CANADA
4-H Saskatchewan

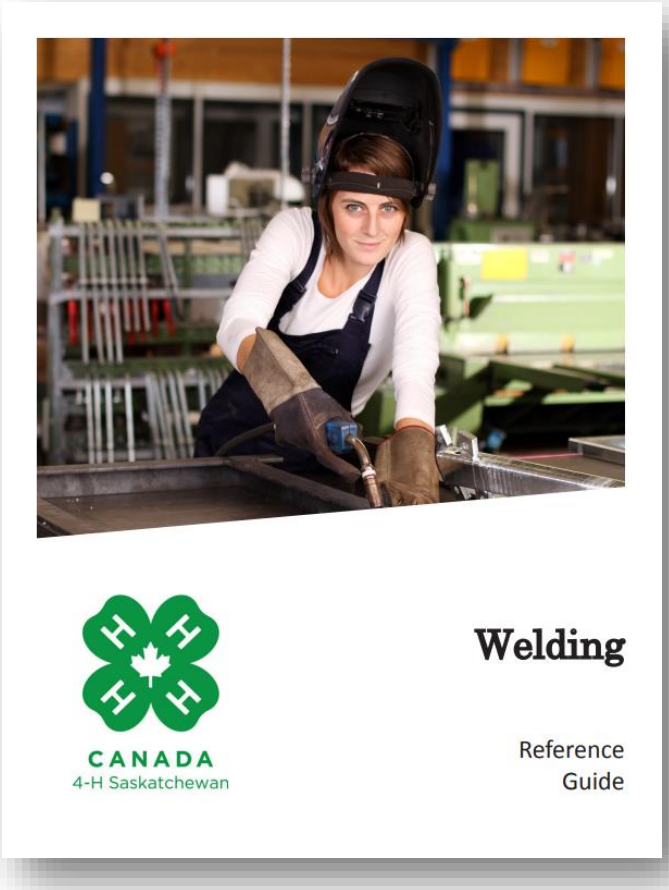
Exploring 4-H at Home

Science and Technology

Pillar: Science & Technology

Project: Welding

Activity: Chocolate Welding



What is Welding? Where can we find it?

Welding is the process of joining pieces of metal together. It is the most common, economical and efficient way to join metals permanently. There are other ways to connect two pieces of metal together (like riveting) but welding is the only way to join pieces of metal together so that they act as a single piece. This is done by melting part of each piece and adding a filler metal to form a joint.

Once we've stopped to think about how many of the objects we depend on are made of metal we can start to see why welding is so important and why we need it.

Could you image if suddenly, all at once, all of the welds in the world came apart? It would be catastrophic! Just picture it. Skyscrapers would crumble down on themselves. Vehicles would flop into heaps of parts in the middle of the road. Ships would fall apart and sink. Airplanes would drop out of the sky in pieces. Farmers wouldn't have any of the tools and machinery they need to produce a crop. Even the way you pass your day and what you do inside of your house would be affected. What would you eat without having a fridge, stove, microwave or toaster? Where would you sleep since most likely your bed has collapsed? How would you spend your free time without a computer, TV, radio or telephone?

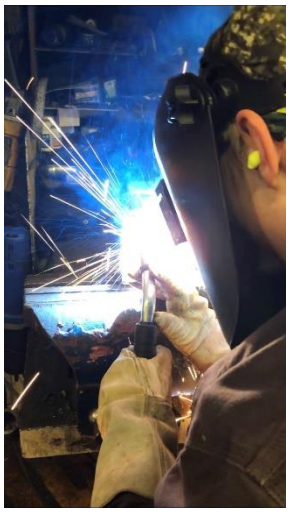
It's easy to see how different and much more difficult life would be without all of these metal things that are held together by welds. But, the scope of how much welding affects our daily lives goes beyond this. Many of the objects around us that are not made of metal are made from a machine that is made of metal and welds. This includes things like clothing, dishes, furniture, building materials and books.

Without metals and the ability to weld them we would have to resort to using materials like stone and wood for all of our needs. These materials would work to replace some of the products we know as common necessity, but many, like computers, would be impossible to replace and most of our ways to manufacture products would disappear.

Would you believe that welding serves another purpose beyond all of this? It does. Welding is also used to make things better and stronger. For example, a bridge made of one single plank is not nearly as strong as a bridge made of several pieces welded together, like a box girder bridge. Even if we join these pieces together with a method other than welding, they wouldn't be nearly as strong as if they were held together by welds.

Here are some pictures from the St. Walburg 4-H Club's Welding Project.

Photography by: Amber Gervais





Chocolate Welding

A look at how welding can make things stronger, by comparing the strength of a bridge made of a single plank and a box girder bridge, made of several pieces welded together.

Materials

- Hot water (and a kettle or other means to heat it)
- Straight-edged glass bottle (wine bottle works well)
- At least 5 chocolate bars (must be solid – no grooves for easily braking off pieces)
- Small weights (if you don't have small weights, try rolls of coins or pieces of metal)
- 2 drinking glasses with flat bottoms (there is a risk of glass breaking by weights falling on them – sturdy plastic glasses are best)
- A jig (optional) made by cutting two right-angles into a plastic box or container
- A fridge (optional)
- A plastic ruler (optimal)

Instructions

To demonstrate how much stronger welding can make objects, weld a box girder bridge made of chocolate bars and compare it to the strength of a plank (single chocolate bar). The heat source to create our welds is hot water.

1. Place hot water into glass bottle. Hold the edges of chocolate bars against the bottle until they melt slightly.
2. Press the melted edges together in a right angle and leave to cool. This is half the box section. If you've made a jig, leave it to cool in the jig. Make another half section the same way.
3. When both half sections have cooled, melt the remaining long edges and press them together to form the box section. Leave to cool (in the jig if you have it) for at least 20 minutes, or put in a fridge to speed up the process.
4. First see how strong a plank bridge is. Place two drinking glasses upside down and then set an unwrapped chocolate bar between the glasses, creating a bridge. Begin to load your bridge with weights, carefully adding a little at a time. Make sure that the bridge is loaded in the middle free span part of the bridge. If you are using coins, you may need to take them out of the rolls in order to add weight that is light enough for the plank to support. Take note of how much weight you loaded when the bridge breaks.
5. Once your box girder has properly cooled (the edges have solidified) it's time to test it. Examine the box girder before you begin. Take note of whether or not it is joined perfectly all along each edge, if there is some distortion causing the beam not to be perfectly square. Talk about how these factors may affect the strength of the bridge. Then, place the box girder between the two glasses and begin to load with weights. See how much more weight the box girder can take than the plank before it breaks.

Discussion Questions

How much weight did the plank bridge hold?

How much weight did the box girder hold?

Why did it hold so much more?

The box girder is made from four bars so it should hold at least four times the load. Did this happen? Why or why not?