

# Unit 6: Heat Treatment of Metals

Content Area: **Industrial Technology**  
Course(s): **Manufacturing Tech III/ IV**  
Time Period: **2 marking periods**  
Length: **10 Weeks**  
Status: **Published**

## Unit Overview

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Students will be introduced to a series of processes that use carefully controlled heating and cooling cycles to change the physical properties of a metal. Many metal parts must be heat treated to make them strong enough for their intended purposes. Some aluminum alloys, magnesium, copper, beryllium, silver, and titanium can also be conditioned by heat treatment.

## Transfer

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Students will be able to independently use their learning to...

Identify the processes that are used to transform steel and other metals properties to change the actual properties of metal so they can be used in the manufacturing of products that are used by consumers and the military.

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For more information, read the following article by Grant Wiggins.

[http://www.authenticeducation.org/ae\\_bigideas/article.lasso?artid=60](http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60)

## Meaning

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Students need to know how materials are changed as consumers of products and future employees of companies that do these processes.

## **Understandings**

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Students will understand that...

- What specifically do you want students to understand?
- What inferences should they make/grasp/realize?

## **Essential Questions**

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Students will keep considering...

Heat Treatment of metal includes a number of processes. They all involve the control of what two things.

What are the five quenching mediums used to cool metal during heat treating.

Tempering a piece of hardened steel does what?

What is the heat-treating process that reduces the hardness of a metal, making it easier to machine?

What is normalizing?

What is case hardening/

What are three case hardening techniques?

What be used to accurately measure the furnace and metal temperature?

What are the four types of hardness testers?

## **Application of Knowledge and Skill**

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Students will be able to apply the techniques they have acquired to their projects to changed the characteristics to what they need for machining welding and manufacturing. Student will use this information when explaining how a specific metal was changed to benefit the product that was made.

## **Students will know...**

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Students will know...

What facts and basic concepts should students know and be able to recall?

Student will be able to recall the Heat Treating Safety rules.

What Stress Relieving is.

What Annealing is.

What Normalizing is.

What Hardening is

What tempering is.

What Surface Hardening is.

What case hardening is.

Types of Heat Treating Furnaces.

What a Pyrometer is used for.

How to heat treat metals other than steel.

## **Students will be skilled at...**

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Students will be skilled at...

Safely lighting furnace and handling of metal when heat treating of steel on individual projects they are working on.

## **Academic Vocabulary**

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anneal

carburizing

case hardening

cyaniding

hardness testin

heat treatment

induction hardening

normalizing

stress relieving

tempering

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### **Learning Goal 1**

SWBAT Heat Treat Individual Projects to change characteristics of Metal.

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### **Target 1**

SWBAT identify the various heat treatment processes, Stress Relieving, Annealing, Normalizing, Hardening, Tempering, Surface hardening, Case Hardening .

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### **Target 2**

SWBAT identify and safely light different types of furnaces and perform a specific heat treatment process after demonstration by instructor.

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### **Summative Assessment**

Students will be able to pass a test on Heat Treatment Processes and perform hands on projects related to these processes.

CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
CAEP.9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education.

### **Formative Assessment and Performance Opportunities**

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Students will be able apply the skills to projects they have selected, skills will be graded in individual project grades.

### **Accommodations/Modifications**

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Students will be able to apply heat treatment skills to other metals besides steel.

### **Unit Resources**

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Modern Metalworking Instructor's Manual by John R. Walker

Modern Metalworking Textbook by John R. Walker

Modern Metalworking Workbook by John R. Walker

Safety Hand outs from NJ and PA. Safety Tests

You tube safety videos on Heat Treatment of steel and Techniques.