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Basic Tools

Part One - Preparation

I. Objectives

- A. Student can identify basic tools (both name and function) used in bike repair.
- B. Student can use each tool in a proper and effective manner.
- C. Student is aware of which tools are required for which jobs.
- D. Student becomes more familiar with the physics concepts of leverage and torque.
- E. Student knows where all tools are placed when finished with them.

II. Materials Needed

Demonstration Parts

- A 2x4 at least five feet in length
- Angle iron to work as fulcrum for 2x4
- Large adjustable wrench
- Small adjustable wrench
- Bicycle Wheel, Not Mounted

Tools

- Adjustable Wrenches
- Fixed Wrenches
- “T” and “Y” Wrenches
- Cone and Brakes Wrenches
- Hammer
- Allen Keys
- Screw Drivers

Other Materials

- Chalkboard & Chalk
- Rags



Vise grips

III. Setting There are two possible settings.

- A. Workshop, with tool benches, bike repair stand and bike storage.
- B. Outdoor, Non-Traffic Practice Area — playground, empty parking lot, wide sidewalk, etc.

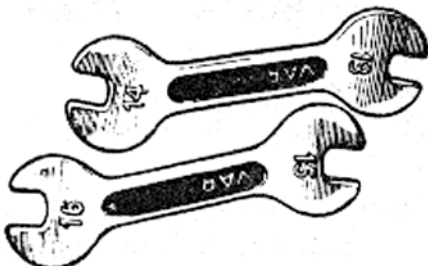
IV. Evaluation

- A. Teacher Observation During Work Session Rotate amongst the students you are working with. Observe for general mechanics skills (e.g. body mechanics, tool use), work habits (e.g. keeping part orderly, replacing tools), and ability to visually confirm good contact between tool and part. Observe for problem solving skills: Is student using visual observations? Is student able to pose questions whose answers will help her come up with a solution?
- B. Oral Review at end of work session.
 - 1) **Language:** How many of the basic tools and specialty tools can students identify? Passively? Actively? Can each student identify the proper function of each tool?
- C. Written Evaluation How well can student narrate what she did that day on her time sheet?
- D. Test Tool Identification Test. See the basic test on the next page, with pictures of each of the basic tools and a list of the names on the edge of the paper. The students should be able to draw lines from the name of the tool to the correct picture.



Tool Identification Test

Connect the tool pictures on the left with their names on the right



Allen Key

Cone Wrench

Screwdriver

Adjustable Wrench

Y-Wrench

Hammer

Pliers



Part Two - Activity Instructions

I. Tool Check! Students & instructors enter the tool area and confirm as a group that all the tools are there.

II. Process

A. Goal — To learn to “use the right tool for the right job.” What does this mean? Have you ever used the wrong tool for the job? What happened? How does leverage change when your lever gets longer?

The right tools for the right job should fulfill these requirements:

- The surface of the tool fits not too tight and not too loose inside or around the object you are trying to loosen or to tighten. Why is a good fit important?
- You have enough leverage to complete the job without straining too much. (Sometimes you may have to strain but that can be fun too!!)



Needlenose Pliers

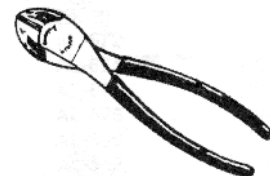
B. The Great Leverage Test — This little test is basic but fun for the students because it’s really hands on.

1. The Parts of a Lever

- a) The Lever (the 2x4)
 - b) The fulcrum (the piece of angle iron)
2. Place the 2x4 over the piece of angle iron to make a small version of a see saw. Be sure to put the angle iron in the middle of the 2x4
 3. Test the abilities of a Lever. If you can, try to find two students who are very different in size and weight. Have the lighter of the two stand on one end of the 2x4. Then have the heavier student slowly stand on the other end of the 2x4 and watch as the smaller of the two is lifted into the air. This is what everybody expects but is still fun to watch and take part in. Now its time to figure out how to make it so that the lighter of the two students can use his or her own weight to lift the heavier student into the air. Make sure that you allow that all the students come up with the answer. First try to figure out how to balance the two students. Draw a line where this point on the lever is. Then figure out the point at which it becomes easy for the lighter of the two the lift the other into the air. Now relate this back to using certain tools that have a longer handle verses a shorter handle. Is it going to be easier to turn a bolt with a wrench that has a long handle or a short one? Why?



**Channel-Locks w/
Parallel Jaws**



Cable Cutters

**C. How to Use the Adjustable Wrench**

1. Find a good sized nut or bolt head. If you don't have a lot of hardware around, an axle-nut on a wheel will do just fine.
2. Pull out an adjustable wrench and show the students how the jaw of the tool adjusts.

Note: The adjustment of the wrench uses a simple tool — the incline plane!!

3. Leaving the wrench open, place the jaws around the bolt head/nut and slowly begin to wind the jaws closed.
4. Leaving the jaws of the wrench slightly open (2 or 3 millimeters) around the nut bring it to the attention of the students what will happen if you attempt to loosen or tighten the nut without the jaws being tight (i.e. stripping/rounding off the corners). What happens if they tighten the jaws against two corners of a nut instead of against the flats?
5. Tighten down the jaws of the wrench until both the adjustable side and the fixed side sit firmly and parallel to the flats/sides of the nut. Voila! You have now properly fitted your adjustable wrench. Practice taking it off and putting it back on. Demonstrate jiggling the wrench a bit as you screw down the adjustable jaw with the thumb screw.

III. Language Skills

Over the course of this lesson we have introduced a whole set of new tools and science terms. At the end of the session it is often helpful to get each kid to put their finger on each of these tools again and say the name.

IV. Systems Understanding Try different ways of phrasing these questions.

What does it mean to have the right tool for the right job? How do we evaluate which tool needs to be used in which situation. What can go wrong if we use the wrong tool?

V. Problem Solving/Diagnosis

Put a bicycle on a stand and hold up each tool. See if the students can pick out spots where that tool will be used. Have each student show what would be the best way to use at least one tool in particular. Once they all have had a chance to give an answer and use a tool on the bike, pat yourself on the back and call it a day.

VI. Review**VII. Clean Up****VIII. Tool Check!** Leave tool area as a group after confirming that all tools are present.