



Metals in the Plant

Course 105: Metals in the Plant

Introduces metals, metallurgy, and metalworking. Discusses the properties of metals, including mechanical properties. Examines several industrial manufacturing processes. Covers iron and standard steels. Explains the different kinds of heat treatment and their usage. Discusses some techniques of working with copper, aluminum, magnesium, titanium, lead, nickel, tin, and zinc.

TPC Training is accredited by IACET to offer **1.0 CEU** for this program.



Lesson 1: Introduction to Metals

Topics

Metals and Metallurgy; Properties of Metals; Internal Structure of Metals; Important Metals; Casting Metals; Metalworking; Joining Metals

Objectives

- Name five metals or alloys commonly used in industry.
- Name five mechanical properties of metals.
- Describe the uses of three metal alloys.
- Describe the metalworking processes of casting, forming, and machining.

Lesson 2: Properties of Metals

Topics

Mechanical Properties; Hardness; Ductility; Malleability; Toughness; Strength; Tensile Strength; Compression; Shear; Elasticity; Strain; Metal Fatigue; Thermal Expansion; Density; Specific Gravity

Objectives

- State the definitions of four mechanical properties of metals.
- Describe the three kinds of stress.
- List the ways in which a metal can fail.
- State the definition of elasticity.
- Demonstrate how to calculate the density of metal.

Lesson 3: Manufacturing Processes

Topics

Casting; Sand Casting; Permanent-Mold Casting; Centrifugal Casting; Die Casting; Forging; Extrusion; Powder Metal Forming; Sheet Metal Forming; Wire Drawing

Objectives

- Name four kinds of molds used in casting.
- List the steps in making a sand mold.
- Describe the differences between hot-chamber and cold-chamber die casting.
- Describe extrusion.
- List the steps involved in making a part by powder metallurgy.

Lesson 4: Iron and Steel

Topics

Iron Ore; Pig Iron; Smelting; Cast Iron; Gray Cast Iron; White Cast Iron; Malleable Cast Iron; Ductile Cast Iron; High-Alloy Cast Iron; Steel

Objectives

- Name the commercial grades of cast iron.
- List the important mechanical properties of commercial grades of cast iron.
- Describe the forms in which carbon appears in commercial grades of cast iron.
- Describe the process of smelting.

Lesson 5: Standard Steels

Topics

Carbon in Steels; Steel Rolling; Steel Classification; Spark Testing; Forms of Steel Stock; Hot-Rolled Plate and Sheet; Cold-Rolled Sheet; Steel Strip; Steel Plate; Steel Bars; Structural Steel; Alloy Steels; Stainless Steels

Objectives

- State the definition of steel.
- Name the method by which a steel was made, based on its AISI code.
- Demonstrate how to conduct a spark test.
- Identify steel sheets having as-rolled edges and cut edges.
- Describe two differences between alloy steels and steels containing only iron and carbon.

Lesson 6: Heat Treatment

Topics

Uses of Heat Treatment; Welding; Repairing Tools; Repairing Machines; Castings; Forgings; Carbon Content of Steels; Science of Heat Treatment

Objectives

- Describe the two basic processes, and state the four major purposes, of heat treatment.
- Explain why distortion and cracking occur during welding.
- Explain how to anneal, harden, and temper a steel drill.
- State the definitions of low-carbon, medium-carbon, and high-carbon steels.

Lesson 7: Copper

Topics

Producing Copper; Copper Alloys; Machining Copper and Copper Alloys; Electrical Conductivity; Corrosion; Annealing Copper; Brasses; Muntz Metal; Admiralty Brass; Bronzes; Nickel Silvers; Aluminum Bronze; Beryllium-Copper Alloys; Cupro-Nickel Alloys; Copper Alloys for Casting

Objectives

- List the steps in producing copper from ore.
- List the contents of brass, Muntz metal, admiralty brass, bronze, nickel silver, aluminum bronze, and cupro-nickel.
- Describe dezincification in brass.
- Name the three groups of brasses, based on their zinc content, and the three categories of hardness.
- List the contents of red brass, and describe its uses.

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Lesson 8: Aluminum

Topics

Properties of Aluminum; Producing Aluminum; Aluminum Alloys; Wrought Aluminum Grades; Cast Aluminum Grades; Alloying Elements; Forming Processes; Anodizing; Welding Aluminum; Brazing Aluminum; Soldering Aluminum; Safety Precautions

Objectives

- List advantages and disadvantages of the oxide coating on aluminum.
- State the definition of wrought-grade and casting-grade aluminums.
- Describe the advantages of aluminum-silicon alloys.
- Describe how aluminum is anodized.
- Name the classifications of aluminum solders.

Lesson 9: Magnesium and Titanium

Topics

Producing Magnesium; Extracting Magnesium; Melting and Refining Magnesium; Alloying Magnesium; Magnesium Alloy Designation; Casting and Wrought Alloys; Extruding; Rolling and Forging; Machining; Joining Magnesium; Properties of Titanium; Uses of Titanium; Processing Titanium; Commercially Pure Titanium

Objectives

- Name the alloys of magnesium and titanium.
- List the useful properties of magnesium and titanium.
- Describe how to join magnesium alloys.
- Describe the precautions that must be taken when working with magnesium and titanium.
- Describe the uses of magnesium and titanium in industry.

Lesson 10: Lead, Nickel, Tin, and Zinc

Topics

Using Lead; Producing Lead; Properties of Lead; Forms of Lead; Fabricating Lead; Joining Lead; Using Nickel; Producing Nickel; Nickel Alloys; Using Tin; Producing Tin; Properties of Tin; Tinplate; Tin Alloys; Tin Solders; Babbitt; Bronze; Using Zinc; Producing Zinc; Machining Zinc

Objectives

- Describe the properties and characteristics of lead.
- List the properties that are improved by adding nickel to stainless steel.
- Describe how tinplate is manufactured.
- Describe how zinc is refined and processed.