Riding Safety
Numerous deaths and serious injuries have occurred with riding equipment powered by small engines. Finding the center of gravity will indicate the risk of a rollover. A low center of gravity provides a smaller risk. You should gain an understanding of what direction is safest for mowing hills; up and down for riding mowers and across the hills for walk-behind mowers. It may be useful to study lawns that have hills and discuss the best mowing pattern. You may want to observe youth mowing a lawn to see if the correct mowing directions are followed.

Make the Cut!
You may want to help youth find the lettuce and other items for this activity. A magnifying glass will be helpful with seeing the differences at the cut edges of the lettuce. The primary objective is to show that more plant cells are injured with a dull knife or blade, which increases the risk of disease.

Information Overload
Anytime you go shopping whether it's groceries or clothing you have choices with respect to quality. This is also true of small engine equipment and their parts. Youth may need help determining quality differences although quite often price is an indicator. Also youth may need assistance in completing the table in the activity.

Business Time?
Youth in grades six through eight are often looking for ways to earn money. Mowing the neighbors' lawns or roto-tilling gardens are good ways to earn money. Youth may need help completing the questions in this activity. When answering these questions, consideration should be given to time needed for school and time spent on other activities. Determination of costs will be useful in determining what to charge.

Level 3, Tune It Up!

Motor Music
Experienced small engine repair people can analyze an engine's problem by the noise it creates. Youth will be recording the sound produced by a small engine under several conditions. Youth may need help to determine differences in the sounds for the different conditions. Be sure to have youth identify each condition on the tape by speaking into a recorder.

Advanced Tools
As more specialized work is done on a small engine, the more advanced or specialized the tools become. Some of these tools also become more costly and, in some cases, the tools are specific to a small engine manufacturer. Descriptions of these tools may be found in the service manual specific to the engine. These tools may not be available in the local hardware store but probably will be available at the manufacturers' authorized repair shops and stores. Youth may need help locating them. Unless youth plan to do extensive small engine repair, the purchase of these tools would not be advised. These tools may be available in schools that have small engine repair programs.

Answer Key for Advanced Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Letter</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dial indicator</td>
<td>E</td>
<td>4</td>
</tr>
<tr>
<td>Digital multimeter</td>
<td>F</td>
<td>7</td>
</tr>
<tr>
<td>Piston ring compressor</td>
<td>D</td>
<td>6</td>
</tr>
<tr>
<td>Piston ring expander</td>
<td>C</td>
<td>1</td>
</tr>
<tr>
<td>Spark tester</td>
<td>G</td>
<td>5</td>
</tr>
<tr>
<td>Tang bender</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>Vibrating wire</td>
<td>B</td>
<td>3</td>
</tr>
</tbody>
</table>

Coming Apart – Coming Together
If youth plan to do the following six activities, they may want to obtain a discarded engine from a small engine repair shop or an engine discarded in their neighborhood. The youth may need help in obtaining the engine. These six activities are designed to be done in pairs, i.e., Fuel and Air Systems – Coming Apart, Fuel and Air System – Coming Together, Electrical System – Coming Apart, Electrical System – Coming Together, Engine Base – Coming Apart, Engine Base – Coming Together.
Fuel and Air Systems – Coming Apart
The fuel system tear-down can be done on a discarded engine or another engine that is available to youth. Although the tear-down steps are listed in the activity, there may be some differences for the small engine the youth are using. Therefore, it will be very important to have the service manual for the engine and fuel system. As youth gain experience with small engines, they will depend less on the manuals. Many steps will become intuitive. If the service manual is not affordable, youth may consider obtaining a photocopy of the few necessary pages. Youth may need assistance obtaining the engine and service manual.

Fuel and Air Systems – Coming Together
In this activity, youth are expected to write the assembly steps, which are very similar to the tear-down steps except in reverse order. Youth may need help obtaining replacement parts if they are necessary. Carburetor repair kits are available for many small engine carburetors. Youth may need assistance in deciding on the detail of the steps to record. Detail should be similar to the tear-down steps.

Electrical System – Coming Apart
Please read the hints for Activity Coming Apart – Fuel and Air Systems.

Electrical System – Coming Together
Of the three assembly activities, this may be the most difficult. In this activity, youth provide verbal directions to someone else who will do the assembly. You can serve as the person who will follow the verbal directions for assembling the electrical system. Or another youth could serve this role. It will be a better experience if the person following the directions is not very knowledgeable about small engines. It is important to stress that youth may not physically help with assembly. They may only give verbal instructions.

Engine Base – Coming Apart
The hints for this activity are similar to Fuel and Air Systems – Coming Apart, except it may be best for the youth to tear-down a discarded engine. Because there will be many more parts, it will be more important for youth to organize and label the parts on a table as they are removed from the engine.

Engine Base – Coming Together
In this activity youth will assemble the engine in the form of a demonstration. This could be presented to you or a small group of people. The audience is expected to record the assembly steps. After the demonstration, you can share your recorded steps with the demonstrator. It will be better to have several people in the audience recording steps. The sharing will be an understanding of the completeness and clarity of the demonstration.

Keep it Sharp!
Youth may need some assistance with removing the lawn mower blade. Be sure the spark plug wire is removed from the spark plug. Also help youth find a file or a grinder to sharpen the blade. If youth use a grinder, be sure the proper safety precautions are followed. For example, eye protection will be required, gloves should be worn, the grinder should be properly adjusted, and ear protection may be necessary. Be aware that the blade will get hot during grinding. A sharp blade can easily cut the skin.

Know the Trends
Like automobiles, small engine equipment is changing with respect to fuel consumption, impact on the environment, noise, and operator comfort. National trends in small engines include fewer two-cycle engines and more valve-in-head engines. These two trends will lead to fewer pollutants and more efficient engines. Youth may need some assistance in finding information on this topic. People who have been employed by an engine equipment company for many years will be a good source. The U.S. Environmental Protection Agency (EPA) is an excellent source of information. Have youth check the website or write to the EPA. They also have a computer model that predicts air pollution levels in various areas of the U.S. if some new technologies are adopted.

Rules and Regulations
The preceding activity focused on federal laws affecting engine trends. The activity deals more with state, county, city, and community rules and regulations. These will deal not only with lawnmowers but other equipment such as ATVs, snowmobiles, watercraft, and boats. Youth may need assistance in finding these rules and regulations. Some sources of information are local law enforcement agencies and recreational park administrative offices. This may be an opportunity for youth to visit with their local elected officials about rules and regulations and how they are developed or changed.

Selecting an Engine
Youth are asked to find a replacement engine for some equipment available. This equipment may or may not need a new engine. The primary goal is to find a replacement engine in catalogs. Presumably, the equipment is older, therefore the engine model on this equipment is not currently available. The replacement engine will have some different specifications. If equipment needs a replacement engine, youth can make the replacement. Be sure youth check with the engine manufacturer or supplier to insure the selected engine is appropriate.
Comparing and Purchasing
Comparison-shopping (decision making) is a skill that can be used with many items that youth will purchase during their lifetimes. In this activity, youth may need help finding stores for three different brands of equipment. You may want to suggest the telephone yellow pages for a listing of stores providing the small engine equipment. You want to visit with youth in deciding on what basic and extra features to consider. Sometimes the advertising literature will provide ideas. Youth may find your assistance helpful in rating the equipment.

Small Engine Project Meeting Ideas

Are you looking for more small engine activity ideas? Here is a list of possibilities. Brainstorm more ideas with the participants in your group.

Small Engine Projects
- Building equipment to be powered by a small engine, e.g., log splitter, go-cart, pumping system
- Building a model of a small engine
- Developing a cut-away of a small engine
- Making a carburetor cut-away
- Developing a display of small engine parts
- Rebuilding a small engine
- Changing engine oil
- Servicing the air cleaner on a small engine
- Studying the engine model numbering system
- Troubleshooting an engine

Careers in Small Engines
- Conducting a small engine career night
- Shadowing on the job
- Writing a résumé
- Interviewing people in a small equipment industry
- Interviewing people managing a small engine repair shop or retail store
- Touring a small engine repair shop or manufacturing plant
- Interviewing an engineer in a small engine equipment company

Recreational
- Interviewing someone from a riding club, e.g., ATVs or snowmobile
- Attending a local riding club meeting
- Discovering trails for ATVs or snowmobiles in your community
- Volunteering to maintain trails
- Attending a local ATV or snowmobile rally

Starting Your Own Business
Youth may need some help in setting realistic goals with respect to level of income. Some consideration should be given to many things including the purpose of the income, time available, other chores to be done around the home, and equipment available. Youth this age often have many ideas for purchasing expensive items. Therefore it is imperative they set realistic goals.

Safety and the Environment
- Interviewing local law enforcement officials regarding community laws
- Exploring the Internet for safety and environmental information
- Attending an approved rider safety course for ATVs, snowmobiles, or motorcycles
- Presenting a lawnmower safety program to kindergartners, first and second graders on bystander safety
- Obtaining new safety decals for small engine equipment around your home
- Collecting newspaper clippings on small engine equipment-related injuries
- Discarding used oil properly
- Conducting a safety inspection of a riding lawnmower

Energy Sources
- Visiting a fuel distribution depot
- Tracing gasoline back to its natural sources
- Creating a display to describe the refining process
- Interviewing people in the fuel and oil industry
- Comparing gasoline and diesel engines
- Comparing the properties of diesel fuel and gasoline

Other
- Exhibiting a small engine project
- Giving a small engine demonstration
- Practicing conference judging
- Conducting a small engine quiz bowl
- Debating small engine issues
- Mowing the lawns for elderly or disabled persons in your neighborhood