



Michigan Apple Educational Kit

Designed to Educate About an Important Michigan Product and Industry

Reinforces Michigan Core Academic Curricula Outcomes
in Language Arts, Math, Science, Social Studies, and Health

Supports Michigan Curriculum Framework Outcomes in Art

Lower Elementary (Kindergarten-Grade 2)
Middle Elementary (Grades 3-4)
Upper Elementary (Grades 5-6)
Middle School (Grades 7-8)
Before and After School Programs
Summer Programs

U p d a t e d 2 0 0 6



Dear Educator:

The Michigan Apple Committee, a nonprofit agency representing Michigan's 1,000 apple growers, has developed this "Michigan Apple Educational Kit" to teach students about Michigan's number one fruit crop and the State's number two industry, agriculture.

Use it to create an "Apple Unit" that includes Social Studies, Science, Math and Language Arts. With your imagination, many interesting and exciting classroom activities can take place with art, science experiments, and more. Please feel free to copy any of the sheets in the kit for use in your classroom.

This educational kit has been developed and evaluated to support the Michigan Department of Education's Content Standards and Benchmarks. It has been designed for ease of use and divided into subject areas. Each subject area is divided with a tab that has teacher information such as learning objectives, activities and vocabulary words.

Please help us by returning the enclosed questionnaire upon completion of your "apple unit." We need your input and ideas as we modify and further develop this program

We hope that these materials will be helpful to you and that your class finds the apple unit to be a great learning experience!

Sincerely,

Michigan Apple Committee
13105 Schavey Road, Suite 2
DeWitt, MI 48820
Ph. (800) 456-2753
Fax (517) 669-9506
www.MichiganApples.com



We Would Like Your Opinion

Please let us know what you think about the Michigan Apple Educational Kit.

Photocopy and return to: **Michigan Apple Committee**
13105 Schavey Road, Suite 2
DeWitt, MI 48820
or fax to (517) 669-9506

Your Name:

School:

Address:

Phone:

Grade Level:

With how many students did you use the lesson plan?

Was there a sufficient amount of materials for a teaching unit?

Was there enough educational information included for you to comfortably teach the content?

Which parts did you use or feel were most helpful?

Did you feel the lesson plan was organized in a useful way?

Did you make use of any of the suggested reading books to complement your teaching unit?

Overall, how would you rate this program? (circle one)

Excellent Very Good Average Poor

Please add any comments you feel would help us as we further develop this program.

Using the Michigan Apple Educational Kit

**It's Apple Time-
Enjoy!**

1. The kit has activities that are designed to teach students about apples and the apple industry and their importance to Michigan.
2. The kit includes seven sections:
 - Michigan Apple Facts
 - Growing Michigan Apples
 - A Bushel of Varieties
 - An Apple a Day
 - Apple Lore
 - Apple Bites
 - Resources
3. The activities are coded at the bottom of each page to help the instructor easily identify grade levels and curricula areas of the lesson or activity:
 - Content Area: Language Arts, Math, Science, Social Studies, Health, Art
 - Levels: Lower Elementary (Kindergarten-Grade 2), Middle Elementary (Grades 3-4), Upper Elementary (Grades 5-6), Middle School (Grades 7-8)
4. The activities are also ideal for enrichment programs, before and after school programs, and summer programs.
5. Each section has identified student learning objectives for use in planning instruction within a curriculum.
6. Each section has a material list for easy preparation. Few materials are required for most activities.
7. The following sections have enhancement ideas:
 - Michigan Apple Facts
 - Growing Michigan Apples
 - A Bushel of Varieties
 - An Apple a Day
 - Apple Lore
8. Activities within a section are designed to be used flexibly according to the time available.
9. Use of an overhead or LCD projector when appropriate may eliminate the need for each student having their own copy and will help reduce use of paper.
10. Ideas are provided for classroom décor to promote a fun learning environment.
11. A survey is included for you to provide feedback to the Michigan Apple Committee. Your feedback will be used to guide future development of support and programming.

Michigan Apple Quick Facts

- Apples are Michigan's #1 most valuable fruit crop, with a value of over \$100,000,000 annually to the apple grower.
- Value-added marketing and processing enhance the economic contribution of Michigan apples up to \$400-500 million of economic impact annually.
- There are over 8 million apple trees, covering 41,000 acres, on 1,000 farms throughout Michigan's Lower Peninsula.
- Michigan expects to harvest 18 million bushels of apples annually.
- Apples are the largest fruit crop grown in Michigan. Michigan produced over 1.25 billion pounds of fruit in 2004 including apples, tart cherries, sweet cherries, blueberries, peaches, grapes, strawberries, pears and plums. Just over 60 percent of that amount was apples, which totaled 760 million pounds.
- Small family farmers who operate their own orchards dominate the Michigan apple industry. According to recent statistics, 99 percent of Michigan orchards had fewer than 100 acres in apples.
- Newer apple orchards are tending toward high-density planting, with upwards of 500 trees per acre. Well-trained, high-density plantings come into production much more rapidly than "standard" apple trees of old, so growers can bring desirable new varieties to market more quickly.
- Longtime favorite varieties still dominate Michigan's orchards. The most prevalent variety remains the Red Delicious, followed closely by the Golden Delicious. The Gala or Royal Gala apple is rapidly gaining on tradition, however.
- Michigan also plays a vital role in processed apples. More than 68 percent of all Michigan apples are processed. Michigan is the largest supplier of apple slices used in commercially prepared apple pies. Michigan apples are also a main source for applesauce, fresh-cut slices, and fresh and shelf-stable apple cider.

Michigan Apple Facts

Upper Elementary

Social Studies ■ Language Arts

Student Learning Objectives

Students will:

- Recognize the climate conditions in Michigan that are conducive to apple growing.
- Relate advances in technology to improved apple production in Michigan.
- Recognize the economic importance of the Michigan apple industry to the Michigan economy.
- State at least five ways that apples can be used.

At a Glance

Students read a short description of growing, producing, and using apples in Michigan. They use the information to complete a crossword puzzle. Enhancement ideas are suggested for language arts, math, and cross-curricular activities.

Materials Needed

Student Handouts	Upper Elementary
<i>Michigan Apple Facts</i> handout for each student	*
<i>Michigan Apple Facts Crossword Puzzle</i> handout for each student	*
Teacher Directions and Keys	
<i>Michigan Apple Facts Crossword Puzzle</i> teacher key See “A Bushel of Apples” section for “Apple Treats” recipes Apple Facts Enhancement Ideas teacher directions (Multi-Grade Level)	

Suggested Vocabulary

Bushel

Climate

Color picking

Commercially

Cost-efficient

Cultivated

Economy

Export

Fertilizer

Flavorful

Great Lakes

Growers

Harvesting

Packing

Pruning

Shipping

Technology

Temper

Terrain

Thinning

Trend

Uncultivated

United States Department of

Agriculture

Variety

Yield

Michigan Apple Facts

Please read and use the information below to complete the *Michigan Apple Facts* crossword puzzle.



Growing Conditions

Michigan's climate and the influence of the Great Lakes are good for growing apples. The lakes temper cold spring temperatures to protect apple trees from frost damage. In the late summer through fall, cool weather is good for harvesting. The result is flavorful, crisp apples.

Nearly 1,000 apple growers farm near Lake Michigan. About 41,000 acres of apple trees are planted across the mitten-shaped state.



Changing Technology

Michigan growers improve the color and size of apples by:

- Color picking
- Summer pruning
- Improved fertilizer practices
- Careful thinning



Production

Apples are the largest of Michigan's fruit and vegetable crops:

- Around 18 million bushels of apples are grown each year.
- Michigan is one of the United States' top three apple-producing states each year.

Michigan apple crop sizes have grown over the last few seasons due to:

- Advanced technology
- Increased growing of several varieties of apples
- More trees being planted
- Young trees now reaching apple bearing age

The apple industry adds \$400-500 million to Michigan's economy through:

- Growing
- Shipping and packing
- Processing

According to the United States Department of Agriculture, the total U.S. apple crop has averaged around 235 million bushels per year.

Variety



There are over 7,500 known varieties of apples in the world. About 2,500 varieties are grown in the United States.

Approximately 100 varieties are grown commercially in 35 states—but a total of 15 popular varieties account for over 90 percent of the crop. These include:

- Red Delicious
- Winesap
- McIntosh
- Jonathan
- Northern Spy
- Ida Red
- Granny Smith
- Rhode Island Greening
- Cortland
- Stayman
- Golden Delicious
- Empire
- Rome
- York
- Gravenstein

Michigan is known as the “Variety State” because more than 20 types of apples are grown commercially throughout its hilly terrain.

The major types grown in Michigan for the fresh market are:

- Red Delicious
- Golden Delicious
- Gala
- Jonathan
- McIntosh
- Empire
- Ida Red
- Fuji
- Rome
- Paula Red

Michigan’s most popular variety is the Red Delicious followed by Golden Delicious, and in third place, the Gala.

The Paula Red was discovered growing uncultivated (in the “wild”) on a farm near Sparta, Michigan.

Michigan leads in Jonathan apple variety, yielding one-half the nation’s crop.

Michigan has more than doubled the number of new plantings of Honeycrisp apples. Rome is becoming one of Michigan’s most important export apples. They are popular in Mexico.

The Empire apple is popular for fresh-cut slices, which have been treated so they don’t brown.

Apple trend watchers have noted large crop increases from newer varieties like Honeycrisp, Fuji, Gala and Jonagold. Growers are also planting Empire, Gingergold and Braeburn.

Many apple varieties provide premium apple slices, juice, and sauce.

Products/Utilization



Apples have a variety of uses:

- They can be eaten as fresh snacks, or in salads.
- They’re great baked, fried, or dried.
- They can be made into applesauce, caramel apples, apple butter and apple jelly.
- Apples also are great in pies, cakes, cookies, breads, turnovers, crepes, muffins, fritters, dumplings, cobblers, tarts, coffee cakes, donuts, pancakes and strudel.
- They’re also squeezed into cider, pasteurized apple juice and vinegar.

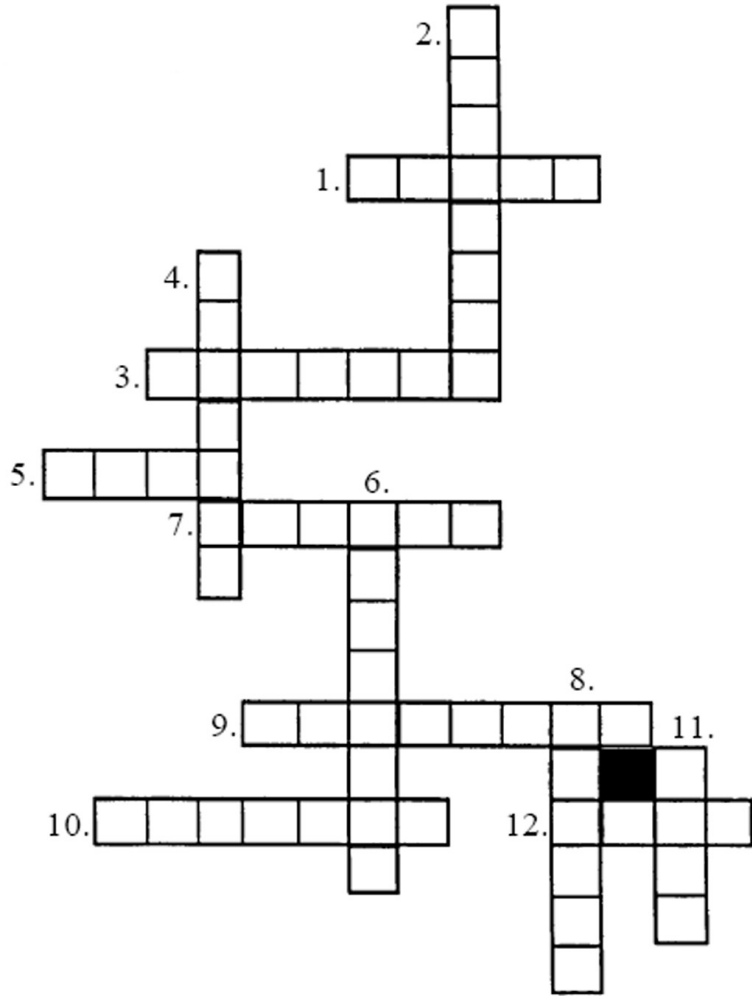
Sixty percent of the Michigan apple crop is usually made into applesauce, pie filling, jams or jellies, juice, and apple chips.

Michigan is the leading producer of slices for commercially prepared apple pies.

Michigan also produces fresh-cut slices for large companies like McDonald’s™ snacks and salads.

Name: _____

Michigan Apple Facts Crossword Puzzle



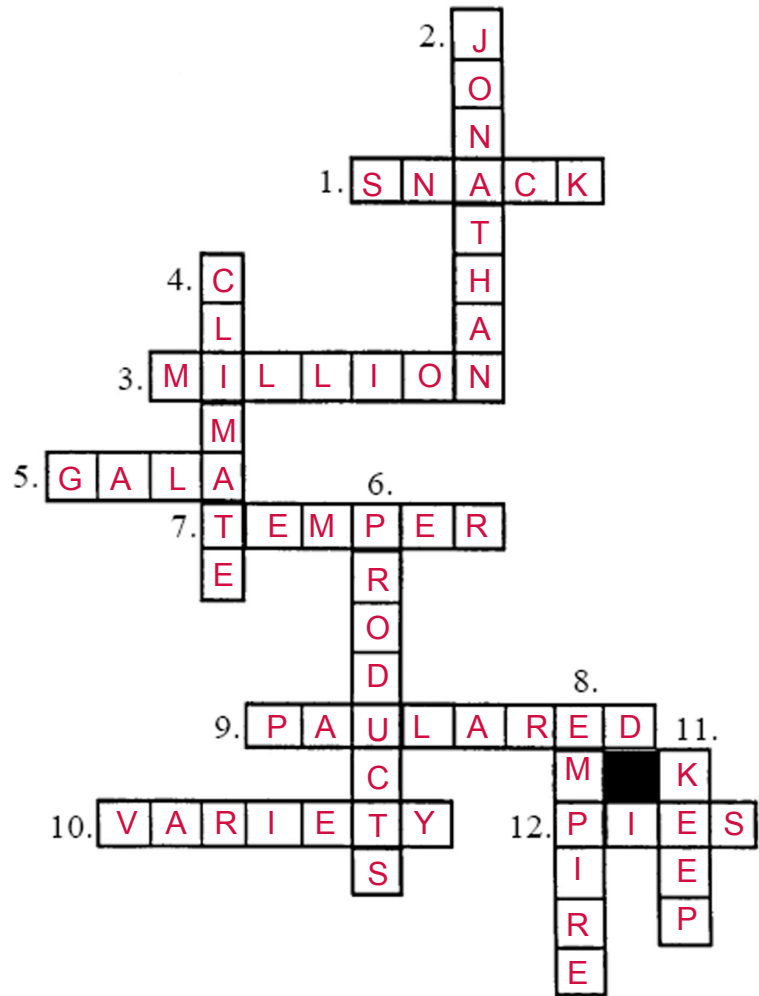
Across:

- 1. Apples are a perfect and healthy _____.
- 3. Michigan produces an average of 18 _____ bushels of apples per year.
- 5. Michigan's third most popular apple variety is the _____.
- 7. Michigan lakes _____ the cold spring winds to protect the buds against frost damage.
- 9. The _____ was discovered growing "in the wild" on a farm near Sparta, Michigan.
- 10. Michigan is known as the _____ state because of the number of different kinds of apples grown.
- 12. Michigan is the leading producer of slices for commercially prepared apple _____.

Down:

- 2. Michigan is the leading producer of the _____ apple.
- 4. Apple growing is well adapted to Michigan because of the _____.
- 6. Applesauce, pie filling, jams, jellies and juice are just some of the _____ made from Michigan apples.
- 8. The _____, a cross between the McIntosh and Red Delicious, is popular for fresh-cut slices that won't turn brown.
- 11. Apples _____ best when refrigerated.

Michigan Apple Facts Crossword Puzzle Teacher Key



Across:

- Apples are a perfect and healthy **SNACK**.
- Michigan produces an average of 18 **MILLION** bushels of apples per year.
- Michigan's third most popular apple variety is the **GALA**.
- Michigan lakes **TEMPER** the cold spring winds to protect the buds against frost damage.
- The **PAULARED** was discovered growing "in the wild" on a farm near Sparta, Michigan.
- Michigan is known as the **VARIETY** state because of the number of different kinds of apples grown.
- Michigan is the leading producer of slices for commercially prepared apple **PIES**.

Down:

- Michigan is the leading producer of the **JONATHAN** apple.
- Apple growing is well adapted to Michigan because of the **CLIMATE**.
- Applesauce, pie filling, jams, jellies and juice are just some of the **PRODUCTS** made from Michigan apples.
- The **EMPIRE**, a cross between the McIntosh and Red Delicious, is popular for fresh-cut slices that won't turn brown.
- Apples **KEEP** best when refrigerated.

Apple Facts Enhancement Ideas



Language Arts

- Make a list of apple products and apple uses and tell which is your favorite and why.
- Write or tell your favorite way to eat apples and explain why.



Language Arts & Math

- Make up a questionnaire about apples with at least five questions. Administer the questionnaire to at least five people. Share a summary of the results with the class. Graph the results.



Across the Curriculum

- Plan an “Apple Fest” during National Apple Month (October). Invite parents or other classes. Send student-made invitations, display apple projects, demonstrate apple experiments, act out apple stories, and serve apple treats.



Just for Fun

- Make caramel apple sundaes, apple finger-gelatin, or apple dip with the class. Serve it at a parent meeting. (See Apple Treat recipe suggestions in “A Bushel of Apples” section.)

Growing Michigan Apples

Middle Elementary ■ Upper Elementary ■ Middle School
Language Arts ■ Social Studies ■ Science ■ Math

Student Learning Objectives

Students will:

- Recognize the importance of apples to early settlers in the United States.
- Describe the contributions of Johnny Appleseed to apple growing.
- Describe the characteristics of Michigan's climate that are conducive to apple growing.
- Explain how grafting produces different varieties of apples.
- Describe the care that is needed to produce a quality crop of apples.
- Explain how apple trees produce apples.
- Explain how apple crops are harvested.
- Describe how apples are stored and shipped.
- State at least five ways that apples can be used.

Materials

Student Handouts	Middle Elementary	Upper Elementary	Middle School
<i>The Apple Tree</i> handout for each student	*		
<i>The Apple Tree Exercises</i> handout for each student	*		
<i>Growing Apples in Michigan</i> handout for each student		*	*
<i>Apple Quiz</i> handout for each student		*	
<i>The Apple Cycle</i> handout for each student		*	
<i>Growing Apples in Michigan Quiz</i> handout for each student		*	*
<i>Growing Apples in Michigan Questions for Discussion</i> handout for each student			*
<i>Apple Vocabulary Bingo</i> handout		*	
<i>Apple Careers</i> handout for each student		*	
<i>Tree Parts</i> handout for each student	*		
<i>Apple Parts</i> handout for each student	*	*	
<i>The Apple Blossom</i> handout for each student		*	
<i>Parts of an Apple Blossom</i> handout for each student			*
<i>How an Apple Tree is Fed</i> handout for each student	*	*	
<i>Apple Growth Stages</i> handout for each student		*	*
<i>Apple Growth Stages-McIntosh Sample</i> handout for each student		*	*

Student Handouts	Middle Elementary	Upper Elementary	Middle School
<i>Apple Pests</i> handout for each student		*	*
<i>Apple Maturity and Harvest</i> handout for each student		*	*
<i>CA (Controlled Atmosphere) Apple Storage</i> handout for each student		*	*
Teacher Directions and Keys			
<i>Michigan Apple Story Educational Video</i> teacher directions			
<i>The Apple Tree Exercises</i> teacher key			
<i>Apple Tree Life Cycle</i> teacher directions (enhancement)			
<i>Apple Quiz</i> teacher key			
<i>The Apple Cycle</i> teacher key			
<i>Growing Apples in Michigan Quiz</i> teacher key			
<i>Growing Apples in Michigan Questions for Discussion</i> teacher key			
<i>Apple Vocabulary Bingo</i> teacher key			
<i>Apple Careers</i> teacher key			
<i>Tree Parts</i> teacher key			
<i>Apple Parts</i> teacher key			
<i>The Apple Blossom</i> teacher key			
<i>Parts of An Apple Blossom</i> teacher key			
<i>How an Apple Tree is Fed</i> teacher key			
<i>Apple Growth Stages Activity</i> teacher directions, card master, and teacher key			
Growing Michigan Apples Enhancement Ideas teacher directions (Multi-Grade Level)			

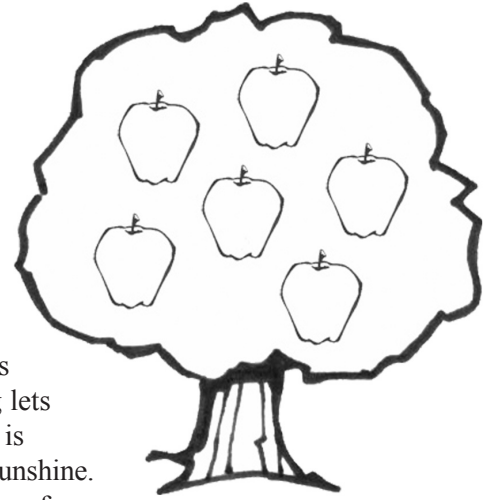
Miscellaneous
Paper and drawing supplies
Apple tree leaves
Microscope
Stalk of celery, knife, two glasses, two colors of food coloring, spoon
<i>Apple Growth Cards</i>
Apple Tree Life Cycle: 12" x 18" construction paper, 4" x 1" brown construction paper, tempera paint (pink, green, red, orange, yellow), sponge pieces, glue, brown and green yarn (enhancement)
Teacher References
<i>Grafting an Apple Tree</i> teacher reference
<i>Monitoring Apple Orchards for Pests & Disease</i> teacher reference
<i>Apple Vocabulary List</i> teacher reference

Suggested Vocabulary

Acreage	Density	Irrigated	Ripening
Aphids	Disease	Leafrollers	Rootstock
Apple family	Dormant	Leaves	Scion
Apple maggot	Dwarf	Marketable	Scout
Apple scab	Edible	Migrant	Seeds
Bacteria	Entomologist	Nectar	Semi-dwarf
Blossom	Fertilization	Nitrogen	Settlers
Blossom end	Fire blight	Orchards	Skin
Branch	Flesh	Ovule	Spores
Bruising	Fork lift	Oxygen	Stamens
Buds	Fragrance	Parasite	Stem
Bushel	Fruit Belt	Pheromones	Stigma
Calyx	Fungicidal	Phosphorous	Tart
Carbohydrate	Fungus	Pigment	Technology
Carbon dioxide	Furrow	Pollen	Tempers
Codling	Grafting	Pollination	Trellis
Colonists	Harvest	Pomology	Variety
Core	Hormone	Potassium	Whip
Cross-pollinated	Hydraulic	Predator	Yield
Cultivation	Insecticide	Preserve	
Cuttings	Integrated Pest	Propagate	
Cycle	Management (IPM)	Pruning	

Name: _____

The Apple Tree



The proud apple tree stands straight and tall. He is 5 years old now. He feels pretty important because he is big enough now to grow some nice big, red, juicy apples. Winter is over. Farmer Ed has pruned out his branches that aren't needed. Pruning lets the sun shine on him. His dormant time is over. He is rested up and ready to wake up to the warm spring sunshine. He can feel his roots beginning to soak up the moisture from the soil. Farmer Ed spreads fertilizer around the tree.

His sap is beginning to run. His buds that formed the summer before are beginning to swell. Farmer Ed will come through with his spray tractor soon. Sprays prevent black scabs on apples and keep insects from feeding on the leaves and making the little tree sick. Soon his buds will burst open into green leaves and beautiful sweet-smelling blossoms.

The little tree loves this time of year. He and all the trees around him are in full bloom. Farmer Ed and his family always take a walk through the orchard during blossom time. The little tree loves to see how much they enjoy this special time of year, too.

The bees also like this time of year. They come out of their hives to gather nectar from the blossoms. They make their honey from the nectar. What the bees don't realize is that while they are busy gathering nectar, they are also spreading pollen from blossom to blossom. The pollen sticks to the bees' fuzzy bodies. This is what causes the blossom to be fertilized so an apple can grow.

As the tiny little apples grow on the tree, the little tree knows that he needs lots of sunshine to keep his leaves healthy. Lots of rain helps his apples grow big and beautiful. If there are too many apples, Farmer Ed will pick some. The apples left on the tree will have more room to grow.

By the end of summer, the little tree is feeling loaded down with the heavy apples. It is looking forward to fall when the apple harvest will begin. Farmer Ed has done a good job of caring for the tree. He has a beautiful crop of big, red, juicy apples on his branches.

Soon the harvest begins. The orchard is busy with pickers. The little tree is glad to be relieved of its load. The tree is sad to see its beautiful apples go into a big bulk box. Tractors load the boxes onto a truck. The truck takes them down the road to the packing shed where they will be sorted and boxed. They are shipped to market. Some apples are stored in refrigerated rooms to be sold later. Some are sent to processing plants where they are made into applesauce, apple pie slices or apple juice.

Harvest is over. The little tree is sad to see that the pickers are all gone now. The orchard is quiet once more. The days are getting shorter and colder now. Soon it will be time for the little tree to rest for the winter and prepare for another growing season. He smiles as he thinks about the coming spring. Next spring the warm sunshine and spring rains will make the little tree come alive for a new year.

Name: _____

The Apple Tree—Exercises

Reading Comprehension



Place a number (1 - 7) in front of each statement, putting them in the order as they happened in the story.

- _____ Big, red juicy apples are ready to be picked.
- _____ The little tree is waking up in the warm spring sunshine. His buds are beginning to swell.
- _____ During dormancy, Farmer Ed has pruned out the branches to let in the sunshine and keep the tree healthy.
- _____ Farmer Ed will spray to protect the tree from disease and harmful insects.
- _____ The bees come out of their hives. They gather nectar to help pollinate the blossoms.
- _____ Harvest is over and the little tree is sad. The orchard is quiet once more.
- _____ The harvest begins. Pickers relieve the little tree of its load.

True or False



Circle True or False for each statement.

- T or F 1. Apple trees need to be 10 years old to produce a crop of apples.
- T or F 2. Apple buds are formed in the winter during dormancy.
- T or F 3. The bees are very helpful during blossom time.
- T or F 4. Bees realize how important they are in pollinating the blossoms.
- T or F 5. If an apple tree forms too many apples, some will need to be removed.
- T or F 6. Some apples will be processed into applesauce, apple pie slices, or apple juice.
- T or F 7. Fresh market apples are stored in refrigerated rooms to be sold later.

Discussion Questions



1. How could you apply the saying, “And the cycle repeats itself,” to this story.
2. Why do you think that growing apples is not an easy career?
3. What elements could affect the size or quality of an apple crop?

The Apple Tree—Exercises

Reading Comprehension: Place a number (1 - 7) in front of each statement, putting them in the order as they happened in the story.

- 5 Big, red juicy apples are ready to be picked.
- 2 The little tree is waking up in the warm spring sunshine. His buds are beginning to swell.
- 1 During dormancy, Farmer Ed has pruned out the branches to let in the sunshine and keep the tree healthy.
- 3 Farmer Ed will spray to protect the tree from disease and harmful insects.
- 4 The bees come out of their hives. They gather nectar to help pollinate the blossoms.
- 7 Harvest is over and the little tree is sad. The orchard is quiet once more.
- 6 The harvest begins. Pickers relieve the little tree of its load.

True or False: Circle T or F (true or false) for each statement.

- T or **F** 1. Apple trees need to be ten years old to produce a crop of apples.
- T or **F** 2. Apple buds are formed in the winter during dormancy.
- T** or F 3. The bees are very helpful during blossom time.
- T or **F** 4. Bees realize how important they are in pollinating the blossoms.
- T** or F 5. If an apple tree forms too many apples, some will need to be removed.
- T** or F 6. Some apples will be processed into applesauce, apple pie slices, or apple juice.
- T** or F 7. Fresh market apples are stored in refrigerated rooms to be sold later.

Discussion Questions:

1. How could you apply the saying, “And the cycle repeats itself,” to this story. **The cycle of the apple tree growing apples and the farmer caring for the tree will be repeated each year.**
2. Why do you think that growing apples is not an easy career? **Farmers work outside in all kinds of weather. They need to be knowledgeable about trees, insects, fertilizer, fruit harvesting, and weather.**
3. What elements could affect the size or quality of an apple crop? **Sunshine, pruning, rain.**

Apple Tree Life Cycle

Materials:

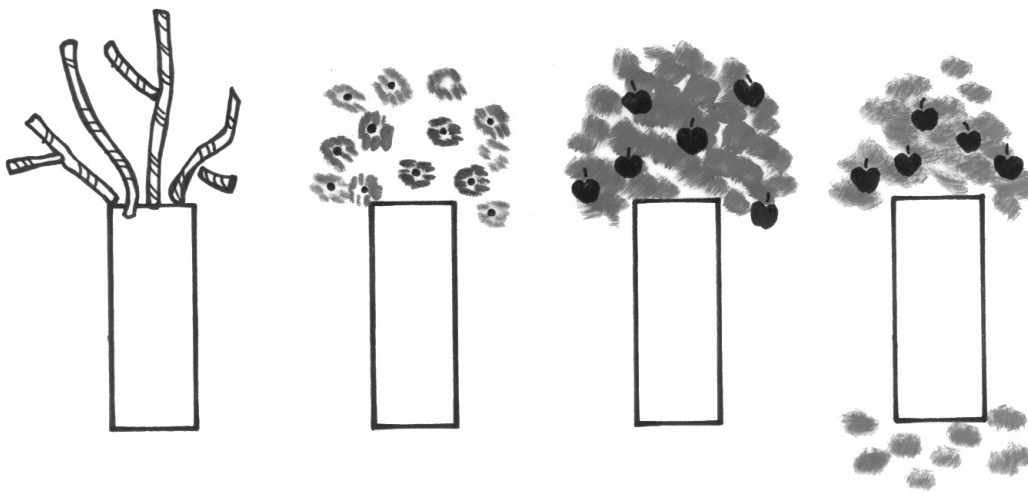
- 12" x 18" construction paper
- 4" x 1" brown construction paper
- pink, green, red, orange and yellow tempera paint
- sponge pieces
- glue
- brown and green yarn

Directions:

1. Glue 4 pieces of brown paper or color trunks on paper. Leave spaces between the trunks to add branches, leaves, and blossoms.
2. Use yarn for branches and green tree.
3. Sponge or print with pink fingerprint on the second tree for blossoms.
4. Sponge or print green paint for leaves and red for apples on third tree.
5. Sponge or print red, yellow, and orange paint on the last tree for fall.

Variation:

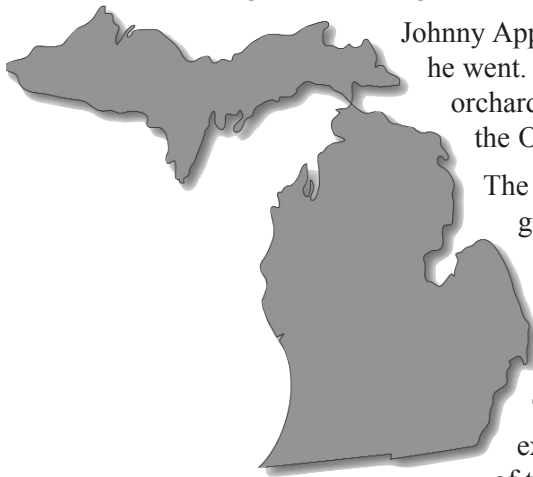
You may also use 1" square pieces of tissue paper for blossoms and leaves. Place on the tree with the tissue paper placed on the end of a pencil eraser, using a dot of glue. Stick on and twist slightly.



Growing Apples in Michigan

In the early 1600s, when colonists came to America they found crabapple trees growing in the wild. They sent for seeds and cuttings from English apples along with bees for pollination. Planting apple orchards was among the first tasks that they undertook. Apples were very important to them. They liked to eat apples fresh. They also had many other uses for them. They found ways to dry apples to preserve them. They could then enjoy the apples year-round. They made apple butter and apple pies. They squeezed apples to make juice, cider and vinegar. They used them for food for their animals. Old apples trees were cut down. The wood was used for toys and furniture or burned for warmth in the winter.

By the late 1700s a man known as **Johnny Appleseed** began his legend as a pioneer. He traveled into the western regions known as Pennsylvania, Ohio, Indiana and Illinois. Formally named John Chapman, he dedicated his life to planting apple seeds wherever he traveled. He was a gentle and religious man who loved animals and nature. He cut holes in coffee sacks. He wore them as shirts and wrapped rags around his feet in the winter to keep them from freezing. He was a hard-working man. It didn't take much to keep him happy. He didn't have a house. He slept on pine needles outdoors. He carried a Bible, a pouch that contained his apple seeds, and a cooking pot. He wore the pot on his head when he wasn't using it for cooking.



Johnny Appleseed made friends with the Indians and the settlers wherever he went. For 40 years, he cleared plots of land. He planted small orchards westward across the nation. Today many of the orchards in the Ohio Valley can be traced back to Johnny Appleseed.

The science of apple growing, or **pomology**, began and a rapidly growing industry began to develop. Growers soon learned how to propagate apples. Improved varieties began to produce larger and more flavorful apples. Now, over 1,000 farm families are making their living by growing apples in Michigan. Approximately 41,000 acres are used to grow apples.

The climate of the Great Lakes and good soil of the state offer excellent sites for growing the finest apples in the world. Most of the orchards are located near Lake Michigan along the western side of the state. This area is known as the Fruit Belt. The lake effect of Lake Michigan tempers the cold spring winds. This helps to protect the buds in the spring from frost damage. It postpones frost in the fall. The longer growing season gives later varieties a chance to ripen.

Michigan winters provide a cold **dormant period**. This is a time of inactivity following harvest. The buds that formed on the branches of the tree at the end of the previous summer need to be dormant to develop properly. These tiny buds contain all the parts that a tree will need for a whole year's growth. They have next spring's new leaves and flower parts. A hairy covering protects the buds throughout the winter. When the days become warmer and longer, these new leaf and flower buds will begin to open. A new growth cycle has begun.

Apples, like humans, belong to a family. They are a member of the **rose family**. Roses and apples all have flowers with five petals and five sepals. Their cousins include peaches, plums, pears, almonds, raspberries, strawberries, cherries and apricots. It may seem odd

that they are all edible except the rose, but what about rose hip tea? Some people even eat rose petals in salads!

Apple farmers use grafting or budding as a way of producing varieties that are all the same. When grown from seed, apple trees do not produce “true to variety”. It is much like our own families. Even though siblings may have the same parents, they all look different. Apple trees are the same. Apple trees grown from seeds may have the same parents, but they are all a little different. Every apple seed produces a new variety. This is why today we have over 7,500 varieties recorded.

Grafting is when a young twig, called a scion, containing the buds of the desired variety is grafted into a slit in the rootstock of an already existing tree to get the variety that the grower wants. **Budding** is where a small section containing a bud is slipped into the whip or the rootstock where the bark has been slit and pulled back. The bud will grow onto the whip forming a new tree of the variety desired.

Michigan is a forerunner in innovative technologies and improved cultivation techniques to develop new varieties. Popular Michigan varieties include Paula Red, which was discovered and patented in Michigan, McIntosh, Empire, Jonathan, Red Delicious, Golden Delicious, Ida Red, Rome, and Northern Spy. Three of the newer varieties which are being planted in Michigan are the Honeycrisp, Fuji and Braeburn. Michigan is the leading producer of the Jonathan apple, yielding one-half the nation’s supply. Michigan is known as the “Apple Variety State” because of the number of different varieties grown.



A good **planting site** is chosen. A good site is high ground with good air current for protection from frosts. Then, density and plants per acre are determined. Trees are planted in early spring by a machine pulled behind a tractor. The planter digs a deep furrow in the ground. A person sits on the back of the machine and drops the trees into the furrow at marked intervals. The number of trees planted depends on the size of tree, dwarf or semi-dwarf. It ranges from 250 to 600 or more per acre. As many as 2,000 trees can be planted in an eight hour day.

Dwarf trees need to be anchored in place with stakes or wires because their root system is too weak to support the tree. Metal or bamboo stakes are driven in close to the trees, or the trees are trained to a trellis system made of wooden posts and wires. A tree’s productive life ranges from about 5 to 30 years. A well-managed orchard can produce up to 1,500 bushels of apples per acre.

Once the trees are planted they need year-round care by trained people. A proper spray program must be followed to protect the tree from disease and insect damage. Apple scab is a common fungus disease. Growers try to prevent it with fungicidal sprays. Spring rains cause spores to be released from the decayed leaves on the ground. The result is a black spot or scab on the apple. Fungicidal sprays are applied every two weeks or after each spring rain until full bloom to prevent this disease. Another disease, called **fire blight**, is caused by bacteria which blackens leaves and fruit. The infected branch ends look like they have been scorched. New growth is especially susceptible to this disease. Copper and antibiotic sprays are somewhat effective in the control of this disease. The only sure means of control is to cut off and remove the infected branches.

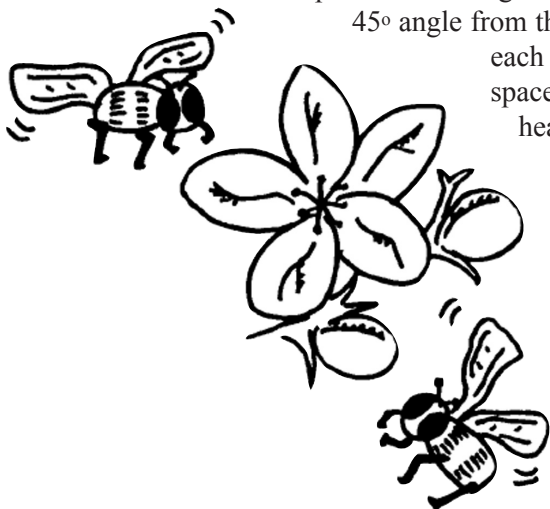
Growers need to watch for insects such as aphids, leafrollers, apple maggot, codling moth (“worm in the apple”), plum curculio and mites. Growers use insecticides to control these pests. Many growers incorporate an **Integrated Pest Management** (IPM) program to help

them decide proper timing for insect sprays. An entomologist and disease specialist, called a **scout**, monitors the orchards to determine the number of insect pests in a given area. This is accomplished by setting traps to catch insects. The traps have pheromones, or chemical scents, that attract insects. The number of insects, environmental conditions such as weather, and the time in the growing cycle are entered into a computer. The data advises the grower when sprays are necessary. This method encourages the preservation and build-up of parasites and natural predators. It helps reduce the risk of pest resistance to pesticides. Natural predators include ladybugs, dragon flies, green lace wings, predator mites, and wasps. IPM also helps growers remain environmentally safe and economically sound. It offers the best and safest approach to pest control. Chemical companies offer “scouting” services. IPM training is available for growers who wish to “scout” their own orchards.

Young apple trees need to be protected from wildlife damage. Wire mesh or plastic wraps are placed around tree trunks to prevent rabbits and rodents from chewing on the bark and girdling the tree. Mouse bait is spread under the trees following harvest each year to prevent damage. Growers also protect trees from deer damage by hanging small bars of soap or small drawstring bags of tankage on the trees. Applying strong odored sprays also help to prevent deer from chewing on the young, tender branches.

Newly planted apple trees also need to be trained to become strong trees. This is done in a variety of ways. Clothespins can be used when the tree starts to branch and followed with spreaders (sticks or wires) as the tree matures. The object is to train the branches to spread out. This allows the maximum amount of light to penetrate into the tree.

Another practice that needs to be followed is consistently **pruning** the tree. The shape of the tree is important. A strong central leader is chosen and any branch with a less than 45° angle from the trunk is removed. Certain branches have to be cut back each year to keep the tree to size. Remaining branches are spaced to allow light to penetrate into the tree and keep it healthy. This is done in the winter months while the tree is



dormant. Summer pruning can also be done to remove new, unnecessary growth. Sunlight penetration colors the apples. Many growers use a hydraulic pruning machine. The machine has a bucket that lifts a worker so he can reach the tops of the trees. It also has a hydraulic pruning gun. These machines have replaced the old method of ladders, hand pruners and saws.

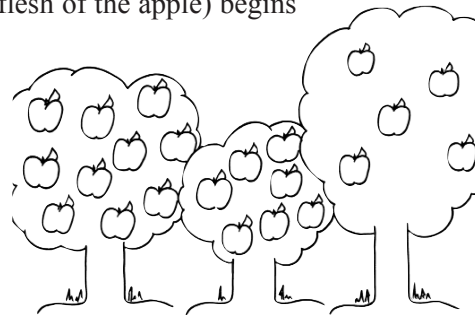
By the third or fourth year after planting, apple trees usually start to produce sufficient crops. Beehives are leased from apiaries and placed throughout the orchard during spring blossom time to pollinate the buds. The bee is attracted to the fragrance and color of the blossom. It goes from bud to bud collecting the nectar to make honey and wax. The tiny grains of pollen stick to their fuzzy legs and body. The pollen is produced by the 20 stamens, the male cells of an apple blossom. When the bee goes to another blossom, the pollen grains are brushed off onto the stigma, the female cell, and pollination occurs. The bee, unknowingly, has just made it possible for an apple blossom to become an apple.

Some flowers can pollinate themselves but most blossoms need to be cross-pollinated. This means that pollen from one apple variety must be crossed with another variety before fertilization can take place.

Stigmas are attached to long narrow tubes called styles. As soon as the pollen lands on the stigma, it makes its own tube. It then travels down through the style and into the ovule. It joins with the ovule and fertilization takes place. There are five compartments in the ovary, each with two eggs or ovules. Only a fertilized ovule can become an apple seed. At least one ovule in every compartment must be fertilized to make a perfect apple. If only some are fertilized, the apple may be deformed.

Weather conditions are a major factor during pollination. Bees do not work well during cool (below 65 degrees Fahrenheit), cloudy or windy days. It is critical that growers have a warm, sunny day during the blossom period so the bees can work. Some blossoms may be pollinated by the wind. However, bees (the growers' "friend in nature") do a more reliable job. Growers depend heavily upon the weather throughout the whole growing season to grow a good crop of apples.

When all or most of the ovules are fertilized, a hormone is produced by the tree. It prevents the flower from falling off. The ovules begin to grow apple seeds. The petals fall to the ground and the ovarian wall (flesh of the apple) begins to grow around the seeds. The stamens and pistils become the dry, hairy part of the bottom of the apple, called the calyx.



Proper care needs to be taken so apples will grow to marketable size and color. If a tree sets too much fruit it will automatically drop or shed some of the excess fruit. Thinning assures larger apples and annual fruit bearing.

Thinning can be done in late spring by the **hand method** (picking off apples by hand when they are very small) or by a **chemical method**. Chemical thinning stresses the tree. This causes some of the fruit to drop. It is a highly technical procedure. If not done properly, it could cause all the fruit to fall off. Experimentation is very much a part of chemical thinning.

Trees are fertilized with nitrogen, phosphorus and potassium to assure proper growth. They are irrigated if necessary during the dry summer months.

Harvesting begins in mid-August for the late summer varieties and continues throughout the month of October, which is National Apple Month. Different varieties of apples ripen at different times. When an apple is ripe the complex sugars, or carbohydrates, break down into simple sugars. This transforms the tart, green apple into a sweet-tasting one. This final ripening time is also when the color-producing materials, or pigment, in the skin begin to change color. This change is caused by sunlight reacting with the sugar that is in the apple. It creates the red or yellow coloring. Apples color best during warm, sunny days and cool nights.

Growers take great care to harvest each variety at the proper time for long-term storage. Apples are checked for firmness by a device called a pressure tester. It measures the pounds of pressure in the apple. Each variety has to be picked at a specific firmness in order to store well. Apples are also tested for ripeness by a simple **starch test** (activity sheet experiment). A special device, called a refractometer, measures the sugar content.

Picking apples is one area where modern technology has not taken over. All apples have to be hand picked to prevent bruising. Most growers hire migrant workers (often people from Florida, Texas or Mexico who migrate with the crops) to harvest the crop. Housing is often furnished for them on the farm. Migrant families begin arriving in late August and early September, unless they came earlier to harvest other crops.

Apples are picked in buckets the pickers strap on themselves. Apples are lowered through a cloth bag on the bottom of the bucket into 18-bushel bins. Careful handling is the name of the game to avoid bruising. Bins are then loaded by a tractor with a fork lift or loader onto a wagon or truck. They are marketed on the farm or transported to storage.

Bins of apples are stored either in refrigerated storage (short-term storage) or controlled atmosphere (CA) rooms (long-term storage). Developed in the mid 1950s, modern technology has invented perfect storing conditions. In CA storage, oxygen is reduced to 1.5 percent (air normally contains about 20 percent oxygen) and carbon dioxide is kept at 3-5 percent. The room is then sealed and a temperature of 31-38 degrees Fahrenheit is maintained. Once the room is sealed, it cannot be entered until the shipper is ready to pack the apples and send them to market. By removing the oxygen from the air, the apple is **“put to sleep.”** The ripening process is stopped. Even after months in CA storage, an apple can be as crisp and fresh-tasting as it was the day after picking. Consumers can now enjoy apples year-round.

Storage rooms are opened and bins full of apples are brought out by fork lifts. The bins are lowered into a water tank where apples are floated out onto a conveyor belt. As they roll down the belt, they are washed, waxed, graded, sized and bagged. Then they are marketed and shipped out by privately owned or grower owned cooperative sales organizations. Michigan apples are shipped by refrigerated trucks, rail cars or boats all over the U.S. They are also shipped far away to places like Puerto Rico, Canada, the United Kingdom, Mexico, Costa Rica and Trinidad.

Michigan ranks among the top three apple producing states. It currently produces an average of 18 million bushels each year. Beginning in the 1950s, Michigan became popular for its bagged apples. Only about 10-15 percent of Michigan’s fresh apple crop is packed into trays for bulk sales. Over 60 percent of Michigan’s apples are processed for pie filling, applesauce, jellies, butter and pasteurized apple juice, cider or vinegar. Michigan is the leading producer of slices for commercially-prepared apple pie.

Name: _____

Apple Quiz

Fill in the sentence with the correct word:

pollen	dormancy	bruise	diseases
sun	water	buds	cold
varieties	insects	nutrients	pollinated
			uses

1. Apple trees need to go through a period of _____ in the winter.
2. Flowers and leaves will develop in the spring from the _____ on the branches.
3. Each apple blossom has to be _____ before an apple will form.
4. The bee carries the _____ from blossom to blossom and pollination takes place.
5. Apples need _____, _____, and _____ to grow.
6. Apple trees need to be sprayed to protect them from _____ and _____.
7. Different _____ ripen at different times.
8. Apples have to all be picked by hand because they _____ easily.
9. Apples have many _____.
10. Apples need to be kept _____.

Apple Quiz

Fill in the sentence with the correct word:

pollen	dormancy	bruise	diseases
sun	water	buds	cold
varieties	insects	nutrients	pollinated
			uses

1. Apple trees need to go through a period of **dormancy** in the winter.
2. Flowers and leaves will develop in the spring from the **buds** on the branches.
3. Each apple blossom has to be **pollinated** before an apple will form.
4. The bee carries the **pollen** from blossom to blossom and pollination takes place.
5. Apples need **sun, water,** and **nutrients** to grow.
6. Apple trees need to be sprayed to protect them from **insects** and **diseases**.
7. Different **varieties** ripen at different times.
8. Apples have to all be picked by hand because they **bruise** easily.
9. Apples have many **uses**.
10. Apples need to be kept **cold**.

Name: _____

The Apple Cycle

Write the code for the season that best fits each statement:

For Winter use W	For Fall use F
For Spring use SP	<i>Note:</i> Some statements may be answered with two seasons.
For Summer use SU	

1. _____ The tree is busy soaking up the sunshine and nutrients from the soil.
2. _____ The apples are growing big and juicy.
3. _____ The majority of the migrant apple pickers move into the camp to prepare to pick the crop.
4. _____ Growers and I.P.M. scouts are beginning to watch for harmful insects.
5. _____ Apples are placed in cold storage immediately after picking.
6. _____ This is the best time to prune an apple tree.
7. _____ Many orchards need to be irrigated to help the apples to continue to grow because of this dry season.
8. _____ Beehives are placed in the orchard to help pollinate the blossoms.
9. _____ The little apples are beginning to form after the blossoms have been pollinated.
10. _____ The trees are dormant.
11. _____ The buds on the branches are beginning to swell.
12. _____ Growers need to protect the trees and apples from disease and insects with chemical crop protection materials.
13. _____ The orchard is a flurry of activity as the crop is being harvested.
14. _____ Some apples are sent immediately after harvesting to processing plants to be made into apple pie slices, applesauce, and apple juice.
15. _____ The trees' blossoms are in full bloom.
16. _____ The trees have no leaves on their branches.
17. _____ Apples are removed from controlled atmosphere rooms to be packed and shipped.
18. _____ Michigan apple month is during this season.

The Apple Cycle

Write the code for the season that best fits each statement:

For Winter use **W**
For Spring use **SP**
For Summer use **SU**

For Fall use **F**
Note: Some statements may be answered
with two seasons.

1. **SP or SU** The tree is busy soaking up the sunshine and nutrients from the soil.
2. **SU or F** The apples are growing big and juicy.
3. **F** The majority of the migrant apple pickers move into the camp to prepare to pick the crop.
4. **SP** Growers and I.P.M. scouts are beginning to watch for harmful insects.
5. **F** Apples are placed in cold storage immediately after picking.
6. **W** This is the best time to prune an apple tree.
7. **SU** Many orchards need to be irrigated to help the apples to continue to grow because of this dry season.
8. **SP** Beehives are placed in the orchard to help pollinate the blossoms.
9. **SP** The little apples are beginning to form after the blossoms have been pollinated.
10. **W** The trees are dormant.
11. **SP** The buds on the branches are beginning to swell.
12. **SP or SU** Growers need to protect the trees and apples from disease and insects with chemical crop protection materials.
13. **SU or F** The orchard is a flurry of activity as the crop is being harvested.
14. **F** Some apples are sent immediately after harvesting to processing plants to be made into apple pie slices, applesauce, and apple juice.
15. **SP** The trees' blossoms are in full bloom.
16. **W** The trees have no leaves on their branches.
17. **W or SP** Apples are removed from controlled atmosphere rooms to be packed and shipped.
18. **F** Michigan apple month is during this season.

Name: _____

Growing Apples in Michigan Quiz

Fill in each sentence with the correct word:

18 million	Fuji	Johnny Appleseed	rose
CA	Honeycrisp	Braeburn	sunlight
disease	grafting	pollinate	third
dormancy	insect	refrigerated	variety
fruit belt	I.P.M.	root	variety state

1. _____ became famous for planting small orchards throughout the Ohio Valley in the late 1700s.
2. The _____ is located along the Great Lakes because of the lake effect that helps protect the buds from frost damage in the spring and offers a longer growing season in the fall.
3. Apple trees need a period of _____, a time of inactivity for the buds to develop properly.
4. Apples belong to the _____ family because their flowers have 5 petals and 5 sepals.
5. Apple trees do not grow “true to variety” from seed. Therefore, growers need to use _____ to produce a desired variety.
6. Michigan is known as the _____ because of the number of varieties grown.
7. New varieties that are currently being planted are _____, _____, and _____.
8. Dwarf trees are staked to support a weak _____ system .
9. A proper spray program is used to protect the trees from _____ and _____ damage.
10. _____ is used by growers to help them decide proper timing for sprays.
11. Trees are trained and pruned to allow the maximum amount of _____ to penetrate into the trees to keep them healthy.
12. During full bloom, growers lease bees to help _____ the blossoms.
13. Harvest begins in August and ends in the latter part of October. Each _____ has to be harvested at the proper time.

14. After harvest, apples are stored in two types of storage. _____ storage is much like a big refrigerator and is used for short-term storage. _____, or controlled-atmosphere storage is used for long-term storage when the oxygen is reduced and the room is sealed, putting the apples to sleep.
15. Michigan ranks _____ among the apple producing states, averaging _____ bushels per year.

Growing Apples in Michigan Quiz

Fill in each sentence with the correct word:

18 million	Fuji	Johnny Appleseed	rose
CA	Honeycrisp	Braeburn	sunlight
disease	grafting	pollinate	third
dormancy	insect	refrigerated	variety
fruit belt	I.P.M.	root	variety state

1. **Johnny Appleseed** became famous for planting small orchards throughout the Ohio Valley in the late 1700s.
2. The **fruit belt** is located along the Great Lakes because of the lake effect that helps protect the buds from frost damage in the spring and offers a longer growing season in the fall.
3. Apple trees need a period of **dormancy**, a time of inactivity for the buds to develop properly.
4. Apples belong to the **rose** family because their flowers have 5 petals and 5 sepals.
5. Apple trees do not grow “true to variety” from seed. Therefore, growers need to use **grafting** to produce a desired variety.
6. Michigan is known as the **variety state** because of the number of varieties grown.
7. New varieties that are currently being planted are **Honeycrisp, Fuji** and **Braeburn**.
8. Dwarf trees are staked to support a weak **root** system .
9. A proper spray program is used to protect the trees from **insect** and **disease** damage.
10. **I.P.M. (Integrated Pest Management)** is used by growers to help them decide proper timing for sprays.
11. Trees are trained and pruned to allow the maximum amount of **sunlight** to penetrate into the trees to keep them healthy.
12. During full bloom, growers lease bees to help **pollinate** the blossoms.
13. Harvest begins in August and ends in the latter part of October. Each **variety** has to be harvested at the proper time.

Growing Apples in Michigan Quiz continued

14. After harvest, apples are stored in two types of storage. **Refrigerated** storage is much like a big refrigerator and is used for short-term storage. **CA**, or **controlled-atmosphere** storage is used for long-term storage when the oxygen is reduced and the room is sealed, putting the apples to sleep.
15. Michigan ranks **third** among the apple producing states, averaging **18 million bushels** per year.

Name: _____

Growing Apples in Michigan

Questions for Discussion

1. Why were apple trees so important to the early settlers?
2. How does Johnny Appleseed fit into the picture of early apple plantings?
3. Why is Michigan's climate well adapted to apple growing?
4. Why does an apple tree need a dormant period?
5. To what family do apples belong and why?
6. Since apple trees do not grow true to seed, what do apple growers do to grow desirable varieties? Explain how grafting is done.
7. What are Michigan's most popular varieties? What are three new varieties being planted in Michigan?
8. How do growers determine where to plant their trees?
9. Why are new dwarf tree plantings staked or put on a trellis wire system?

Growing Apples in Michigan continued

Questions for Discussion

10. What are some things that fruit growers have to spray for? What is IPM?

11. How do growers protect their trees from wildlife damage?

12. What is the object of training trees?

13. Why do growers prune apple trees?

14. Why are bees such an important part of growing apples? How does pollination take place? What weather conditions can affect pollination?

15. Should a tree set too many apples, what can a grower do to thin off some of the crop?

16. Who picks the apple crop and when are the apples picked?

17. How do growers know when to pick the apples?

18. Explain the two types of apple storage. What is CA and what is the object of it?

Growing Apples in Michigan continued

Questions for Discussion

19. How are Michigan apples transported and where do they all go?

20. How many bushels does Michigan grow in an average year and how does it compare to other apple growing states?

21. What percent of Michigan apples go into processed fruit?

22. List as many apples products as you can.

Growing Apples in Michigan

Questions for Discussion

1. Why were apple trees so important to the early settlers? **The settlers preserved the apples to eat year-round. They also made juice and vinegar from them.**
2. How does Johnny Appleseed fit into the picture of early apple plantings? **Johnny Appleseed traveled West and for 40 years planted apple seeds throughout the Ohio Valley.**
3. Why is Michigan's climate well adapted to apple growing? **Michigan's lake effect helps temper the cold spring winds and protect buds from spring frost damage. It postpones frost in the fall. This offers a longer growing season so later varieties have a chance to ripen.**
4. Why does an apple tree need a dormant period? **An apple tree needs a temporary time of inactivity following harvest. Buds will not develop properly without this period of dormancy.**
5. To what family do apples belong and why? **Apple trees belong to the rose family, because they all have flowers with five petals and five sepals.**
6. Since apple trees do not grow true to seed, what do apple growers do to grow desirable varieties? Explain how grafting is done. **Growers graft or bud trees to get the variety they want. A young twig, scion, containing the buds of the desired variety is grafted into a slit in a rootstock of an already existing tree to get the variety that the grower wants. Budding is where a small section containing a bud is slipped into the whip or the rootstock where the bark has been slit and peeled back. The bud will grow onto the whip forming a new tree of the variety desired.**
7. What are Michigan's most popular varieties? **Popular Michigan varieties are the Paula Red, McIntosh, Empire, Jonathan, Red Delicious, Golden Delicious, Ida Red, Rome and Northern Spy.** What are three new varieties being planted in Michigan? **Three new varieties are the Honeycrisp, Fuji and Braeburn.**
8. How do growers determine where to plant their trees? **Growers choose high ground with good air current for protection against frost.**
9. Why are new dwarf tree plantings staked or put on a trellis wire system? **New plantings are staked or put on a trellis wire system because the root system of a dwarf tree is too weak to support the tree.**
10. What are some things that fruit growers have to spray for? **Growers spray for fungus disease such as apple scab and insects such as aphids, leafrollers, maggots, codling moths, plum curculio and mites.** What is IPM? **IPM is Integrated Pest Management. Traps are set out in the orchards with pheromones in them to attract insects. Entomologists monitor the traps to determine the insect population. Environmental conditions, the growing cycle, and insect population help the grower know when sprays are necessary.**

11. How do growers protect their trees from wildlife damage? **Growers put wraps around the tree trunks and apply mouse bait after harvest to control mice population. Small bars of soap or small drawstring bags of tankage are hung on the young trees. Strong odored sprays can be used to prevent deer damage.**
12. What is the object of training trees? **Training is used to establish a good permanent structure for maximum light penetration.**
13. Why do growers prune apple trees? **Trees are pruned to keep the tree to size, to allow light penetration, to keep the tree healthy and to allow the apples to color.**
14. Why are bees such an important part of growing apples? **The bees pollinate the blossoms.** How does pollination take place? **The pollen sticks to the bee's fuzzy body as he flies to the blossom to gather nectar. When he flies to another blossom, the pollen is brushed off, resulting in pollination. The ovule is fertilized and becomes a seed and the flesh of the apple begins to grow.** What weather conditions can affect pollination? **The bees will not work when it is too cold, cloudy or windy.**
15. Should a tree set too many apples, what can a grower do to thin off some of the crop? **The grower can thin off some of the small apples by hand or he can spray a chemical thinner that will cause some of the apples to drop off the tree.**
16. Who picks the apple crop and when are the apples picked? **Migrant workers come from the South to harvest the crop. Apple harvest begins in mid-August and lasts until late October.**
17. How do growers know when to pick the apples? **Growers determine when to pick each variety by the color, firmness and sugar content of the apples.**
18. Name the two types of apple storage. **Refrigeration and CA.** What is CA and what is the object of it? **CA is a controlled atmosphere storage where apples can be held long-term. The oxygen is reduced in these rooms and temperatures are held at 31-38 degrees Fahrenheit. The apples' ripening process is stopped and the apple is "put to sleep" so that consumers can enjoy apples year-round.**
19. How are Michigan apples transported and where do they all go? **Apples are transported by refrigerated trucks, rail cars or boats all over the U.S. as well as Puerto Rico, Canada, South America, the United Kingdom, Norway, Sweden, Costa Rica and Trinidad.**
20. How many average bushels does Michigan grow and how does it compare to other apple growing states? **Michigan averages 18 million bushels of apples per year and ranks third among the apple producing states.**
21. What percent of Michigan apples go into processed fruit? **Sixty percent of Michigan apples go into processing.**
22. List as many apples products as you can. **Pie filling, applesauce, jelly, butter, apple juice, cider, vinegar, dried apple slices, fresh-cut apples.**

Name: _____

Apple Vocabulary Bingo

Use buttons or colored paper squares as markers.

Orchard	Dormant	Bud	Storage	Bruise
Prune	Dwarf	Bees	Variety	Spray
Process	Harvest	FREE	Seeds	Graft
Bloom	Pollen	Cider	Apiary	Forklift
Sunshine	Insects	Nutrients	Disease	Weather

Apple Vocabulary Bingo

APIARY: A place where bees are raised.

BEES: An insect used to pollinate apple blossoms.

BLOOM: Period when apple blossoms are exposed and wide open.

BRUISE: A blemish that necessitates hand picking and careful handling during harvesting and storage.

BUD: A small, covered bulge on the tree limb that contains the parts that will develop into leaves or blossoms.

CIDER: A popular apple beverage.

DISEASE: A sickness of the tree such as: fire blight, scab, and powdery mildew.

DORMANT: Temporary time of inactivity during the winter.

DWARF: A plant much below usual size for its kind.

FORKLIFT: Machinery that has replaced hand pruning of trees.

GRAFT: To join together a scion and a rootstock. Used to produce “like” varieties.

HARVEST: To gather a crop.

INSECTS: Organisms that can cause diseases that damage trees or that can be introduced into orchards to protect or pollinate trees.

NUTRIENTS: Substances or minerals used by the tree for growth.

ORCHARD: A group of planted fruit trees.

PROCESS: When apples are peeled, cooked and prepared for canning, drying, or freezing.

PRUNE: To cut away and shape a tree to allow for maximum light penetration and to preserve the health of the tree.

SEEDS: The flesh of the apple grows around these.

SPRAY: To apply chemicals or natural substances several times during growing season to protect trees from insects and diseases.

STORAGE: One form is called CA.

SUNSHINE: Energy source that penetrates trees after pruning and keeps them healthy.

VARIETIES: Different kinds of apples.

WEATHER: Environmental conditions that affect the quality and quantity of the apples produced each season.

Name: _____

Apple Careers

Fill in the blank in each sentence with the name of an apple career.

1. The _____ grafts desired varieties on rootstocks to produce young trees for apple growers to purchase.
2. An entomologist, or _____, checks insect traps in the orchard to help the grower determine when he needs to spray.
3. A tree _____ trims out certain branches and limbs each year to allow the sunlight to penetrate the tree, keeping it healthy.
4. A _____ brings the beehives into the orchard each spring during bloom to help pollinate the blossoms.
5. An _____ comes each fall to harvest the crop, picking the apples carefully to prevent bruising.
6. An _____ has to be knowledgeable in all the areas of growing fruit.
7. To prepare for shipment, apples are run over a conveyor belt where an _____ takes out any apples that have defects.
8. Many Michigan apples are made into pie slices, applesauce, apple juice, apple jelly, apple butter, and baby food by a _____.
9. Fresh market apples are shipped to retail stores where a _____ displays them on shelves to be sold.
10. The _____ purchases apples and takes them home to eat.

Apple Careers

Fill in the blank in each sentence with the name of an apple career.

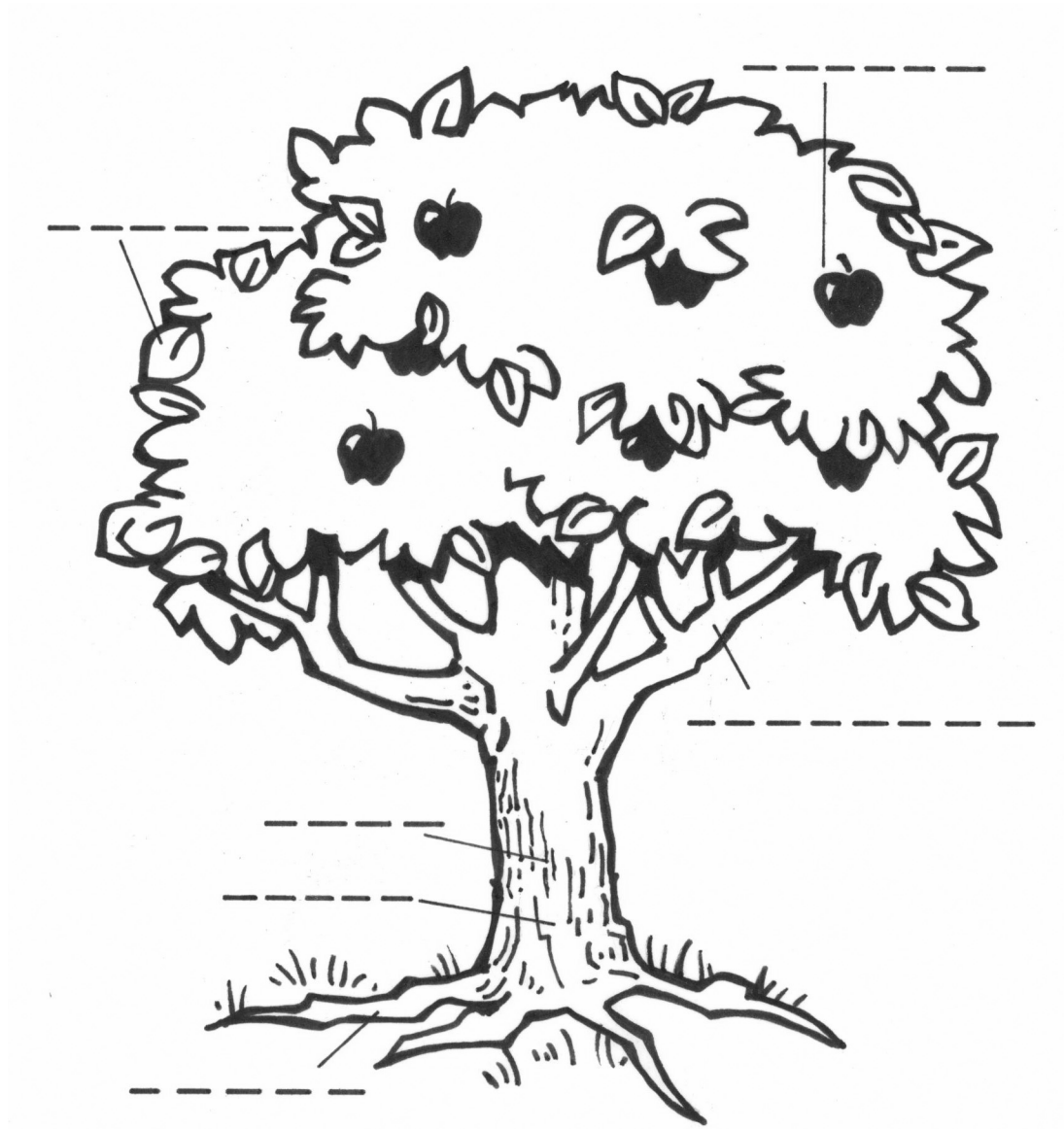
1. The **nursery worker** grafts desired varieties on rootstocks to produce young trees for apple growers to purchase.
2. An entomologist, or **scout**, checks insect traps in the orchard to help the grower determine when he needs to spray.
3. A tree **pruner** trims out certain branches and limbs each year to allow the sunlight to penetrate the tree, keeping it healthy.
4. A **bee keeper** brings the beehives into the orchard each spring during bloom to help pollinate the blossoms.
5. An **apple picker** comes each fall to harvest the crop, picking the apples carefully to prevent bruising.
6. An **apple grower** has to be knowledgeable in all the areas of growing fruit.
7. To prepare for shipment, apples are run over a conveyor belt where an apple **sorter** takes out any apples that have defects.
8. Many Michigan apples are made into pie slices, applesauce, apple juice, apple jelly, apple butter, and baby food by a **food processor**.
9. Fresh market apples are shipped to retail stores where a **produce manager** displays them on shelves to be sold.
10. The **consumer** purchases apples and takes them home to eat.

Name: _____

Tree Parts

Apple trees have many parts. Name the parts of a tree.

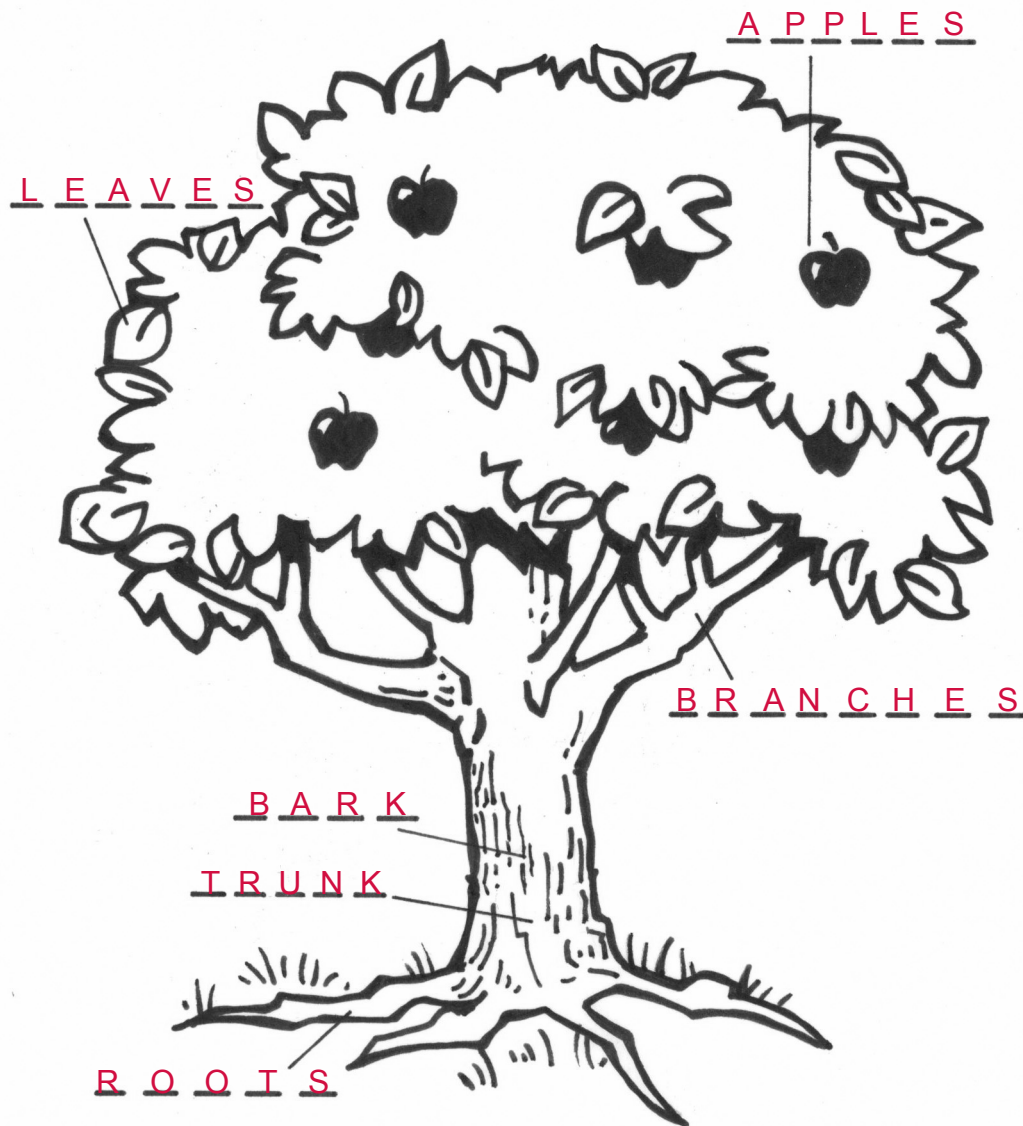
roots	bark	leaves
trunk	branches	apples



Tree Parts

Apple trees have many parts. Name the parts of a tree.

roots	bark	leaves
trunk	branches	apples

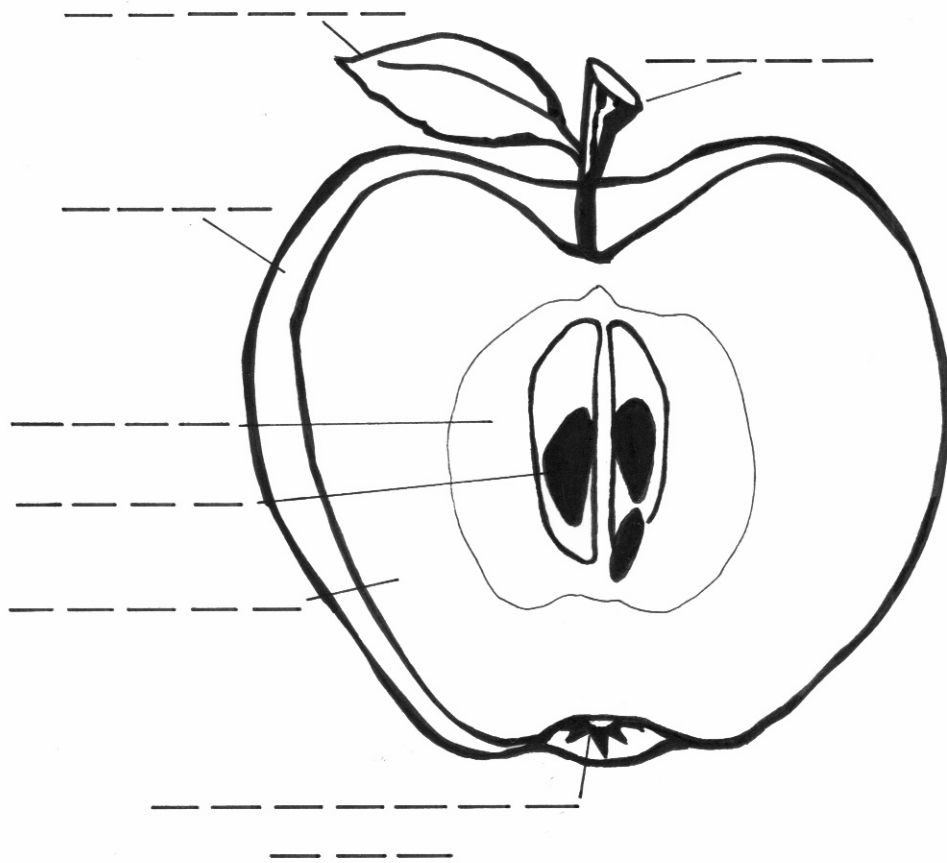


Name: _____

Apple Parts

Use these words to label the parts of an apple:

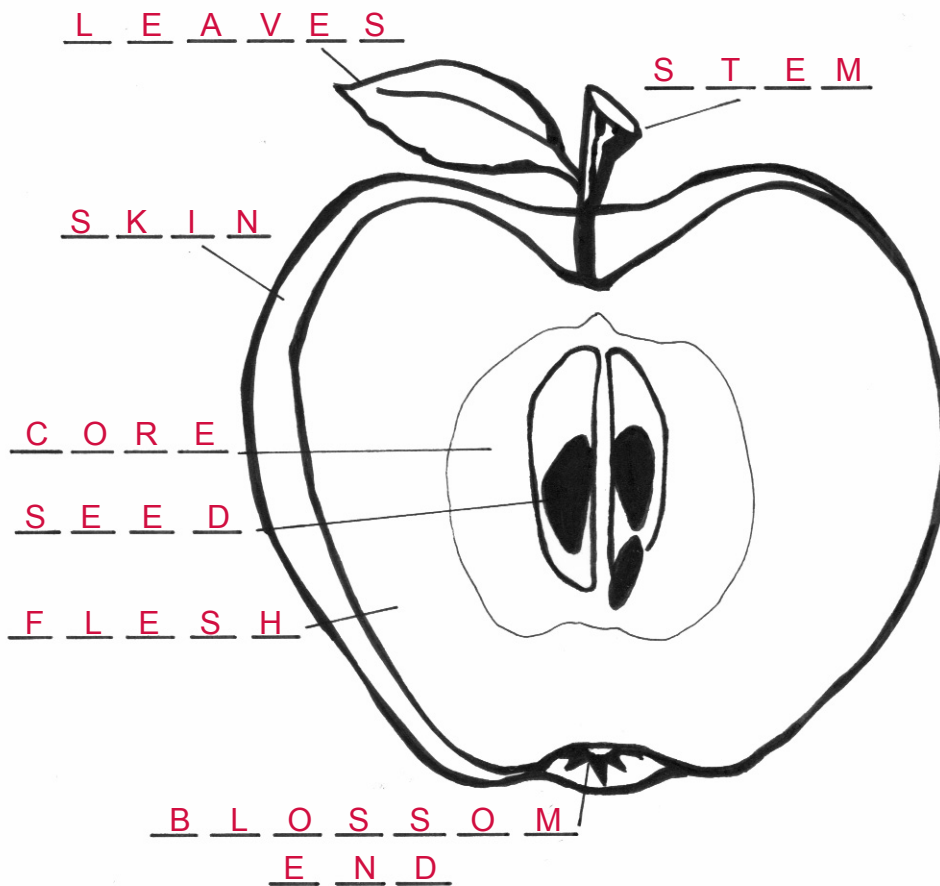
flesh	seed	blossom end	skin
stem	core	leaves	



Apple Parts

Use these words to label the parts of an apple:

flesh	seed	blossom end	skin
stem	core	leaves	



Name: _____

The Apple Blossom

Fill in the sentence with the correct word:

petals	stamen	pistil	sepals	seeds	stigma
---------------	---------------	---------------	---------------	--------------	---------------

1. Bees are attracted to the _____ by the sweet smell and color.
2. _____ makes the pollen that will be carried to the pistil to fertilize and bud.
3. The pollen sticks to the _____ on the _____ and is carried down to the seed to produce an apple.
4. _____ are the leaves that protect the bud.
5. The new little apple will form around the _____.

The Apple Blossom

Fill in the sentence with the correct word:

petals	stamen	pistil	sepals	seeds	stigma
--------	--------	--------	--------	-------	--------

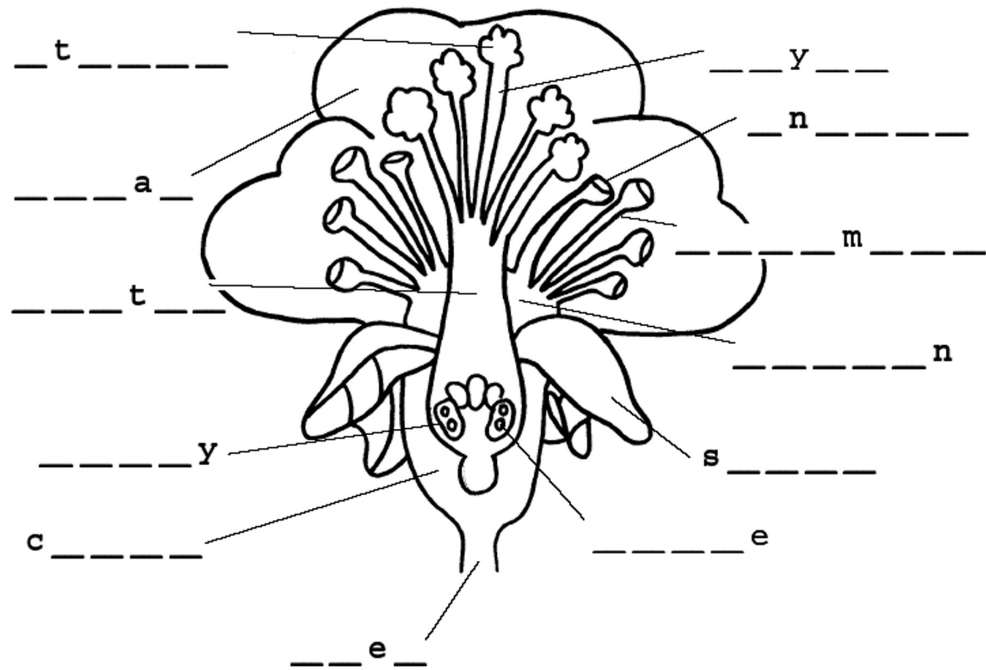
1. Bees are attracted to the **PETALS** by the sweet smell and color.
2. **STAMEN** makes the pollen that will be carried to the pistil to fertilize and bud.
3. The pollen sticks to the **STIGMA** on the **PISTIL** and is carried down to the seed to produce an apple.
4. **SEPALS** are the leaves that protect the bud.
5. The new little apple will form around the **SEEDS**.

Name: _____

Parts of An Apple Blossom

Use these words to label the parts of an apple blossom:

stamen	ovule	anther	ovary
stigma	pistil	filament	sepal
style	stem	calyx	petal

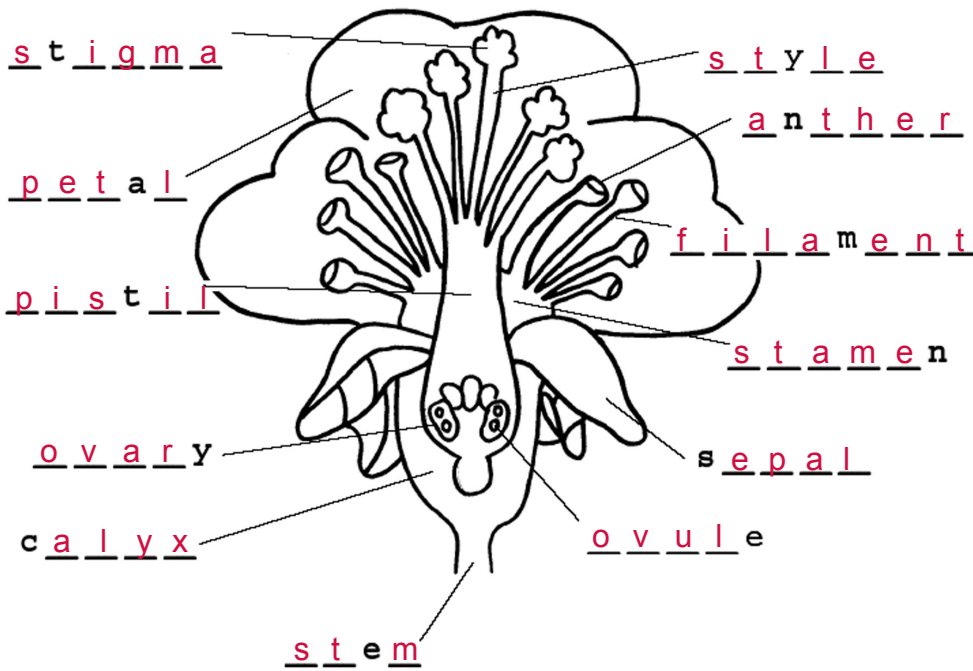


- Petal** The part of the flower that attracts the bee by the fragrance and color
- Pistil** Female part of the flower, made up of a stigma, style and an ovary
- Stigma** The top of the flower's pistil
- Style** The part of the pistil that connects the stigma and the ovary
- Ovary** The rounded base of the pistil, inside of which are five compartments each containing two ovules
- Ovules** Female reproductive cells that will become seeds if fertilized
- Stamens** The male reproductive part made up of anther and filament
- Anther** The part of the stamen that produces pollen
- Filament** The stalk of the stamen
- Calyx** The base of the flower containing the five sepals of leaves
- Sepals** Five green, leaflike structures that make up the flower's calyx
- Stem** The stalk of the flower that connects it to the branch

Parts of An Apple Blossom

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style	stem	calyx	petal



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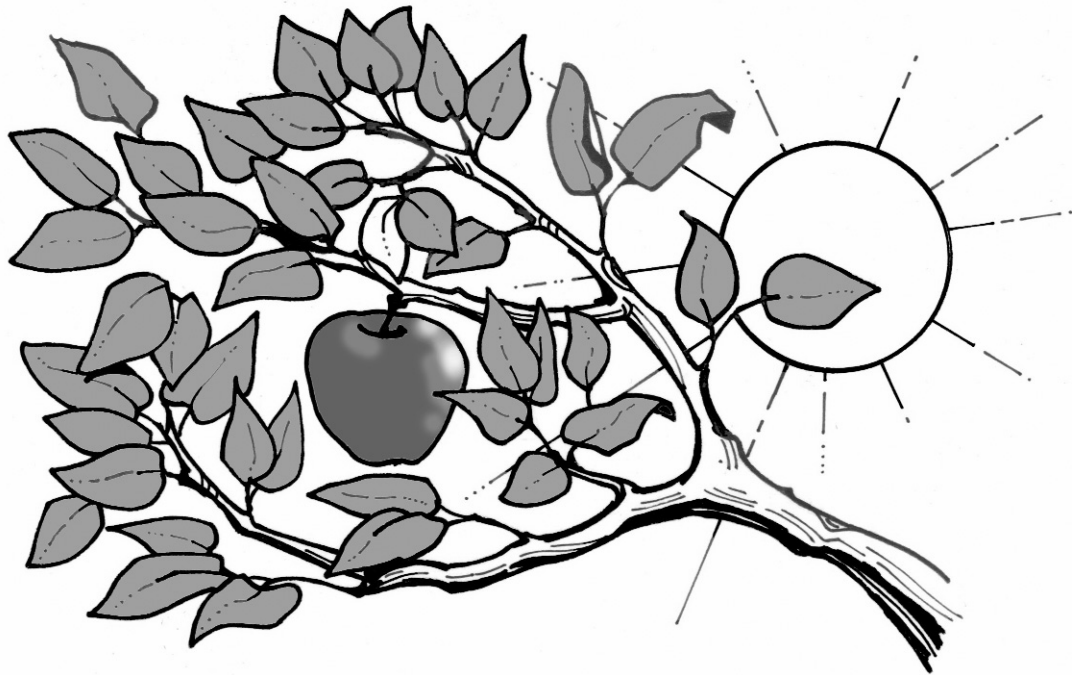
Name: _____

How An Apple Tree is Fed—Part I

Leaves: Miniature Food Factories

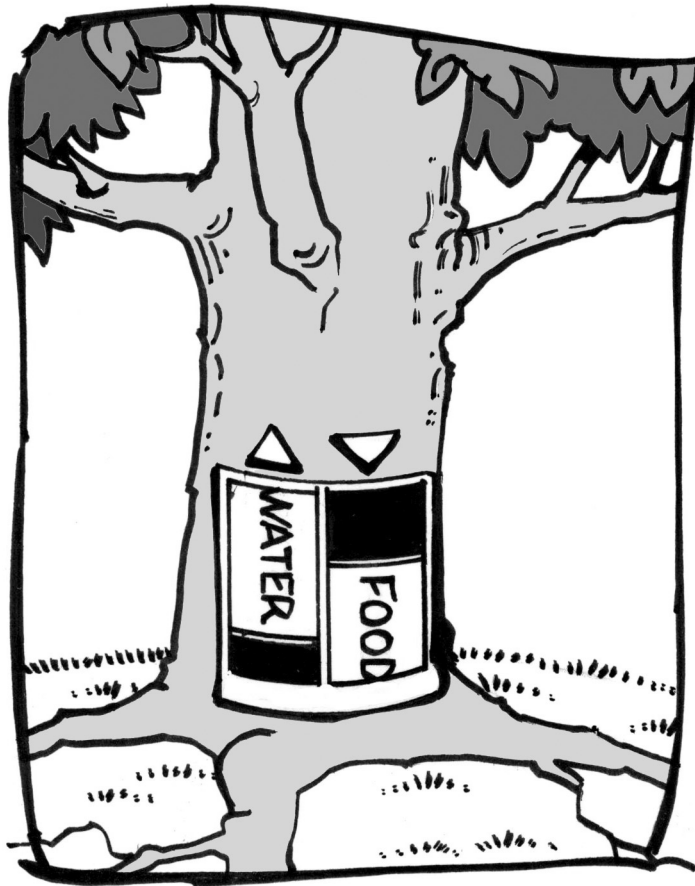
Leaves breathe like your lungs do, except lungs breathe in oxygen and breathe out carbon dioxide. Leaves breathe in carbon dioxide, a gas that is in the air, and breathe out oxygen.

Leaves also make food. Each leaf is a miniature food factory. Inside leaves is a chemical called chlorophyll. It gives the leaves their green color. When the sun shines on the chlorophyll, the leaf manufactures food in the form of sugars. The tree and the apples on the tree use the sugars to grow. This process is called photosynthesis. It takes about 40 leaves to make enough food for one apple to grow to its full size.



How An Apple Tree is Fed—Part 2

Transporting & Storing Food



A tree needs water and nutrients to grow. The tree's "feet", or roots, drink water from the soil that is rich in nutrients. These are carried up to the leaves through the tree's "backbone," or trunk. The trunk acts like an elevator that never stops. Water and nutrients from the roots travel up to the leaves through a layer of tissue in the elevator called the sapwood.

Food made by the leaves travels down through the layer of tissue called the phloem to the roots. Roots have another big job—they store food for the tree during the winter. If a large root is destroyed, the whole tree may die.

The bark on a tree is very rough and cracked because it stretches as the tree grows. Bark protects the tree from hungry animals and insects. It also keeps the tree warm in winter and cool in summer.

How an Apple Tree Is Fed



Part I: Leaves—Miniature Food Factories

Discuss:

1. How are lungs and trees alike?
2. How are lungs and trees different?

Suggested Activities:

1. Draw a miniature food factory using your own ideas.
2. Use a microscope to observe apple tree leaves.



Part II: Transporting & Storing Food

Discuss:

1. What is the “job” of a tree trunk?
2. What is the “job” of tree roots?
3. What is the “job” of tree leaves?
4. What might happen if tree leaves are severely damaged or destroyed?



Experiment: How Does an Apple Tree Get Fed?

Do an experiment with celery to show how the water and nutrients flow up from the tree’s roots to the leaves and flower.

Materials:

a stalk of celery
knife
two glasses
two colors of food coloring
spoon

Directions:

Fill 2 glasses half-full with water. Stir in a spoonful of different food coloring in each glass. Trim off end of celery and split the stalk in half lengthwise almost to the top. Put one side of stalk in one glass and other side in the other glass. Leave for 1-2 hours to see the results.

How an Apple Tree Is Fed

Part I: Leaves—Miniature Food Factories



Discuss:

1. How are lungs and trees alike? **They breathe.**
2. How are lungs and trees different? **Lungs breathe in oxygen and exhale carbon dioxide. Trees breathe in carbon dioxide and exhale oxygen.**

Suggested Activities:

1. Draw a miniature food factory using your own ideas.
2. Use a microscope to observe apple tree leaves.

Part II: Transporting & Storing Food



Discuss:

1. What is the “job” of a tree trunk? **The trunk carries water and nutrients from the tree roots to the tree leaves. The trunk also carries food for the tree that was created by the leaves to the tree roots.**
2. What is the “job” of tree roots? **They drink nutrients from the soil, which are transported by the trunk to the leaves to make food for the tree. The food that is transported from the leaves to the roots is stored in the roots. The roots also anchor the tree in the ground.**
3. What is the “job” of tree leaves? **The leaves contain chlorophyll. Chlorophyll, with the help of the sun, causes the leaves to form sugars. These sugars are food for the tree and the growing apples.**
4. What might happen if tree leaves are severely damaged or destroyed? **The tree will not be healthy and will not be able to produce fruit very well (less quantity and quality). Eventually, the tree may die.**

Experiment: How Does an Apple Tree Get Fed?



Do an experiment with celery to show how the water and nutrients flow up from the tree’s roots to the leaves and flower.

Materials:

a stalk of celery
 knife
 two glasses
 two colors of food coloring
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Fill 2 glasses half-full with water. Stir in a spoonful of different food coloring in each glass. Trim off end of celery and split the stalk in half lengthwise almost to the top. Put one side of stalk in one glass and other side in the other glass. Leave for 1-2 hours to see the results.

Grafting an Apple Tree

Apple trees cannot be grown from seed since they do not produce “**true to variety.**” It is much like our own families. Even though siblings may have the same parents, they all look different. Apple trees are the same. Apple trees grown from seeds may have the same parents but they will all be a little different. Every apple seed produces a new variety, which is why today we have over 7,000 varieties recorded. So apple farmers use grafting or budding as a way of producing varieties that are all the same.

There are two kinds of grafting, whip grafting and cleft grafting. **Whip grafting** is done on small 1-year-old trees. A 1-year-old tree is nothing more than a slender whip with roots, called a rootstock. A young twig, called a scion, is cut from the variety that you want to grow. The scion contains 3-4 buds from which twigs and leaves will grow. This scion is inserted, or grafted, into a slit made at the top of the rootstock. The two parts are bound together, creating a new young tree. These trees are protected in nurseries for one to two years after they are budded before being replanted by an apple grower. Some growers bud their own trees by purchasing the rootstock from the nursery and grafting it over to the variety that is desired, while others purchase the trees already grafted and ready for replanting.

Cleft grafting can be used to create new trees and it is also possible to gradually change an existing tree to grow any variety of apple by grafting new scions to the old tree. A cleft, or slit, is made in the rootstock and is gently wedged open. The scion, cut to expose the parts of the branch underneath the bark, is then inserted into the cleft. The open cut is then bound up or covered with wax to protect it from the weather and from disease. The living tissues of the scion and the new rootstock will soon join, creating a new tree. As the new tree grows, it will produce only the variety that was grafted into it.

Budding is done by peeling a small section containing a bud from the green bark of a young tree. This bud section is slipped into the slender whip of a 1-year-old tree where the green bark has been split and peeled back. The bud will grow onto the whip, forming a new tree of the same variety from which the bud was taken. Grafting and budding are the only ways of growing trees that will bear exactly the variety of apple wanted.

Name: _____

Apple Growth Stages—Part 1

Typical Time of Year	Growth Stage	Comment
Winter	Dormant	No green tissue shows and buds are closed.
Early April	Green Tip (bud burst)	The first green tissue (early leaves) emerge from buds.
Late April	Pink	Flower petals are just emerging from buds. This is just before the flower opens to bloom.
Early May	Bloom	The flower is exposed and wide open. Flower open over a period of days.
Middle of May	Petal Full	Flower petals fall off each flower. Petal fall is when all petals have fallen off.
Late May	Ovary Swells	Flower is completely pollinated and the ovary swells and surrounding fruit grows.
June-July	Fruit Growing Enlarges	Flesh surrounding the seed continues to enlarge.
August-October	Fruit Ripening	Fruit continues to grow in size. Cool nights and sunny days color the apple.
August-October	Harvest	Fruit is mature and picked.

Apple Growth Stages Activity—Part 1

Note: This activity reinforces the skill of sequencing and provides an opportunity for movement (brain break) as students move to form trios and the continuum.

1. Use the *Apple Growth Stages Card Master* for duplication. Cut the duplicated page(s) to make cards for each student in your class.
2. Review the *Apple Growth Stages—Part 1* student handout with students.
3. Give a card to each student.
4. Direct students to form trios by matching times (left column on master), stages (middle column on master), and descriptions of stages (right column on master). The correct matches are represented on the *Apple Growth Stages Card Master* by reading across the columns.
5. Direct the trios of students to form a continuum (in an open space in the room, hallway, or outdoors) that represents the growth stages from the earliest (winter) to the latest (August-October).
6. Start with the winter end of the continuum and move to the August-October end of the continuum. Have each trio of students read the statements on their cards beginning with season, then growth stages, and ending with description.

Apple Growth Stages Card Master

Season	Growth Stage	Description
Winter	Dormant	Buds closed
Early Spring	Bud burst	Green tissue
Late April	Pink	Emerging petals
Early May	Bloom	Flowers open
Mid May	Petal fall	Flowers fall
Late May	Ovary swells	Pollination
June-July	Fruit enlarges	Flesh grows around the seed
August-October	Fruit ripens	Color emerges
August-October	Harvest	Fruit is picked

Name: _____

Apple Growth Stages—Part 2

McIntosh Sample

	1985	1986	1987	1988	1989	1990
Dormant	Nov-Mar	Nov-Mar	Nov-Apr	Nov-Apr	Nov-Apr	Nov-Mar
Green Tip	March 30	April 9	May 2	April 18	April 22	April 6
Pink	April 20	April 22	May 9	May 9	April 29	May 8
Bloom	May 4	April 28	May 24	May 14	May 18	May 14
Petal Fall	May 13	May 3	May 30	May 18	May 23	May 18
Fruit Ripening	May-Sept	May-Sept	June-Sept	May-Sept	May-Sept	May-Sept
Harvest	Sept 6	Sept 1	Sept 15	Sept 7	Sept 12	Sept 9

Activities:

- Use the information above on apple growth stages. Find different ways to graph the results.
- Check with a local apple grower for information about this year's apple crop. Graph the results according to the starting dates of each growth stage.
- Find the average date for each growth stage.

Part I: Apple Pests

Common Apple Pests/Diseases/Predators

Michigan apple growers face multiple apple pests and diseases in their orchards. Beneficial insects or predator mites may also be present. Growers want to keep the natural predators while they free orchards from pests and disease. Careful monitoring and timely control are necessary to restrain these pests and diseases. This often means a fungicide or pesticide spray must be applied to the trees. Weather can play a large factor for diseases and pests. Temperature, precipitation and relative humidity can alter the development of plant growth.

Activity: Apple Pests, Diseases/Predators



Research the pests, diseases, other causes and predators found in apple orchards. Contact apple growers, your local county extension service or use published books to find out more. Find out the extent and type of damage each one does. Also, look for things of importance such as: hosts, life stages, life history, monitoring techniques and trap management of each.

Listed below are common apple pests, pome fruit diseases and other common causes of apple damage as well as beneficial insects and predator mites.

Common Apple Pests

- STLM - Spotted Tentiform Leafminer
- OBLR - Obliquebanded Leafroller
- RBLR - Redbanded Leafroller
- AM - Apple Maggot
- CM - Codling Moth
- OFM - Oriental Fruit Moth
- WALH - White Apple Leafhopper
- SJS - San Jose Scale
- TPB - Tarnished Plant Bug
- PC - Plum Curculio
- GFW - Green Fruitworm
- Mites:
 - European Red Mite
 - Two-Spotted Mite
 - Apple Rust Mite
- Aphids:
 - Green Apple Aphid
 - Rosy Apple Aphid
 - Wooly Apple Aphid

Common Pome Fruit Diseases

- Apple Scab
- Bitter Pit
- Fireblight
- Sooty Blotch and Fly Speck
- Rust Diseases
- Moldy Core
- Powdery Mildew






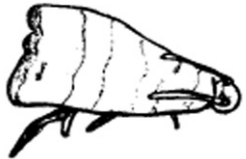











Other Common Causes of Apple Damage

- Limb Rub (caused by wind)
- Frost (temperatures became critical during early growth stages)
- Hail (dents put in the apples while they are growing on the tree)
- Mechanical (tractors, trucks, pruners, etc.)
- Sun Scald (too much direct sun on an apple)

Name: _____

Part II: Apple Pests

Apple Pest Illustrations

 <p>1. Spotted Tentiform Leafminer</p>	 <p>2. Oblique Banded Leafroller</p>	 <p>3. Redbanded Leafroller</p>
 <p>4. Apple Maggot</p>	 <p>5. Codling Moth</p>	 <p>6. Oriental Fruit Moth</p>
 <p>7. White Apple Leafhopper</p>	 <p>8. San Jose Scale</p>	 <p>9. Tarnished Plant Bug</p>
 <p>10. Plum Curculio</p>	<p>12. Mites</p>  <p>European Red</p>	 <p>Two-Spotted Spider</p>
 <p>11. Green Fruitworm</p>	<p>Apple Rust</p> 	
<p>13. Aphids</p> <p>Green Apple</p> 	 <p>Rosy Apple</p>	
<p>Wooly Apple</p> 		

Name: _____

Part III: Apple Pests

Sample IPM (Integrated Pest Management) Scout Weekly Report

Apple Pest Management	Grower Report Form
Grower <u>John Appleseed</u>	Orchard <u>Applewood Dr.</u> Date <u>June 15</u>
Apple Growth Stage <u>1 1/2" fruit diameter</u>	

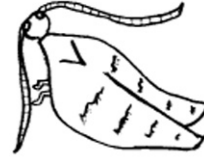
Pest/Disease	Life Stage	Action/Comments
Spotted Tentiform Leafminer	eggs	Eggs are commonly found in light numbers. Watch closely and control 2nd generation as it is typically the most harmful.
Oblique Banded Leafroller	egg hatch 1st instar larvae	There is no evidence of a leafroller problem. The orchard looks clean from this pest at this time.
White Apple Leafhopper	large nymphs (end of 1st generation)	Light amounts of 1st generation evidence are found. This is the end of WALH until 2nd generation in late July/early August.
Apple Maggot		Apple maggot will not be a potential problem until July when its only generation of the season begins to invade orchards.
San Jose Scale	crawlers	No crawlers are found in your orchard. The 1st generation is expected to last another week which is longer than normal.
Mites	all stages	Both European red mites and two-spotted mites are under control presently. However, eggs are hatching and young nymphs are crawling. Eggs are found in abundance and early season damage is already found (foliage bronzing).
Green Aphid	all stages	Light amounts of green apple aphids are found throughout the orchard on terminals of branches. They like the tender growth!
Apple Scab	secondary scab	The primary scab lesions found earlier this season have been burned out. No secondary scab is found now.

TRAPS	
Oblique Banded Leafroller	6
Red Banded Leafroller	4
Codling Moth	0
Apple Maggot	Traps not set until July
Spotted Tentiform Leafminer	5
Oriental Fruit Moth	1

OTHER OBSERVATIONS
1. Green lacewing predator eggs are present.
2. Powdery mildew is found in light amounts in the Ida Red trees.
3. Tarnished plant bug injury to fruit is found in scattered locations.

Name: _____

Part III: Apple Pests



Activity 1:

Look at the IPM scout's sample report. **Notice** the trap catches. The pests were found in light amounts. This finding indicates that it was not at the adult growth stage for these pests. **Read the comments** regarding each pest or disease. **What action** do you think the grower should take now?

Activity 2:

Look at the IPM scout's sample report. **Take note** of the growth stages and comments about generations. **Evaluate** the present situation and predict future possibilities in this orchard.

Monitoring Apple Orchards for Pests, Disease, and Predators

Michigan apple growers realize that their crop has a complex environment. With so many pests and diseases that growers must face in the orchard, they often take special training to become familiar with all of them. Timing of sprays is critical to control these factors.

Many growers choose to hire trained IPM (Integrated Pest Management) scouts to monitor their orchards. These scouts visit the orchards weekly to check traps and look for evidence of common pests or disease. Traps are set with pheromone in them. These pheromone lures have chemical scents to attract insect pests. The amount of adult pests caught in the trap weekly helps to determine the timing and need for sprays.

Growers evaluate the scout's report and then determine their potential orchard problems. This allows apple growers to use appropriate pesticide/fungicide chemicals to fit their orchard's needs and to apply them only when necessary. Sprays should be timed when pests/disease are at a young stage in growth. This gives the best results as adults are difficult to control.

Activity: Pheromone Traps

Contact Great Lakes IPM (7563 North Crystal Rd., Vestaburg, MI 48891, Phone (989) 268-5693, www.greatlakesipm.com) and order pheromone and traps for some of the insect pests. Suggested pheromones are Spotted Tentiform Leafminer and Obliquebanded Leafroller. Set the traps hanging outside and monitor them at least weekly. Determine if these pests would be a problem in your area should an orchard be present. Also, try to determine the growth stages of the insects by graphing the weekly trap catches over a month. When adult catches are the heaviest, the egg growth stage will follow.



STLM Spotted Tentiform Leafminer

Adults are small (4mm) and golden-brown with white bands or spots, giving them a silvery appearance in sunlight.



OBLR Obliquebanded Leafroller

Adults are tan or brownish (15-20 mm) with numerous small lines and a larger dark band crossing the forewings.

Activity: Scout An Orchard

Contact a local apple grower and ask to visit an orchard or find wild apple trees. Look for evidence of pests/diseases in the orchard. Check tree trunks, branches, and undersides of leaves. A microscope can be very useful when scouting orchards. Bring in results to share with your class and try to identify each.



Metamorphosis: Growth Stages of Insects

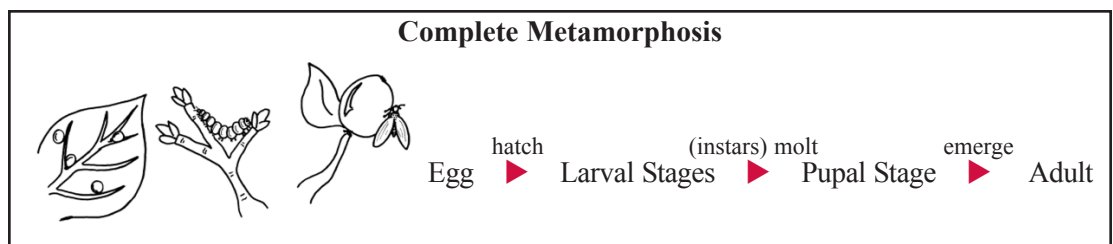
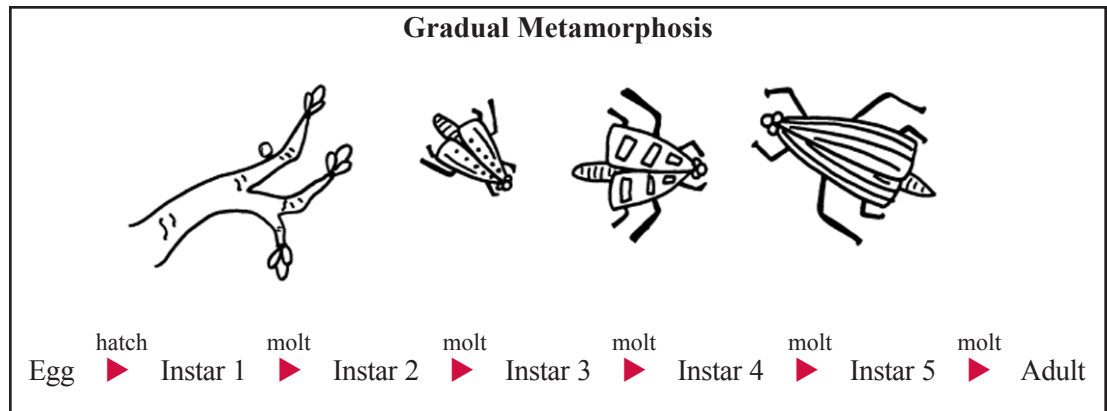
IPM scouts indicate growth stages of insect pests. Growers need to spray problem pests during their immature or young growth stages for best results. A change in the form of an insect, such as a caterpillar changing into a butterfly, is called metamorphosis.

There are two basic types of metamorphosis for insects. One is **gradual metamorphosis**, in which the insect continually grows larger at each molt while the external change is not very visible. They resemble the adults even at a young stage. Examples of insects exhibiting gradual metamorphosis are plant bugs, leafhoppers, aphids, scale and mites.

The second type is **complete metamorphosis**, in which greater changes in body style and life style take place. Immature stages of these insects do not resemble the adult form. Their eggs hatch and then five larvae growth stages are present in the form of a grub, worm or caterpillar. Then the larval has a special resting stage called the pupa. Finally, the pupa transforms into the adult stage of a beetle, moth or fly. Examples of insects exhibiting complete metamorphosis are plum curculio, leafrollers, codling moth, leafminer and apple maggot.

Most fruit tree pests complete 2-3 generations or life cycles each year. Yet some, such as aphids and mites, will complete up to 6-8 generations and continue to reproduce until the conditions are unfavorable. Apple maggot completes only one generation each year, yet can be an apple grower's greatest enemy. Because these pests are cold blooded, they will not continue activity over the winter. Each pest species has one life stage especially adapted for winter survival. They also have special locations where they survive winter.

Activity:
Monitoring Growth Stages
 Collect eggs of any insect. Keep them in a clear jar where you can monitor the growth stages daily. Determine if your insect develops by gradual metamorphosis or complete metamorphosis.



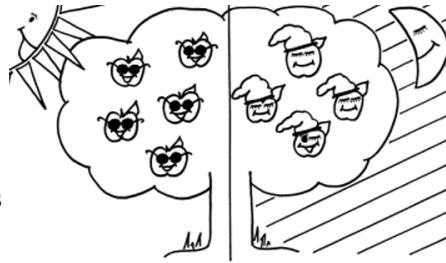
Name: _____

Apple Maturity and Harvest

After the winter, spring and summer of careful monitoring and treatment of apple orchards, growers must decide when to harvest their crops. If they pick the apples too early, the fruit may not have the best color and flavor. If they pick the apples too late, the fruit may be overripe which breaks down the apples' firmness while in storage. The timing of apple harvest is as critical as the timing of pest/disease control in the orchard. Different varieties are harvested at different times.

Some apples are early varieties (August harvest) and some are late varieties (October harvest). **Early varieties** include the Paula Red, which had its origin in Michigan.

Mid-season varieties (September harvest) include the Gala, McIntosh, Cortland, Jonathan and Empire. **Late season varieties** (October harvest) include the Ida Red, Red Delicious, Golden Delicious, Winesap and Rome.



Knowing the sequence of harvesting apple varieties is necessary for growers. Growers carefully test samples of the fruit prior to harvest to determine

prime harvest dates. Growers use several apple maturity tests on crop samples. They include **pressure testing** (apple firmness) and **ethylene gas testing** (natural gas found in apples). Three of the easiest tests are the apple color, seed color, and the starch-iodine tests.

For these three tests, you need randomly collected apples. McIntosh or Red Delicious apples are necessary for the starch-iodine test. A minimum sample of 10 apples from each variety is best, with 15-20 fruit providing a more reliable estimation. The fruit should be recently harvested and kept at room temperature for best results. All three tests can be performed with the same apples, provided they are done in the given order.

Activity: Apple Color Test



Consumers demand plenty of color in the apples they buy. A grower works hard to get color on apples. Sunny days and cool nights in the fall help bring color to apples. Well-pruned trees allow sunlight to reach apples throughout the summer.

1. Individually look at each apple in your sample and estimate what percentage of each is red in color. _____
2. Graph your results on another piece of paper.
3. Average the estimations. _____
4. Would you be willing to buy apples with this percentage of red color? _____
5. Would the weather forecast for the next week be helpful to gain more red color on the apple crop? _____
6. Would you harvest now or wait to harvest due to apple color? _____

Apple Maturity and Harvest continued



Activity: Seed Color Test

Another apple maturity test is the seed color test.

1. Cut apples across the core so the seed cavities are exposed. A mature apple's seeds have turned brown.
2. Group the seeds according to their color (no color, 1/4 brown, 1/2 brown, 3/4 brown, full color). The apples are not usually ready for harvesting until all seeds have turned completely brown.
3. If possible, check apple samples from the same orchard weekly to evaluate changes and progression. Graph your results weekly.

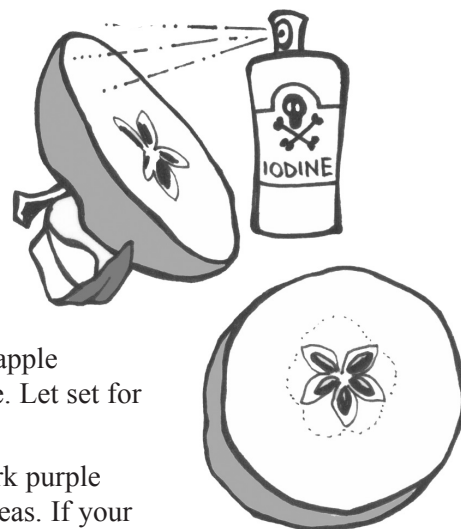


Activity: Starch-Iodine Test

As apples mature and ripen, the starch in immature fruit changes to sugar. By treating fruit with an iodine solution, the decreasing starch level can be measured.

Once iodine is applied to starch in apples (immature fruit), it reacts leaving a blue-black color in a characteristic pattern. There is no reaction of iodine to sugar (mature fruit).

1. Cut apples across the core so the seed cavities are exposed.
2. Place the halves with the cut side up on newspaper or outside on the ground to prevent iodine stains.
3. Use a spray bottle with iodine in it to spray the apple halves or dip the halves into a dish full of iodine. Let set for 1 minute.
4. Watch to see the parts of the apple become a dark purple color. The purple will show up on the starchy areas. If your apple has a lot of starch, it is not fully ripe. If it has only a little, it is ready for picking. The starch has changed to sugar!
5. Repeat the test in 2-3 days with new fruit from the same orchard if possible.



Iodine Recipe

Dissolve 10 grams of potassium iodine with 1/8 cup of water. Once dissolved, add 2.5 grams of iodine crystals. Shake to dissolve crystals. Dilute mixture with water to make about 1 quart of iodine solution. This solution is sensitive to light and should be stored in a dark container. Materials are available at most drug stores.

CA (Controlled Atmosphere) Apple Storage

Each fruit takes in oxygen from the air and uses it to stay alive. Cold air helps slow the ripening process down, but it doesn't stop it. The key to slowing down this process is to lower the oxygen content of the air. Air normally contains about 20 percent oxygen. By reducing the oxygen to 1.5 percent and keeping the temperature at 31-38 degrees Fahrenheit, the apple can be put to sleep. Carbon dioxide given off by the fruit also helps keep the fruit from ripening more. In CA (Controlled Atmosphere) storage, the humidity is kept at about 95 percent, which keeps the fruit from drying out. Even after months in CA storage, an apple can be as crisp and fresh-tasting as it was the day after picking.

Activity: Visit An Apple Packing/Shipping House



1. Make a list of questions and interview some of the employees.
2. Learn the duties of each employee.
3. Learn function of each department, such as sorting, packing, marketing, transporting, etc.

Apple Vocabulary List

ANTHER: The part of the stamen that produces and holds the pollen.

APHID: A minute insect that sucks the juice from the leaves.

APIARY: A place where bees are raised.

BUD: A small, covered bulge on the tree limb that contains the parts that will develop into leaves or blossoms.

CA: Controlled atmosphere storage where the oxygen level is reduced to stop the ripening process of the fruit. The fruit is stored in an airtight room where the carbon dioxide and humidity levels are controlled.

CALYX: The dry, hairy part at the base of the apple formed by the five sepals.

CARBON DIOXIDE: A gas which is absorbed from the air by plant leaves.

CHEMICAL: A substance used to protect the tree from diseases and insects.

CHLOROPHYLL: The green pigment, or coloring, found in leaves. It traps the energy from the sun so the leaves can make food.

CLEFT GRAFT: A graft which joins a rootstock and a scion by means of a cleft made in the rootstock.

CODLING MOTH: A moth the caterpillars of which live in apples and other fruit.

CYCLE: The period of time occupied by a series of events that repeat themselves regularly and in the same order such as; blossom, pollination, growth, maturity, harvest, and dormancy.

DISEASE: A sickness of the tree such as: fireblight, scab and powdery mildew.

DORMANT: Temporary time of inactivity during the winter.

DWARF: A plant much smaller than usual size for its kind.

ETHYLENE: A natural gas released by apples as they mature.

FERTILIZATION: When male and female reproductive cells are united by the pollen.

FERTILIZER: A mixture of plant food such as nitrogen, phosphorus, potassium and calcium nitrate used to make soil richer in nutrients.

FILAMENT: The stalk of the stamen.

Apple Vocabulary List continued

FUNGUS: Diseases that form on the host plant such as apple scab and powdery mildew.

GLUCOSE: A form of sugar that is produced by the leaves and used as a food and energy source by the apple tree.

GRAFTING: To join together a scion and a rootstock. Used to produce “like” varieties.

HARVEST: To gather a crop.

HORMONE: A fluid produced by the blossom following fertilization that prevents the flower from falling off.

INSECTICIDE: An agent or chemical that kills insects.

INSECTS: Pests that need to be controlled in the apple orchard such as aphids, leaf rollers, apple maggot, codling moth, plum curculio and mites.

INTEGRATED PEST MANAGEMENT (IPM): A program that helps growers to determine proper timing for sprays. An entomologist monitors orchards setting traps to determining insect population.

NECTAR: A sweet liquid found in plants that bees use in their making of honey.

NUTRIENT: A nutritive substance or mineral used by the tree for growth.

ORCHARD: A group of planted fruit trees.

OVARIAN WALL: The flesh of an apple that forms around the seeds.

OVARY: The female part of the flower. The rounded base at the bottom of the pistil, inside of which are five compartments each containing two ovules.

OVULE: A female reproductive cell that becomes a seed after fertilization.

OXYGEN: A gas which is released by the leaves during the growth process.

PARASITE: A plant that lives in or on another organism to its harm.

PETAL: The part of a flower that attracts insects by its fragrance and color.

PHEROMONE: Chemically-scented lures used in traps to attract adult pests.

PIGMENT: Color-producing material that is present in plants.

PISTIL: The female organ in the center of a flower, made up of a stigma, a style, an ovary and ovules.

Apple Vocabulary List continued

POLLEN: The fine, yellow dust that is produced by the anther of a seed plant and contains the sperm.

POLLINATION: The transfer of pollen from the male cell (anther) of one flower to the female cell (stigma) of another.

POMOLOGY: The study of fruits and nuts.

PREDATOR: An insect that kills other insects for food.

PRESSURE TESTER: A device that measures the firmness, or pounds of pressure, of an apple.

PROCESSING: A manufacturing process by which apples are peeled, cooked and prepared for canning.

PROPAGATE: Budding or grafting to reproduce a certain variety.

PRUNE: To cut away and shape a tree to keep the tree to size, to allow for maximum light penetration and preserve the health of the tree.

REFRACTOMETER: A device that measures the sugar content in an apple.

ROOTSTOCK: A section of tree with roots that is used as the base of the graft. The scion is grafted onto it.

SCION: A living section of a tree branch that supports two or more dormant buds and is grafted to the rootstock. The scion determines the kind of fruit the tree will produce.

SEMI-DWARF: A plant smaller than normal size for its kind.

SEPAL: Five green, leaflike structures that make up a flower's calyx.

SPERM: The male reproductive cell.

STAMEN: The male reproductive part of a flower made up of an anther and a filament.

STEM: The stalk of the flower that connects it to the branch.

STIGMA: The sticky top of a flower's pistil.

STYLE: The part of a pistil connecting the stigma and the ovary.

TRELLIS: Support and training system for young trees using wooden posts and cross wires.

VARIETY: Different kinds of apples.

Growing Michigan Apple Enhancement Ideas

Language Arts

- After reading *The Apple and Other Fruits*, *An Apple Tree through the Year*, or *Apple Trees*, have students make a mural that shows how the apple tree changes with each season.



Language Arts & Science

- Divide students into groups to research specific apple growing topics: grafting, pollination, pruning, spraying, picking, storing, and uses.



Language Arts & Art

- Create a story roller-box and a long strip of paper. Draw the story of “how apples are grown”.



Science

- Adopt an apple tree if you have one nearby. Take the students to visit the tree to observe and discuss its growth and change.
- Bring in a live apple blossom so students can study the different parts of the blossom.
- Have students write or demonstrate how a bee pollinates an apple blossom.
- Cut apart an apple and name the parts. Cut crosswise and you will find a star.
- Do an experiment to determine which apple stays fresh longer—one that is refrigerated or one that is left on the shelf.
- Do an experiment that shows what happens when an apple is bruised.
- Use a magnifying glass to look at a section of raw apple. Bake the apple and observe a section of cooked apple. Compare the difference and discuss changes that took place in color, texture, and taste. How do the changes when cooked impact uses of different varieties of apples.
- Observe apple seeds and compare them with seeds of other fruits. Are they larger or smaller? Does the size of the seed impact the size of the fruit? Do they vary in color? Does the color of the seed impact the color of the fruit?



Science & Art

- Create a mural that shows how apples are grown.
- Create a mural that shows how the apple tree changes with each season.
- Create a poster of how a bee pollinates an apple blossom.



Field Trips

- Take a field trip to an apple orchard, packing house or farm market. Before the visit, make a list of things to look for and questions to ask.
- Visit a packing house to learn first hand how apples are stored, packed, marketed, and transported.



A Bushel of Varieties

Upper Elementary ■ Middle School
Language Arts ■ Math ■ Social Studies

Student Learning Objectives

Students will:

- Determine that different apple varieties have different characteristics that influence how they are used.
- Recognize the influences of other countries on apple growing in Michigan. (middle school)

At a Glance

Students use information to read a graph, chart data, and complete a word search and definition activity. Enhancement ideas are suggested for language arts, math, and art. Recipes for apple treats are provided. A field trip is recommended.

Materials Needed

Student Handouts	Upper Elementary	Middle School
<i>Popular Michigan Apple Varieties</i> handout for each student (chart format)	*	
<i>Popular Michigan Apple Varieties</i> handout for each student (prose format)		*
<i>Apple Varieties</i> handout for each student	*	
<i>A Bushel of Apples</i> handout for each student	*	*
<i>Major Apple Growing States</i> handout for each student	*	*
<i>Michigan Apple Varieties</i> handout for each student	*	*
<i>Apple Varieties Matrix</i> handout for each student	*	*
<i>Apple Variety Word Search</i> handout for each student	*	*
<i>Michigan Apples Usage Chart</i> handout for each student	*	*
<i>Apple Treats</i> handout for each student (enhancement)	*	*
Teacher Directions and Keys		
<i>Apple Varieties</i> teacher key		
<i>A Bushel of Apples</i> teacher key		
A Bushel of Varieties Enhancement Ideas teacher directions		
Supplies		
Ingredients for apple treats (enhancement)		

Suggested Vocabulary

Acid
All-purpose
Blush

Crimson
Crisp
Firm

Flesh
Tart
Tender

Name: _____

Popular Michigan Apple Varieties

McIntosh <p>An old favorite. Juicy, slightly tart and tender with a very white flesh. Has a deep red blush against a yellow-green background. Not recommended for baked apples.</p>	Red Delicious <p>The most popular variety and most widely available. Bright crimson in color and oval shaped with five knobs at the bottom. Sweet and crunchy. Mainly a fresh eating apple. Not recommended for pies or cooking.</p>	Jonathan <p>Michigan grows half of the nation's supply of this all-purpose apple. Brilliant red speckled with gold and green in color. Slightly tart and firm.</p>
Rome <p>Red and red striped in color. Firm and medium tart. Best for baking and cooking.</p>	Ida Red <p>Bright red with a tart flavor. A good storage variety. Great for fresh eating and also an excellent pie apple.</p>	Golden Delicious <p>Yellow in color. Oval shaped. Sweet and juicy. An all-purpose apple that is low in acid.</p>
Northern Spy <p>Yellow and green with red blush. A tart processing and pie apple.</p>	Paula Red <p>A late summer variety that originated in Michigan. Colored a red blush against a yellow-green background. A juicy and slightly tart all-purpose apple. A newer variety that is fast growing in popularity.</p>	Empire <p>A cross between a McIntosh and Red Delicious. Firm and crisp with an excellent tart flavor. An all-purpose apple colored a deep red blush against a yellow-green background.</p>
Gala <p>A new variety originating in New Zealand. Gala is a cross between Pippin and Golden Delicious. Very firm with an excellent sweet flavor. Orange and yellow striped to full red-orange in color. An all-purpose apple.</p>	Jonagold <p>A new, all-purpose variety that is a cross between Jonathan and Golden Delicious. Colored an orange-red blush over a yellow background. A new variety to Michigan.</p>	Fuji <p>A cross of Rall Janet and Red Delicious originating in Japan. Has a very firm flesh with a crunchy "sweet tart" flavor. Great for eating fresh, in salads, or using for desserts.</p>

Name: _____

Popular Michigan Apple Varieties

OLD FAVORITES



Red Delicious

Discovered as a seedling by a farmer in an orchard in Peru, Iowa, in 1870 and named by a nurseryman in Missouri in the 1890s, the Red Delicious has become the best-known apple in the world. Jessee Hiatt entered his discovery in a fruit fair sponsored by the Stark Brother's nursery in 1893. Exhibits of fruit were entered from all over the world and Jesse Hiatt's apple won first prize and gained an official name. Stark Brother's bought the tree that revolutionized the domestic apple industry. The flavor of this glossy, red apple with the distinctive, five-pointed, elongated shape makes it an ideal choice for a snack, salad, or dessert fruit. The Red Delicious has a smooth, bright crimson skin and a juicy and crunchy texture that makes it a popular favorite. They are best when eaten fresh.

Jonathan

The Jonathan was discovered in 1826 in Woodstock, New York. It is a good all-purpose crimson apple with a sweet, spicy flavor. It is not as widely grown as it once was, as it does not store as well as other varieties. Michigan, however, is the leading producer of Jonathan apples. Jonathan is known for its versatility. It is excellent for pies and sauces, and is superior for baking, salads and eating out-of-hand.

Rome

Perfectly round and nearly solid red, with the look of a "storybook" apple, the Rome is one of the most colorful apples available. The Rome was not named after the ancient city, but rather after Rome Township, Ohio, where it was discovered in 1816. The fruit has a tough, smooth skin and the flesh is sweet with a tinge of yellow and green coloring. Because the fruit is very firm it has excellent storage and shelf life. The qualities that have made the Rome popular are more easily discovered in the oven than if eaten fresh. It has gained an excellent reputation as a baking apple because of its ability to retain its flavor and shape.

Ida Red

This bright red apple is being grown extensively, probably because of its excellent keeping ability and its growing popularity as a pie apple. Developed in Moscow, Idaho, at the Idaho Experiment Station, it was introduced commercially in 1942, and is a cross between Jonathan and Wagener. It's a nearly red apple from Idaho which is where its name was derived. Ida Red has a firm, crisp, and juicy flesh bursting with Jonathan-like flavor. For those who like a tart and tangy flavor the Ida Red is a favorite. It is also excellent for baking, sauces, and pies.

Popular Michigan Apple Varieties continued

McIntosh

Probably one of the most popular and best-tasting varieties grown, a McIntosh tree was discovered by John McIntosh growing on his farm near Dundela, Ontario, in 1796. All the millions of McIntosh trees planted since then owe their heritage to that one lone tree. It is a juicy, aromatic, slightly tart apple with a tough skin and very white flesh. The McIntosh variety has a mixed red and green coloring. Many new varieties have been developed from a McIntosh cross, some to ripen earlier than the parent and others to suit particular growing conditions. Some of these are the Cortland, Early McIntosh, Empire, Jonamac, Macoun, and Spartan. Besides being a delightful out-of-hand apple, McIntosh perks up salads, and makes an especially tasty applesauce.

Golden Delicious

The Golden Delicious is a sunshine yellow apple with a thin skin and a sweet and juicy flesh. It has an excellent eating flavor as well as a distinctive aromatic scent that is actually enhanced by cooking. It is a good apple to use in recipes where apple pieces need to hold their shape. Golden Delicious makes a good choice for apple cakes and pies, baked apples, applesauce and salads, because very little sugar needs to be added. Although similar to a Red Delicious in name and flavor, it is not genetically related. It was discovered in West Virginia in 1890 and is thought to have grown from a seed, which was a cross between a Golden Reinette and a Grimes Golden.

Northern Spy

The Northern Spy—an old favorite and a popular cooking apple—is harvested late in the fall as it is one of the last to ripen. It has a yellow-green skin with a red blush and a yellowish flesh which holds its shape and flavor in cooking. It was discovered near Rochester, New York, around 1800 and is believed to be a descendant of the Wagener.

Paula Red

The Paula Red, discovered on the Lewis Arends orchard near Sparta, Michigan, was named after Mr. Arends' wife, Pauline. Now in strong production in Michigan, the Paula Red is a late summer apple harvested in late August. It is one of the first varieties to reach the market. The all-purpose apple has a pleasingly tart flavor, light flesh, and is good for fresh eating and cooking. The skin has a yellow-green background with a solid-red blush much like a McIntosh. Since it is a short-season apple, its availability lasts only for a few weeks from late August through late September.

Winesap

Until about 1950, Winesap was one of the most popular varieties in America. As consumer tastes have changed, so has the demand for certain apple varieties. Winesaps are still readily available through the fall from Michigan. The Winesap variety is medium in size with a somewhat oblong shape. The skin is deep red with some yellow showing. The flesh is yellowish, firm and crisp and has a sweet, aromatic flavor. The Winesap variety is good for cooking and for eating.

Popular Michigan Apple Varieties continued

Cortland

This variety was first raised in 1898 at the New York State Agricultural Experiment Station from a cross between Ben Davis and McIntosh varieties. It is a well colored dessert-type apple that has found acceptance for eating fresh. Cortland is a very “natural” looking apple, with a ground color of pale yellow almost completely flushed with a deep red or crimson color. It is highlighted by very short, dark, red strips and grey-green dots. The Cortland variety has a very white flesh with a slightly tinged green color near the core. It is slightly coarse-textured, moderately juicy, and has a sweet, refreshing flavor.

NEWER MICHIGAN APPLE VARIETIES



Empire

Developed by Dr. Roger Way at the Geneva Agricultural Experiment Station at Cornell University, the Empire apple is still popular. Named in 1966, it is a cross between a McIntosh and a Red Delicious. The McIntosh-like apple takes on the best characteristics of the two popular varieties. It is excellent for fresh eating and is also a high-quality dessert apple. Empires are excellent when used for salads, baking and cooking. Widely grown in New York, Ontario and Michigan, Empire is popular for fresh-cut apples.

Gala

The Gala is a new variety to Michigan even though it was developed in 1939. It is a cross between a Kidds Orange and a Golden Delicious. Gala had its origin in New Zealand and was released in 1960 by J.H. Kidd of Greytown. It was brought to the United States in 1972 by Stark Brother’s Nursery. Today, there are many strains of Galas being offered for different growing regions. Each strain has a little different color pattern ranging from a striped orange and yellow to a full red-orange. Galas’ outstanding feature is its excellent eating quality. It has a very firm yellow flesh with a sweet flavor.

Jonagold

Jonagold is another new variety to Michigan. It originated at the Agriculture Research Station in Geneva, New York, from a cross of Golden Delicious and Jonathan. Jonagold is best grown in Michigan because it demands a cooler climate. It has an orange-red blush over a yellow background. It is a firm and juicy apple with an excellent flavor. It is an excellent all-purpose apple, characteristic to its parentage. Production will increase annually as new plantings come into production and popularity increases.

Popular Michigan Apple Varieties continued

Spartan

The Spartan is a McIntosh-type apple of Canadian origin. It is a cross between McIntosh and Yellow Newton Pippin. It looks much like a McIntosh, though it has a firmer and crisper flesh than its parent variety. The Spartan apple variety flavor is fairly rich, sweet and juicy, and is very aromatic even before being cut. Like the McIntosh, it is an excellent apple for eating fresh, as well as for pies, cider, sauces, etc.

Crispin (Mutsu)

The Crispin is a relatively newer apple variety in Michigan, being grown in limited numbers. Crispin is a cross between the Golden Delicious and Indo varieties. It was discovered in Japan in 1930, and originally named Mutsu. It was renamed Crispin in the United Kingdom in 1968. The Crispin is shaped much like the Golden Delicious, and is larger in size than many other varieties. It is green in color, with pale creamy white flesh. It has a firm, fine texture and juicy flesh, with a slightly sweet, refreshing, moderate flavor.

Fuji

A cross of Ralls Janet and Red Delicious that originated in Japan, Fuji is very high quality variety that is known for its long storage capability. It has a very firm flesh, with a crunchy sweet-tart flavor and is great for eating fresh, in salads, or using for desserts. Growers are increasing the Fuji apple tree plantings in Michigan.

Braeburn

Braeburn is a new apple variety to Michigan, currently planted in small numbers, but likely to grow in production in the future. It originated as a chance seedling in New Zealand. The Braeburn is a medium to large sized apple, with a gold-green base shaded by striping-red color. The variety is crisp, very juicy, full-flavored, and mildly sweet. The Braeburn is a late season apple with a long storage life.

Ginger Gold

Ginger Gold was discovered as a chance seedling in an orchard in Virginia. It is similar to the Golden Delicious in appearance and taste, but becomes ready for harvest about six weeks earlier. It exhibits all of the excellent qualities of a Golden Delicious. Ginger Gold has a texture and sweetness similar to the Golden Delicious, but also mildly spicy flavor that makes it unique.

Name: _____

Apple Varieties

Match an apple variety in box below with a statement and write the name of the variety in the blank that follows the appropriate statement.

Rome	Jonagold	Empire
Jonathan	Golden Delicious	McIntosh
Gala	Paula Red	Northern Spy
Red Delicious	Ida Red	Fuji

1. Most popular variety in the United States. _____
2. Sweet and yellow. _____
3. Late summer variety, originated in Michigan. _____
4. Firm apple, better for cooking than eating fresh. _____
5. Michigan grows half the nation's supply of this variety. _____
6. New variety that originated in New Zealand. _____
7. New variety that is a cross between a McIntosh and Red Delicious.

8. Tart apple, excellent for pies. _____
9. Old favorite, early variety good for fresh eating and applesauce.

10. Cross between a Jonathan and Golden Delicious. _____
11. A long-time favorite for processing and homebaked pies. _____
12. A new variety that originated in Japan. _____

Apple Varieties

Match an apple variety in box below with a statement and write the name of the variety in the blank that follows the appropriate statement.

Rome	Jonagold	Empire
Jonathan	Golden Delicious	McIntosh
Gala	Paula Red	Northern Spy
Red Delicious	Ida Red	Fuji

1. Most popular variety in the United States. Red Delicious
2. Sweet and yellow. Golden Delicious
3. Late summer variety, originated in Michigan. Paula Red
4. Firm apple, better for cooking than eating fresh. Rome
5. Michigan grows half the nation's supply of this variety. Jonathan
6. New variety that originated in New Zealand. Gala
7. New variety that is a cross between a McIntosh and Red Delicious. Empire
8. Tart apple, excellent for pies. Ida Red
9. Old favorite, early variety good for fresh eating and applesauce. McIntosh
10. Cross between a Jonathan and Golden Delicious. Jonagold
11. A long-time favorite for processing and homebaked pies. Northern Spy
12. A new variety that originated in Japan. Fuji

Name: _____

A Bushel of Apples

1. Complete the activities on the *Major Apple Growing States* student handout.
2. Compare the information on the *Popular Michigan Apple Varieties* student handout and the information in the box on the *Major Apple Growing States* student handout.

Which states are named in the *Popular Michigan Apple Varieties* student handout and not named as leading apple producing states on the *Major Apple Growing States* student handout? _____

3. Use the *Michigan Apple Varieties* student handout and the *Popular Michigan Apple Varieties* student handout to answer the following questions:

A. Which apple variety produces the largest crop annually? _____

B. Which characteristics of the apple might influence why the apple variety is produced in smaller or larger quantities annually? _____

4. Use the *Michigan Apple Usage Chart* student handout to answer the following questions:

A. Name the apples identified as sweet on the chart. _____

B. Name the apples identified as good for eating fresh only. _____

C. If three medium apples make a pound and it takes 6-8 medium apples to make a pie, how many pounds of apples would it take to make a pie? _____

D. If a bushel of apples makes 16-20 quarts of applesauce and one pound of apples makes 1 ½ cups of applesauce, how many pounds of apples might be expected to be in 1 bushel of apples? _____

A Bushel of Apples continued

5. Use the *Michigan Apple Usage Chart* to answer the following questions:
 - A. How many varieties are listed on the chart? _____
 - B. How many varieties are identified as crunchy? _____
 - C. How many varieties are identified as juicy? _____
6. Complete the *Apple Varieties Matrix* student handout activities.
7. Complete the *Apple Varieties Word Search* student handout.

A Bushel of Apples

1. Complete the activities on the *Major Apple Growing States* student handout.
2. Compare the information on the *Popular Michigan Apple Varieties* student handout and the information in the box on the *Major Apple Growing States* student handout.

Which states are named in the *Popular Michigan Apple Varieties* student handout and not named as leading apple producing states on the *Major Apple Growing States* student handout? **Iowa, Ohio and Idaho**

3. Use the *Michigan Apple Varieties* student handout and the *Popular Michigan Apple Varieties* student handout to answer the following questions:
 - A. Which apple variety produces the largest crop annually? **Red Delicious**
 - B. Which characteristics of the apple might influence why the apple variety is produced in smaller or larger quantities annually? **The Red Delicious is a very popular apple that many people eat fresh. Jonagold is a newer variety but it has become a favorite with consumers.**
4. Use the *Michigan Apple Usage Chart* student handout to answer the following questions:
 - A. Name the apples identified as sweet on the chart. **Red Delicious, Jonagold, Honeycrisp, Golden Delicious, Gala, Fuji, Braeburn**
 - B. Name the apples identified as good for eating fresh only. **Gingergold, Honeycrisp, Red Delicious**
 - C. If three medium apples make a pound and it takes 6-8 medium apples to make a pie, how many pounds of apples would it take to make a pie? **2-3 pounds**
 - D. If a bushel of apples makes 16-20 quarts of applesauce and one pound of apples makes $1\frac{1}{2}$ cups of applesauce, how many pounds of apples might be expected to be in 1 bushel of apples? **4 cups = 1 quart; so a bushel of apples making 16-20 quarts = 64-80 cups of applesauce. One-half cup of applesauce is produced by 1 pound of apples, so $64 \div 1\frac{1}{2} = 43$ (rounded) and $80 \div 1\frac{1}{2} = 53$ (rounded)**

A Bushel of Apples continued

5. Use the *Michigan Apple Usage Chart* to answer the following questions:
 - A. How many varieties are listed on the chart? **14**
 - B. How many varieties are identified as crunchy? **3**
 - C. How many varieties are identified as juicy? **7**
6. Complete the *Apple Varieties Matrix* student handout activities.
7. Complete the *Apple Varieties Word Search* student handout.

Major Apple Growing States

Name: _____



Leading Apple Producing States

Washington	138 million bushels
New York	24 million bushels
Michigan	18 million bushels
Pennsylvania	12 million bushels
California	8 million bushels
Virginia	6 million bushels
North Carolina	3 million bushels
West Virginia	2 million bushels

Based on USDA figures for 2005.

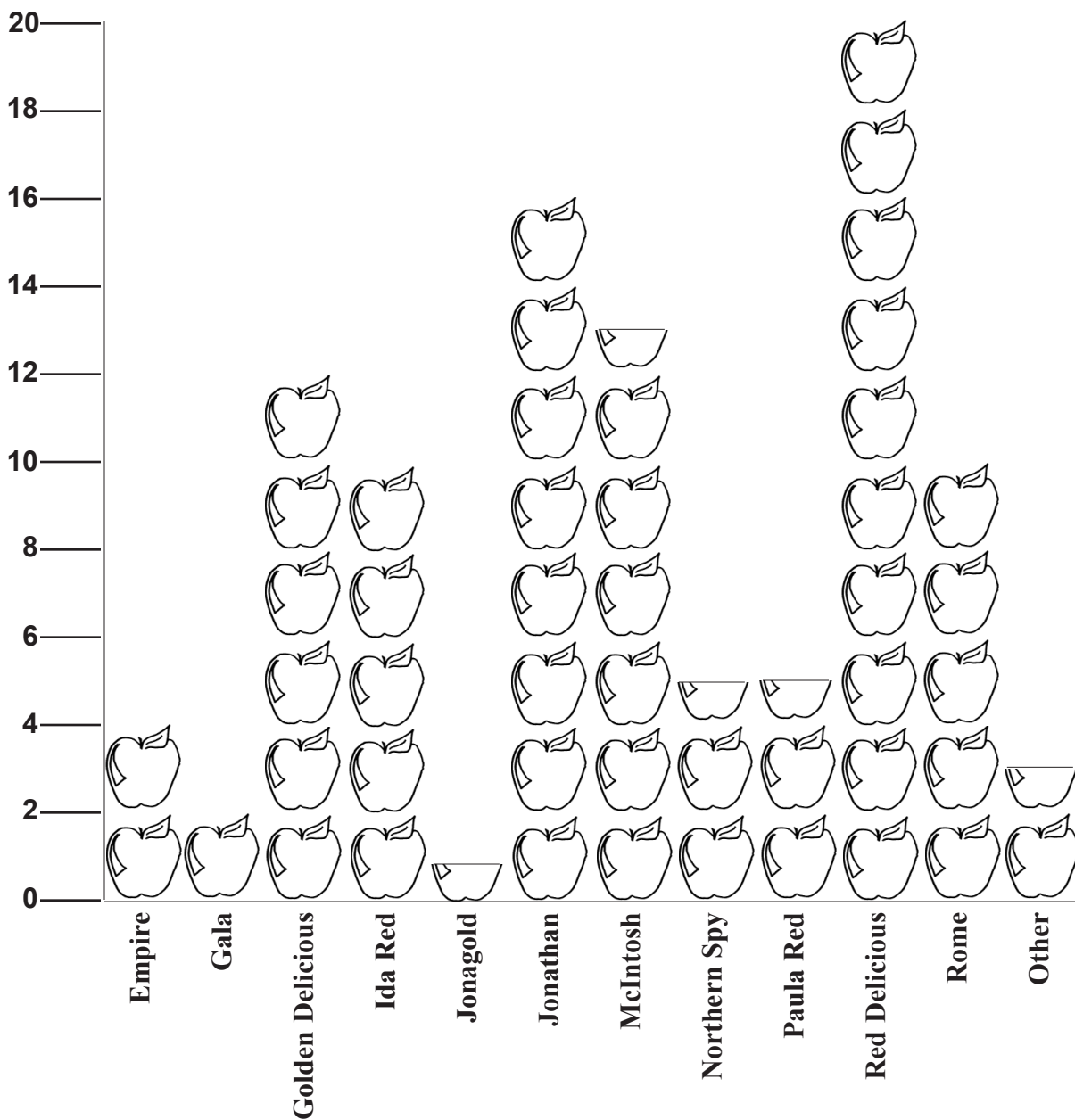
Activities


- Write in the names of these major apple growing states.
- Color the three leading apple producing states red and the other apple producing states green.
- Color the Great Lakes, Atlantic Ocean, and Pacific ocean blue.
- Write the postal abbreviation and name on each state (write outside of the map and draw arrows if you need to).
- Name the three leading apple producing states.
- What geographic characteristic does each of the three apple growing states share?

Name: _____

Michigan Apple Varieties

Michigan is known as the variety state, with perhaps more varieties grown for commercial use than any other state. The percentage of each variety from a typical annual Michigan apple crop is shown on this graph.



one  = 2%

Name: _____

Michigan Apples Usage Chart



Variety	Taste and Texture	Uses
Braeburn	Mildly sweet and crisp	Fresh and baked
Empire	Combo sweet and tart	Fresh and baked
Fuji	Sweet and crunchy	Fresh and baked
Gala	Sweet and crunchy	Fresh and baked
Gingergold	Sweet-spicy and firm	Fresh
Golden Delicious	Sweet and firm	Fresh and baked
Honeycrisp	Sweet, crisp and juicy	Fresh
Ida Red	Tart, firm and juicy	Fresh and baked
Jonagold	Sweet, firm and juicy	Fresh and baked
Jonathan	Sweet-spicy	Fresh and baked
McIntosh	Sweet-tart and juicy	Fresh and baked
Paula Red	Sweet-tart and juicy	Fresh and baked
Red Delicious	Sweet, juicy and crunchy	Fresh
Rome	Mildly tart and juicy	Fresh and baked

**Generally accepted uses—personal preference may vary.*

Apple Quantity Chart

3 medium sized apples makes a pound

6-8 medium sized apples makes a 9-inch pie

1 bushel of apples makes 16-20 quarts of applesauce

1 pound (3-4 medium sized apples) makes 1½ cups of applesauce

Name: _____

Apple Varieties Matrix

Divide the class into groups. Give each student five different apple varieties and have them observe the differences and similarities of each. Have the students make a list of words that describe the apple varieties. The students can use this matrix to write an apple poem.

APPLE VARIETY	McIntosh	Red Delicious	Golden Delicious	Ida Red	Gala
Sounds					
Tastes					
Feels					
Smells					
Looks					

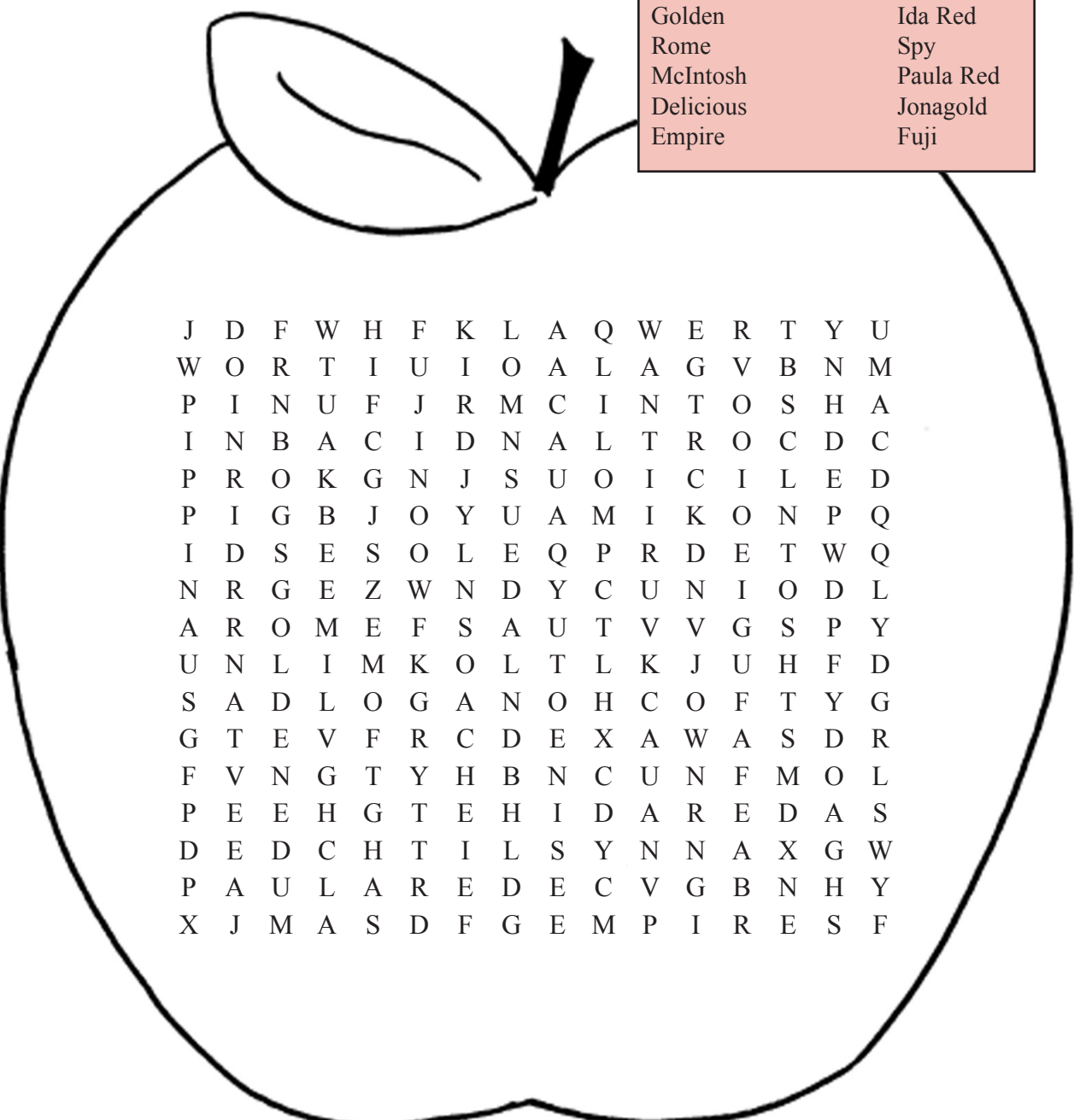
Name: _____

Apple Variety Word Search

Find the names of 12 different Michigan apple varieties in the word search. They may be written forward, backward, or diagonal.

Michigan Apple Varieties

Jonathan	Gala
Golden	Ida Red
Rome	Spy
McIntosh	Paula Red
Delicious	Jonagold
Empire	Fuji

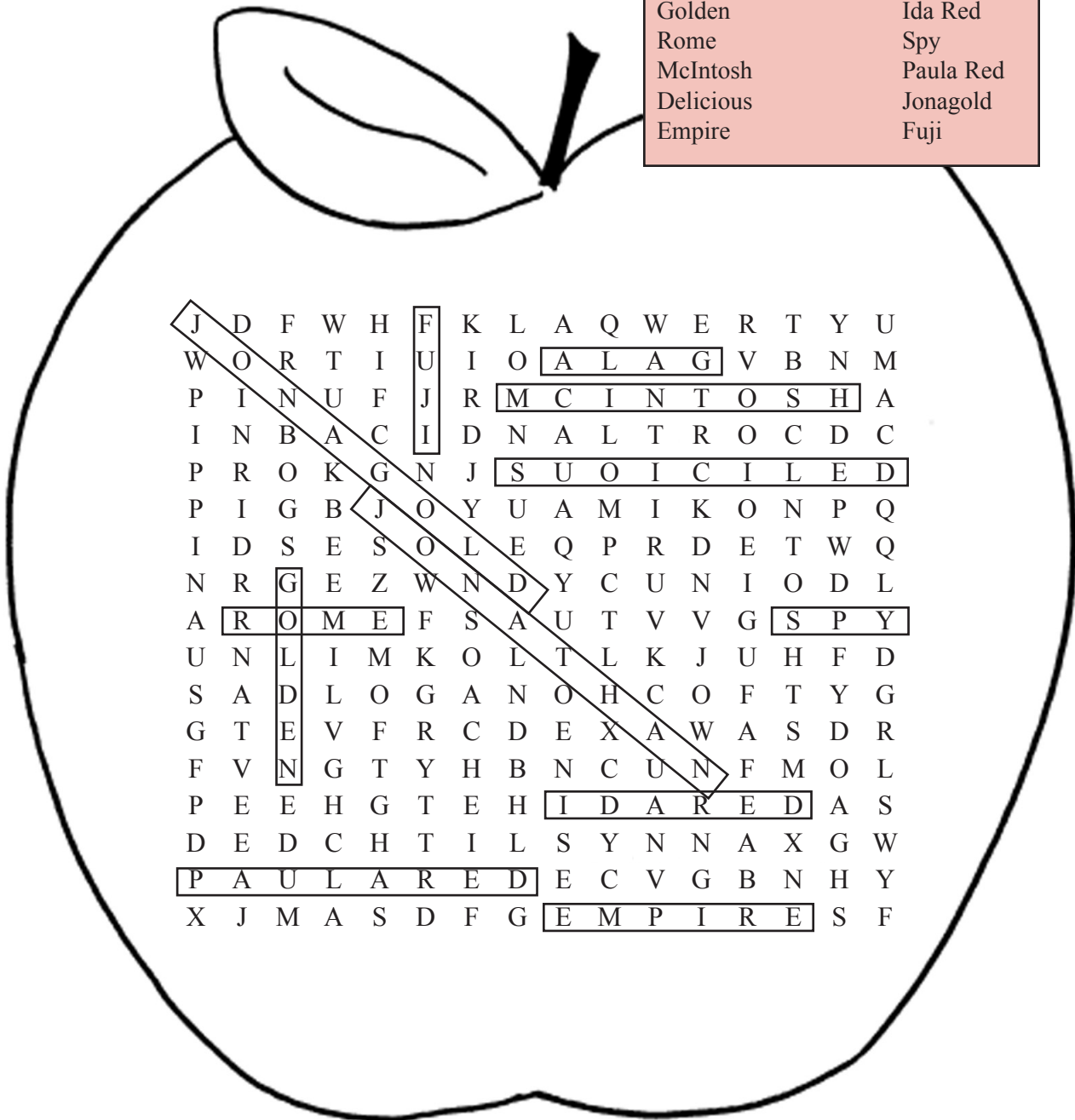


J D F W H F K L A Q W E R T Y U
W O R T I U I O A L A G V B N M
P I N U F J R M C I N T O S H A
I N B A C I D N A L T R O C D C
P R O K G N J S U O I C I L E D
P I G B J O Y U A M I K O N P Q
I D S E S O L E Q P R D E T W Q
N R G E Z W N D Y C U N I O D L
A R O M E F S A U T V V G S P Y
U N L I M K O L T L K J U H F D
S A D L O G A N O H C O F T Y G
G T E V F R C D E X A W A S D R
F V N G T Y H B N C U N F M O L
P E E H G T E H I D A R E D A S
D E D C H T I L S Y N N A X G W
P A U L A R E D E C V G B N H Y
X J M A S D F G E M P I R E S F

Apple Variety Word Search

Find the names of 12 different Michigan apple varieties in the word search. They may be written forward, backward, or diagonal.

Michigan Apple Varieties	
Jonathan	Gala
Golden	Ida Red
Rome	Spy
McIntosh	Paula Red
Delicious	Jonagold
Empire	Fuji



Name: _____

Apple Treats



Fresh Apple Chips

Mix 1 cup sugar and 1 teaspoon cinnamon. Put into a shaker. Core and slice apples. Sprinkle with sugar mixture.

Apple-Pops

Freeze apple juice in small paper cups with a popsicle stick inserted in the center.

Apple Finger-Gelatin

Pour 2 envelopes of unflavored gelatin into a bowl. Dissolve in 2 cups boiling water. Add a 6-ounce can of unsweetened frozen apple juice. Pour into a lightly greased 9" x 13" cake pan and refrigerate until firm. Cut into squares or into apple shapes with a cookie cutter.

Caramel Apple Dip

Blend 8 ounces cream cheese, 3/4 cup brown sugar, 1 teaspoon vanilla, and 1 cup salted chopped peanuts (optional). Serve with sliced apples, dipped in orange juice to prevent browning.

Stuffed Baked Apples

Peel (if desired) and core any baking variety apple. Place in baking dish and stuff with 1 teaspoon butter and 1 tablespoon brown sugar. Add raisins or nuts if desired. Bake in microwave until tender. Top with whipped cream or ice cream.

Applesauce

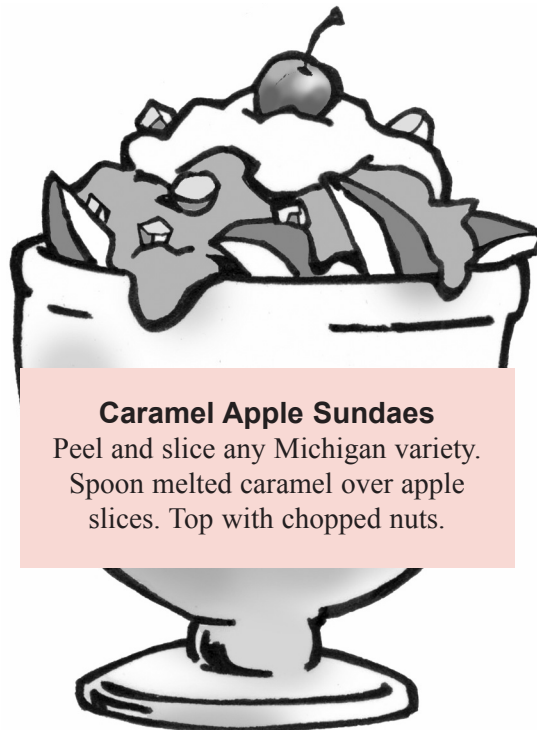
Peel, core, and slice 12 tart Michigan apples. Put in saucepan and add a small amount of water. Cover and simmer until tender (25-30 minutes). Add sugar and cinnamon to taste. Serves 20.

Applesauce Ideas

Mix vanilla yogurt and applesauce together and freeze for a frozen yogurt treat. Spoon warm applesauce over ice cream, pancakes, waffles, or French toast.

Applewiches

Core and slice an apple. Spread peanut butter or cream cheese on one side of each apple slice. Place 4 small marshmallows between 2 apple slices.



Caramel Apple Sundaes

Peel and slice any Michigan variety. Spoon melted caramel over apple slices. Top with chopped nuts.

A Bushel of Varieties

Enhancement Ideas



Language Arts

- Name a new apple variety and describe its characteristics.
- Make a list of five words that describe an apple. Write a poem using the five words. Use the first letter of the word apple or the first letter of an apple variety for each line of the poem.
- Make a graph based on a class vote of favorite varieties of apples.
- Bring recipes from home and compile an apple cookbook for a holiday gift.
- Decide on a new way or recipe to use apples in the school lunch program.
- Create presentations to advocate for use of apples in the school lunch program or for after school snacks.
- Give a demonstration speech on how to make a caramel apple sundae.



Language Arts & Math

- Make an apple booth and sell apples or apple treats during lunch. This could be a money making project. Have students develop commercials for apples and practice salesmanship strategies. Keep and analyze records of sales and profits.



Math

- Make a graph based on a class vote of favorite choice of red, green or yellow apples.
- Make several apple treats and graph the results.
- Make arrangements with a local farmer or farm market to buy and sell $\frac{1}{2}$ bushels of apples at a parent meeting. Keep records of sales and profits.



Art

- Make an “Apple a Day” collage that shows all the ways apples are used.
- Make an apple bulletin board to illustrate apple products, apple varieties, or the nutritional value of apples.



Field Trips

- Arrange a field trip with the produce person of a local grocery store. Before the visit, make a list of things to look for and questions to ask. Have students walk down the food aisles and make a list of all of the apple products they see.



Just for Fun

- Make caramel apple sundaes, apple finger-jello, or apple dip with the class. Serve it at a parent meeting.

An Apple A Day

Lower Elementary ■ Middle School

Health

Student Learning Objectives

Students will:

- Compare the cleanliness of their teeth after eating lunch and after eating an apple.
- Correlate characteristics of apples and health benefits of eating apples.

At a Glance

Lower elementary students use their tongue to feel their teeth and eat an apple to discover the teeth cleaning qualities of apples. Middle school students complete worksheets and use research to discover the nutritional value of apples.

Materials Needed

Student Handouts	Lower Elementary	Middle School
<i>The Nutrition Tree</i> handout for each student		*
<i>Apples Build a Healthy Body</i> handout for each student		*
Teacher Directions and Keys		
<i>Nature's Toothbrush</i> teacher directions		
<i>The Nutrition Tree</i> teacher key		
<i>Apples Build a Healthy Body</i> teacher key		
<i>Extension Activities</i> teacher directions		
Supplies		
Apples for <i>Nature's Toothbrush</i>		

Suggested Vocabulary

Acid	Carbohydrate	Heart disease	Quencher
Alert	Cholesterol	High blood pressure	Sodium
Apple flesh	Crisp	Infant	Sugar
Artificial	Diabetes	Juicy	Tooth decay
Boron	Dietary fiber	Minerals	Vitamins
Brain	Energy	Particles	
Calories	Fructose	Pectin	
Cancer	Gum massage	Potassium	

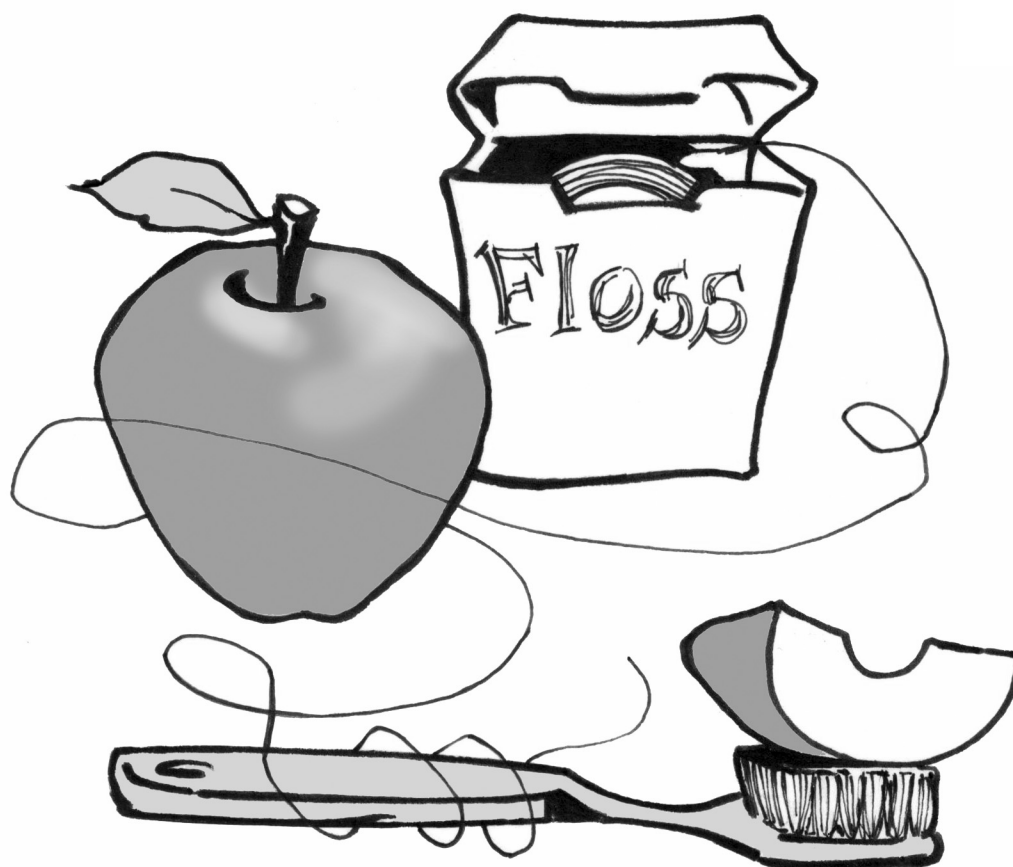
Nature's Toothbrush

Information

The apple is called “Nature’s Toothbrush” because it helps clean the teeth and massage the gums. The crisp juicy flesh of the apple brushes and cleans the teeth while you eat it. The juice swishes and washes particles out from between the teeth, helping to prevent tooth decay. The natural vitamins and minerals and sugars in the apple are all good for your teeth and your body. Keep your teeth bright and clean by regular brushing and eating lots of crisp and juicy Michigan apples.

Activity

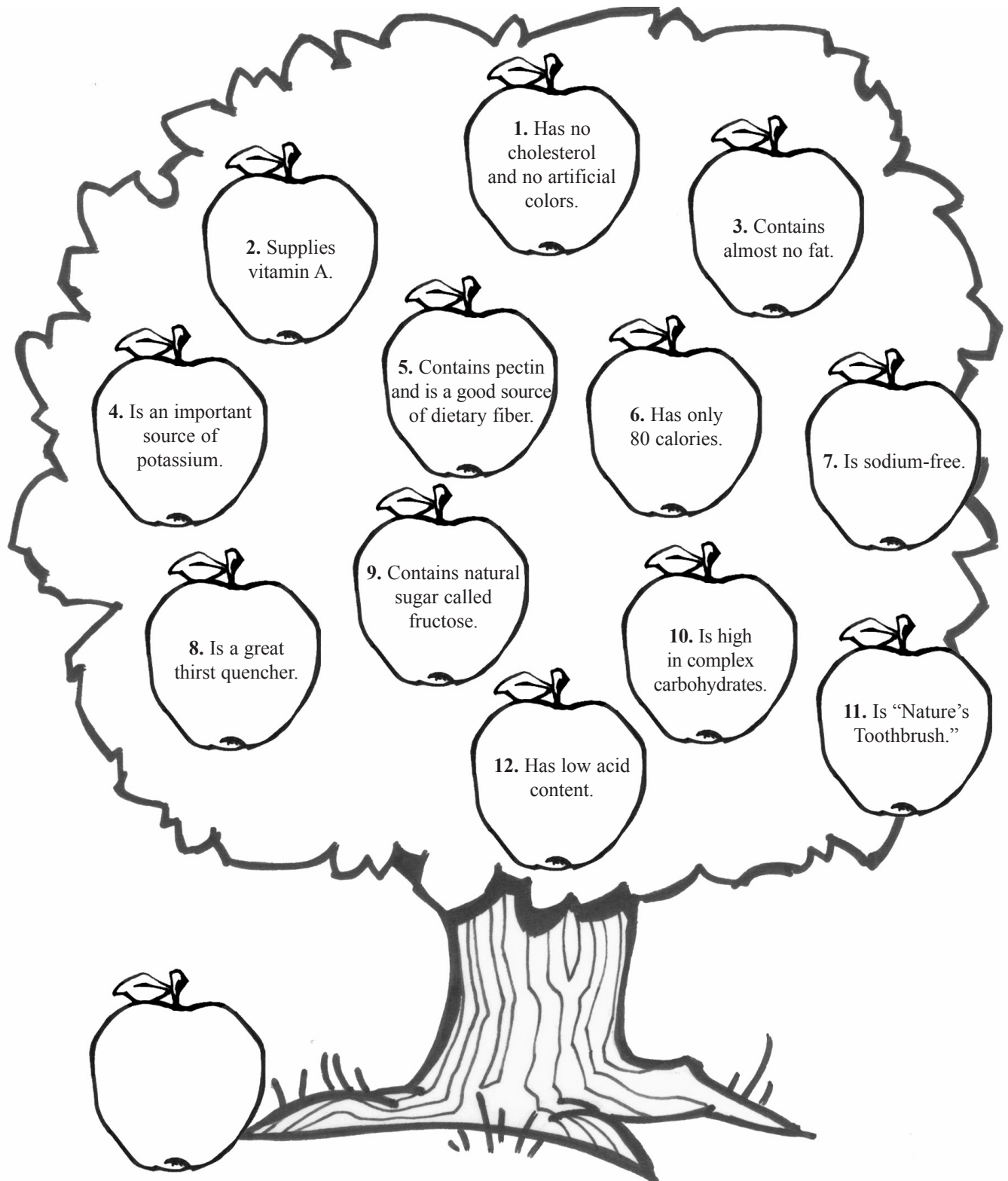
After lunch, have students feel their teeth with their tongues. Ask them to describe what they feel (“fuzzy”). Have students eat a section of an apple. Have students feel their teeth with their tongues. Ask them to describe what they feel (“smooth”).



Name: _____

The Nutrition Tree: A Dozen Good Reasons to Eat Apples

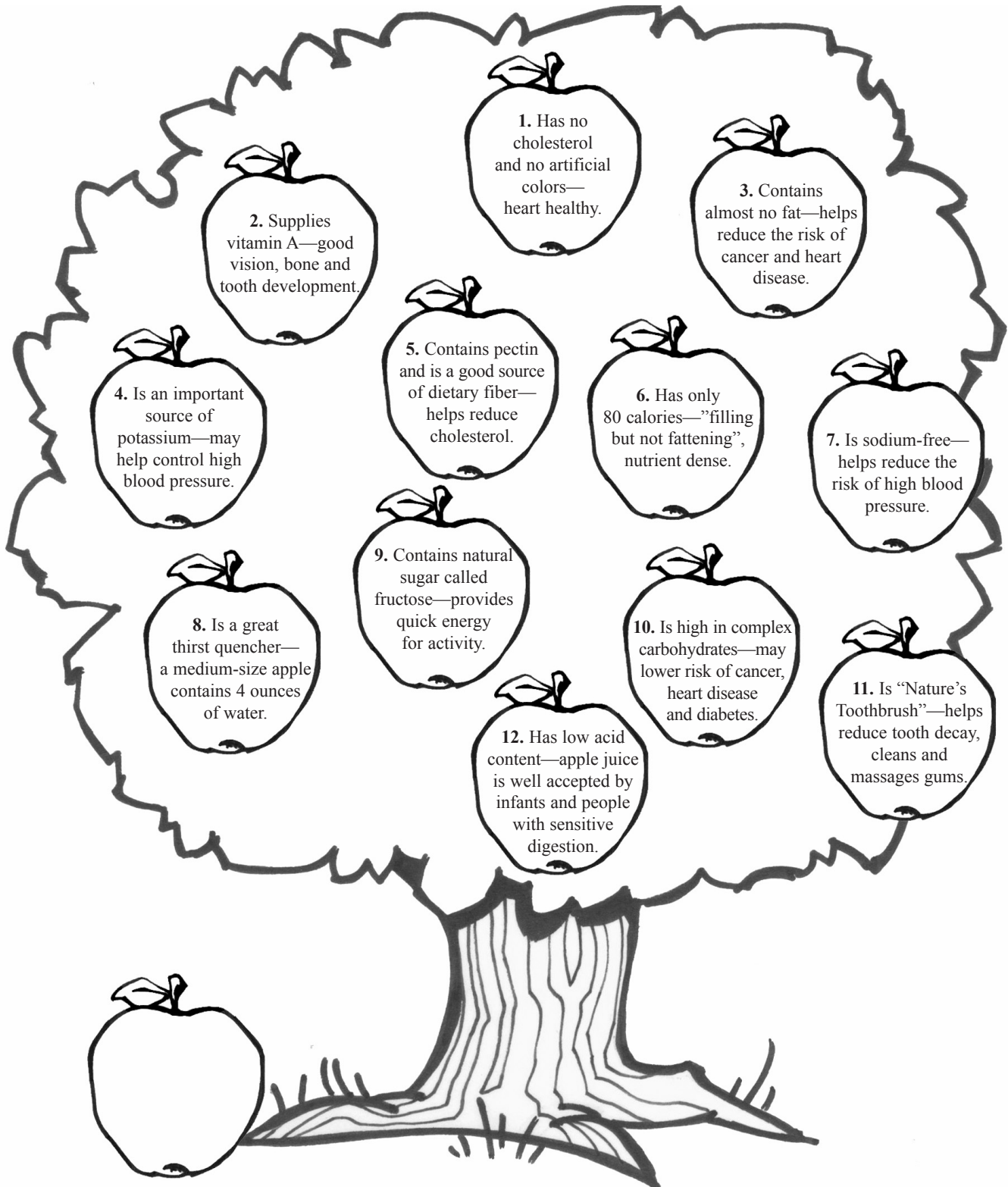
Apples are a very good fruit for building healthy bodies. What health benefit is the result of each of the apple claims?



An Apple A Day ■ Student Handout

The Nutrition Tree: A Dozen Good Reasons to Eat Apples

Apples are a very good fruit for building healthy bodies. What health benefit is the result of each of the apple claims?



Name: _____

Apples Build A Healthy Body

Fill in the blank in each sentence below with the correct word from the box.

calories	potassium	4 ounces water
sodium	vitamin A	low acid
pectin	cholesterol	
carbohydrates	natural sugar	

1. Apples have no _____, or salt which helps keep blood pressure down.
2. A medium sized apple has only 80 _____.
3. The _____ and other fibers in an apple helps balance cholesterol.
4. Apples have _____ which helps maintain good vision, bone and tooth development.
5. Apples supply a good amount of _____ which helps control high blood pressure.
6. Apples are high in _____ which keeps our heart healthy and may lower the risk of cancer and diabetes.
7. An apple quenches thirst because it contains _____.
8. An apple is a source of quick energy because of its _____ called fructose.
9. An apple has no _____ and is fat free which makes in a healthy snack.
10. People with sensitive digestive systems are able to drink apple juice because it has _____ content.

Source: Produce Marketing Association, 1991.

Apples Build A Healthy Body

Fill in the blank in each sentence below with the correct word from the box.

calories	potassium	4 ounces water
sodium	vitamin A	low acid
pectin	cholesterol	
carbohydrates	natural sugar	

1. Apples have no **sodium**, or salt which helps keep blood pressure down.
2. A medium sized apple has only 80 **calories**.
3. The **pectin** and other fibers in an apple helps balance cholesterol.
4. Apples have **vitamin A**, which helps maintain good vision, bone and tooth development.
5. Apples supply a good amount of **potassium** which helps control high blood pressure.
6. Apples are high in **complex carbohydrates** which keeps our heart healthy and may lower the risk of cancer and diabetes.
7. An apple quenches thirst because it contains **4 ounces water**.
8. An apple is a source of quick energy because of its **sugar** called fructose.
9. An apple has no **cholesterol** and is fat free which makes in a healthy snack.
10. People with sensitive digestive systems are able to drink apple juice because it has **low acid** content.

Source: Produce Marketing Association, 1991.

An Apple a Day Enhancement Ideas

- Make an apple nutrition chart.
- Research the nutritional value of an apple and tell what each vitamin and mineral does for your body.
- Discuss why an apple is better for you than a candy bar.
- Study the basic food groups and have students determine if their meals the previous day included all the basic food groups.
- Compare the nutritional value of various apple products and recipes that use apples.
- Have students write a rap with an “apples are good for you” or “eat an apple a day” theme.

Apple Lore

Lower Elementary ■ Middle Elementary ■ Upper Elementary Language Arts ■ Science ■ Art

Student Learning Objectives

Student will:

- Read apple stories for comprehension.
- Sequence events in apple stories they have read.
- Create visual illustrations of their understanding of apple stories they have read.
- Define new vocabulary in apple stories.
- Complete sentences with words based on the part of speech required for the sentence.

At a Glance

Students read short stories and answer questions, use the dictionary, complete a crossword puzzle, sequence events of a story, illustrate a story, and do an art activity. Enhancement ideas are suggested for language arts, social studies, and cross-curricular activities.

Materials Needed

Student Handouts	Middle Elementary	Upper Elementary
<i>William Tell</i> handout for each student	*	*
<i>Isaac Newton</i> handout for each student	*	*
<i>John Chapman a.k.a. Johnny Appleseed</i> handout for each student	*	*
<i>Johnny Appleseed Puzzle</i> handout for each student	*	*
<i>Johnny Appleseed Sentence Strips</i> handout for each student	*	*
Teacher Directions and Keys		
<i>The Little Red House—No Doors, No Windows, and a Star Inside</i>		
<i>Apple Prints</i> teacher directions		
<i>Funny Faces</i> teacher directions		
<i>William Tell</i> teacher key		
<i>Isaac Newton</i> teacher key		
<i>John Chapman a.k.a. Johnny Appleseed</i> teacher key		
<i>Johnny Appleseed Puzzle</i> teacher key		
<i>Johnny Appleseed Puppets</i> teacher directions		
Apple Lore Enhancement Ideas teacher directions		

Supplies

Apple prints: apples cut in half or sponges cut in apple shapes, foam meat trays, paper towel, undiluted liquid tempera paint (red, green, yellow), white construction paper or paper strips

Johnny Appleseed apple puppets: 12" x 18" sheets of paper, crayons, markers, yarn, buttons or other miscellaneous supplies for decorating the puppets

Suggested Vocabulary

Authority

Avid

Black Plague

Day dreamer

Discoveries

Disobedience

Herbs

Independence

Lashed

Law of universal gravitation

Legendary

Mission

Neglected

Orbit

Physics

Planets

Pomace

Professors

Pulp

Revolt

Sparked

Symbol

Universe

Working models

The Little Red House—No Doors, No Windows, and A Star Inside

Adopted from a story by Caroline Sherwin Bailey

There was once upon a time a little boy who was tired of playing with his toys and tired of his books and puzzles.

“What shall I do?” he asked his mother. And his mother, who always knew fun things for little boys to do, said, “Why not go and find a little red house with no doors and no windows and a star inside.”

This really made the little boy wonder. Usually his mother had good ideas, but he thought that this one was very strange. “Which way shall I go?” he asked his mother. “I don’t know where to find a little red house with no doors and no windows.”

“Go down the lane past the farmer’s house and over the hill,” said his mother, “And then hurry back as soon as you can and tell me all about your journey.”

So the little boy put on his hat and his jacket and started out. He had not gone very far down the lane when he came to a merry little girl dancing along in the sunshine. Her cheeks were like pink blossom petals and she was singing like a robin.

“Do you know where I shall find a little red house with no doors and no windows and a star inside?” asked the little boy.

The little girl laughed. “Ask my father, the farmer,” she said. “Perhaps he knows.”

So the little boy went on until he came to the great brown barn where the farmer kept barrels of fat potatoes and baskets of yellow squashes and golden pumpkins. The farmer himself stood in the doorway looking out over the green pastures and yellow grain fields.

“Do you know where I shall find a little red house with no doors and no windows and a star inside?” asked the little boy of the farmer.

The farmer laughed too. “I’ve lived a great many years and I’ve never seen one,” he chuckled, “but ask Granny who lives at the foot of the hill . . . She knows how to make homemade cookies, taffy, and popcorn balls . . . and red mittens! Perhaps she can tell you.”

So the little boy went on farther still, until he came to the Granny sitting in her rocker on her front porch. She had lots of wrinkles and a big smile on her sweet face.

“Please, dear Granny,” said the little boy. “Where shall I find a little red house with no doors and no windows and a star inside?”

Granny was knitting a red mitten and when she heard the little boy’s question, she laughed so cheerily that the wool ball rolled out of her lap and down to the little stone path.

“I should like to find that little house myself,” she chuckled. “It would be warm when the frosty night comes and the starlight would be much prettier than a candle. But ask the wind who blows about so much and listens at all the chimneys. Perhaps the wind can tell you.”

So the little boy took off his cap politely to the Granny and went on up the hill rather sadly. He wondered if his mother, who usually knew almost everything, had perhaps made a mistake.

The Little Red House—No Doors, No Windows, and A Star Inside continued

The wind was coming down the hill as the little boy climbed up. As they met, the wind turned about and went along, singing beside the little boy. It whistled in his ear, and pushed him along and dropped a pretty leaf into his hands.

“I wonder,” thought the little boy, after they had gone along together for awhile, “If the wind could help me find a little red house with no doors, and no windows and a star inside.”

The wind cannot speak in our words, but it went singing ahead of the little boy until it came to an orchard. There it climbed up in the apple tree and shook the branches. When the little boy caught up, there, at his feet, lay a big red apple. The little boy picked up the apple. It was as much as his two hands could hold. It was as red as the sun had been able to paint it, and it had no doors and no windows. Was there a star inside?

The little boy called to the wind, “Thank you,” and the wind whistled back, “You’re welcome.”

The little boy hurried back down the lane with the big, red apple in his hand. When he reached his house the little boy gave the apple to his mother. His mother said, “You have found a house with no doors and no windows but where is the star?”

His mother took a knife (AT THIS POINT, START CUTTING AN APPLE CROSSWISE) and cut the apple through the center. Oh, how wonderful! There inside the apple, lay a star holding five brown seeds.

“It is too wonderful to eat without looking at the star, isn’t it?” the little boy said to his mother.

“Yes, indeed,” answered his mother.

Suggested Activities

- Have an apple for each student so they can observe their own “star”.
- Before cutting the apple, have each student estimate the number of seeds (see Math Activities sheet).
- Discuss the five parts of the core and relate them to pollination (see Apple Parts sheet in Growing Michigan Apples section).
- Sequencing the parts of the story (playing with toys; what shall I do; find red house with no door; merry little girl; farmer; Granny; wind; apple at the boy’s feet; finds the star)
- Art activities such as Apple Prints and Funny Faces
- Apple Experiments (activity sheet)



Apple Prints

Materials

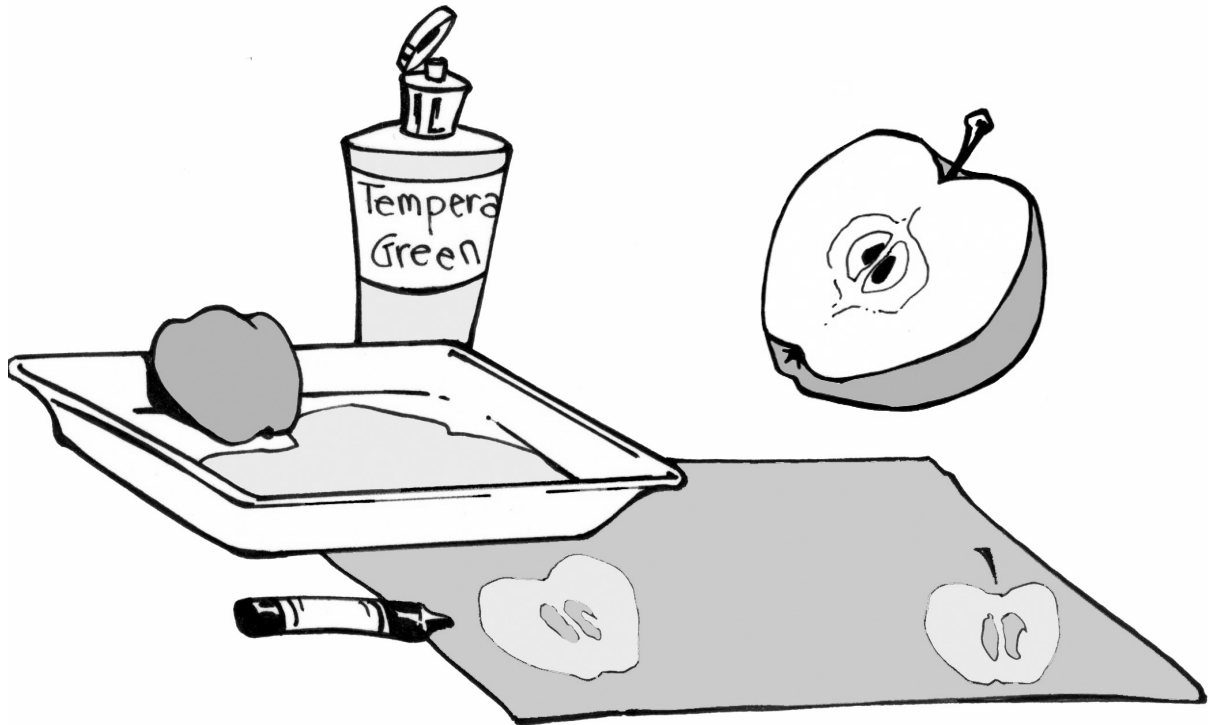
- Foam deli trays or heavy-duty paper plates
- Paper towel
- Undiluted liquid red, green, and yellow tempera paint
- Apples cut in half and allowed to dry slightly or sponges cut into apple shapes
- White construction paper or paper strips

Procedures

1. Pour paint into trays lined with a paper towel.
2. Dip apple (flat surface down) into paint tray.
3. Press onto paper.
4. Repeat to make desired design.

Suggestions

- Have students draw and cut out an apple tree shape to print their apples on.
- Younger grades can count the apples!
- May be used for a greeting card, wrapping paper, a border for a bulletin board.



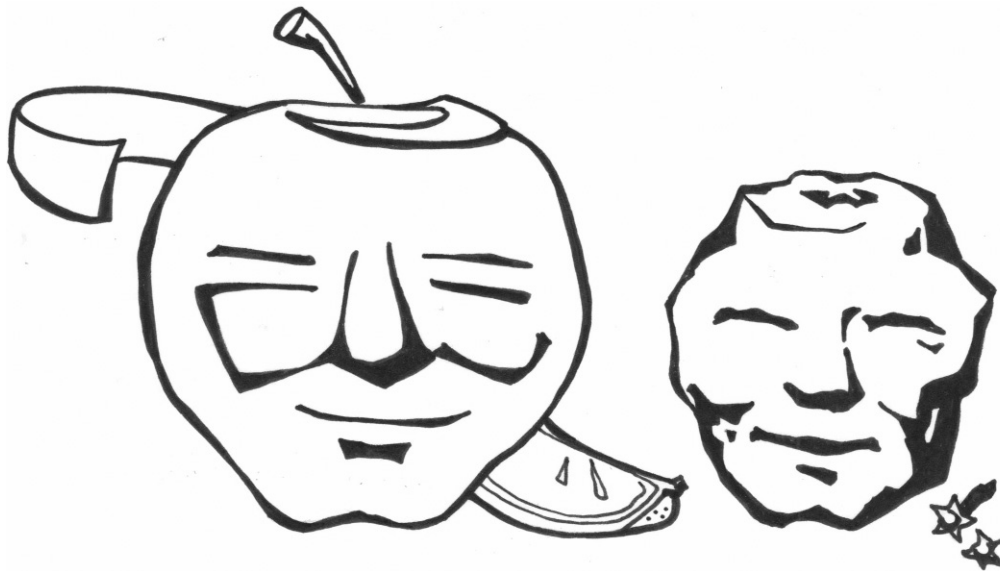
Funny Faces

Materials

Apples (Red and Golden Delicious varieties do not work well)
Plastic knives
1-foot long wooden dowels (sharpened on one end)
Lemon juice
Bowl
Water

Procedure

1. Peel the apples.
2. Use the plastic knife to make slits for eyes and the mouth. Cut a wedge nose and shape a chin and cheeks.
3. Fill bowl halfway with water. Add two tablespoons lemon juice.
4. Soak apples in water for 20 minutes.
5. Remove apples. Put the sharpened dowel through the bottom.
6. Put in a warm, dry place out of the sun for 10-14 days. Watch faces slowly shrink and change.
7. May add blush for cheeks, cloves for eyes, cotton for hair, and fabric for clothes.



Name: _____

William Tell

William Tell is a legendary person who lived in the fourteenth century. The Austrian government had taken over his country of Switzerland. One day, an Austrian governor tried to force all the people in the town to bow to a hat perched on a pole. The hat was a symbol of authority.

William Tell refused. For his disobedience, he was ordered to shoot an apple off his son's head with a bow and arrow. The brave young boy stood still while his father successfully shot the arrow through the apple. The mean governor still ordered William Tell to be chained and prepared to take him by boat to an island prison.

As they were rowing across the lake, waves lashed at the sides of the boat. Out of fear, the governor unchained his prisoner and ordered him to start rowing. William Tell escaped and went back to his people.

Word of William Tell's bravery sparked a revolt by his people that eventually led to freedom from Austrian rule. William Tell became a symbol of freedom and independence.



True or False

1. The country of Switzerland was taken over by the Austrian government. **T or F**
2. The hat on a pole stood for a symbol of purity. **T or F**
3. The governor released William Tell after successfully shooting the apple off his son's head. **T or F**
4. William Tell escaped to go back to his people. **T or F**
5. William Tell's bravery eventually led to freedom for his people. **T or F**



Dictionary Exercise

Look up the meaning of each word that applies to the story.

1. legendary
2. symbol
3. authority
4. disobedience
5. lashed
6. sparked
7. revolt
8. independence

William Tell

True or False



1. The country of Switzerland was taken over by the Austrian government. **True**
2. The hat on a pole stood for a symbol of purity. **False**
3. The governor released William Tell after successfully shooting the apple off his son's head. **False**
4. William Tell escaped to go back to his people. **True**
5. William Tell's bravery eventually led to freedom for his people. **True**

Isaac Newton

Isaac Newton was born on Christmas Day in 1642, on a farm in Woolsthorpe, England. Isaac was a poor student in grade school. He was a day dreamer and had very few friends. He often neglected the simplest chores on the farm. Isaac spent much of his time making working models and studying the world around him.

When he was 18 years old, Isaac attended Trinity College in Cambridge University. His professors soon realized how brilliant he was. He was an avid reader with special interests in math and physics. After graduation, he was forced to return to the farm to escape the Black Plague. During the next 18 months, he made many of his discoveries.

One day, while sitting in the garden, he watched an apple fall to the ground. He wondered, "Why do apples fall down and not up?" He realized it must be because the earth was attracting objects to itself.

Isaac began to work out the law of attraction between all objects in the universe. This law explains why the planets orbit the sun and why the moon orbits the Earth. The law of universal gravitation and his many other discoveries made Isaac Newton one of the greatest scientists of all time. All of this began with an apple!



Discussion Questions

1. Why do you think Isaac Newton was a poor student in grade school?
2. Why do you think Isaac Newton had very few friends?
3. Why do you think the 18 months on the farm after graduation was a special time for him?
4. Why do objects fall down and not up? Why do the stars and moon stay in the sky?



Isaac Newton

Discussion Questions



1. Why do you think Isaac Newton was a poor student in grade school? **He was a day dreamer.**
2. Why do you think Isaac Newton had very few friends? **He was more interested in spending time making working models and studying the world around him.**
3. Why do you think the 18 months on the farm after graduation was a special time for him? **It provided an opportunity to study the world around him and he began to work on laws concerning attraction between objects and universal gravitation.**
4. Why do objects fall down and not up? Why do the stars and moon stay in the sky? **The law of universal gravitation.**

John Chapman a.k.a. Johnny Appleseed

John Chapman was born in Leominster, Massachusetts, on September 26, 1774. His mission in life was to plant apple seeds. Each fall at cider making time, Johnny went to the cider presses. There he collected pomace, or pulp, that was left after the apples had been squeezed. He'd wash the seeds and let them dry in the sun. In the spring, he'd put his treasures in deerskin pouches, or coffee or flour sacks, and head west to plant the seeds. Johnny planted seeds throughout the Ohio Valley. He became known as "Johnny Appleseed".

He wore cut-out flour sacks for shirts and wrapped his feet in rags in the winter to keep them from freezing. He carried his cooking pot on his head when he wasn't using it for cooking and he carried his favorite book, the Bible, under his arm. He slept in the wilderness and taught settlers how to plant and care for apple trees.

Johnny was a gentle and religious man who everyone liked. He loved nature and the animals were his best friends. Some thought he was crazy because he never carried a gun and he considered the Indians to be his brothers. He was sometimes called the "Medicine Man" because he often helped them treat their illnesses and wounds with herbs.

Many people liked to tell tall tales about Johnny and his travels. Only his death in 1845 stopped him from carrying on with his mission. Many of the orchards in northern New York, Ohio and Michigan can be traced back to Johnny Appleseed.



Fill in the Missing Parts of Speech

Word Box

treat
tell
slept
collect
planted
animals
seeds
ate
nature
wandered
wash
herbs
pot

- Johnny's mission was to plant apple _____.
(noun)
- Johnny would _____ pomace after the apples had been squeezed.
(verb)
- He would _____ the seeds out and let them dry in the sun.
(verb)
- Johnny _____ seeds all throughout the Ohio Valley.
(verb)
- He carried his cooking _____ on his head.
(noun)
- He _____ out in the open, _____ whatever was handy and _____ throughout the wilderness.
(verb) (verb) (verb)
- He loved _____ and the _____ were his friends.
(noun) (noun)
- He often helped the Indians _____ their illness and wounds with _____.
(verb) (noun)
- People like to _____ tall tales about Johnny.
(verb)

John Chapman a.k.a. Johnny Appleseed

Fill in the Missing Parts of Speech

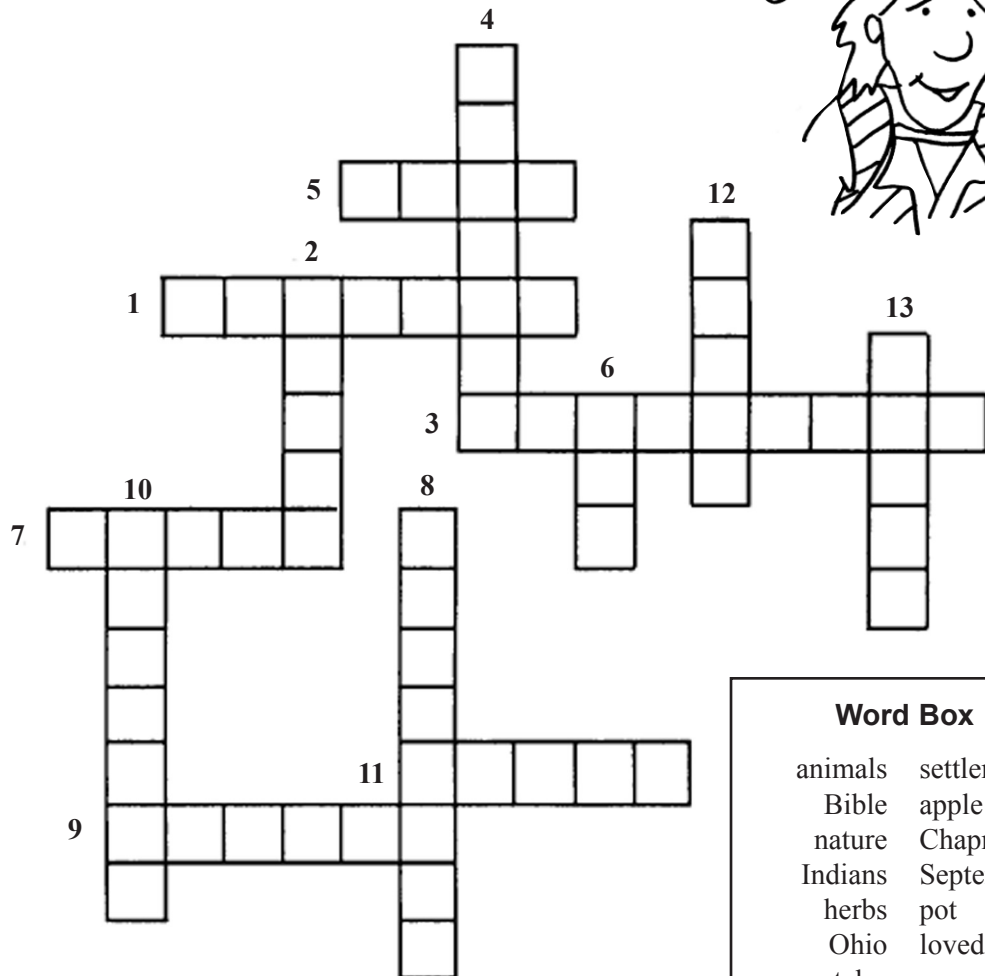


1. Johnny's mission was to plant apple **seeds**.
(noun)
2. Johnny would **collect** pomace after the apples had been squeezed.
(verb)
3. He would **wash** the seeds out and let them dry in the sun.
(verb)
4. Johnny **planted** seeds all throughout the Ohio Valley.
(verb)
5. He carried his cooking **pot** on his head.
(noun)
6. He **slept** out in the open, **ate** whatever was handy and **wandered** throughout the wilderness.
(verb) (verb) (verb)
7. He loved **nature** and the **animals** were his friends.
(noun) (noun)
8. He often helped the Indians **treat** their illness and wounds with **herbs**.
(verb) (noun)
9. People like to **tell** tall tales about Johnny.
(verb)



Name: _____

Johnny Appleseed Puzzle



Word Box

animals	settlers
Bible	apple
nature	Chapman
Indians	September
herbs	pot
Ohio	loved
tales	

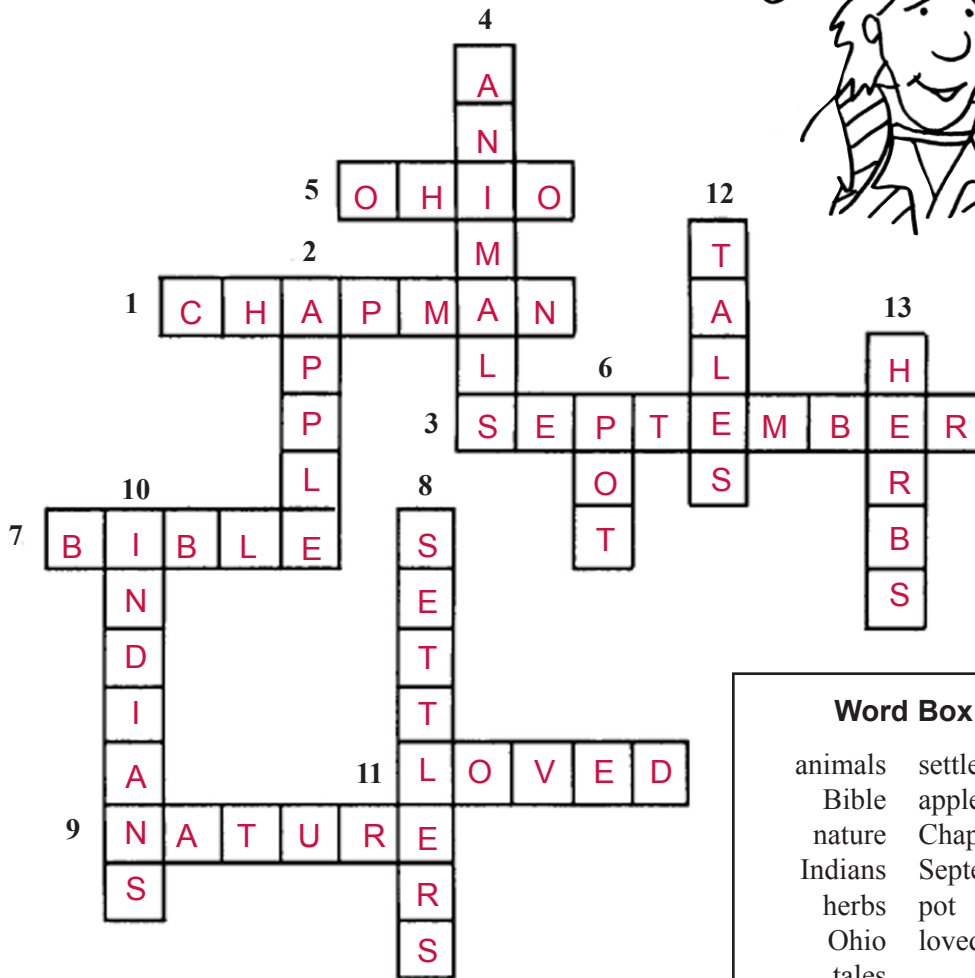
Across

- Johnny's real name was John _____.
- Johnny was born in the month of _____.
- Johnny planted seeds in the _____ valley.
- Johnny carried his favorite book, the _____.
- Johnny was happiest when he was outdoors because he loved _____.
- Johnny was a gentle man who was _____ by all.

Down

- Johnny went West to plant _____ seeds.
- Even the _____ were his friends.
- Johnny carried a _____ on his head when he wasn't using it for cooking.
- The _____ learned how to plant orchards from Johnny.
- He made friends with the _____.
- People liked to tell tall _____ about Johnny.
- Johnny knew how to cure the sick with _____.

Johnny Appleseed Puzzle



Word Box	
animals	settlers
Bible	apple
nature	Chapman
Indians	September
herbs	pot
Ohio	loved
tales	

Across

- Johnny's real name was John **CHAPMAN**.
- Johnny was born in the month of **SEPTEMBER**.
- Johnny planted seeds in the **OHIO** valley.
- Johnny carried his favorite book, the **BIBLE**.
- Johnny was happiest when he was outdoors because he loved **NATURE**.
- Johnny was a gentle man who was **LOVED** by all.

Down

- Johnny went West to plant **APPLE** seeds.
- Even the **ANIMALS** were his friends.
- Johnny carried a **POT** on his head when he wasn't using it for cooking.
- The **SETTLERS** learned how to plant orchards from Johnny.
- He made friends with the **INDIANS**.
- People liked to tell tall **TALES** about Johnny.
- Johnny knew how to cure the sick with **HERBS**.

Name: _____

Johnny Appleseed Sentence Strips

Cut apart the sentence strips and glue in order to construction paper or poster board. Illustrate each sentence to make a poster or Johnny Appleseed book.

Johnny gathered up a few belongings; a pan that he wore on his head when he wasn't using it to cook with, his favorite book, the Bible, and his bag of apple seeds and headed west.

He walked throughout the Ohio Valley planting apple seeds and showing the Indians how to grow apples.

Johnny learned as a boy how to grow apple trees and how to take care of himself.

John Chapman was born on September 26, 1774, in a small town near Boston, Massachusetts.

As Johnny traveled, he made friends with the animals and the Indians.

In March of 1845, Johnny became ill and died.

People loved to talk about the "Apple Man" and they nicknamed him "Johnny Appleseed".

Johnny Appleseed Puppets

Make a Johnny Appleseed puppet by folding a 12" x 18" sheet of paper in thirds lengthwise. Fold this in quarters with the top and bottom edges back. Let students design and decorate their puppet with crayons, yarn, and buttons, or scraps of construction paper.

Apple Lore Enhancement Ideas



Language Arts

- Have students research the story of Johnny Appleseed and write a paper or tell the story of his life.



Language Arts & Social Studies

- Read *Johnny Appleseed* by Steven Kellogg. List ways that Johnny helped others and then list ways students can help each other.
- Have students choose one thing that they will do for someone else during the apple unit. Have them implement their plan and then report on their experience.



Language Arts, Social Studies, & Art

- Have students act out the story of Johnny Appleseed at a parent meeting.
- Have students act out the story of *The Giving Tree*.



Across the Curriculum

- Plan a birthday party for Johnny Appleseed (on or near September 26). Invite parents or another class. Send student-made invitations, make apple name tags, decorate with apple art, serve apple treats, demonstrate apple experiments, display apple projects, and act out the story of Johnny Appleseed.

Apple Bites

Across Grade Levels Across Curriculum

Student Learning Objectives

Students will:

- Write poems, sentences and paragraphs about apples.
- Complete math problems using apple questions.
- Perform a science experiment testing water in apples.
- Use apple vocabulary for a spelling bee.

At a Glance

Students write poems, sentences and paragraphs about apples. They also work with math, science and do a spelling bee. Enhancement ideas are suggested for language arts, art, science and math,

Materials Needed

Student Handouts	Lower Elementary	Middle Elementary	Upper Elementary
<i>Apple Language Arts</i> handout for each student			*
<i>Apple Alphabet</i> handout for each student	*	*	
<i>Apple Poem</i> handout for each student		*	
<i>Apple Tree Worksheet</i> handout for each student	*		
<i>Apple Fractions</i> handout for each student		*	
<i>Apple Graph Sheet</i> handout for each student		*	
<i>Apple Math I</i> handout for each student		*	
<i>Apple Math II</i> handout		*	
<i>Apple Math Tasks I</i> handout for each student		*	*
<i>Apple Math Puzzle</i> handout for each student		*	
<i>Apple Secret Code</i> handout for each student			*
<i>Fill in the Missing Apple</i> handout for each student			*
<i>Apple Math Tasks II</i> handout for each student			*
<i>Water in Apples Worksheet</i> handout for each student		*	
<i>Just for Fun Word Search</i> handout for each student		*	
<i>Apple Products Word Search</i> handout for each student		*	
<i>Apple Phrases</i> handout for each student			*
<i>Apple Products Coloring Page</i> handout for each student	*		

Teacher Directions and Keys

Apple Spelling Bee teacher reference

Apple Tree Worksheet teacher key

Apple Math Games teacher directions

Apple Fractions teacher key

Apple Math teacher directions

Apple Math I teacher key

Apple Math II teacher key

Apple Math Tasks I teacher key

Apple Secret Code teacher key

Fill in the Missing Apples teacher key

Apple Math Tasks II teacher key

Apple Science Experiments teacher directions

Water in Apples Graph teacher directions

Apple Art teacher directions

Just for Fun Word Search teacher key

Apple Products Word Search teacher key

Apple Phrases teacher key

Apple Bites Enhancement Ideas teacher directions

Supplies

Felt, flannel board, basket, posterboard for apple math games

String and knives for apple fractions activity

Scale, apple varieties, paper strip and ruler for apple math activities

Large bowl, carrot, apples, scales, gram weights, knife, plastic containers for apple science experiments

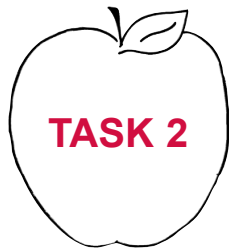
Colored tissue paper, construction paper, markers, yarn, salt, dry powdered tempera paints, margarine cups, paintbrushes, liquid glue, paper plates, butcher paper, fingerpaint, apples, knives, lemon juice for art activities

Apple Language Arts



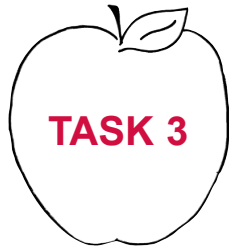
Write a 6-line rhyming poem using the first line . . .

Michigan apples are _____



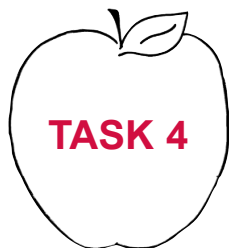
Put these apple names in alphabetical order:

Delicious	Jonathan	McIntosh
Empire	Rome	Jonagold
Paula Red	Ida Red	Golden Delicious
Gala	Spy	Fuji



Use these sentence patterns to write sentences about apples:

1. N V.
2. N V N.
3. N V Adj N.
4. Adj N V Adj N.
5. Adj N V Adj Prep Phrase.



Describe a Michigan apple for a commercial:

Apple Language Arts continued



Find 15 words using letters from APPLE ORCHARD:

- | | |
|----------|-----------|
| 1. _____ | 9. _____ |
| 2. _____ | 10. _____ |
| 3. _____ | 11. _____ |
| 4. _____ | 12. _____ |
| 5. _____ | 13. _____ |
| 6. _____ | 14. _____ |
| 7. _____ | 15. _____ |
| 8. _____ | |

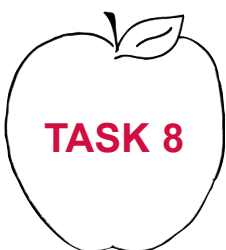


Use the dictionary or your apple vocabulary list. Look up these words. Write the pronunciations and the definitions.

- | | |
|---------------|----------------|
| 1. processing | 7. nectar |
| 2. bud | 8. pollination |
| 3. grafting | 9. scion |
| 4. cycle | 10. rootstock |
| 5. pollen | 11. variety |
| 6. dormant | 12. pruning |



You own a large orchard. The apples are ready to pick. Write an ad for apple pickers. Give complete information.



Make up a questionnaire with five apple-related questions. Give it to at least five people and share the results with the rest of the class. You may also graph the results.

Name: _____

Apple Alphabet

- A** is for American apples, oh what a treat!
- B** is for the bees that pollinate the trees.
- C** is for cider that fills our cups.
- D** is for dwarf, a smaller apple tree.
- E** is for each apple eaten each day of the year.
- F** is for the fruit farmers who work so hard.
- G** is for Goldens—apples that are not red.
- H** is for healthy—for that’s what apples are.
- I** is for insects—some help and some don’t.
- J** is for Johnny Appleseed spreading his seeds.
- K** is for keeping apples—tossing candy and sweets.
- L** is for ladders so pickers can reach high.
- M** is for Michigan where apples are best.
- N** is for nutritious—that means good for you.
- O** is for orchard, planted in rows.
- P** is for picking then packing carefully.
- Q** is for quality—that’s what people want.
- R** is for recipes, pies, cakes and more.
- S** is for the sun and soil which helps them grow.

Apple Alphabet continued

T is for the tree which provides so much for all.

U is for uses—how many we don't know.

V is for varieties—there are approximately 20 different apple varieties in Michigan.

W is for weather on which it all depends.

X is for extra care the pickers must use.

Y is for yummy in any way you choose.

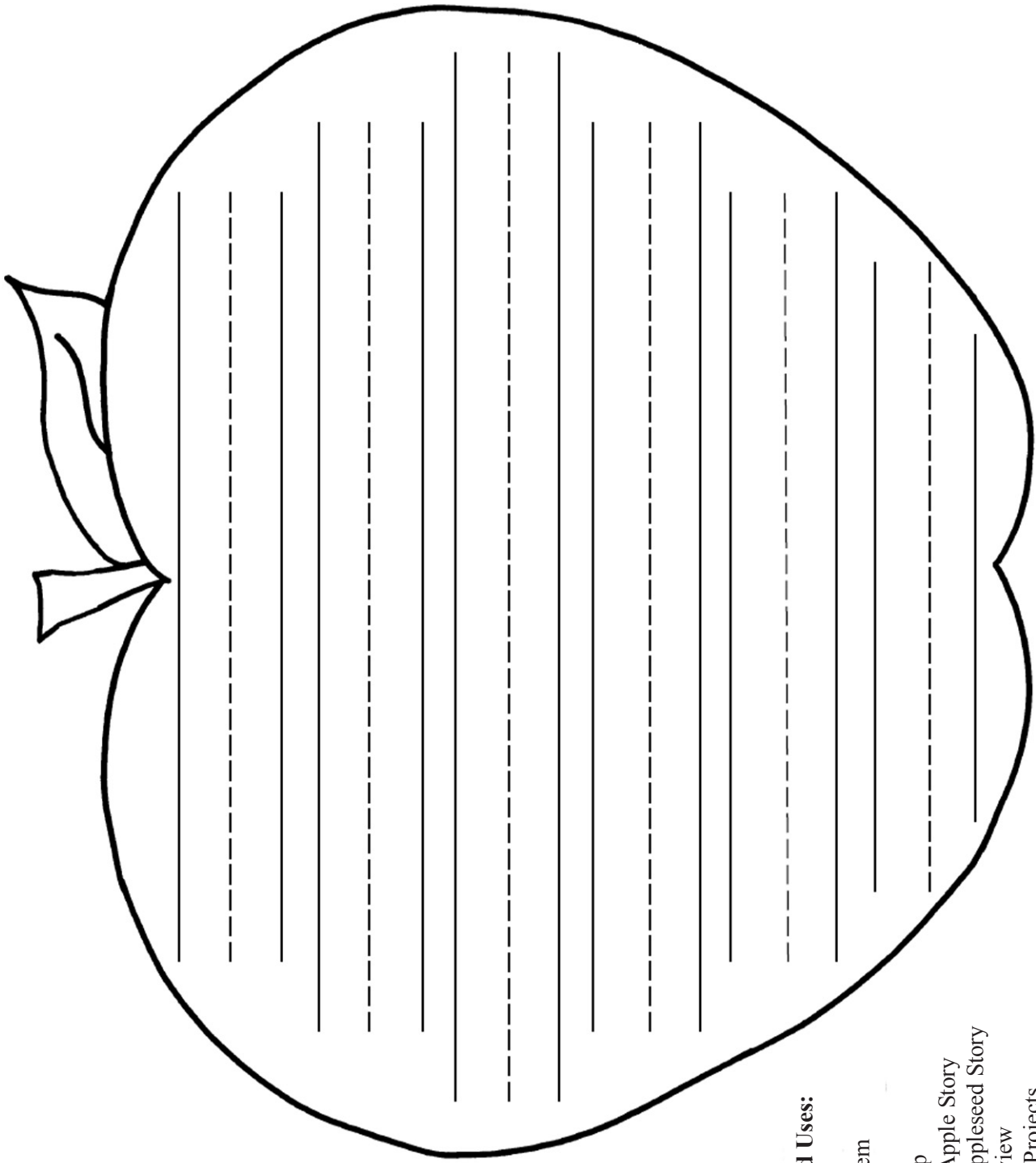
Z is for zebras—who probably eat them, too!

Suggested Activities

- Choose a letter and memorize the saying. Use for a play skit, a Johnny Appleseed party, or an applefest celebration.
- Make a large apple tree out of tagboard. Cut a hole in the apple for the students' heads to fit in. Have students take turns reciting apple letter sayings. Take pictures of students peeking through the apple tree.
- Write each letter and a saying on an apple cut-out and laminate. Give each student an apple cut-out and ask them line up, ordering themselves from A to Z. Then ask them to read the words on their apple cut-outs.



Name: _____



Suggested Uses:

- Apple Poem
- Apple Ad
- Apple Rap
- Favorite Apple Story
- Johnny Applesseed Story
- Book Review
- Research Projects
- Apple Recipe

Apple Spelling Bee

Suggestions for use: Spelling list, spelling bee, reading words, vocabulary words, dictionary exercise, classify into parts of speech, alphabetize, etc.

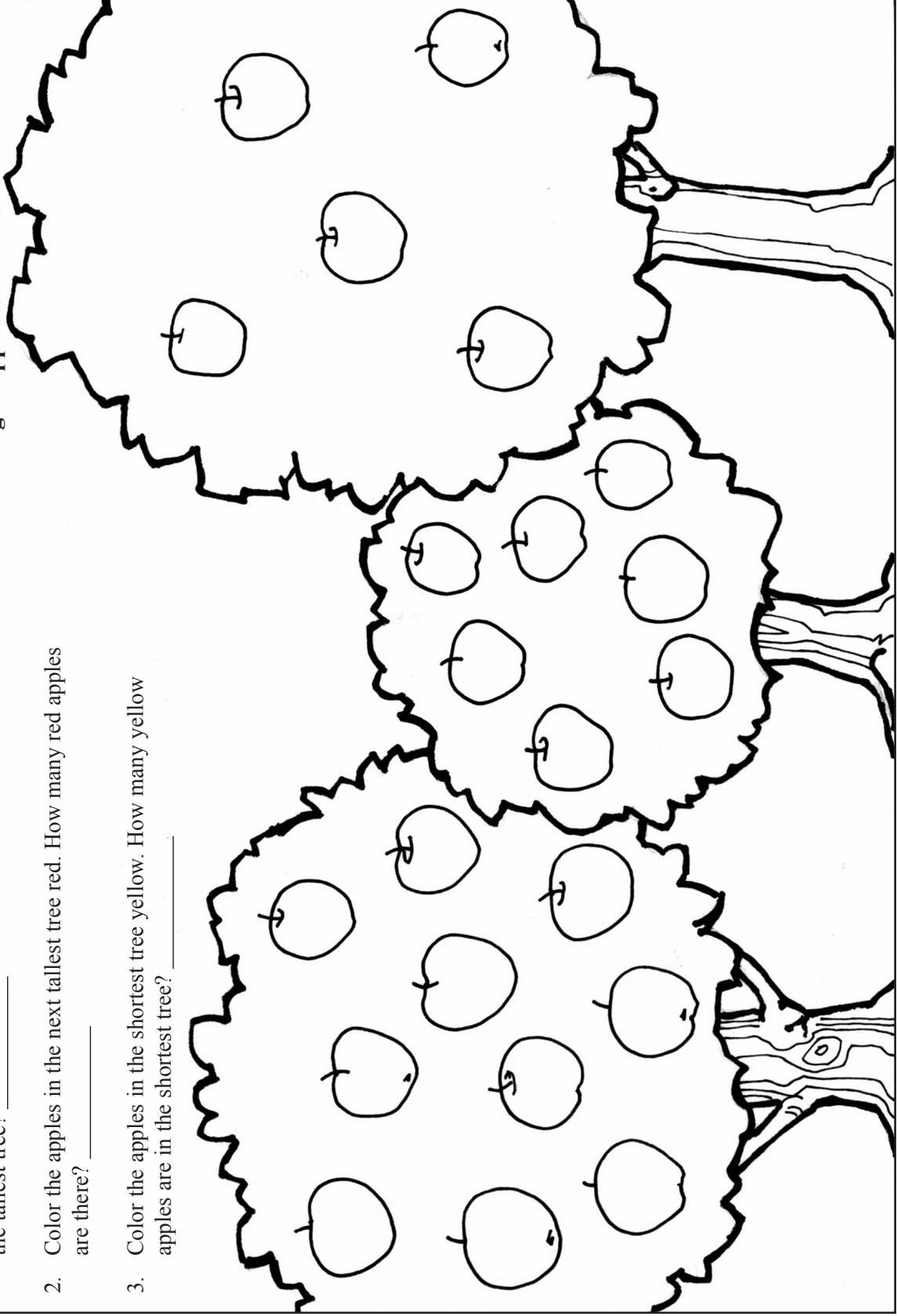
adapt	grow	prune
apple	hard	recipe
applesauce	harvest	red
bake	healthy	ripe
bee	Ida Red	root
bloom	insect	round
blossom	irrigation	science
branch	Jonagold	scion
bright	Jonathan	season
bruise	juice	seeds
bud	juicy	sepal
bushel	leaf	shiny
carbohydrate	market	size
carbon dioxide	McIntosh	skin
cider	migrant	snack
climate	nursery	sort
cluster	nutrition	spray
core	orchard	stamen
crisp	oxygen	stem
crispy	Paula Red	stigma
crunchy	peck	storage
cycle	pectin	sun
delicious	petal	sweet
dormant	pie	tart
Empire	pigment	taste
fertilization	pistil	tree
firm	plant	variety
flavor	pollen	vinegar
flesh	pollination	vitamin
fruit	pomology	water
Gala	potassium	yellow
golden	preserve	
graft	process	
green	production	

Name: _____

Apple Tree Worksheet

1. Color the apples in the tallest tree green. How many apples are in the tallest tree? _____
2. Color the apples in the next tallest tree red. How many red apples are there? _____
3. Color the apples in the shortest tree yellow. How many yellow apples are in the shortest tree? _____

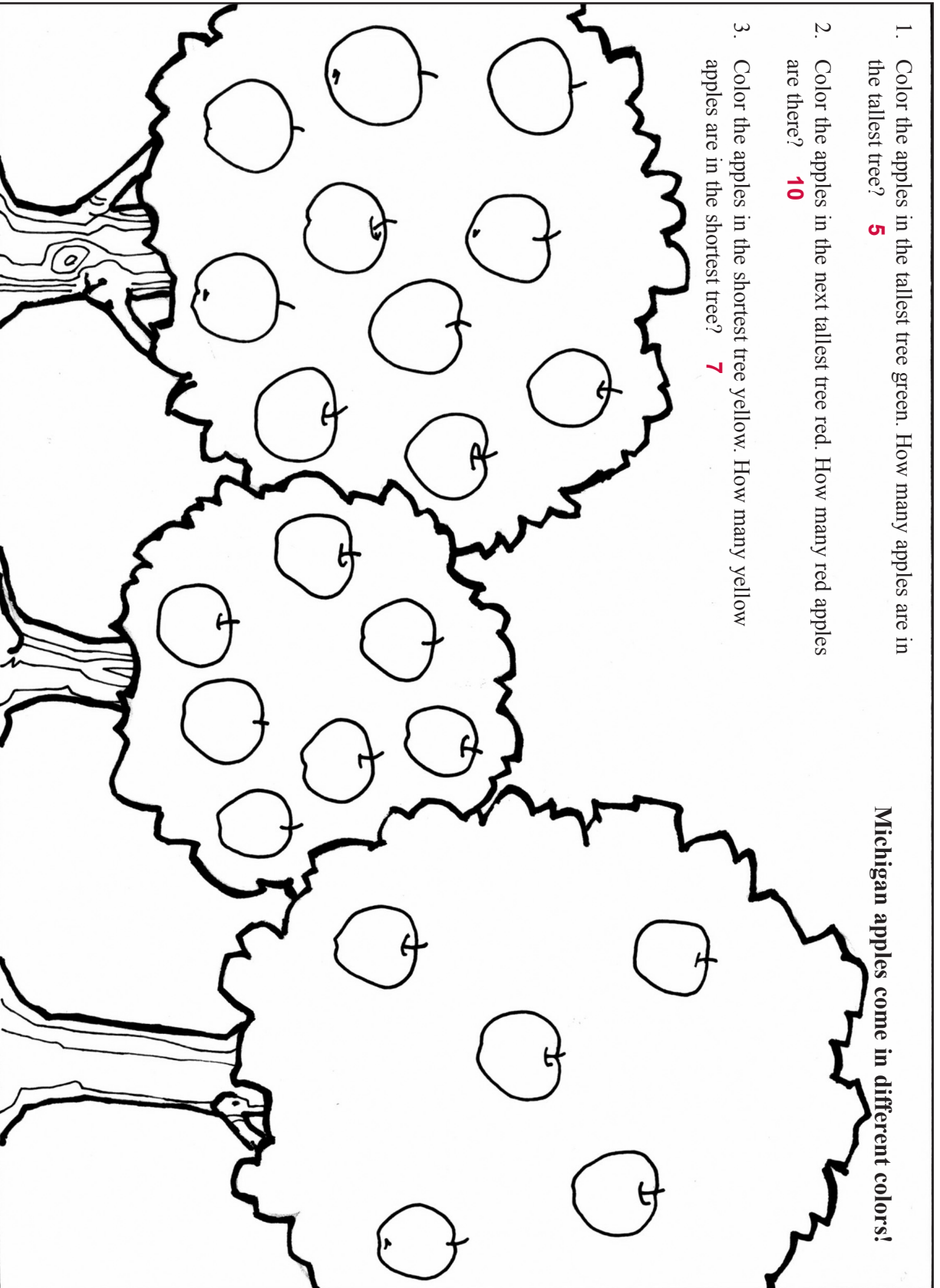
Michigan apples come in different colors!



Apple Tree Worksheet

1. Color the apples in the tallest tree green. How many apples are in the tallest tree? **5**
2. Color the apples in the next tallest tree red. How many red apples are there? **10**
3. Color the apples in the shortest tree yellow. How many yellow apples are in the shortest tree? **7**

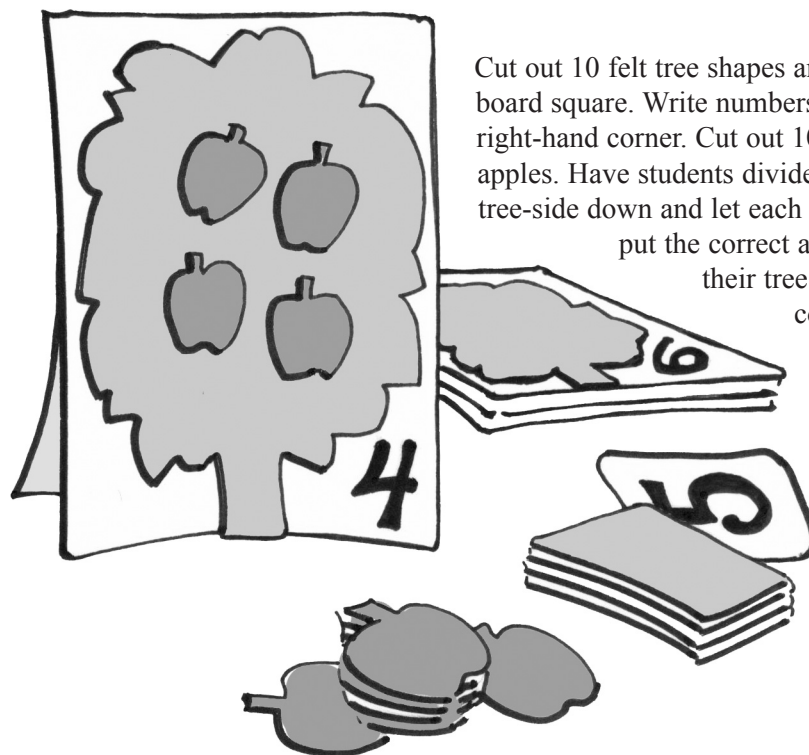
Michigan apples come in different colors!



Apple Math Games



Cut out a felt apple tree and 10-20 red or yellow felt apples. Put a number on each apple large enough for the class to see. Place the tree on a flannel board easel. Let each student draw an apple from a basket. Ask them to identify the number and hang the apple on the tree. Review the numbers with the class when all the apples are on the tree.



Cut out 10 felt tree shapes and glue to a poster board square. Write numbers from 1 to 10 in lower right-hand corner. Cut out 10 red or yellow felt apples. Have students divide into teams. Turn cards tree-side down and let each player draw a card and put the correct amount of apples on their tree. One point for each correct answer.

Name: _____

Apple Fractions

Measure around the apple with a string.

How big is your apple's **circumference** (distance around the outside)? _____

Cut your apple in **half**.

How many parts do you have? _____

Each part is called **one-half**.

Write one-half in a fraction. _____

Cut each half in two parts.

How many pieces do you have? _____

Each piece is called **one-fourth**.

Write one-fourth in a fraction. _____

Cut each piece into two parts again.

How many pieces are there all together?

Each piece is called one-eighth or _____

Eat a piece of your apple. Write why you like to eat apples.

Apple Fractions

Measure around the apple with a string.

How big is your apple's **circumference** (distance around the outside)? _____

Cut your apple in **half**.

How many parts do you have? **2**

Each part is called **one-half**.

Write one-half in a fraction. **$\frac{1}{2}$**

Cut each half in two parts.

How many pieces do you have? **4**

Each piece is called **one-fourth**.

Write one-fourth in a fraction. **$\frac{1}{4}$**

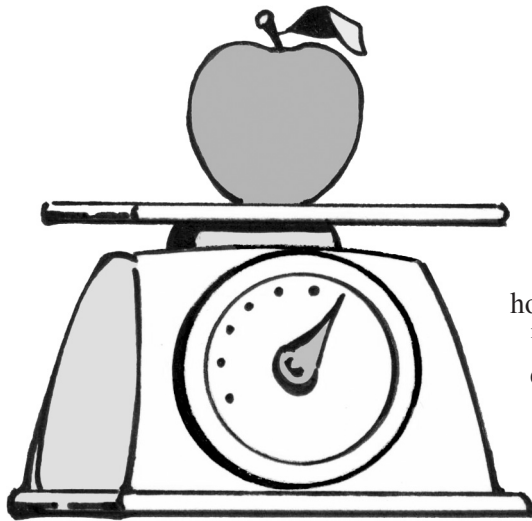
Cut each piece into two parts again.

How many pieces are there all together? **8**

Each piece is called one-eighth or **$\frac{1}{8}$**

Eat a piece of your apple. Write why you like to eat apples.

Apple Math



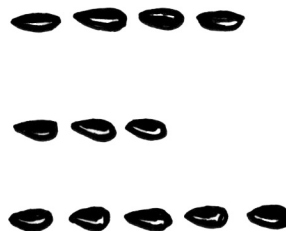
Apple Comparisons

Using a scale, have students estimate how many apples are in a $\frac{1}{2}$ peck, a peck, a $\frac{1}{2}$ bushel and a 3 lb. bag. Have students estimate the weight of each container. Compare the cost of apples by the pound for each size.

An apple weighing 3 lbs., 1 oz. was reported by F. Foveridge of Ross-on-Wye, England, in 1965 to the *Guinness Book of World Records*.

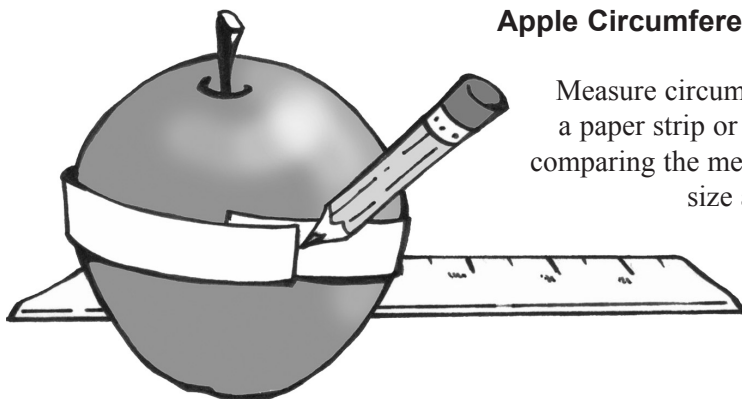
Count The Apple Seeds

Bring in several different apple varieties and have students guess the number of seeds. Use seeds for math games or graphing by variety and size of apples and the number of seeds found in each.



Mr. & Mrs. Harold Spittler of Arcanum, Ohio, grew two Stark Jumbo apples in 1985 that measured 17 $\frac{1}{2}$ inches in circumference according to the *Guinness Book of World Records*.







Apple Circumference



Measure circumference of apples by placing a paper strip or a string around an apple and comparing the measurement to a ruler. What size apples are packed in bags and what size are sold bulk?

Name: _____



Apple Graph Sheet

Name: _____

Apple Math I

1. 6  2  4  How many apples altogether? _____



2. 10  on a tree. 4  fell off. How many apples are left on the tree? _____

3. 15  . Bobby ate 4  . How many are left? _____



4. Which apple is cut in half?   

5. Which apple is cut in fourths?   

6. 3  3  on each  How many apples altogether? _____









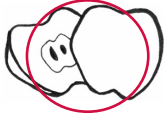














7. 7  . 6 more  . How many apples altogether? _____

8. Which apple is cut in thirds?   

9. 8  . Mother used 5  for a pie. How many apples are left? _____

10. Mr. Rasch had 50 apple trees in his orchard. There were 5 equal rows in the orchard. How many apple trees in each row? _____

Apple Math I

1. 6  2  4  How many apples altogether? **12**
2. 10  on a tree. 4  fell off. How many apples are left on the tree? **6**
3. 15  . Bobby ate 4  . How many are left? **11**
4. Which apple is cut in half?   
5. Which apple is cut in fourths?   
6. 3  . 3  on each  . How many apples altogether? **9**
7. 7  . 6 more  . How many apples altogether? **13**
8. Which apple is cut in thirds?   
9. 8  . Mother used 5  for a pie. How many apples are left? **3**
10. Mr. Rasch had 50 apple trees in his orchard. There were 5 equal rows in the orchard. How many apple trees in each row? **10**

Apple Math II

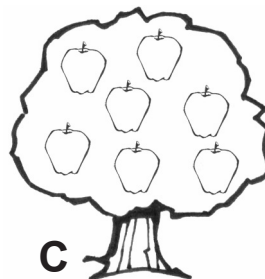
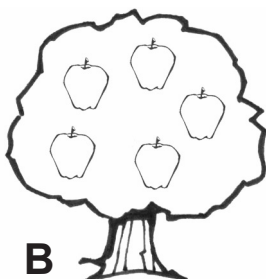
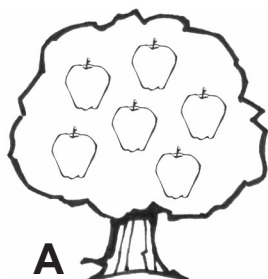
Color the apple that has the greater number:



Compare the apple numbers with less than (<) or more than (>):



Complete these number patterns:



7. Which tree has the most apples? _____
8. Which tree has the fewest apples? _____
9. Pick all the apples on trees A and B. How many do you have? _____
10. Pick all the apples on trees A and C. How many do you have? _____
11. You have 12 apples. Which two trees did you pick? _____
12. How many apples on trees A, B, and C? _____
13. Three apples fell off tree C. How many are left? _____
14. Four apples have been eaten off of tree B. How many are left? _____

Apple Math II

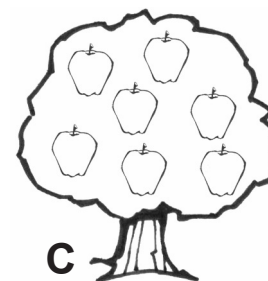
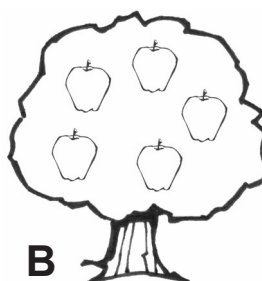
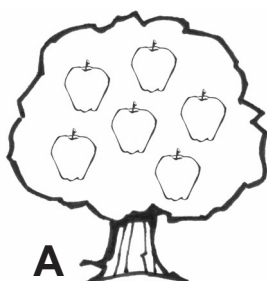
Color the apple that has the greater number:



Compare the apple numbers with less than (<) or more than (>):



Complete these number patterns:

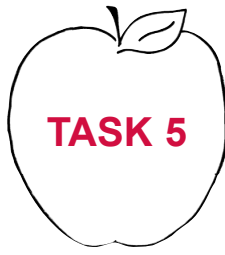


- Which tree has the most apples? **C**
- Which tree has the fewest apples? **B**
- Pick all the apples on trees A and B. How many do you have? **11**
- Pick all the apples on trees A and C. How many do you have? **13**
- You have 12 apples. Which two trees did you pick? **B and C**
- How many apples on trees A, B, and C? **18**
- Three apples fell off tree C. How many are left? **4**
- Four apples have been eaten off of tree B. How many are left? **1**

Apple Math Tasks I



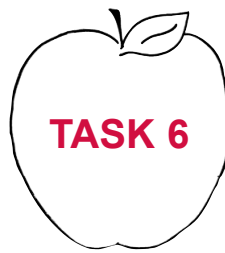
75 boxes of apples were loaded on a truck in Sparta, Michigan. 85 more boxes were loaded on in Belding, Michigan. How many boxes of apples were sent to market?



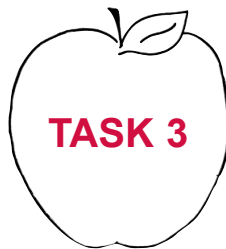
Debbie picked apples from 8:00 a.m. until 5:00 p.m. She took an hour off for lunch. How many hours did Debbie work?



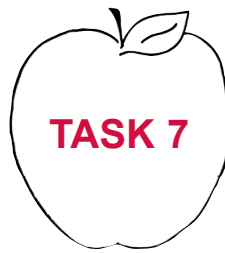
The smaller and bruised apples were pressed into 16 gallons of cider. How many quarts would that be?



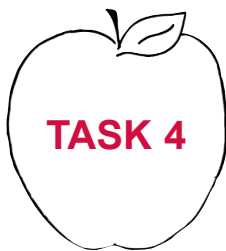
If apples are selling for \$7.98 a bushel, how much would 3 bushels cost?



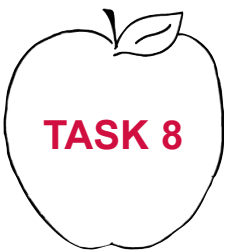
George Adrian of Indianapolis, Indiana, picked 366 bushels of apples in 8 hours on September 23, 1980. How many bushels of apples did George pick per hour?



There were 55 rows of apple trees in John's orchard. Steve's orchard had 63 rows of trees. The orchard down the road had 87 rows. How many rows of trees did they have altogether?

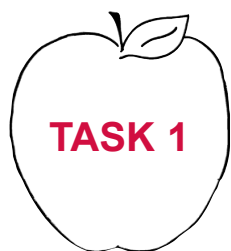


David and Cindy picked apples on Saturday. David had 385 apples in his bin. Cindy had 263. How many more did David pick than Cindy?



Carrie bought a peck of apples for \$2.20. She gave the clerk \$5.00. How much change did she get back?

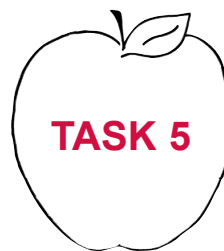
Apple Math Tasks I



TASK 1

75 boxes of apples were loaded on a truck in Sparta, Michigan. 85 more boxes were loaded on in Belding, Michigan. How many boxes of apples were sent to market?

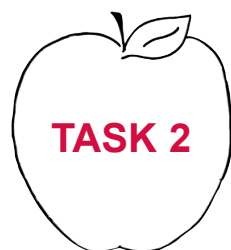
160 boxes



TASK 5

Debbie picked apples from 8:00 a.m. until 5:00 p.m. She took an hour off for lunch. How many hours did Debbie work?

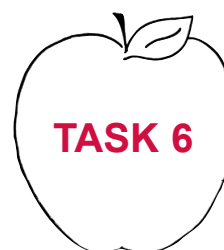
8 hours



TASK 2

The smaller and bruised apples were pressed into 16 gallons of cider. How many quarts would that be?

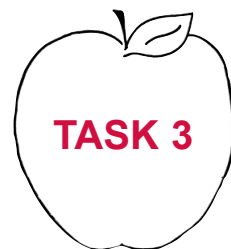
64 quarts



TASK 6

If apples are selling for \$7.98 a bushel, how much would 3 bushels cost?

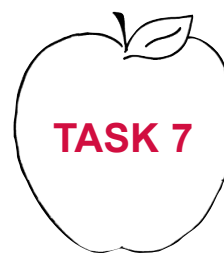
\$23.94



TASK 3

George Adrian of Indianapolis, Indiana, picked 366 bushels of apples in 8 hours on September 23, 1980. How many bushels of apples did George pick per hour?

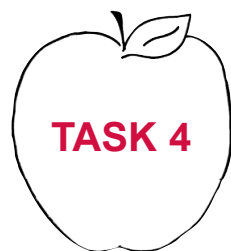
45.75 or $45 \frac{3}{4}$ bushels per hour



TASK 7

There were 55 rows of apple trees in John's orchard. Steve's orchard had 63 rows of trees. The orchard down the road had 87 rows. How many rows of trees did they have all together?

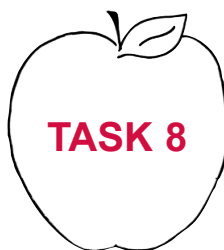
205 rows



TASK 4

David and Cindy picked apples on Saturday. David had 385 apples in his bin. Cindy had 263. How many more did David pick than Cindy?

122 apples



TASK 8

Carrie bought a peck of apples for \$2.25. She gave the clerk \$5.00. How much change did she get back?

\$2.75

Name: _____

Apple Math Puzzle

Color these spaces as follows:


- 10 = red 2 = green 3 = blue 4 = yellow 5 = brown
6 = purple 7 = black 8 = orange 9 = pink


The puzzle consists of an apple shape divided into numerous sections. Each section contains a math problem. The problems are as follows:


- 3 + 2 + 1 =
- 5 + 2 =
- 6 - 3 =
- 12 - 3 =
- 1 + 1 =
- 2 - 0 =
- 4 + 3 =
- 9 - 3 =
- 10 / 50
- 2 / 20
- 2 / 10
- 3 + 1 =
- 3 + 3 =
- 30 - 20 =
- 3 + 1 =
- 16 - 6 =
- 5 + 5 =
- 7 + 3 =
- 9 + 1 =
- 10 x 1 =
- 10 - 6 =
- 4 + 0 =
- 4 + 2 + 1 + 3 =
- 20 - 10 =
- 1 + 1 + 8 =
- 4 / 40
- 2 x 2 =
- 4 + 2 =
- 3 / 30
- 6 + 4 =
- 2 / 20
- 2 + 4 =
- 23 - 13 =
- 3 + 0 =
- 9 - 3 =
- 5 + 1 + 4 =
- 5 + 2 + 3 =
- 4 + 2 =
- 4 + 3 =
- 10 - 2 =
- 14 - 4 =
- 1 / 10
- 6 + 2 =
- 9 - 2 =
- 5 + 4 =

Name: _____


Apple Secret Code


1. $134 + 126 =$ 


7. $678 \div 6 =$ 


13. $216 - 3 =$ 

2. $516 - 207 =$ 


8. $129 - 6 =$ 


14. $467 - 4 =$ 


3. $196 + 328 =$ 


9. $520 \div 5 =$ 


15. $2214 - 2016 =$ 


4. $615 - 236 =$ 


10. $648 \div 4 =$ 

16. $616 + 289 =$ 

5. $265 \times 8 =$ 

11. $326 - 9 =$ 

6. $219 - 68 =$ 


12. $431 - 3 =$ 


$$\begin{array}{r} \overline{524} \overline{1293} \quad \overline{524} \overline{260} \overline{260} \overline{309} \overline{905} \quad \overline{524} \quad \overline{113} \overline{524} \overline{2934} \end{array}$$


$$\begin{array}{r} \overline{162} \overline{905} \overline{905} \overline{260} \overline{1868} \quad \overline{774} \overline{2120} \overline{905} \quad \overline{113} \overline{72} \overline{198} \overline{774} \overline{72} \overline{151} \end{array}$$

$$\begin{array}{r} \overline{524} \overline{104} \overline{524} \overline{2934} \overline{379} \end{array}$$


Apple Secret Code


1. $134 + 126 =$ 


7. $678 \div 6 =$ 


13. $216 - 3 =$ 

2. $516 - 207 =$ 


8. $129 - 6 =$ 


14. $467 - 4 =$ 


3. $196 + 328 =$ 


9. $520 \div 5 =$ 


15. $2214 - 2016 =$ 


4. $615 - 236 =$ 


10. $648 \div 4 =$ 

16. $616 + 289 =$ 

5. $265 \times 8 =$ 

11. $326 - 9 =$ 

6. $219 - 68 =$ 

12. $431 - 3 =$ 


A N A P P L E A D A Y
 524 1293 524 260 260 309 905 524 113 524 2934


K E E P S T H E D O C T O R
 162 905 905 260 1868 774 2120 905 113 72 198 774 72 151


A W A Y !
 524 104 524 2934 379


Name: _____


Fill in the Missing


1. What is the largest number you can write using the digits 2 and 8? 

2. What is the smallest number you can write using digits 6 and 3? 


3. $185 + 537 =$ 


4. $944 - 236 =$ 


5. $435 - 187 =$ 


6. $123 - 119 =$ 


7. $126 -$  $= 118$

8.  $+ 16 = 155$

9.  $- 11 = 263$


10. $166 +$  $= 517$


11. $3636 \div 9 =$ 

12. $812 \div 7 =$ 


13.  $- 8 = 128$

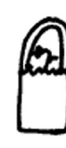
14. $6 \times$  $= 1134$

15. What is the largest number you can write using digits 7, 2 and 9 once? 

16. What is the smallest number you can write using digits 8, 6 and 1 once? 

17.  $\frac{1}{2}$ bushel
\$4.95

 1 peck
\$2.75

 $\frac{1}{2}$ peck
\$1.50

$\frac{1}{2}$ bushel = two pecks $\frac{1}{2}$ bushel = four $\frac{1}{2}$ pecks

- a. How much would four $\frac{1}{2}$ peck bags cost? _____
- b. How much would two peck bags cost? _____
- c. Which container is the most expensive per apple? _____
- d. Which container is the better buy? _____
- e. Estimate the cost of one bushel of apples. _____

Fill in the Missing

1. What is the largest number you can write using the digits 2 and 8?



2. What is the smallest number you can write using digits 6 and 3?



3. $185 + 537 =$

4. $944 - 236 =$

5. $435 - 187 =$

6. $123 - 119 =$

7. $126 -$ $= 118$

8. $+ 16 = 155$

9. $- 11 = 263$

10. $166 +$ $= 517$

11. $3636 \div 9 =$

12. $812 \div 7 =$

13. $- 8 = 128$

14. $6 \times$ $= 1134$

15. What is the largest number you can write using digits 7, 2, and 9 once?




16. What is the smallest number you can write using digits 8, 6, and 1 once?



17.  $\frac{1}{2}$ bushel
\$4.95

 1 peck
\$2.75

 $\frac{1}{2}$ peck
\$1.50

$\frac{1}{2}$ bushel = two pecks $\frac{1}{2}$ bushel = four $\frac{1}{2}$ pecks

a. How much would four $\frac{1}{2}$ peck bags cost? **\$6.00**

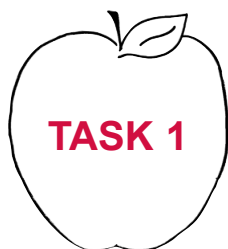
b. How much would two peck bags cost? **\$5.50**

c. Which container is the most expensive per apple? **$\frac{1}{2}$ peck**

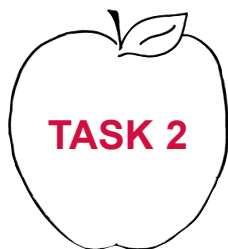
d. Which container is the better buy? **$\frac{1}{2}$ bushel**

e. Estimate the cost of one bushel of apples. **\$10.00**

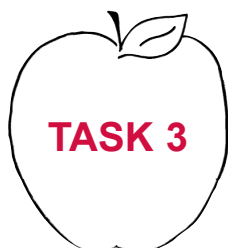
Apple Math Tasks II



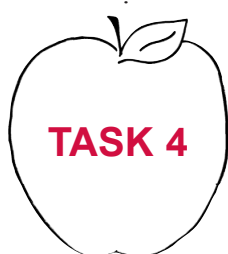
Joan wants to buy 1 bushel of apples. They cost \$8.00 a bushel, \$5.00 a $\frac{1}{2}$ bushel, and \$2.75 a peck. How many different ways could Joan buy 1 bushel of apples? What would be the cost of each?



The world's biggest apple pie weighed 30,116 pounds and took 600 bushels of apples to make. If it was cut in 8-ounce pieces, how many people would it take to eat the world's biggest pie? (*Guinness Book of World Records*)



For Christmas presents this year, Mr. Jones wants to give each of his 24 students 7 apples, one of each variety listed for sale. If each 5-pound bag has approximately 16 apples and each 3-pound bag has approximately 10 apples, which bags and how many should Mr. Jones buy for his presents? How much will it cost?



<i>Michigan Apple Prices</i>	<i>5-pound bag</i>	<i>3-pound bag</i>
Red Delicious	\$2.39	\$1.59
Golden Delicious	\$2.59	\$1.83
McIntosh	\$2.68	\$1.95
Jonathan	\$2.45	\$1.69
Ida Red	\$2.49	\$1.79
Empire	\$2.78	\$2.09
Gala	\$3.29	\$2.59

What is the average cost of a 5-pound bag? _____

What is the average cost of a 3-pound bag? _____

How much per pound do each of the varieties cost in a 5-pound bag? _____

How much per pound do each of the varieties cost in a 3-pound bag? _____

Apple Math Tasks II continued



Which apple varieties have you tasted? Which would you like to? Which are your favorites and why?



John's orchard has 55 rows with 48 trees in each row. Steve's orchard has 63 rows with 42 trees in each row. Estimate which orchard has more trees. _____

Now figure the actual difference. _____



Apple cider is often sold in 30- or 50-gallon drums to large stores where customers pour their own.

How many quarts in a full 30-gallon drum? _____

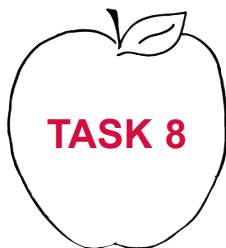
How many quarts in a full 50-gallon drum? _____

How many pints in a 30-gallon drum? _____

How many pints in a 50-gallon drum? _____

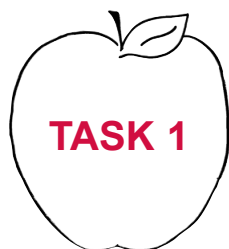
How many cups in a 30-gallon drum? _____

How many cups in a 50-gallon drum? _____



Each bulk box holds 18 bushels of apples. Each picking bag holds $\frac{1}{2}$ bushel. How many times must an apple picker empty their full picking bag?

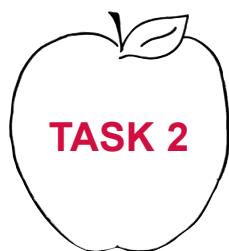
Apple Math Tasks II



Joan wants to buy 1 bushel of apples. They cost \$8.00 a bushel, \$5.00 a $\frac{1}{2}$ bushel, and \$2.75 a peck. How many different ways could Joan buy 1 bushel of apples? What would be the cost of each?

TASK 1

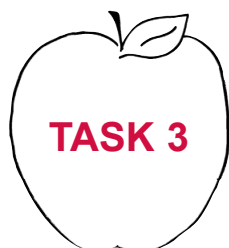
**1 bushel = \$8.00; 2 $\frac{1}{2}$ bushels = \$10.00;
4 pecks = \$11.00; or $\frac{1}{2}$ bushel and 2 pecks = \$10.50**



The world's biggest apple pie weighed 30,116 pounds and took 600 bushels of apples to make. If it was cut in 8-ounce pieces, how many people would it take to eat the world's biggest pie? (*Guinness Book of World Records*)

TASK 2

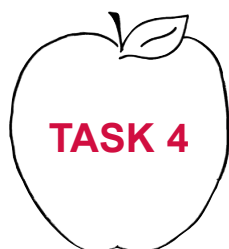
60,232 people



For Christmas presents this year, Mr. Jones wants to give each of his 24 students 7 apples, one of each variety listed for sale. If each 5-pound bag has approximately 16 apples and each 3-pound bag has approximately 10 apples, which bags and how many should Mr. Jones buy for his presents? How much will it cost?

TASK 3

He should buy one 5-pound bag and one 3-pound bag of each variety. It will cost \$32.20.



<i>Michigan Apple Prices</i>	<i>5-pound bag</i>		<i>3-pound bag</i>	
Red Delicious	\$2.39	.47	\$1.59	.53
Golden Delicious.	\$2.59	.51	\$1.83	.61
McIntosh	\$2.68	.53	\$1.95	.65
Jonathan	\$2.45	.49	\$1.69	.56
Ida Red	\$2.49	.33	\$1.79	.59
Empire	\$2.78	.55	\$2.09	.69
Gala	\$3.29	.65	\$2.59	.86

What is the average cost of a 5-pound bag? **\$2.66**

What is the average cost of a a 3-pound bag? **\$1.93**

How much per pound do each of the varieties cost in a 5-pound bag? **see chart above**

How much per pound do each of the varieties cost in a 3-pound bag? **see chart above**

Apple Math Tasks II continued



Which apple varieties have you tasted? Which would you like to?
Which are your favorites and why?



John's orchard has 55 rows with 48 trees in each row. Steve's orchard has 63 rows with 42 trees in each row. Estimate which orchard has more trees. **John's = 2640, Steve's = 2646**

Now figure the actual difference. **6 trees**



Apple cider is often sold in 30- or 50-gallon drums to large stores where customers pour their own.

How many quarts in a full 30-gallon drum? **120 quarts**

How many quarts in a full 50-gallon drum? **200 quarts**

How many pints in a 30-gallon drum? **480 pints**

How many pints in a 50-gallon drum? **800 pints**

How many cups in a 30-gallon drum? **960 cups**

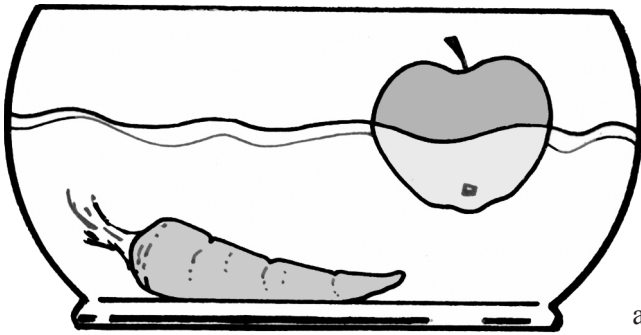
How many cups in a 50-gallon drum? **1600 cups**



Each bulk box holds 18 bushels of apples. Each picking bag holds $\frac{1}{2}$ bushel. How many times must an apple picker empty his full picking bag?

36 times

Apple Science Experiments



Apple Cell Density

Materials: large bowl (filled with water)
a carrot and an apple

Ask students to guess what the carrot and apple will do when placed in the bowl of water. Put the carrot and the apple in the bowl one at a time. Have students try to explain why the carrot sinks and the apple does not. Experiment with

other fruits and vegetables for added fun. Explain to the students that foods like carrots and apples vary greatly in the amount of air they contain. Carrot cells are packed very tightly and are very heavy, making the carrot sink. The apple cells contain more air spaces, which causes it to float. Slice the carrot and apple to observe.

Water in Apples Experiment

Materials: 3 uniform-size apples
balance scales
gram weights
knife
plastic containers for apples
(Water In Apples worksheet and graph)

Monday: Weigh whole apple **A** and record weight.
Peel apple **B** and record weight.
Chop apple **C** and record weight.
Place apples on a windowsill.

Tuesday - Friday: Weigh and record weight loss for each day.
Graph each apple's daily weight.

Friday: Total weight loss for each apple.
Average each apple's daily moisture loss and discuss.
Why didn't apple **A** lose any moisture? **The skin protects the fruit and prevents moisture from escaping.**
Why did apple **C** lose more moisture than apple **A** or **B**? **The more flesh exposed, the greater the amount of moisture loss.**

Name: _____

Water in Apples Worksheet




Record weight of each apple:

Whole apple **A** _____

Peeled apple **B** _____

Chopped Apple **C** _____

Record losses in daily weight:

	Monday - Tuesday	Tuesday - Wednesday	Wednesday - Thursday	Thursday - Friday	TOTAL
					
					
					

What is the average amount of moisture that apple **A** lost daily?

total _____ 4 = _____ (average)

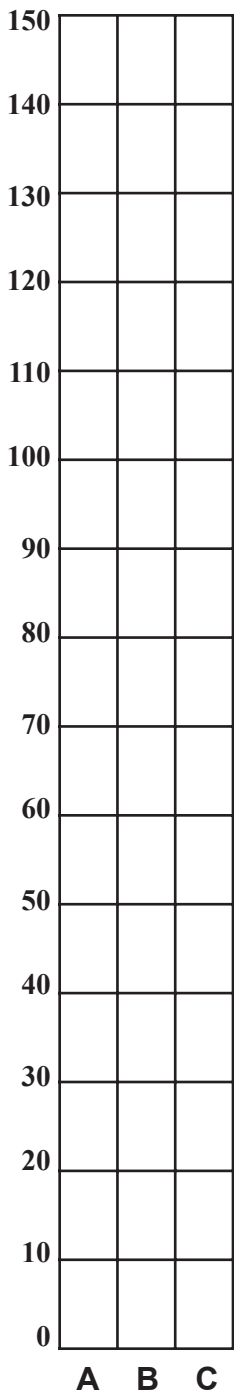
What is the average amount of moisture that apple **B** lost daily?

total _____ 4 = _____ (average)

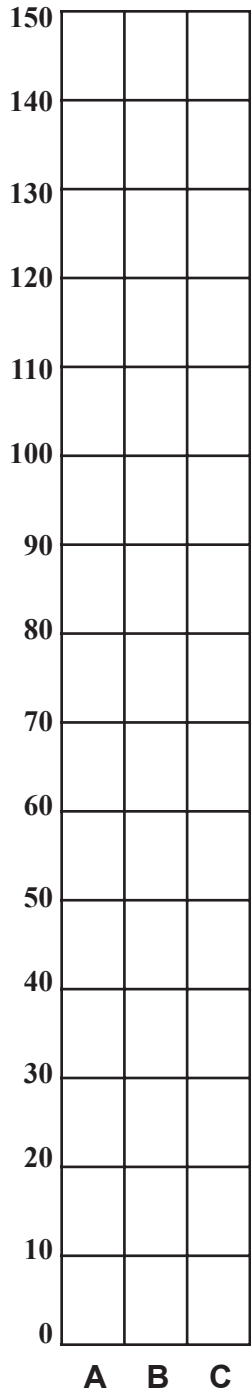
What is the average amount of moisture that apple **C** lost daily?

total _____ 4 = _____ (average)

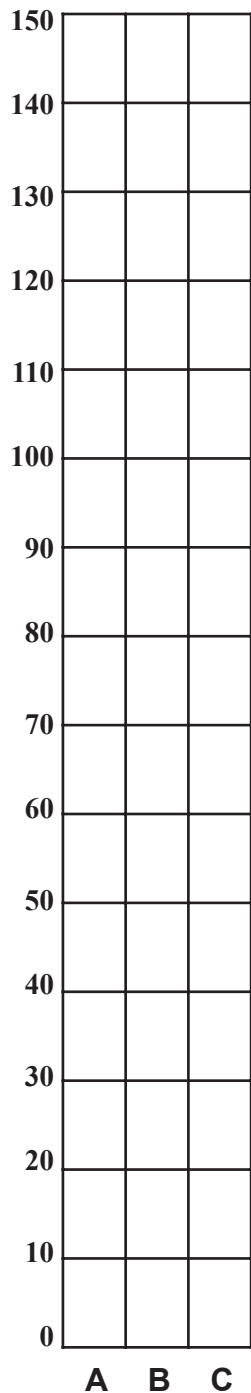
Water in Apples Graph



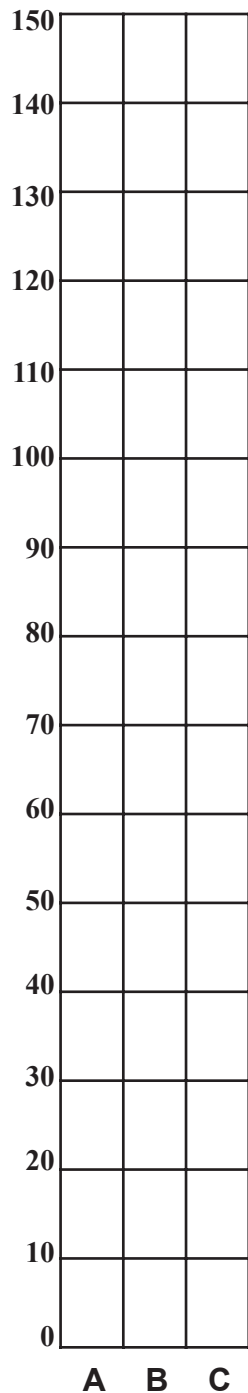
Monday



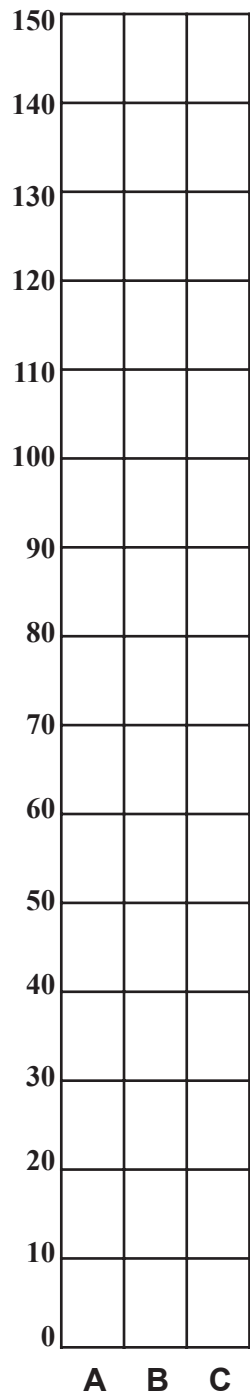
Tuesday



Wednesday

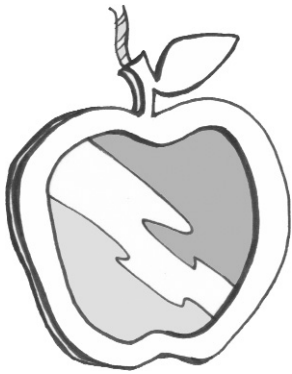


Thursday



Friday

Apple Art

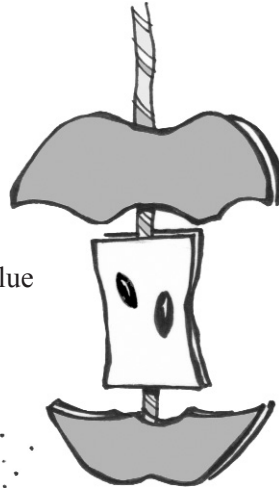


Apple Windows

Sandwich a piece of colored tissue paper or cellophane between two apple-shaped frames for light catchers. Hang about the room and in windows for colorful decorations.

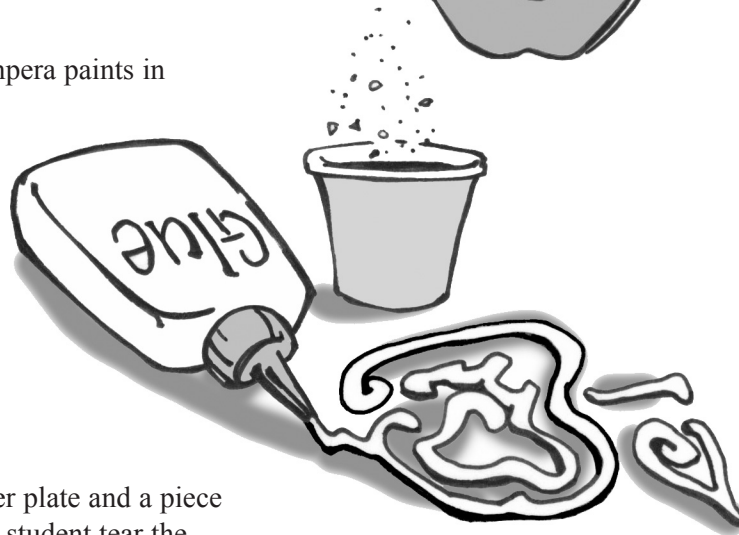
Apple Mobiles

Make apple mobiles from construction paper by cutting two red or yellow tops, two white centers and two red or yellow bottom pieces. Draw in seeds for each apple with black crayon or marker. Glue pieces together with yarn between to make a mobile.



Salty Apples

Mix some salt and dry powdered tempera paints in margarine cups. Brush or dribble liquid glue in an apple pattern on drawing paper. Sprinkle the salt and paint mixture over the pattern. Use as many colors as desired. When dry, gently remove excess salt.



Apple Collages

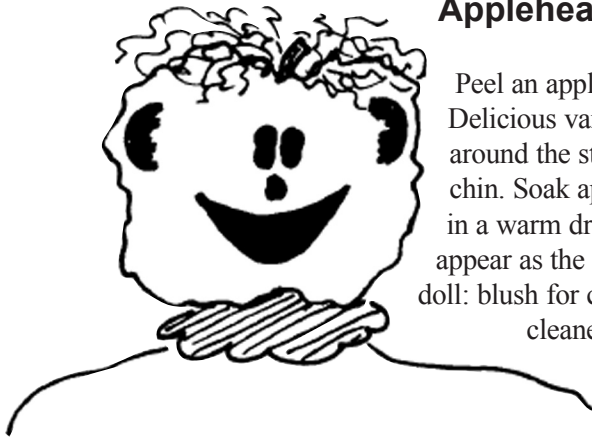
Give each student a small white paper plate and a piece of red construction paper. Have each student tear the construction paper into small pieces and glue them to the paper plate. Let them cut out and glue on a green leaf and stem. Hang from ceiling to create an “orchard” classroom.

Fingerpaint Apples

Cut out large apple shapes from white butcher paper. Give each student a small amount of red fingerpaint and let them paint their apples. Have them attach a green leaf and stem when dry.

Apple Art continued

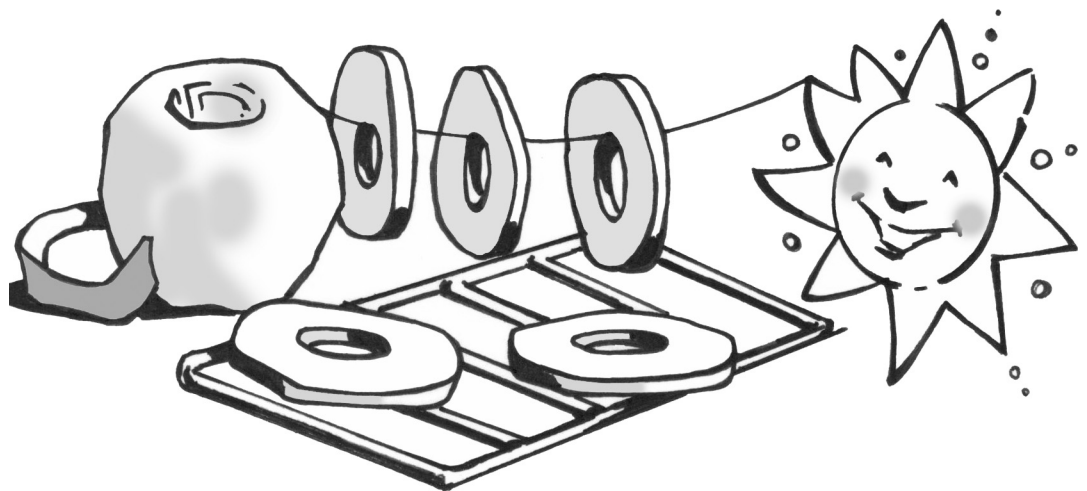
Applehead Doll



Peel an apple (a hard variety, like Rome works well; Red or Golden Delicious varieties do not work well), leaving the stem and a ring of peel around the stem. Carve away apple to form eyes, nose, ears, mouth and a chin. Soak apple in lemon juice for an hour. Tie a string to the stem and hang in a warm dry spot out of the sun. Drying will take 2-4 weeks and details will appear as the apples dries and shrinks. Use any materials available to finish doll: blush for cheeks and lips, cloves for eyes, cotton for hair or a beard, pipe cleaners for the body, and strips of cloth for clothes.

Dried Apples

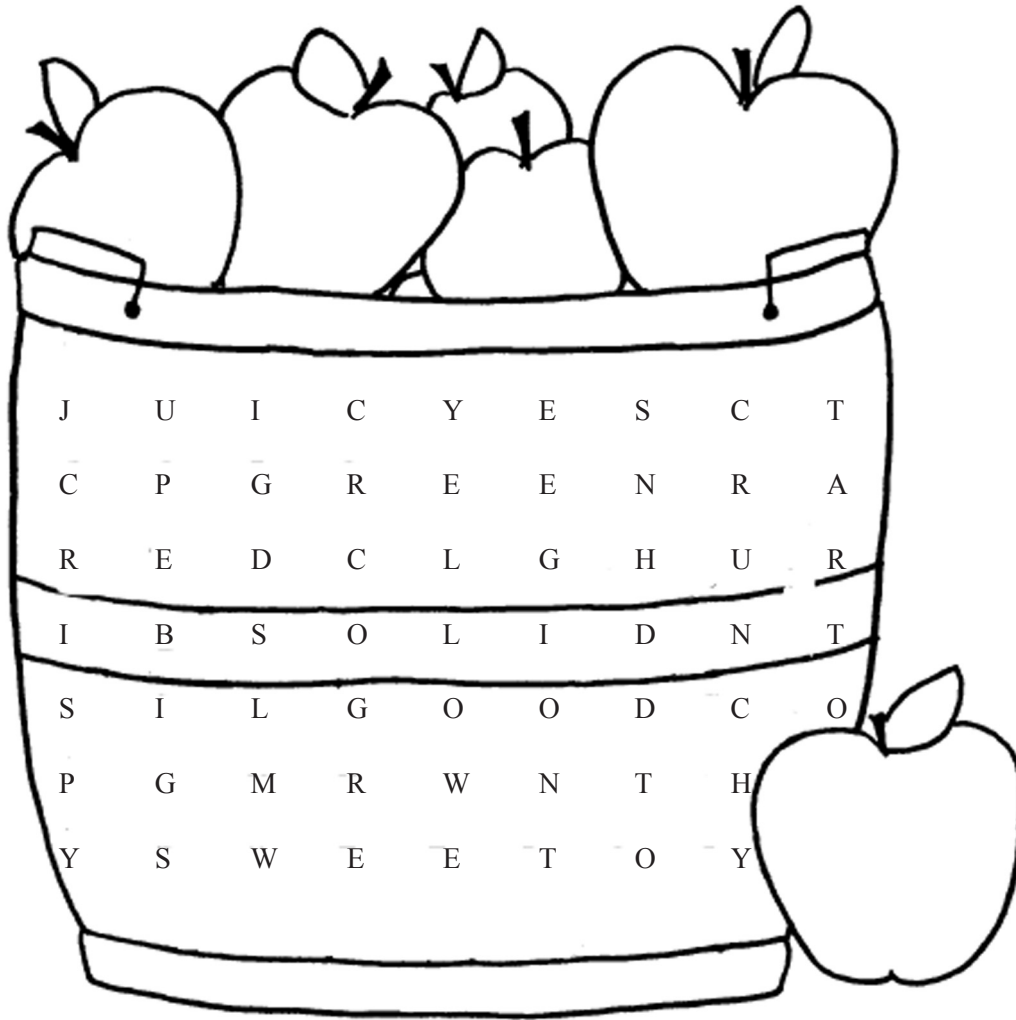
Peel and core apples (Red or Golden Delicious varieties do not work well). Slice into rings approximately 1/4" thick. String on a string and hang in a warm place or lay on racks in the sun. Apples should not be touching each other. Drying will take approximately one week. May also be dried on racks in a 150 degree Fahrenheit oven for 5-6 hours. Store in a glass jar or paper bag. Great for snacks or may be used to make dried apple wreaths.



Name: _____

Just for Fun Word Search

There are eleven apple words hidden in the puzzle. Put a "C" next to color words. Put a "T" next to texture words. Put an "F" next to flavor words. Find the words in the puzzle and circle them. They may be written from left to right or from top to bottom.



GOOD

TART

GREEN

JUICY

SOLID

BIG

RED

CRUNCHY

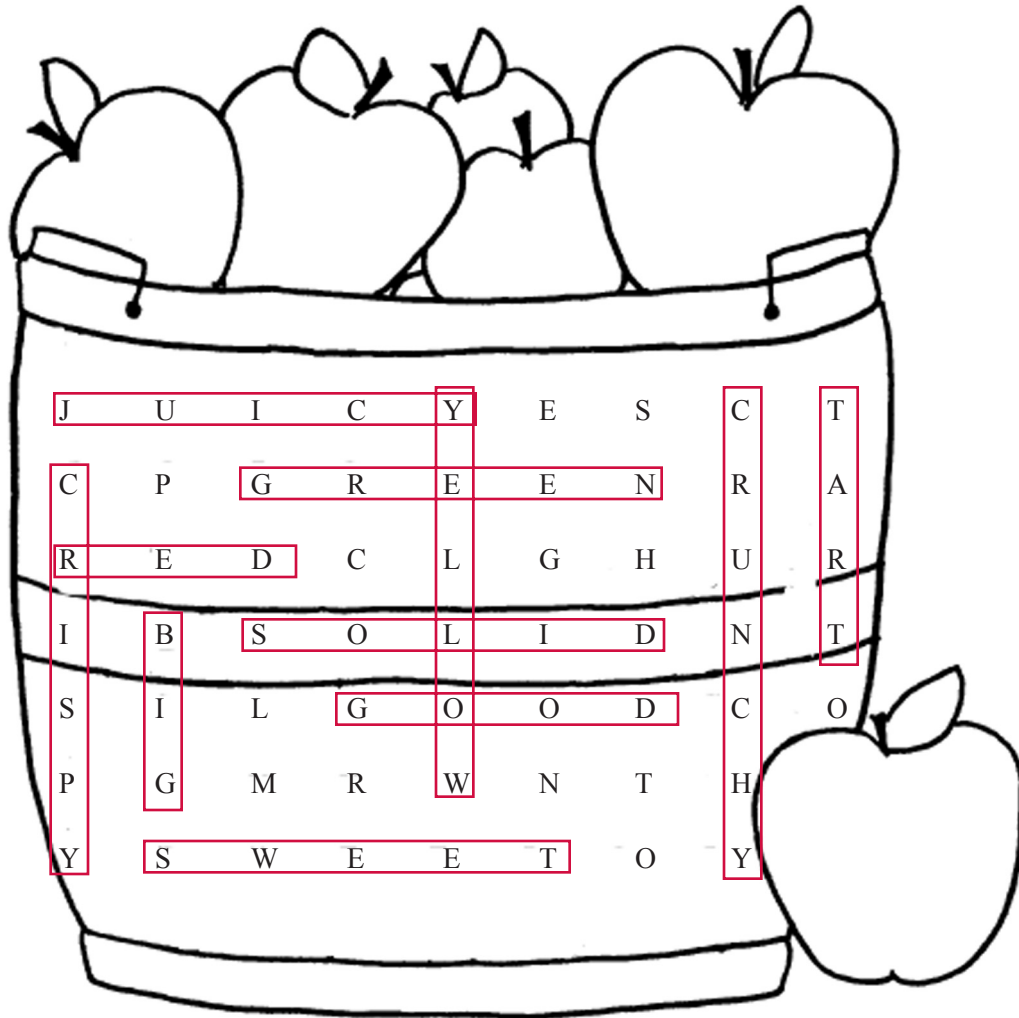
SWEET

YELLOW

CRISPY

Just for Fun Word Search

There are eleven apple words hidden in the puzzle. Put a “C” next to color words. Put a “T” next to texture words. Put an “F” next to flavor words. Find the words in the puzzle and circle them. They may be written from left to right or from top to bottom.



GOOD **F**

TART **F**

GREEN **C**

JUICY **T**

SOLID **T**

BIG **T**

RED **C**

CRUNCHY **T**

SWEET **F**

YELLOW **C**

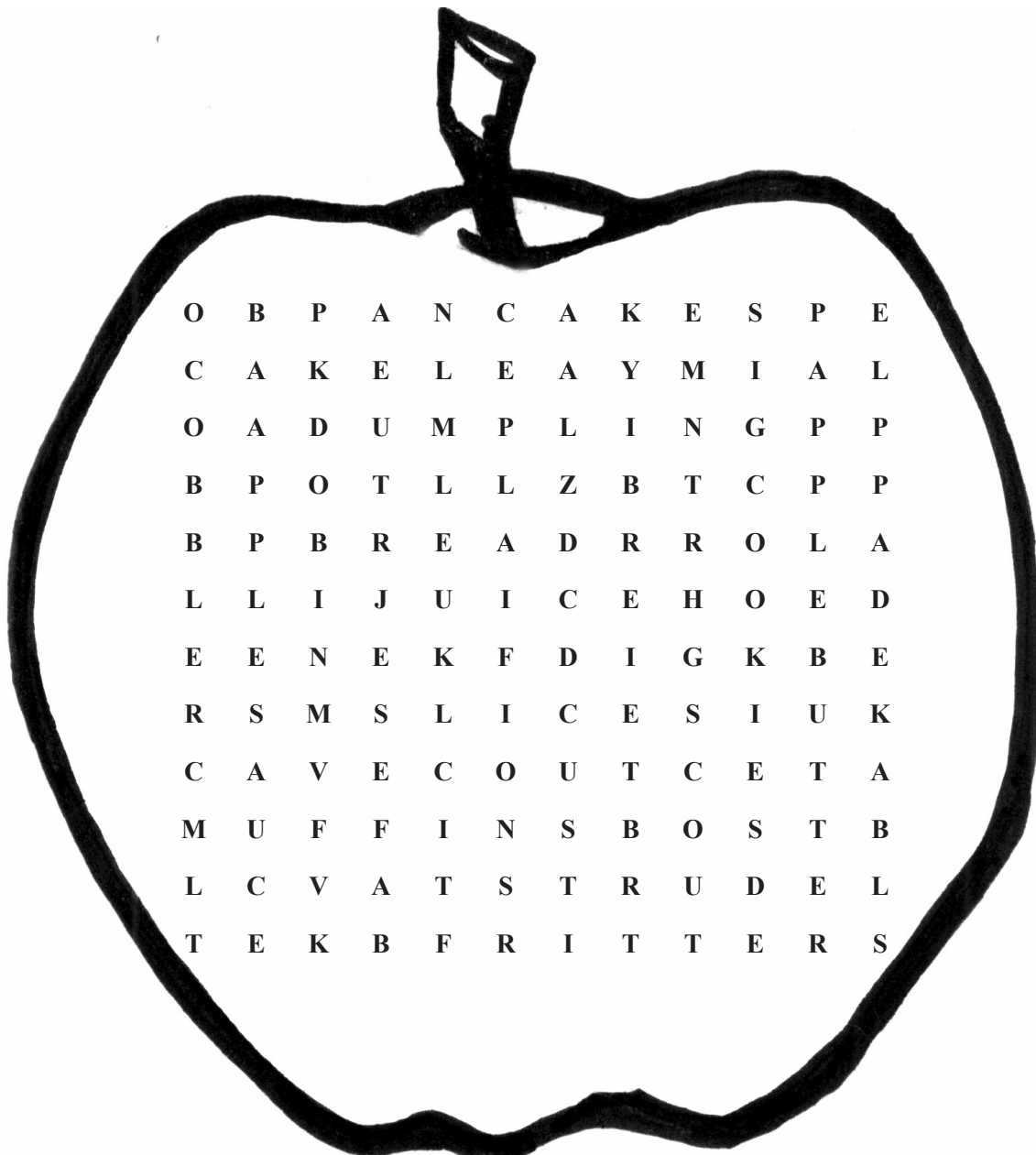
CRISPY **T**

Name: _____

Apple Products Word Search

Search for the following words. They may be written forward, backward or diagonal.

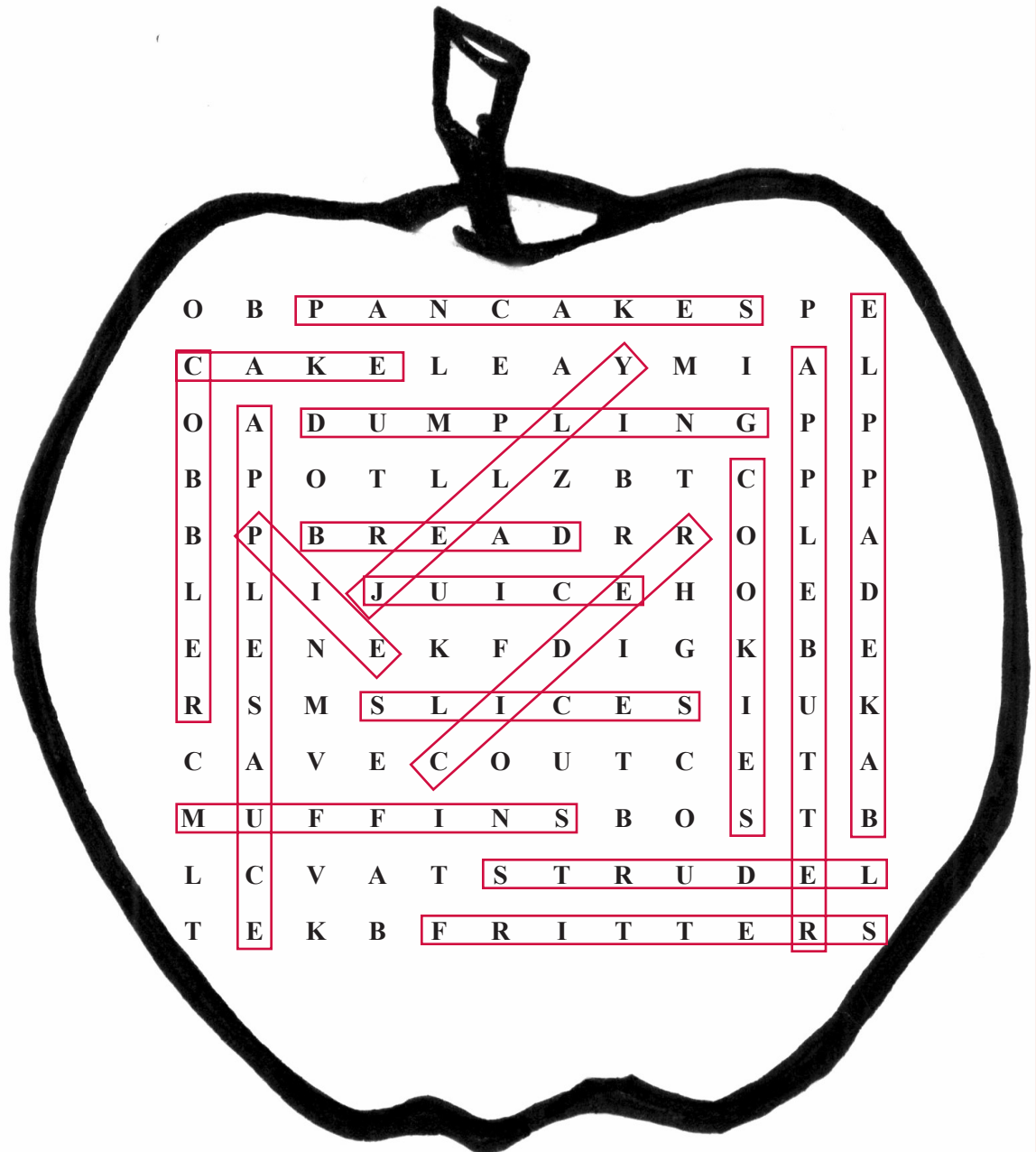
slices	cider	strudel
fritters	cake	pancakes
applebutter	pie	baked apple
applesauce	juice	cookies
dumpling	cobbler	bread
jelly	muffins	



Apple Products Word Search


Search for the following words. They may be written forward, backward or diagonal.

slices	cider	strudel
fritters	cake	pancakes
applebutter	pie	baked apple
applesauce	juice	cookies
dumpling	cobbler	bread
jelly	muffins	




Name: _____

Apple Phrases

1. Z M  Z W Z B P V V K H G S V
W L X G L I Z D Z B.

2. Z H Z N V I R X Z M Z H  K R V.

3. Z M  U L I G S V G V Z X S V I.

4. G S V  L U N B V B V.

5. Z R H U L I .

6. L M V Y Z W  H K L R O H G S V
D S L O V Y F H S V O.

7. W L M G F K H V G G S V  X Z I G.

Key:

- A.....Z
- B.....Y
- C.....X
- D.....W
- E.....V
- F.....U
- G.....T
- H.....S
- I.....R
- J.....Q
- K.....P
- L.....O
- M.....N
- N.....M
- O.....L
- P.....K
- Q.....J
- R.....I
- S.....H
- T.....G
- U.....F
- V.....E
- W.....D
- X.....C
- Y.....B
- Z.....A

Apple Phrases

1. AN  A DAY KEEPS THE
Z M Z W Z B P V V K H G S V
DOCTOR AWAY.
W L X G L I Z D Z B.

Key:

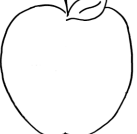
A.....Z
 B.....Y
 C.....X
 D.....W
 E.....V
 F.....U
 G.....T
 H.....S
 I.....R
 J.....Q
 K.....P
 L.....O
 M.....N
 N.....M
 O.....L
 P.....K
 Q.....J
 R.....I
 S.....H
 T.....G
 U.....F
 V.....E
 W.....D
 X.....C
 Y.....B
 Z.....A

2. AS AMERICAN AS  PIE.
Z H Z N V I R X Z M Z H K R V.

3. AN  FOR THE TEACHER.
Z M U L I G S V G V Z X S V I.

4. THE  OF MY EYE.
G S V L U N B V B V.

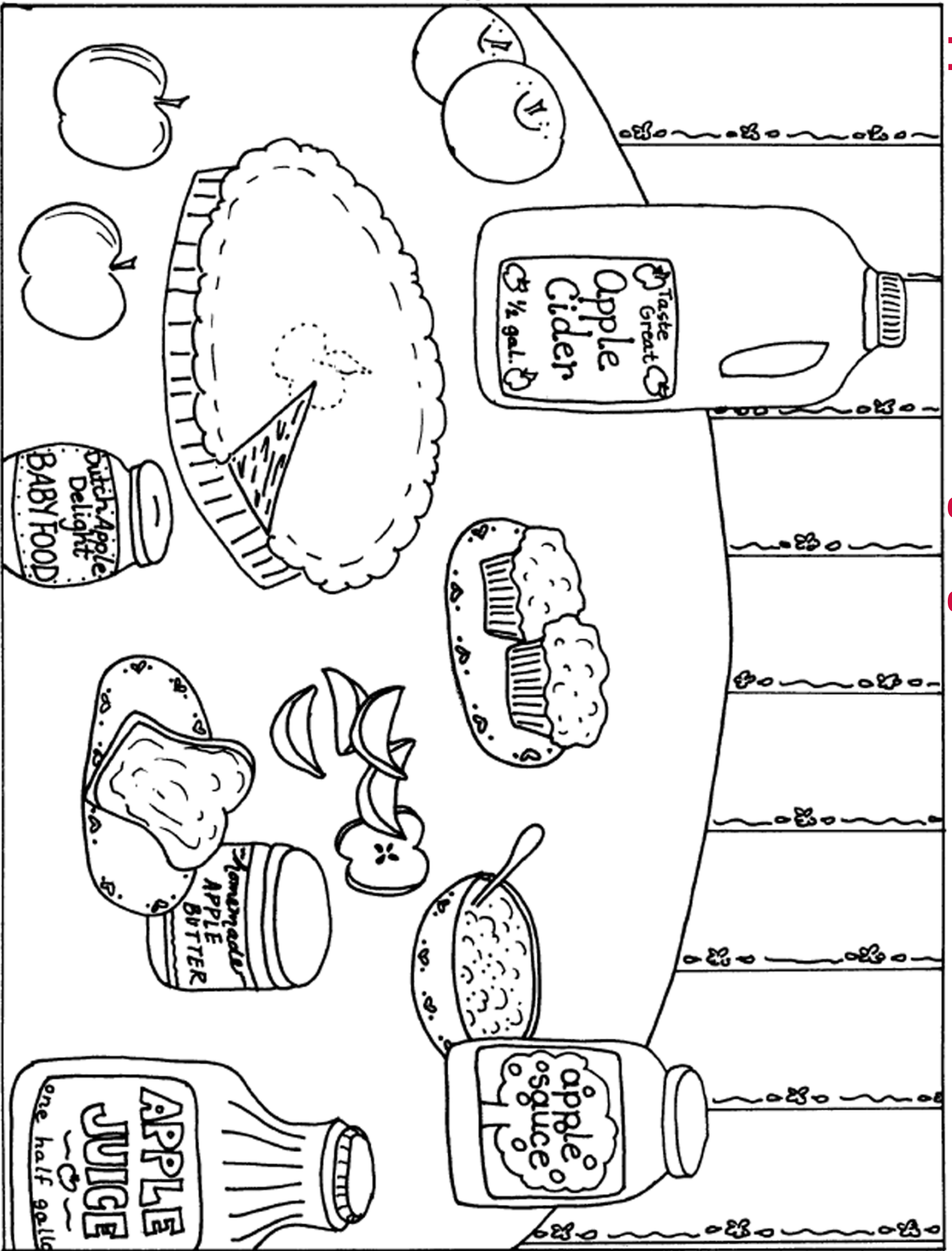
5. A IS FOR  .
Z R H U L I .

6. ONE BAD  SPOILS THE
L M V Y Z W H K L R O H G S V

WHOLE BUSHEL.
D S L O V Y F H S V O.


7. DON'T UPSET THE  CART.
W L M 'G F K H V G G S V X Z I G

Name: _____



I am *good* to the CORE!

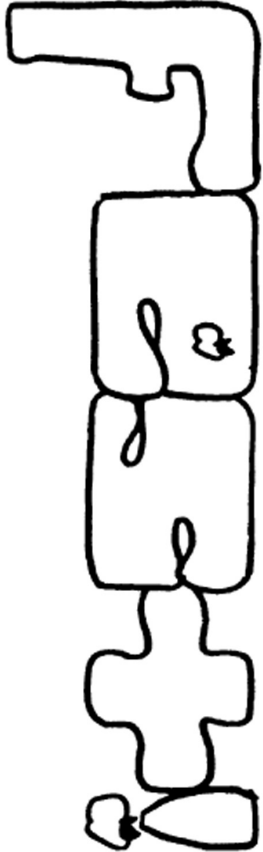
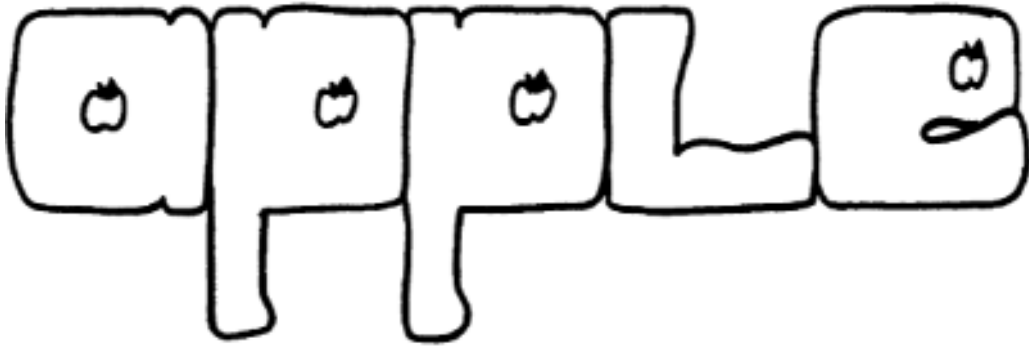

I am the
apple of my
teacher's eye!



What:

Where:

When:



What:

Where:

When:

Apple Bites Enhancement Ideas



Language Arts

- Write new apple words on apple shapes and put in a basket. Have students draw out an apple shape and read the word. Also use for learning vocabulary.
- Use a large apple shape with a collage of pictures of things that start with the letter “A”. Identify students whose names begin with the letter “A”. Identify things in the room that begin with the letter “A”.
- Make an apple tachistoscope for each student. Cut two slits in the apple. Cut strips of paper to go through the slits. List new reading or vocabulary words.
- Designate a special section of your library corner as the “Apple Orchard” and display books about apples. Decorate the corner with apple art.
- Using two pieces of heavy cardboard make a large 3-D apple tree for your reading corner. Slit one apple piece in half and slide the slit piece over the other apple piece.
- Read suggested apple books to the class and have students report on their favorite. Record favorite apple books and have students read and listen to them in learning centers.
- Have students divide into small groups and read suggested books to each other in the “Apple Orchard” reading area of your classroom.
- Make apples with each student’s name and the name of a book they have read or short book review that they wrote. Place the apples on an apple basket bulletin board.
- Do “story mappings” of a book that students have read. Use a large sheet of butcher paper and divide the paper into six categories: title, author, characters, physical description, good traits, and bad traits.
- Make a list of questions about apples and research the answers.
- Make apple books about apple nutrition, apple facts, apple growing, apple varieties, apple products, apple uses, or other apple topics.
- Have students give demonstration speeches on how to make an apple treat: caramel apple sundaes, apple chips, apple finger-gelatin, or other apple treats.
- Have students keep a journal of all apple unit activities.



Language Arts & Art

- Make an apple alphabet book using all apple terms. Illustrate the book.
- Make an apple vocabulary book. Illustrate the book.
- Pair students and assign them to write and act out a commercial for apples.



Science

- Discuss or tell how cider is made and use illustrations to show the process. Refer to *An Amazing Apple Book* by Paulette Bourgeois.

Apple Bites Enhancement Ideas cont'd

Math



- Use apples to teach fractions. Cut apples in halves, thirds, fourths, or other fractional units.
- Bring in empty $\frac{1}{2}$ pint, pint, quart, $\frac{1}{2}$ peck, peck, $\frac{1}{2}$ bushel, and bushel containers for students to compare sizes of measures.
- Bring in apples and graph number of seeds, sizes, colors, favorites, favorite ways to eat, or other apple data.
- Bring in apples and a scale. Estimate weights.
- Compare size and cost of individual apples, bagged apples, and bulk apples.
- Use string to measure the circumference of various varieties of apples.
- Use apples to teach the concept of smaller and larger. Have students line up apples from the smallest to the largest. *Note:* Make this a “brain break” activity by giving each student an apple and ask them to line up according to the apple size that they are given from smallest to largest.
- Take a survey of how many students brought apples or apple products in their lunch at the beginning of the apple unit. Complete the survey again at the end of the unit. Summarize, compare, and graph the results.

Art



- Design an apple bookmark.
- Draw an apple cartoon.

General



- Make an apple calendar and mark special days with apple shapes or apple stickers.
- Have each student make an apple folder to collect all their apple activity projects.
- Make an apple bulletin board with each student’s picture glued on a student-made apple.
- Make a large apple tree out of butcher paper or tag board and hang personalized apples on it for books read, tasks completed, learning centers completed, and other classroom tasks.
- Use apple treats for snacks in the classroom.
- Think of ways apples are used for decoration (apple candles, apple candle holders, apple jewelry, in artwork such as pictures, plaques, figurines). Make a dried apple wreath for a holiday gift.

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