

Lampeter-Strasburg High School Agriculture Department

Teacher	K. Janae McMichael
Class	Agriculture Mechanics 1
Unit	Plumbing
Essential Question	What are the steps involved in soldering?
Standards	<p><u>PA Academic Standards:</u></p> <ul style="list-style-type: none"> - <u>3.2.12.B3:</u> Describe the relationship between the average kinetic molecular energy, temperature, and phase changes. - <u>3.2.12.B4:</u> Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them. - <u>3.4.10.C2:</u> Analyze a prototype and/or create a working model to test a design concept by making actual observations and necessary adjustments. - <u>3.1.12.A6:</u> Analyze how cells in different tissues/organs are specialized to perform specific functions. <p><u>National AFNR Standards</u></p> <ul style="list-style-type: none"> - PS.02.02.03.c. Evaluate the function of the xylem, phloem and cambium tissues and the impact on plant systems. - PS.02.02.02.b. Analyze root tissues and explain the pathway of water and nutrients into and through root tissues. - PST.01.02.02.a. Identify the tools, machines and equipment needed to construct and/or fabricate a project in AFNR. - PST.04.03.04.a. Compare and contrast the characteristics of materials used in plumbing and water systems (e.g., copper, PVC, PEX, etc.). - PST.04.03.04.c. Install and/or repair pipes and plumbing equipment and fixtures in AFNR structures.
Materials	Propane Torch, Misc. Pieces of ½” copper tubing, ½” copper fittings, solder, flux, bench vise, pipe vise, needle nose pliers, quench buckets
Prep/Teaching Time	82 minutes/1 class
Key Vocabulary	Capillary Action, Propane Torch, Misc. Pieces of copper tubing, copper fittings, solder, flux
Bellwork	In what context have you heard the term “capillary action?” Do you know what it means?
ENGAGE: <i>Activating Strategy</i>	Color Transfer Activity: http://www.kixcereal.com/kix-cereal-magical-color-transfer/
EXPLORE: Recall	Have students quiz their table partner on the proper steps and necessary materials for cementing PVC (<i>AGMC_L08.1_PlumbingIntro&PVCCement</i>)

EXPLAIN: Differentiated Instruction
(Independent, Group, Directed)

Define Capillary Action with **Color Transfer Activity**

- Capillary action is the movement of liquid along a surface of a solid caused by the attraction of molecules of the liquid to the molecules of the solid. Let's simplify.
 - Students define on a post-it in LBNB
 - Plants use capillary action to bring water up the roots and stems to the rest of the plant. The molecules of the water (the liquid) are attracted to the molecules of the inside of the stem (the solid). This attraction is used to help force the water up from the ground and disperse throughout the plant.
 - Adhesion is the process of attaching one thing to another. For plants, adhesion allows for the water to stick to the organic tissues of plants.
 - Cohesion keeps molecules of the same substance together. For plants, cohesion keeps the water molecules together.
 - Surface tension is the effect of intermolecular attraction that causes liquids to form a top or outer layer that behaves like a thin film of sorts. Surface tension is responsible for the shape of water drops and for holding the structures together as plants soak up the water.
- Solder, the filler metal, acts as the adhesive
 - "This scientific phenomenon allows molten alloy to be drawn into the joint between two metal parts"
- Connect capillary action to the process that occurs during soldering

Introduction to Soldering

- Define required tools for the soldering process
 - Solder - A filler metal that has a melting point LOWER than the base metal (copper)
 - Flux & Brush
 - Steel Wool
 - Table Clamp
 - Propane Torch
 - Copper Tubing & Fitting
 - Needle Nose Pliers
- Ask: Why do we use the soldering process?
 - Low-temperature process
 - Economical
 - Used in electrical and plumbing settings
 - Similar concept to brazing
- Define Steps to Soldering process
 - 1. Clean Pipe and Fitting
 - 2. Apply flux to pipe and fitting
 - 3. Secure Fitting to Pipe piece
 - 4. Heat Pipe first, then fitting to ensure even heating
 - 5. When hot enough, apply solder

	<ul style="list-style-type: none"> - If hot enough, solder should melt and “suck into” or travel into the fitting by capillary action - Ensure solder gets the whole way around the fitting - 6. Apply heat to fitted are to ensure alloy as filled properly - 7. Turn off torch - 8. Cool metal - Teacher Demo <ul style="list-style-type: none"> - Students take notes in LBNB - Teacher leads individual student demo <ul style="list-style-type: none"> - Give students page 4 of AGMC_L08.2_PlumbingSquareDirections <ul style="list-style-type: none"> - Ask them to draw each step in their LBNB <ul style="list-style-type: none"> - Take some students JOS - Switch students LBNB to finish drawings - Students complete practice solders <ul style="list-style-type: none"> - Students can reheat fitting and take apart, clean and practice again - Students submit a final solder for practicum grade
ELABORATE: Summarization/Examples	Soldering should be clean; avoid extra drips down the side of the project, etc.
TICKET-OUT:	List the steps to performing a correct solder
EVALUATE: Homework/Assessments	Practicum 1 - Soldering
Additional Notes	Resource Links: https://www.lucasmilhaupt.com/en-US/about/blog/2013/2/Capillary-Action-Video