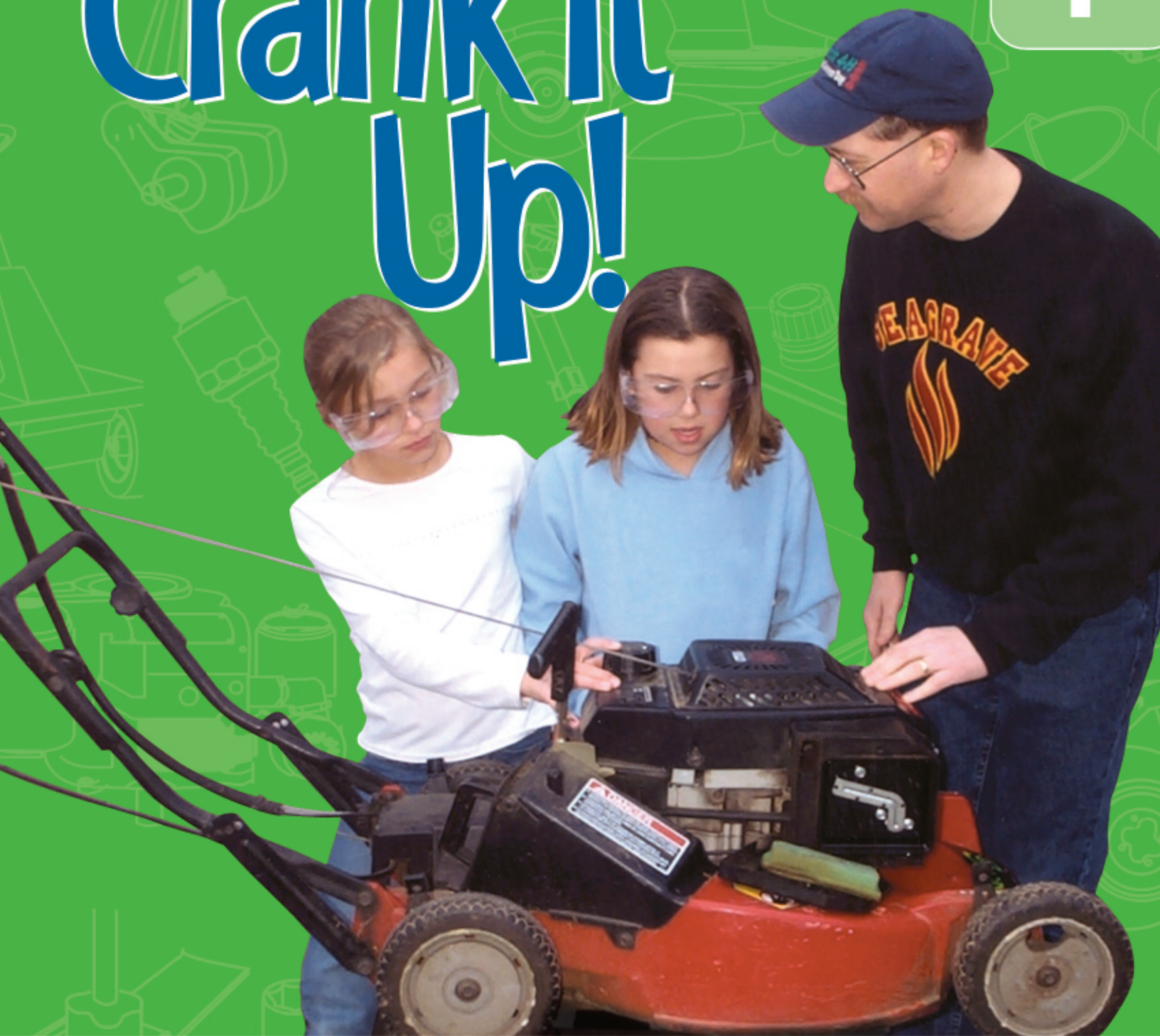




LEVEL  
**1**

# Crank It Up!



## Small Engines Activities for Youth

Name \_\_\_\_\_

County \_\_\_\_\_



REVIEWED & RECOMMENDED  
National 4-H Curriculum



## Note to the Project Helper

### *Congratulations!*

A young person has asked you to be a helper for Start Your Engines! This activity guide is for boys and girls who want to learn about small engines. But they can't do it without you! You play a key role in helping them learn about small engines and about themselves. You can help through your enthusiasm and thought-provoking questions. With your help, they will set goals, find resources, and evaluate their own progress as they complete each level of Start Your Engines!

### **Start Your Engines! Project Activity Guides**

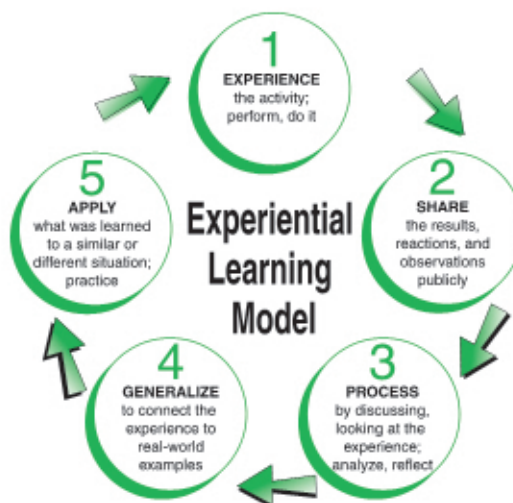
The small engines project is aimed at youth in grades 3–12. This is the first of three levels. Each activity guide features an achievement program for youth to complete.

- 1 – Crank It Up! ..... BU-08186
- 2 – Warm It Up! ..... BU-08187
- 3 – Tune It Up! ..... BU-08188
- Helper's Guide ..... BU-08189

### **Start Your Engines! Helper's Guide**

The Start Your Engines! Helper's Guide includes several group activities, which are adaptable to family settings, classrooms, and other youth gatherings. In the guide you'll also find important information about life skills and youth characteristics, and advice to help you with the youth guide activities.

## Experiential Learning Model



Pfeiffer, J.W., & Jones, J.E., "Reference Guide to Handbooks and Annuals" © 1983 John Wiley & Sons, Inc. Reprinted with permission of John Wiley & Sons, Inc.

Experiential learning distinguishes 4-H youth development education from many formal education methods. Activities are designed so youth learn by doing first then reflecting on what they did and thinking about how they can apply what they learned to other situations. Your aim as Helper is to "guide" youth while they explore each activity.

In each activity you'll find descriptions of a life skill and project skill to emphasize, suggestions for more activities, and other helpful information. The question-and-answer section is called Cool Your Engines. Here you can help the youth share and process what they did, generalize to everyday experiences and then discuss how to apply the life skill to other situations.

## Acknowledgments

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# Crank It Up! Table of Contents

*For more on small engines, look for these other guides in this set.*



BU-08187

## Level 2 - Warm It Up!

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BU-08188

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BU-08189

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[www.4hcurriculum.org](http://www.4hcurriculum.org)

National 4-H Curriculum



## Having Fun with *Crank It Up!*

**A**re you ready for some learning fun? In this project you will learn about basic small engines. You will learn about engine parts, tools of the trade, safety issues, and what makes small engines work.

But that isn't all you'll be doing. You'll learn more about yourself, too. You'll learn things you can use all your life, like planning and organizing, comparing and measuring, decision making, communication, safety and problem solving.

You'll also find some words that are **boldfaced** in the activities. The meanings of these words are found in the Specs (short for "Specifications") section at the end of this activity guide.

### Your Portfolio

You'll want to save all your good ideas as you complete this project. Start a Start Your Engines! Portfolio to save all your notes, drawings, pictures, and other things you create. You can use a big envelope, manila folder or a box for your portfolio.

### Your Project Helper

There is a lot to do in Crank It Up! Do at least seven activities this year. There are 14 main activities in this project guide. There are lots of other fun activities in the Race Ahead sections.

You don't have to do all of this alone. Ask a parent, neighbor or older friend to guide you in this project. Your helper can help you find the things you'll need for an activity. Your helper can also assist you as you talk about what you learned. When you're done with an activity, your helper can check it off the list on page 4 in this guide.

*Write the name, address, phone number, and email of your project helper here.*

My project helper

Phone

Address

Email

### Inventory

#### Tools and Supplies You Will Need for Activities in *Crank It Up!*

- |   |  |  |
|---|--|--|
| <input type="checkbox"/> Lawn Mower         | <input type="checkbox"/> Feeler Gage, Wire   | <input type="checkbox"/> Screw Driver-Phillips |
| <input type="checkbox"/> Owner's Manual     | <input type="checkbox"/> Hammer              | <input type="checkbox"/> Socket Set            |
| <input type="checkbox"/> Pencil             | <input type="checkbox"/> Open-end Wrench Set | <input type="checkbox"/> Socket Wrench-ratchet |
| <input type="checkbox"/> Paper              | <input type="checkbox"/> Pliers              | <input type="checkbox"/> Spark Plug Socket     |
| <input type="checkbox"/> Box-end Wrench Set | <input type="checkbox"/> Screw Driver-blade  |  |

**Good luck with *Crank It Up!***



## Crank It Up! Planning Guide

Name \_\_\_\_\_

### My Project Goals

Make a list or draw pictures of some of the exciting things you plan to do in this project. Put this information into your portfolio.

### Things I Plan to Do

Year 1

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Year 2

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Year 3

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### My Project Highlights

When you're done with Level 1, make a list or draw pictures of the most exciting things you actually did in the project. How does this list compare with your plan list?

Things I Did

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### Before and After—What do you know?

Here is a great way to see if you learn something new and develop important skills in this project. Before you start doing the activities in this guide, indicate what you know **NOW**. Then when you complete the Small Engines Achievement Program, write down here what you know **AFTER**. You may be surprised to see what you learned! Share the results with your helper.

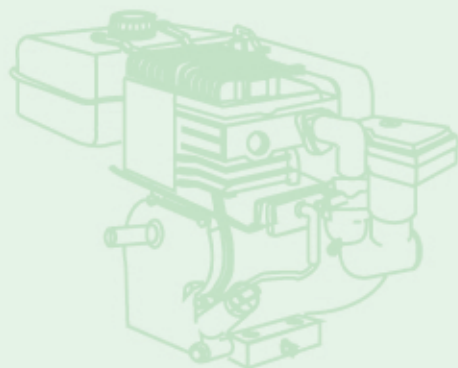
Begin each skill with the words “*I know how to...*”

Then circle **1** (to a great extent), **2** (somewhat) or **3** (not at all).

<i>I know how to ...</i>	Before	After
Name external parts of a lawn mower	1 2 3	1 2 3
Start an engine safely	1 2 3	1 2 3
Identify tools used to maintain and repair small engines	1 2 3	1 2 3
Identify parts of an engine	1 2 3	1 2 3
Identify different grades of oil	1 2 3	1 2 3
Describe the importance of clean air filters	1 2 3	1 2 3
Demonstrate how moving air cools	1 2 3	1 2 3
Demonstrate spark plug maintenance	1 2 3	1 2 3
Service an air cleaner on a small engine	1 2 3	1 2 3
Identify safety labels	1 2 3	1 2 3
Describe safe clothing to wear when working with small engines	1 2 3	1 2 3
Identify the job a machine does	1 2 3	1 2 3
Conduct an interview	1 2 3	1 2 3
Evaluate the best tools to purchase for the job	1 2 3	1 2 3

# *Crank It Up!* Achievement Program

**D**o at least seven activities each year. There are 14 main activities in this guide and many extra activities in the Race Ahead sections. You can also make up your own activities. Ask your project helper to initial each activity after you've done it.



## Required Activities

Activities	Year Plan To Do	Date Completed	Helper's Initials
<b>Chapter 1 - How Engines Work</b>			
Parts Are Parts? I can identify external parts of a small engine.			
Crank It Up! I can start an engine safely.			
Time for Tools I can identify tools used with small engines.			
Parts, Parts, Everywhere Parts! I can identify 7 engine parts.			
A Slippery Subject I can identify differences in oil grades.			
Suck It Up! I can list two reasons for having clean air filters.			
Cool It! I can demonstrate how moving air cools.			
Spark It Up! I can demonstrate spark plug maintenance.			
Let It Breathe! I can service an air cleaner on a small engine.			

## Chapter 2 - Working Well with Small Engines

Keep It Labeled! I can list reasons why safety labels are important.			
Closet Cues! What to Wear? I will wear the safe and correct clothing when using small engines.			
Lawn Ranger I can match the machine to the job.			

## Chapter 3 - Making Small Engines Work for You

Learn to Earn I can conduct an interview.			
Wise Buys I can decide when an item is the best buy.			

## Race Ahead Optional Activities

Select and do your choice of the Race Ahead activities. Record the page and Race Ahead activity number of each one you complete and discuss with your helper.

### A. Race Ahead

Page: \_\_\_\_\_ Date: \_\_\_\_\_ Initial: \_\_\_\_\_

### B. Race Ahead

Page: \_\_\_\_\_ Date: \_\_\_\_\_ Initial: \_\_\_\_\_

### C. Race Ahead

Page: \_\_\_\_\_ Date: \_\_\_\_\_ Initial: \_\_\_\_\_

### D. Write your own activity

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Page: \_\_\_\_\_ Date: \_\_\_\_\_ Initial: \_\_\_\_\_



# Crank It Up!



## Completion Certificate

I certify that

\_\_\_\_\_

has completed all requirements of the  
Crank it Up! Achievement Program.

Project Helper's Signature \_\_\_\_\_ Date \_\_\_\_\_



Photo of me and my project

# Chapter 1

## How Engines Work

# Parts Are Parts



<b>Life Skill:</b>	Locating and using resources
<b>Small Engine Skill:</b>	Identifying parts of a small engine
<b>Education Standards:</b>	NS.K-4.1 – Science as Inquiry
<b>Success Indicator:</b>	Name external parts of a lawnmower.
<b>Toolbox:</b>	Owner's manual, pencil, paper, lawnmower

### Warm Up!

Can you imagine trying to mow a golf course without a lawnmower? Or remove snow from a long driveway without a **snow thrower**? These and other important machines are powered by **small engines**. Small engines are very significant in the world today. They help people accomplish many tasks much faster. Small engines come in many different shapes and sizes, but there are some things they all have in common. That's what you will look for in this activity.



Identifying external parts of a lawnmower.

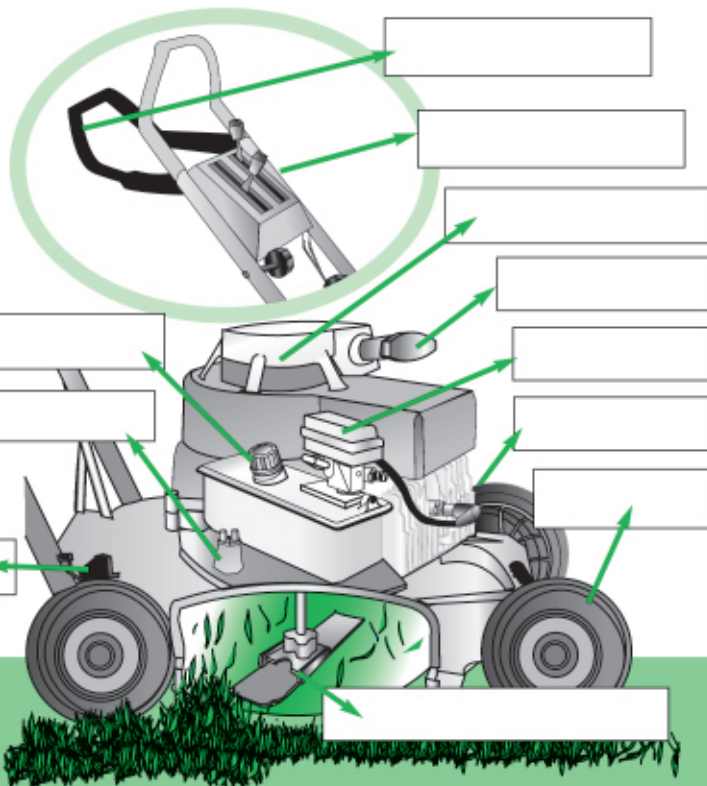
### Throttle Up!

**1** With your helper use your owner's manual to list the following information about your small engine.

#### My Small Engine

Purpose of Equipment \_\_\_\_\_  
 Manufacturer \_\_\_\_\_  
 Model \_\_\_\_\_  
 Type/Specification \_\_\_\_\_  
 Code/Serial Number \_\_\_\_\_

**3** On the diagram of the lawnmower write the name of each part in the space provided. See the parts listed in #2 if you need a hint.



### 2 Parts of My Engine

Check (✓) each of these parts that you find on your lawnmower.

- |  |   |
|--|---|
| <input type="checkbox"/> Gasoline tank | <input type="checkbox"/> Starter <input type="radio"/> Pull (or) <input type="radio"/> Electric |
| <input type="checkbox"/> Oil fill      | <input type="checkbox"/> Air cleaner  |
| <input type="checkbox"/> Spark plug    | <input type="checkbox"/> Air cooling vents  |
| <input type="checkbox"/> Speed Control | <input type="checkbox"/> Wheels   |
| <input type="checkbox"/> On/Off switch | <input type="checkbox"/> Cutting height adjustment  |
|  | <input type="checkbox"/> Mower blade  |



# Cool Your Engine

## Share

- How did you go about finding and identifying the parts?

## Process

- Why is it important to be able to identify parts of an engine?
  - What would you do if you didn't know what a part was, or where to locate a part?
- 
- 
- 

## Generalize

- Name other times when you need to use diagrams or other resources to help you identify things.
- 
- 
- 

## Apply

- When might you use pictures, instead of words, to explain something?
  - When might you use a diagram as a resource in the future?
- 
- 
- 



1. Check for the same parts on other lawnmowers.
2. Identify other external parts of a small engine that you and your helper think are important.

## Manual Moment

- Check the quality of gasoline the engine uses in the owner's manual for this equipment.
- Check the type of oil the engine uses in the owner's manual for this equipment.

## Pit Stop

### Engine Parts

- Gasoline tank: The tank stores the gas until the engine needs it.
- Gasoline: Makes the engine go.
- Oil fill: Engine hole for adding engine oil, which acts as a **lubricant** for the internal parts.
- Spark plug: Creates the spark, which ignites the gasoline and air mixture to give the engine power.
- Controls
  - On/Off switch: Connects or disconnects the electrical system to control whether the engine will run or not.
  - Speed control: Adjusts the engine speed or forward speed.
  - Starter: Turns the **crankshaft** to start the engine.
- Air cleaner: Removes dirt and debris from the air entering the engine.
- Air cooling vents: Openings for air to enter engine to remove heat from the engine.
- Wheel: Allows machine to move easily.
- Cutting height adjustment: Allows the operator to control the height of the cut grass.
- Mower blade: Does the actual cutting of the grass.



## Caution Corner

- Do not work alone
- Get permission before you start
- Be sure the engine is off during all your observations
- Remember that the blade on a lawn mower can be sharp
- When trying to identify the blade, be careful when tipping the lawnmower. Tipping can cause gasoline and oil to spill

# Crank It Up!



Life Skill:	Planning and organizing
Small Engine Skill:	Starting an engine
Education Standards:	NS.K-4.2 – Physical Science
Success Indicator:	Start an engine safely.
Toolbox:	Working small engine, helper, owner's manual

## Warm Up!

Can you imagine brushing your teeth before you eat or putting your clothes on before you take a shower? There is a procedure, or way of doing things, that should be followed with many things you do.

## Throttle Up!

If you operate or own a small engine, you need to be familiar with and follow proper starting and operating procedures. It will save you lots of time and frustration later on. It will also protect you and your engine.

The procedures may vary slightly from engine to engine, and whether it's the first start up or an everyday start up. Following are procedures for day-to-day start up of a manual-start engine.

Following procedure to start a lawnmower.



## 1 Preparing the engine for starting

1. Move engine and/or equipment outside or into a well-ventilated area. **Exhaust gases** contain **carbon monoxide**, an odorless deadly poison.
2. Check the **fuel** tank. Be sure the tank is at least half full of good quality, fresh, clean regular gasoline. Add gasoline if necessary.
3. Check the oil level. Add oil if necessary.
4. Open the fuel shut-off valve if your engine has one.
5. Close the **choke** valve or **prime** the **carburetor**. Choking or priming makes more fuel available, a must for starting a cold engine.
6. Turn on the **ignition** key if your engine has one.
7. Set the speed control to the recommended position. Usually one-quarter to one-half open is sufficient. This step will happen automatically if the choke and throttle lever are combined.

## 2 Starting the engine

Remember that an adult must be present when starting the engine. Crank the engine; pull the cord slowly until the "catch" engages, then pull with a firm and quick motion. Have clearance so your arm or hand does not hit anything. Two or more pulls may be necessary to start some engines.

## 3 After the engine starts

1. Let it warm up for a minute or two, adjusting the choke to keep the engine running smoothly.
2. Open choke fully as the engine warms up.
3. Start the blade or engage power to machine.
4. If the engine is running rough, make any adjustments to the choke or throttle.



# Cool Your Engine

## Share

- Describe the steps you used to prepare your engine for starting.
- What happened when you tried to start the engine?

## Process

- Why is it important to follow proper starting procedures?
- What could happen if you didn't check the oil or the fuel?

## Generalize

- Name some other situations where it is necessary to follow procedures.

## Apply

- What is something you did that would have worked better if you had a planned procedure to follow.



1. Visit a small engine shop to study the two types of starters. Are some more common than others?

2. Try to start each of the two types of starters. Which is the easiest to use?

## Manual Moment

Compare this procedure with the owner's manual. Describe any differences in your procedure and the owner's manual.

## Pit Stop

### Types of Starters

When starting an engine, you are rotating the engine crankshaft. The crankshaft converts the power from the engine. It drives the mower blade, other cutting devices and the wheels.

Two types of **starters**

- **Recoil/rewind starting system**

Mechanical starter that usually consists of a rope, pulley, and a return spring to manually rotate the crankshaft to start an engine.

- **Electric system**

A group of electrical components, including a starter motor which is activated by the operator to rotate the crankshaft when starting the engine.

With a rope rewind starter, the most effective cranking occurs if you pull briskly. Your engine should start after two or three attempts. If not, refer to the section on troubleshooting in your owner's manual.

### Starting a cold engine

When an engine has not been operated for more than 15 minutes, the engine is considered to be cold. In order to start it, a rich air-fuel mixture is needed. The rich mixture can be created by choking the engine which restricts the flow of air into the engine or by priming the engine. When the operator primes an engine, fuel is sprayed into the air passage in the carburetor. Because of the extra fuel, the air and fuel mixture more readily ignites and black smoke may be seen coming from the engine when starting.



## Caution Corner

- Clean grass and dirt from the mower.
- Make sure all **safety shields** or guards are in place.
- Make sure all objects are cleared away before you start mowing.
- Wear safe clothing (boots, jeans, long hair pulled back, and no loose-fitting clothing that can catch in moving parts).
- Make sure no one is in the path of the discharge chute when starting the engine or using the mower.

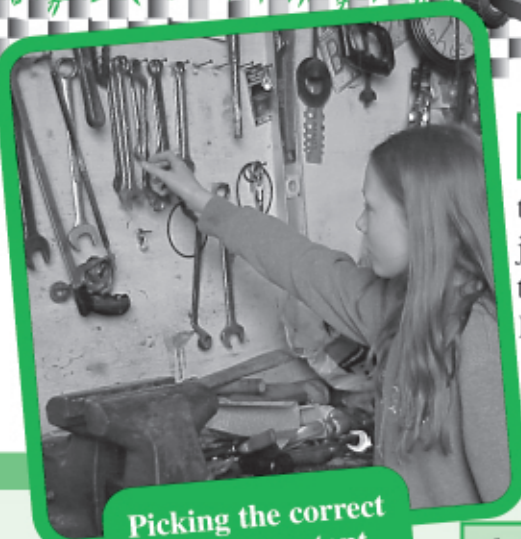
# Time for Tools

<b>Life Skill:</b>	Locating and using resources
<b>Small Engine Skill:</b>	Identifying tools used with small engines
<b>Education Standards:</b>	NS.K-4.1 – Science as Inquiry
<b>Success Indicator:</b>	Identify tools used to maintain and repair small engines.
<b>Toolbox:</b>	See list below



## Warm Up!

What would you do if you had to do your homework without a pencil, pen or computer? What if you tried to eat your dinner without a fork? There are proper tools for every job, including working with small engines. You may have seen some of these tools around the house or shop. Research the tools you will need. If you don't have a tool you need or cannot afford to buy it, see if you can borrow the tool from your helper. Because tools are expensive, be sure to check out the "helpful buying hints" in the Pit Stop section.



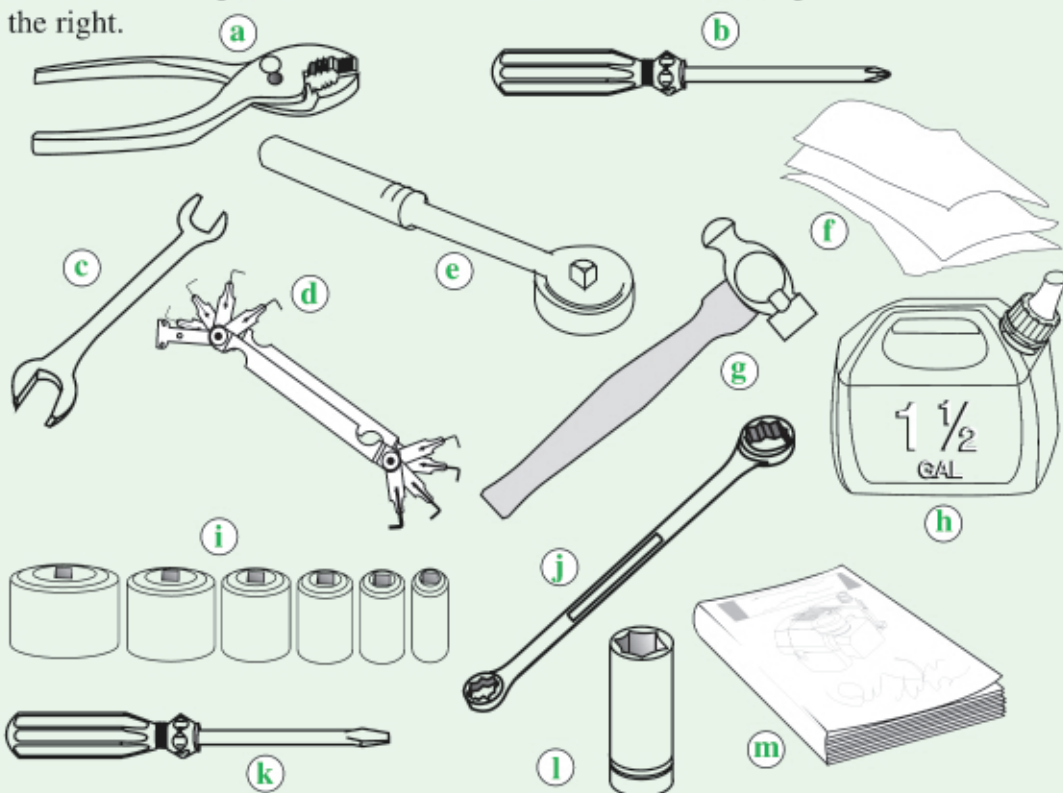
Picking the correct tool is important.

## Throttle Up!

Tools come in all shapes and sizes. Pictured below are basic tools commonly used for small engine maintenance and repair. Match the name at left with the correct picture on the right.

## Tool Matching Game!

- \_\_\_ Socket wrench, ratchet
- \_\_\_ Socket set
- \_\_\_ Screw driver (blade and Phillips)
- \_\_\_ Hammer
- \_\_\_ Spark-plug socket
- \_\_\_ Pliers
- \_\_\_ Open-end wrench
- \_\_\_ Box-end wrench
- \_\_\_ Feeler gauge, wire
- \_\_\_ Rags
- \_\_\_ Container for gasoline and oil storage
- \_\_\_ Owner's manual



Go to the place where the tools are stored in your home. Using the pictures of the tools above, circle the tools you have. Put an "X" by the ones you may need to borrow or buy in the future.



# Cool Your Engine

## Share

- Which tools were the hardest to identify in the Tool Matching Game?
- Which tools do you already have at home?

## Process

- How did you find the names of the tools that you didn't know?

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## Generalize

- What other times have you used a small engine manual as a resource?

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## Apply

- What other times is it important to use resources to correctly identify something?

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## Manual Moment

Check to see if you need **English** or **metric** tools to service your engine.



Explore more at

[www.4-hcurriculum.org](http://www.4-hcurriculum.org)

National 4-H Curriculum

Pit  
Stop

## Buying Tools

### Helpful Hints

- Look for tools with a **warranty**
- Evaluate the craftsmanship of the tool
- Look for tools that come in sets  
They are usually a better deal.

### Taking Care of Tools

- Put your tools in a tool box or on a peg board to keep them organized
- Be sure your tools are clean before you put them away.

Race  
Ahead

1. Visit a hardware store to study the many different types of tools available to repair small engines. Were you able to identify all of them?
2. Visit a small engine repair shop to see how the many tools are organized.
3. Talk to someone who uses tools for a living for advice on the proper care of tools.
4. Design an area to properly store your tools at home.

## Caution Corner

- Each tool has a purpose and it should only be used for that purpose.
- Properly dispose of used rags.