SMALL ENGINES

Project Guide

CANADA
4-H Alberta

The 4-H Motto

"Learn To Do By Doing."

The 4-H Pledge

I pledge

My ***HEAD*** to clearer thinking,
My ***HEART*** to greater loyalty,
My ***HANDS*** to larger service,
My ***HEALTH*** to better living,
For my club, my community and my country.

The 4-H Grace

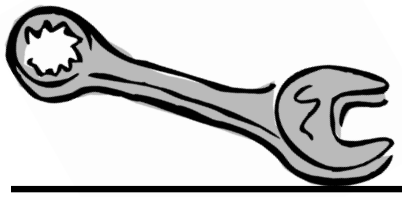
(Tune of Auld Lang Syne)

We thank thee, Lord, for blessings great
On this, our own fair land.
Teach us to serve thee joyfully,
With head, heart, health and hand.

Developed by

Elizabeth Webster, M.Ag.

printed August 1999



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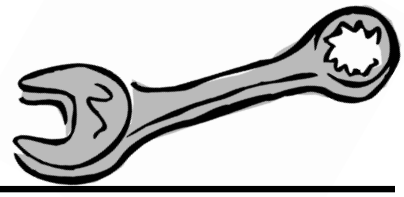

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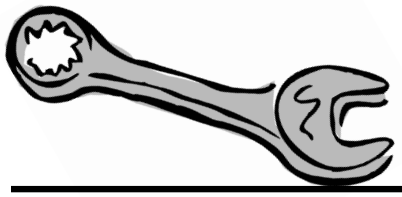

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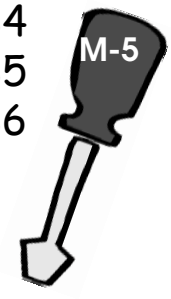
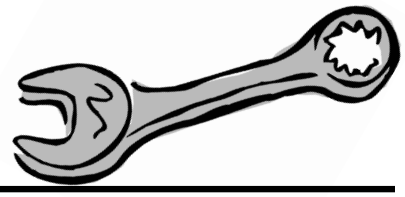
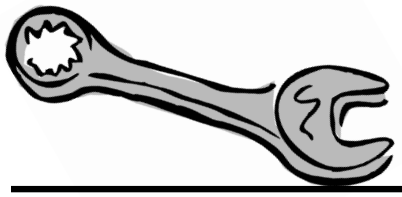






Member Information

Member's name _____ Year _____

Address _____

Postal Code _____ Age _____ Birthdate _____

Name of Parent or Guardian _____

Name of Club _____

Name of Club Leader _____

Name of 4-H Region _____

Number of Years in 4-H ☐ Number of Years in Project ☐

Project Information

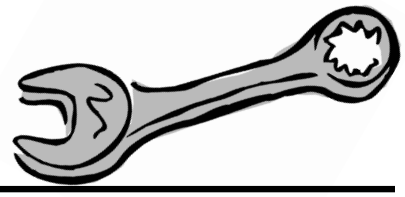
Type of Engine (if one is owned) _____

_____

Model Type and Serial Number _____

_____

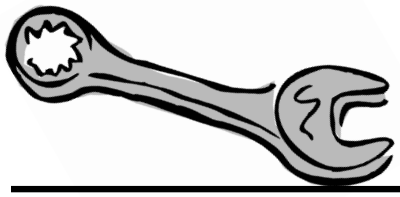
Cost _____



Objectives

The club member will:

- gain knowledge in operation, care and maintenance of small engines
- develop and demonstrate safe work habits
- gain knowledge and skill in use of tools and chemicals related to small engines
- demonstrate proper care and maintenance of a work area
- develop skills in leadership, problem-solving, communication, planning, assessment, decision-making, evaluation, money management and time



To Get The Most From This Project

- Attend regularly. You won't miss important information, shop time or fun.

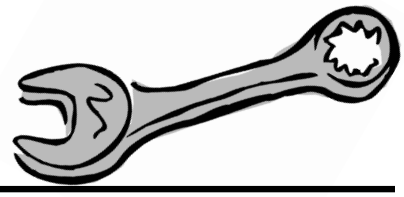
- Listen, then ask questions. You will learn from other members as well as your leaders.

- Work on your small engine regularly so you become familiar with it and the tools required. Your skill will grow.

- Keep organized. Keep parts together. Label tools.

- Take pictures of your engine, before, during and after working on it. Pictures are good records.

- Keep simple records as you go along. Jot notes in a pocket size notebook as you work. Transfer important material to your project record book.



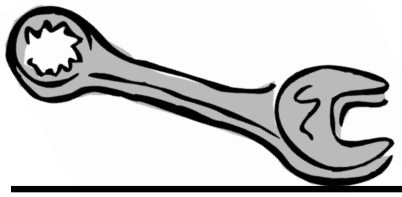
To Get The Most From This Project

- Work safely. If you hurt yourself or another person all the fun stops.

- Let your parents know what you're working on. They might be able to help or encourage you.

- Ask for help if you need it. Offer help when you can.

- Be patient with yourself and others. We are all learning.



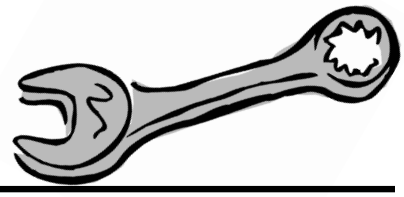
Observation - Your Most Important Tool!

What can you see?
What is missing?

- is it running?
- smoke - volume, colour?
- cracks?
- worn or missing parts?
- any parts discoloured by heat?
- how good a job is it doing?

Listen

- is it rough, smooth, intermittent?
- varying?
- vibration?
- is something hitting?



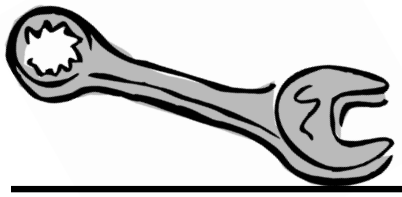
Observation - Your Most Important Tool!

Feel

- vibration, roughness?
- power level?
- heat?
- grit in the oil?

Smell

- exhaust?
- leaks?
- burning?



Tips From Other 4-H Members And Leaders

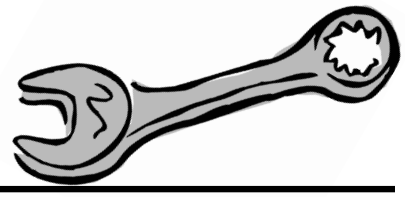
- Always take old parts with you when ordering or picking up new parts

- Lay parts out in order of disassembly and keep them in order. We use numbered zip-lock bags and put only a few parts in each bag.

- Draw a sketch of an assembly before or while you're working on it. This will help when you put it back together. It will also help develop your observation skills.

- Cut open a large cardboard box and flatten it to protect the garage or shop floor.

- If a Phillips screw is extremely tight, put a bit of valve lapping compound on the screwdriver tip. It'll grip better.

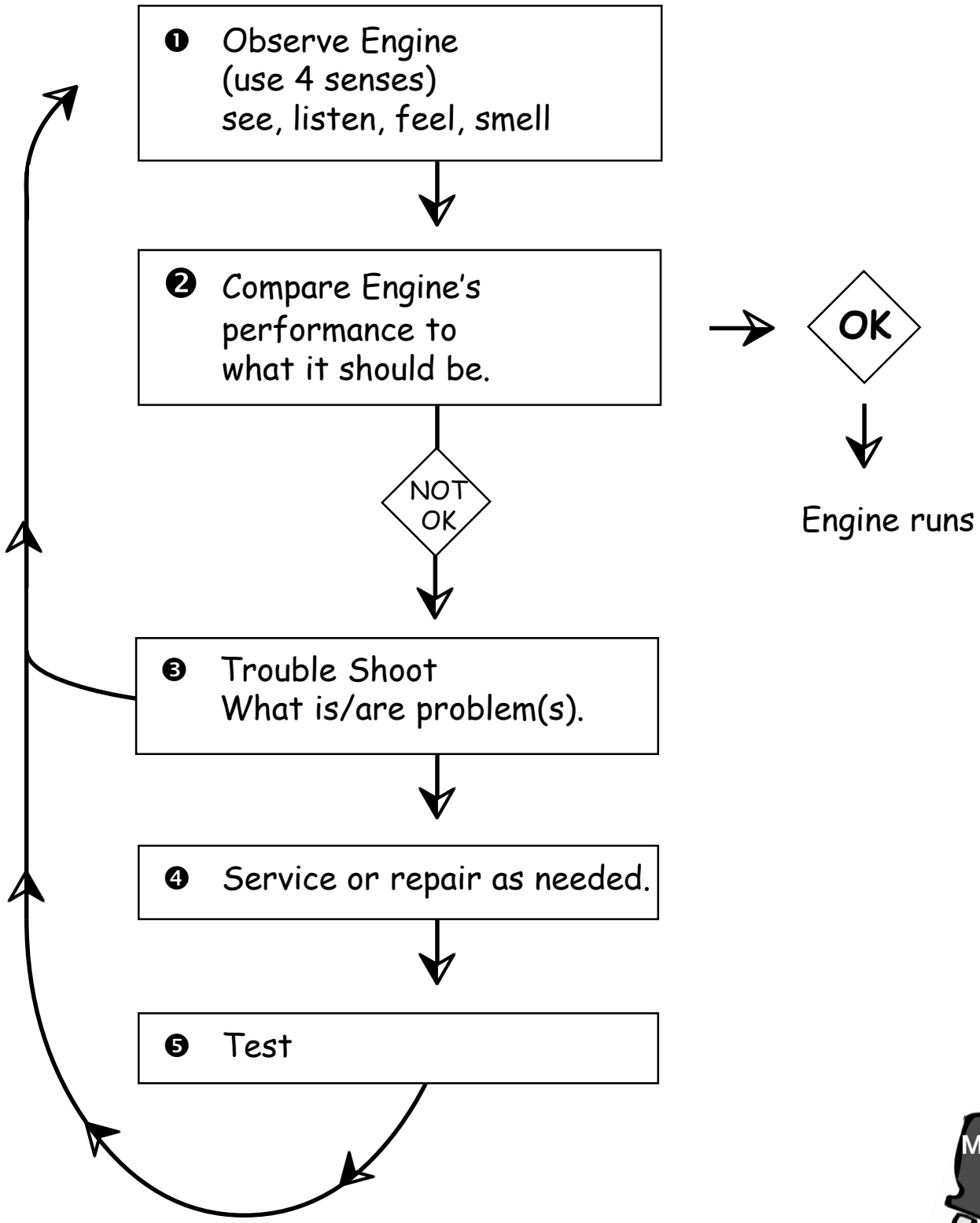


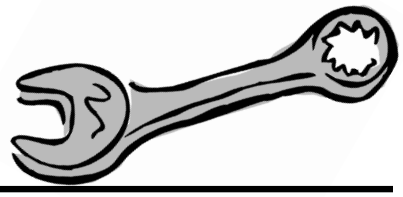
Tips From Other 4-H Members And Leaders

- Use an old muffin tin to keep nuts, bolts, washers or tiny parts together. You can label the contents with tape if necessary.

- Test the simplest and most probable cause of trouble first. Most small engine service and repair jobs can be done without taking the whole engine apart!

Working on a Small Engine





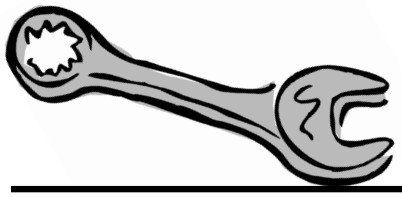
Achievement Day Requirements

Many of the requirements for Achievement Day are met during the club year. E.G. member explained and demonstrated how to clean an engine. Initial the member's records at time of completion.

Achievement Day can be a "Recognition/Celebration Day" if checking of work and records is done regularly during the year. Checking of record books could be done by a parent helper who knows what the requirements are.

Junior

1. Attends and participates in at least 70% of all club activities.
2. Displays completed records for meeting attended.
3. Displays engine (clean) worked on during year.
4. Scores a pass on safety quiz/questions administered by leaders or other adults.
5. Correctly identifies at least five tools displayed.
6. Differentiate between two and four cycle engines.



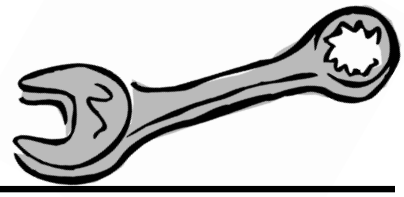
Achievement Day Requirements

Intermediate

1. Attends and participates in at least 70% of all club activities.
2. Displays completed records for meeting attended.
3. Displays engine (clean) worked on during the year.
   Answers questions regarding work done on engine.
4. Display/exhibit/poster of hazards in the work place, emphasizing accident prevention.
5. Identifies correctly at least 10 tools displayed.

Senior

1. Attends and participates in at least 70% of all club activities.
2. Thorough record of year's work on a small engine including: before and after photos, settings, record and costs of work done, hours, performance of engine.
3. Display and answer questions about small engine worked on.
4. Exhibit of at least five worn or damaged parts, labelled as to cause of damage and the preventative maintenance or care recommended.



Resources for Learning

People

- farmers
- parents
- local small engine repair people
- former 4-H'ers

  (especially those in related field of study or line of work)
- mechanics
- oil field workers
- people who use a lot of small engines in the community

Places and Organizations

- agricultural societies, exhibitions
- colleges, universities
- museums
- private industry
- snowmobile clubs

Resources for Learning

Things

- magazines, books, newsletters
- owners' manuals
- advertisements
- comics and cartoons
- video tapes
- catalogues
- sales displays

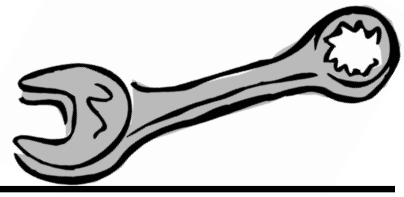
Web Sites and News Groups

1. Briggs & Stratton

   http://www.BriggsandStratton.com/

2. Kohler Engines page.

   http://www.kohlerco.com/powersystems/engines/index.html



3. Tecumseh Engines page.

   http://www.tecumseh.com/engines.htm

4. Jacks Small Engines & Generator Service, LLC. Web Div.

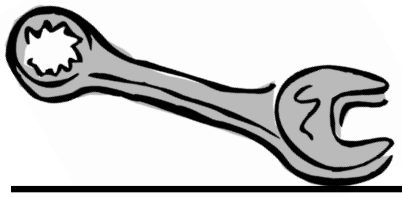
   http://www.jackssmallengines.com/index.htm

   "the largest online lawn mower & generator parts supplier"

Jokes

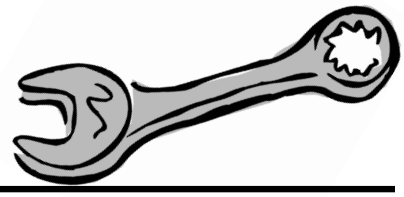
Q. What do you serve at a 4-H Small Engines party?

A. Nuts and Bolts.

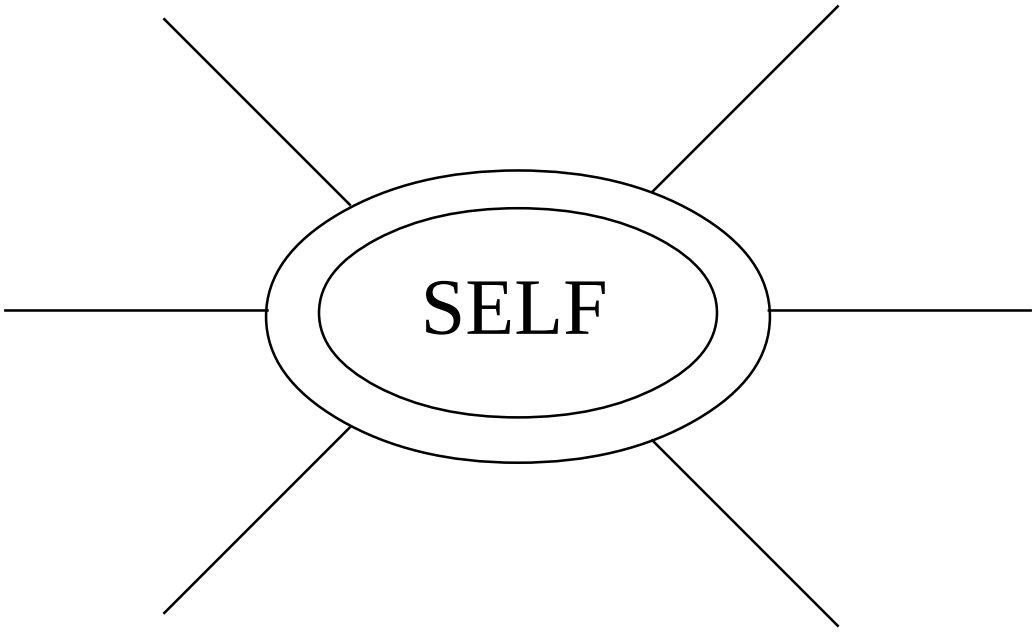


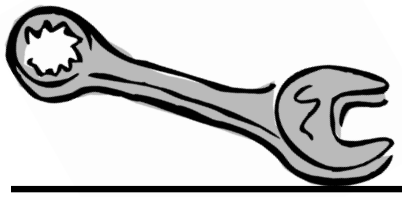
Safety in the Small Engine Project

At Risk	Risk	Preventative Action
Back	- lifting too much - falls - lifting incorrectly - turning incorrectly - trying to catch a falling, heavy object	
Ears	- exposure to loud noises	
Eyes	- splashes - dust, flying objects - fumes, smoke - struck - tools slipping or bouncing toward eyes - flash/heat - compressed air used improperly	
Lungs	- dust - fumes from cleaning agents, exhaust, fuel - flash/heat from fire/explosion - carbon monoxide poisoning - inadequate ventilation	
Skin, Limbs, Hands, Feet	- exposure to fuel, solvents, battery acid - rips, punctures from sharp, rough edges - rips, punctures from tools - burns from hot parts - electrical shock/burn - crushing - heavy tools or engines - punctures - debris thrown up by machine - punctures - pressurized air - cut - lawnmower blade	



Who does an unsafe worker affect?

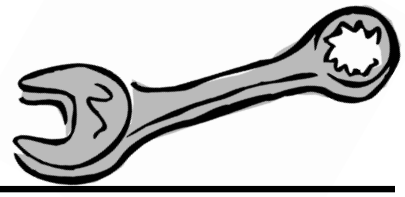




Safety Steps

1. Name the risks.
2. Safeguard the work area.
3. Wear necessary protective equipment.
4. Use the right tools.
5. Follow correct procedure.
6. Monitor work habits.
7. Correct as necessary.

*Ensure all adult helpers follow safe procedures.



Safety Contract

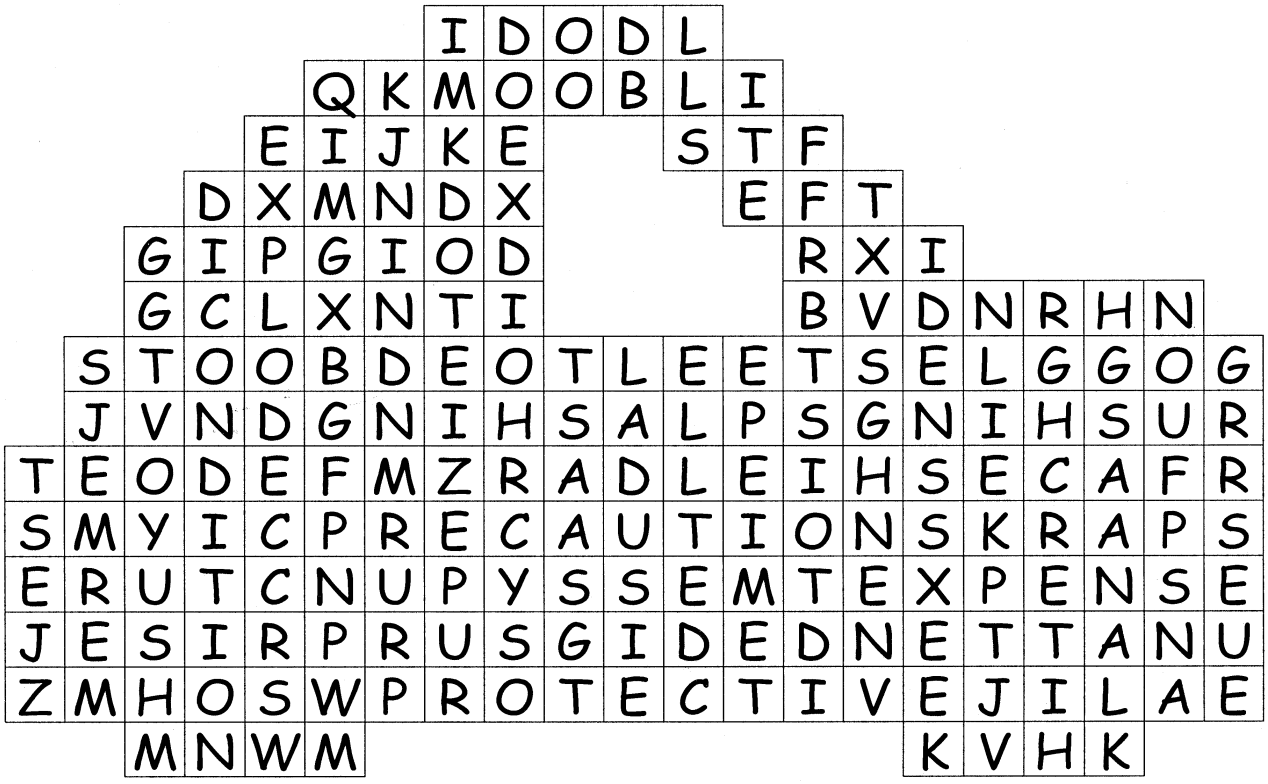
I will:

- ☑ identify risks of activities
- ☑ take actions to eliminate or reduce risk
- ☑ ask for help when needed
- ☑ select the correct tools, equipment and materials for the activity
- ☑ watch for and allow for proximity of other people
- ☑ stop work and move back when asked to
- ☑ exit work area on command (in case of emergency)
- ☑ return tools and supplies to storage after use
- ☑ follow safe disposal procedure
- ☑ dress appropriately for club activities
- ☑ share responsibility for safety in the club

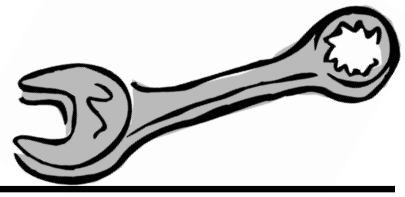
_____ _____ _____

Member Leader Date

Safety #1 - Word Search



condition
expense
explode
faceshield
gloves
goggles
lifting
messy
monoxide
observe
precaution
protective
puncture
rushing
sparks
splashing
steel toed boots
surprise
time
unattended
ventilation



Safety #2 - Word Search

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

brain
burns
chemicals
corrosive
decision
explosion
facemask
gloves
helping
lifting
monoxide
observe
prevention
projectile
punctures
rushing

Safety Logos

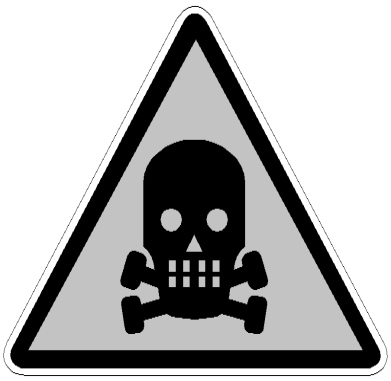
flammable

explosive

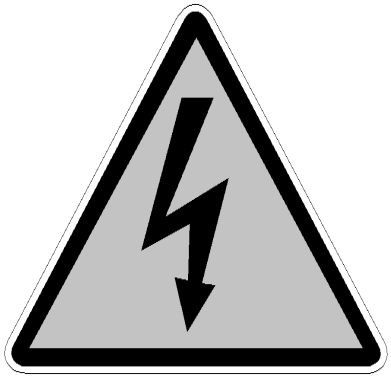
corrosive

crushing hazard

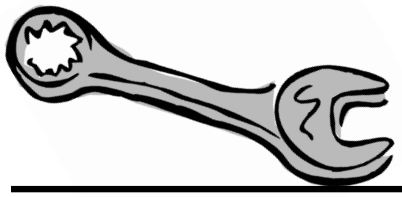
Safety Logos



poison



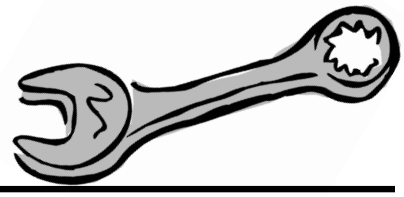
electrical hazard



PROTECT YOURSELF

Protect your **BACK**

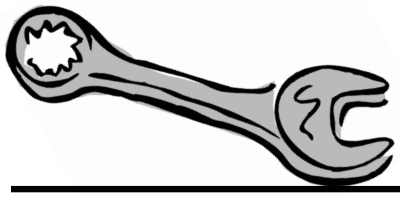
Protect your **EARS**



Protect your **EYES**

Protect your **LUNGS**

Protect your **SKIN, HANDS, FEET**



Safety Tips for Using Tools

- Pull on a wrench rather than push it. You can hurt yourself if it slips. If you must push, push with an open hand to avoid scraped knuckles.

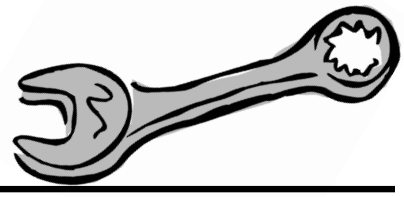
- Clean all tools. Greasy tools slip and cause accidents.

- Store tools carefully. Damaged tools are dangerous.

- Keep long hair, clothing, jewellery and body parts away from equipment and tools.

- Use the right size tool for the job.

- Use the correct tool for the job. (E.G. do not use a screwdriver as a pry bar)

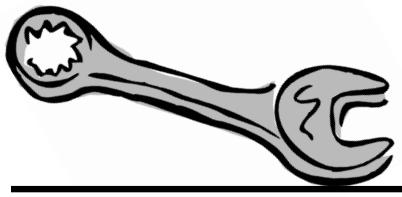


Safety Tips for Using Tools

- Safety goggles or a face shield will protect your eyes from dust, chunks, caustic materials and compressed air.

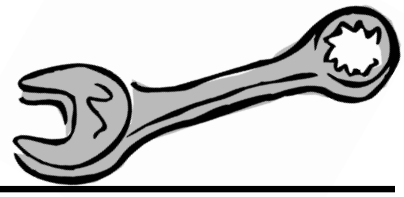
- Grind off mushroomed tops on chisels.

- Replace or repair a tool as soon as it shows signs of wear.



How Small Engines Work Checklist

	Leader's initials/date
Intake, compression, ignition, exhaust = one cycle	
Name the differences between four cycle and two cycle engines	
Identify a two cycle engine	
Identify a four cycle engine	
Classify your engine as a two cycle or four cycle engine	
List safety risks with small engines	
List safety practices with small engines	
Name three crankshaft positions	
Name types of machines that use small engines	
Explain how to mix fuel for a two cycle engine	
Locate ports (two cycle)	

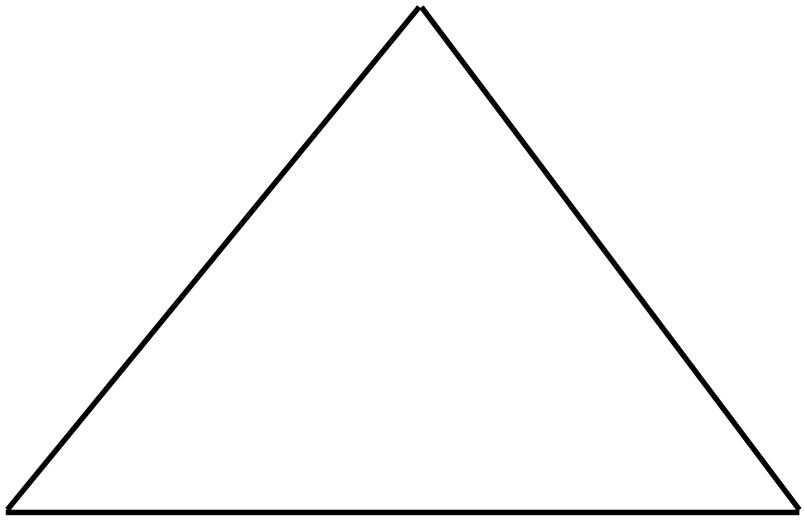


What Does An Engine Need To Run?

How Small Engines Work

Fuel and air mixed

in correct proportions.



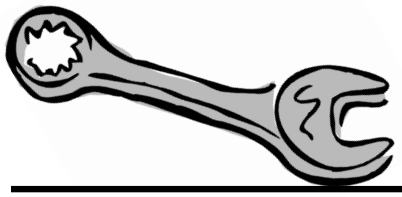
Compression of the fuel/air mixture.

Ignition at the right time.

Remember this when troubleshooting an engine that won't start.....

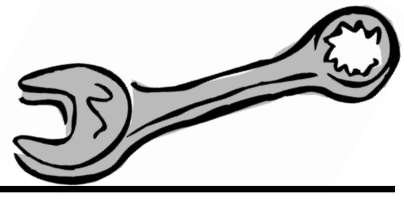
Check in this order:

1. **compression**
2. **ignition**
3. **carburetor**



Differences Between a Two and Four Cycle Engine.

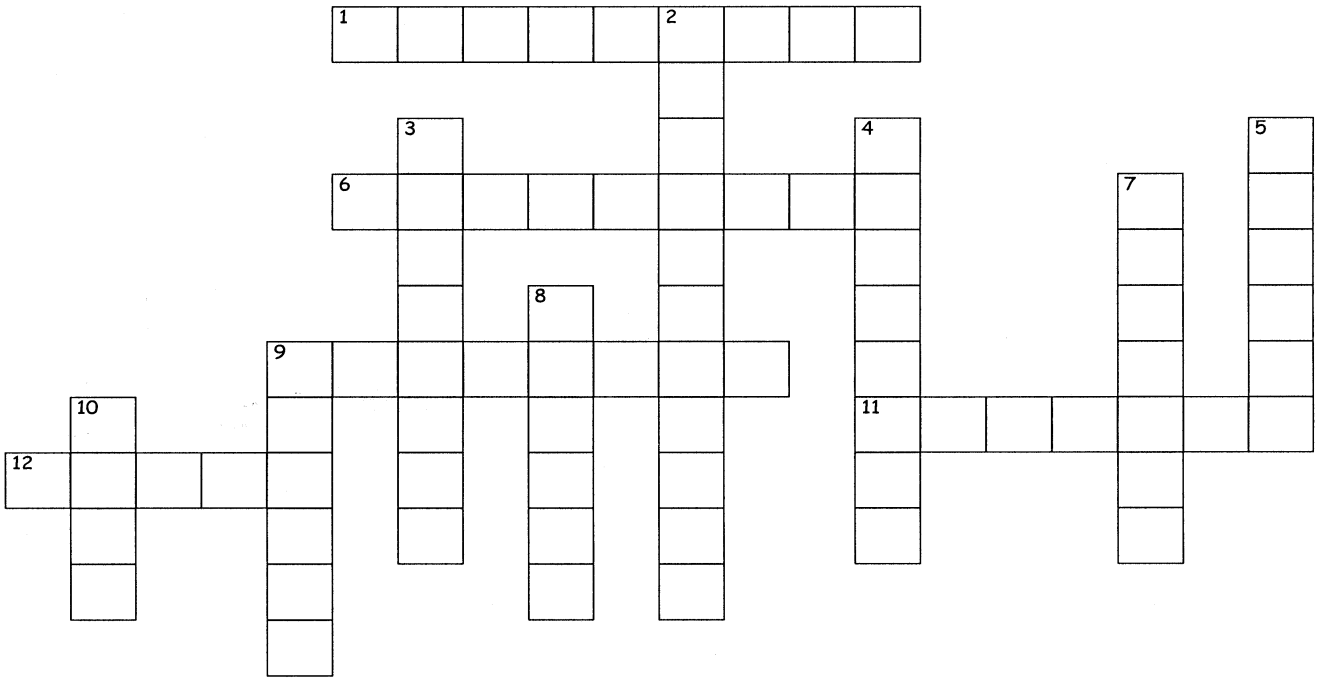
	Two Cycle Engine	Four Cycle Engine
Fuel		
Oil		
Muffler		
Number strokes per crankshaft revolution		
Method of getting fuel/air mixture in combustion chamber and burned gases out		
Number moving parts in the engine		
Weight		
Size		
Pollution		
Camshaft		



Differences Between a Two and Four Cycle Engine.

	Two Cycle Engine	Four Cycle Engine
Sound		
Initial Cost		
General Maintenance		
General Operating Efficiency (hp. wt. ratio)		
Number of major moving parts		

How Small Engines Work - Crossword Puzzle

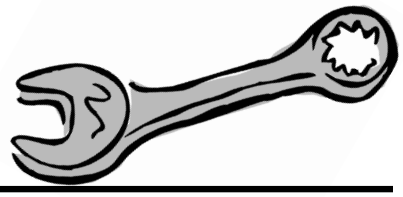


Across

1. A hard, brittle material, like china.
6. A double-hinged connector.
9. The end.
11. Hot, dirty, used air.
12. Strength.

Down

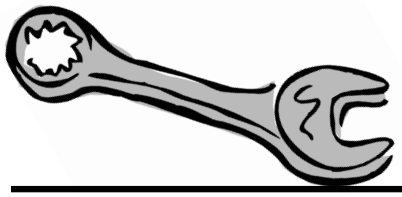
2. Oil provides _____.
3. Not external.
4. Attaches to crankshaft.
5. Flat piece of material that reduces leaks.
7. An oil/gas blend or _____.
8. Moves inside cylinder.
9. Turning force.
10. Opening.



How Small Engines Work - Word Search

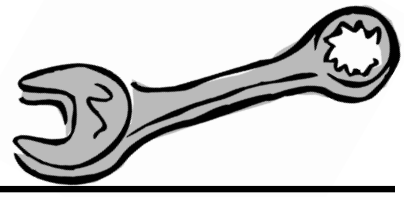
					P	E	Z	H	J										
				V	B	H	T	X	E	Z	L								
			H	O	I	J	I			X	T	N							
		H	T	B	W	U	Z				H	B	Z						
	H	S	U	R	E	Z	K					A	C	H					
	H	J	U	L	N	M	X					O	U	T	Z	G	R	K	
Y	M	B	J	V	A	L	V	E	C	O	M	B	U	S	T	I	O	N	R
M	B	G	F	J	W	N	S	C	K	P	S	J	K	S	T	R	O	K	E
V	P	U	A	J	C	J	O	R	C	R	A	N	K	S	H	A	F	T	W	W
U	M	A	C	Y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

cam
combustion
compression
crankshaft
cylinder
exhaust
intake
internal
mixture
piston
port
power
stroke
valve



Checking Compression Checklist

	Leader's initials/date
Check tightness of spark plugs	
Check tightness of cylinder head bolts	
Locate and disconnect spark plug wire	
Turn flywheel by hand until comes to compression stroke	
Quick twist to flywheel (by hand or manual starter)	
Assess compression (good/bad)	
Check for air leaks (listen)	
Inspect for hot spots	
Check condition of piston rings, cylinder walls	
If cylinder walls dry: Remove spark plug [__] Pour one tablespoon (15ml) oil into cylinder [__] Recheck compression [__]	
Check valve, cylinder, piston ring wear if compression is still low	



Ignition Troubleshooting Chart

Problem: Engine will not start.

Spark plug malfunction? ⇨ YES ⇨ Replace plug.

⇩ NO ⇩

Magneto points burned or maladjusted? ⇨ YES ⇨ Install new points and set gap.

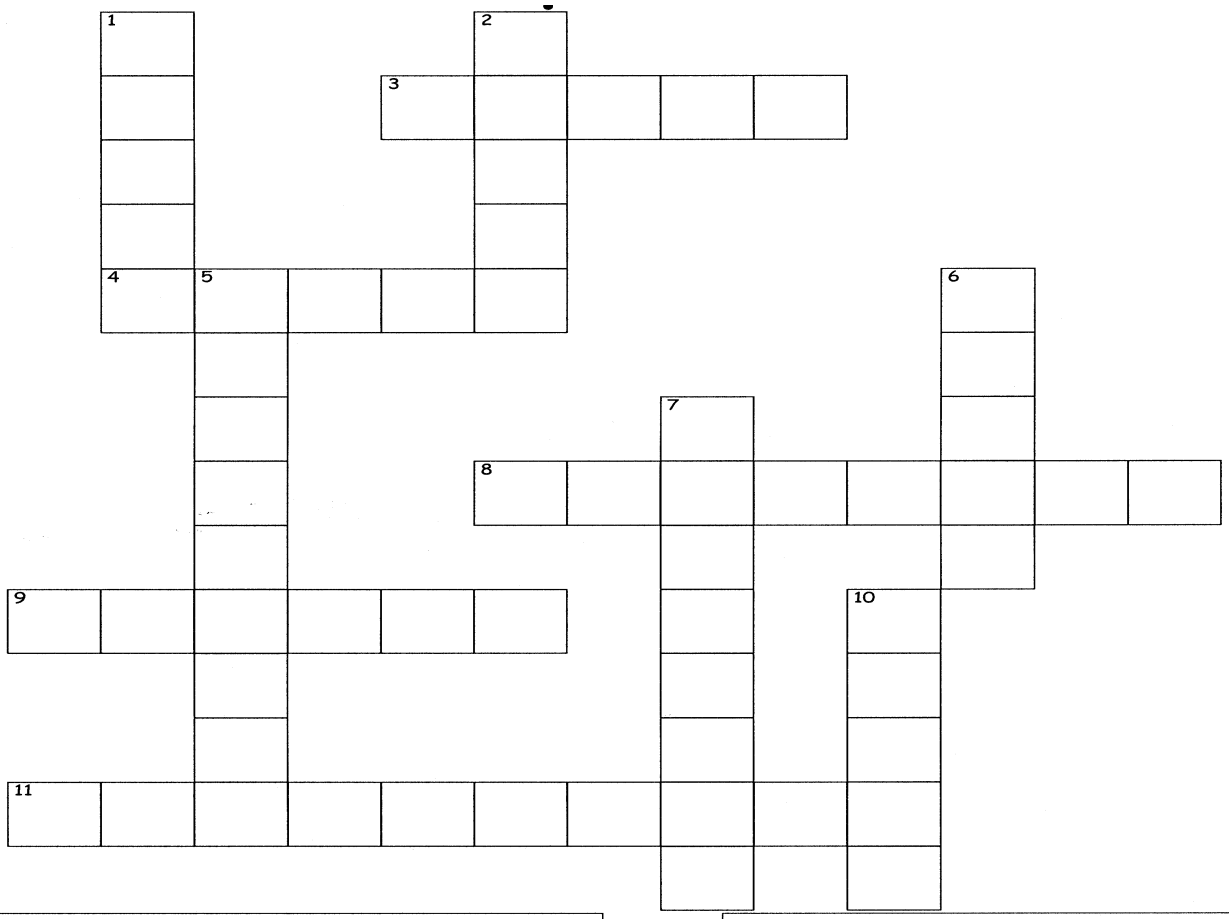
⇩ NO ⇩

Coil air gap maladjusted? ⇨ YES ⇨ Reposition coil to get correct air gap.

⇩ NO ⇩

Crankshaft key sheared or partially sheared? ⇨ YES ⇨ Replace key. Recheck ignition timing.

Compression - Crossword Puzzle

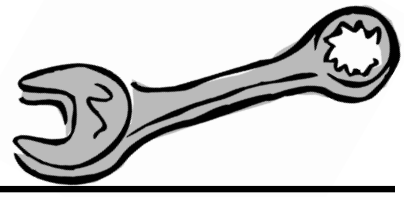


Across

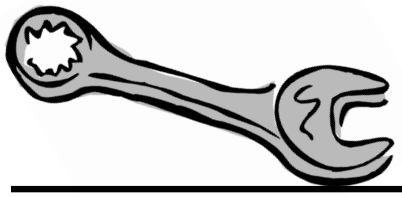
3. If these are dry, compression will be lower.
4. Good compression makes it easier to _____ your engine.
8. Turn this when checking compression.
9. The spark causes the gases to _____.
11. It is important to _____ the spark plug wire before compression testing.

Down

1. Loose cylinder head _____ allow gases to escape.
2. Use this sense to check for burned spots.
5. Check spark plug for _____.
6. Good compressions means more _____.
7. The space where the air/gas mixture is compressed is the _____.
10. Check compression every _____ hours of use.



Notes

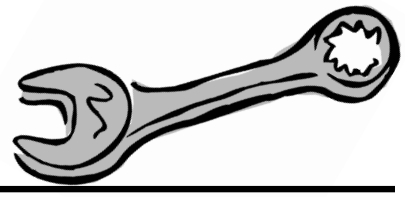


Parts of a Small Engine Checklist

Member locates and correctly identifies from a picture or an engine or a display of parts the following:

	Leader's initials/date
air cleaner	
air filter	
battery	
blower shroud	
cam	
camshaft	
carburetor	
choke valve	
cooling fins	
crankcase breather	
crankshaft	
cylinder	

	Leader's initials/date
dipstick	
exhaust port	
exhaust valve	
fylwheel	
fuel strainer	
fuel tank	
gasket (various)	
idle-mixture adjustment valve	
ignition switch	
jets	
manifold - exhaust	
manifold - intake	



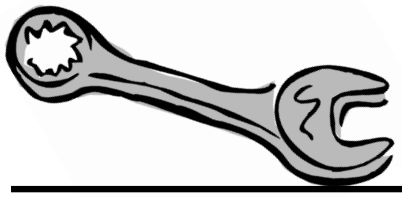
Parts of a Small Engine Checklist

	Leader's initials/date
muffler	
oil filter plug	
oil filter	
oil sump	
piston	
piston rings	
sediment bowl	
spark plug - entire	
spark plug - electrodes	
speed control lever	
starter - electric type	
starter - rope rewind type	
starter - rope wind type	
starter - windup type	
throttle linkage	

	Leader's initials/date
valve - butterfly (throttle)	
valve - carburetor	
valve - crankcase breather	
valve - fuel shutoff	
valve - reed type	
valve springs	
venturi	
wing nut	
wire bail	

By the end of the club year, members must identify the number of parts for their level.

Junior Members **10 parts**
Intermediate Members **20 parts**
Senior Members **30 parts**

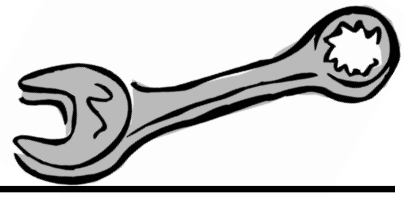


Nameplate Checklist

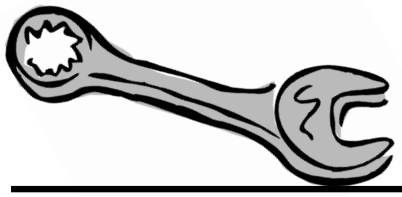
	Leader's initials/date
Locates nameplates on three different engines	
Finds make of engine/name of manufacturer	
Finds model number or engine name	
Finds serial number	
Finds type number	
Finds specification number	
Transfers above information accurately and neatly into records	
Uses chalk to bring out the numbers on an old nameplate	

Owner's Information Form Checklist

	Leader's initials/date
Completes accurately and neatly	
Stores in record book	



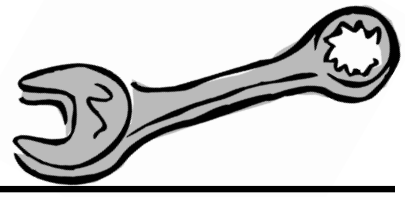
Notes



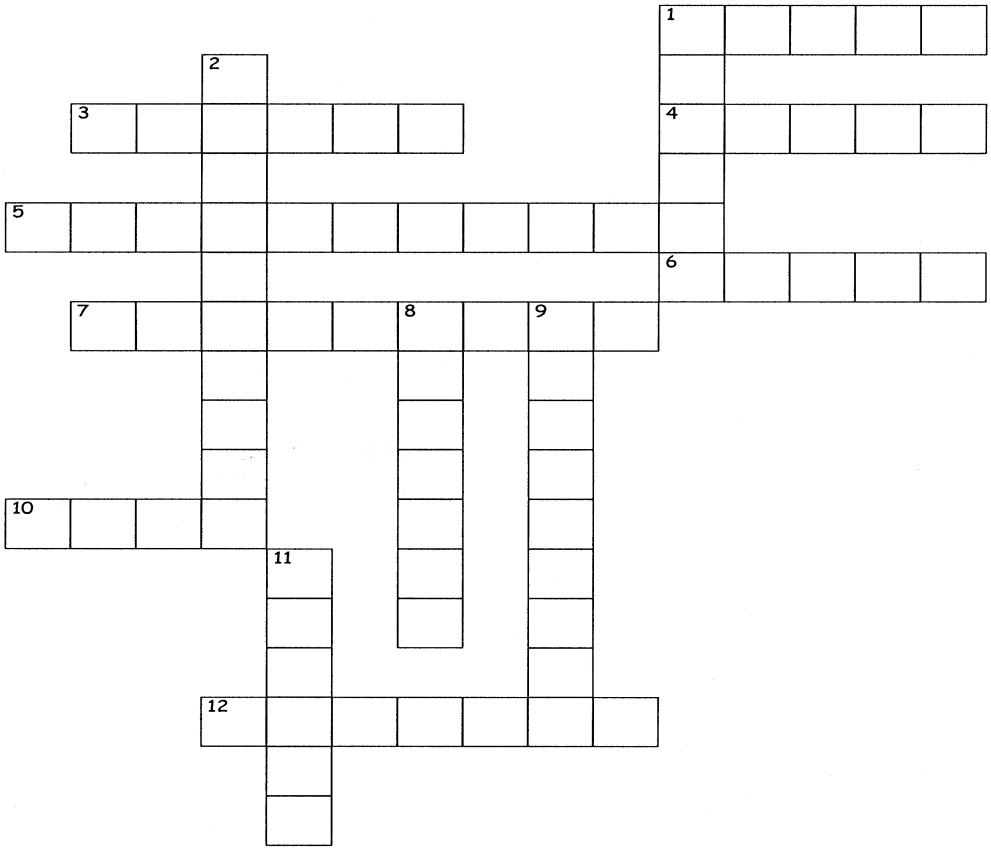
Care and Handling Checklist

Members whose engines are not yet running, will be able to explain what proper care and handling is. Members whose engines and machines are operating should be demonstrating proper care and handling.

	Leader's initials/date
Protects engine from damage in travel to and from meetings	
Cleans engine on regular basis	
Stores engine out of weather/harm's way	
Services regularly	
Checks for worn parts/leaks regularly	
Checks oil level before use (4 cycle)	
Checks for obstacles to engine (e.g. rocks or steel pins in lawn)	
Uses engine within load and speed limits (does not overload or overspeed)	
Warms engine up before applying load	
Stops engine if a problem is suspected	
Lets engine cool off before shutting off	
Steadies engine on work surface during repair or service	
Member can list/explain examples of improper care and handling	
Member can point to signs of improper car and handling	



Care and Handling - Crossword Puzzle

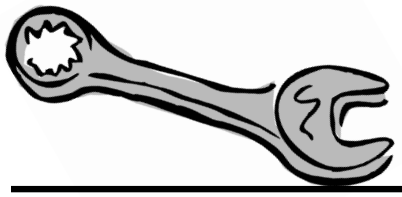


Across

1. Old gas gets _____.
3. Let your engine _____ before applying a load.
4. Adjust your _____ according to the terrain.
5. Regular _____ will help your engine last.
6. Use proper _____.
7. Before you mow, check the lawn for _____.
10. Don't let _____ get into the engine.
12. Reduces noise.

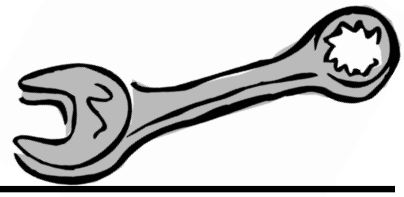
Down

1. Don't blow a _____.
2. A lawnmower has a vertical _____.
8. Provide for _____ before shutting down.
9. Repairs can be _____.
11. Refer to your operator's _____.



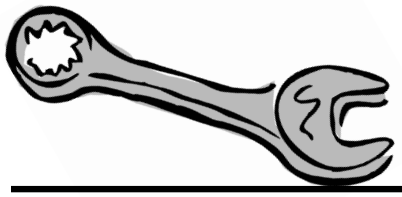
Cleaning - A Generic checklist

	Leader's initials/date
Name two benefits of this cleaning	
Identify potential risks, if any	
Take steps to reduce or eliminate safety risks	
Wear appropriate protective gear	
DO NOT CONTINUE UNTIL THESE STEPS ARE COMPLETE	
Visual inspection	
Use correct solutions and materials	
Recognize and correctly interpret hazard logos	
Use correct equipment, tools	
Notice and allow for proximity of others	
Use appropriate amount of force	
Ask for help if needed	
Clean thoroughly, following procedure:	
Correctly dispose of waste	
Leave work area in good condition	
Record efforts/observations	



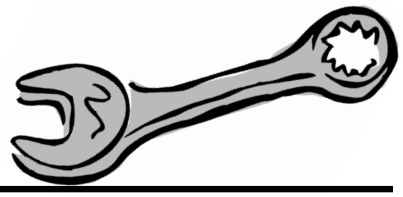
Degreasing the Crankcase Checklist

	Leader's initials/date
1. Examine for leaks	
2. Remove blower shroud	
3. a. Remove air cleaner	
b. Cover air cleaner opening	
4. Clean exhaust system	
Steps for two-cycle engine a. Remove muffler	
b. Rotate crankshaft so that piston covers the exhaust port	
c. Clean exhaust ports -wooden scraper used -no carbon in cylinder	
d. Muffler cleaned in solvent	
e. Replace muffler or engine	
f. Exhaust ports covered if engine has no muffler	
5. a. Solvent evenly applied	
b. Solvent left on 5 minutes or more	

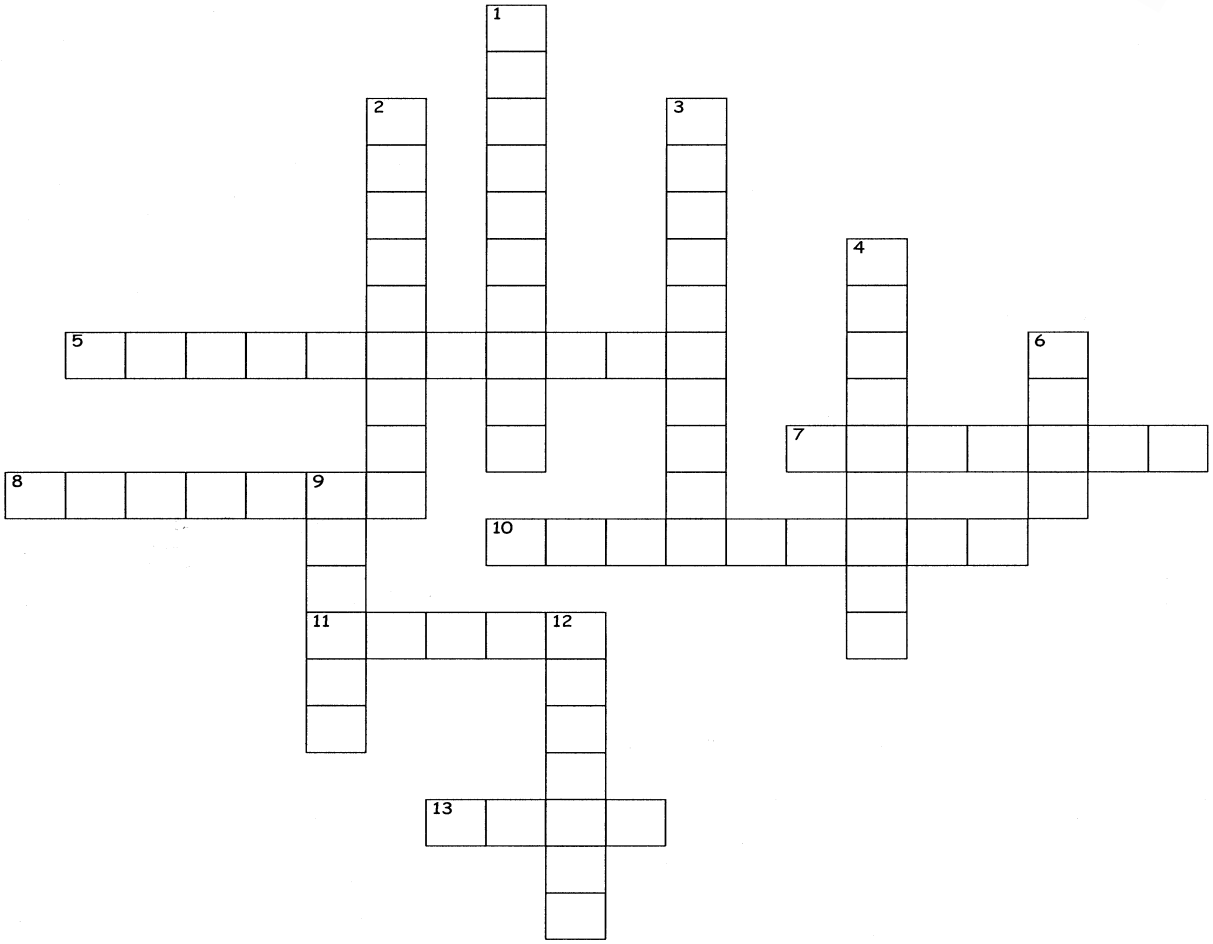


Degreasing the Crankcase Checklist

	Leader's initials/date
6. Removal of solvent -water stream used for rinsing clean (degreaser) -soap solution, rinsed clean (petroleum solvent) -clean areas that were missed by solvent	
7. Protective covers on air cleaner and exhaust parts removed	
8. Replace carburetor air cleaner	
9. Operate engine to dry or use compressed air	



Cleaning Engine - Crossword Puzzle



Across

5. To make dirty.
7. A liquid to help clean.
8. To examine carefully.
10. Rusting.
11. To keep the dust out.
13. Dispose of _____ rags carefully

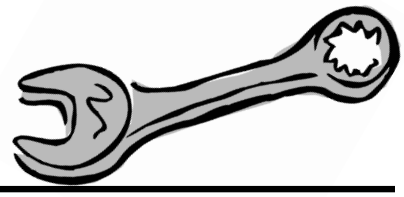
Down

1. Cleaning adds to the life _____ of an engine.
2. Tools or _____.
3. Remove dust with _____ air.
4. An eating away of material.
6. Protect your _____ when cleaning.
9. Cleaning makes it easier to find _____.
12. Cleaning should be done on a _____ basis.

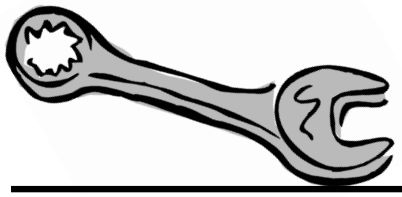
Cleaning Engine - Word Search

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

contaminate
correct
cracks
disposal
dust covers
effective
equipment
inspection
order
parts
routine
solvent
storage
timing

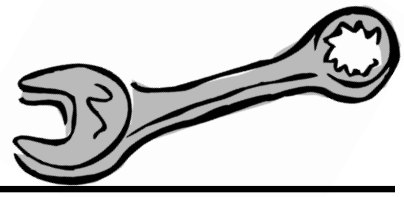


Notes



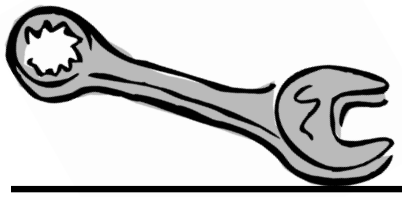
Cooling System Checklist

	Leader's initials/date
1. Removing the fuel tank	
a. Drain fuel tank	
b. Close fuel shut-off valve	
or c. Disconnect the supply tube	
d. Drain fuel tank	
2. Cover ends of fuel lines	
3. Remove the blower shroud	
5. Remove baffles and deflectors	
6. Clean shroud and baffles	
a. Putty knife used	
b. Shroud and baffles cleaned	
c. Fibre bristle brush used	
d. Screen brushed clean	
e. Screen cleaned in solvent	



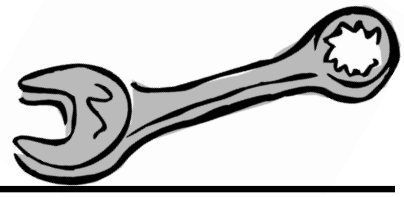
Cooling System Checklist

	Leader's initials/date
7. Clean cylinder fins	
a.. Wooden scraper used	
b. Cleanliness (excellent, good, fair, poor)	
8. Clean blower flywheel fins	
a.. Use a wooden scraper	
b. Cleanliness (excellent, good, fair, poor)	
9. Pre-assembly	
a. Blower flywheel	
b. Shroud	
c. Cylinder head baffle	
d. Cylinder baffle	
e. Blower shroud	
f. Recoil starter or screened sheave	
g. Uncover fuel line ends	
h. Fuel tank	



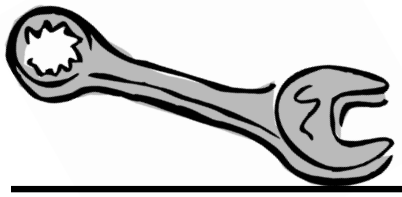
Air Cleaner Checklist

	Leader's initials/date
1. Disconnect the spark plug wire	
2. Remove air filter	
a. Clean around air filter	
b. Remove filter element cover	
c. Remove filter element	
d. Cover carburetor air intake	
3. Clean filter	
a. Polyurethane sponge in soapy water	
b. Cleanliness (excellent, good, fair, poor)	
c. Dried correctly	
or d. Metal mesh in solvent	
e. Cleanliness (excellent, good, fair, poor)	
f. Dried correctly	
g. Both types - housing brushed clean	
4. Uncovered carburetor intake	



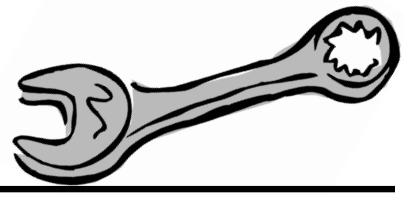
Air Cleaner Checklist

	Leader's initials/date
5. Clean carburetor intake	
a. Clean cloth and solvent used	
b. Cleanlinesss (excellent, good, fair, poor)	
c. Dip in oil	
6. Reassembly	
a. Filter element	
b. Install cover	
c. Reconnect spark plug	



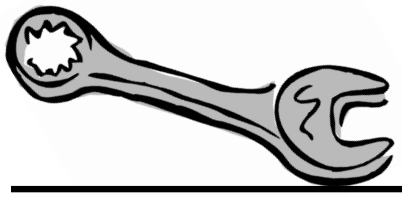
Air Cleaner Checklist

Oil Bath Type	Leader's initials/date
1. Disconnect spark plug wire	
2. Remove air cleaner	
a. Free bail wire	
or b. Remove wing nut	
or c. Unscrew cover	
3. Cover air intake	
4. Measure sediment deposit	
5. Clean parts in solvent	
a. Cup	
b. Filter	
6. Refill oil cup	
a. Correct oil	
b. Fill level (high, online, low)	
7. Assemble and install air cleaner	



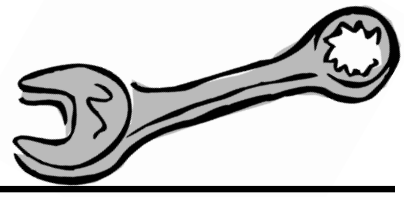
Air Cleaner Checklist

Dry Filter Type	Leader's initials/date
1. Disconnect spark plug	
2. Clean around the air cleaner	
3. Remove filter element	
a. Remove stud bolt	
b. Remove cover	
c. Cover carburetor air intake	
4. Filter element	
a. Damaged, replace	
b. Paper element - clean by tapping on flat surface	
c. Moss fibre, wash in soapy water	
5. Reassembly	
a. Uncover carburetor	
b. Clean filter cover	
c. Clean carburetor intake	
d. Replace filter element	
e. Replace cover, tighten	



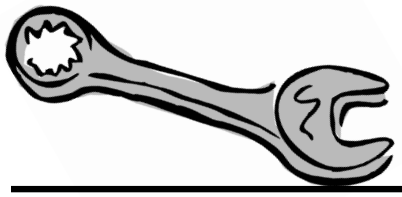
Fuel Strainer Checklist

Screen Type	Leader's initials/date
1. Disassembly	
a. Disconnect the spark plug wire	
b. Drain fuel tank	
c. Close fuel shut-off valve	
d. Fuel line removed from tank	
e. Remove fuel shut-off valve and/or fuel strainer	
2. Clean fuel strainer	
a. Use solvent	
b. Dry	
3. Assembly	
a. Replace fuel strainer	
b. No cracks or damage to fuel line or replace	
c. Replace fuel line	
d. Open fuel shut-off valve	
e. Reconnect spark plug wire	



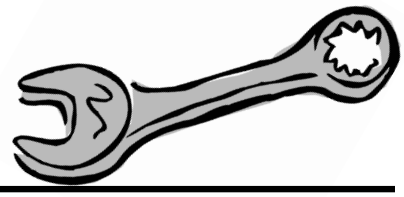
Fuel Strainer Checklist

Bowl Type	Leader's initials/date
1. Removal of the sediment bowl	
a. Disconnect spark plug	
b. Close fuel shut-off valve	
c. Loosen jam-nut	
d. Move wire bail	
e. Twist bowl free	
2. Cleaning the sediment bowl	
a. Remove gasket	
b. Remove strainer screen	
c. Wash screen in solvent	
d. Clean and dry sediment bowl	
3. Drain fuel	
a. Open fuel valve and drain one cup (250 ml) of fuel	

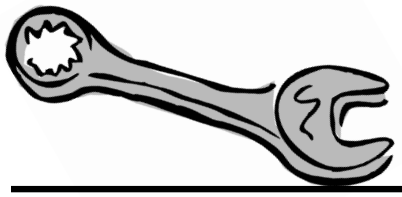


Fuel Strainer Checklist

Bowl Type	Leader's initials/date
4. Reassembly	
a. Install gasket in good condition	
b. Install strainer	
c. Install sediment bowl	
d. Fill sediment bowl	
e. Tighten jam-nut	
f. Tighten bowl against gasket	
g. Reconnect spark plug wire	
h. Operate engine to check for leaks	

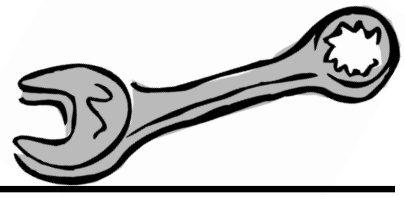


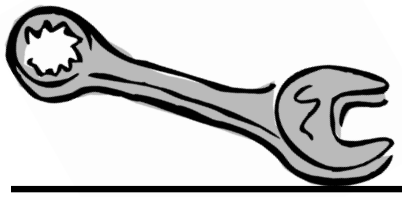
Notes



Crankcase Breather Checklist

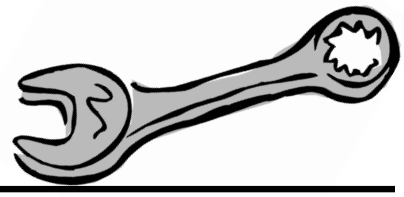
	Leader's initials/date
1. Remove crankcase breather cover	
a. Disconnect the spark plug wire	
b. Check for leaks	
c. Release breather tube	
d. Removal of other parts necessary	
2. Check breather clearance	
a. Selection of correct feeler guage	
b. Check clearance of reed valves	
c. Check clearance of disc valves	
3. Dissassemble parts in order	
4. Cleaning the breather	
a. Solvent used	
b. Rinsed clean	
c. Dried	
d. Cleanliness (excellent, good, fair, poor)	
5. Assembly	
a. Order (correct, partially correct, parts left over)	





Lubrication Checklist

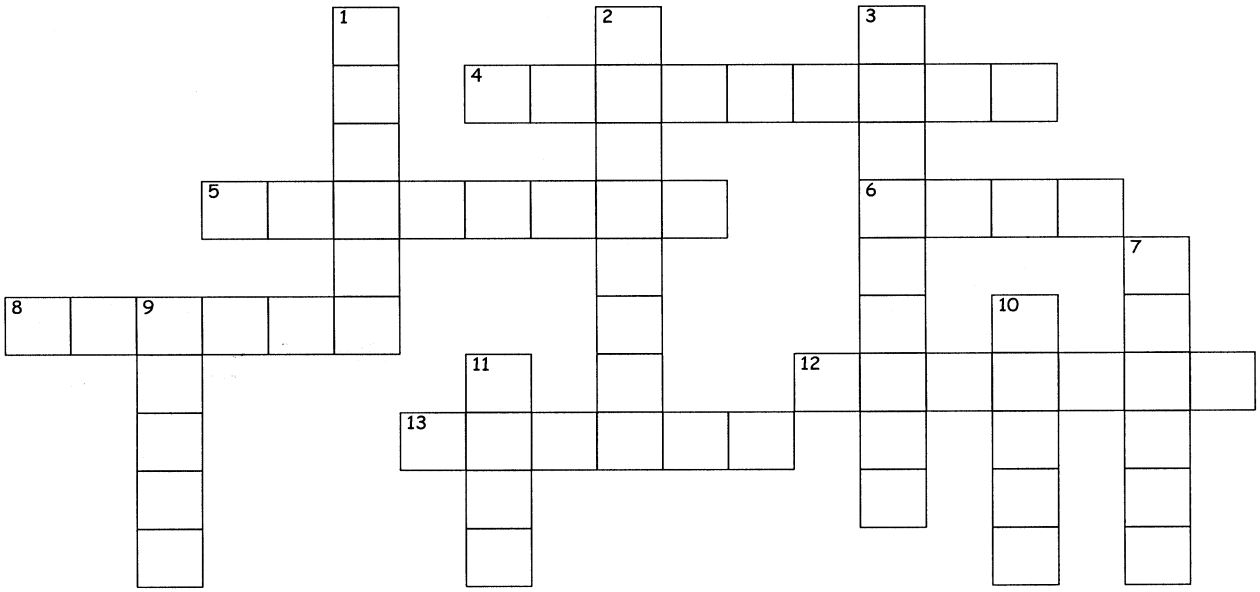
	Leader's initials/date
1. Locate oil filter	
2. Clean off filler plug or cap	
3. Remove filler plug or cap	
4. Identify presence or absence of dipstick	
5. Oil level, no dipstick (oil low, oil correct)	
6. Oil level, dipstick	
a. Remove dipstick	
b. Wipe clean	
c. Reinsert	
d. Check level (normal, low)	
7. Check oil condition	
8. Add oil (if low)	
9. Changing oil	
a. Operate engine until warm	
b. Stop engine, disconnect spark plug	



Lubrication Checklist

	Leader's initials/date
c. Locate drain plug and clean	
d. Remove drain plug	
e. Drain five minutes	
f. Replace drain plug	
g. Refill crankcase with oil	
h. Oil recommended by manufacturer's specifications	
i. Area around plug cleaned	
j. Reconnect spark plug, start engine	
k. Checked for oil leaks	
l. Stop engine	
m. Recheck oil level	
n. Destroy or clean the rags used	

Lubrication - Crossword Puzzle

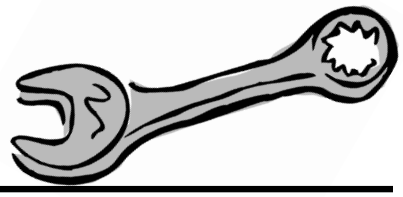


Across

4. Lubrication prevents _____.
5. Check oil levels with a _____.
6. Oil helps _____ an engine.
8. Takes dirt out of oil.
12. Two cycles use an oil gas _____.
13. Use a _____ to aid oil.

Down

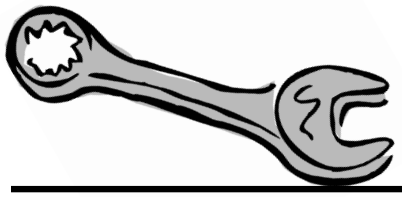
1. This splashes oil in the engine.
2. Lubrication reduces _____.
3. Thickness of a liquid.
7. Oil washes away bits of _____.
9. New gaskets prevent _____.
10. Avoid _____ slopes.
11. Oil collects in a



Lubrication - Word Search

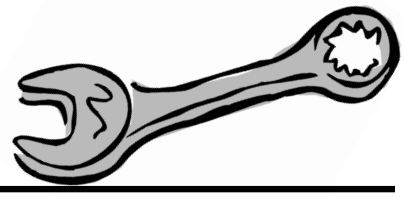
					U	B	P	X	K											
				F	V	E	N	C	X	Q	J									
			S	P	S	K	O			L	S	X								
		R	S	E	F	R	F				G	G	A							
	G	Q	R	P	R	R	D					U	N	F						
	N	V	G	O	I	Y	D					Y	U	I	I	C	S	V		
J	I	U	S	C	P	I	T	E	R	U	T	X	I	M	R	F	D	L	N	
C	L	I	T	F	P	R	B	I	S	E	L	C	I	T	R	A	P	R	G	J
E	P	O	I	N	S	U	M	P	V	S	A	B	L	E	L	U	D	E	H	C	S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

bearings
clean
cooling
corrosion
crankcase
cylinder
dipstick
friction
funnel
mixture
particles
plug
power
recommendation
rings
schedule
service
sump
viscosity



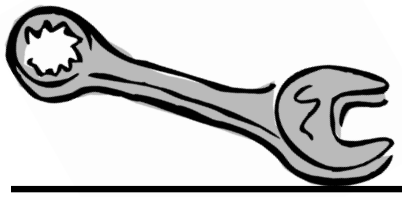
Spark Plug Checklist

	Leader's initials/date
1. Removing the spark plug	
a. Disconnect spark plug wire	
b. Loosen spark plug wire	
c. Remove dirt from around plug	
d. Correct wrench used	
e. Removed without stripping threads	
f. Gasket removed	
2. Checking the spark	
a. Reconnect the wire	
b. Ground plug to engine	
c. Crank engine	
d. Identification of spark quality	
3. No Spark	
a. Disconnect wire	
b. Hold wire 1/2 centimetre from cylinder head, crank engine	
c. Problem identification	



Spark Plug Checklist

	Leader's initials/date
4. Checking the plug	
a. Condition identification	
b. Plug selection if required	
5. Cleaning spark plugs	
a. Cleaned in solvent	
b. Dried correctly	
c. Threads cleaned with wire brush	
d. Hard deposits removed	
e. All loose material removed	
f. Electrodes filed smooth	
g. Ground electrode in original position	
6. Spark plug and spacing	
a. Proper spacing according to manufacturer's specifications	
a. Feeler guage according to manufacturer's specifications	
7. Spark plug installation	
a. Hand tighten in place	
b. Correctly tighten	
c. Reconnect wire	



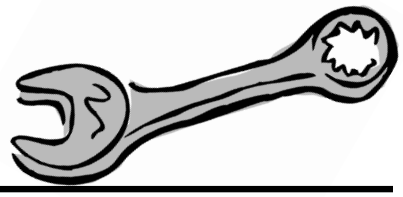
Review Checklist for Spark Plugs

	Leader's initials/date
Identify correct spark plug for a given engine	
Recall purpose of spark plug	
Identify main parts of spark plugs	
Identify engine troubles by examining used plugs	
Locate spark plug on several engines	
Handle spark plug gently	
List potential risks of servicing plugs	
Select appropriate tools for working on plugs	
Record any work done	
List three (3) causes of spark plug failure	
Find spark gap in service manual	

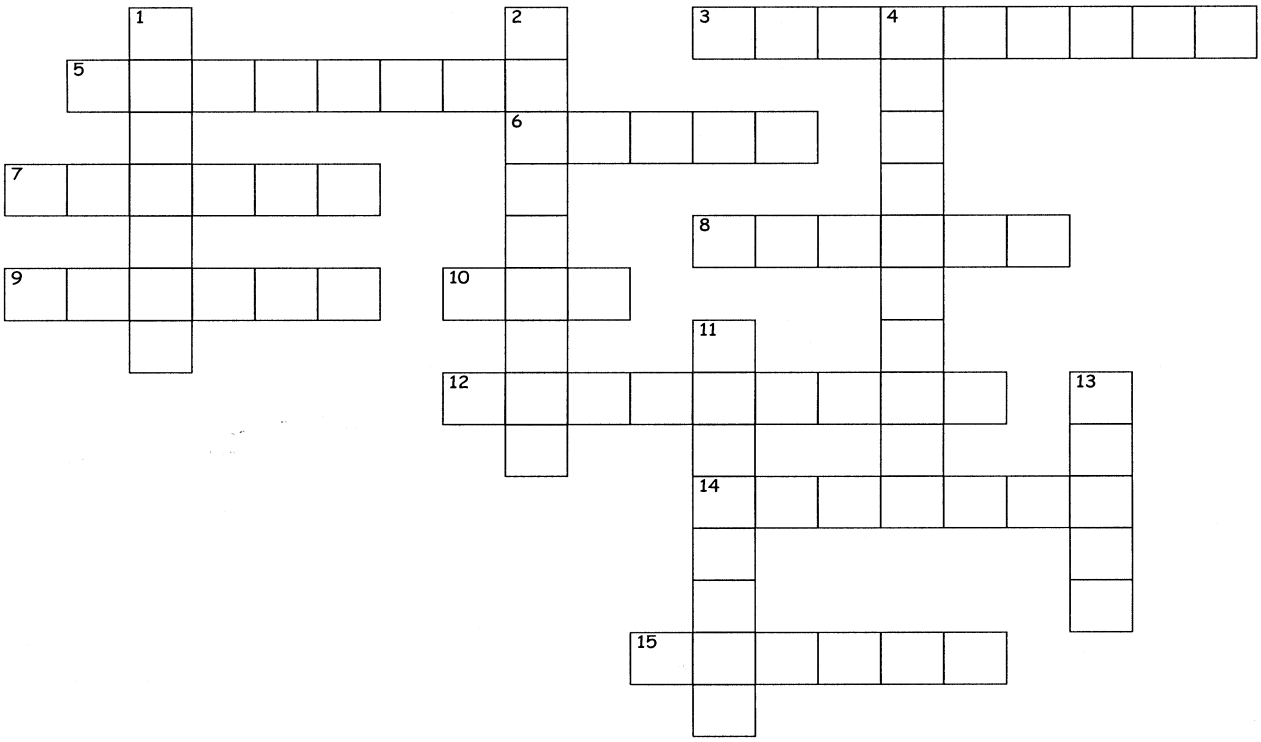
Notes: _____

_____

_____



Spark Plug - Crossword Puzzle



Across

3. A wire-like part of the plug
5. A hard, white metal.
6. Spark plugs come in different _____.
7. Black crud.
8. Electrical connection.
9. To start burning.
10. Close the _____.
12. Like china.
14. Makes an electric spark.
15. Spark plug should have one.

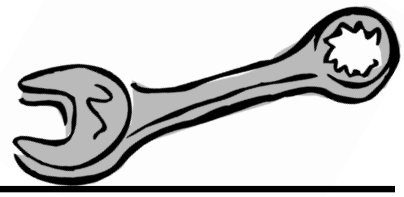
Down

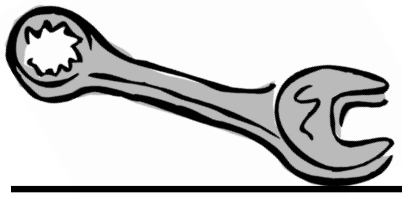
1. Flow of electrons.
2. Something that does NOT conduct electricity.
4. What happens when fuels starts to burn.
11. The end.
13. Touch the wrong wire and you'll get a _____.

Spark Plug - Word Search

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

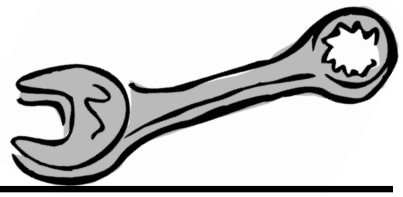
carbon
cold
cylinder
electrode
foul
gap
gasket
gauge
hot
ignition
insulator
overheat
piston
polarity
porcelain
reach
service
socket
solvent
spark
voltage



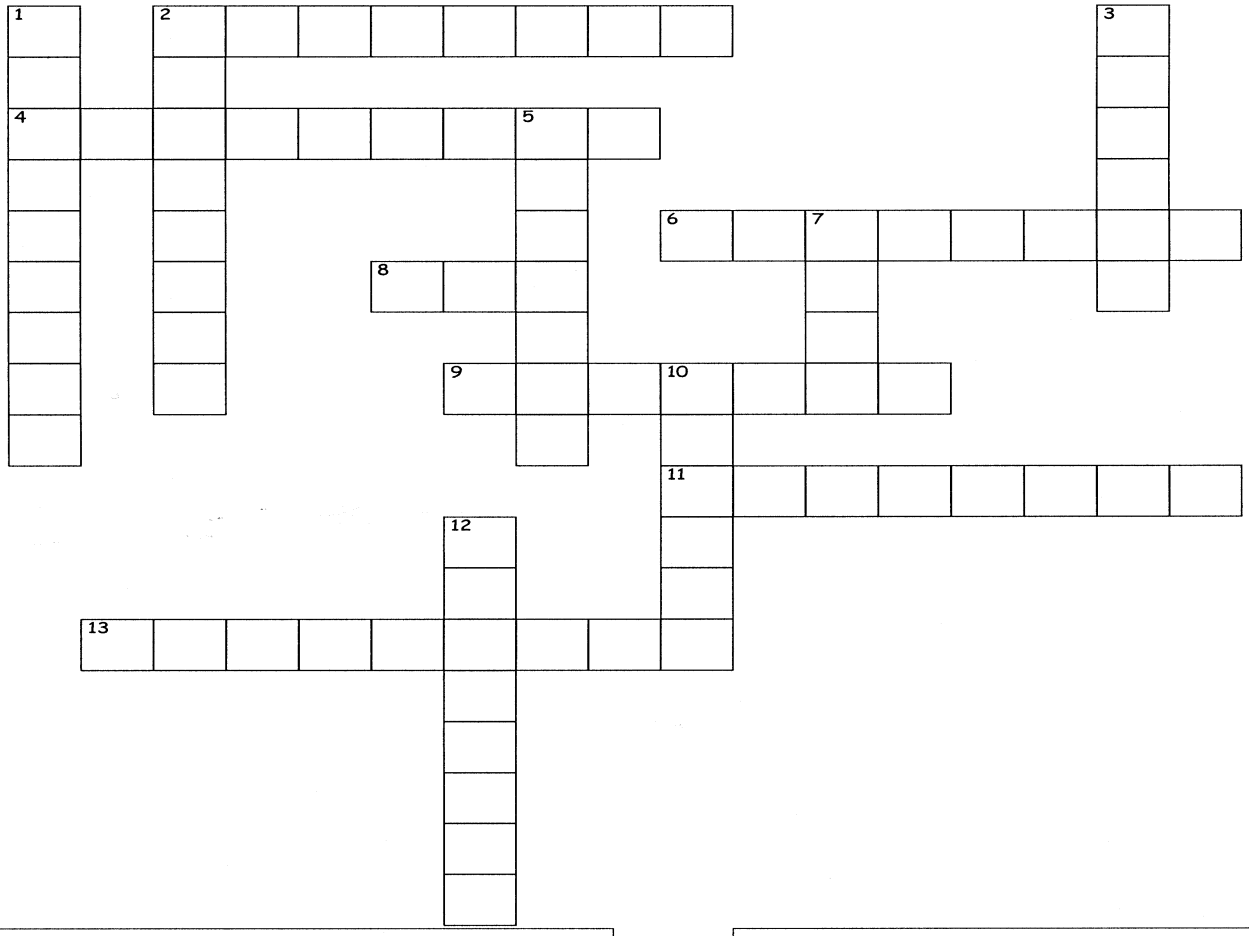


Carburetor Checklist

	Leader's initials/date
1. Operation check (non-starting engines)	
a. Remove spark plug	
b. Thumb over spark plug hole	
c. Choke valve closed	
d. Engine cranked with starter	
e. Finger check for fuel	
f. Gasoline combustion chamber	
g. Reinstall spark plug	
h. Start engine	
2. Problem identification	
3. Carburetor adjustment	
a. Check for air leaks	
b. Identify idle-speed stop switch	
c. Identify idle-mixture screw	
d. Identify high speed load-adjustment	
4. Adjusting the carburetor choke valve	
a. Remove air cleaner	
b. Valve position check using the control	



Carburetor - Crossword Puzzle



Across

2. Speed.
4. Gas fumes are _____.
6. Speed control for engine.
8. Tube with a small opening.
9. Natural force that pulls things toward earth's centre.
11. Container.
13. Flexible wall separating two cavities.

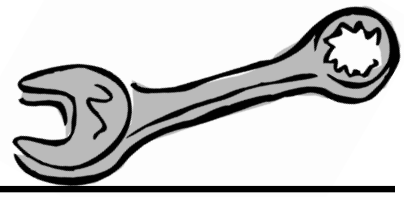
Down

1. To speed up.
2. To turn into vapour.
3. Black gunk.
5. Narrow place in a carburetor.
7. A hole for air movement.
10. Free of atmospheric pressure.
12. A value that controls amount of fuel.

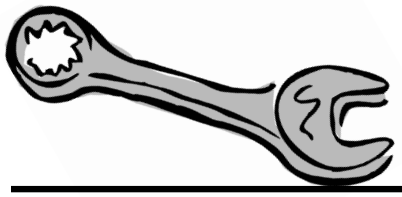
Carburetor - Word Search

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

accelerate
carburetor
choke
cylinder
diaphragm
float
intake
mixture
pressure
speed
spray
suction
throttle
valve
vaporize
venturi

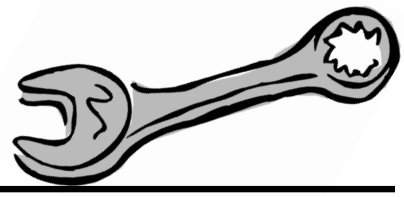


Notes



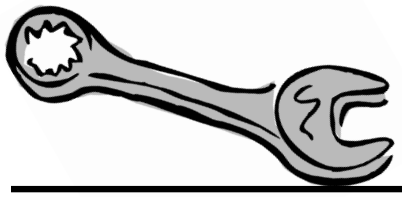
Servicing Battery Checklist I

	Leader's initials/date
1. Wearing safety glasses or goggles	
2. Remove caps from battery cells	
a. Threaded caps -exterior damage (little, moderate, extreme) -interior damage (little, moderate, extreme)	
b. Snap-down cap (edge damaged, edge not damaged)	
c. Caps set upside down on battery case	
3. Check battery fluid level	
a. Clean stick used	
4. Adding fluid to the battery	
a. Distilled water	
b. Tap water (clean)	
c. Filled to correct level	
d. Over or underfilled	
5. Replace caps	
a. Caps clean	
b. Caps soiled	
c. Vent in cap clean	



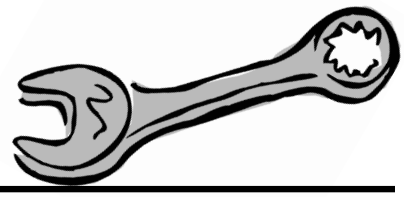
Servicing Battery Checklist II

Frame and Cable Connections	Leader's initials/date
1. Wearing safety glasses or goggles	
2. Remove battery caps	
3. Using the hydrometer	
a. Electrolyte drawn into hydrometer	
b. Float free in solution	
c. Held vertically for reading	
d. Reading taken at eye level	
e. Cells tested (all, one half)	
f. Hydrometer rinsed with clean water	
g. Specific gravity (correct)	
h. Interpretation (correct)	
Load Capacity Test - voltmeter	
1. Connecting the voltmeter	
a. Correct lead to post	
b. Coil wire grounded to battery	
2. Reading the voltage	
a. Reading taken while turning the starter	
b. Maximum time with starter not passed	



Servicing Battery Checklist III

Cleaning the Battery	Leader's initials/date
1. Wearing safety glasses or goggles	
2. Cable and ground strap	
a. If corroded remove these	
b. Ground strap removed first	
c. Tag terminal connections	
3. Cleaning	
a. Wire brush used, outside surface	
b. Sandpaper used, inside surface	
c. Battery posts cleaned	
d. Cable clamps cleaned	
e. No loose dirt or corrosion on battery top	
f. Breather caps plugged	
g. Soda and water used for cleaning	
h. Rinsed well	
i. Battery dried off	
4. Reconnecting	



Safety Tips: Working Around Batteries

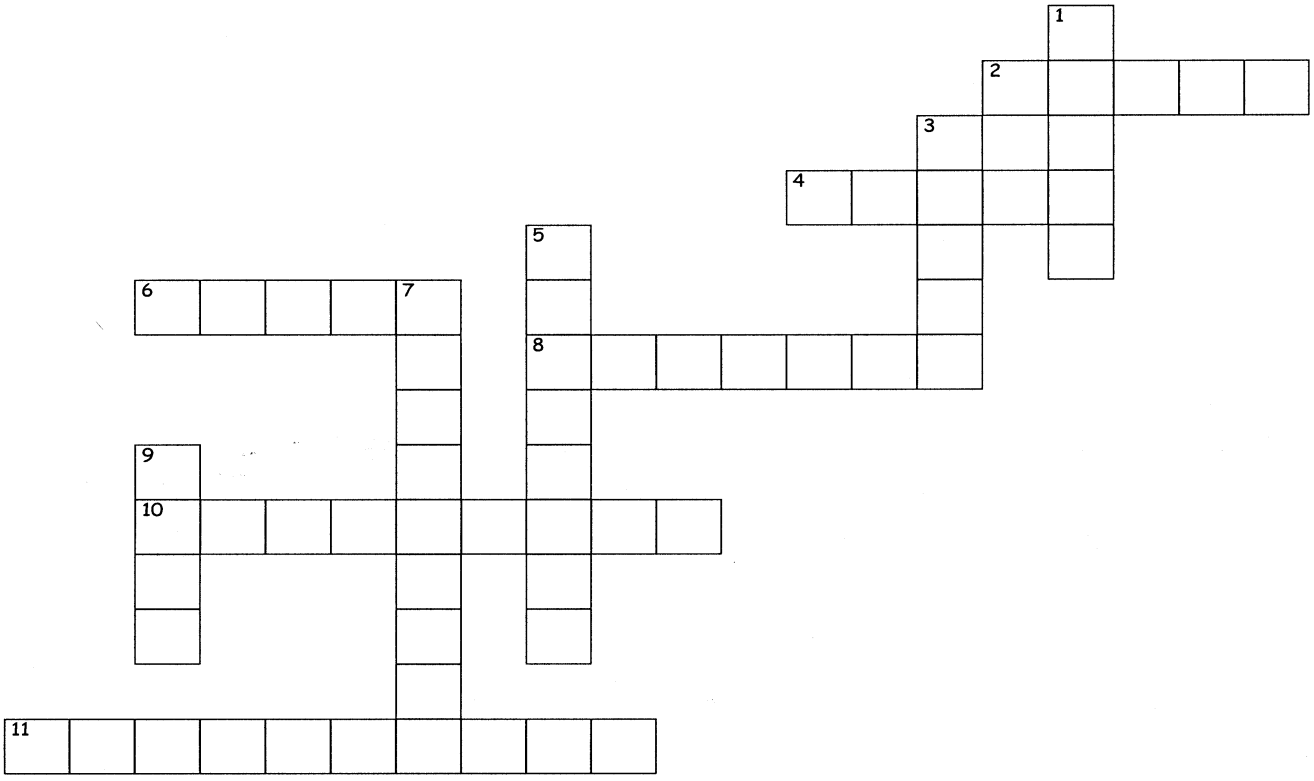
- Protect hands, eyes and clothes

- Batteries give off an explosive gas.
  No Smoking! No Flames! No Sparks! (grinding, welding etc.)

- Battery acid is very corrosive. Rinse any spills immediately with lots of fresh water.

- Battery acid in the eyes? Wash them immediately with a gentle flow of clean water, holding lids open.
  See a doctor fast.

Battery - Crossword Puzzle

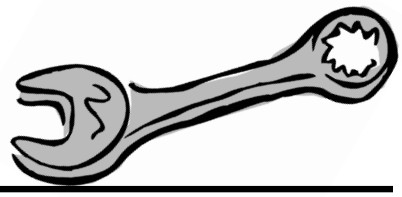


Across

2. A wire connector.
4. Don't do this around batteries.
6. Holds the battery.
8. Use these to protect eyes.
10. Dirty posts are signs of _____.
11. Use this to test battery charge.

Down

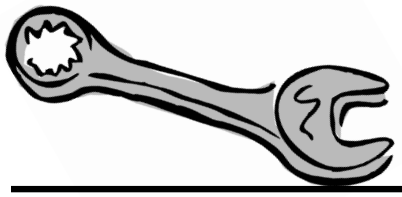
1. If splashed with acid, rinse with this.
3. Put petroleum jelly on these.
5. Not positive.
7. Batteries give off an _____ gas.
9. Caustic liquid.



Battery - Word Search

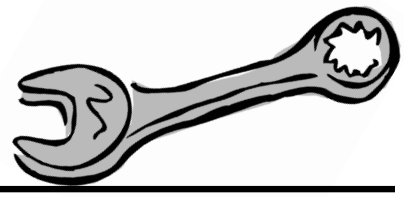
					L	F	H	D	T											
				H	B	E	M	A	R	F	U									
			D	A	S	V	E			E	K	F								
		Q	T	C	D	E	Y				T	S	K							
	B	S	G	I	I	L	L					E	L	H						
	F	P	N	D	Q	R	Y					I	M	T	W	N	G	Y		
G	K	N	J	S	T	D	U	P	L	C	O	R	R	O	S	I	V	E	D	
B	M	L	T	Y	W	T	S	F	N	A	M	E	T	A	R	O	P	A	V	E
M	M	O	R	G	R	S	M	U	E	L	O	R	T	E	P	V	D	P	B	G	C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

acids
batteries
cable
charge
corrosive
evaporate
frame
hydrogen
hydrometer
level
petroleum
plates
post
service
spark
sulfuric
syrine



Safety Tips: Working Around Fuel/Oil

- Have a fire extinguisher handy and know how to use it.
- No smoking, lighting of matches, striking sparks around gas or gas-soaked rags!
- Dispose of gas or oil soaked rags in a sealed metal barrel, preferably outside. Rags left in a pile could start a fire.
- Gas fumes are highly explosive. Store gasoline in a sturdy, sealed, labelled can.
- Gas fumes are dangerous to breathe. Provide good ventilation.
- Clean up spills promptly to avoid falls.



Safety Tips: Working Around Fuel/Oil

- Dispose of used oil according to local environment laws.
- Do not fuel a running or hot engine.
- Do not use gas for cleaning parts.
- Refuel outdoors if at all possible.

Fuel System - Troubleshooting

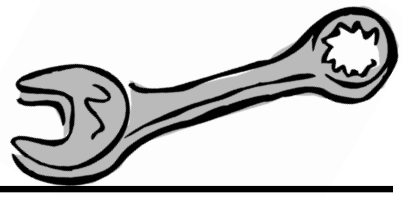
Problem: No fuel reaching the carburetor.

Gravity Fed

1. Is there gas in the fuel tank? ⇨ NO ⇨ Fill tank

   ⇩ YES

2. Is fuel flow blocked by a dirty filter or a damaged/blocked line? ⇨ YES ⇨ Clean filter. Replace and clean line.



Fuel System - Troubleshooting

Problem: No fuel reaching the carburetor.

With Fuel Pump

1. Is there gas in the fuel tank? ⇨ NO ⇨ Fill tank

   ⇩ YES

2. Are fittings connecting fuel line to pump and tank tight? ⇨ NO ⇨ Correct.

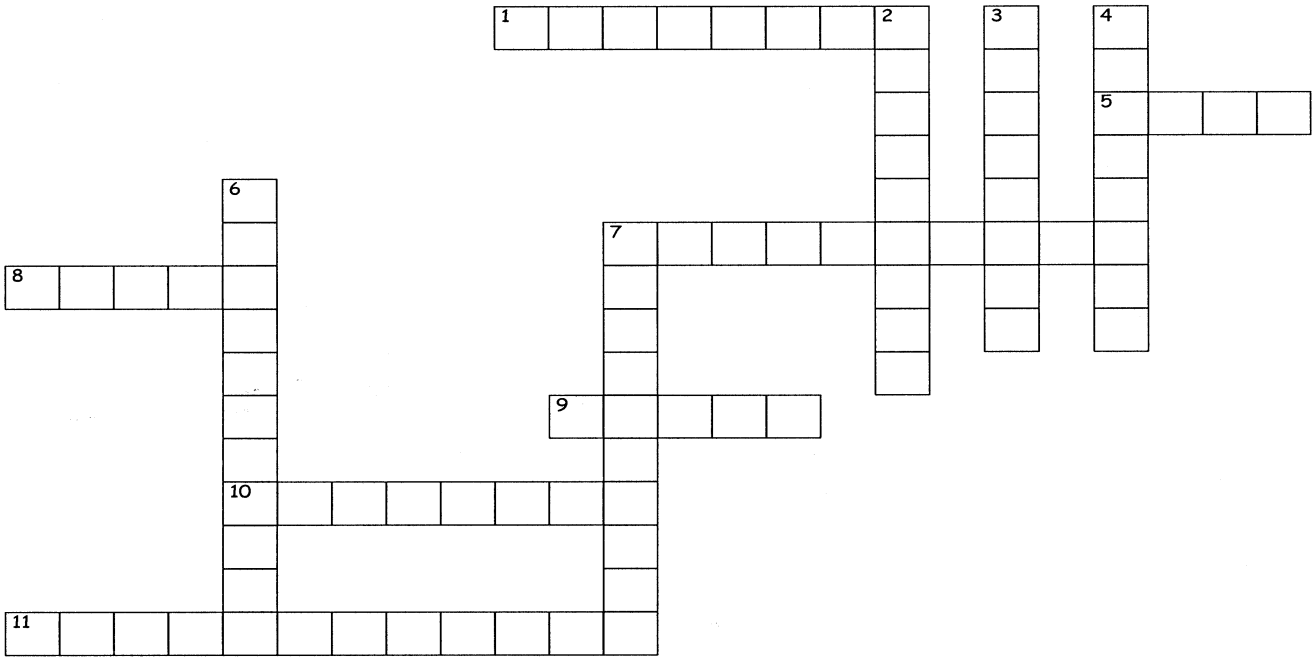
   ⇩ YES

3. Is pump filter clean? ⇨ NO ⇨ Clean it.

   ⇩ YES

4. Is fuel pump working? Check it. ⇨ NO ⇨ Repair or replace .

Fuel - Crossword Puzzle

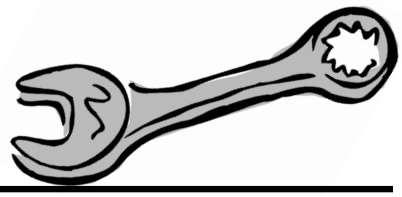


Across

1. The carburetor does this to the fuel.
5. Stop, drop and _____.
7. What happens when fuel starts to burn.
8. If your engine will be stored, _____ the fuel.
9. Old gas becomes _____.
10. A valve that controls the amount of fuel.
11. Have one nearby.

Down

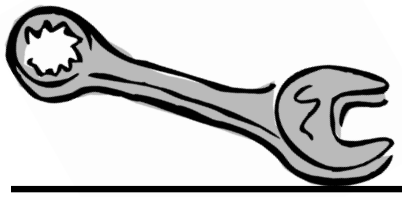
2. Fuel plus spark equals _____.
3. Two cycles burn an oil/_____ mixture.
4. Cleans dirt out of fuel.
6. Movement of air.
7. Mixes fuel and air.



Fuel - Word Search

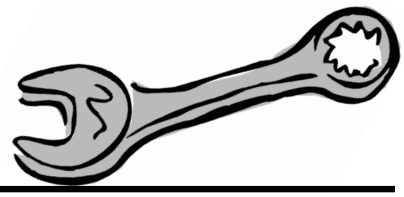
					C	Y	M	W	H											
				U	V	O	D	W	D	Z	X									
			S	G	V	M	G			S	G	F								
		V	Y	S	E	P	C				V	N	S							
	Q	C	P	J	N	R	M					T	T	C						
	A	A	G	J	T	E	Q					L	R	V	B	E	R	H		
	B	R	R	N	O	I	S	O	L	P	X	E	N	A	T	C	O	Y	L	I	
	K	M	B	E	O	L	S	H	E	U	A	S	P	I	L	L	F	D	G	Q	B
L	V	C	U	Q	S	A	I	A	C	K	O	O	O	N	L	K	K	F	C	H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

carburetor
clean
compression
drop
explosion
extinguisher
gum
leak
mixture
octane
roll
spark
spill
stop
strainer
vaporize
ventilation



Engine Start-up and Shutdown Checklist

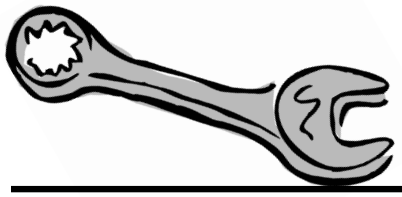
	Leader's initials/date
1. Opening fuel shut-off valve	
a. Part recognition	
b. Activity completed	
2. Closing the choke	
a. Part recognition	
b. Activity completed	
or (no primer)	
a. Ignition switch off	
b. Crank starter	
4. Setting the throttle	
a. Part recognition	
b. Set at recommended position	
5. Turn on ignition switch (if present)	



Engine Start-up and Shutdown Checklist

	Leader's initials/date
6. Crank the engine	
<u>Rope wind starter type</u> a. Wind rope around flywheel	
b. Crank slowly to compression stroke	
c. Rewind rope	
d. Pull rope away -braced against engine -rope pulled straight and evenly	

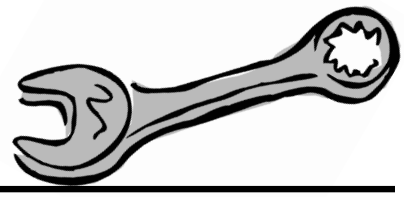
<u>Rope Rewind starter type</u> a. Crank engine to compression stroke	
b. Slacken rope	
c. Rope allowed to rewind	
d. Rope pulled briskly and firmly	
e. Rope not pulled out too far	
f. Allow rope to rewind while holding handle	



Engine Start-up and Shutdown Checklist

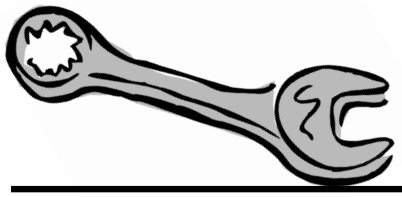
	Leader's initials/date
6. Crank the engine (cont'd)	
Windup starter type a. Place release lever in windup position	
b. Lift handle to cranking position	
c. Extend handle to cranking position	
d. Wind starter	
e. Fold windup handle to retracted position	
f. Move release lever to "run" position	

Electric starter type a. Locate switch	
b. Engage switch	
c. Time held (under 10 seconds, 10 to 15 seconds, over 15 seconds)	
d. Allow switch to return to off position	



Engine Start-up and Shutdown Checklist

	Leader's initials/date
Stopping the Engine	
7. Reduce idle speed	
a. No load	
b. Correct throttle speed	
c. Time, 1 to 2 minutes	
8. Turn off ignition	
9. Close fuel tank shut-off valve	



Storage Checklist

Junior

Give two reasons why an engine should be stored properly.

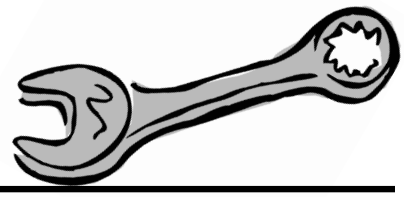
Recognize, name and assemble at least 5 tools and supplies for storage preparation.

Identify at least three jobs that need to be done before storing. (Refer to checklists for those jobs.)

With assistance, perform at least one of the jobs.

With some assistance, record efforts in record book.

Check small engine at least once during storage period.



Storage Checklist

Intermediate (prerequisite: Junior Level)

Give four reasons why an engine should be stored properly.

Recognize, name and assemble at least 8 tools and supplies for storage preparation.

Identify at least two jobs that need to be done before storing. (Refer to checklists for those jobs.)

With assistance, perform at least two major jobs before storage.

Independently record efforts in record book.

Check on small engine at least twice during storage period.

Senior (prerequisite: Intermediate Level)

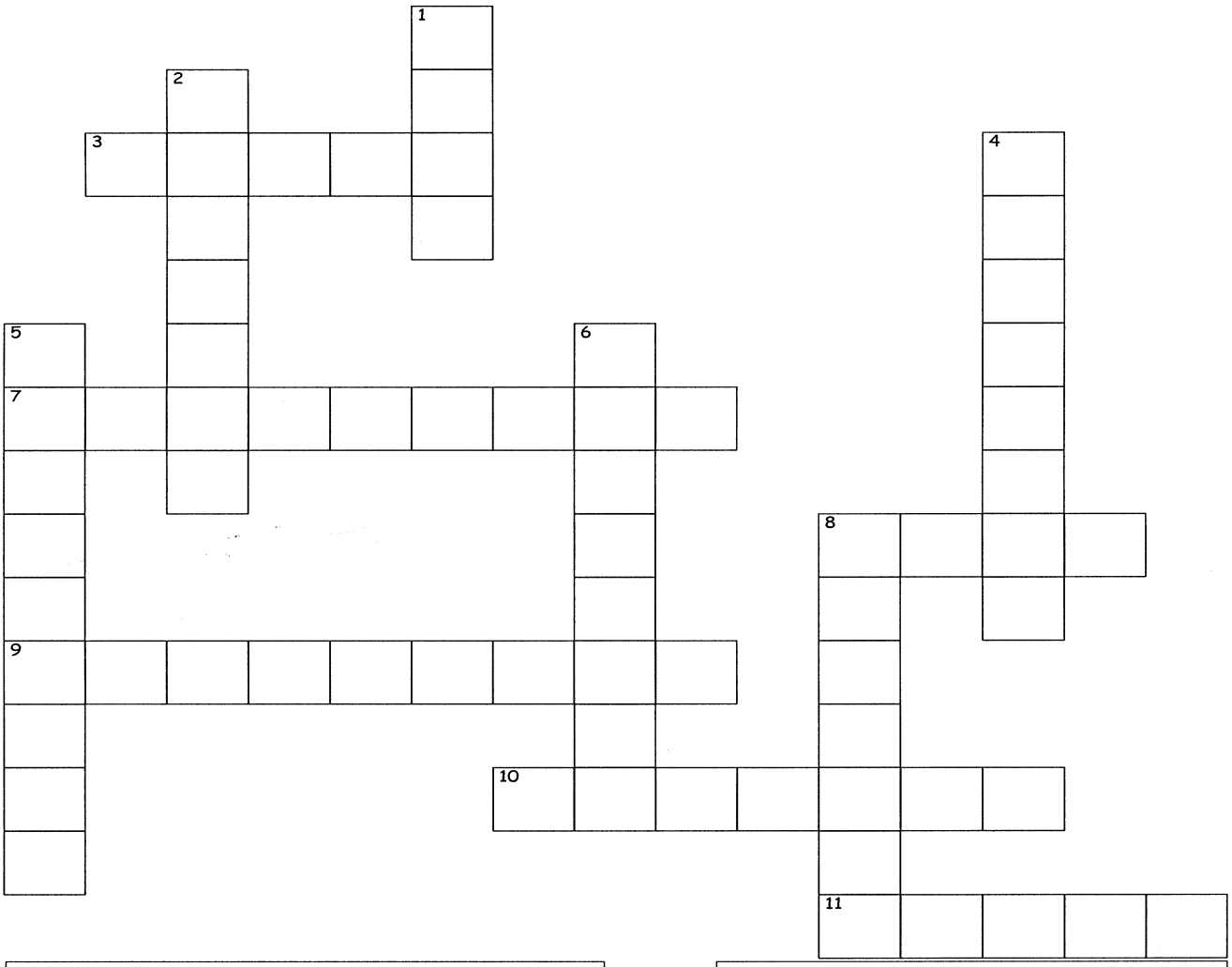
Assess engine condition and plan for additional service.

Independently assemble tools and supplies for service.

With little assistance, prepare small engine for storage.

(Refer to checklists for the jobs to be done.)

Storage - Crossword Puzzle

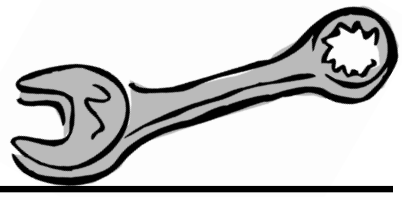


Across

3. Not dirty.
7. Rust.
8. Drain this.
9. Regap this.
10. Do these before storage.
11. Old gas becomes _____.

Down

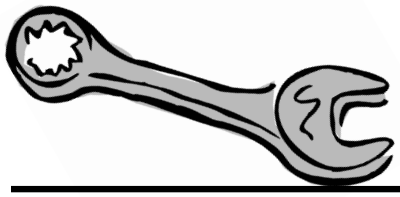
1. Holds fuel.
2. Cover with this.
4. Keep small _____ away.
5. Protect from _____.
6. Condensation.
8. Watch out for _____ objects!



Storage - Word Search

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

clean
cover
damage
disconnect
drain
gum
investment
moisture
plastic
protection
repair
tarp



The Twelve Days of 4-H

On the first day of 4-H, my leader sent to me
A small engine, very dirty.

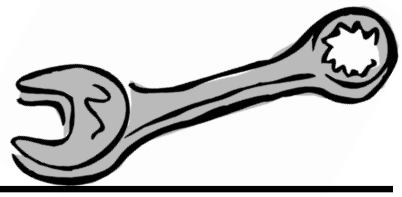
On the second day of 4-H, my leader sent to me
Two cans of gunk
and a small engine, very dirty.

On the third day of 4-H, my leader sent to me
Three air filters, two cans of gunk
And a small engine, very dirty.

On the fourth day of 4-H, my leader sent to me
Four bowl gaskets, three air filters, two cans of gunk
And a small engine, very dirty.

On the fifth day of 4-H, my leader sent to me
Five piston rings.
Four bowl gaskets, three air filters, two cans of gunk
And a small engine, very dirty.

On the sixth day of 4-H, my leader gave to me
Six new magnetos,
Five piston rings.
Four bowl gaskets, three air filters, two cans of gunk
And a small engine, very dirty.

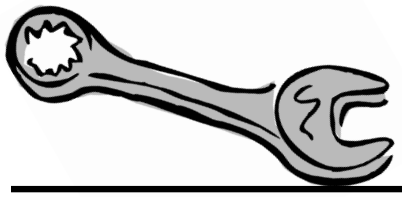


On the seventh day of 4-H, my leader gave to me
Seven carburetors, six new magnetos,
Five piston rings.
Four bowl gaskets, three air filters, two cans of gunk
And a small engine, very dirty.

On the eighth day of 4-H, my leader gave to me
Eight ring compressors, seven carburetors, six new magnetos,
Five piston rings.
Four bowl gaskets, three air filters, two cans of gunk
And a small engine, very dirty.

On the ninth day of 4-H, my leader gave to me
Nine connecting rods,
eight ring compressors, seven carburetors, six new magnetos,
Five piston rings.
Four bowl gaskets, three air filters, two cans of gunk
And a small engine, very dirty.

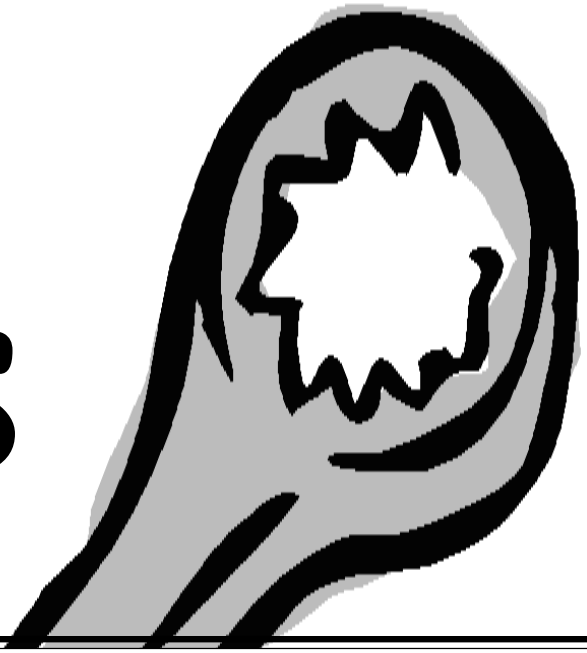
On the tenth day of 4-H, my leader gave to me
Ten crankcase seals,
nine connecting rods, eight ring compressors, seven carburetors, six new magnetos,
Five piston rings.
Four bowl gaskets, three air filters, two cans of gunk
And a small engine, very dirty.



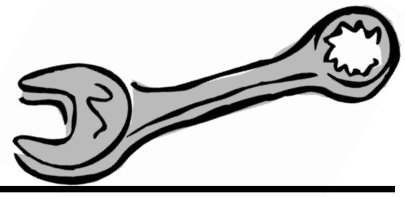
On the eleventh day of 4-H, my leader gave to me
Eleven new torque wrenches,
Ten crankcase seals, nine connecting rods,
eight ring compressors, seven carburetors, six new magnetos,
Five piston rings.
Four bowl gaskets, three air filters, two cans of gunk
And a small engine, very dirty.

On the twelfth day of 4-H, my leader gave to me
Twelve charged batteries,
eleven new torque wrenches, ten crankcase seals, nine connecting rods,
eight ring compressors, seven carburetors, six new magnetos,
Five piston rings.
Four bowl gaskets, three air filters, two cans of gunk
And a small engine, very dirty.

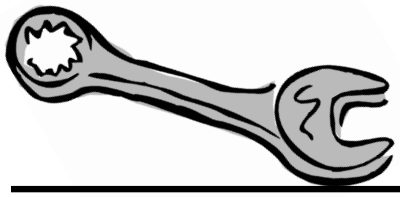
Small Engines



GLOSSARY



Notes



Abrasive
a material which is used to wear away some surface

Additive
chemicals which are added to oil to make it work better in the engine

Alloy
a metal made by mixing two or more base metals (e.g. brass is an alloy of copper and zinc)

Alternating Current (AC)
the kind that is used in our homes. The current flows first in one direction then in the opposite direction.

Antifreeze
a poisonous liquid which prevents engines from freezing up. It has a lower freezing point and higher boiling point than water.

Bearing
the surface of any part of a machine on which another part turns or moves.

Bore
the diameter of the cylinder

Bushing
a friction type of shaft bearing

Camshaft
the shaft in an engine which pushes open the intake and exhaust valves

Capacitor
another name for condenser

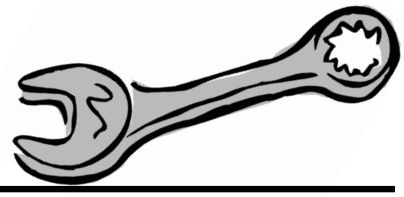
Carbon
hard, black material which forms when too much fuel is mixed with air in cylinder.

Carburetor
device that mixes gas and air in the right amount so they can be ignited

Centrifugal
moving away from the centre

Combustion
what happens when fuel starts to burn

Condenser
an electrical device which can collect and hold electricity



Connecting Rod
connects the piston to the crankshaft

Corrosion
chemical process which causes metal or other material to slowly be eaten away

Counterbalance
weight used to balance a force

Crankcase
the part of the cylinder block where the crankshaft revolves

Crankshaft
the rotating, main shaft in an engine - the piston and connecting rods make it rotate

Current
the flow of electrons through a conductor, measured in amperes.

Cylinder Block
the large, main part of any engine

Cylinder Head
metal cover bolted to the top of the cylinder block

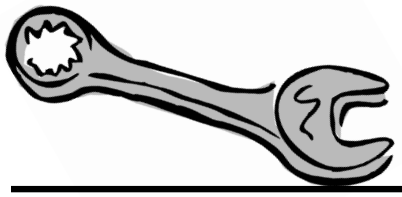
Diaphragm
flat disc of rubber or cloth in a fuel pump. It separates the fuel tank side of the pump from the engine side.

Diesel
type of engine in which fuel is injected into very hot, compressed air to ignite.

Direct Current (DC)
electric current which flows in only one direction. Direct current can be found in batteries and dry cells.

Diode
device that changes alternating current to direct current. Also called a rectifier.

Electrodes
two wire-like parts in a spark plug that extend into the cylinder to make a gap for the electric spark to jump across



Electrolyte
a liquid that will conduct electricity. In a battery the electrolyte is water and sulphuric acid.

Extension
part that adds length

Filter
special screen with tiny holes in it. A filter screens out dust and dirt but lets air through.

Flywheel
wheel that attaches to the crankshaft. It helps start the engine and keep it running smoothly.

Friction
the resistance between two things rubbing together. Friction causes heat.

Gasket
a flat piece of material, usually rubber, cork, paper or asbestos which is fitted between metal parts to keep fluid or air from escaping.

Governor
a speed control for an engine

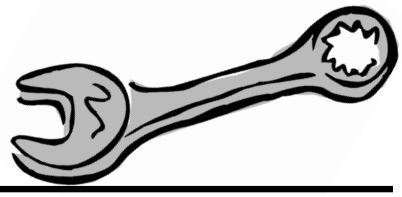
Ground
an electrical connection or contact to the cylinder block

Hone
an abrasive tool used to enlarge holes and make them very accurate - to polish very smoothly.

Inhibitor
a chemical that stops or prevents rusting.

Insulator
a material that does not conduct electricity. Insulators are used to contain electricity so it does not cause shock, injury or damage.

Insulator
a type of metal that does not conduct electricity.



Intake Manifold
the pipe that brings fuel/air mixture from the carburetor to the cylinder for combustion.

Jet
a tube with a small opening to allow air or liquid to rush through

Lapping
polishing, using an abrasive mounted on a special backing such as brass, wool, leather etc..

Lobe
a rounded, projecting part of a revolving shaft.

Lubrication
adding oil or grease to an engine so the moving parts slide easily and quickly without getting too hot.

Magnet
a piece of metal which has a force field around it which attracts some metals.

Magneto
a device that makes an electric spark to ignite fuel in the cylinder.

Mesh
the fine wire of a net or screen

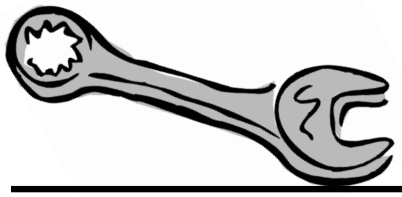
Peen
to bend or flatten some material (usually metal)

Pilot
a device on valve seat cutters and grinders to guide and hold them in the correct position while working

Piston
a cast cylindrical piece of metal which fits in the cylinder of the engine and moves up and down.

Porcelain
a hard brittle material like china.

Port
a hole in a cylinder wall, designed to let fuel and air in, or exhaust gases out.



Preignition
the burning of the air/fuel mixture before normal ignition occurs.

Radiator
a device designed to give off heat into the air

Ratchet
a mechanical device that allows free movement in only one direction at a time.

Reamer
a tool used to make a hole larger

Reed
a thin, flat strip of spring material

Rotary
turning on a shaft

r/min or rpm
revolutions per minute

Short Circuit
to make a new, shorter path for electricity (sometimes unintended). The original circuit would no longer work.

Shroud
a covering which acts to direct cooling air. Also can act as a safety cover.

Solvent
a liquid used as a cleaner. Often flammable.

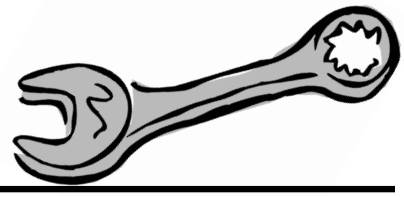
Spark Plug
a device designed to let a spark jump across a small gap to ignite fuel.

Sprocket
a wheel with teeth on its edge. These teeth usually catch in holes in chain links and make another sprocket turn.

Stationary
fixed in one position

Suction
a force that moves a liquid or air from high pressure to low pressure

Sump
a container for oil or other liquids.



Swivel
to swing or turn on a hinge pin.

Terminal
a point in electrical devices where wires can be connected.

Thermostat
a device that helps control temperatures of an engine

Throttle
a valve that controls the amount of fuel and air entering the cylinder of the engine.

Timing Gears
gears used to turn the camshaft and open and close the valves at the right time.

Torque
the amount of turning force applied to or by a shaft.

Transistor
a small electronic device used to control an electric current.

Troubleshooting
a process of figuring out what is wrong or missing

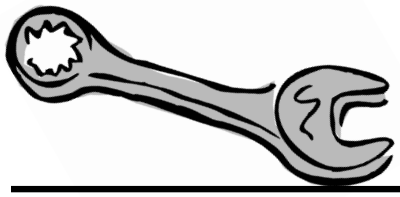
Tungsten
a hard, white metal that is a very good conductor of electricity.

Universal
a double-hinged connector used to apply torque through a hinge (often called a U-joint).

Vacuum
an area of very low air pressure. Air always tries to move into a vacuum.

Valve
a device used to control the movement of gas, air or liquid through an opening.

Valve Lifters
small rods with one flat end, they push valve open.



Vane
a flat metal or plastic surface fastened to a shaft and moved by air or wind.

Venturi
a narrow place in a carburetor that causes a low pressure area around the fuel jet.

Viscosity
the thickness of a liquid. Maple syrup has a higher viscosity than water.

Volt
a unit of electrical pressure

Warp
to bend or twist out of shape.