**Intro to Electric ARC and Gas Welding**  
**Grades 10-12**  
**Unit #1**

<table>
<thead>
<tr>
<th>Course/Subject:</th>
<th>Grade:</th>
<th>Unit 1: Welding Fundamentals</th>
<th>Suggested Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Electric Arc and Gas welding</td>
<td>10-12</td>
<td>6-8 weeks</td>
<td></td>
</tr>
</tbody>
</table>

**Grade Level Summary**

Introductory Electric ARC and Gas Welding builds on instruction learned in Introductory Agricultural Engineering and combines basic instruction with hands-on training in the field of metalworking. This course includes instructions in sheet metal working, welding, metal cutting and fabrication. Instruction includes gas welding processes and shielding, AC and DC welding.

**Grade Level Units**

- Unit 1: Welding Fundamentals
- Unit 2: Metal Technology
- Unit 3: Shielded Metal Arc Welding
- Unit 4: Gas Tungsten, Gas Metal, and Flux Cored Arc Welding
- Unit 5: Oxyfuel Gas Processes
- Unit 6: Plasma Arc Cutting

**Unit Title**

Welding Fundamentals

**Unit Summary**

In this unit students will look at the safety in the welding industry. The unit will look at shop and personal safety. Also a key aspect of welding is being able to read welding prints, a big portion of this unit revolves around the basics of print reading, different types of joints, symbols and welding positions. Once print reading can be accomplished the unit then looks at all the different types of welding and cutting processes.

**Unit Essential Questions:**

1. Why are the fundamentals of welding the most important aspect to becoming a successful welder?

**Key Understandings:**

1. Shop safety
2. Welding safety
3. Weld print reading
4. Weld joints
5. Welding positions
6. Different types of welding and cutting processes

**Focus Standards Addressed in the Unit:**

<table>
<thead>
<tr>
<th>Standard Number</th>
<th>Standard Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PST.01.03.01.a</td>
<td>Compare and contrast the principles and procedures of different welding and cutting processes.</td>
</tr>
<tr>
<td>PST.02.02.02.b</td>
<td>Apply safety principles and applicable regulations to operate equipment, machinery and power units used in AFNR power, structural and technical systems.</td>
</tr>
</tbody>
</table>

7/26/17 – PAGE 1
Interpret and explain the meaning of symbols used in sketches of agricultural structures.

### Important Standards Addressed in the Unit:

#### Misconceptions:

1. Welding is done by touching an electrical source to metal and they become one.
2. Math and reading skills are not needed to have a welding career.

#### Proper Conceptions:

1. Most welding is done by creating an electrical arc. The electrode and metal do not actually touch during the welding process.
2. Math is a big component of welding and weld print reading. Diagrams and schematics are how projects are constructed. Reading and measuring are key components to becoming a successful welder.

### Knowledge & Concepts

- Dangers in an agricultural mechanics shop and work place
- Safety colors used on signs and icons in the agriculture industry
- Proper firefighting equipment.
- Safety rules and regulations
- First aid methods and procedures using supplies in a first aid kit
- Various types of welding and cutting equipment including oxyacetylene and plasma arc
- Various joints to include fillet butt joint, vertical tee joint, double bevel joint and fillet tee joint
- Welding print reading
- Welding print symbols

### Skills & Competencies

- List safety procedures that promote avoidance of shop hazards and accident reduction.
- Identify and demonstrate wearing of personal protective equipment
- Demonstrate positive safety attitudes and responsibilities
- Describe regulations, safety and consumer protection
- Read blueprints and schematics for welding
- Read work order, instructions, formulas or processing charts
- Perform daily safety practices

### Dispositions & Practices

- Persistence
- Resilience

### Academic Vocabulary:

- Accident
- Personal factors
- Physical factors
- American Welding Society
- Safety in Welding, Cutting, and Allied Processes
- Housekeeping
- Combustibles
- Flame resistance
- Mechanical drawing
- Assembly drawing
- Filter shade
- High voltage
- Air-supplied breathing apparatus
- Powered air purifier
- Air supplied respirator
- Air-purifying respirators
- High pressure cylinder
- Torch lighter
- Fire watch
- Object lines
- Hidden edge lines
- Flame retardant
- Arc helmet
- Leather apron
- Leather cape
- Cap
- Gloves
- Safety glasses
- Arc ray
- Work envelope
- Kill switch
- Fillet welds
- Detail drawing
- Orthographic projection
- Multiview projection
- Projection plane
- Parallel projection
- Front view
- Right side view
- Left side view
- Top view
- Bottom view
- Back view
- Rear view
- Pictorials
- Pictorial drawings
- Axonometric projection
- Isometric view
- Trimetric view
- Diametric view
- Section view
- Detail view
- Field weld symbol
- Plug weld
- Slot weld
- Pitch
- Spot weld
- Seam weld
- Electrode angle
- Travel angle
- Drag angle
- Drag travel angle
- Backhand welding
- Push angle
- Forehand welding
- Work angle
- Flash welding
- Plasma arc cutting
- Shielded metal arc cutting
- Air carbon arc cutting
- Arc stud welding (SW)
- Cold welding (CW)
- Explosion welding (EXW)
- Forge welding (FOW)
- Friction welding (FRW)
- Friction stir welding (FSW)
- Center lines
- Dimension line
- Cutting plane line
- Section line
- Extension lines
- Leader lines
- Full scale
- Drawn to scale
- Half scale
- Weld joint
- Butt joint
- Edge preparation
- Groove weld
- Groove joint
- Groove face
- Groove angle
- Bevel angle
- Weld root
- Root face
- Weld face
- Lap joint
- Corner joint
- T-joint
- Edge joint
- Flange joint
- Flare-groove joint
- Welding temperature
- Filler material
- Shielded metal arc welding
- Base metal
- Alternating current (AC)
- Direct current (DC)
- Gas Tungsten Arc welding
- Tungsten inert gas (TIG)
- Ultrasonic welding (USW)
- Laser beam welding (LBW)
- Electric beam welding (EBW)
- Torch plastic welding
- Stringer bead
- Weave bead
- Joint geometry
- Tack weld
- Penetration
- Welding position
- Weld axis
- Overhead welding
- American National Standards Institute (ANSI)
- American Welding Society (AWS)
- Weld symbol
- Reference line
- Arrow side
- Other side
- Root opening
- Finish symbol
- Intermittent welding
- Length dimension
- Pitch dimension
- Chain intermittent weld
- Staggered intermittent welds
- Weld-all-around symbol
- Stringer bead
- Cover pass
- Gas metal arc welding
- Metal inert gas (MIG)
- Flux cored arc welding (FCAW)
- Oxyacetylene welding
- Torch soldering
- Oxidizing flame
- Torch brazing
- Oxyfuel gas cutting (OFC)
- Oxyfuel gas under water cutting
- Oxygen Arc cutting
- Oxygen lance cutting
- Exothermic cutting
- Flux cutting
- Metal powder cutting
- Resistance spot welding
- Projection welding
- Resistance seam welding (RSEW)

### Assessments:

- Test
- Quizzes
- Daily logs
- Projects
- Safety checks
- Participation
Differentiation:

- Book work
- Lecture
- Demonstrations
- Video clips
- Hands on learning
- IEP accommodations

Interdisciplinary Connections:

- This unit covers many aspects of safety in an industrial setting which can be used in everyday situation. Students will learn safe practices to handle flammable substances and protective gear against fire. Information like this can be used in classes such as chemistry where they may use chemicals and flames. Another large portion of this Unit is related to math and in particularly Geometry. The part of this unit that speaks about weld prints and weld angles is highly relatable to geometry in the use of angles and shapes. This part of the unit can also be related to Technology Education and the technical drawing courses.

Additional Resources:

- Video clips
- Articles
- Personal Accounts
- Modern Welding textbook
- Welding Technology Fundamentals text book
- Agricultural Technology and Mechanics textbook

Created By:

Troy Summey
<table>
<thead>
<tr>
<th>Course/Subject: Introduction to Electric Arc and Gas welding</th>
<th>Grade: 10-12</th>
<th>Metal Technology</th>
<th>Suggested Timeline: 3 weeks</th>
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</thead>
</table>

**Grade Level Summary**
Introductory Electric ARC and Gas Welding builds on instruction learned in Introductory Agricultural Engineering and combines basic instruction with hands-on training in the field of metalworking. This course includes instructions in sheet metal working, welding, metal cutting and fabrication. Instruction includes gas welding processes and shielding, AC and DC welding.

**Grade Level Units**
- Unit 1: Welding Fundamentals
- Unit 2: Metal Technology
- Unit 3: Shielded Metal Arc Welding
- Unit 4: Gas Tungsten, Gas Metal, and Flux Cored Arc Welding
- Unit 5: Oxyfuel Gas Processes
- Unit 6: Plasma Arc Cutting

**Unit Title**
Metal Technology

**Unit Summary**
This unit looks at the process of making different metals and how they are shaped. Along with how they are made the unit looks at the different properties that each metal has from the process it has gone through. Finally, in the unit we learn how to heat treat different metals and what the heat treatment does for metal.

**Unit Essential Questions:**
1. With so many different metals, what are considerations you must think about when selecting one for a project?

**Key Understandings:**
1. Production of metals
2. Identifying metals
3. Metal properties
4. Heat treating metal

**Focus Standards Addressed in the Unit:**

<table>
<thead>
<tr>
<th>Standard Number</th>
<th>Standard Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PST.01.03.02.a</td>
<td>Compare and contrast the properties of different metals used in AFNR power, structural and technical systems.</td>
</tr>
</tbody>
</table>

**Important Standards Addressed in the Unit:**
### Misconceptions:
1. All steel is the same.
2. All metal is “hard”.

### Proper Conceptions:
1. Steel comes with different carbon contents that contribute to different properties and strengths.
2. Hardness is created through a heat treatment process that actually make the metal more brittle.

<table>
<thead>
<tr>
<th><strong>Knowledge &amp; Concepts</strong></th>
<th><strong>Skills &amp; Competencies</strong></th>
<th><strong>Dispositions &amp; Practices</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Heat treatment process</td>
<td>• Identify and select various types of metals.</td>
<td>• Curiosity</td>
</tr>
<tr>
<td>• Ferrous metals</td>
<td>• Differentiate between ferrous and nonferrous</td>
<td></td>
</tr>
<tr>
<td>• Nonferrous metals</td>
<td>• Identify and select metal by shape</td>
<td></td>
</tr>
<tr>
<td>• Production of metals</td>
<td>• Treat metal for desired properties</td>
<td></td>
</tr>
<tr>
<td>• Shaping of metal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Metal properties</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Academic Vocabulary:
- Alloy steels
- Straight carbon steel
- Plain carbon steel
- Hot iron
- Pig iron
- Steelmaking furnace
- Flux
- Blast furnace
- Hopper
- Tuyere
- Basic oxygen furnace
- Ladle
- Heat
- Open hearth furnace
- Vacuum furnace
- Vacuum streaming
- Ladle degassing
- Vacuum induction furnace
- Vacuum arc furnace
- Electroslag remelting process
- Continuous casting process
- Tundish
- Ingot
- Soaking pit
- Billet
- Decarburization
- Grey cast iron
- White cast iron
- Cupola furnace
- Tapping
- Crucible
- Electrolysis
- Nonferrous metal
- Ferrous metal
- Carbon steel
- Alloy steel
- Physical property
- Compression strength
- Hardness
- Elongation
- Brittleness
- Toughness
- Ductility
- Simple alloy
- Body-centered cubic structure
- Hexagonal close-packed structure
- Iron-carbon diagram
- Ferrite
- Critical temperature
- Cementite
- Pearlite
- Austenite
- Eutectoid point
- Hypoeutectoid steels
- Hypereutectoid steels
- Eutectic point
- Hypoeutectic cast iron
- Liquidus line
- Solidus line
- Oxyacetylene torch test
- Color test
- Density
- Specific gravity test
- Magnet test
- Preheating
- Interpass heating
- Post-weld heat treatment
- Temperature gradient
- Heat-affected zone (HAZ)
- Critical temperature
- Electrical resistance heating
- Induction heating
- Furnace
- Upper transformation temperature
- Time-temperature-transformation (T-T-T)
- Annealing
- Grain-refined region
- Grain-coursed region
- Elastic limit
- Yield strength
- Process anneal
- Normalizing
- Thermal stress relieving
- Spheroidizing
- Surface hardening
- Flame hardening
- Case hardening
- Ductile cast iron Hall process
- Distilling process
- Rolling mill
- Forging
- Extrusion
- Drawing
- Powdered metal
Assessments:

- Test
- Quizzes
- Daily logs
- Projects
- Safety checks
- Participation

Differentiation:

- Book work
- Lecture
- Demonstrations
- Video clips
- Hands on learning
- IEP accommodations

Interdisciplinary Connections:

- This unit relates very well to science courses when the metal is taking on different physical properties. Also in the creation of many of the metals and alloys. Elements and chemical reactions are being combined to create many alloys.

Additional Resources:

- Video clips
- Articles
- Personal Accounts
- Modern Welding textbook
- Welding Technology Fundamentals textbook
- Agricultural Technology and Mechanics textbook

Created By:
Troy Summey
**Intro to Electric ARC and Gas Welding**  
**Grades 10-12**

**Unit #3**

<table>
<thead>
<tr>
<th>Course/Subject:</th>
<th>Grade:</th>
<th>Shielded Metal Arc Welding</th>
<th>Suggested Timeline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Electric Arc and Gas welding</td>
<td>10-12</td>
<td></td>
<td>6-8 weeks</td>
</tr>
</tbody>
</table>

**Grade Level Summary**  
Introductory Electric ARC and Gas Welding builds on instruction learned in Introductory Agricultural Engineering and combines basic instruction with hands-on training in the field of metalworking. This course includes instructions in sheet metal working, welding, metal cutting and fabrication. Instruction includes gas welding processes and shielding, AC and DC welding.

**Grade Level Units**
- Unit 1: Welding Fundamentals
- Unit 2: Metal Technology
- Unit 3: Shielded Metal Arc Welding
- Unit 4: Gas Tungsten, Gas Metal, and Flux Cored Arc Welding
- Unit 5: Oxyfuel Gas Processes
- Unit 6: Plasma Arc Cutting

**Unit Title**
- Shielded Metal Arc Welding

**Unit Summary**  
This unit looks into the equipment and supplies needed to weld with a shielded arc welder. Technique and safety are also aspects of this unit that will be looked while students practice their skills of arc welding.

**Unit Essential Questions:**
1. What are essential safety precautions that keep you and others safe while welding?
2. What considerations must be taken when setting up to weld?

**Key Understandings:**
1. Arc welding supplies
2. Arc welding equipment
3. Arc welding safety
4. How the arc welding system works
5. How to weld using the arc welder (starting, running a bead)
6. Weld defects

**Focus Standards Addressed in the Unit:**

<table>
<thead>
<tr>
<th>Standard Number</th>
<th>Standard Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PST.01.03.02.b</td>
<td>Assess and select the proper electrode for use in various shielded metal arc welding situations.</td>
</tr>
<tr>
<td>PST.01.03.01.c</td>
<td>Evaluate the quality of metal fabrication procedures.</td>
</tr>
<tr>
<td>PST.01.03.02.c</td>
<td>Construct and/or repair metal structures and equipment using metal fabrication procedures.</td>
</tr>
</tbody>
</table>
Important Standards Addressed in the Unit:

<table>
<thead>
<tr>
<th>Misconceptions:</th>
<th>Proper Conceptions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. There is no serious issue while welding</td>
<td>1. Welding can be dangerous and even fatal if not done correctly. Electrocution can occur if the electrode and ground are connected.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge &amp; Concepts</th>
<th>Skills &amp; Competencies</th>
<th>Dispositions &amp; Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety rules and regulations.</td>
<td>Identify and demonstrate wearing of personal protective equipment.</td>
<td>Persistence</td>
</tr>
<tr>
<td>Various joints to include fillet butt joint, vertical tee joint, double bevel joint and fillet tee joint</td>
<td>Identify and use proper firefighting equipment</td>
<td></td>
</tr>
<tr>
<td>Various types of welders (AC, DC, CC)</td>
<td>Demonstrate positive safety attitudes and responsibilities</td>
<td></td>
</tr>
<tr>
<td>Methods to create an arc</td>
<td>Identify and select various types of welding and cutting equipment including oxyacetylene and plasma arc</td>
<td></td>
</tr>
<tr>
<td>Various metals and classifications</td>
<td>Identify and weld various joints to include fillet butt joint, vertical tee joint, double bevel joint and fillet tee joint.</td>
<td></td>
</tr>
<tr>
<td>Ohm’s law and the flow of electricity</td>
<td>Fabricate a product by hand.</td>
<td></td>
</tr>
<tr>
<td>Hand tools, personal safety equipment, and clothing for welding task</td>
<td>Determine correct shade of welding lens</td>
<td></td>
</tr>
<tr>
<td>Basic welding joints</td>
<td>Complete a safety inspection of arc welding station</td>
<td></td>
</tr>
<tr>
<td>Basic welding position</td>
<td>Select correct electrode, current and polarity for welding</td>
<td></td>
</tr>
<tr>
<td>Welding defects</td>
<td>Strike a welding arc and produce acceptable stringer and weaving beads</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Restart arc and blend new and old beads</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weld all 5 basic welds in all positions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Identify welding defects</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pass safety test related to arc welding areas</td>
<td></td>
</tr>
</tbody>
</table>

### Academic Vocabulary:

- Shielded metal arc welding (SMAW)
- Inverter
- Static volt ampere curve
- Output slope
- Constant current machine
- Droop curve machines
- Drooper
- Primary winding
- Tapped secondary winding
- Saturable reactor
- Magnetic amplifier control
- Generator
- Alteration current
- Constant current transformer-rectifier
- Armature coil winding
- Brushes
- Carbon and low alloy steel electrode classification number
- Tensile strength
- Suffix
- Low-hydrogen electrodes
- Copper-based electrodes
- Nickel-based electrode
- Chipping hammer
<table>
<thead>
<tr>
<th>Primary coil</th>
<th>Field windings</th>
<th>Arc flame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducer</td>
<td>Exciter</td>
<td>Vaporized metal</td>
</tr>
<tr>
<td>Step-down transformer</td>
<td>Direct current electrode negative</td>
<td>Liquid metal</td>
</tr>
<tr>
<td>Secondary winding</td>
<td>Direct current electrode positive</td>
<td>Polarity</td>
</tr>
<tr>
<td>Secondary coil</td>
<td>Inverter switcher</td>
<td>Metal composition</td>
</tr>
<tr>
<td>Laminated iron core</td>
<td>Dual source with inverter switching</td>
<td>Welding position</td>
</tr>
<tr>
<td>Solid-state devices</td>
<td>Rated output current rating</td>
<td>Arc length</td>
</tr>
<tr>
<td>Diode</td>
<td>Rated load voltage</td>
<td>Spattering</td>
</tr>
<tr>
<td>Silicon-controlled rectifiers</td>
<td>Welding voltage</td>
<td>Stringer bead</td>
</tr>
<tr>
<td>Transistor</td>
<td>Electrical power input requirements</td>
<td>Weave bead</td>
</tr>
<tr>
<td>Movable shunt transformer control</td>
<td>Lugs</td>
<td>Weld reinforcement</td>
</tr>
<tr>
<td>Movable core reactor</td>
<td>Connectors</td>
<td>Hard surfacing</td>
</tr>
<tr>
<td>Inductive reactance</td>
<td>Neutral gasses</td>
<td>Run-off tab</td>
</tr>
<tr>
<td>Backstep method</td>
<td>Slag</td>
<td>Slag inclusion</td>
</tr>
<tr>
<td>Contoured</td>
<td>Drag electrodes</td>
<td>Forward arc blow</td>
</tr>
<tr>
<td>Undercut</td>
<td>Porosity</td>
<td>Backward arc blow</td>
</tr>
<tr>
<td>Flat welding</td>
<td>Root pass</td>
<td></td>
</tr>
<tr>
<td>Horizontal welding</td>
<td>Whipping motion</td>
<td></td>
</tr>
<tr>
<td>Vertical welding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhead welding</td>
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# Intro to Electric ARC and Gas Welding

## Grades 10-12

### Unit #4

<table>
<thead>
<tr>
<th>Course/Subject:</th>
<th>Grade:</th>
<th>Gas Tungsten, gas metal, and flux core arc welding</th>
<th>Suggested Timeline:</th>
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<tbody>
<tr>
<td>Introduction to Electric Arc and Gas welding</td>
<td>10-12</td>
<td></td>
<td>6-8 weeks</td>
</tr>
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## Grade Level Summary

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## Grade Level Units

- Unit 1: Welding Fundamentals
- Unit 2: Metal Technology
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- Unit 4: Gas Tungsten, Gas Metal, and Flux Cored Arc Welding
- Unit 5: Oxyfuel Gas Processes
- Unit 6: Plasma Arc Cutting

## Unit Title

Gas Tungsten, gas metal, and flux core arc welding

## Unit Summary

In this unit students will examine the other types of arc welding including MIG, TIG, and Flux core welding. Welders that use gas as a flux and a continuous flow of metal instead of the traditional stick arc welder. Students will learn the setup and proper welding techniques using the MIG, TIG, and Flux core welders.

## Unit Essential Questions:

1. What advantages are there to MIG and TIG welding? What are the disadvantages?

## Key Understandings:

1. Gas tungsten welding (TIG)
2. Flux core welding
3. Gas metal arc welding (MIG)
4. Welding techniques
5. Welder setup
6. Welder maintenance

## Focus Standards Addressed in the Unit:

<table>
<thead>
<tr>
<th>Standard Number</th>
<th>Standard Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PST.02.02.02.c</td>
<td>Adjust equipment, machinery and power units for safe and efficient operation of AFNR power, structural and technical systems.</td>
</tr>
<tr>
<td>PST.02.02.02.a</td>
<td>Examine and identify safety hazards associated with equipment, machinery and power units used in AFNR power, structural, and technical systems.</td>
</tr>
<tr>
<td>PST.02.02.02.b</td>
<td>Apply safety principles and applicable regulations to operate equipment, machinery and power units used in AFNR power, structural and technical systems.</td>
</tr>
</tbody>
</table>
## Important Standards Addressed in the Unit:

**Misconceptions:**

1. MIG and TIG welding does not have flux.

**Proper Conceptions:**

1. MIG and TIG welding both use a gas flux to clean the weld.

## Knowledge & Concepts

- Function of GTAW, GMAW, and FCAW
- Various types of shielding gases used in GMAW, GTAW, and FCAW
- Assemble the parts of GTAW welding station and GTAW torch
- Metal preparation for welding
- Self shielded and gas shielded methods of FCAW
- Weld joints
- Weld positions

## Skills & Competencies

- Identify and specify the type of electrode used for GMAW
- Identify and specify the various electrode wires used in GMAW and FCAW
- Correctly set and adjust the welding current and shielding gas flow rate
- Weld different base metals using GTAW, GMAW, and FCAW processes
- Identify potential safety hazards
- Pass safety test on proper and safe use of GTAW, GMAW, and FCAW processes
- Select the proper arc welding machine, wire feeder, shielding gas, flow rate, contract tube, nozzle size, and welding wire type to produce an acceptable weld.
- Identify and demonstrate wearing of personal protective equipment
- Identify and select various types of metals
- Identify and weld various joints to include fillet butt joint, vertical tee joint, double bevel joint and fillet
- Fabricate a product by hand.

## Dispositions & Practices

- Persistence

## Academic Vocabulary:

- Gas Tungsten arc welding (GTAW)
- Gas metal arc welding (GMAW)
- Flux core arc welding (FCAW)
- Constant current
- Rectified
- Balanced wave
- Unbalanced wave
- Reinitiate
- Sinusoidal wave
- Semiautomatic welding
- Peak current
- Background current
- Sine wave
- Upslope current
- Downslope current
- Preflow
- Postflow
- Peak time
- Self-shielded flux cored welding (FCAW-S)
- Gas Shielded flux cored arc welding (FCAW-S)
- Inch switch
- Jog switch
- Purge switch
- Liner
- Self-contained wire feeder
<table>
<thead>
<tr>
<th>Porosity</th>
<th>Exit diameters</th>
<th>Contact tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collet body</td>
<td>Hot shortness</td>
<td>Contact tip</td>
</tr>
<tr>
<td>Gas lens</td>
<td>Touch start</td>
<td>Deoxidizers</td>
</tr>
<tr>
<td>Turbulent stream</td>
<td>Superimposed high frequency</td>
<td>Denitrifiers</td>
</tr>
<tr>
<td>Bird’s nest</td>
<td>High-voltage start</td>
<td>Dash number</td>
</tr>
<tr>
<td>Inert gas</td>
<td>Keyhole</td>
<td></td>
</tr>
<tr>
<td>Reactive gases</td>
<td>Inductance</td>
<td></td>
</tr>
<tr>
<td>Electrode extension</td>
<td>Wire feeder</td>
<td></td>
</tr>
</tbody>
</table>

**Assessments:**

- Test
- Quizzes
- Daily logs
- Projects
- Safety checks
- Participation

**Differentiation:**

- Book work
- Lecture
- Demonstrations
- Video clips
- Hands on learning
- IEP accommodations

**Interdisciplinary Connections:**

- This unit has connections with science. The use of air elements such as Argon, helium, nitrogen etc are found in chemistry class. Students will use these elements while welding.

**Additional Resources:**

- Video clips
- Articles
- Personal Accounts
- Modern Welding textbook
- Welding Technology Fundamentals text book
- Agricultural Technology and Mechanics textbook

**Created By:**
Troy Summey
### Grade Level Summary

Introductory Electric ARC and Gas Welding builds on instruction learned in Introductory Agricultural Engineering and combines basic instruction with hands-on training in the field of metalworking. This course includes instructions in sheet metal working, welding, metal cutting and fabrication. Instruction includes gas welding processes and shielding, AC and DC welding.

### Grade Level Units

- **Unit 1:** Welding Fundamentals
- **Unit 2:** Metal Technology
- **Unit 3:** Shielded Metal Arc Welding
- **Unit 4:** Gas Tungsten, Gas Metal, and Flux Cored Arc Welding
- **Unit 5:** Oxyfuel Gas Processes
- **Unit 6:** Plasma Arc Cutting

### Unit Title

**Oxyfuel Gas Processes**

### Unit Summary

This unit looks at welding using an oxygen and acetylene set up. Flame is produced by the gasses to make a flame hot enough to melt steel. Using the oxyfuel gas welding process, metals can be fused together, bond with additive metals, and cut apart. Other processes that will be examined in this unit are soldering and brazing.

### Unit Essential Questions:

1. Why is an oxyfuel gas set up something every mechanic should have in their shop?

### Key Understandings:

1. Oxyfuel gas welding equipment and supplies
2. Oxyfuel gas welding
3. Oxyfuel gas cutting equipment and supplies
4. Oxyfuel gas cutting
5. Soldering
6. Brazing and braze welding

### Focus Standards Addressed in the Unit:

<table>
<thead>
<tr>
<th>Standard Number</th>
<th>Standard Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PST.01.03.01.a</td>
<td>Compare and contrast the principles and procedures of different welding and cutting processes.</td>
</tr>
<tr>
<td>PST.01.03.01.c</td>
<td>Evaluate the quality of metal fabrication procedures.</td>
</tr>
</tbody>
</table>
Important Standards Addressed in the Unit:

PST.01.03.02.b Analyze the situation and determine the best welding and cutting process to be used in metal fabrication.

<table>
<thead>
<tr>
<th>Misconceptions:</th>
<th>Proper Conceptions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Oxyacetylene is one gas.</td>
<td>1. Oxyacetylene setup is made up of 2 gases, oxygen and acetylene. Acetylene is the combustible gas and oxygen is the accelerant to make the flame hotter.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge &amp; Concepts</th>
<th>Skills &amp; Competencies</th>
<th>Dispositions &amp; Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify and use proper firefighting equipment</td>
<td>Demonstrate safety rules and regulations.</td>
<td>• Curiosity</td>
</tr>
<tr>
<td>positive safety attitudes and responsibilities</td>
<td>Describe regulations, safety and consumer protection.</td>
<td>• Persistence</td>
</tr>
<tr>
<td>various gauges and testers used in agricultural power equipment</td>
<td>Select, adjust, operate and maintain oxy-fuel equipment with and without filler rods.</td>
<td></td>
</tr>
<tr>
<td>various types of welding and cutting equipment including oxyacetylene and plasma arc</td>
<td>Identify and weld various joints to include fillet butt joint, vertical tee joint, double bevel joint and fillet tee</td>
<td></td>
</tr>
<tr>
<td>soldering process</td>
<td>Use soldering equipment.</td>
<td></td>
</tr>
<tr>
<td>brazing process</td>
<td>Repair sheet metal products.</td>
<td></td>
</tr>
<tr>
<td>oxyfuel cutting and welding</td>
<td>Fabricate a product by hand.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cut, assemble and pressure test components within various types of water supply systems</td>
<td></td>
</tr>
</tbody>
</table>

Academic Vocabulary:

- Oxyfuel gas welding outfit
- Oxyfuel gas welding station
- Gas supplies
- Regulators
- Hoses
- Welding torch
- Welding goggles
- Spark lighter
- Dewar flasks
- Cylinder cap
- Valve
- Oxygen line regulator
- Master regulator
- Annealed
- Backfire
- Work angle
- Drag angle
- Push angle
- Eye of the weld pool
- Convex
- Plug weld
- Undercut
- Waterseal flashback arrestor
- Acetylene regulator
- Pressure regulator
- High pressure gauge
- Low pressure gauge
- Bourdon tube
- Inside diameter
- Cutting torch
- Mixing chamber
- Throttle
- Orifice
- Welding tip
- Broach
- Filter lense
- Cover lense
- Bellmouthed orifice
- Electric motor-driven carriage
- Stack cutting
- Ignition temperature
- Cutting outfit
- Cutting oxygen lever
- Oxygen jet
- Economizer
- Liquefied petroleum
- Oxyhydrogen
- Natural gas
- Check valve
- Flashback arrestor
- Refractory
- Brazing
- Soldering
- Oxyacetylene
- Oxyhydrogen
- Oxynatural gas
- Oxyp propane
- Oxidizing flame
- Carburizing flame
- Positive pressure torch
- Injector-type torch
- Servomotors
- Vernier gear mechanism
- Solder
- Capillary action
- Solidus
- Surface tension
- Crowned
- Kerf
- Infrared soldering
- Induction soldering
- Reaction fluxes
- Hydrostatically
- Chemical cleaning
- Pickling solution
- Mechanical cleaning
- Drag
- Refractory oxides
- Oscillating
- Pierce
- Automatic cutting
- Semi-automatic cutting
- Adhesion
- Brass
- Bronze
- Organic fluxes
- Inorganic fluxes
- Rosin-based fluxes
- Degreasing solvent
- Pickling
- Tinning
- Sweating
- Solvent
- Melting temperature
- Flow temperature
- Galvanic corrosion

Assessments:
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- Participation

Differentiation:
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- Hands on learning
- IEP accommodations

Interdisciplinary Connections:
- This unit has connections to science in that there are many natural elements being used. Gas such as oxygen and acetylene are used to produce the flame needed to weld and cut with. Also the metal being used to bond metals together is bronze when brazing.

Additional Resources:
- Video clips
- Articles
- Personal Accounts
- Modern Welding textbook
- Welding Technology Fundamentals text book
- Agricultural Technology and Mechanics textbook

Created By:
Troy Summey
# Intro to Electric ARC and Gas Welding

**Course/Subject:** Introduction to Electric Arc and Gas welding  
**Grade:** 10-12  
**Unit Title:** Plasma Arc Cutting  
**Suggested Timeline:** 2 weeks

## Grade Level Summary
Introductory Electric ARC and Gas Welding builds on instruction learned in Introductory Agricultural Engineering and combines basic instruction with hands-on training in the field of metalworking. This course includes instructions in sheet metal working, welding, metal cutting and fabrication. Instruction includes gas welding processes and shielding, AC and DC welding.

## Grade Level Units
- **Unit 1:** Welding Fundamentals  
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- **Unit 5:** Oxyfuel Gas Processes  
- **Unit 6:** Plasma Arc Cutting

## Unit Title
Plasma Arc Cutting

## Unit Summary
This unit examines the plasma arc cutting process and machines. The unit will look at cutting possibilities and how the system works.

## Unit Essential Questions:
1. Why would you choose plasma cutting when you can cut with so many other machines?

## Key Understandings:
1. Plasma cutter equipment  
2. Plasma machine set up  
3. Cutting  
4. Safety equipment

## Focus Standards Addressed in the Unit:

<table>
<thead>
<tr>
<th>Standard Number</th>
<th>Standard Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PST.02.02.02.c</td>
<td>Adjust equipment, machinery and power units for safe and efficient operation in AFNR power, structural and technical systems.</td>
</tr>
<tr>
<td>PST.01.03.01.b</td>
<td>Analyze the situation and determine the best welding and cutting process to be used in metal fabrication.</td>
</tr>
</tbody>
</table>

## Important Standards Addressed in the Unit:
Misconceptions:
1. Plasma cutter uses plasma.

Proper Conceptions:
1. Plasma cutters use electricity and high pressure air to cut through metal.

### Knowledge & Concepts
- various types of welding and cutting equipment including oxyacetylene and plasma arc
- Equipment required to cut with PAC
- Assemble and set up PAC equipment
- Safety equipment required when PAC

### Skills & Competencies
- Conduct training in product use.
- Demonstrate proper and safe use of air operated equipment.
- Identify and select various types of metals.
- Perform acceptable cut using the PAC process
- Recognize PAC safety and fire hazards

### Dispositions & Practices
- curiosity

### Academic Vocabulary:
- Plasma arc cutting
- Constricting nozzle
- Plasma gas
- Shielding gas
- Transferred arc
- Pilot arc
- Nontransferred
- Dross
- Dual flow plasma arc cutting
- Hertz
- Swirl ring
- Heat shield

### Assessments:
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- Participation

### Differentiation:
- Book work
- Lecture
- Demonstrations
- Video clips
- Hands on learning
- IEP accommodations

### Interdisciplinary Connections:
- This unit has connections to science in the use of electrical circuits. Hand eye coordination is an important element in this unit in order to make a good cut.

### Additional Resources:
- Video clips
- Articles
- Personal Accounts