

WAMC Lab Template

Math Concept(s): Adding and Subtracting Fractions

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Attach the following documents:

- Lab Instructions
- Student Handout(s)
- Rubric and/or Assessment Tool

Short Description (Be sure to include where in your instruction this lab takes place):

Lab Plan

Lab Title: Plumbing and Pipefitting

Prerequisite skills: General knowledge of addition and subtraction of fractions and how they relate to plumbing and pipefitting trades.

Lab objective: The goal of this lab is to provide a basic understanding of the measurements and calculations required to cut and fit $\frac{1}{2}$ " copper pipe.

Standards: (Note SPECIFIC relationship to Science, Technology, and/or Engineering)

Mathematics K–12 Learning Standards:

- HSN-Q: Reason quantitatively and use units to solve problems.
- 7.NS: Apply and extend previous understandings of operations with fractions to add, subtract, multiply and divide rational numbers.

Standards for Mathematical Practice:

- 1. Reason abstractly and quantitatively.
- 4. Model with Mathematics.
- 6. Attend to precision.

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- Speaking and Listening: Comprehension and Collaboration
- B. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.
- C. Propel conversations by posing and responding to questions that probe reasoning and evidence.

Technology

- 1. Empowered learner. Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by learning sciences.
- 5. Computational thinker. Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technology.

Engineering

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- HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

Leadership/21st Century Skills:

<p><u>21st Century Interdisciplinary themes</u> (Check those that apply to the above activity.)</p> <input type="checkbox"/> Global Awareness <input type="checkbox"/> Financial/Economic/Business/Entrepreneurial Literacy <input type="checkbox"/> Civic Literacy <input type="checkbox"/> Health/Safety Literacy <input type="checkbox"/> Environmental Literacy			
<p><u>21st Century Skills</u> (Check those that students will demonstrate in the above activity.)</p>			
<p>LEARNING AND INNOVATION</p> <p><u>Creativity and Innovation</u></p> <input checked="" type="checkbox"/> Think Creatively <input checked="" type="checkbox"/> Work Creatively with Others <input checked="" type="checkbox"/> Implement Innovations <p><u>Critical Thinking and Problem Solving</u></p> <input checked="" type="checkbox"/> Reason Effectively <input checked="" type="checkbox"/> Use Systems Thinking <input checked="" type="checkbox"/> Make Judgments and Decisions <input checked="" type="checkbox"/> Solve Problems <p><u>Communication and Collaboration</u></p> <input checked="" type="checkbox"/> Communicate Clearly <input checked="" type="checkbox"/> Collaborate with Others	<p>INFORMATION, MEDIA & TECHNOLOGY SKILLS</p> <p><u>Information Literacy</u></p> <input type="checkbox"/> Access and Evaluate Information <input type="checkbox"/> Use and manage Information <p><u>Media Literacy</u></p> <input type="checkbox"/> Analyze Media <input type="checkbox"/> Create Media Products <p><u>Information, Communications and Technology (ICT Literacy)</u></p> <input type="checkbox"/> Apply Technology Effectively	<p>LIFE & CAREER SKILLS</p> <p><u>Flexibility and Adaptability</u></p> <input type="checkbox"/> Adapt to Change <input type="checkbox"/> Be Flexible <p><u>Initiative and Self-Direction</u></p> <input checked="" type="checkbox"/> Manage Goals and Time <input type="checkbox"/> Work Independently <input type="checkbox"/> Be Self-Directed Learners <p><u>Social and Cross-Cultural</u></p> <input type="checkbox"/> Interact Effectively with Others <input type="checkbox"/> Work Effectively in Diverse Teams	<p>Productivity and Accountability</p> <input checked="" type="checkbox"/> Manage Projects <input checked="" type="checkbox"/> Produce Results <p><u>Leadership and Responsibility</u></p> <input type="checkbox"/> Guide and Lead Others <input checked="" type="checkbox"/> Be Responsible to Others

Math Council

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Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- Each student will need;
 - Pipe: 6' of ½" copper tube
 - Fittings: (4) ½" ell, (4) ½" tee, (2) ½" male adapter, (4) ½" cap, (2) ½" cast iron mounting flange
 - Lumber: 5' of 1x6 Pine
 - Flux and Solder
 - Tools: Tape Measure, Torch, Miter Saw, Drill Press, Sander, PPE, tube cutter

Set-Up Required:

- Purchase and procure materials
- Prepare tools

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

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Cooperative Learning:

- Each student will construct (1) shelf but will work in teams of 2-3 individuals to accomplish the task.

Expectations:

- Students will use math skills to build a shelf from the attached specification sheet.

Timeline:

- (4) 60 minute shop periods

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

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Career Applications

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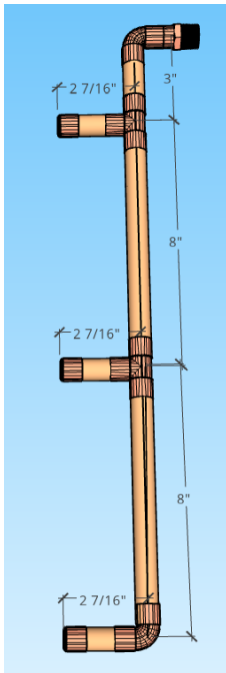
Optional or Extension Activities

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Washington

Copper Shelf Directions for Plumbing Lab

- 1) Read and study the entire plan set before making any cuts.
- 2) To begin the copper work you will need;
 - Pipe: 6' of $\frac{1}{2}$ " copper tube. Share if longer than 6'
 - Fittings: (4) $\frac{1}{2}$ " ell, (4) $\frac{1}{2}$ " tee, (2) $\frac{1}{2}$ " male adapter, (4) $\frac{1}{2}$ " cap, (2) $\frac{1}{2}$ " cast iron mounting flange
 - Flux and Solder
 - Tools: Tape Measure, Torch, PPE, tube cutter
- 3) The below drawing is the specifications you will need to meet for the construction of the copper shelf supports. Measure the pipe-makeup of each of the fittings and determine how many and what size you will need to cut your tubing to. You will need to make two of these shelf supports.



- 4) After all of your sizes and quantities are calculated, cut all of your pieces and tape them together with blue tape.

- 5) For the woodworking portion of this project, you will need.
 - Lumber: 5' of 1x6 pine
 - PPE, Tape Measure, Drill Press, Sander, $\frac{7}{8}$ " spade bit. Router and round over bit

- 6) The below drawing is the specifications you will need to meet for the (3) wooden shelves. After cutting, drilling, routing and sanding, you may want to stain or paint your shelves.



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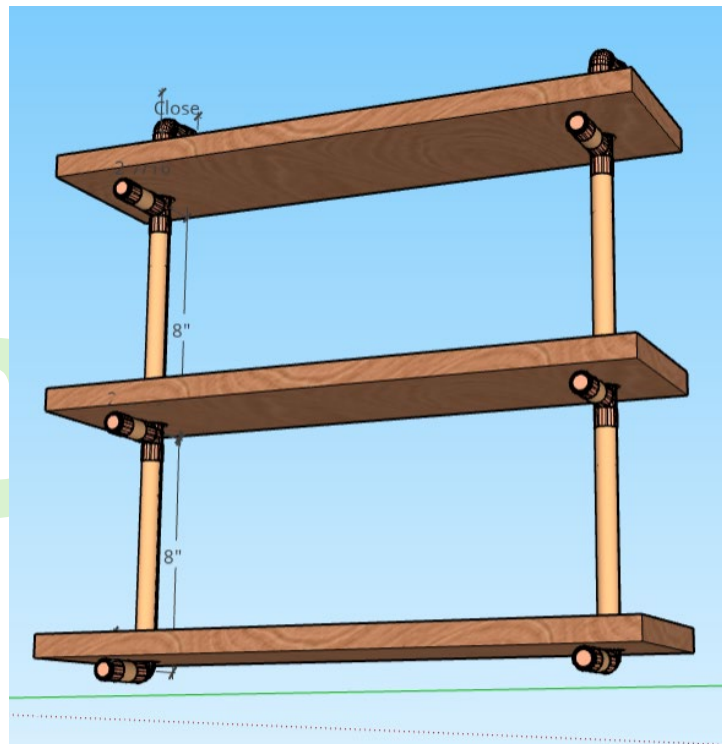
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Washington

7) Flux and solder the copper shelving brackets from the bottom of the bracket and work your way to the top. Make sure to insert the wooden shelves before you solder the next fitting.

8) Cleanup any extra solder by heating up the joints and wiping quickly with a rag. Be careful not to burn yourself. Touch up your stain and rub copper with steel wool to make your copper shine and wood to look great. When you are finished with the project it should look something like this.

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Copper Shelf Project Rubric

Name: _____ Date: _____

Project: _____ Project Grade: _____ /60

Category Standard	8-10 pts Above	7-8 pts At	4-6 pts Approaching	1-3 pts Far Below	Score	Comments
Size and Preparation of Tubing	Tubing has been cut and assembled to size within 1/16".	There are inconsistencies between 1/16" and 1/4" on the tubing.	There is inconsistencies between 1/4" to 1/2" on the tubing.	There are major inconsistencies on the tubing in excess of 1/2".		
Soldering	The joints are thoroughly soldered in a strong and aesthetic way.	The joints are securely soldered with minor imperfections.	Soldering was attempted but may not be secure and have moderate imperfections.	Soldering was attempted on some but not all the joints and may not be secure at all.		
Wooden Shelf Size and preparation	The shelving was cut within 1/16" of the specifications. The drilling is consistent.	The shelving was cut within 1/16" and 1/4" of the specification. There are minor imperfections in the drilling.	There are major inconsistencies on the shelving between 1/4" and 1/2". The drilling has moderate imperfections.	There are major inconsistencies on the shelving in excess of 1/2". The drilling has major imperfections.		
Sanding & Routing	Everything was sanded and routed perfectly.	Project was sanded and routed sufficiently.	Some sanding and routing was done but not enough.	Project was not sanded or routed sufficiently.		
Overall Construction	Construction is very solid, symmetrical and square. Everything lines up.	Construction is solid, and mostly square. Most components line up.	Not very solid. Out of square in places. Parts don't line up. Symmetry is off.	Construction is poor. Nothing lines up. There is no symmetry. Nothing is square. Joints are not solid.		
Finish	Finish is smooth and consistent. There are little to no imperfections. There are no drips or missed spots.	Very few imperfections. Stain or paint is consistent. Very few drips. Finish is smooth to the touch.	There are few imperfections. Stain or paint is not consistent throughout. Some drips are visible.	There are imperfections everywhere. Finish was applied haphazardly. Stain or paint appears blotchy. There are multiple drip marks.		