DISCOVER A TRADE

Activity Book

CFBC

Building foundations for empowered futures

We gratefully acknowledge that we work, live, and play on the traditional and unceded lands of the First Peoples. Much of our work takes us across Turtle Island and we raise our hands in gratitude to the many Nations who have called this land home for time immemorial.

The printing of this book was made possible through the generosity of the BC Centre for Women in the Trades.

Skilled trades are an essential part of our society, and they play a crucial role in building and maintaining the infrastructure that we all rely on. From repairing pipes and electrical systems to constructing buildings and bridges, skilled tradespeople ensure that our communities are safe, functional, and comfortable places to live. By learning about skilled trades, you'll gain a better understanding of the work that goes into creating the world around us, and you may even discover a passion for a particular trade.

In this book, you will find a variety of activities that are designed to help you learn about different skilled trades, including:

- Colouring pages that feature tools and materials used in skilled trades
- Puzzles and quizzes that test your knowledge of different trades
- Hands-on activities that allow you to practice skills like measuring, cutting, and assembling materials
- Treestamp Coasters/Stamps for coasters
- Pinwheel Project
- Electrical Fruit Salad Project
- Tree cookie coasters

Through these activities, you'll gain a better understanding of what it takes to become a skilled tradesperson and the many rewards that come with pursuing a career in this field. So grab your pencils, put on your safety glasses, and let's get started on our journey into the world of skilled trades!

ICE BREAKER BINGO

Is wearing orange	Doesn't like chocolate	Has green eyes	Favourite subject is a shop class	Has used a drill
Has a sibling	Has rode a horse	Knows a foreign language	Is left handed	Favourite food is pizza
Plays sports	Was born in another province	FREE SPACE	Favourite subject is/was math	Does not have any pets
Loves to swim	Has a cat	Has built something cool	Can play the guitar	Has a dog
Has a birthday in the summer	Enjoys being creative	Has red hair	Is the baby of the family	Shares a name with an ancestor

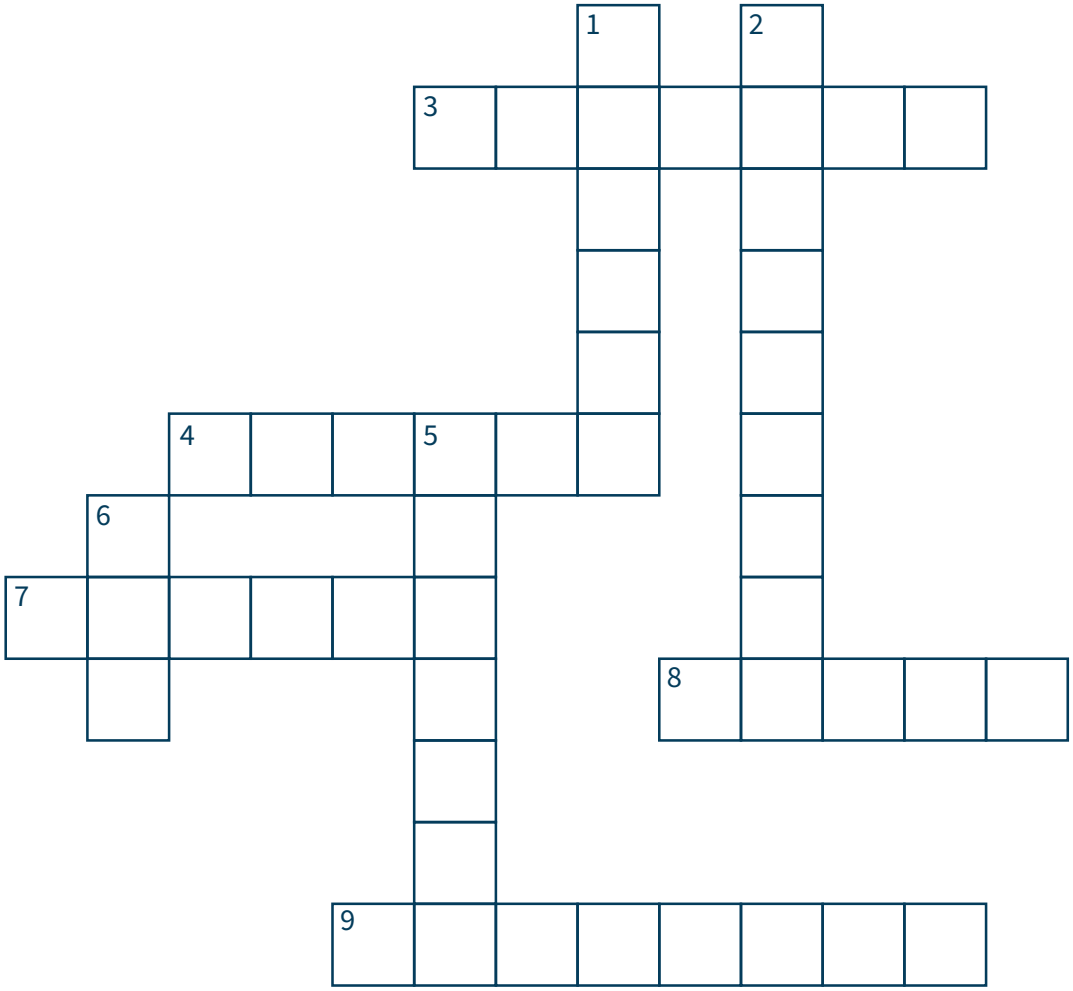
WORD SEARCH

Find the following words that a tradesperson might say.

L L B S E C J O P G S E P Q D
J A I I U L Y K A L O P L M Y
F O D G U R E B I A L T U E C
R M U D H A V C N S A R M T O
A E E R E T P E T S R U B A N
M J N A N R I P Y R E S I L C
I O C G S E A N R O I S N X R
N I Y A I U Y X G E R C G P E
G S R W R N R P G M N O I E T
J T R O S P E E E C J T D T E
P Y L O N Y E E M R Q G I L Y
W I N D O W N N R E S V R C U
Q O C R A N E Y T I N O T S E
J A S B E S T O S R F T N A B
P L Y W O O D D V N Y S S W D

Journeyperson
Apprentice
Lighting
Plumbing
Plywood
Ladder
Glass
Wood
Measurements
Concrete
Asbestos
Surveyor
Metal
Solar
Window
Electricity
Carpentry
Engineer
Framing
Truss
Pylon
Crane
Paint
Joist
Dirt
Saw

CONSTRUCTION CROSSWORD!



DOWN

1. Use this to protect your hands

2. Create a smooth surface using this type of paper

5. Use this to protect your head

6. Use this to cut wood in half

ACROSS

3. A measurement commonly referred to in electrical

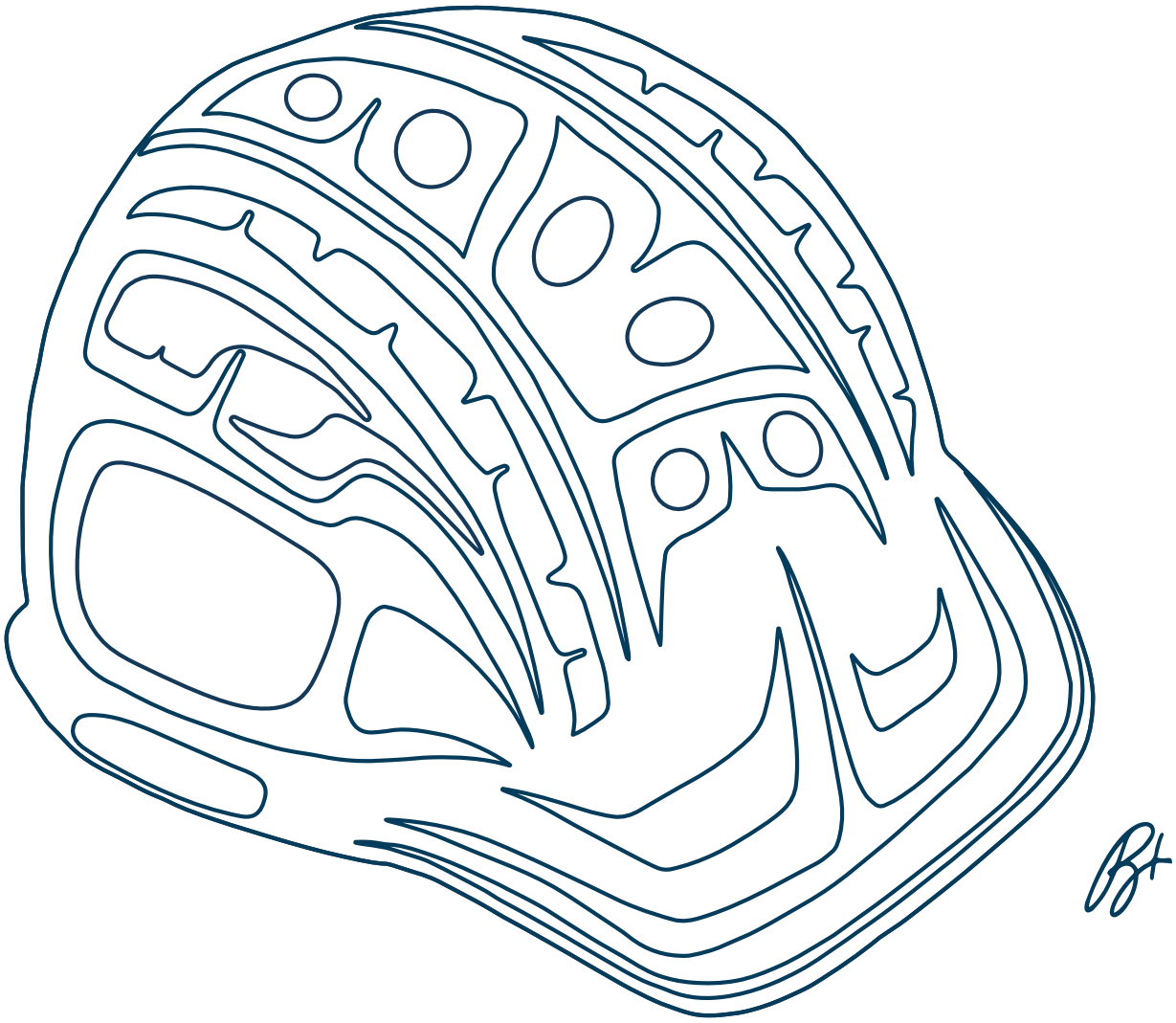
4. Illuminate hallways with these

7. Use this to put nails in wood

8. Use this to apply paint to the wall

9. Use this type of boot to protect your feet

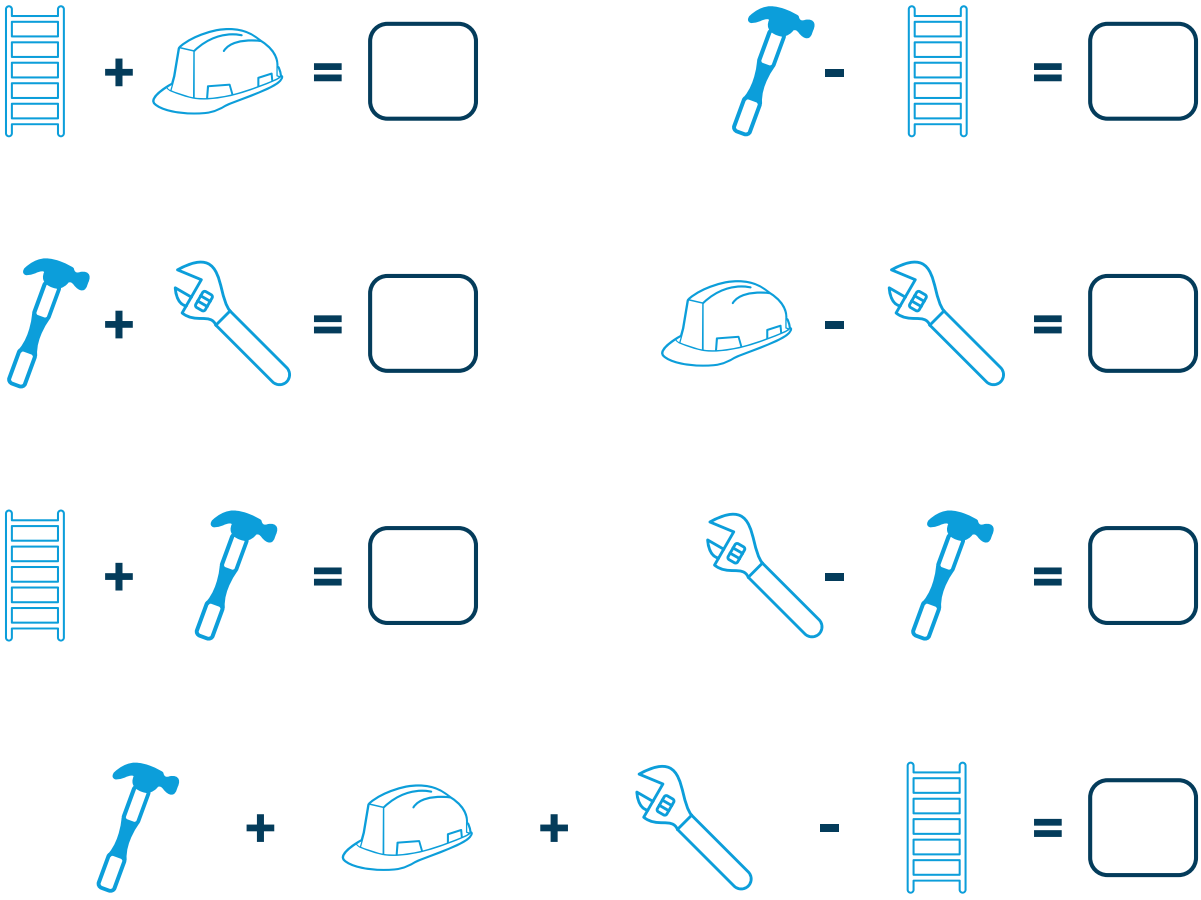
GET CREATIVE WITH COLOUR



With gratitude, we thank Raven Hillenbrand RSE Plumber, Steamfitter and Gas B Fitter of Gitxaala Nation and Git Lax Moon - people of the salt water for sharing her art and creativity with us.

CREATIVE BUILDING SKILLS

Can you solve these math problems using the key at the bottom?

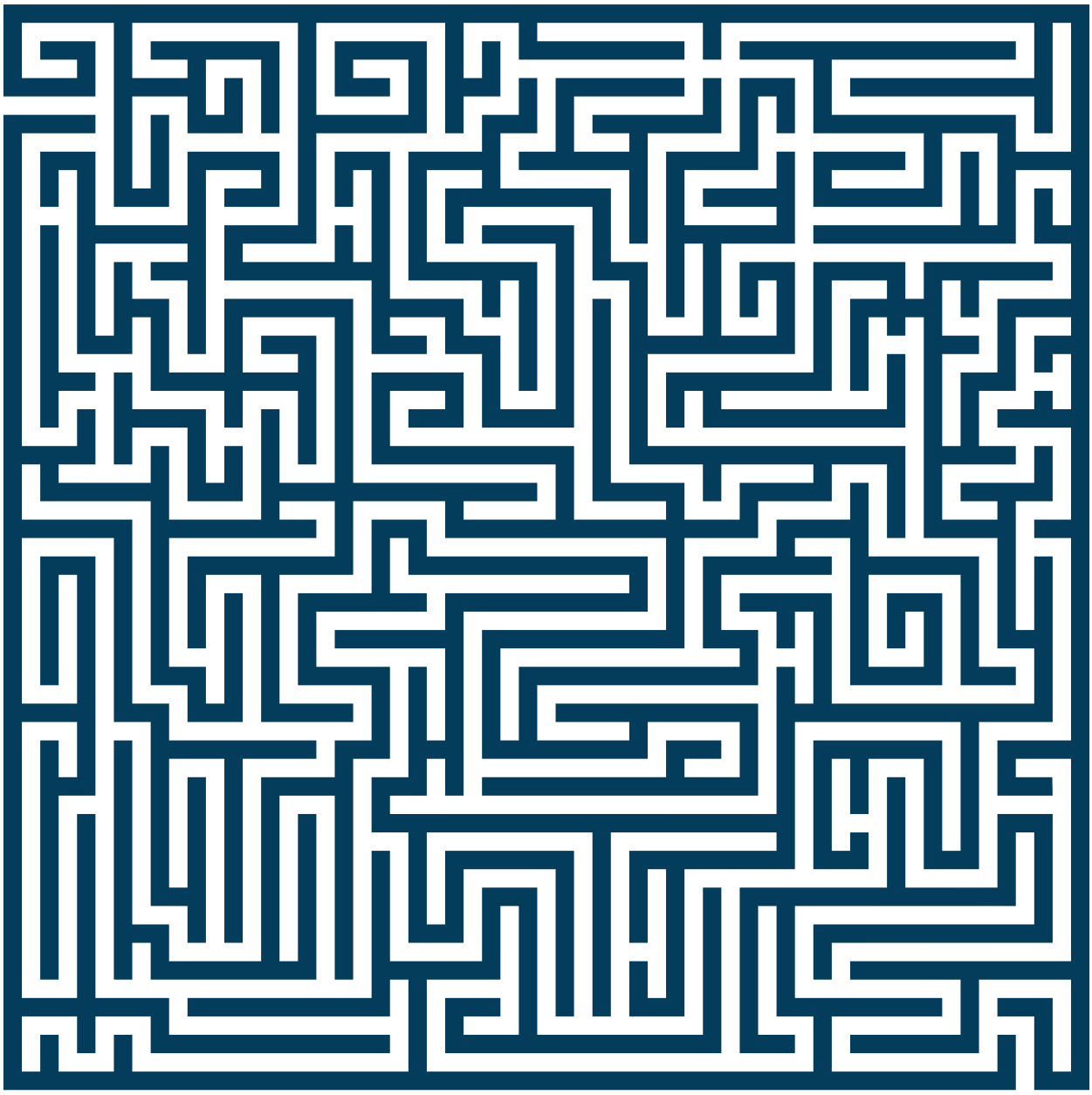


Key

GARDEN MAZE

Can you get from start to finish?

START



FINISH

HELP MEASURE THE WOOD

Andrea needs help measuring the wood so she knows where to cut each piece. Use a ruler and draw a line at each specified distance.

5 inches

4 1/2 inches

2 3/4 inches

3 7/8 inches

MATCH UP

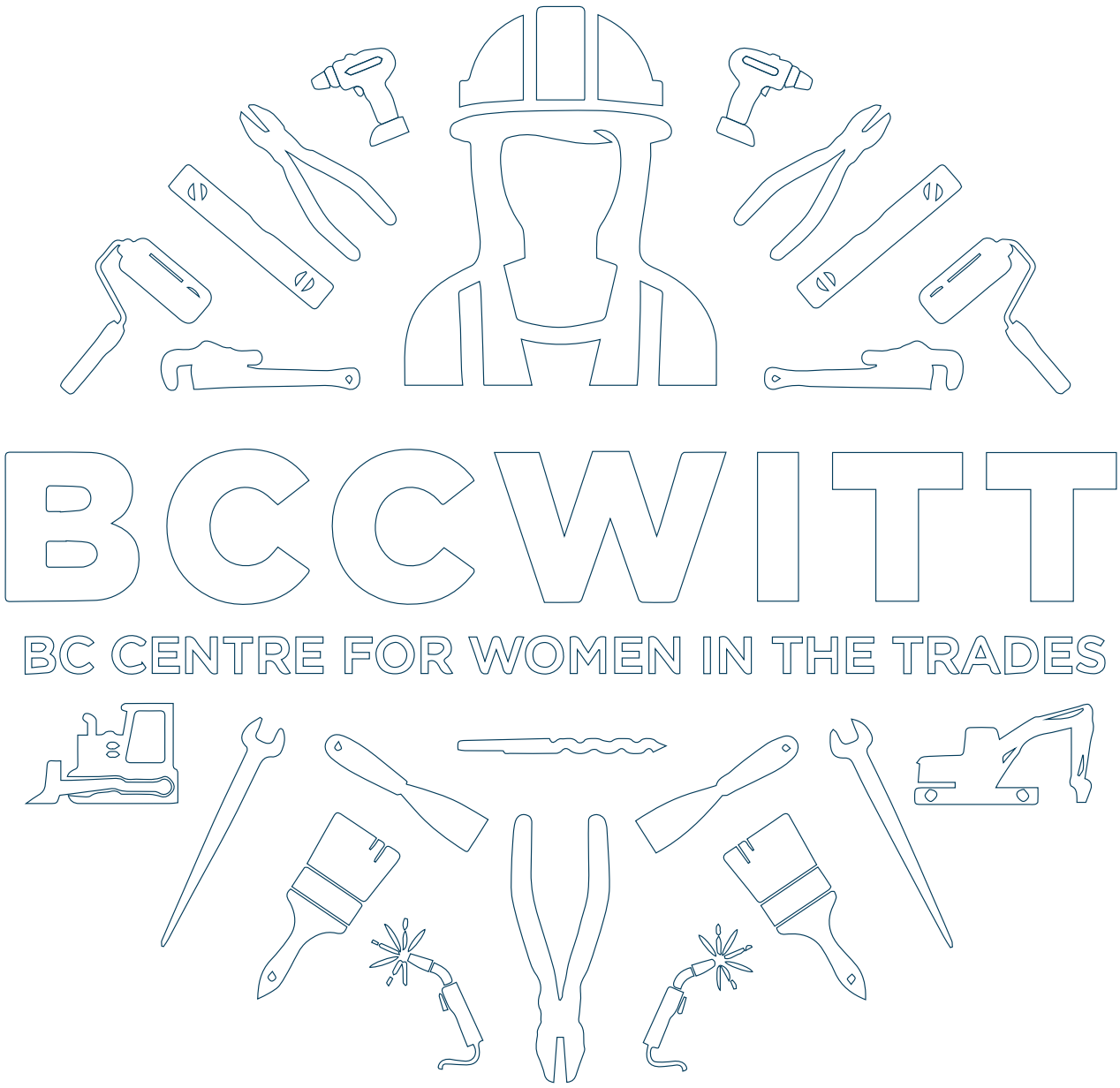
Can you figure out which job uses which item?
Draw a line connecting each job with the item they use.

JOB	ITEM
Painter	Light Bulb
Electrician	Brick
Plumber	Saw
Carpenter	Paint Brush
Masonry	Wrench

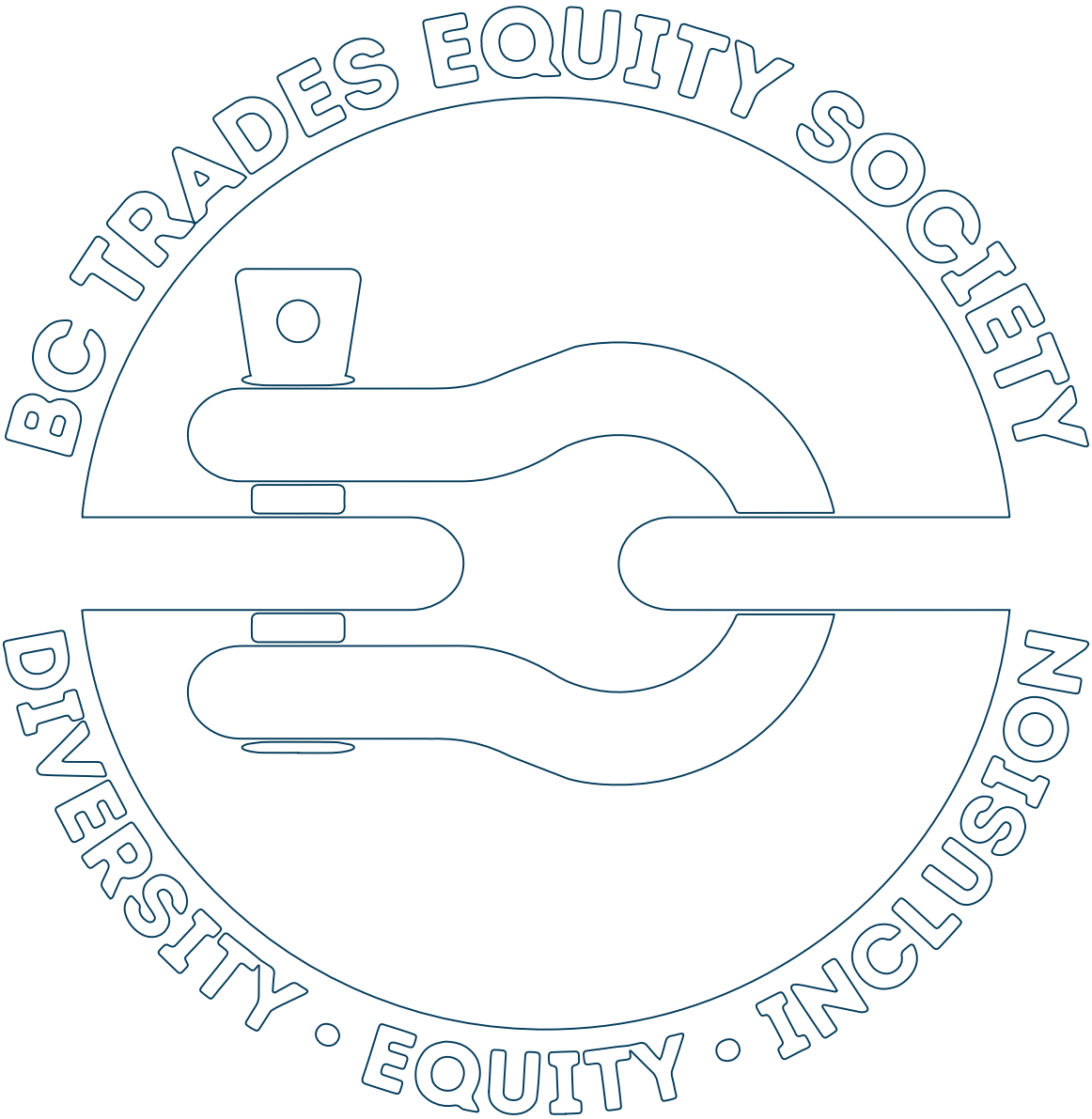
TAPE MEASURE SCAVENGER HUNT

Item to Be Measured	Metric	Imperial
What is the height of your table?		
What is the length of your table?		
What is the height of a window? Location_____.		
What is the width of a window? Location_____.		
What is the height of a door? Location_____.		
What is the width of a doors? Location_____.		
How wide is the hallway?		
Height of your partner? Name:		
Height of you?		

ADD SOME COLOUR




WOMEN IN TRADES
BUILDING A BETTER FUTURE
CFBC


BC TRADES EQUITY SOCIETY
DIVERSITY • EQUITY • INCLUSION

WORD SCRAMBLE

Help unscramble each word!

WDOO _____

OSLRA _____

METAL _____

DIRT _____

ORCEETNC _____

NTPIA _____

AWS _____

LPONY _____

TLIGNGHI _____

SREETMMNSUEA _____

LASSG _____

WNDIOW _____

PTNCRAYRE _____

CNRAE _____

AERDLD _____

OSEPRONYJNUER _____

ERPAEPNITC _____

OEYVRUSR _____

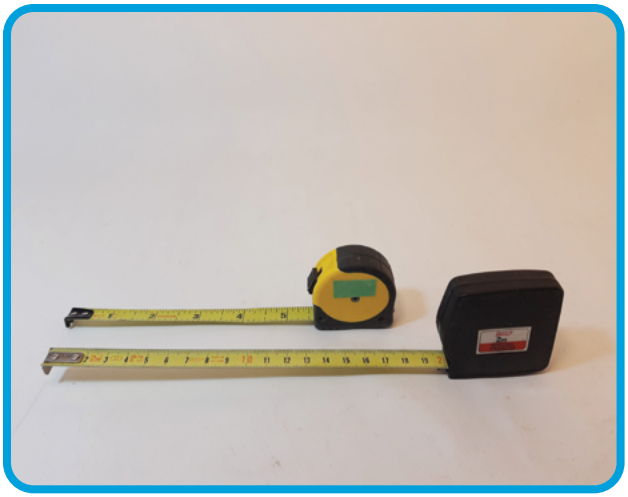
EREGIENN _____

ODOYWPL _____

LANDSCAPE DESIGN

This magnificent house needs some landscaping done.
Add in flowers, trees, rocks, etc. to create a beautiful front yard!

TOOL TUTORIAL:
Tape Measure



TOOLS & MATERIALS

Material List
- Various found objects or rooms to measure
- Notebook or paper

Tool List
- Tape measure (imperial and/or metric)
- Pencil

PROCEDURE

What's A Tape Measure Used For?

1. Some of the tasks you can use a tape measure for are: to measure lengths of materials (like wood, pipe, or wire) that you need to cut, where to drill a hole, to measure for area and volume calculations (for ordering materials), and to determine where objects get built.

2. For ordering flat material (flooring, or wallpaper), use a tape measure to determine the length and width of a space and then calculate the area by multiplying the length by the width (A = L x W).

3. For ordering bulk material (gravel, concrete) use a tape measure to determine the height of a space or object, then multiply the height by length by width to find the volume (V = L x W x H).

4. Tape measures are made with metric and imperial measures on them. Construction drawings are usually in metric, while many trades people still use imperial measures while building. It is great to know both systems.

Safety Considerations

5. Tape measures have internal mechanisms to retract (pull back) the tape automatically. The tape can move really fast when retracting and you can cut your hand or whip around and hit your arms or face; always wear your gloves and safety glasses! Practice using the thumb lock; this is a brake to stop or slow the tape from retracting.

Operating The Tape Measure

6. To measure a length, secure the hook over the end of the material and pull the tape measure back. Use the thumb lock to lock it in place. Keep tension pulling AWAY from the hook while you read your number.

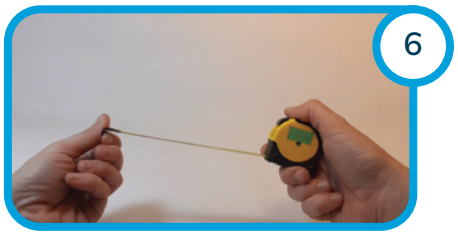
7. You may have noticed that the hook is a bit loose; this is to allow you to measure an INSIDE dimension as it accounts for the tiny length of the hook itself. To measure an inside dimension, extend the tape and push the hook into the material or wall. Keep pressure TOWARD the hook so it stays pushed in while you read your number.

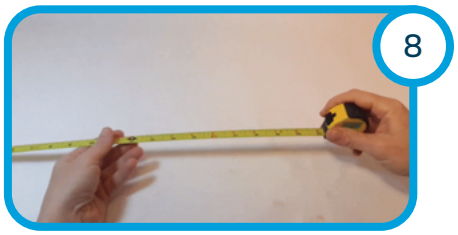
8. Retract the tape slowly using the thumb lock to control its speed.

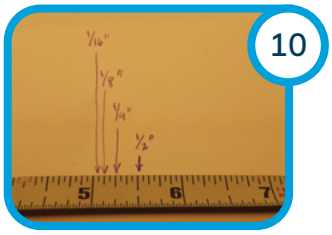
9. Practice using imperial measurements. Start by measuring objects and rounding to the nearest inch. Draw a sketch of what you are measuring and note the measurements (use the symbol ” to denote inches, eg, Six inches can be written as 6”).

10. Try rounding to the closest ½” (half inch). When you want to try more accurate measuring, learn how to read ¼”, 1/8”, and 1/32” intervals on your tape. Have fun and be proud of yourself for working hard to learn a new skill! On a jobsite tradespeople will often say “measure twice, cut once”.

11. Try measuring something bigger, like a room. You might see measurements in “feet” on your tape: there are twelve inches in one foot. Use the ’ symbol to denote feet, eg, Five feet can be written as 5’. You can describe a window width that is 29 inches as 29”. There are 12 inches in each foot, you can also write 29” (29” = 12” + 12” + 5”), as 2’-5”. Challenge yourself to learn this new skill, and don’t be afraid to make some mistakes!







Environmental Considerations

12. Tape measures are often made of a metal tape and a plastic case, which recycled when they are beyond repair.

EXTENSION CHALLENGES

1. It has been said that the distance between someone's fingertips when their arms are outstretched in a "T" is the same as their height. Is this true? Measure your friends and family and record your findings.

2. Imagine you are making custom furniture for a friend: how tall would you make a chair for them? How tall would you make the tabletop?

3. Imagine you are making a piggy bank that sorts coins by size into different compartments. What are the diameters of the different coins? What kind of mechanism can you imagine making that would sort the coins as they were inserted?

TOOL TUTORIAL:
Hammer

TOOLS & MATERIALS

Material List
- Scrap wood, 2x4 or similar
- Five or more 1 1/2” to 2” common nails

Optional
- ~3”X3” corrugated cardboard pieces

Tool List
- Safety glasses
- Ear protection
- 7oz claw hammer or “finishing” hammer

PROCEDURE

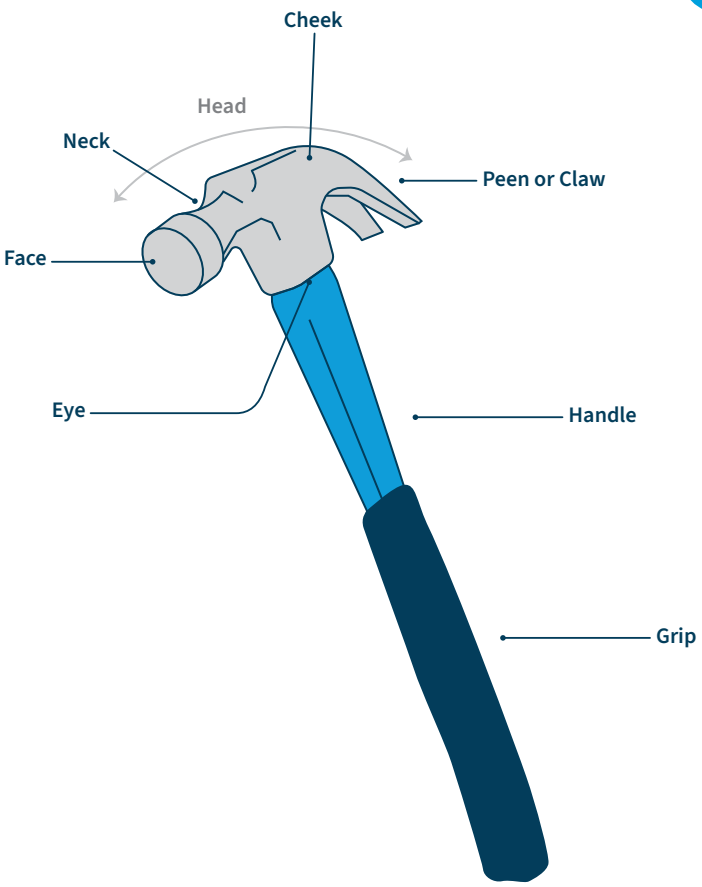
What’s A Hammer Used For?

1. Claw hammers, are commonly used to drive nails into wood. A nail can be used to fasten two pieces of wood together by being driven in until the head of the nail is flush with the top piece of wood.

2. You can also use a hammer to drive nails part way in. You may want to hang a picture or make a project like the wooden loom.

3. Claw hammers have the “claw” end, which allows you to pull nails out of wood, as well as pry pieces of wood apart.

1



Sledgehammer

Framing Hammer

Dead Blow Hammer

Ball Peen Hammer

Mallet

Chipping Hammer

Different Hammers Are Used For Different Jobs

4. A “sledge” or sledgehammer can be used by an ironworker to drive metal pins into holes in big metal beams (like you see on a bridge), a sledgehammer is also often used in concrete demolition, and for driving stakes into the ground.

5. A ball peen hammer can be used in metalworking. The flat end of the head is for hitting punches to make holes in sheet metal, and the rounded “peen” end for smoothing the sharp edges of rivets.

6. A framing hammer is a heavier claw hammer and is used when building the frame for a structure (such as a house or deck).

7. A mallet is used to tap the end of other tools to do the work. For example, you can tap the end of a chisel to cut and shape wood, stone, and metal.

8. A “dead blow hammer” has a heavy, weighted, rubber or plastic-coated head that you can use to knock pieces of wood into place without damaging the wood, these hammers are also commonly used by metalworkers.

9. A chipping hammer has a narrow head and can be used for removing slag and spatter from welds, as well as for demolition purposes.

Safety Considerations

10. Always wear eye protection while you or anyone nearby is using hammer as nails and debris can go flying.

11. Wear ear protection while hammering; the noise is loud enough to cause hearing damage.

12. Inspect your hammer for any damage, and check that the head is securely attached to the handle.

13. Check your surroundings before you begin: make sure you have room to swing your hammer, and that nobody is in your way. Give the same space to others who are hammering.

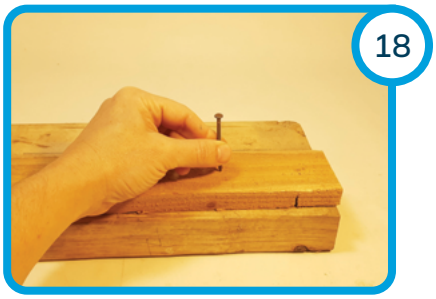
Operating The Hammer

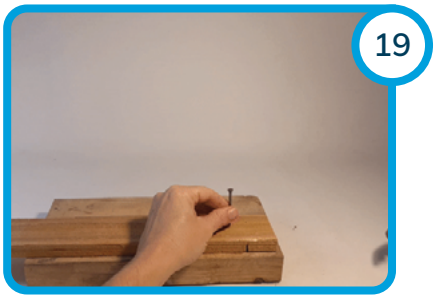
14. Before starting, remind yourself that learning a new skill and making mistakes is okay. Even professionals miss the mark and send a nail flying. Be proud of yourself for working hard to learn something new.

15. Secure your wood piece(s) with a clamp if necessary.

16. Check your surroundings to make sure you can swing your hammer freely. Place your wood on the floor if your worktop is unstable or flimsy.

17. Hold the, your fingers should be near the end of the handle, the face pointing down.

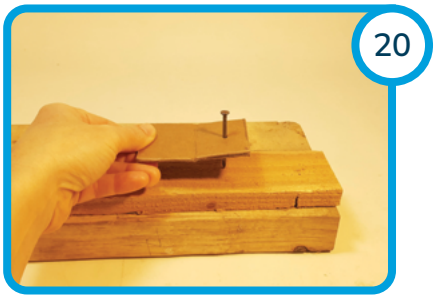




Set The Nail

18. Hold a nail with your other hand. Place the tip of the nail straight up on the mark where you want to drive it.

19. Tap the head of the nail with the hammer. Repeat this tapping until the nail stands on its own.



Helpful Hints

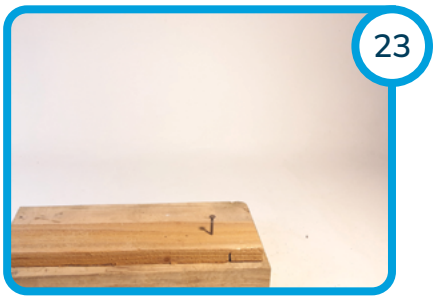
20. If you need some practice with aiming your hammer ask someone to set a few nails for you to practice hitting. When you are confident that you can hit the hammer in the same spot consistently, try setting your own nails.

Drive The Nail

21. Let go of the nail and hold the wood piece steady. Swing your hammer up about 10”, then down at the nail head in a controlled arc.

22. Try to keep your shoulders relaxed. Brace yourself and your work by holding the wood as you hammer. Continue hammering the nail until the head is flush with the wood.

Pull A Nail



23. Hammer a nail into the wood, so the head is sticking at least ½” above the surface of the wood.

24. Align the hammer head with the length of the wood, hook the claw over the nail and stabilize the wood using your non-dominant hand to hold it in front of the claw.

25. Move the hammer handle down, driving the claw upwards to pull the nail.

26. Try slotting a scrap piece of wood underneath the hammer head: this will protect your project and can also give you more leverage.

EXTENSION CHALLENGES

1. 1. Make some string art: Take a piece of 2x4 and write your name in big block letters (make your letters large but leave at least ½” of bare wood along each edge). Hammer 1” nails into your letters, anywhere the lines change direction, stopping when the nail is still sticking up by about 1/2”. Wrap yarn or string around the nails to complete the letters and spell your name!

2. Try making a wooden loom, which will give you practice with hammering nails flush, as well as driving them part way in.

TOOL TUTORIAL:
Wire Strippers

TOOLS & MATERIALS

Material List
- ~3’ 14/2 Electrical wire (or similar)
- ~3’ 12 Awg stranded wire (or similar)

Optional
- Materials to make the residential wiring model project

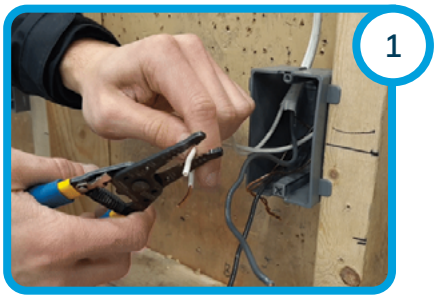
Tool list
- Wire strippers
- Utility knife

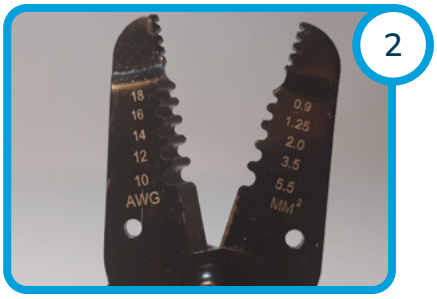
PROCEDURE

What Are Wire Strippers Used For?

1. Wire strippers are multi-tasking tools They are great for cutting wires to length and for “stripping” wires, meaning to take the plastic insulation coating off to reveal the copper below.

2. Many wire strippers are a standard size that can strip both solid and stranded wire of different gauges (a measure of wire thickness). You will see the labeled half-circle slots numbered on the jaws to show you where to place the wires depending on their gauge.





Safety Considerations

3. Always wear safety glasses when using hand tools. Sometimes small clippings of wire can go flying while you’re cutting.

4. Make sure to disconnect any electrical circuit that you are working on! it is good practice to make sure that there is no chance for any electricity to be flowing through the wires while you are working on them.

Cutting Wire To Length

5. Place the wire between the blades at the base of the wire stripper jaws as shown. Hold the wire still and squeeze the handles of the wire strippers together to clip the wire. Try clipping off a few 1” pieces of the different wires you have.

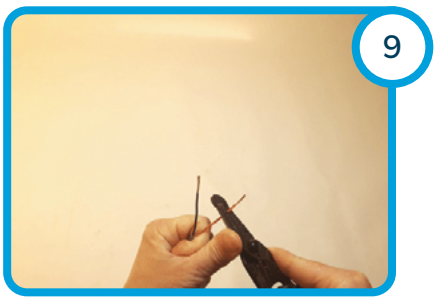
Stripping Wire

6. You want to match the gauge of the wire that you are stripping to the numbered hole on the wire stripper jaws. Sometimes the numbers will indicate holes for “solid” or “stranded” wire–look at the end of your wire to see if it contains one thick piece of copper (solid), or many strands of thin copper wires (stranded), then check the insulation casing for a printed gauge number that you can match to your wire strippers.

7. Use your utility knife to slice the white exterior jacket from the 14/2 wires in a lengthwise slice, exposing the three wires beneath. Choose either the white or black wire and place the last 1” in the hole labelled “14” on the wire stripper jaws. Squeeze to close the jaws fully.

8. Keep the wire strippers closed with one hand, and hold the wire secure with your other hand, pull the wire through the hole to slide the insulation off the wire.

9. If you are unsure of what gauge wire you are stripping, start with the largest hole on your wire strippers, and keep moving the wire to smaller holes until you feel the jaws “bite” gently into the insulation. Use that hole size to strip your wire.



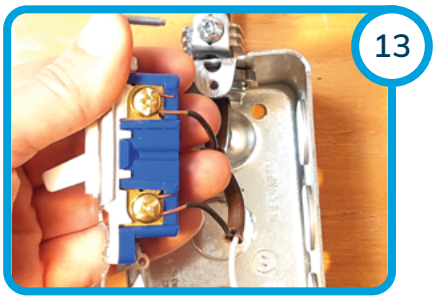
10. Try stripping some of the 12 AWG stranded copper wire. Be delicate with stranded wire, as the blades for stripping the insulation are sharp enough to cut the copper strands inside.

Hooking The Wire End

11. When you are wiring up an outlet or a switch in a residential wiring setting, you will be stripping the last 1” of insulation off your 14/2 wire pieces and connecting the bare wire to a conductive screw on the side of the outlet or switch.

12. Poke the end of the stripped wire about ½” through the “loop” or “hook” hole on your wire strippers. Hold the wire in one hand, and twist with your wrist to create a “U” hook shape in the wire.

13. You can now hook this wire end over the screw on the outlet or switch and tighten the screw to secure the connection.



Environmental Concerns

14. Choose a high-quality pair of wire strippers as they will last a long time. Collect any scrap wire that you made while practicing using your wire strippers and take it to a metal scrapper for recycling.

EXTENSION CHALLENGES

1. Ask an electrician for some 14/2 wire scraps. Practice your wire cutting and stripping. Bend small sections of wire into tiny human or animal figures, using the hook function of your wire strippers to make feet. Use needle nose pliers to help you make finer adjustments and bends to your wire.

TOOL TUTORIAL:
Cordless Drill

TOOLS & MATERIALS

Material List

- Two pieces scrap wood, eg, 6”x6” plywood any thickness
- Masking tape
- ~2” Screws with square drive heads (to match driver bit)

Tool list

- Cordless drill
- Safety glasses
- Twist bit, ~1/8” or so
- Clamp (see our clamp tool tutorial)
- Robertson driver bit (square)

PROCEDURE

What’s A Cordless Drill Used For?

1. You can drill different sized holes in wood, metal, and concrete using a cordless drill. Small holes called “pilot holes” make inserting nails and screws much easier and prevent your wood from splitting. To drill pilot holes for nails, use a drill bit that is slightly smaller in diameter than your nail body (“shank”). For screws, use a bit with the same diameter as the inner part of the screw shaft (not including the threads).

2. You can install a “driver bit”, which turns your cordless drill into a screwdriver. You can also install a “hex” driver to insert or remove bolts.

3. You can use a special bit on your drill to “counter sink” a hole, which removes a small cone of wood to make room for your screw head.

4. If you want to cut out an internal shape in a piece of wood, but you don’t want to cut through the edge, you can drill a hole in the middle, then use a keyhole saw starting from the hole to cut from the inside out!

Safety Considerations

5. Always wear safety glasses when operating tools.

6. Make sure to tie long hair back, take all jewelry off, and avoid clothes with loose bits (like hoodie strings or dangly sleeves).

7. Students, always check in and ask permission from your teacher before operating the cordless drill.

8. Make sure to remove the battery before you make any adjustments to the drill, such as changing the bits. If you leave the battery installed, the trigger can be easily bumped or grasped unintentionally, which will power up the drill.

9. Many drills have a neutral stop between the forward and reverse button. Leaving tools in neutral can prevent accidents!

Setting Up The Cordless Drill

10. To remove the battery: squeeze the release buttons on the battery at the base of the drill and slide the battery forward to remove it. To put the battery on, slide it onto the handle until you hear it click into place.

11. To insert your bit: Remove the battery. Widen the chuck by turning it counter clockwise if you need to. Put twist bits in straight edge first (so the twisty part is pointing OUT), put driver bits in so the part that fits the screws is pointing OUT. Tighten the chuck by twisting it clockwise until you hear it clicking and it's tight.

12. To remove a bit: Remove the battery. Twist the chuck counter clockwise to loosen the bit, and pull it out.

13. To change the direction the drill turns: locate the "reverse switch" near the trigger. Push it to one side, then gently pull the trigger to see which direction the drill turns. Push the reverse switch across to the other side to change the drill's direction. Look for the neutral stop function here and leave the drill in neutral when not using.

Drilling Holes

14. Install your twist bit. Clamp your wood to a solid surface, with a piece of scrap wood underneath to protect the table. Test the drill to make sure it is turning clockwise. Place the tip of the twist bit on your mark, point the drill straight down, and gently pull the trigger. Drill to your desired depth, then pull the drill back out of the hole while it is still spinning.

15. Helpful hint: to drill a hole to a specific depth, or to drill many holes to the same depth, mark your twist bit with a piece of masking tape so that you can see when the bit has reached the desired depth.

Diving Screws

16. Drill a pilot hole with a twist bit. Install a driver bit that matches your screw head (eg, Robertson square, Phillips "+", Torx star-shape, etc.). Place your screw on the end of the driver bit. Position the drill so that your screw is on your mark, pointing straight in line with the pilot hole. Gently squeeze the trigger to drive the screw in slowly until the head of the screw is just below flush with surface of wood. Drills can be tricky to learn at first. Screws may strip when drills are used on an angle or may slip if too much or too little pressure is applied. Be patient with yourself and practice often!

17. To remove a screw: Check that the drill is turning counter clockwise. Insert the bit into the screw head and pull the trigger gently for a slower speed while keeping pressure towards the screw as it reverses out.

18. Many drills have clutch settings: numbers above the chuck which relate to the resistance of the drill to a certain torque. Setting the clutch to a lower number can be used to stop the drill from spinning once it meets a specific amount of resistance (it will "slip" instead of continuing to drive around). For example, if you want the drill to stop spinning when your screw reaches a desired depth, set the clutch to the lowest number and drive a screw to test it. Set the clutch to a higher setting if you want the drill to drive a bit deeper before it slips.

Environmental Considerations:

19. A good quality cordless drill that is treated well should last for many years. If the electricity used to charge the battery is from a sustainable source, the emissions are negligible. Be sure to dispose of batteries properly when they no longer hold a charge.

EXTENSION CHALLENGES

1. Practice using your new tool! Make a base for some string art using a scrap of plywood, a twist bit, and your cordless drill. Mark holes in whatever shape you choose, make sure the holes are at least 1/2” away from the edge. Drill the holes out, sand the edges, then sew a pattern with a big needle and some colourful yarn.

2. Use your newfound skills to tackle a design challenge where you need to drill holes or drive screws! Does your plastic patio chair pool with water? Do you need to insert a dowel as a handle for a toolbox? Do you need to hang a project on the wall? How can a cordless drill help you with these tasks?

Concrete Planter

TOOLS & MATERIALS

Material List

- Found objects for molds (plastic, aluminum, or tetrapak are best)
- Dry concrete mix, quickrete or similar
- Water
- Vegetable oil (also, spray-on cooking oil works well for this)
- Sandpaper 100 grit

Optional

- Acrylic paint

Tool List

- Safety glasses
- Work gloves
- Dust mask
- Measuring tape
- Felt pen
- Cup measure
- Mixing spoon
- 15ml tablespoon measure
- ~3 Cups of small pebbles or similar
- Bucket to mix concrete in

Optional

- Utility knife or scissors
- Paint brush

PROCEDURE

SAFETY NOTES:

1. Be sure to wear safety glasses, a dust mask and gloves while working with cement as the dust is very bad for your lungs and eyes. Wet concrete is also irritating to your eyes and skin. This is an ideal project to do outside if you can.

GETTING STARTED

2. Choose two drink or food containers to use to make your mold: the larger one will be the outside, and the smaller one will fit inside to make the space for the soil. Make sure that there is at least 1" of space between the two containers all around so the concrete layer will be thick and strong enough. Look for containers that don't have bulges or flares that will make them difficult to remove from the concrete once it's hardened.

Calculate How Much Concrete You Will Need To Mix:

3. Hold your containers in place (small inside big) while a helper pours water into the space between them until the water takes the shape you want your planter to be. Draw a line with felt pen on the outside of the small container where the water line was when you were happy with the shape.

4. Pour this water off slowly, using your measuring cup to count how many cups of water you pour out of the big container. Round UP to the nearest cup, then write this number down beside the words “cups of dry concrete”.

5. Multiply the number from the last step by 3, then write your answer down beside the words “tablespoons of water”.

Mix Your Concrete

6. Right before you begin your concrete mixing, spray or wipe the inside of your big container, and the outside of your little container, with cooking oil. This will help you loosen them off when the concrete has set.

7. Put on your safety glasses, gloves, and dust mask.

8. Scoop your dry concrete mix into your mixing bucket according to the amount you noted in step 4.

9. Use a mixing spoon to make a little well in the middle of the dry concrete, then add the amount of water you calculated in step 5 using a tablespoon measure.

10. Gently stir the concrete with the mixing spoon, making sure you scoop the bottom thoroughly until there are no more pockets of dry concrete. It should be the consistency of thick oatmeal.

11. Pour the concrete from the mixing bucket into your big container.

12. Tap out any trapped bubbles by dropping your container (right side up) from about 1cm repeatedly for a minute or so. You can also tap the sides of your container with your spoon or your hand.

13. Push your smaller container into the surface of the concrete up to the line. Fill it with some pebbles so it stays in place.

14. Let your concrete set in a cool, damp place, out of direct sun, for at least 24 hours.

15. Wearing gloves, gently remove the containers from the concrete. If they don’t peel away easily, ask an adult to help you cut them away with a utility knife or scissors.

16. Put on your safety glasses, gloves, and dust mask again, and sand your planter with sandpaper to remove any rough edges.

17. Decorate your planter by adding acrylic paints, if you choose.

18. Add some soil and a plant, and place it on a sunny window ledge where you can admire your work!

EXTENSION CHALLENGES

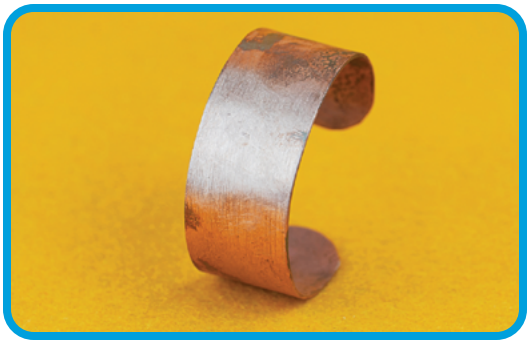
1. Add liquid cement colour to your water before mixing your concrete.

2. Does your final product have small air holes, or “honeycombing” on the sides? On the jobsite, concrete finishers fill these holes with grout to make a smooth finish. You may choose to leave the holes in your planter because you like the texture, or you could use pre-mixed tile grout to fill them before painting.

3. Build a form using wood and duplex nails, and spray the inside with cooking oil. Mix your concrete in a bucket, then place it in your wood form. Push a container in the top to make the interior space for your soil.

4. Design and build a form using Lego blocks, making sure any of the blocks that will touch the concrete are flat (not the nubbly surface). Spray the inside of your mold with cooking oil to help it separate from the concrete.

Copper Bracelet



TOOLS & MATERIALS

Material List

Materials Found In The Learnary Kit:

- 18-gauge copper piece - approximately 2.5 x 15 cm (1x6 inches)
- Sandpaper (5 different grits)
- Steel wool
- Small nail for marking
- Soft cloth

Optional Extras

- Metal snips
- More marking tools
- Torch
- Clamp
- Copper polish

Tool List

- Hammer
- Dust mask
- Safety glasses
- Gloves

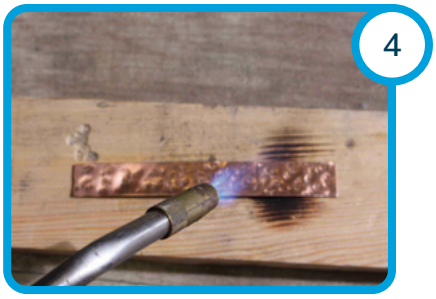
PROCEDURE

1. To change the size or shape of your copper strip, use a pair of metal snips to cut the copper.

2. The edges will be very sharp. Wearing safety glasses, gloves, and a mask, use the roughest piece of sandpaper to sand all the edges and round the corners of your piece.

3. There are lots of ways to mark copper. You can use the sandpaper and nail to scratch an image or make indentations. Using the flat head of a hammer, you can pound a pattern into the metal (the metal will curl up, just turn over and hammer flat again).

Optional Torching Step



4. Ask an adult with experience using a torch for this step. Place your copper on a piece of scrap wood or a flame-proof surface and wave the torch flame over the bracelet to change the colour of the copper. The piece will be hot afterwards, so let it cool before moving to the next step.

5. Now it's time to form the bracelet. Copper is soft you can form it around the handle of a hammer or other hard round object. Starting at one end, use your hands to shape the copper slowly and gently. If you have access to roll formers, you could also use those.

EXTENSION CHALLENGES

1. Use metal stamps and a hammer to add letters, words, or numbers to your bracelet.

Flower String Art

TOOLS & MATERIALS

Material List

- Flat wood, any type, approx 3/4” x 4” x 10”
- Scrap piece of wood for sanding block
- cloth rag
- Scrap piece of wood or cardboard, larger than wood base
- Wood stain
- Simple flower outline template

Optional:

- Tape
- One large-headed nail
- 20+ finishing nails
- String or yarn, various colours, 3’+
- Scissors
- Sawtooth hanger and mini nails to secure to project

Tool List

- Safety glasses
- Vice and/or c-clamps
- Block plane and/or spokeshave
- Flat rasp
- Sand paper (various grits 80-120)
- Paint brush
- Workshop table or scrap piece of wood larger than project base
- Hammer
- Ruler or speed square
- Pencil

PROCEDURE

Shape And Smooth The Wood Base

1. Clamp your wood piece firmly to a table or into a vice.

2. Use the block plane and/or spokeshave to round the long edges of your wood base (you will be rounding 4 long corners). Don’t worry about the edges on the short sides yet.

3. Clamp your wood base (or secure in a vice) so that the ends are exposed. Use the rasp to round the corners and edges of the short ends. Continue smoothing out any other edges that need rounding.

4. Wrap a piece of coarse sandpaper (80 grit) around a small block, secure your wood base with a clamp or vice, and sand all edges and faces of your piece. Switch up to a piece of 100 grit paper, and then 120 grit, sanding your wood base until desired smoothness is achieved.

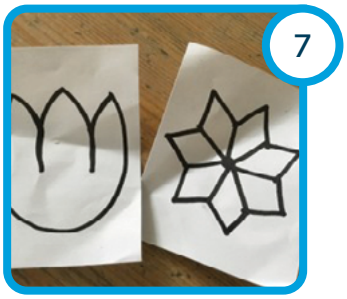
Stain The Wood Base

5. Use a damp cloth rag to remove any wood dust from the wood base.

6. Outside, or in a well-ventilated area, place your wood base on a scrap piece of wood or cardboard. Paint the wood stain onto the wood base, making sure to drain any excess stain off the brush by running the brush up along the inner rim of the can each time you dip it. Allow to dry and apply a second coat, if you choose.

Create The Flower Design

7. Use a pencil and paper to design a flower outline, or print one from an internet search. Make sure it will be small enough to fit onto your wood base, with at least 1/2” of clearance on all sides.



8. Position your template onto the prepared wood base. You may choose to tape the edges so it doesn’t move around.

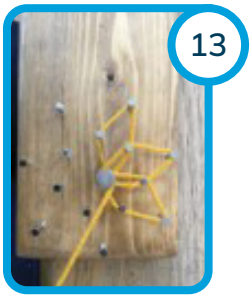
9. Put on your safety eyewear. If you need to, place your project on a scrap piece of wood to protect the table top you’re working on (just in case your nails go all the way through).

10. If your flower design has a central point, hammer the larger-headed nail through the template and into your wood base. Try not to hammer the nails more than about three-quarters of the way through the wood base, or they might poke out the back of your project. Hammer a finishing nail in at each corner or line intersection on your template. Try to make the nails poke out straight up and all at the same height (about 1/2” to make space for yarn loops).

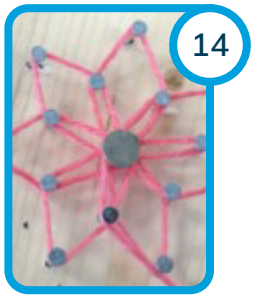
11. When you are finished adding nails, rip your template away, making sure to remove all bits of paper from your project.

12. Choose your yarn/string colour and begin by tying a knot on the large nail. Double knot your yarn to ensure it's secure.

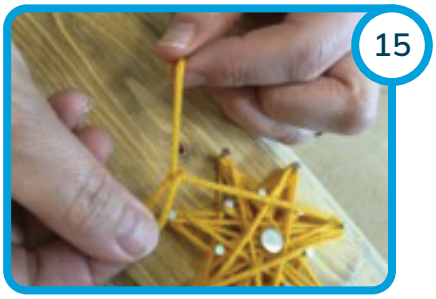
13. Weave your yarn around the nail heads, making a loop on each nail, and return to the centre after each petal is complete.



14. You can create different designs depending on how you weave your yarn over the same nail pattern. Experiment with your design, removing the yarn and relooping it until you have a pattern you like. Continue weaving until you have at least three loops on each outer nail; this creates depth in your flower. You may need to push the yarn loops down as you go to make room for more yarn.



15. When you are finished, double knot the yarn to the centre nail and use scissors to cut the tail short.



16. Use templates or improvise with your nail placement to add additional flowers, stems, leaves, etc, after your initial flower is finished. Remember to wear eye protection while you are hammering. Try to utilize the whole wood base for your design, making sure the nails are no closer than about 1/2" to the edge of the wood.

17. Follow steps 12-14 to add yarn to your new nail patterns.

Add The Hanger

18. Using a ruler (or speed square) and pencil, mark a horizontal line about 1-1/2" (or 4cm) below the top edge.

19. Measure the width of your wood base and divide that number by 2. Make a dot at this dimension along the horizontal line you drew, this should be at the centre of your project. Line up the middle of your sawtooth hanger over this dot, and make sure the holes in the hanger line up with the horizontal pencil line.

20. Put on your protective eyewear, and place your project on a scrap piece of wood to protect the table top. Hammer a tiny nail into each hole of your sawtooth hanger.

21. Choose a place to hang your finished piece! Ask an adult to help you hammer a nail into the wall to hang the sawtooth hanger on.

EXTENSION CHALLENGES

1. Try our “nail and string art” project using a more complex base design and more nails.

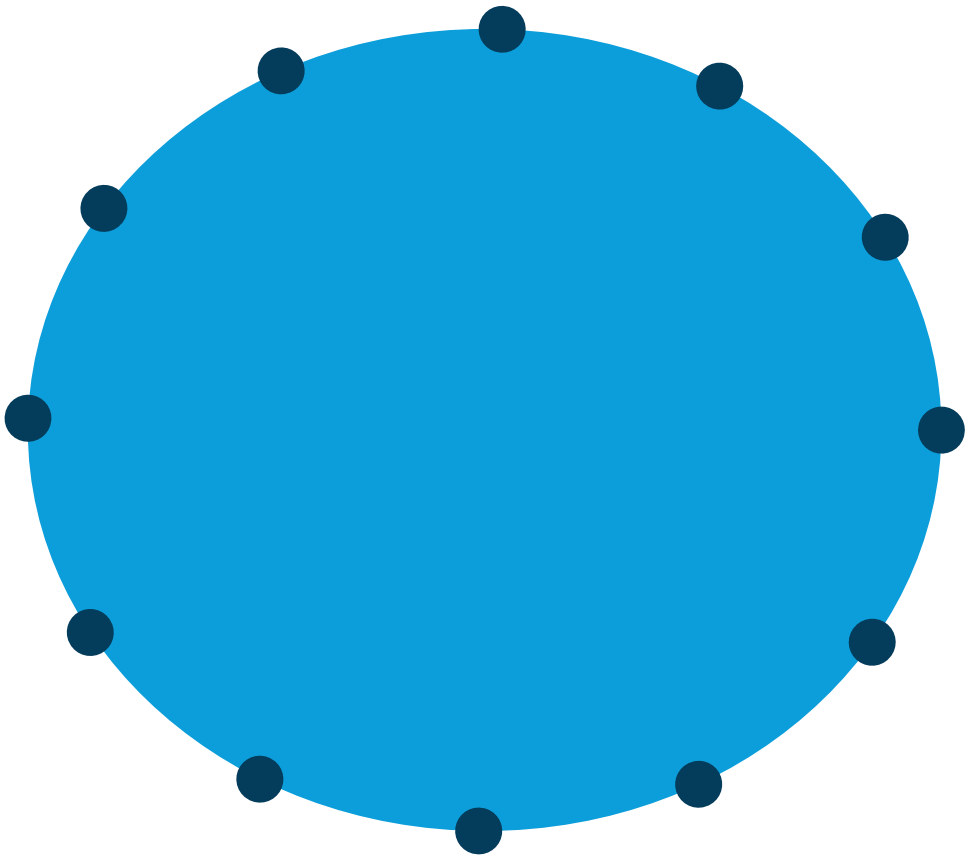
2. Instead of a flower, try using the same techniques to spell out a word, or draw an animal, etc.

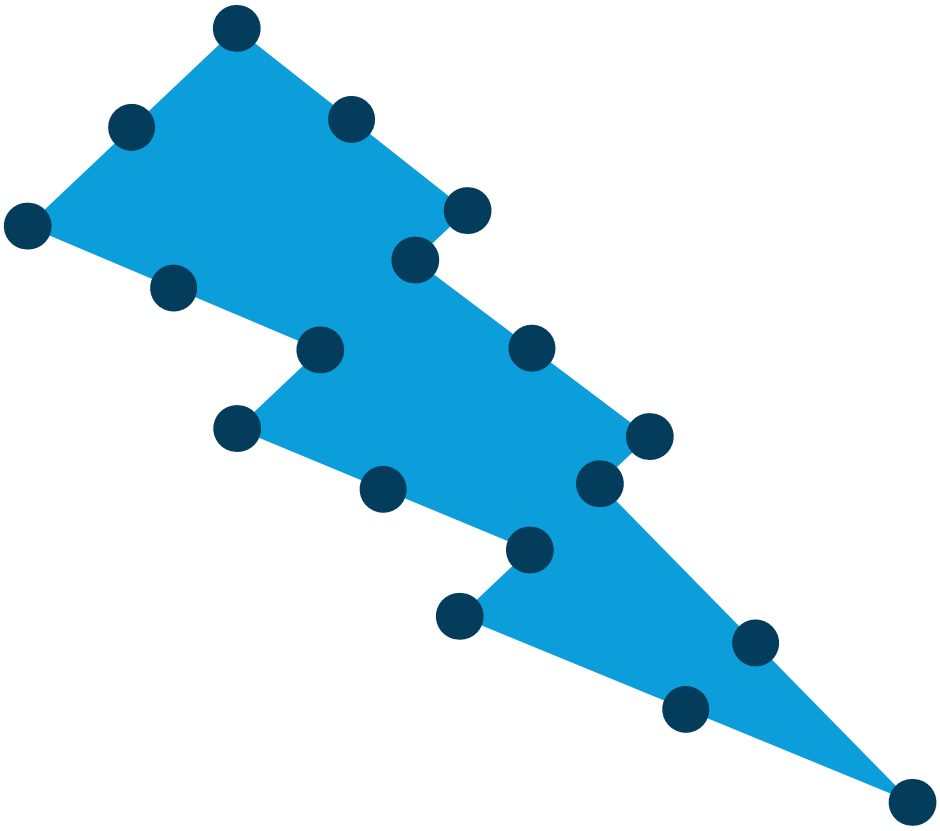
3. Use many different colours of yarn and build up the loops on your nails to create a 3D effect. Research in books or online to see what kinds of designs and effects are possible with string art.

4. Build a 3D structure or frame to place your nails on to create even more depth and intricacy to your project.

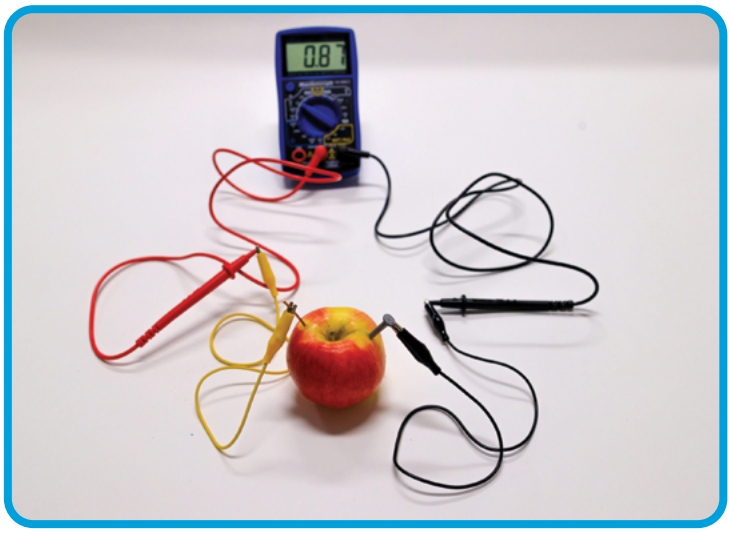
5. Instead of nails, have students drill holes through the base and thread the string through for a needlepoint effect.

6. Design a template and choose accurate yarn colours based on pictures of actual flowers.





Electrical Fruit Salad



TOOLS & MATERIALS

Material List

- 5 (Five) or more connector wires with alligator clip ends
- 1 (One) Galvanized (zinc) roofing nails (one per food item)
- 1 (One) 3mm red LED bulb
- 2” pieces of thick copper wire (one per food item)
- Various fruits, vegetables, tubers, etc.

Tool List

- Multimeter
- Damp cloth

Optional Extras

- Notebook
- Pencil
- Pliers or side cutters to cut copper wire to length

PROCEDURE

Choose which piece of food you want to make your battery out of. Insert your copper wire electrode and your galvanized zinc nail electrode, making sure they do not connect to one another inside the fruit.

Clip one connector wire to the copper wire, and another connector wire to the nail.

Set up your multimeter to read volts according to the instructions: plug the black cord into “COM”, and the red cord into “VΩ”. Set it to read “DC” volts at the largest number it can.

Clip the free ends of the wires to your multimeter probe ends. If no numbers appear on the screen, switch the multimeter down to read smaller voltage amounts until you get numbers appearing (the “20” will usually work, if your multimeter has it). Your fruit is now a battery!

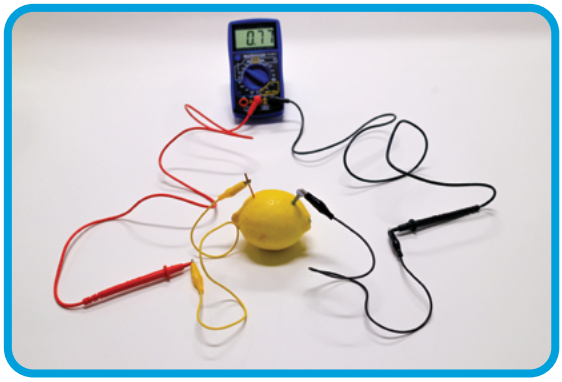
In your notebook, write down the type of fruit you are testing, the settings on the multimeter that you are on, and the number of volts it reads. One at a time, try out all the different pieces of food you have collected!

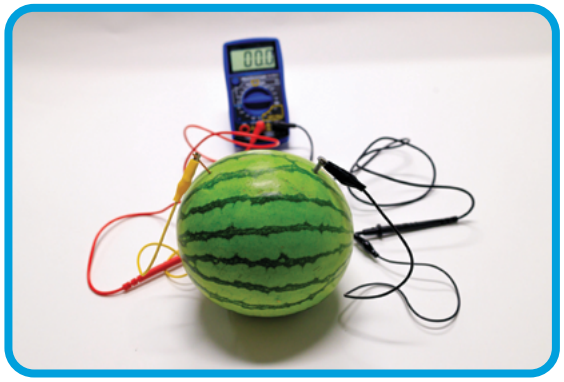
Try wiring up more than one piece of fruit in a row (this is called “in series”). Make sure that you attach copper anodes to zinc anodes (don’t attach copper to copper or zinc to zinc, as you want all the electron flow to go in the same direction). Record in your notebook the types of food connected and the voltage reading.

Try connecting the LED into your circuit to see if you can make it light up! (Instead of clipping the connector wires to the multimeter probes, clip them to the LED wires instead). How many fruits in series does it need to power up?

Note: LEDs need electricity to flow in one specific direction – each time you test the LED, test it in both orientations by reversing it and attaching the alligator clips to the opposite LED wires.

Clean up by turning off the multimeter, disconnecting all the wires, then wiping down the alligator clips and table with a damp cloth. Remove the metal from the foods and save the nails and wire for another project. You can’t be sure that your wire and nails were food safe and clean before starting, so compost your foods when you’re finished - do not eat them.





TROUBLESHOOTING

If the copper wire is too thin to push into the food easily, poke a pilot hole with the nail first.

If the multimeter is showing no voltage while your food is connected, try turning the multimeter dial to read a smaller voltage. You can also check that the multimeter is working by turning the dial to the continuity selection and connecting the probe tips together (if there are no numbers or no beep noise, your multimeter might need a new battery).

If your LED won’t light up, try reversing it as it will light up only when the electricity is flowing in one specific direction. Try adding additional fruits in series to increase the voltage.

EXTENSION CHALLENGES

When you connect foods together in series, do you notice a pattern in the voltage amount? Can you use this pattern to predict the voltage any two foods will produce when you connect them in series?

Try wiring up different liquids with your copper and zinc electrodes by taping them to the inside of a small plastic cup, submerging the ends in the liquid. Can you make a battery out of a cup of vinegar? Fruit juice? Sea water?

Explore using different metals other than copper and zinc. What other metals might turn the fruit into a battery? Do they produce the same amount of voltage in the same fruit as the copper and zinc electrodes do?

Tree Cookie Coasters

TOOLS & MATERIALS

Material List

- Dry branch, ~4”-6” in diameter
- Sandpaper, 80-120 grit
- Varnish

Tool List

- Work gloves
- Safety glasses
- Dust mask
- Backsaw
- Measuring tape
- Paint brush
- Optional
- Palm sander
- Ear protection

PROCEDURE

Put on work gloves to protect your fingers, and safety glasses to protect your eyes. Hold the branch firmly to a solid surface or workbench, and use a backsaw to cut the end off a branch. Try to make it square to the length of the branch (like the bottom of a soup can).

Move the saw up the branch by 1/2” and make another cut. Try to keep the second cut parallel to the first cut so your coaster will be flat.

Repeat Step 2 to make an entire coaster set of four or six if you choose.

Put on a dust mask. Place your sandpaper gritty side up on a flat table and run the faces of your coasters along the surface until the saw marks have disappeared. Work your way up from 80 grit to 100 grip to 120 grip until they are smooth.

Apply a thin coat of varnish to the faces and sides of the coasters, leaning them up against a scrap piece of wood so that the backs can dry. Add varnish to the outer edges to protect any interesting bark features that you wish to keep.

Add as many layers of varnish as you choose. Allow each coat to dry fully, then lightly sand the faces before applying the next coat.

Make a pot of tea and invite some neighbours over to enjoy your new set of coasters!

EXTENSION CHALLENGES

Try making a trivet or pot holder by cutting a tree cookie off a bigger log, 6” or more in diameter.

Cut tree cookies off thinner branches and drill a small hole in the top of each to make ornaments, pendants, rear view mirror charms, etc.

Paint a picture or design on the coaster before varnishing.

Saw a class set of 30 and donate them to a local kindergarten class for the students to sand and decorate.

Pinwheel

TOOLS & MATERIALS

Material List

- 1 (One) aluminum handle (aluminum flat bar ~8”)
- 1 (One) foam sheet
- 1 (One) 1 1⁄2” bolt (size 6-32)
- 1 (One) washer (size 6-32)
- 4 (Four) hex nuts (size 1⁄4-20)
- 1 (One) locking nut (size 6-32)

Tool List

- Pen or pencil
- Cordless screwdriver
- A range of drill bits from 5/64” to 5/32”
- Clamp
- Ruler
- Scissors
- Hole punch
- Optional Extras
- Philips screwdriver (small)
- Adjustable wrench

PROCEDURE

Prepare The Aluminum Or Wood Handle

Gather your clamp(s), screwdriver and bits, safety glasses, and aluminum handle.

At one end of the aluminum handle, measure and mark a dot with your pencil 1 - 2 cm down from the top and equal distances from each side.

Clamp your handle to a sturdy work table so that the flat side with the mark is facing up. Put on your safety glasses.

Starting with the smallest drill bit, drill a hole where you have marked the handle. Go slow and steady, making sure the hole goes straight down and not at an angle. Once a small

hole is drilled, choose the drill bit that is the next size up and drill through the hole again, working your way up in bit size until the bolt can just slide through, easily but without much room for wiggling.

Make The Wheel

Measure a 22 cm by 22 cm square from your foam piece. The easiest way to do this is to fold one corner of the foam over until it reaches the opposite edge in a triangle shape and draw a line along the edge. When you unfold, you should have drawn a square. Cut this out.

Using a ruler for a straight edge, draw a line from each corner to the opposite corner, so that you have an "X" through your shape.

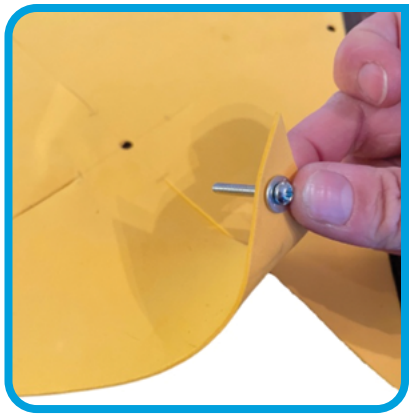
At each corner, on the right side of each line, measure 1 cm from the line and 1 cm from the top edge. Mark a dot there. You will be making 4 dots in total, one for each corner of the square.

From the centre point of the square (where the X lines meet), mark 2.5 cm up on each line. This will be your stop line. There will be four of these in total.
Now cut along each of the four lines from the corner to the centre stop lines.

Punch a hole where you marked a dot at each corner. (Be careful when you line up the hole punch, to make sure it is not over the edge of the foam. Try using the punch on some paper first). Also punch a hole at the centre point. You may need to squish the foam a bit to get the punch to reach the centre - that's fine!)

Assemble Your Pinwheel

Insert a washer onto the bolt and then, from the back of the sheet, thread one corner of the foam onto the bolt.



Move from one corner to the next around the outside of the wheel, until you have threaded each of the four corners of the foam square onto the bolt. Always come from the back of the project. You will be bending the corner with the hole in it towards the centre and then sliding it onto the stack of layers on the bolt. The bolt should always be facing down, towards the centre point.

Thread the bolt through the centre hole.

To the end of the bolt, add a washer followed by four large nuts.

Finally, add the handle, then the locking nut, tightening with your fingers to start.
Make sure the pinwheel spins easily and smoothly. If it doesn't, make sure the nuts spin loosely and that there is just a tiny bit of room on the bolt for them to wiggle. Also, make sure the wheel itself isn't hitting the handle. If it is, smooth out the foam until it spins freely.

Secure the locking nut using a screwdriver and a wrench. If not, ask an adult to tighten it with their hands.

Your pinwheel is ready to roll. You can blow on it or bring it outside and let the wind do the work for you!

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