

**Benchmarks – Indicators -- Mapping  
Metals I**

**Arc Welding**

- 1. Explain and demonstrate equipment safety, set-up, and operation. (I, II, IV, V, VI)**  
(January) **CS, LS**
  - A. Explain and demonstrate all safety precautions associated with arc welding. **(wt, pt, to)**
  - B. Explain and demonstrate straight and reverse polarity. **(wt, pt)**
  - C. Explain and demonstrate AC and DC welding applications. **(wt, pt)**
  - D. Explain and demonstrate amperage settings. **(wt, pt)**
  - E. Explain and demonstrate the use of other tools and protective clothing needed for arc welding. **(wt, pt)**
  
- 2. Understand and explain the properties of various metals. (VI)** (January) **CS, LS**
  - A. Point out the characteristics of various metals. **(wt)**
  - B. Determine which metals to use for best results. **(wt)**
  
- 3. Explain and demonstrate the various electrodes. (IV, V, VI)** (January, February) **LS**
  - A. Explain the purpose of flux. **(wt)**
  - B. Explain and select electrodes using the coding numbers. **(wt, pt)**
  - C. Explain and select current settings for electrode diameter and metal thickness. **(wt, pt)**
  - D. Explain and identify “special” electrodes. **(wt)**
  
- 4. Explain and demonstrate the five things needed to produce a good weld. (I, II, III, IV, V, VI)** (February/March/April/May) **CS, LS, HOTS**
  - A. Explain and select correct electrode according to type, position, and preparation of joint. **(wt, pt)**
  - B. Explain and select correct current setting. **(wt, pt)**
  - C. Explain and demonstrate correct arc length. **(wt, pt)**
  - D. Explain and demonstrate correct speed of travel. **(wt, pt)**
  - E. Explain and demonstrate correct angle. **(wt, pt)**
  
- 5. Explain and demonstrate the basic techniques in arc welding. (I, II, III, IV, V, VI)**  
(February/March/April/May) **CS, LS, HOTS**
  - A. Explain and demonstrate various weave patterns. **(wt, pt)**
  - B. Explain and demonstrate “starting” the arc. **(wt, pt)**
  - C. Explain and demonstrate running a bead. **(wt, pt)**
  - D. Explain and demonstrate arc welding the various joints in the various positions. **(wt, pt)**

**Infused Areas**

**CE = career education**  
**GE = global education**  
**CS = communication skills**  
**HOTS = higher order thinking skills**  
**MCGF = multicultural gender fair**  
**LS = learning skills**  
**TI = technology integration**

**Assessments**

**ws = worksheet**  
**wt = written test**  
**to = teacher observation**  
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**Resources:** Text Books, handouts, arc welders, safety glasses, welding helmets, metal, electrodes, chipping hammers, aprons, gloves, pliers.

## Metals I (continued)

### Mig Welding

1. **Explain and demonstrate equipment safety, set-up, and operation. (I, II, IV, V, VI)**  
(January) **CS, LS**
  - A. Explain and demonstrate all safety precautions associated with mig welding. **(wt, pt, to)**
  - B. Explain mig welding processes. **(wt)**
  - C. Explain and demonstrate choosing the correct amperage settings. **(wt, pt)**
  - D. Explain the types of filler wire and factors to consider when selecting filler wire. **(wt, pt)**
  - E. Explain and demonstrate choosing the correct wire rate of speed. **(wt, pt)**
  - F. Explain and demonstrate proper care of shielding gas cylinders. **(wt, pt)**
  - G. Explain the types of shielding gases. **(wt)**
  - H. Explain and demonstrate the factors to consider when adjusting the rate of flow of shielding gases. **(wt, pt)**
  - I. Explain and demonstrate other protective tools and clothing associated with mig welding. **(wt, pt)**
  
2. **Explain and demonstrate the five things needed to produce a good weld. (I, II, III, IV, V, VI)**  
(February/March/April/May) **CS, LS, HOTS**
  - A. Explain and select correct wire speed. **(pt, to)**
  - B. Explain and select correct current setting. **(pt, to)**
  - C. Explain and demonstrate correct arc length. **(pt, to)**
  - D. Explain and demonstrate correct speed of travel. **(pt, to)**
  - E. Explain and demonstrate correct angle. **(pt, to)**
  
3. **Explain and demonstrate the basic techniques in mig welding. (I, II, III, IV, V, VI)**  
(February/March/April/May) **CS, LS, HOTS**
  - A. Explain and demonstrate various weave patterns. **(pt, to)**
  - B. Explain and demonstrate starting the arc. **(pt, to)**
  - C. Explain and demonstrate running a bead. **(pt, to)**
  - D. Explain and demonstrate mig welding the various joints in the various positions. **(pt, to)**

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## Metals I (continued)

### Oxy/Acetylene Welding

1. **Explain and demonstrate the safety practices used with the Oxy/Acetylene welding equipment. (I, II, IV, V, VI)** (January) **CS, LS**
  - A. Explain and demonstrate safe cylinder handling procedures. **(wt, pt, to)**
  - B. Explain and demonstrate safe Oxy/Acetylene cart set-up. **(wt, pt, to)**
  - C. Explain and demonstrate connecting regulators to cylinders. **(wt, pt, to)**
  - D. Explain and demonstrate testing for leaks. **(wt, pt, to)**
  - E. Explain the other tools and safety clothing used in Oxy/Acetylene welding. **(wt)**
  
2. **Explain and demonstrate torch tip, welding tips, and heating tips. (I, II, V, VI)** (January) **CS, LS, HOTS**
  - A. Explain the purpose of the various parts of the cutting torch attachment. **(wt, pt, to)**
  - B. Explain and demonstrate selecting the correct size welding tip. **(wt, pt, to)**
  - C. Explain and demonstrate cleaning the torch and welding tips. **(wt, pt, to)**
  - D. Explain and demonstrate the heating tip. **(wt, pt, to)**
  - E. Explain and demonstrate a carbonizing, oxidizing, and neutral flame. **(wt, pt, to)**
  
3. **Explain and demonstrate using the cutting torch. (I, II, III, IV, V, VI)** (January/February/March/April/May) **CS, LS, HOTS**
  - A. Explain and demonstrate the steps in start-up. **(wt, pt, to)**
  - B. Explain and demonstrate the steps in shut-down. **(wt, pt, to)**
  - C. Explain and demonstrate proper grip and angle. **(wt, pt, to)**
  - D. Explain and demonstrate correct time for cutting and moving phase. **(wt, pt, to)**
  
4. **Explain and demonstrate Oxy/Acetylene welding processes. (I, II, III, IV, V, VI)** (January/February/March/April/May) **CS, LS, HOTS**
  - A. Explain and demonstrate the steps in start-up and shut-down. **(wt, pt, to)**
  - B. Explain and demonstrate making a bead without filler rod. **(pt, to)**
  - C. Explain and demonstrate making a bead with filler rod. **(pt, to)**
  - D. Demonstrate welding various joints in various positions. **(pt, to)**
  
5. **Explain and demonstrate brazing. (I, II, III, IV, V, VI)** (April/May) **CS, LS, HOTS**
  - A. Explain the advantages and disadvantages of brazing. **(wt)**
  - B. Explain and point out the factors that produce good brazed joining. **(wt)**
  - C. Explain and demonstrate the use of brazing filler rod and flux. **(wt, pt)**
  - D. Explain the effects of heat on brazing. **(wt)**
  - E. Explain and demonstrate brazing joint preparation. **(wt, pt, to)**
  - F. Demonstrate the brazing process by completing a few joints. **(pt, to)**

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**Metals I (continued)**

**Oxy/Acetylene Welding (continued)**

- 6. Review the career opportunities associated with welding. (VII) (May) CE, GE**
- A. List occupations that encompass welding. **(wt)**
  - B. Explain possible educational and training requirements. **(wt)**
  - C. Explain possible skills needed for the welding industry. **(wt)**

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## Metals I (continued)

### Getting Acquainted With Metals

1. **Understand and explain the various aspects and characteristics of Iron. (VI)** (January) **CS, LS**
  - A. Explain the term metallurgy. (**ws, wt**)
  - B. Explain, in detail, iron. (**ws, wt**)
  - C. Explain iron ore. (**ws, wt**)
  - D. Explain pig iron. (**ws, wt**)
  - E. Explain cast iron. (**ws, wt**)
  - F. Explain the various kinds of cast iron. (**ws, wt**)
  - G. Explain wrought iron. (**ws, wt**)
  
2. **Understand and explain the various aspects and characteristics of Steel. (VI)** (January, February) **CS, LS**
  - A. Explain the term steel. (**ws, wt**)
  - B. Explain the kinds and grades of steel. (**ws, wt**)
  - C. Explain what carbon has to do with steel and cast iron. (**ws, wt**)
  - D. Explain the five ways of making steel. (**ws, wt**)
  - E. Explain a Bessemer Converter. (**ws, wt**)
  - F. Explain the basic-oxygen process (BOP) (**ws, wt**)
  - G. Explain an open-hearth furnace. (**ws, wt**)
  - H. Explain a crucible furnace. (**ws, wt**)
  - I. Explain the electric furnace. (**ws, wt**)
  - J. Explain low-carbon steel. (**ws, wt**)
  - K. Explain medium-carbon steel. (**ws, wt**)
  - L. Explain high-carbon steel. (**ws, wt**)
  - M. Explain hot-rolled steel. (**ws, wt**)
  - N. Explain cold-rolled steel. (**ws, wt**)
  - O. Explain cold-drawn steel. (**ws, wt**)
  - P. Explain cast steel. (**ws, wt**)

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## Metals I (continued)

### 3. Understand and explain the various aspects and characteristics of Steel Alloys. (VI) (February, March) CS, LS

- A. Explain what an alloy is. (ws, wt)
- B. Explain a special alloy steel. (ws, wt)
- C. Explain nickel steel. (ws, wt)
- D. Explain chromium steel. (ws, wt)
- E. Explain chrome-nickel steel. (ws, wt)
- F. Explain manganese steel. (ws, wt)
- G. Explain molybdenum steel. (ws, wt)
- H. Explain tungsten steel. (ws, wt)
- I. Explain vanadium steel. (ws, wt)
- J. Explain high-speed steel. (ws, wt)
- K. Explain cast alloys. (ws, wt)
- L. Explain the spark test of iron and steel. (ws, wt)
- M. Explain the AISI steel specifications. (ws, wt)
- N. Explain the properties of metals. (ws, wt)

### 4. Understand and explain the nonferrous metals. (VI) (March, April) CS, LS

- A. Explain aluminum. (ws, wt)
- B. Explain copper. (ws, wt)
- C. Explain brass. (ws, wt)
- D. Explain bronze. (ws, wt)
- E. Explain zinc. (ws, wt)
- F. Explain silver. (ws, wt)
- G. Explain gold. (ws, wt)
- H. Explain magnesium. (ws, wt)
- I. Explain lead. (ws, wt)
- J. Explain tin. (ws, wt)
- K. Explain Babbitt. (ws, wt)
- L. Explain pewter. (ws, wt)
- M. Explain nickel. (ws, wt)

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## Metals I (continued)

### 5. Heat treatment of steels. (I, II, III, IV, V, VI) (April, May) CS, HOTS, LS

- A. Explain heat treatment of steel. (ws, wt)
- B. Explain furnaces and temperature controls. (ws, wt)
- C. Explain how carbon content affects hardening. (ws, wt)
- D. Explain and demonstrate hardening. (ws, wt, pt)
- E. Explain hardening temperature. (ws, wt)
- F. Explain quenching solutions. (ws, wt, pt)
- G. Explain tempering and demonstrate tempering. (ws, wt, pt)
- H. Explain annealing. (ws, wt)
- I. Explain normalizing. (ws, wt)
- J. Explain case hardening. (ws, wt)
- K. Explain other methods of heat treatment. (ws, wt)

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