Title: Comparing and Contrasting Types of Welding (part 2)

Objectives	Time frame to Complete
Students will be able to write a multi-paragraph compare-contrast essay.	30-45 minutes
	NRS EFL
	4

Stackable Cert. Documentation	Technology	Study / Life skills	EL-Civics	Career Pathways	Police	Paramedic	Fire Rescue	Medical Asst.	EKG / Cardio	Phlebotomy	Practical Nursing	Healthcare Admin	Pharmacy Tech	IMT	AMT	HVAC	Welding	Other:						
X																	X							

Standard(s) Addressed in Lesson

Write to Convey Ideas

Benchmark(s) Addressed in Lesson

W.4.2. Write for varying purposes (for example, to persuade, to explain, to entertain).
W.4.3. Write for varying types of tasks (for example, business letters, letters to the editor, job applications, literature responses, informational essays, informal writing).
W.4.5. Formulate a thesis from a main or controlling idea.
W.4.10. Choose an organizational pattern (for example, order of importance, problem to solution, topical) to present ideas logically.
W.4.11. Develop writing with an effective introduction, a body and a conclusion that summarizes, extends or elaborates on points or ideas in the writing.
W.4.12. Group related ideas into well-developed paragraphs with topic sentences and supporting sentences.
W.4.19. Reread and revise writing to clarify meaning (for example, sentence variety, transitions among paragraphs).

Materials

Types of Welding handout (from Comparing and Contrasting Types of Welding – part 1)
Completed Venn diagram (from Comparing and Contrasting Types of Welding – part 1)
Computer with internet access
Paper and pencil
Suggested websites:
http://www.ajeepthing.com/welding.html
http://en.wikipedia.org/wiki/Welding

Learner Prior Knowledge

Students should understand what it means to compare and contrast.
Students should use standard writing conventions to write complete sentences and paragraphs.
Students should understand and recognize thesis statement, supporting details, introduction, and conclusion.

Activities

*** Note * This lesson is a follow-up activity to a reading lesson titled Comparing and Contrasting Types of Welding – part 1.**

Step 1 Review the basic components of a compare-contrast essay including thesis statement, supporting details, and suggested structures. One suggested structure is a four-paragraph essay that contains an introductory paragraph, one paragraph about topic A, one paragraph about topic B, and a concluding paragraph.

Another suggested structure is a five-paragraph essay that contains an introductory paragraph, a series of three paragraphs that each compares and contrasts one aspect of the two topics, and a concluding paragraph.

Step 2 Students review the *Types of Welding* handout and their completed Venn diagram (from Comparing and Contrasting Types of Welding – part 1). Students determine the most important similarities and differences between the types of welding and plan a multi-paragraph essay based upon a suggested structure for comparing and contrasting the two processes.

Step 3 Students research each type of welding for further information in order to add details to their essays. Suggested websites include: http://en.wikipedia.org/wiki/Welding, http://www.ajeepthing.com/welding.html

Step 4 Students compose essays, seeking help as needed.

Step 5 The teacher reads the essays and provides guidance regarding organization, sentence structure, transitions, or content. Students revise as necessary.

Assessment/Evidence

Compare-contrast essay. (This may be used as documentation for a Stackable Certificate. Copy for student portfolio if applicable.)

Adaptations for Beginning Students

Beginning students may complete a more limited assignment such as writing one paragraph that compares the two topics.

Adaptations for Advanced Students

Advanced students may deviate from the suggested format and write a longer essay. If more challenge is needed, students may also research a third type of welding and include details about it in the essay.

Teacher Reflection/Lesson Evaluation

This lesson was created by Middletown ABLE.

Go Welding.Org

Ultimate Guide To The Various Types Of Welding

Welding is defined as a process where two or more pieces of metal or thermoplastics are fastened together by use of heat and pressure. The process of applying heat softens the material and enables it to affix together as one in a joint area when an adequate amount of pressure is applied. The concept of welding first developed in the middle ages, though it did not form into the process of welding as it is today until the latest years of the 19th century. Before this, a process known as "forge welding" was the only means of joining two metal objects together. Forge welding consisted of using a flame to heat metal to extremely high temperatures and then hammering each piece together until they became one. This method was replaced around the time of the industrial revolution. Electric and gas flame heating methods proved to be much safer and faster for welders. Practically every material object that has made society what it is today, was created by welded construction tools or has been welded itself. Because of this, welders have a wide range of areas for employment, many welders specialize in pipe welding or automobile welding while others specialize in machinery. The possibilities are endless for welders seeing as welding can be performed in a diverse range of locations, including underwater, though not all forms of welding are the same. Some forms of welding use gas, while others use electric and the newest forms involve use of a laser. The process of welding that is used depends on a variety of factors but the form and thickness of the material is usually the deciding factor for which method is most effective. Arc, Electroslag, Flux-Cored, Gas Metal-Arc, Gas Tungsten-Arc, Metal Inert Gas, Plasma Arc, Shielded-Metal Arc, Submerged Arc and Tungsten Inert Gas are the most widely used welding methods.

Arc Welding

Arc welding is a popular form of welding due the low cost of the process. The process begins with a device that gives off an electric current. This device can differ greatly from process to process yet it always enables electric current to move through materials that without the device, would be considered non-conductive. It is called ‘arc welding’ because an electrical current is created between the welding device and the materials to be welded which at times gives an arch like appearance. The first basic form of arc welding was invented in the year 1802. Today, many other subcategories of arc welding exist.

Electric Arc Welding

Occupational Safety & Health Administration: Arc Welding and Cutting

Arc Welding- Safe Selection, Operation and Maintenance

Arc Welding Pros and Cons

Electroslag Welding

Electroslag welding came into practice in the mid-1950s. Electroslag is a generally fast welding process used to join large materials such as thick steel plates. These plates or materials are usually arranged in a vertical position, as the Electroslag weld is designed to weld at this angle without causing distortion to the welder. The name ‘Electroslag’ was derived from the use of water filled copper areas within the device, which were included and designed solely to prevent melted ‘slag’ from pouring into other areas as it liquefied.

Fundamental Aspects of Electroslag Welding of Titanium Alloys

System and Method for Electroslag Welding Spliced Vertical Columns

Narrow-Gap Electroslag Welding

Consumables for Electroslag & Electrogas Welding

Flux-Cored Welding

Flux-cored welding was created and put into use in the early years of the 1950's. Its purpose was to give another option to the popular use of 'stick welding'. The Flux-Cored process is mostly used for projects that require fast speed as it is an automatic form of welding. Many construction workers use this process on the job because of the speed and the ability to use flux-cored welding in multiple situations on various materials.

Flux Cored Arc Welding Process Description

Flux Cored Arc Welding - Final Report

Section VIII, Table 8.2- Flux Cored Welding

Gas Metal Arc Welding

The process of Gas Metal Arc Welding (GMAW), created in the 1940's, is another automatic welding process. This method consists of the use of a welding gun which automatically feeds the weld metal through the gun for use. The weld gun also automatically distributes a protective gas as a shield from the natural elements. This process saves a lot of time and is best for a large quantity of welding work. It was originally developed for use with aluminum metals. Today, this method is mostly used by those welders in the automobile repair and manufacturing industries.

Parametric Optimization of Gas Metal Arc Welding Processes by Using Factorial Design Approach

GMAW Training

Modeling Macro-and Microstructures of GMAW

Gas Metal Arc Welding Process Characteristics

Gas Tungsten-Arc Welding

Gas Tungsten-Arc Welding is considered to be one of the most difficult and time consuming of welding processes used today (along with Plasma Arc Welding). This is because it requires a great amount of focus and skill due to the small area of space between the 'arc' of the flame and the material being welded. Usually, small strips of metal that do not contain much iron are welded with this process. Though it is difficult, it produces extremely strong high quality welds when done correctly. Welders manufacturing bicycles and aircraft, both commercial and military, use Gas Tungsten-Arc Welding often while many other welders will never come across this process. Very little change has been made to this process since its release in 1941.

Gas Tungsten-Arc Welding Introduction

Gas Tungsten Arc Welding- Mild Steel

Recent Progress on Gas Tungsten Arc Welding of Vanadium Alloys

MIG (Metal Inert Gas) Welding

Metal Inert Gas Welding is a process of welding that uses a gas to shield the weld metal. The gas keeps the metal being welded from being effected from natural elements in the environment, such as oxygen. This allows the welder to operate at a continuous rate, making the process fairly quick. Operation of the equipment does not require an extreme level of skill by welders, however, the equipment used in MIG Welding can only be used indoors due to the gas involved in the welding process. MIG Welding was originally released in the 1940's but underwent many upgrades until being perfected in the 1960's.

Metal Inert Gas (MIG) Welding Tips

Welding Processes: MIG

What is MIG Welding?

Fundamentals of MIG Welding

Plasma Arc Welding

Plasma Welding is very much like that of Gas Tungsten-Arc Welding (GTAW). The two processes are often compared because they basically work in the same fashion, only using a different type of torch. This method was developed in 1954, though even today, it is still being improved upon. Plasma Welding also requires more concentration than GTAW because of the smaller arc and precision of the weld. In Plasma Welding, the electrical current is passed through an extremely small nozzle which passes through the protective gases, enabling extreme accuracy when welding small areas. Plasma Welding can heat metals to very extreme temperatures which can result in deeper welds. Like GTAW, this welding process is generally used in the aircraft manufacturing industry.

The Plasma Arc Welding Process- How Plasma Welding Works

The Ternary Gas Plasma Welding Torch

Plasma Arc Cutting Technical Considerations

Welding Technology: PAW

Shielded-Metal Arc Welding

Shielded-Metal Arc Welding (SMAW) is also referred to as 'stick welding'. This process is known to be the most popular and widely used processes in welding today. The first form of SMAW was created in 1938 but the process and equipment continues to undergo upgrades. It is a manual welding process that is very simple and inexpensive to operate. The results often are not as 'neat' as other methods and molten splatter is a common occurrence. Stick welding is mostly used by construction welders working on steel structures and other industries that require welding but do not have large budgets.

Global Security: Gas Shielded- Arc Welding

Stick (SMAW) Welding Processes

Shielded-Metal Arc/Stick Welding Basics

Characterization of Welding Fume from SMAW Electrodes

Submerged Arc Welding

The Submerged Arc Welding process can only be used properly on materials containing high iron contents, such as stainless steel. The device used in this process can be automatic or semi-automatic making it a fairly fast welding process. While it is a fast process, the electrical arc must constantly be covered by 'flux' in order to protect the metal from the atmosphere during the welding process. This cover also prevents any welding spatter which makes it safer for welders than some of the other forms of welding. The process is named after this need to be 'submerged' in a flux cover.

Submerged Arc Welding Technical Handbook

Cold Wire Feed Submerged Arc Welding

Submerged Arc Welding Guide

Welding Imperfections of Submerged Arc Welded Duplex Steel Joints

TIG (Tungsten Inert Gas) Welding
Tungsten Inert Gas welding is much like the process of Metal Inert Gas (MIG) welding. The main difference between these two forms of welding is that TIG uses a tungsten current form, while MIG uses a metal electrode. Because TIG uses tungsten, it requires an additional filler placed inside the welding device as tungsten does not melt in the welding process. Tungsten is unique as it can be heated to a higher temperature before melting than all other metals. Tungsten Inert Gas Welding is usually used in industries that work with stainless steel.

Principals of TIG Welding

Health and Safety Executive: Tungsten Inert Gas (TIG) Welding

Welding Dictionary- TIG Welding

TIG Welding Guides

MIG & TIG Welding