANY

Pictures of Phyla of the Plant Kingdom

Purposes:

To introduce the phyla of the Plant Kingdom
To develop appreciation and understanding of the classification of plants
To further establish a sense of order
To improve observational skills
To develop appropriate vocabulary

Preliminary Exercises:

Observation of live plants specimens of as many of the phyla as possible
Sensorial experiences involving appearance, odor, texture and taste of various plants.

Materials:

Ten containers with six pictures or drawings, each color coded as given in Information on Phyla of the Plant Kingdom
Container with two pictures or drawings from each phylum mounted on cream, identical to those mounted on color, with colored dot on reverse for control of error, color-coded heading card mounted on 8 1/2" by 2" for each phylum

Procedure:

1. Invite a child to the lesson, choose any container and place on a table on your non-dominant side with the child seated on your dominant side.
2. Name the phylum chosen. Remove one picture at a time, naming each specimen and giving pertinent information from the backs of the pictures. Invite the child to examine each picture, then lay on the table in a row from left to right.
3. Have the child replace the pictures in the container. Thank the child and say that any of the picture containers for phyla of the plant kingdom may be chosen.
4. Stand, replace chair and return container to the shelf.

Control of Error:

Color code of each container and picture mounting

Observations:

Handling of materials
Return of pictures to the container
Child's reaction to error
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration

Variations:

Invite the child to sort pictures mounted on cream under the appropriate heading cards.

Vocabulary:

names of specimens in pictures

Bryophyta (bri-uh-fite' uh) 25,000 species (light blue)
Growing in a moist habitat, these are not adapted to life on land since sperm must swim through water to reach eggs. There are only three classes: liverworts, hornwarts and mosses.
Example: sphagnum

Psilophyta (si-luh-fite'-uh) (light orange)
This bare or smooth plant has external sex organs and contains only two genus.
Example: whisk fern

Lycopodophyta (li-kuh po' duh fite uh) 1,000 species (light green)
Living on other plants, these do not bear seeds. They grow in moist habitats.
Example: club mosses

Sphenophyta (sfee-no-fite' uh) 40 species (pink)
Commonly called scouring rush, wedge plants have jointed and hollow stems with rough, ribbed textures and thrive on salt flats, along banks of streams and in moist low-lying wooded areas.
Example: horsetail

Filicinophyta (fil-uh-sin-uh-fite' uh) 12,000 species (red)
Little wing or feather plants grow in habitats which are occasionally moist.
Reproduction is by means of spores rather than seeds.
Example: ferns

Cycadophyta (sik-uh-duh-fite' uh) 100 species (orange)
Palm plants, called gymnosperm, bear naked seeds that are not inside ovaries. The compound leaves are palm-like or fern-like.
Example: sago palm

Ginkgophyta (ging' ko-fite-uh) (gray)
These dioecious plants have small bilobed leaves resembling fronds of maidenhair fern.
Example: maidenhair tree

Coniferopyhta (kuh-nif'uhr-uh-fite-uh) 580 species (yellow)
Cone bearing plants have leaves which usually are needle-shaped. The monoecious seeds are naked. These trees are of great economic importance.
Examples: fir, pine, spruce

Gnetophyta (net' uh-fite-uh) 70 species (purple)
Cones of these desert plants lack resin canals and seeds are naked. They resemble flowering plants in many ways. Useful drugs are extracted from some species.
Example: ephedra

Angiospermophyta (an' jee-uh-sperm-uh-fite'-uh) 230,000 (green)
This phylum contains nearly every familiar tree, shrub and garden plant that produces flowers and seeds.
Examples: dogwood, rose

Phyla of the Plant Kingdom

Purposes:

To develop awareness of the phyla of the plant kingdom.
To develop appreciation and understanding of the classifications of plants
To emphasize the interrelationship of all living matter
To improve observational skills
To develop appropriate vocabulary

Preliminary Exercises:

Activities which involve sorting by color, size and shape
Work with picture cards from Classification of Living Organisms
Work with picture cards for each phyla of the plant kingdom
Practice with phonogram materials

Materials:

Cream container labeled Phyla of the Plant Kingdom with a control strip and mute cards to represent the phyla of the plant kingdom
Cream container of definition cards, labels and control booklet

Procedure:

1. Invite a child to the lesson and lay out the control strip in the center of the table. The child is seated on your dominant side.
2. Have the child match and place the mute cards beneath the control strip and, if reading, place labels on the mute cards.
3. Show the child how to refold the control strip.
4. Place materials in the container, stand, replace chair.
5. Return materials to shelf, thank child and say that these materials may be chosen.

Control of Error:

Color coding of cards and labels
Control strip

Observations:

Handling of materials
Arrangement of materials
Child's reaction to error
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration

Variations:

Teach names of phyla by the three period lesson to the child who cannot read.

Invite the child to arrange mute cards without reference to the control strip until layout is complete.

For those who can read, invite the use of definition cards to be matched with drawings, using the control booklet.

Once pictures can be identified without reference to the control, invite the child to trace drawings.

Vocabulary:

phyla phylum names of each phylum

Parts of the Plants in Phyla of the Plant Kingdom

Purposes:

To aid perception of similarities and differences of parts of plants in each phyla of the Plant Kingdom
To establish awareness of parts of plants and their function
To improve observational skills
To develop appropriate vocabulary

Preliminary Exercises:

Use of pictures and controls of each phyla of the Plant Kingdom

Materials:

Plant with roots, stem, leaf, flower, the flower having sepals, receptacle, corolla, stamen, pistil; black tray or tray with black paper; small scissors
Small numeral cards 1 to 10 from mathematics materials
Containers with control and mute cards with separate labels for the parts of a typical plant in each phyla color coded according to previous information
Container with definition cards mounted on appropriate colors for each part represented and a control booklet for each selected phyla
Containers of leaf forms, flower forms; parts of flower, leaf, stamen, pistil, stem, root, fruit, seed; types of fruit, seeds; leaf margins, veins, bases, apexes, leaf arrangement, along with separate labels and control booklets or cards for each form or catagory

First Procedure:

1. Invite a few children to the lesson and place the scissors and the tray with plant on the table. Have the children sit around the table.
2. Say, “This is a plant.” Move the plant to the left of the tray. Be sure that everyone at the table has a good view at each step, turning the tray if necessary.
3. Cut the root from the plant and place it to the right but in the same relative position as when attached. Say, “This is the root,” or, “ These are the roots,” whichever is appropriate.
4. Cut the leaves from the stem and place to the right but in the same relative position as when attached. Say, “These are the leaves.”
5. Cut the flower from the stem. Move the stem to the right but leave space between it and the root as well as the leaves. Say, “This is the stem.”
6. Point to the receptacle or base of the flower and say its name.
7. Point to the combined petals and sepals and say, “This is the perianth.”
8. Point to the calyx and give its name.
9. Point to all of the petals and say, “This is the corolla.”
10. Remove each sepal from the calyx and place separately in a row just above the stem. Point to one sepal and say, “This is a sepal.” If the receptacle has become separated, place it between the top of the stem and the bottom of the sepals. Say its name again.
11. Remove each petal from the corolla and place separately in a row just above the row of sepals. Point to one petal and say, “This is a petal.”
13. Remove the stamens and place above the petals, saying the name.
14. Remove the pistil and place above the stamens, saying the name.
15. Have different children count the separate parts and place a numeral card at the right of each section of parts.

16.. Thank the children, stand, replace chair and place the tray on the shelf where the parts of the plant may be observed. Return the scissors to their storage place.

Second Procedure:

1. Invite a child to the lesson and place any container on the table. Have the child sit on your dominant side.
2. Ask the child to lay out control cards, place matching mute cards below and, if reading, place labels on the mute cards.
3. Once it is apparent that the procedure is understood, say that any of the containers for parts of plants may be chosen. Leave the table and observe unobtrusively.
   Note: By now, the child knows to return the materials to the container and to replace them on the shelf.

Procedure for Cabinet and Cards of Leaf Shapes

1. Invite a child who has had experience using the geometric cabinet and cards to bring any drawer from the cabinet of leaf shapes to a table along with the apppropriate cards having the solid green forms.
2. Tell the child to place the tray to the left and to arrange the cards at right of the tray in two rows.
3. Have the child examine the card at the upper left, then locate the leaf inset that matches and place it on the card by grasping the knob with the first two fingures and thumb of the dominant hand. It is not necessary for the child feel the edge of the leaf shape because visual skills have been developed by now which preclude feeling. Indicate that this procedure continues for the remaining leaf shapes if the child seems hesitant about it.
4. Leave and say that any drawer and cards with may be chosen.
5. After observing the child's use of the cards with solid forms, invite the use of cards with thick outlines, then the thin outlines.
6. If the child can read, introduce the separate labels naming the leaf forms with the control cards or booklet.

Procedure for Cabinet of Leaf Shapes of Familiar Trees

1. Invite the child to use the cabinet of familiar tree leaf shapes with a control chart or separate cards which give the name of the tree from which the leaf came, and place the separate labels on the appropriate shapes.
2. Have the child collect leaves from trees in the local environment to identify by using the controls.

Procedure for Use of Other Botanic Materials

1. Invite the child to use materials for leaf forms, flower forms; parts of flower, leaf, stamen, pistil, stem, root, fruit, seed; types of fruit and seeds; leaf margins, veins, bases, apexes, leaf arrangement, with separate labels and control booklets or cards for each form or catagory, following the procedure previously given.

Control of Error:

Control cards

Observations:

Handling of materials
Matching of control and mute cards
Labeling of mute cards by child who reads
Child's reaction to error
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration

Variations:

Using the three period lesson, teach names of plant parts to those who cannot read.
Invite the use of the materials without referring to controls until layout is complete.
Once the names of plant parts are known, invite the child to trace drawings.
Invite the child to compare plant parts among various phyla.
If available, puzzles with parts of tree, flower and leaf may be used, each with a control on which to place the parts. Each puzzle should have a separate piece for each part with a knob for easy removal and replacement

Vocabulary:

stem trunk branch root primary root secondary root root cap root hair flower calyx corolla receptacle stamen pistil sepals petals ovary style stigma anther filament leaf blade petiole stipule vein epidermis terminal bud lateral bud node bud scales seed seed coat embryo food storage tissue flower forms leaf forms names of kinds of leaves, flowers, roots, stems, seeds, trees

Life Cycles of Phyla of the Plant Kingdom

Purposes:

To provide information about the sequence of life in each of the phyla of the Plant Kingdom
To aid understanding and appreciation of the developmental process of plants
To develop an appreciation of order in classification
To improve observational skills
To develop appropriate vocabulary

Preliminary Exercises:

Planting of different kinds of seeds and bulbs to observe during their life cycle processes
Use of phyla of Plant Kingdom pictures and control strips
Work with materials for parts of plants

Materials:

Container with control for the life cycle of a typical plant in each of the four phyla given in the "White Pages", mounted on color previously given; mute cards and separate labels for each; definition cards and information booklets

Procedure:

1. Invite a child to the lesson, choose a container for any plant life cycle and place on a table. Have the child sit on your dominant side.
2. Ask the child to unfold the control, then place the matching mute cards below it.
3. Labels may be placed on the mute cards if the child can read.
4. Have the child return control, mute cards and labels to the container.
5. After the materials are returned to the shelf, thank the child and say that any of the plant life cycles may be chosen.

Control of Error:

Control time line
Color code

Observations:

Handling of materials
Placement of pictures
Placement of labels
Child's reaction to error
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration

Variations:

By the three period lesson, teach terms used in life cycles to those who cannot read.
Invite the child to trace drawings once the terms used in life cycles are learned.
Invite the child to read the information booklets.

Vocabulary:

names of stages in life cycles

Comparison of Monocotyledons and Dicotyledons

Purposes:

To learn to distinguish monocotyledons from dicotyledons
To improve observational skills
To develop appropriate vocabulary

Preliminary Exercises:

Planting of monocotyledon and dicotyledon seeds and observation of their growth
Work with materials for parts of seeds
Practice in classifying leaves by veination and flowers by form
Exercises for reading phonograms

Materials:

Container with green control and mute cards with labels for seeds, roots, stems, leaves and flowers of monocotyledons
Container with green control and mute cards with labels for seeds, roots, stems, leaves and flowers of dicotyledons
Note: Each diagram except that for the seed has a very small diagram of a monocotyledon or dicotyledon in the upper right corner on the reverse as appropriate to act as a control.
Information booklet about monocotyledons
Information booklet about dicotyledons
Container of seeds that are monocotyledons and dicotyledons; labels for monocotyledon and dicotyledon

Procedure:

1. Invite a child to the lesson and place the container of control and mute cards on a table in front of the child who is seated on your dominant side.
2. Ask the child to lay out the control cards for either monocotyledons or dicotyledons from left to right and to place the matching mute cards below them., starting with the seed diagram. Indicate that the similar cards for the remaining category are placed so that the seed diagrams are under each other, the leaf diagrams are under each other, etc.
   Note: The diagrams can be in any sequence following the seed, but it must be the first on the left.
3. If able to read, have the child place labels appropriately on the mute cards. Otherwise, teach the names by the three period lesson over a period of time.
4. Ask the child to return the materials to the container and to replace the container in its storage place once the work is complete.
5. Thank the child and say that the material for monocotyledons and dicotyledons may be chosen. Stand and replace chair.

Control of Error:

Control cards
Small seed diagram on the reverse of each card to indicate its classification

Observations:

Handling of materials
Placement of control and mute cards
Labeling of control and mute cards by the child who can read

Child's reaction to error
Length of work time and number of repetitions
Length of period of contemplation
Degree of interest and concentration

Variations:

Invite the child who can read to place the labels without referring to the control cards until the work is complete.
Once the terms are known, invite the child to trace the diagrams.
Invite the child who can read to read the information booklet.
Invite the child to mix the control pictures and sort them into monocotyledons and dicotyledons, using the small pictures on the reverse as a control.
Invite the child to lay out the labels for monocotyledon and dicotyledon, then to classify seeds by placing them under the appropriate labels.

Vocabulary:

monocotyledon dicotyledon

Instructions for Preparing Biology Materials

Zoology

Preparation of Materials for Kingdoms

Pictures

1. Collect pictures for each Kingdom with information about each picture.
   Note: Due to the difficulty in obtaining appropriate pictures in the quantity required for some Kingdoms, all of the various organisms within each Kingdom may not necessarily be represented.
2. Separate pictures according to Kingdom, trim pictures on paper cutter.
3. For each picture, use cover stock either 8 l/2" by 11" or 8 l/2" by 5 l/2" in color appropriate for the Kingdom as stated previously. Size is determined by picture size, but no matter how small the picture, use the 8 1/2" by 5 1/2" size. Pictures must not be larger that 8" by 10 1/2".
4. Type or letter information about the specimen on the back, then mount the corresponding picture on the front, using glue stick or spray adhesive.
5. Laminate the pictures back and front according to directions previously given and place in color-coded containers.
6. Prepare a color-coded container by cutting vinyl 10 1/2" wide and 25 1/2" long. Place right sides of fabric together, leaving at least 3" at top for flap, and sew the two sides. Turn right side out. Round corners of flap by trimming.
7. Place pictures in their matching color container labeled with Kingdom name.

Drawings

1. Cut the drawings from the white pages to 4 14" by 4 1/4" and mount on cream cover stock 5 1/4" by 5 1/4". Place a colored dot in the top right corner of the back to indicate the kingdom and mount appropriate information on the back. Laminate.
2. Place all drawings in one cream container.

Heading Cards

1. Cut Kingdom heading cards 1" by 4 1/4" and mount on 2" by 5 1/4" cover stock in the colors previously given for the Five Kingdoms.
2. On the back, letter the phonetic pronunciation.
3. Laminate.

Note: Always letter the phonetic pronunciation on the reverse of the label for any word which is difficult to pronounce.

Colors:

Prokaryotae bacteria (color-coded gray)
Protoctista nucleated algae, flagellated water molds, slime molds, protozoa (color-coded light blue)
Fungi eukaryotes that form spores and lack flaggellum (color-coded tan)
Plantae plants (color-coded green)
Animalia animals (color-coded white)

Preparation of Materials for Five Kingdoms

1. Using white paper, make three copies of one drawing of a representative organism from each phyla and appropriate labels, and two copies of the appropriate definition.
2. Cut each drawing to measure 4 1/4" by 4 1/4".
3. Cut each label 1" by 4 1/4".
4. Cut each definition to measure 2 1/2" by 4 1/4".
5. Cut two pieces of cover stock for each kingdom according to the color scheme previously given 6 3/4" high by 5 1/4" wide. Cut one cream card 6 3/4" by 5 1/4" and label it The Five Kingdoms.
6. Mount two copies of each drawing on appropriate color of paper with 1/2" border at top and sides.
7. On one set of drawings, which will be the control, mount appropriate label so that there is a 1/2" border at the bottom.
8. Lay out control cards in sequence according to list in the Five Kingdoms with the cream title card first.
9. Transfer these cards in proper sequence with back side down to laminate, leaving 1/8" space exposed between each card to allow for folding.
10. Trim control strip around top, bottom and two ends. Do not cut between cards. Laminate the front, leaving a border of approximately 3/4" to fold over the edge.
11. Accordion fold the control strip so that the title card is uppermost.
12. Mount one copy of each remaining label on appropriately colored cover stock for each kingdom 5 1/4" wide by 2" high.
13. Leaving a 1/2" border on all sides, mount one copy of each definition on cream cover stock for each kingdom 5 1/4" wide by 3 1/2" high. Place a dot of the approprriate color at top right corner on the reverse.
14. Laminate separate labels, mute cards and definition cards.

Booklet Preparation

1. Cut cream cover stock 11" wide by 7" high for the cover.
2. Fold in half to make the cover 5 1/2" by 7". Center and letter the title on the front cover. Laminate the cover on both sides.
3. Cut white paper 10 1/2" wide by 6 1/2" high for inside pages.
4. Fold each piece of paper in half to make pages 5 1/4" by 6 1/2" and arrange into booklet form.
5. Beginning in order, arrange and mount drawings with appropriate labels on the left pages and definitions on right pages. (The first right-sided page of the booklet is blank.) Laminate each page on both sides.
6. Sew the center of the booklet with dental floss or quilting thread by inserting the needle through all pages as well as the cover from the inside center of the fold. Leave about 2" of thread loose on the inside so that a knot can be tied upon completion of sewing. Stitch toward the top by inserting the needle through the holes, then backstitch to the center. Stitch toward the bottom and backstitch to the center. End at the inside center by tying a square knot. Clip the thread about 1/4" from the knot. (See video tape for demonstration.)
7. Fold back the cover and trim the fore-edge of the white pages to make all pages even.

Note: Prepare the information booklet on Linnaeus according to the preceding directions. There are no pictures, so the left page will be blank

Preparation of Classification Vocabulary

1. Make one copy of classification vocabulary words from white page and two copies of each drawing.
2. Two pieces of cream cover stock are needed for each picture mounting, but only one label mounting is needed for each because the second label is mounted under its appropriate picture. Cut pictures, labels and cream cover stock to the sizes as follows:

	two each size		one each size	
label	picture size	label size	cover stock for picture	cover stock
Kingdom	4 1/4" by 4 1/4"	4 1/4" by 1"	5 1/4" by 6 3/4"	5 1/2" by 2"
Phylum	4 1/4" by 3 3/4"	4 1/4" by 7/8"	5 1/4" by 6"	5 1/2" by 1 3/4"
Class	4 1/4" by 3 1/4"	4 1/4" by 3/4"	5 1/4" by 5 1/4"	5 1/2" by 1 1/2"
Order	4 1/4" by 2 1/2"	4 1/4" by 5/8"	5 1/4" by 4 1/2"	5 1/2" by 1 1/2"
Family	4 1/4" by 2"	4 1/4" by 5/8"	5 1/4" by 3 3/4"	5 1/2" by 1 1/4"
Genus	4 1/4" by 1 1/4"	4 1/4" by 1/2"	5 1/4" by 3"	5 1/2" by 1 1/4"
species	4 1/4" by 1"	4 1/4" by 1/2"	5 1/4" by 2 1/4"	5 1/2" by 1"

3. Using glue stick or spray adhesive, mount one set of pictures with corresponding labels under each on the appropriate sizes of cover stock as given above. Mount the other set of pictures which are not labeled on the appropriate sizes of cover stock. Mount the separate labels on appropriate sizes of cover stock.
4. Lay out vertically the set of cards with labels, starting with kingdom at the top, according to the sequence above. Sizes of cards and words will descend. This will be the control.
5. Transfer control cards onto laminating material as sequenced above with back side down, leaving 1/8" space exposed between each card to allow for folding.
6. Trim control strip around top, bottom and two ends. Do not cut between cards. Laminate the front, leaving a border of approximately 3/4" to fold over the edge.
7. Accordion fold the control strip.
8. Laminate separate cards and labels
9. Prepare cream colored packet as in previous directions, or provide other container for control and cards.

Note: For your information, in the drawings given for this material, the nomenclature is: Kingdom, Animalia; Phylum, Chordata; Class, Mammalia; Order, Carnivora; Family, Felidae; Genus, Felis; species, catus.

Color Scheme and Information on Selected Phyla of the Animal Kingdom

Porifera (po-rif'uh-ruh) 10,000 species (light blue)
Pori means small opening. There are many cells, bearing numerous small pores which are openings to canals. The skeletons are spongy fibers or glassy spicules.
Examples: sponges, Venus flower basket

Cnidaria (ni-dar'e-uh) 10,000 species (light orange)
The body and digestive cavity are combined. There are many cells in two layers; simple tissues are present and body parts have radial symmetry.
Examples: hydra, jellyfish, coral

Platyhelminthes (plat-e-hel'min-thez) 15,000 species (light green)
The flat, ribbon-like body is bilaterally symmetrical with digestive, nervous, excretory, and reproductive systems usually present. They may be parasitic or free living.
Examples: planarian, fluke, tapeworm

Nematoda (nem-uh-tod'uh) 80,000 species (pink)
These round, unsegmented worms have cylindrical bodies tapering at each end. They may be free living or parasitic.
Examples: vinegar eel, pinworm, hookworm, filaria worm

Brachiopoda (brak'e-uh-pawd-uh) 30,000 species (light yellow)
Shell-bearing forms resemble mollusks in appearance but are very unlike them otherwise. The bivalve shell is attached to the substratum by a stalk called the peduncle.There is bilateral symmetry at right angles to valves of shell. This is one of the oldest phyla.
Example: lingula

Mollusca (maw-lus'kuh) 110,000 species (orange)
Soft sac bodies contain organ systems. There is a muscular foot and a mantle that usually secretes shell.
Examples: Clam, snail, slug, whelk, squid, octopus

Annelida (an'el-id-uh) 8,800 species (gray)
Bodies are tubular and have true segmentation. The digestive tract is a tube with anterior mouth and posterior anus. There is a body cavity and organ systems are complete.
Examples: earthworm, clam worm, leech

Arthropoda (ar'thrah-pahd-ah) 500,000+ species (yellow)
Exoskeleton usually contains chitin. There is bilateral symmetry with distinct body regions, segmentation, jointed appendages and a high degree of specialization.
Examples: lobster, crayfish, spider, centipede, insect

Echinodermata (ih-ky'nuh-der-mat-ah) 6,000 species (lavender)
Characteristics are radial symmetry, limy skeletal parts, tube feet, and the outer surface covered with spines.
Examples: starfish, sea urchin, sea cucumber

Chordata (kor-da'-tuh) 45,000 species (beige)
The notable characteristics are: a notochord, a dorsal tubular nerve cord, and/or paired gill clefts.
Examples: lamprey, shark, perch, frog, snake, sparrow, man

Preparation of Pictures for Each Selected Phyla

1. To prepare picture containers to introduce the types of specimens typical of each phylum, collect twelve pictures for each phylum with information about each picture. Different pictures of the same specimen may be used.
2. Separate pictures according to phylum, trim pictures on paper cutter and determine the number of pieces of paper in each size and color needed. The same number and sizes of cream paper are needed.
3. Cut six pieces of cover stock either 8 l/2" by 11" or 8 l/2" by 5 l/2" in color appropriate for the phylum as stated previously. Cut cream index or card stock in sizes appropriate for picture sizes. Size of mounting is determined by picture size, but no matter how small the picture, use mounting no smaller than 8 1/2" by 5 1/2". Pictures must not be larger than 8" by 10 1/2".

   Note: Due to the difficulty in obtaining appropriate pictures in the quantity required for some phyla, all of the various classes within each phylum may not necessarily be represented.
4. Type or letter information about the specimen on the back of the colored card, then mount the corresponding picture on the front, using glue stick or spray adhesive. Mount pictures on cream and place a colored dot on the top right of the back to act as a control for the phylum in which the picture is classified.
5. Cut cover stock 8 1/2" by 2" in color appropriate for each phylum as stated previously.
6. Make one copy of each phylum name. Cut each 7 1/2" by 1" and mount on appropriately colored card from step 5.
7. Laminate the pictures and labels back and front.
8. For each group of pictures, prepare a color-coded container such as a plastic packet. To prepare a packet, cut fabric 10 1/2" wide and 25 1/2" long. Place right sides of fabric together, leaving 3" at top for flap, and sew the two sides. Turn right side out. Phylum name may be written on the flap..
9. Place pictures mounted on colors in their container of matching color. Place all the pictures mounted on cream and the labels in a cream container labeled “Phyla of the Animal Kingdom”.

Preparation of Materials for Selected Phyla of the Animal Kingdom

1. Using white paper, make three copies of each drawing and label, and two copies of each definition.
2. Cut each drawing to measure 4 1/4" by 4 1/4".
3. Cut each label 1" by 4 1/4".
4. Cut each definition to measure 2 1/2" by 4 1/4".
5. Cut two pieces of cover stock for each phylum according to the color scheme previously given 6 3/4" high by 5 1/4" wide.
6. Mount two copies of each drawing on appropriate color of paper with 1/2" border at top and sides.
7. On one set of drawings, which will be the control, mount appropriate label so that there is a 1/2" border at the bottom. Cut cream card 6 3/4" by 5 1/4" and letter the title, Selected Phyla of the Animal Kingdom.
8. Lay out control cards in sequence according to list in Selected Phyla of Animal Kingdom with the title card first at the left.
9. Transfer cards in proper sequence with back side down to laminate, leaving 1/8" space exposed between each card to allow for folding.
10. Trim control strip around top, bottom and two ends. Do not cut between cards. Laminate the front, leaving a border of approximately 3/4" to fold over the edge.
11. Accordion fold the control strip so that the title card is uppermost.
12. Mount one copy of each remaining label on appropriately colored index or card stock for each phylum 5 1/4" wide by 2" high.
13. Leave a 1/2" border on all sides, mount one copy of each definition on cream cover stock for each phylum 5 1/4" wide by 3 1/2" high.
14. Laminate separate labels, mute cards and definition cards.
15. Place control, mute cards, labels and definition cards in appropriate color-coded container.

Booklet Preparation

1. Cut one piece of cream cover stock 11" wide by 7" high for the booklet cover.
2. After folding cover in half to make the cover 5 1/2" by 7", center and letter the title, Selected Phyla of Animal Kingdom, on the front cover. Laminate the cover on both sides.
3. Cut six pieces of white paper 10 1/2" wide by 6 1/2" high for inside pages of the booklet.
4. Fold each piece of paper in half to make pages 5 1/4" by 6 1/2" and arrange into booklet form.
5. Beginning in the same order as on the control strip, arrange and mount a drawing with the correct label under it on the left page and definition on right facing the drawing. Continue with remaining drawings, labels, and definitions. (The first and last right-sided pages of the booklet will be blank.) Laminate each page on both sides.
6. Following the procedure given for sewing booklets, sew the booklet together.

Preparation of Materials for
Parts of Animals of Selected Phyla of Animal Kingdom

1. Using white paper, make copies of each drawing 4 1/4" by 4 1/4", label 1/2" by 3", and two copies of definitions 2 1/2" by 4 1/4". Three times the number of parts plus one more set will be the number of drawings needed, the extra set labeled with the name of the animal. Use the picture of the adult from the life cycles in the white pages.
2. Using a red water-base marker that does not “bleed”, outline or fill in only one body part on each of three copies of a drawing. Repeat this procedure until each body part has been outlined in red on separate drawings.
3. Cut two pieces of cover stock for each drawing 6 3/4" high by 5 1/4" wide according to the color scheme previously given.
4. Mount two of each drawing on appropriate color with 1/2" border at top and sides.
5. On one of each pair of drawings, which will be the control, mount appropriate label so that there is a 1/2" border at the bottom.
6. Mount one of each remaining label on appropriately colored cover stock 3 1/2" wide by 1" high so that there is a 1/2" border.
7. Mount one copy of each definition on cream cover stock 5 1/4" wide by 3 1/2" high so that there is a 1/2" border on all sides.
8. Laminate separate labels, mute cards, control cards and definition cards
9. Place control cards, mute cards, labels and definition cards in color-coded container such as a vinyl packet.

Booklet Preparation

1. Make a separate booklet for each organism represented above. To make each booklet cover, cut one piece of appropriately colored cover stock 11" wide by 7" high for each phyla. For booklets of more than ten pages see Directions for Preparation of Books with Spines given below.
2. After folding cover in half, label with name of phylum, class and Parts of (name of animal) on the front cover. Laminate both sides and refold.
3. For booklet pages, cut appropriate number of pieces of white paper 10 1/2" wide by 6 1/2" high.
4. Fold each piece of paper in half to make pages 5 1/4" by 6 1/2" and arrange in booklet form.
5. Arrange and mount each drawing with the correct label under it on the left page and mount the definition on right page opposite the drawing.
6. Laminate both sides of each page.
7. Sew each booklet together according to instructions given previously.

Book Preparation for Books with Spines

1. If there are more than ten pages, count the number of pictures to determine how many pages will be need. Then divide into groups of no more than six pages. Fold the paper to make groups of pages with not more than six pages per group. Determine the sequence of drawings and information. Mount on the pages appropriately and laminate both sides of each page. Restablish sequence of pages in each group and the sequence of groups.
2. Place the groups of pages together and measure the thickness at the folded edge to determine the width of the spine.
3. Cut a front and a back cover 7" by 51/2", adding on to the 51/2"" dimension the width of the spine which is folded so that both covers are now 7 1/2" by 5 1/2".
4. Label the front cover. Overlap the two folded edges and glue together to form a spine.
5. After the glue has dried laminate both sides of the cover.
6. Refold to form the spine again.
7. Sew the first group of folded pages into the spine near the left side of the spine. Repeat with other groups of pages, keeping the groups in sequence. There will be parallel line of stitches showing alone the spine.

Preparation of Life Cycle Time Lines of Selected Phyla of the Animal Kingdom

1. Use white fabric-backed vinyl for each life cycle of a particular organism in each selected phyla of animal kingdom.
2. Time scale will be 1" for 1 day on all life cycle time lines.
3. Cut vinyl 7" wide. The length is determined by number of days of each life cycle plus 5".
4. Cut two time lines for each life cycle, one for the control and one for the mute.
5. Make two copies of each drawing of the stages of each life cycle. One copy will be used to trace over to make the drawings on the control time line. The second copy will be mounted on appropriately colored cover stock, trimmed to give a 1/4" border around the shape of the drawing and laminated. These mounted drawings will be placed on the mute time line. Make two labels 1" by 4 1/4" and mount on appropriate color 2" by 5 1/4" .
6. On the control time line, measure the inches for the number of days for each stage of development and trace the outline of each stage in pencil, leaving enough space at the bottom for the label.
7. After verifying correct placement according to time scale, use appropriately colored permanent marker or paint pen to make outline on the control time line. Color must match the color code given previously for each phylum.
8. Under each drawing, label appropriately in the same color as the drawing.
9. On the second time line, the mute, mark time scale at top in same color as outline drawing on control. On the time scale, write only the number representing days for each stage in the appropriate color.
10. Prepare information cards and control booklets according to previous directions.
11. Make containers in the appropriate colors for the cards which have the drawings of the stages, labels and information cards.

Note: Information about the number of days for life cycles in some phyla is not available. For these phyla, drawings are arranged in sequence spaced 4" from center to center of each drawing. No time scale is marked on the mute. Call the child's attention to these points.

Color Scheme for Classes of Phylum Chordata

Cyclostomata (si-kluh-stow'-muh tuh) (color-coded yellow)
jawless fish lacking scales and having round suction cup mouths, such as lampreys, slime eels

Chondrichthyes (kawn-drik'-theez) (color-coded gray)
fish which have cartilaginous skeletons, such as sharks and skates

Osteichthyes (aws-tee-ik'-theez) (color-coded green)
bony fish with scales, such as perch

Amphibia (am-fi b'ee-uh) (color-coded orange)
animals lacking scales which spend part of their life cycle in water, respiring through gills and respiring through skin, lungs or mouth lining on land, such as frogs, toads and salamanders

Reptilia (rep-til'e-uh) (color-coded dark tan)
animals which breathe through lungs and have dry skin covered with scales, such as turtles, snakes, lizards and crocodiles

Aves (a'veez) (color-coded light blue)
birds which have scaly skin with feathers, generally have wings for flying, and lack teeth, such as chickens, robins, and cardinals

Mammalia (muh-may'-lee-uh) (color-coded red)
animals which develop from fertilized eggs usually inside the female who secretes milk to nourish the young, which have hair-covered skin at some stage of life, and complex teeth, such as cows, humans, and dogs

Preparation of Pictures for Phylum Chordata

1. Collect pictures of specimens typical of orders within each class with information about each picture.

Note: Due to the difficulty in obtaining appropriate pictures in the quantity required for some classes, all of the various orders within each class may not necessarily be represented.

2. Sort pictures according to class, trim pictures on paper cutter and determine the number of pieces of paper in each size and color needed.
3. Cut cover stock cut either 8 1/2" by 11" or 8 1/2" by 5 1/2" in color appropriate for the class as stated previously. Size is determined by picture size, but no matter how small the picture, use the 8 1/2" by 5 1/2" size. Pictures must not be larger that 8" by 10 1/2".
4. Type or letter information about the specimen on the back of its card, then mount the corresponding picture on the front, using glue stick or spray adhesive.
5. Cut cover stock 8 1/2" by 2" in color appropriate for each class as stated previously.
6. Make one copy of each class name. Cut each 7 1/2" by 1" and mount on appropriately colored card. from step 5. Letter the phonetic pronunciation on the reverse.
7. Laminate the pictures and labels back and front.
8. For each group of pictures, prepare a color-coded container such as a vinyl packet. Cut fabric 10 1/2" wide and 25 1/2" long for packet. Place right sides of fabric together, leaving 3" at top for flap, and sew the two sides in a 1/2" seam. Turn right side out. Round the corners of the flap. Class name is written on the flap.
9. Place pictures in their matching color container.

Preparing Materials for Phylum Chordata

1. Using white paper, make three copies of each drawing and label and two copies of each definition.
2. Cut each drawing to measure 4 1/4" high by 4 1/4"wide.
3. Cut each label 1" high by 4 1/4" wide.
4. Cut each definition to measure 2 1/2" high by 4 1/4" wide.
5. Cut two pieces of cover stock 6 3/4" high by 5 1/4" wide for each class according to the color scheme in pictures for phylum Chordata. Cut one cream card 6 3/4" by 5 1/4" and letter the title, Phylum Chordata.
6. Mount two copies of each drawing on appropriate color of paper with 1/2" border at top and sides.
7. On one set of drawings, which will be the control, mount appropriate label so that there is a 1/2" border at the bottom.
8. Lay out control cards in sequence according to list in phylum Chordata and laminate on the back, leaving 1/8" between each drawing. Trim control strip around top, bottom, and two ends. Laminate the front, leaving a border of approximately 3/4" to fold over the edge.
9. Accordion fold the control strip with the title card uppermost.
10. Leaving a 1/2" border on all sides, mount one copy of each remaining label on appropriately colored index or card stock for each class 5 1/4" wide by 2" high. Write the phonetic pronunciation on the back.
11. Leaving a 1/2" border on all sides, mount one copy of each definition on cream cover stock for each class 5 1/4" wide by 3 1/2" high.
12. Laminate each label, mute cards, and definition cards.
13. Prepare booklet according to instructions previously given and title it Definitions for Classes of Phylum Chordata.
14. Place materials in beige containers.

Preparation of Materials for
Parts of Animals for Classes of Phylum Chordata

1. Using white paper, make three copies of the drawing of each adult animal for each body part, three labels per drawing, and two definitions per drawing.
2. Using a water-base red marker, outline or fill in one body part on each of the three copies of the drawings. Repeat this procedure until all body parts have been outlined.
3. Cut each drawing to measure 4 1/4" by 4 1/4".
4. Cut each label 1" high by 4 1/4" wide.
5. Cut each definition to measure 2 1/2" high by 4 1/4" wide.
6. Cut two pieces of cover stock for each class according to the color scheme for phylum Chordata 6 3/4" high by 5 1/4" wide.
7. Mount two of each drawing on appropriate color with a 1/2" border at top and sides.
8. On one set of drawings, which will be the control, mount the label naming the part depicted on the drawing so that there is a 1/2" border on sides and bottom.
9. Mount another set of labels on appropriate colors 2" by 5 1/4".
10. Leaving a 1/2" border on all sides, mount one copy of each definition on cream 5 1/4" wide and 3 1/2" wide.
11. Laminate separate labels, mute cards, control cards and definition cards.
12. Make booklets according to previous instructions and title them phylum Chordata, class (name), Parts of (name of animal) on the front cover of each booklet.
13. Place control cards, mute cards, labels and definition cards in appropriately color-coded containers.

Preparation of Materials for Life Cycle Time Lines for Classes of Phylum Chordata

Note: Use life cycle time line for cat prepared in “Selected Phyla of Animal Kingdom”.

1. Use beige vinyl for all life cycles of the classes of phylum Chordata. Cut 7" wide with the length determined by number of days of each life cycle plus 5".
2. Time scale will be 1" for l day on all life cycle time lines.
3. Cut two time lines for each life cycle, one for the control and one for the mute.
4. Make two copies of each drawing of the stages of each life cycle. One copy will be used to trace the drawing onto the control time line. Cut around the general shape of the second drawing, mount on appropriately colored index or card stock and trim to give a 1/4" border the shape of the drawing. Laminate back and front of drawings as before. Note: If drawing is so small that it might be lost, make the border larger.
5. Copy one label for each part of the life cycle, cut to 1/2" by 3" and mount on colored paper 3 1/2" by 1" according to the color code given in phylum Chordata. Laminate as before.
6. On the control time line, measure the inches for the number of days for each stage of development and trace the outline of each stage in pencil in the appropriate place. Leave space for the label at the bottom.
7. After verifying correct placement according to time scale, use appropriately colored permanent marker or paint pen to go over the pencil outline on the control. Color of the outline must match the color code given for each class in phylum Chordata.
8. Under each drawing on the control, letter the label in the same color as drawing.
9. On the second time line, which will be the mute, mark time scale at top in same color as outline drawing on control. Write number representing days for each stage in the appropriate color, if number of days is known.
10. Make information cards and control booklets according to the previous directions in the Life Cycle Time Lines of the Selected Phyla of the Animal Kingdom.
11. Provide containers in the appropriate colors for the cards which have the drawings of the stages, labels and information cards.

Note: Information about the number of days for life cycles in some phyla is not available. For these phyla, drawings are arranged in sequence spaced 4" from center to center of each drawing and there is no time scale on the mute time line. Call the child’s attention to these points.

Preparation of the Materials for External Parts of the Human Body, Phylum Chordata, Class Mammalia

Procedure:

1. There will be seven packets of drawings for the parts of the human body: major parts, parts of the trunk, parts of the arm, parts of the hand, parts of the leg, parts of the foot, and parts of the head.
2. Make two copies of each drawing and label.
3. Using a water-based red marker, outline or fill in one body part on two copies of the drawing. Repeat this procedure until each body part has been outlined in red on pairs of drawings.
3. Cut each drawing to measure 4 1/4" high by 4 1/4" wide.
4. Cut each label 1" high by 4 1/4" wide.
5. Cut red index or card stock 6 3/4" high by 5 1/4" wide to mount each drawing.
6. Mount each drawing with 1/2" border at top and sides.
7. On one set of drawings, which will be the control mount appropriate label so that there is a 1/2" border at sides and bottom.
8. Mount remaining labels on red index or card stock paper 5 1/4" wide by 2" high.
9. Laminate separate labels, control cards, and mute cards.
10. Prepare a red container for the materials.
11. Follow the instructions for Preparation of Parts of the Human Body, Class Mammalia to make materials for other classes, using the stated color scheme.

Botany

Color Scheme and Information on Phyla of the Plant Kingdom

Bryophyta (bri-uh-fite' uh) 25,000 species (light blue)
Growing in a moist habitat, these are not adapted to life on land since sperm must swim through water to reach eggs. There are only three classes: liverworts, hornwarts and mosses.
Example: sphagnum

Psilophyta (si-luh-fite'-uh) (light orange)
This bare or smooth plant has external sex organs and contains only two genus.
Example: whisk fern

Lycopodophyta (li-kuh po' duh fite uh) 1,000 species (light green)
Living on other plants, these do not bear seeds. They grow in moist habitats.
Example: club mosses

Sphenophyta (sfee-no-fite' uh) 40 species (pink)
Commonly called scouring rush, wedge plants have jointed and hollow stems with rough, ribbed textures and thrive on salt flats, along banks of streams and in moist low-lying wooded areas.
Example: horsetail

Filicinophyta (fil-uh-sin-uh-fite' uh) 12,000 species (red)
Little wing or feather plants grow in habitats which are occasionally moist.
Reproduction is by means of spores rather than seeds.
Example: ferns

Cycadophyta (sik-uh-duh-fite' uh) 100 species (orange)
Palm plants, called gymnosperm, bear naked seeds that are not inside ovaries. The compound leaves are palm-like or fern-like.
Example: sago palm

Ginkgophyta (ging' ko-fite-uh) (gray)
These dioecious plants have small bilobed leaves resembling fronds of maidenhair fern.
Example: maidenhair tree

Coniferopyhta (kuh-nif'uhr-uh-fite-uh) 580 species (yellow)
Cone bearing plants have leaves which usually are needle-shaped. The monoecious seeds are naked. These trees are of great economic importance.
Examples: fir, pine, spruce

Gnetophyta (net' uh-fite-uh) 70 species (purple)
Cones of these desert plants lack resin canals and seeds are naked. They resemble flowering plants in many ways. Useful drugs are extracted from some species.
Example: ephedra

Angiospermophyta (an' jee-uh-sperm-uh-fite'-uh) 230,000 (green)
This phylum contains nearly every familiar tree, shrub and garden plant that produces flowers and seeds.
Examples: dogwood, rose

Preparation of Pictures for Phyla of the Plant Kingdom

1. Collect at least eight pictures of typical specimens for each phylum with information about each.

Note: All classes within each phylum may not be represented due to the difficulty in finding some pictures.

2. Separate pictures according to phylum, trim on paper cutter and determine the number of pieces of paper in each size and color needed.
3. Cut six pieces of cover stock either 8 1/2 by 11" or 8 1/2 by 5 1/2" in color appropriate for the phylum as given previously. Pictures must not be larger than 8" by 10 1/2". Remaining pictures from each phylum are mounted on cream .with a color-coded dot in the top right corner of the back as a control.
4. Type or letter information about each specimen on the back of the card, then mount with glue-stick or spray adhesive the corresponding picture on the front.
5. Cut cover stock 8 1/2" by 2" in color appropriate for each phylum as stated previously.
6. Make one copy of each phylum name. Cut each 7 1/2" by 1" and mount on appropriately colored card * 1/2" by 2 ". Write the phonetic pronunciation on the back.
7. Laminate the pictures and labels on both sides.
8. For each group of pictures, prepare a color coded container such as a plastic packet according to directions given previously.
9. Place the pictures in their matching color container and label with the name of the phylum. Pictures mounted on cream are placed in a cream container.

Preparation of Materials for Phyla of the Plant Kingdom

1. Using white paper, make three copies of each drawing and label and two copies of each definition.
2. Cut each drawing to measure 4 1/4" by 4 1/4", each label 1" by 4 1/4" and each definition 2 1/2" by 4 1/4".
3. Cut two pieces of cover stock 6 3/4" high by 5 1/4" wide for each phylum according to the color scheme previously given. Cut one cream card in the same dimensions and letter title on it.
4. Mount two copies of each drawing on appropriate color with a 1/2" inch border at top and sides.
5. On one set of drawings, which will be the control, mount appropriate label so that there is a 1/2" border at the bottom.
6. Lay out control cards in sequence according to the list of phyla of the Plant Kingdom with the title card first.
7. Transfer control cards in proper sequence with back side down to laminate, leaving 1/8" space exposed between each cards to allow for folding.
8. Trim control strip around top, bottom and both ends. Do not cut between the cards. Laminate the front, leaving a border of approximately 3/4" to fold over the edge.
9. Accordion fold the control strip with the cream title card uppermost.
10. Mount one copy of each remaining label on appropriately colored cover stock 5 1/4" by 1" for each phylum. Letter the phonetic pronunciation on the back.
11. Leaving a 1/2" border on all sides, mount one copy of each definition on cream cover stock 5 1/4" by 3 1/2".
12. Laminate separate labels, mute cards and definition cards.
13. Prepare booklet as previously instructed.
14. Provide a green container for the control strip, mute cards, labels and definitions.

Preparation of Materials for Parts of Plants of the Phyla of the Plant Kingdom

1. Using white paper, make copies of each drawing 4 1/4" by 4 1/4", labels 1" by 4 1/4" and definitions 2 1/2" by 4 1/4 ". Three times the number of plant parts plus three more drawings will be needed with the same number of labels. Make two copies of each definition.
2. Using a permanent marker, outline or fill in each part of the plant in red (or its natural color if preferred) for all three drawings. Repeat until each plant part has been outlined separately on each of three drawings.
3. For each drawing, cut two pieces of cover stock 6 3/4" by 5 1/4" inches according to the color scheme previously given. Mount drawings so that there is a 1/2" inch border at top and sides. Cut cover stock into strips 2" by 5 1/4 " in appropriate colors and mount one copy of each label.
4. On one set of drawings, mount the other label appropriately with a 1/2" border at the sides and bottom.
5. Mount one copy of each definition on cream cover stock 3 1/2" by 5 1/4" so that there is a 1/2" border.
6. Laminate all materials as instructed previously.
7. Prepare booklet as previously instructed.
8. Place control cards, mute cards, labels and definition cards in appropriately color- coded labeled containers.

Preparation of Materials for Parts of Angiosperms

1. Using white paper, make three copies of each drawing and label, two copies of each definition for each different category of plant parts.
2. Cut each drawing 4 1/4" by 4 1/4", each label 1" by 4 1/4"and each definition 2 1/2" by 4 1/4".
3. Cut green cover stock or index 6 3/4" by 5 1/4". Mount two copies of each drawing so that there is a 1/2 inch border at top and sides of green card.
4. On one set of cards, mount appropriate labels under drawings so that there is a 1/2" border at the bottom. These are control cards.
5. Mount another set of labels on green 2" by 5 1/4" so that here is a 1/2" border on all sides. Letter the pronunciation on the back.
6. Leaving a 1/2" border on all sides, mount one copy of each definition on green 5 1/4" by 3 1/2".
7. Laminate all cards and labels.
8. Prepare booklet as previously instructed.

Preparation of Flower Form Materials

1. Using white paper, make three copies of each drawing and label, two copies of each definition.
2. Cut each drawing 4 1/4" by 4 1/4", each label 1" by 4 1/4" and each definition 2 1/2" by 4 1/4".
3. Cut 22 pieces of green cover stock 6 3/4" by 5 1/4"s. Mount two copies of each drawing so that there is a 1/2" border at top and sides of green card.
4. On one set of cards, mount appropriate labels under drawings so that there is a 1/2" border at the bottom. These are control cards.
5. Mount another set of labels on green 2" by 5 1/4" so that here is a 1/2" border on all sides. Letter the phonetic pronunciation on the back.
6. Leaving a 1/2" border on all sides, mount one copy of each definition on green 5 1/4" by 3 1/2".
7. Laminate all cards and labels.
8. Prepare booklet as previously instructed.

Preparation of Materials for Classification of Fruits and for Leaves

1. Using white paper, make three copies of each drawing and label, two copies of each definition for each different topic.
2. Cut each drawing 4 1/4" by 4 1/4", each label 1" by 4 1/4" and each definition 2 1/2" by 4 1/4".
3. Cut green cover stock or index 6 3/4" by 5 1/4". Mount two copies of each drawing so that there is a 1/2" border at top and sides of the green card.
4. On one set of cards, mount appropriate labels under drawings so that there is a 1/2" border at the bottom. These are control cards.
5. Mount another set of labels on green 2" by 5 1/4" so that here is a 1/2" border on all sides.
6. Leaving a 1/2" border on all sides, mount one copy of each definition on green 5 1/4" by 3 1/2".
7. Laminate all cards and labels.
8. Prepare booklet as previously instructed.

Preparation of Materials for Life Cycles of Phyla of the Plant Kingdom

1. Using white paper, make three copies of each drawing and label, two copies of each definition.
2. Cut each drawing 4 1/4" by 4 1/4", each label 1" by 4 1/4" and each definition 2 1/2" by 4 1/4".
3. Cut 2 pieces of cover stock 6 3/4" by 5 1/4" in the color appropriate for each phylum as previously given. Mount two copies of each drawing so that there is a 1/2" border at top and sides of the cards.
4. On one set of cards, mount appropriate labels under drawings so that there is a 1/2 inch border at the bottom. Cut cream card 6 3/4" by 5 1/4" and letter title on it.
5. Lay out the cards in the proper sequence with the title card first and transfer with back side down to laminate, leaving 1/8 inch space between each card to allow for folding.
6. Trim the control strip around top bottom and ends. Do not cut between the cards. Laminate the front, leaving about a 3/4" border to fold over the edge. Accordion-fold the strip with the title card uppermost.
7. Mount labels on appropriate colors 2" by 5 1/4" so that there is a 1/2" border on all sides. Write the phonetic pronunciation on the back.
8. Leaving a 1/2" border on all sides, mount one copy of each definition on the appropriate color 5 1/4" by 3 1/2".
9. Laminate all cards and labels.
10. Prepare booklets as previously instructed.

Preparation of Materials for Comparison of Monocotyledons and Dicotyledons

1. From green cover stock, cut twenty cards 6 3/4" by 5 1/4" and ten labels 2" by 5 1/4".
2. Make three copies of each diagram 4 1/4" by 4 1/4" and of each label 1" by 4 1/4".
3. Mount the diagrams on green cards so that there is a 1/2" border at the top and sides. Mount one set of labels at the bottom of one set of diagrams so that there is a 1/2" border at bottom and sides. Mount another set of labels on the 2" by 5 1/4" cards so that there is a 1/2"border on all sides.
4. On the reverse in the upper right corner mount a small picture of either a monocotyledon or dicotyledon seed as appropriate.
5. Laminate as previously instructed and place in a container.

6 To prepare booklet and definition cards, make two copies of the information on white paper 2 1/2" by 4 1/4" and one copy of labels 1" by 4 1/2".

7. Mount one set of the information on green cards 3 1/2" by 5 1/4" so that there is a 1/2" border. Laminate and place in container with diagrams and labels.
8. Cut green cover stock 11" by 7" for booklet cover which will be 5 1/2" by 7" when folded. Label the front cover, Characteristics of Monocotyledons and Dicotyledons. Laminate the cover.
9. Cut 6 pieces of white paper 10 1/2" by 6 1/2" and fold each piece separately to make a double page 5 1/4" by 6 1/2". Put the pages together.
10. Mount the word Monocotyledons on the first page. The second page will have the diagram of the monocotyledonous seed with the label under it. The third page will be on the right side, facing the diagram and on it will be mounted the appropriate information for that diagram.
11. Continue mounting diagrams and labels on the left page and information on the right page. After all drawings for monocotyledons are on the pages, mount the word **Dicotyledons** on the next right page. Follow the sequence as shown in the white pages for dicotyledons with drawings and labels on left pages, information on right. Laminate white pages.
12. Place the white pages in their proper sequence in the cover and sew as previously instructed.