**Metal Trades Materials Identification**

**Description**

There is a variety of different metals used in the metal trades and throughout school metal shops. This activity plan provides instruction for the foundational knowledge of material identification in the metal trades. It includes the common processes and procedures used to identify and categorize individual samples based on specific criteria. Students will gain experience identifying and differentiating common metal types.

## Lesson Objectives

The student will be able to:

* Identify samples of material
* Accurately categorize materials as ferrous and non-ferrous
* Identify the characteristics of common metals in the machine and welding shops

## Assumptions

The teacher should:

* Have experience differentiating different ferrous and non-ferrous materials
* Have an understanding of the various processes used to identify metals

The student should:

* Know that there are several metal types used in the metal shop
* Have an basic understanding of what a metal is

## Terminology

**Alloy**: a mixture of metals and/or elements that creates characteristics different from those of the component materials.

**Cold rolled**: steel that is processed below its recrystallization temperature. Usually higher carbon, harder, and more accurately sized than hot rolled steel.

**Ductile**: a material that will deform under tension (pulling force).

**Ferrous**: a metal contains iron and is often magnetic.

**Fusible**: capable of being fused, especially by heat.

**Hardness**: a metal’s ability to resist deformation or indentation.



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**Hot rolled**: steel that is processed above its recrystallization temperature. Usually lower carbon, softer, and more economical than cold rolled steel.

**Magnetic**: whether or not the metal is attracted to a magnet.

**Malleable**: a material that will deform under compression.

**Metal**: a material that is usually hard, shiny, malleable, fusible, and ductile, with good heat and electrical conductivity.

**Non-ferrous**: a metal that doesn’t contain iron and is not magnetic.

**Relative weight**: weight of a sample compared to other metals.

## Estimated Time

1–1.5 hours

## Recommended Number of Students

20, based on the *BC Technology Educators’ Best Practices Guide*

## Facilities

Secondary school metal shop or equivalently equipped technology education shop

## Tools

* + Whiteboard
  + Overhead or data projector
  + Computer

## Materials

* + Worksheets
  + Samples of materials to identify
  + Writing implement

## Resources

BCIT Technology Teacher Education Program course notes/worksheets

*Modern Metalworking*, textbook by John R. Walker

## Teacher-Led Activities

1. Describe and define *metal*.
2. Explain the difference between ferrous and non-ferrous metals, using examples either online or physical.
3. Outline the main criteria for determining the characteristics of different metals:
   1. Magnetic/non-magnetic – whether or not a magnet attracts the metal.
   2. Ferrous/non-ferrous – this is often determined through the test for magnetism, except with stainless steel, which is an alloy of steel that isn’t magnetic.
   3. Colour/appearance – a visual physical characteristic that helps determine the metal type. Hot rolled has black carbon coating while cold rolled is uncoated.
   4. Relative weight – weight of a sample as compared to other metals.
4. Explain the additional tests, some of which aren’t always possible or feasible in every shop:
   1. Spark testing – using a grinder to test metal based on spark colour, frequency, length, and overall appearance
   2. Hardness testing – it would be rare for a school shop to have a hardness tester (i.e., Rockwell scale tester). However, hardness would also be a possible determinant.
   3. Comparative tests in malleability, and ductility could be performed in class.
5. Get students started on the identification activity.

## Student Activity

1. Students will move from station to station with a worksheet to identify metals based on properties and characteristics.
2. Stations will be set up with all of the common metal types found in the shop:
   1. Hot rolled mild steel
   2. Cold rolled mild steel
   3. Tool steel
   4. Cast iron (less common)
   5. Stainless steel
   6. Aluminum
   7. Copper
   8. Brass
   9. Bronze (less common)
3. Students will fill out the worksheet based on the observations of four to six properties.

## Assessment

Consider co-creating the evaluation criteria with your students at the beginning of the activity/ project. You may want to include the following:

* Worksheet completion: worksheet is complete and neatly filled out.
* Observations: all tests were completed accurately and data was noted.
* Summary: information was accurate and complete.

## Optional Extension Activity

Students could analyze several different carbon steel samples, including mild steel, tool steel, wrought iron, and cast iron, and use a grinder to do a spark test on the samples.

Students could refer to the chart at the link below to determine the carbon content in the samples and the corresponding category of the iron-based sample:

<http://www.weldingwire.com/Images/Interior/documentlibrary/metal%20id.pdf>

# Student Activity:

**Identifying Metal Samples Name(s):**

### Instructions

You and your partner(s) must move station to station and identify the characteristics of the metal sample at each station based on the common tests. Your teacher may also instruct you to conduct the optional tests.

After completing your observations, summarize your data gathered on each sample. Please ensure that you are summarizing in full sentences.

#### Station ID #

**Observations (What can you see?)**

|  |  |
| --- | --- |
| **Common Tests** |  |
| Magnetic/non-magnetic |  |
| Ferrous/non-ferrous |  |
| Colour/appearance |  |
| Relative weight |  |
| **Optional Tests** |  |
| Spark testing |  |
| Hardness testing |  |

**Summary (What metal is it and why?)**

**Station ID #**

**Observations (What can you see?)**

|  |  |
| --- | --- |
| **Common Tests** |  |
| Magnetic/non-magnetic |  |
| Ferrous/non-ferrous |  |
| Colour/appearance |  |
| Relative weight |  |
| **Optional Tests** |  |
| Spark testing |  |
| Hardness testing |  |

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| Spark testing |  |
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**Summary (What metal is it and why?)**