Teacher Section

Concept Development Activity

Materials
(teams of 3 - 4)
- envelope of PICTURES
- blank cards
- markers

Procedure:
1. Have students work in teams to group the pictures into subgroups they choose. Students should derive the pattern for grouping the examples.

2. Have students create a title and subtitle cards for their selected groupings. Using the example below, explain the relationship between title and subtitles and how they connect.

An example for grouping ANIMALS is shown below:

<table>
<thead>
<tr>
<th>Vertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphibians</td>
</tr>
<tr>
<td>Mammals</td>
</tr>
<tr>
<td>Reptiles</td>
</tr>
<tr>
<td>Fish</td>
</tr>
<tr>
<td>Birds</td>
</tr>
</tbody>
</table>

3. Once students have grouped and labeled their examples, have them share their grouping patterns with the class.

4. Next, have the students look at the pictures for plant adaptations. Tell students to group the examples using patterns they observe that fall under the title “Plant Adaptations.” Once again, they should create cards for the title and subtitles. (Refer to the sheets, “Adaptive Characteristics” for background information.)
Student Section

Concept Development Activity

Materials
(teams of 3 - 4)
Plant pictures
Blank cards
Markers

Procedure:
1. As a team, group the pictures into subgroups using any title or pattern you choose. Write your title on a blank card. The picture groups should fall under the title that you derive. An example for grouping *animals* is shown below:

```
Vertebrate
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```
Amphibians  Mammals  Reptiles  Fish  Birds
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2. Your team will decide the number of subgroups. Next, derive a title for each subgroup. Write these new titles on blank cards to label your subgroups.

3. Select a spokesperson for your team to present your grouping pattern to the class.

4. Once the class has completed the activity in the individual teams, you will share your individual information with the class.

5. Next, group the cards by a pattern specified by your teacher.
Teacher Section

Concept Development: Plant Adaptations

Materials:
Concept Development Plant Cards
Environmental Conditions Cards

Preparation and Procedure:
1. Have each student in the class take one card from the Concept Development activity. The students will refer to their plant cards for each set of conditions provided in the evaluation.

2. Divide the room into two sides to represent the following groups:
   - Survive
     - Show characteristics needed to survive in this environment
   - Die
     - Lack overall characteristics needed to survive in this environment

3. Draw a card to introduce a set of environmental conditions, and have students observe their cards to determine “survive” or “die.” Next, they should quickly move to the side of the room that best describes the fate of their individual cards.

4. Once students are divided into two sides, have each group brainstorm by looking at the cards, collectively, to derive two or three characteristics that justify the choice to survive or die.

5. Get representatives from each group to share the characteristics with the class.

6. Draw a different card with a set of environmental conditions, and have the class repeat the procedure of choosing a side and brainstorming to find similar characteristics. Again, representatives from each group should share the information.

7. Repeat this procedure for each card drawn.
<table>
<thead>
<tr>
<th>HOT</th>
<th>HOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRY</td>
<td>HUMID</td>
</tr>
<tr>
<td>SUNNY</td>
<td>SUNNY</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>COLD</td>
<td>COLD</td>
</tr>
<tr>
<td>DRY</td>
<td>HUMID</td>
</tr>
<tr>
<td>SUNNY</td>
<td>SUNNY</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>TEMPERATE</td>
<td>HOT</td>
</tr>
<tr>
<td>HUMID</td>
<td>SWAMPY</td>
</tr>
<tr>
<td>SHADY</td>
<td>SHADY</td>
</tr>
</tbody>
</table>
White Onions
Cantaloupe
Poison Hemlock
Water Hyacinth
<table>
<thead>
<tr>
<th>PLANT</th>
<th>ADAPTIVE CHARACTERISTICS</th>
</tr>
</thead>
</table>
| 1. Cattail   | • Spread by numerous underground stems (rhizomes)
• Tissue contains pockets of oxygen to stay afloat and allow gas exchange
• Deep lateral roots anchor the plant
• Numerous fruits—to insure seed production—are produced in a spike that resembles a cat’s tail
• Leaf blades are strap-like and stiff with rounded backs for growing tall
• Leaf blades spiral in the top half to facilitate plants getting sunlight exposure in thick stands |
| 2. Creosote  | • Small, shiny (waxy), thick leaves conserve water and reflect sunlight to stay cool
• Loses most leaves during dry periods
• Strong smell/taste and resin coated leaves to deter predators
• Two types of roots – radial roots get surface water and deep roots grow towards ground water; both make plant a strong competitor in arid climates |
| 3. Dandelion | • Deep root to anchor and absorb water
• Many reduced flowers in a cluster resemble one flower and insure pollination leading to many seeds
• Seeds blow in the wind |
| 4. Ephedra   | • Conifer with needle-like leaves that are circular in shape and covered in a thick cuticle to reduce water loss
• Produces chemical (ephedrine) that is deadly in high doses |
| 5. Four O’clock | • Bloom late afternoon through evening hours to reduce water loss during mid-day temperature peaks
• Flowers release a musky aroma to draw pollinators |
| 6. Poison Ivy | • Produces sap with chemicals that causes a rash; leads to pain, inflammation, and ulcers of skin |
| 7. Jimsonweed | • Produces deadly chemicals, as do other members of its family, the nightshade family that includes potatoes and tomatoes
• Produces a large flower to attract pollinators |
<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
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</thead>
</table>
| **8. Joshua Tree** | - Succulent leaves with thick cuticles and reduced size to prevent water loss in this plant  
- Spiked leaves to deter predators - not a cactus, but actually the largest of the yuccas, which are members of the lily family  
- Clusters of flowers with unpleasant aroma to attract pollinators  
- Numerous surface roots to quickly collect water |
| **9. Pine Tree** | - Small, waxy, round needles reduce surface area and prevent water loss—small surface to volume ratio  
- Deep tap root grows to deep ground water needed in drought conditions  
- Produces resin to deter predators |
| **10. Poinsettia** | - Special leaves turn red to attract pollinators to small yellow flowers that are clustered in the center  
- Produces a milky latex sap that is an irritant to skin (studies show the sap is not deadly) |
| **11. Water Lily** | - Shiny leaves reflect sunlight  
- Large flat leaves (high surface to volume ratio) and oxygen pockets in the leaves help leaves to float  
- Flowers open in the morning to attract pollinators and close during the day to prevent water loss |
| **12. Potato** | - Stores food in an underground stem (not a root)  
- Like other members in the nightshade family, it produces a toxic substance in the leaves, stems and berries to deter predators |
| **13. Purslane** | - Low growing plant with succulent stems and leaves to prevent water loss  
- Small flowers to minimize water loss  
- Produces many seeds in each flower to assure future generations  
- Red coloration in the leaves and stems to reflect some of the high-intensity light |
| **14. Saltbush** | - Reduced leaf size to reduce transpiration and hairy to hold moisture  
- Light gray leaves to reflect light  
- Leaves weep salt that it removes from soils that are too salty for most plants |
| **15. Onion** | - Stem protected below the soil line by fleshy leaves that store food for the plant (bulb)  
- Strong smell deters predators |
| 16. Cantaloupe | Produces fleshy, smelly fruit with numerous seeds to draw animals that will eat the fruit and pass seeds  
Thick epidermis protects fruit from small pests  
Hairy leaves keep moisture close to plant  
Hairy leaves and prickly stems deter pests  
Large leaves maximize photosynthesis but curl in drought conditions  
Produces tendrils that facilitate quick, aggressive growth |
| 17. Cocklebur | Reduced leaves to prevent water loss  
Numerous, spiny fruits attach to predators for seed dispersal |
| 18. Water Hyacinth | Reduced roots  
Shiny leaves to reflect light and stay cool  
Flat, thick leaves with oxygen pockets for floating  
Dominates ponds by growing so rapidly: abundant decaying biomass creates an anaerobic environment that eliminates other plants |
| 19. Watermelon | Plants produce fleshy, smelly fruits and numerous seeds to attract animals that will disperse the seeds  
Plants have tendrils to facilitate quick spreading and aggressive growth  
Leaves and stems have coarse, prickly hairs to prevent water loss and to protect the plant from predators  
Thick epidermis protects fruit from small pests  
Large leaves maximize photosynthesis but curl in drought conditions |
| 20. Mesquite | Has modified stem extensions called thorns that provide protection  
Has deep roots that grow to the water table to get water  
Reduces water loss by small leaf size; leaves fold to reduce surface area |
| 21. Prickly Pear | Conserves water by having reduced leaves: spines  
Stores water in fleshy stems: cactus pads  
Extensive shallow root system quickly collects water when it rains  
Spines to protect form predators  
Contains calcium oxalate under the skin that causes kidney damage when eaten  
Fruits have thick, waxy covering with spines to deter predators |
| 22. Poison Hemlock | - Reduced leaves in alternating pattern that reduces plant stress from sun  
- Numerous, tiny flowers in clusters facilitates pollination and seed production  
- Poisonous sap that causes paralysis and possible death |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 23. Bermuda Grass  | - Deep root system; above ground stems (stolons) and below ground stems (rhizomes) for spreading  
- Leaves are a gray-green color and are short (usually 1 to 4 inches tall) and narrow blade to reduce water loss  
- During droughts the upper parts die off  
- Flowers in spikes are reduced in size to prevent water loss; numerous seeds are easily dispersed by wind |
| 24. Duckweed      | - Small water plant; grows in dense populations  
- Leaves and stems are not differentiated; air pockets keep the plant afloat  
- Stomata on top for gas exchange  
- World’s smallest fruit (smaller than a salt grain)  
- Needs high levels of nitrogen and phosphorous; grows in non-flowing water where nutrients build |
| 25. Hibiscus      | - Large flower (to attract pollinators); large cluster of stamen in a tree shape surrounding pistil  
- Flower that closes at night to reduce water loss  
- Stomata on lower epidermis of leaves to reduce water loss  
- Large leaves with numerous chloroplasts in the palisade mesophyll, spongy mesophyll and guard cells |
| 26. Horseweed     | - Tall plant; narrow leaves (reduced surface area)  
- Inconspicuous flowers; wind-dispersed seeds  
- Oils that irritate skin |
| 27. Spurge        | - Succulent stem with spiny ridges; not a cactus (Euphorbia)  
- Minute, deciduous leaves; spines  
- Toxic chemical (latex); poisonous when eaten; skin irritant |
| 28. Bluegrass     | - Spreads by rhizomes or underground stems  
- Flowers in spikes are reduced in size to prevent water loss; numerous seeds are easily dispersed by wind  
- Winter annual; prefers cool and moist |
7. Saltbush-- http://plants.usda.gov
13. Four o’clock-- http://www.desertusa.com/wildflo/images09/Four-o-clock8395b.jpg
19. Poinsettia - http://z.about.com/d/houseplants/1/0/0/0/0/0/0/0/Poinsettia.JPG
27. Bluegrass - http://www.missouriplants.com/Grasses/Poa_annua_plant.jpg