

Junk Drawer Robotics

Facilitator's Guide



Activity Supplies

This is a sample of the kinds of stuff that you might use to build your *Junk Drawer Robotics* robots.

The items listed and shown are some of the things and parts that can be useful for the robotics activities in this curriculum. This is not a complete list and should be used just as a reference and source for other ideas.

Most of the items do not have to be exactly the same as the ones listed or shown and can be whatever you can find or have locally. You can browse in the grocery, hardware, office supply and the “dollar” stores to find different items that can be used by the youth.

Sometimes inexpensive items can be used in constructing other items. A cheap toy vehicle can be taken apart. The axles and wheels, and motor if it has one, can be used to make the robots cheaper than buying new parts.

Other items like a bicycle, iPod, tongs, or pliers that might be used in some activities can be borrowed for that activity.

A collection of old parts and equipment can become a great learning experience for young explorers. They can find and frame problems and develop creative solutions from such items.



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Facilitator's Guide



Activity Supplies

Junk Drawer Robots

Many of the items you will want to use in these activities can be found in your home's "Junk Drawer" and local crafts, office supply, hardware, and other stores. But some of the items may be harder to find or get locally. Also, if you get them in bulk they can be cheaper per item. Many of the following items can be found on-line.

JDR Starter Set

A Junk Drawer Robotics "Starter Set" may be available through some state 4-H Offices, check with your state to see if they offer a starter set. This starter set would have many of the not so common supplies and the harder to get supplies as well as examples of other items that can be used in building Junk Drawer robots. The Starter Set design is to have the basic materials for a small group in a project. Common supplies like paper clips will have to be secured locally.

Gear Fonts

Not all gear teeth will mesh together, so getting gear sets or fonts that work (mesh) together is important. Not all brands or sources of gears will work with other sets, but some do. It may be easiest to get all your gear sets from one source. The different gear fonts may also have various size holes for axles and motors.



Wheels

Many craft or hobby stores carry wooden or other toy wheels. For small groups, collecting recycled items for wheels can be fun, especially from the ice cream novelties "Push Up Pops" plus they include axles! Wheels in bulk are available on-line if you need a lot for larger groups. At least one company has a special wheel with a built-in gear, it works great!

Syringes

Because of controlled substances laws, some states limit or monitor the sale of syringes. Veterinary supply companies carry them and there are a number of on-line sources. Again, bulk sources may have a lower rate, but check different sites to get the best deal for the number you need. Getting different sizes, 3cc, 10cc, 20cc, etc. will allow exploration of ratios for force and distance in the movements.



Junk Drawer Robotics

Facilitator's Guide

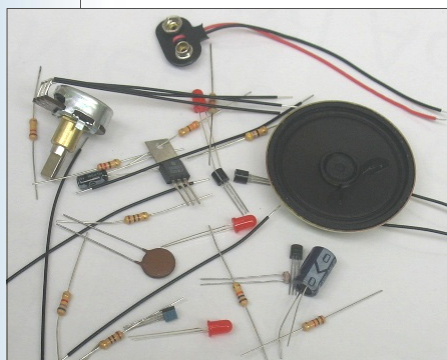
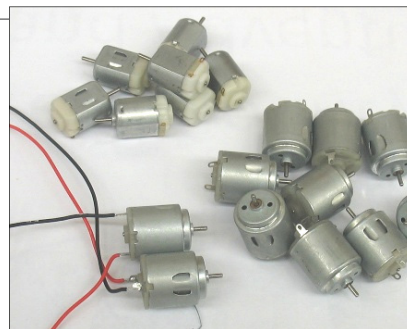


Activity Supplies

Motors

These can be purchased at some hobby and electronic stores for a few dollars; most come without wire leads, both styles are shown. For these activities the voltage ratings are not real critical. The range of 1.5 volts up to 6 and 12 volts should work for most projects. For example in the Can-Can robot a smaller 1.5v motor will readily work with one AA battery (1.5v); since they are physically smaller it makes mounting them to the cup easier. Then in the Es-Car-Go or the underwater ROV, you will need more power, so using two batteries in series (adds up to 3v) you can still run the 1.5v motor but a little overpowered or use a bigger motor (3v to 6v range) as youth design their vehicles.

You can get motors in bulk on-line for less than a dollar. You can order motors with lead wires but it may take more time for delivery, in one case it took two months, so plan according. Attaching lead wires is fairly easy and there is a "How To" sheet available on the process to attach wires. This could be a good teen member activity to prep the motors for younger youth and at the same time practice soldering skills.



Electronic parts and components

The individual parts can be obtained in electronics shops or on-line, but individual components can be more costly. Group parts or packets may be cheaper overall and the activities have some flexibility on the exact component values that can be used. For facilitators with less electronics experience using a training kit like the *Tronix Jr** that can be ordered on-line, may be a better option.

Where to get stuff on-line*

Below are a few on-line sources for things like gears, motors, syringes, toy wheels, electronic parts, and other building materials and tools. Most of these sites cater to school and group science and technology programs*.

ABS Supplies - <http://www.absupplies.com/>
GSS Tech ED - <http://www.gssteched.com/>
Kelvin Educational - <http://www.kelvin.com/>

Kidder - <http://www.kidder.ca/>
Nasco - <http://www.enasco.com/>
Pitsco - <http://www.shop-pitsco.com/>

* The above are listed only as a reference and do not imply endorsement nor exclusion of sources not listed.

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Facilitator's Guide



Trunk of Junk

Create your own and have your members add to the *Junk Drawer Robotics Trunk of Junk*. You can start by filling a box, bucket, sack, crate, or other container with old materials such as old household hardware, brackets, drapery cord guides, hinges, bolts, nuts, screws, wheels, pulleys, and more. These may come from old appliances like hair dryers, VCRs, computers, egg beaters, and other items with old gears, pulleys, wheels, switches, etc. (Try to stay away from items with glass and tubes like TVs and monitors.)

Also add in old toys, cars, wheeled items, and battery powered toys that are good sources of parts. Some of the above items can be obtained at garage sales, secondhand stores, and old toy boxes. Some may be cheap enough to buy new.

Craft supply stores also may have items that you can use for the robots you build. Look around to see what other items you can find or recycle that might work for robot building.

Here are some sample materials and parts to collect when building your own Trunk of Junk:

- conductors – wires, aluminum foil, metal,
- electrical supplies – small switches, toy motors,
- shapes of – building materials for sorting and building,
- pegboard and tubing for pneumatics,
- assorted batteries – AA, AAA, C, D,
- light bulbs – flashlight and mini lights (regular and LED),
- assembly – construction cutouts, beads, paper clips, glue, etc.,
- other small things – old tongs, coat hangers, ping pong balls, etc.,
- axles and wheels – round things, CDs, toy gears, toy wheels, straws, coffee stirrers, food skewers, wood dowels, bolts, and more,
- more shapes – for levers, wood, PVC pipe, springs, straws, etc.,
- recycled materials – cardboard boxes, plastic containers, jars, and other packing, and
- other stuff that you find around the house, garage, second hand store, or garage sales.



Junk Drawer Robotics

Facilitator's Guide



Level 1: "Give Robots a Hand" Activity Supplies - part 1

Enter Number of Youth = 10						
Level 1: "Give Robots a Hand"	Module 1					Total
Activity Supplies	Activity					Module
Each Activity Lists the approximate Number of Items Needed for One Group	A	B	C	D	E	- 1 - sub total
3-D Tic-Tac-Toe Game (board, spinner, markers)	0	0	0	0	0	0
Balloons	0	0	0	0	0	0
Binder Clips	3	3	0	0	5	37
Bulb Basters or Plastic Squeeze Bottles	0	0	0	0	0	0
Cardboard or Pegboard - (flats or squares)	0	0	0	0	0	0
Cardboard - Tubes	0	0	0	0	0	0
Chopsticks (Pair)	0	0	0	0	0	0
Clothespins or Other Similar Clamps	3	3	0	0	3	30
Coffee Stirrers - Straw Type	3	3	0	0	3	30
Craft Sticks - (regular, jumbo, other)	3	3	0	0	3	30
Grippers (pliers, tongs, scissors, nutcrackers)	0	0	0	0	0	0
Items to be picked up - (marbles, plastic eggs, golf balls, ping-pong balls, toy blocks, etc.)	3	3	0	0	0	20
Marshmallows	0	0	0	0	3	10
Paint Sticks	3	3	0	0	10	53
Paper Brads - 1" to 1 1/2"	3	3	0	0	0	20
Paper Clips - (various sizes, shapes, and colors)	3	3	0	0	5	37
Plastic Syringes - (various sizes 3cc - 20cc)	0	0	0	0	0	0
Plastic Tubing - (about 10', 1/4" to fit syringes)	0	0	0	0	0	0
Rubber Bands - (various sizes shapes and colors)	3	3	0	0	5	37
Straws, Drinking - (different sizes, colors, flex, etc.)	3	3	0	0	3	30
Toy Pinwheels	0	0	0	0	0	0
Washers, metal -(use as weights)	0	0	0	0	0	0
Trunk of Junk - general and miscellaneous items	x	x	x		x	x

Junk Drawer Robotics

Facilitator's Guide



Level 1: "Give Robots a Hand" Activity Supplies - part 2

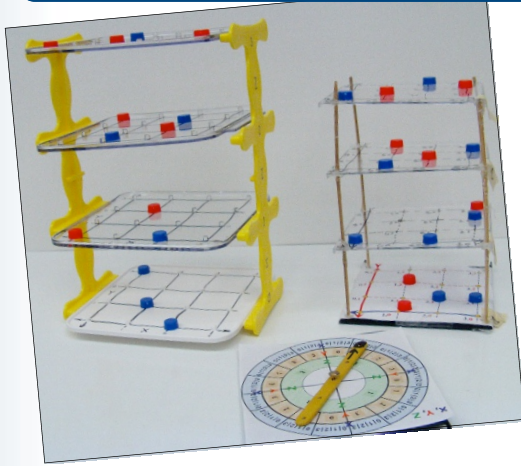
Module 2							Total	Module 3							Total	
Activity							Module	Activity							Module	Level
F	G	H	I	J	K	L	- 2 - sub total	M	N	O	P	Q	R	S	- 3 - sub total	Grand Total
0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
0	0	0	0	4	0	0	13	0	0	0	0	0	0	0	0	13
0	0	0	5	0	0	3	27	0	0	0	0	3	0	0	10	73
0	0	0	0	1	0	1	7	0	0	0	0	0	0	0	0	7
0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	3
0	0	0	2	0	0	0	7	0	0	0	0	0	0	0	0	7
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	3
0	0	0	5	0	0	3	27	0	0	0	0	0	0	0	0	57
0	0	0	3	0	0	0	10	2	0	0	0	0	0	0	7	47
0	0	0	5	0	0	3	27	0	0	0	0	5	0	0	17	73
0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	8	8
0	0	0	0	0	0	0	0	2	2	2	0	1	0	0	5	25
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
5	0	0	5	0	0	0	33	0	0	0	0	0	0	0	0	87
0	0	0	5	3	0	3	37	0	0	0	0	3	0	0	10	67
6	0	0	5	3	0	3	57	0	0	0	0	3	0	0	10	103
0	0	0	0	1	0	4	17	0	0	0	0	4	0	4	13	30
0	0	0	0	1	0	1	3	0	0	0	0	1	0	1	3	7
0	0	0	5	0	0	0	17	0	0	0	0	0	0	0	0	53
0	0	0	3	0	0	3	20	2	0	0	0	0	0	0	7	57
0	0	0	0	2	0	0	7	0	0	0	0	0	0	0	0	7
10	0	0	0	5	0	0	50	0	0	0	0	0	0	0	0	50
			x	x		x	x	x	x	x		x		x	x	x

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Facilitator's Guide



Make Your Own 3-D Game Board

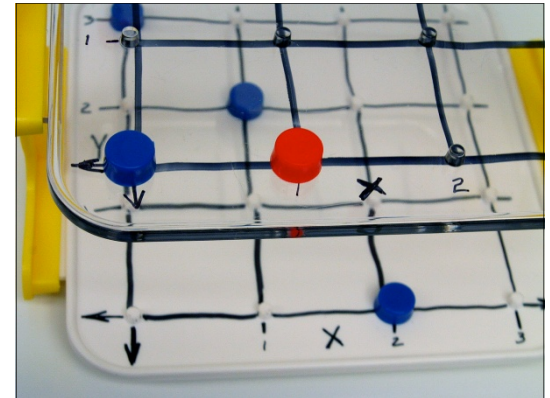


The basic game board can be purchased on-line or you can make your own game board using pieces of clear plastic. If you purchase a ready made stand you'll still have to make the grid pattern on the levels and make a game spinner.

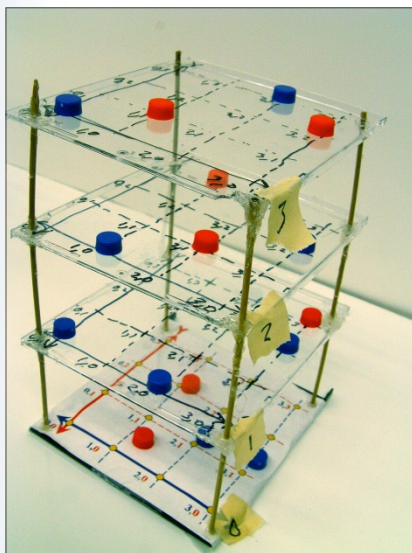
Game Stand:

Purchase a four-level game board on-line as a starter (you'll still have to mark it for the X,Y grids), or make your own game board. Use CD cases or another transparent item as the four bases of your game board. Draw an X,Y grid on the bases and number them accordingly (Z - 0, 1, 2, 3).

The graphics included in this guide should help you in drawing the grids onto the bases; or you could print out the grids and place them on your bases.

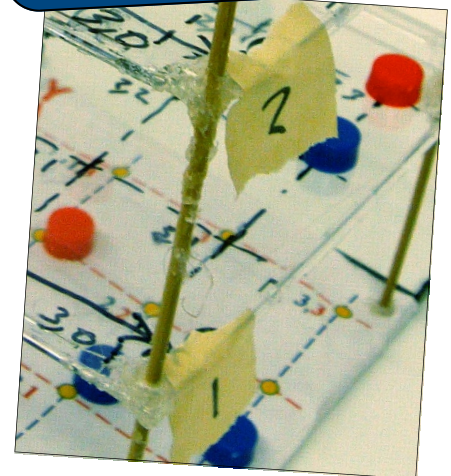


For the Z coordinate, mark each level as appropriate, 0 is the base level and 1, 2, and 3 are the upper levels.



You should also number each base level, starting from the bottom, 0 to 3 to represent the Z-axis of the stand.

- Use straws, dowels, and/or skewers for the vertical supports of the game stand.
- You could drill holes in your bases and slide the supports through the holes.
- Use glue or tape to hold the stand together.



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Facilitator's Guide



Make Your Own 3-D Game Board

Game Wheel and Spinner:

The wheel and spinner must be made as they do not come with a purchased stand.



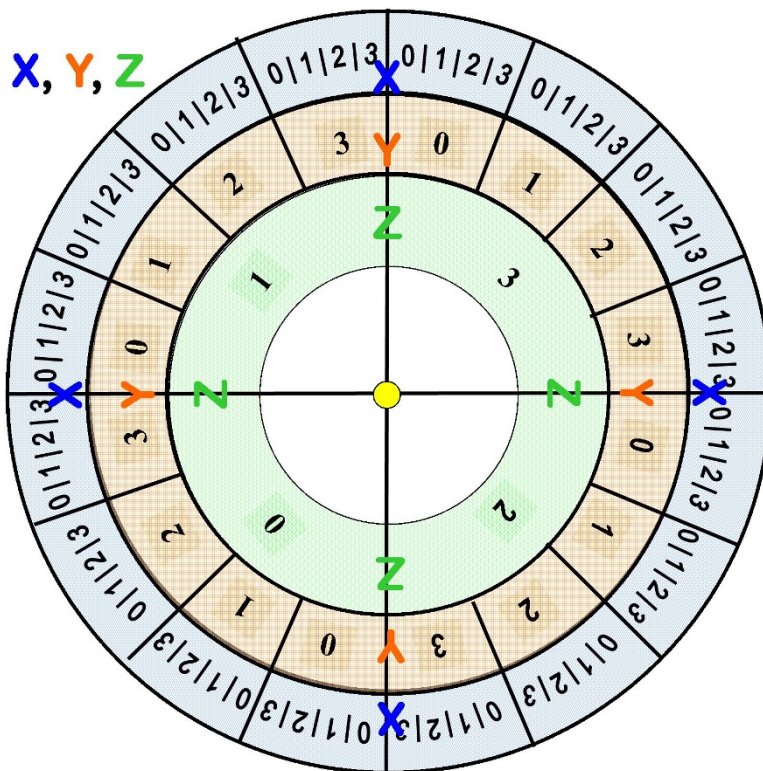
The **Game Wheel** is designed to provide the three (X,Y,Z) coordinate numbers with each spin. There are three rings with numbers (X,Y,Z). Different combinations of X,Y,Z can then be read from the spinner and marked on the scorecard. Marking on the scorecard ensures that it was read correctly and can be used to verify proper placement of each team's markers.

The **Game Spinner** can be cut from cardboard or a craft stick with a hole also could be used. The spinner should turn freely (spin) and stop at different places on the wheel.

Game Wheel Template:

Print out the game wheel template on paper and attach it to a backing material. Make a hole in the center for the spinner.

- Game wheel is to be printed or copied (in color, if possible, for easier reading of X,Y,Z coordinates).
- The wheel is formatted to fit the bottom of a CD case if printed about 4 inches in diameter, but can be attached to any stiff material (plastic, cardboard, etc.).
- Adjust copy size, if needed, if using different material for backing.



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Facilitator's Guide



Make Your Own 3-D Game Board

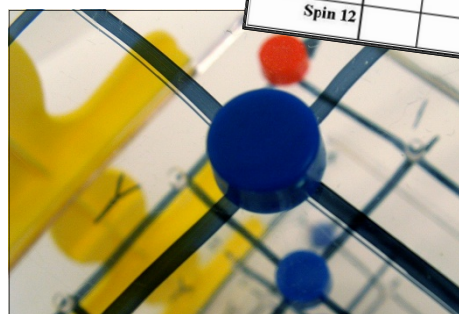
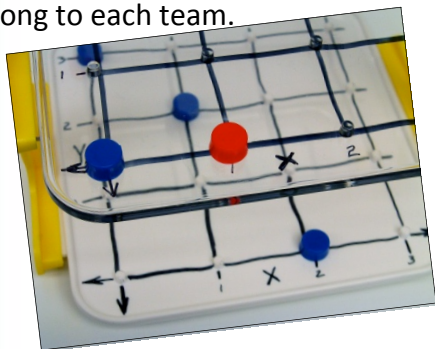
3-D Tic-Tac-Toe Game Rules and Scorecards:

Make copies of the sample cards and rules in the Presenter's Activity Guide so that each team has a copy or have youth use the Robotics Notebook to keep coordinates for each team spin.

Team Markers:

Small items that do not move around and that can stack make good markers. Buttons might be good, while marbles would not work well.

Each team should have different colors, shapes, or some other way to distinguish which markers belong to each team.



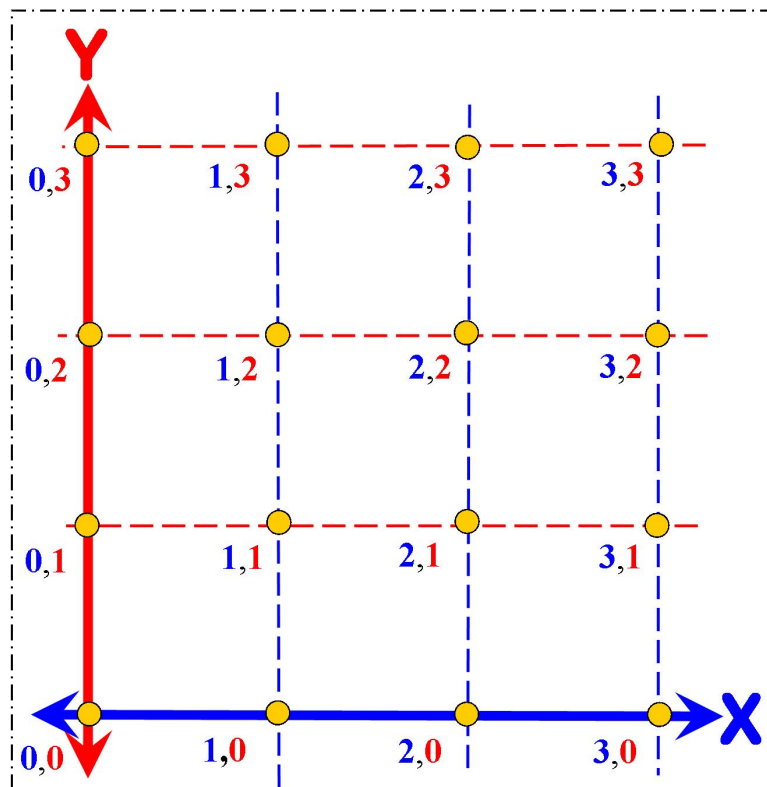
Team Name:			
Turn	X	Y	Z
Spin 1			
Spin 2			
Spin 3			
Spin 4			
Spin 5			
Spin 6			
Spin 7			
Spin 8			
Spin 9			
Spin 10			
Spin 11			
Spin 12			

X,Y, Z Grid - Template:

The template is used for both a prebuilt game board or a homemade board. Copy or print out the X-Y template on the right and trace the grid onto the clear plastic levels (1 to 3) of the game board with a sharp marker. Attach or mark the printed X,Y grid template directly onto the bottom level.

The grid template is formatted to fit a CD case if printed as a 4 inch by 4 inch grid template.

If using a different size game board, adjust the template size to fit the game board you are using.



Junk Drawer Robotics

Facilitator's Guide



Level 2: "Robots on the Move" Activity Supplies - part 1

Enter Number of Youth = 10														
Level 2: "Robots on the Move"					Module 1		Total	Module 2			Total			
Activity Supplies					Activity				Module	Activity				Module
Each Activity Lists the approximate Number of Items Needed for One Group					A	B	C	D	- 1 - sub total	E	F	G	H	- 2 - sub total
Aluminum Foil - (strips and sheets)					0	0	0	0	0	1	0	0	0	3
Batteries (AA)					0	0	0	0	0	0	0	0	1	3
Batteries (C or D)					0	0	0	0	0	1	1	0	0	3
Batteries (four pack D or 6 volt lantern)					0	0	0	0	0	0	0	0	0	0
Binder Clips - (clothespins, other clamps or clips)					0	0	0	1	3	0	0	0	0	0
Cardboard, Ramp - (about 12"x36" to share)					1	1	0	1	2	0	0	0	0	0
Coffee Stirrers - (Straw Type)					0	4	0	1	17	0	0	0	0	0
Compass (magnetic needle)					0	0	0	0	0	0	1	0	0	3
Container (shallow and wide pan type)					0	0	0	0	0	0	0	0	0	0
Craft Sticks - (regular, jumbo, other)					0	3	0	3	20	0	0	0	0	0
Cups - (8 to 16 oz paper or plastic)					0	0	0	0	0	0	0	0	1	3
Erasers - (pencil top or mechanical pencil type)					0	0	0	0	0	0	0	0	1	3
Felt Pens - (thin tip, colors, & washable)					0	0	0	0	0	0	0	0	3	10
Flashlight Bulbs - (1.5 to 6 volt)					0	0	0	0	0	2	0	0	0	7
Gears - (same pitch to mesh - various sizes)					0	0	0	0	0	0	0	0	0	0
Gears, Worm - (same pitch as other gears)					0	0	0	0	0	0	0	0	0	0
Gears, Wheel - (special wheel with gear)					0	0	0	0	0	0	0	0	0	0
Magnet - (any regular magnet)					0	0	0	0	0	0	1	0	0	3
Motor, small toy - (1.5 to 6 volts)					0	0	0	0	0	0	0	0	1	3
Multi Speed Bicycle - (borrow)					0	0	0	0	0	0	0	0	0	0
Nail, Steel - (12 to 16p to make electro-magnet)					0	0	0	0	0	0	1	0	0	3
Paper Clips, Full Box - (box for sliding and cargo)					0	1	0	1	3	0	0	0	0	0
Paper Brads, Brass - (1" to 1 1/2")					0	0	0	2	7	0	0	0	0	0
Paper Clips					10	8	0	2	67	0	3	0	0	10
Pennies					0	0	0	0	0	0	0	0	0	0
Ping-Pong Balls					0	0	0	0	0	0	0	0	0	0
Plastic Canvas Mesh or Cardboard - (2 to 4 inches for mounting gears)					0	0	0	0	0	0	0	0	0	0
Protractor					1	1	0	0	3	0	0	0	0	0
Rubber Bands - (various sizes shapes and colors)					0	0	0	1	3	0	0	0	3	10
Surfaces - (about 10 " strips various grits, sandpapers, packing tape, duct tape, etc.)					1	1	0	0	7	0	0	0	0	0
Soda Bottle, 2-liter -(or other tall container)					0	0	0	0	0	0	0	0	0	0
Straws, Drinking - (various sizes, colors, flex, etc.)					0	4	0	1	17	0	0	0	0	0
Tape, Electrical - (for underwater use)					0	0	0	0	0	0	1	0	0	2
Tape, Masking - various activities					1	1	0	0	2	1	0	0	1	3
Toy Propeller - (for underwater motor shaft)					0	0	0	0	0	0	0	0	0	0
Water Dive Tank - (pool, tub, etc. for ROVs)					0	0	0	0	0	0	0	0	0	0
Wheels, Toy - (plastic or wood various sizes)					0	0	0	4	13	0	0	0	0	0
Wire, Coat Hangers - (small metal sizes)					0	0	0	0	0	0	0	0	0	0
Wire, 18-22 Gauge - (short pieces for motors)					0	0	0	0	0	0	1	0	1	7
Wire, Flexible Cable - (4-5 feet for ROV tether)					0	0	0	0	0	0	1	0	4	17
Wood Skewers - (small dowels for axles)					0	0	0	1	3	0	0	0	0	0
Trunk of Junk								x	x					x

Junk Drawer Robotics

Facilitator's Guide



Level 2: "Robots on the Move" Activity Supplies - part 2

Level 2: "Robots on the Move"	Module 3						Total	Module 4					Total	
Activity Supplies	Activity						Module	Activity					Module	
Each Activity Lists the approximate Number of Items Needed for One Group	I	J	K	L	M	N	- 3 - sub total	O	P	Q	R	S	- 4 - sub total	Grand Total
Aluminum Foil - (strips and sheets)	0	0	0	0	0	0	0	1	0	0	0	0	3	7
Batteries (AA)	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Batteries (C or D)	0	0	0	1	0	1	3	0	0	0	0	0	0	7
Batteries (four pack D or 6 volt lantern)	0	0	0	0	0	0	0	0	0	0	1	0	2	2
Binder Clips - (clothespins, other clamps or clips)	0	0	0	0	0	1	3	0	1	0	0	0	3	10
Cardboard, Ramp - (about 12"x36" to share)	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Coffee Stirrers - (Straw Type)	0	0	0	2	0	2	13	0	0	0	0	0	0	30
Compass (magnetic needle)	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Container (shallow and wide pan type)	0	0	0	0	0	0	0	1	0	0	0	0	3	3
Craft Sticks - (regular, jumbo, other)	0	2	0	2	0	4	27	0	0	0	0	0	0	47
Cups - (8 to 16 oz paper or plastic)	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Erasers - (pencil top or mechanical pencil type)	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Felt Pens - (thin tip, colors, & washable)	0	0	0	0	0	0	0	0	0	0	0	0	0	10
Flashlight Bulbs - (1.5 to 6 volt)	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Gears - (same pitch to mesh - various sizes)	0	3	0	3	0	3	30	0	0	0	0	0	0	30
Gears, Worm - (same pitch as other gears)	0	1	0	1	0	1	7	0	0	0	0	0	0	7
Gears, Wheel - (special wheel with gear)	0	1	0	1	0	1	5	0	0	0	0	0	0	5
Magnet - (any regular magnet)	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Motor, small toy - (1.5 to 6 volts)	0	0	0	1	0	1	3	0	0	0	1	1	3	10
Multi Speed Bicycle - (borrow)	1	0	0	0	0	0	2	0	0	0	0	0	0	2
Nail, Steel - (12 to 16p to make electro-magnet)	0	0	0	0	0	0	0	0	1	0	0	0	3	7
Paper Clips, Full Box - (box for sliding and cargo)	0	1	0	1	0	1	10	0	0	0	0	0	0	13
Paper Brads, Brass - (1" to 1 1/2")	0	5	0	5	0	5	50	0	1	0	0	0	3	60
Paper Clips	0	0	0	0	0	5	17	0	1	0	0	0	3	97
Pennies	0	0	0	0	0	0	0	100	0	0	100	100	300	300
Ping-Pong Balls	0	0	0	0	0	0	0	0	1	0	4	4	30	30
Plastic Canvas Mesh or Cardboard - (2 to 4 inches for mounting gears)	0	1	0	1	0	1	10	0	0	0	0	0	0	10
Protractor	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Rubber Bands - (various sizes shapes and colors)	0	0	0	0	0	5	17	0	0	0	0	0	0	30
Surfaces - (about 10 " strips various grits, sandpapers, packing tape, duct tape, etc.)	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Soda Bottle, 2-liter -(or other tall container)	0	0	0	0	0	0	0	0	1	0	0	0	3	3
Straws, Drinking - (various sizes, colors, flex, etc.)	0	0	0	2	0	2	13	0	0	0	0	0	0	30
Tape, Electrical - (for underwater use)	0	0	0	1	0	0	2	0	0	0	1	1	2	5
Tape, Masking - various activities	1	0	0	1	0	0	3	0	0	0	0	0	0	8
Toy Propeller - (for underwater motor shaft)	0	0	0	0	0	0	0	0	0	0	1	1	3	3
Water Dive Tank - (pool, tub, etc. for ROVs)	0	0	0	0	0	0	0	0	0	0	1	0	1	1
Wheels, Toy - (plastic or wood various sizes)	0	0	0	0	0	4	13	0	0	0	0	0	0	27
Wire, Coat Hangers - (small metal sizes)	0	0	0	0	0	0	0	0	0	0	1	1	7	7
Wire, 18-22 Gauge - (short pieces for motors)	0	0	0	0	0	1	3	0	0	0	0	0	0	10
Wire, Flexible Cable - (4-5 feet for ROV tether)	0	0	0	0	0	2	7	0	0	0	1	1	7	30
Wood Skewers - (small dowels for axles)	0	2	0	2	0	2	20	0	0	0	0	0	0	23
Trunk of Junk				x		x	x		x		x	x	x	x

Junk Drawer Robotics

Facilitator's Guide



Level 3: "Mechatronics" Activity Supplies - part 1

Level 3: "Mechatronics"	Module 1					Total	Module 2					Total
Activity Supplies	Activity					Module	Activity					Module
Each Activity Lists the approximate Number of Items Needed for One Group	A	B	C	D	E	- 1 - sub total	F	G	H	I	J	- 2 - sub total
Aluminum Foil - (strips and sheets)	1	1	1	0	1	3	0	0	0	0	0	0
Batteries (AA, C or D)	1	1	1	0	1	3	0	0	1	0	1	3
Batteries (9 volt)	0	0	0	0	0	0	0	0	0	0	0	0
Blindfolds	0	0	0	0	0	0	0	1	0	0	0	3
Braille Cards	0	0	0	0	0	0	0	5	0	0	0	17
Cardboard Tube - (combine to make approx 3' long)	0	0	0	0	0	0	2	0	0	0	0	7
Craft Sticks - (regular, jumbo, other)	3	4	4	0	4	17	0	0	0	0	4	13
Felt Pens or Chalk - (for marking line follower)	0	0	0	0	0	0	2	0	0	0	0	7
Graph Paper	0	0	0	0	0	0	0	0	0	0	0	0
Light Bulbs - (holiday mini lights)	3	3	2	0	0	9	0	0	1	0	0	3
Light Bulbs - (LEDs or mini LEDs)	0	0	2	0	0	7	0	0	0	0	0	0
Motor, small toy (1.5 to 6 volts)	0	0	1	0	1	3	0	0	0	0	1	3
Music Playing Device - (like musical chairs)	0	0	0	0	0	0	0	0	0	0	0	0
Poster Paper - (large note pad, newspaper, or chalk on sidewalk)	0	0	0	0	0	0	1	0	0	0	0	3
Paper Brads, Brass - (1" to 1 1/2")	5	5	0	0	5	17	0	0	0	0	4	13
Paper Clips - (various sizes, shapes, and colors)	4	4	0	0	5	22	0	0	0	0	4	13
Pegboard, Cardboard, or Plastic Canvas	1	0	0	0	1	3	0	0	0	0	0	0
Ping-Pong Ball - (component game)	0	0	0	0	0	0	0	0	0	0	0	0
Tape, Blue Painter's Tape - (for marking lines)	0	0	0	0	0	0	1	0	0	0	0	3
Wheels, Toy - (plastic or wood various sizes)	0	0	1	0	4	13	0	0	0	0	4	13
Wire, 18-22 Gauge - (short pieces for switches)	0	2	2	0	2	20	0	0	1	0	2	10
Don't Buzz Me Game - (purchase or make a steady hand tester using wood base, stiff 12-14 gage wire, buzzer, lamp, battery, wire connectors, and follow loop)	0	0	0	0	0	0	0	0	1	0	0	2
Component Game - (use recycled items to create/represent electronic components - foam pool noodle, various containers, plastic spoons, etc.)	0	0	0	0	0	0	0	0	0	0	0	0
Electronics Experiment Kit- (purchase kit or individual components)	0	0	0	0	0	0	0	0	0	0	0	0
Trunk of Junk		x	x		x	x					x	x

Junk Drawer Robotics

Facilitator's Guide



Level 3: "Mechatronics" Activity Supplies - part 2

Level 3: "Mechatronics"	Module 3					Total	Module 4				Total	
Activity Supplies	Activity					Module	Activity				Module	
Each Activity Lists the approximate Number of Items Needed for One Group	K	L	M	N	O	- 3 - sub total	P	Q	R	S	- 4 - sub total	Grand Total
Aluminum Foil - (strips and sheets)	0	0	0	0	0	0	0	0	0	0	0	3
Batteries (AA, C or D)	0	0	0	0	0	0	0	0	0	0	0	6
Batteries (9 volt)	0	0	0	0	1	3	0	0	0	0	0	3
Blindfolds	0	0	0	0	0	0	0	0	0	0	0	3
Braille Cards	0	0	0	0	0	0	0	0	0	0	0	17
Cardboard Tube - (combine to make approx 3' long)	0	0	0	0	0	0	0	0	0	0	0	7
Craft Sticks - (regular, jumbo, other)	0	0	0	0	0	0	0	0	0	0	0	30
Felt Pens or Chalk - (for marking line follower)	0	0	0	0	0	0	0	0	0	0	0	7
Graph Paper	0	0	0	0	0	0	0	2	2	2	15	15
Light Bulbs - (holiday mini lights)	0	0	0	0	0	0	0	0	0	0	0	12
Light Bulbs - (LEDs or mini LEDs)	0	0	0	0	0	0	0	0	0	0	0	7
Motor, small toy (1.5 to 6 volts)	0	0	0	0	0	0	0	0	0	0	0	7
Music Playing Device - (like musical chairs)	1	0	0	0	0	1	0	0	0	0	0	1
Poster Paper - (large note pad, newspaper, or chalk on sidewalk)	0	0	0	0	0	0	0	0	0	0	0	3
Paper Brads, Brass - (1" to 1 1/2")	0	0	0	0	0	0	0	0	0	0	0	30
Paper Clips - (various sizes, shapes, and colors)	0	0	0	0	0	0	0	0	0	0	0	35
Pegboard, Cardboard, or Plastic Canvas	0	0	0	0	0	0	0	0	0	0	0	3
Ping-Pong Ball - (component game)	0	0	0	30	0	50	0	0	0	0	0	50
Tape, Blue Painter's Tape - (for marking lines)	0	0	0	0	0	0	0	1	1	1	3	6
Wheels, Toy - (plastic or wood various sizes)	0	0	0	0	0	0	0	0	0	0	0	27
Wire, 18-22 Gauge - (short pieces for switches)	0	0	0	0	0	0	0	0	0	0	0	30
Don't Buzz Me Game - (purchase or make a steady hand tester using wood base, stiff 12-14 gage wire, buzzer, lamp, battery, wire connectors, and follow loop)	0	0	0	0	0	0	0	0	0	0	0	2
Component Game - (use recycled items to create/represent electronic components - foam pool noodle, various containers, plastic spoons, etc.)	0	0	0	1	0	2	0	0	0	0	0	2
Electronics Experiment Kit- (purchase kit or individual components)	0	0	0	0	1	3	0	0	0	0	0	3
Trunk of Junk												x

Junk Drawer Robotics

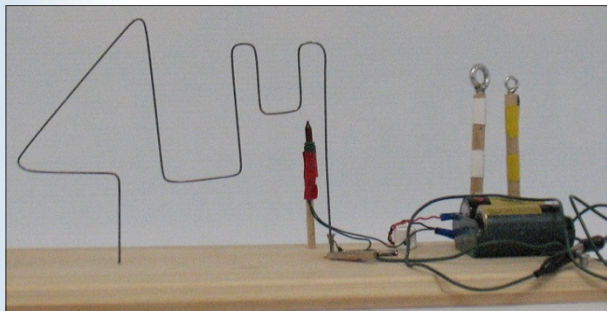
Facilitator's Guide



Make Your Own “Don’t Buzz Me” Game

The activity is to see how fast youth can move the loop from one end to the other end of the follow wire with the fewest touches (completed circuits). This activity is sometime call and “steady hand tester” and there are number of plans to make similar games on-line.

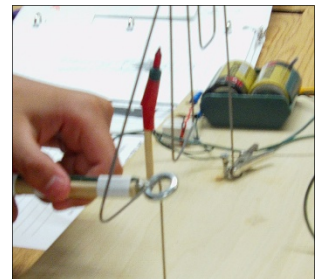
Base - the base can be made from a block of wood, shoebox lid, or something flat that you can put holes into. The base will hold the battery and the circuit will make the “Don’t Buzz Me” activity functional.



Wires - there are two different types of wires needed for this game. The first wire needed is a stiff bare wire to hold a shape to follow. This can be copper wire bought from a hardware store, wire clothes hanger with the enamel insulation stripped off, a gas welding rod, or any bare 12-14 gage wire. The second wire needed is 20-22 gage lead wire. This lead wire will be connected to the battery, the light, the buzzer, and the stiff wire.

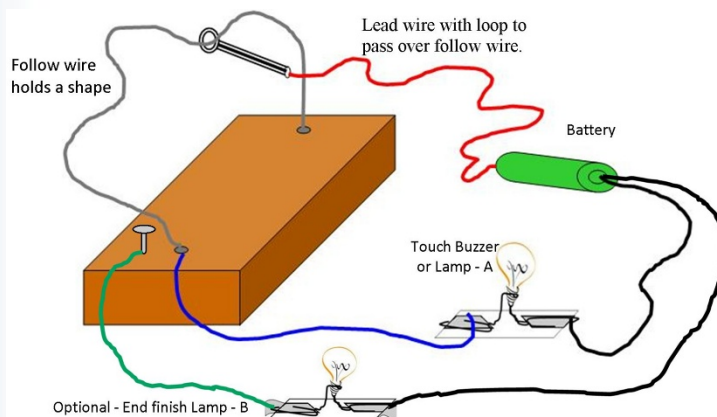
Sensors - these can be either a holiday light, LED, and/or buzzer that will alerts the players that the user has touched the stiff wire by mistake, and signals that the pass is completed lighting the lamp B.

Loop or Hook - one end of the lead wire is to be attached to a metal paper clip, eye screw or hook that can be past around the follow wire. Different size loops will create levels of difficulty (sensitivity) to move the loop without touching the follow wire and buzzing or lighting the lamp.



Circuit - The circuit for the “Don’t Buzz Me” is very simple. The lamp and buzzer are in parallel and the loop is like a single pole double throw switch connection.

- Starting at the end closest to the buzzer, pass the loop over the gray *follow* wire.



- Move loop towards the end with the lamp attached, while trying not to touch the orange wire and loop to the gray *follow* wire.
- When the orange wire with loop touches the nail and green *Lamp B* wire, the lamp will light to note completion.
- If the orange loop touches the gray follow wire then the blue *Buzzer A* will sound. But remember, **don’t buzz me!**

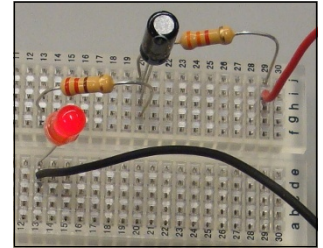
Junk Drawer Robotics

Facilitator's Guide

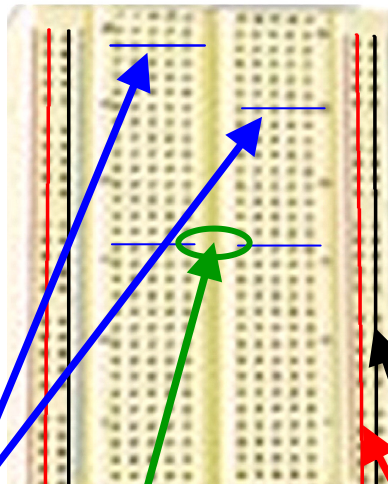


For your Information - Breadboard

A breadboard is also known as a solder-less prototyping board, used to help create temporary circuits for testing. Breadboards come in different sizes commonly known as full size, half size, and mini board. Breadboards are made up of two different parts, terminal strips and bus strips.



Terminal strips are the main areas where the components can be connected to other components or to jumper wires. The terminal strips are divided down the middle, usually by a groove. Terminal strip holes are electrically connected in a horizontal line across the breadboard. The terminal strips are not connected across the groove or with other horizontal rows.

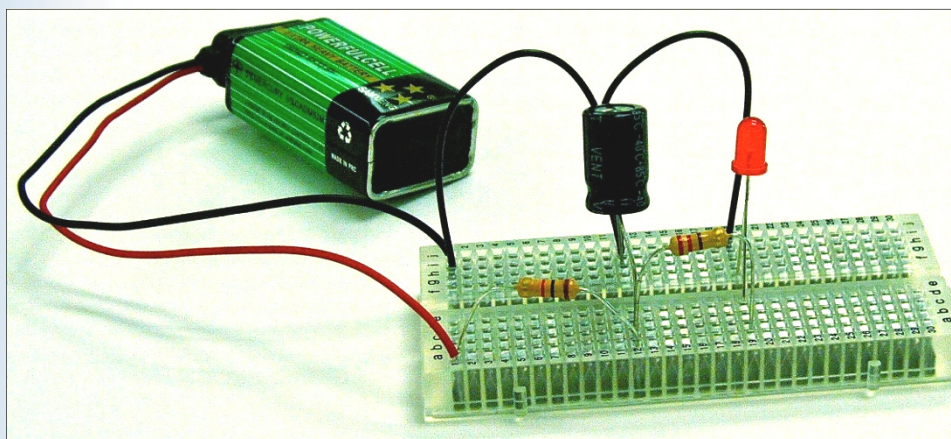


Terminal Strips

Groove
no connections

Bus strips are usually vertical lines (running the length of the board) on the outer edge of the breadboard. The bus strips are used as power rails, providing power to the breadboard. The bus strips are usually color coded and labeled for the power supply and ground. One must connect a power supply to the bus strip to provide power. Some mini boards may not have bus strips, like the one in the upper right photo.

Negative Bus Strip
Positive Bus Strip



Using a breadboard

All electrical components plug into the breadboard through terminal strips. To make a connection to other components, jumper wires may be used. Jumper wires are normally 22awg solid wires; these can be bought in packs or made from extra wires.

When using a breadboard, you can plan and test where you want to place the different components. Using a breadboard to create circuits makes it easy. There are no connections to solder and you can quickly change components and connections if needed.

Junk Drawer Robotics

Facilitator's Guide



For your Information - Breadboard

Resistor

A resistor restricts the flow of current in a circuit to a set value. Resistors are not polarized and can be placed in a circuit in any direction.



Capacitor

A capacitor stores the current in a circuit, and then releases the current once the capacitor is filled. The capacitor will continue to repeat this process as long as the circuit is complete and a current is flowing. Capacitors are polarized and will only work if connected correctly.



Diode

A diode restricts the flow in a current in a single direction. Diodes are polarized and must be placed in a circuit in the correct direction.



LED

A light emitting diode also known as an LED, is a special diode that produces a light when a current is passed through. LED are polarized and will not light if placed in an incorrect orientation. There is usually a notch or flat side on the LED to mark the cathode (negative) side.



Battery

A battery is used to provide direct current (DC) to the circuit. Batteries come in several different sizes and shapes. Some of the common batteries are AA, C, D, and 9v.



Wire

Wire is used to carry current in a circuit. Wires are made of a conductive material usually copper. Wires come in different sizes, and are measured by diameters and units of AWG (American Wire Gauge).



Switch

A switch is used to open and close a circuit. There are several different types of switches. They are named by the amount of poles and throws they have for example, a Single Pole Single Throw switch. A pole is the number of circuits to control, and a throw are the number of circuit paths that are controllable.

