



Pump It Lab! Kids' Engineering Challenge



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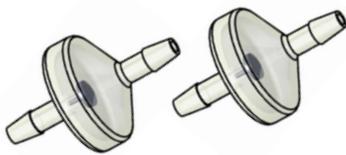
2 - **Large Cylinders** (14mL)



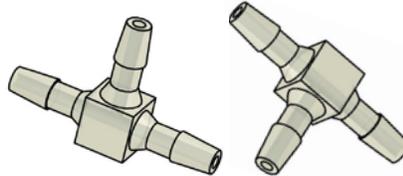
1 - **Small Cylinder** (4mL)



4 - **Vinyl Tubing Pieces**
(15 in | 38 cm)



2 - **Check Valves**



2 - **Tee Connectors**



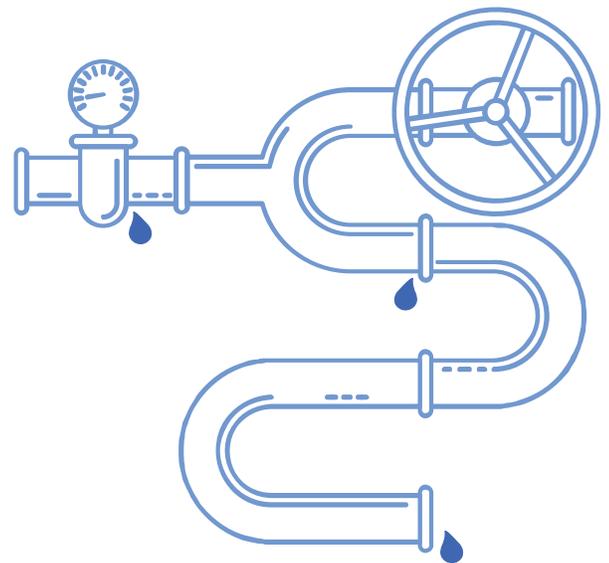
Liquid (Water, etc.)

Pump It Up!

How does water *move* to fill your bathtub or garden hose?
With pumps!

Use cylinders, tubing, valves and innovation to engineer your own water pump to race, squirt OJ, dispense drinks and so much more!

Water, Water Everywhere!

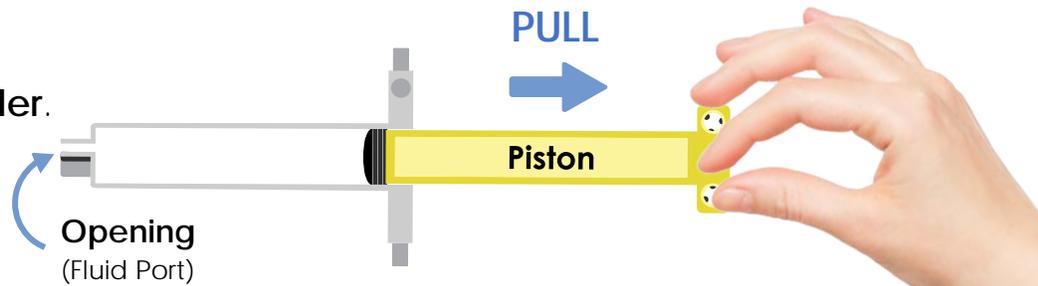




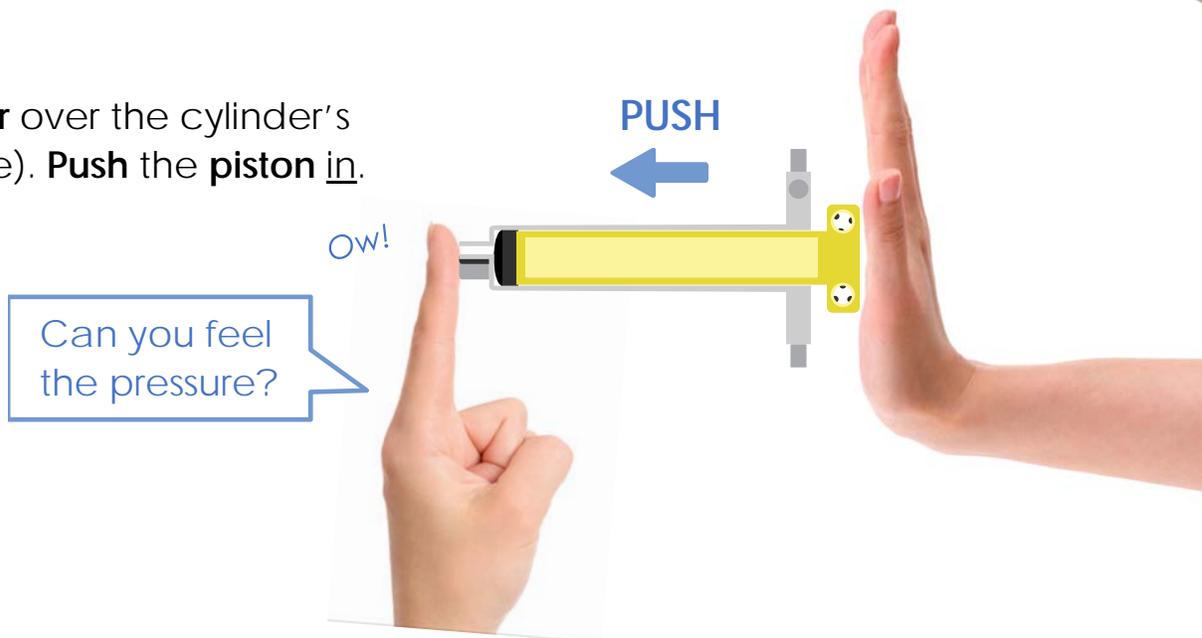
Cylinders

How Do Cylinders Work?

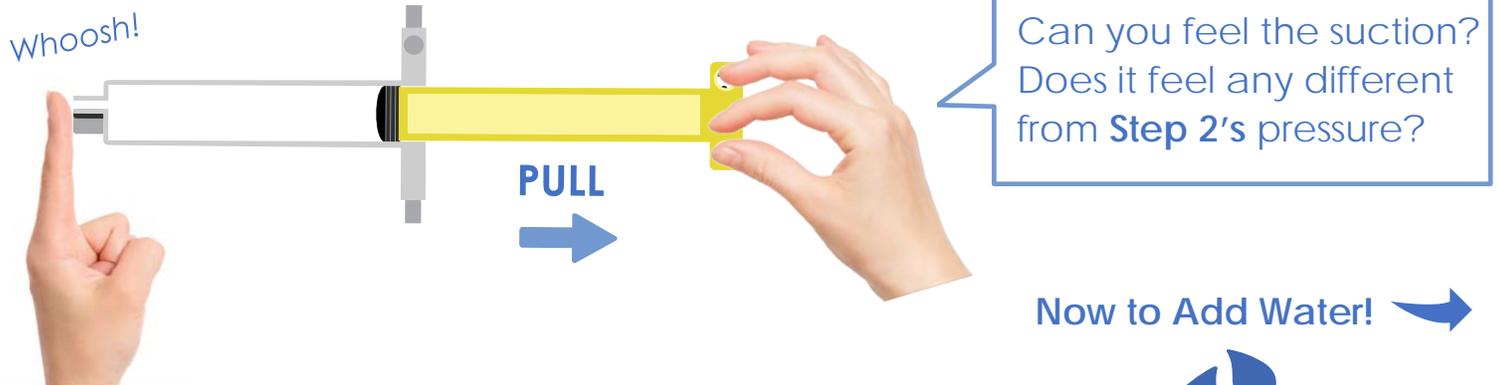
- 1 Grab the **yellow** cylinder. **Pull** the **piston** out.



- 2 Place a **finger** over the cylinder's opening (hole). **Push** the **piston** in.



- 3 Now place a **finger** over the opening (hole). **Pull** the **piston** out.



Now to Add Water! →

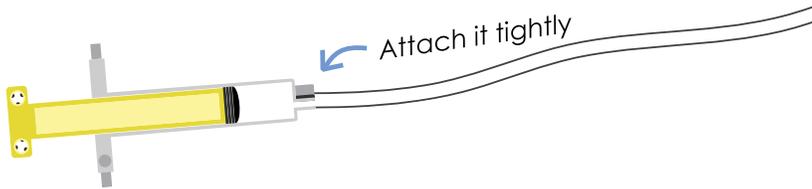




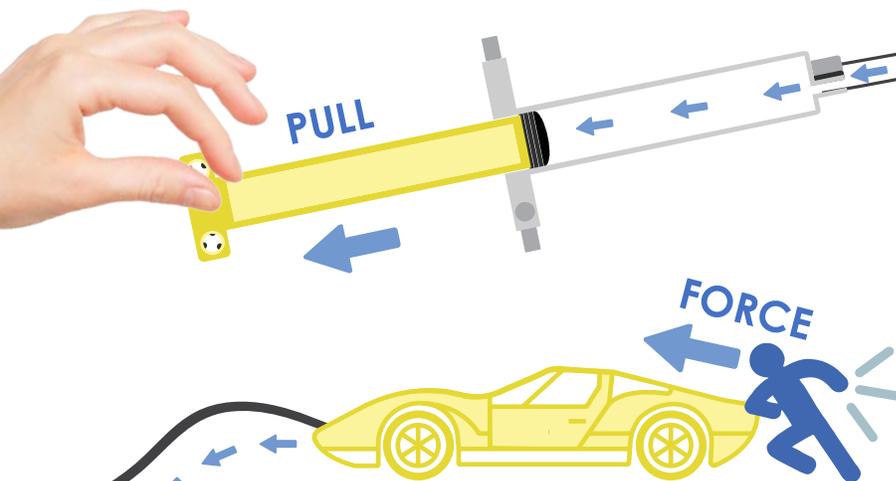
Vinyl Tubing

Add Tubing

- 4** Grab a 15 in piece of tubing.
Attach one end to the **yellow** cylinder.

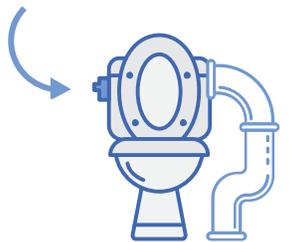


- 5** Place one end of the **tubing** in a glass of **water**. Push and pull the **piston**.
What happens to the water?

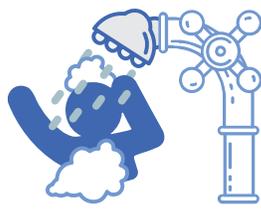


Bubbles Are Bad For Pumping Water
They interrupt the flow of liquid. Be sure to **pull** the piston slowly to keep extra bubbles at bay.

Pushing a car moves it from one place to another. Pushing (and pulling) water works in the same way.



Flushing Toilets!



Taking a Shower!

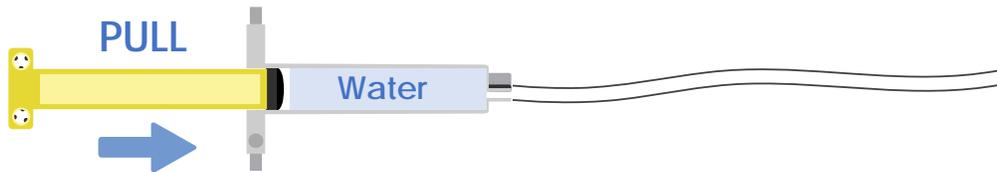




Moving Water

Connecting Cylinders

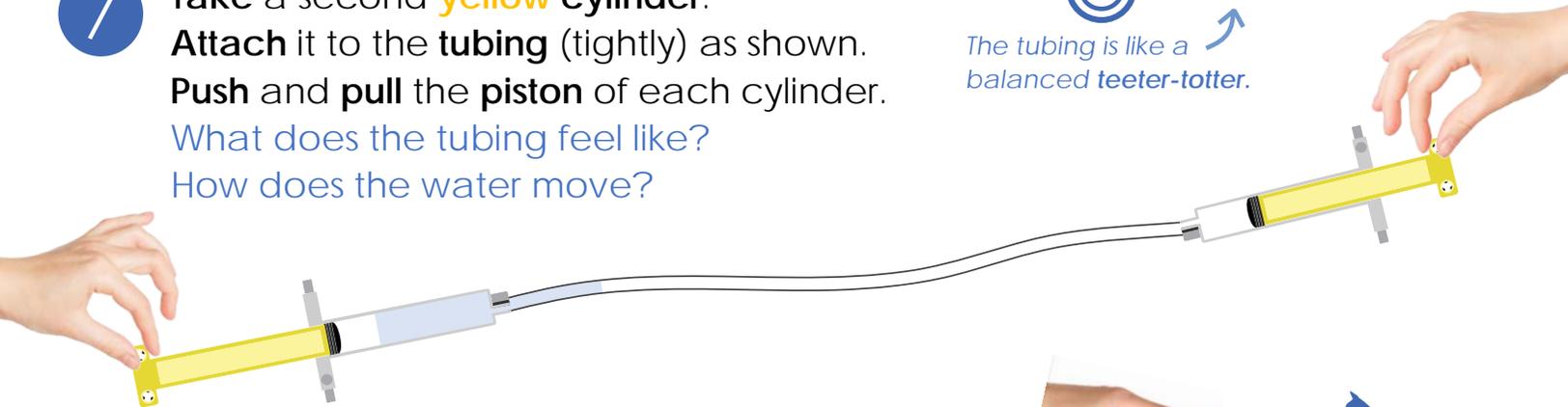
- 6 Grab the **yellow** cylinder and tubing from Step 6. Keep the water inside the cylinder by **pulling** the **piston** out.



- 7 Take a second **yellow** cylinder. **Attach** it to the **tubing** (tightly) as shown. **Push** and **pull** the **piston** of each cylinder. What does the tubing feel like? How does the water move?



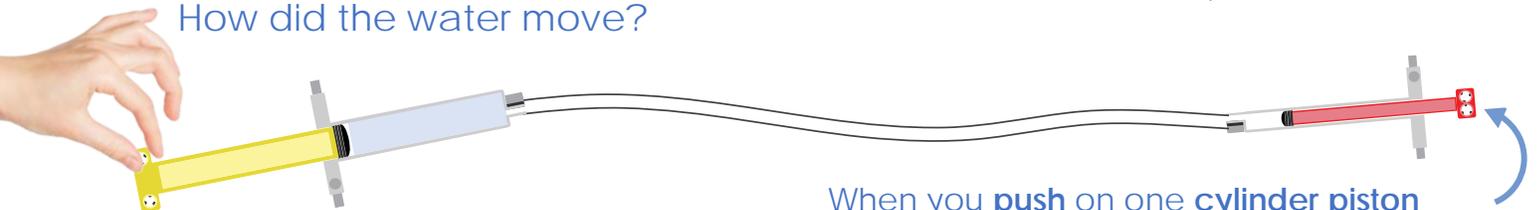
The tubing is like a balanced teeter-totter.



- 8 Switch one **yellow** cylinder with a **red** cylinder. **Attach** it to the **tubing**, then **push** and **pull** the **piston**. How did the water move?



Now the teeter-totter has different weights (unbalanced).



When you **push** on one cylinder piston (teeter totter side), the other side goes up!

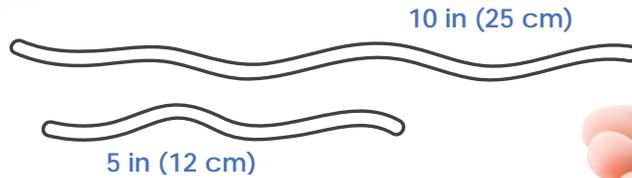


Valves

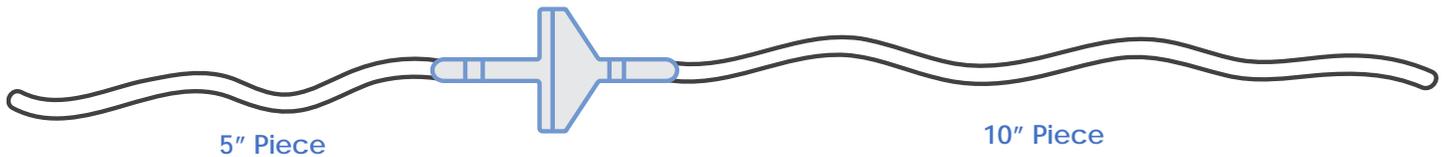
Add a Check Valve



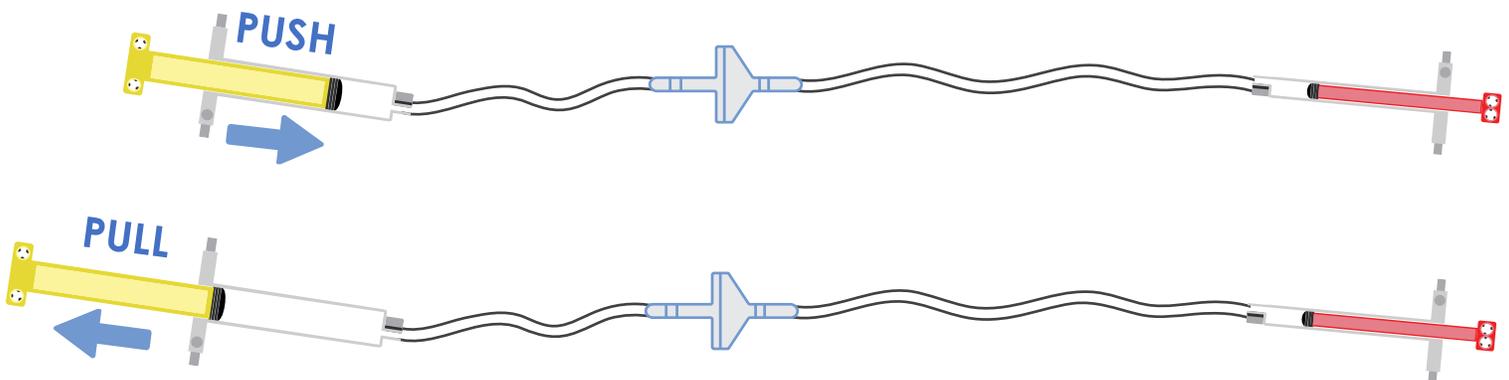
9 Cut vinyl tubing into two pieces as shown:



10 Grab one check valve. Attach the tubing, one piece on each side.



11 Attach a **yellow** cylinder to one tubing side, and a **red** cylinder to the other tubing side. **Push and Pull:** What happens to the flow of water?



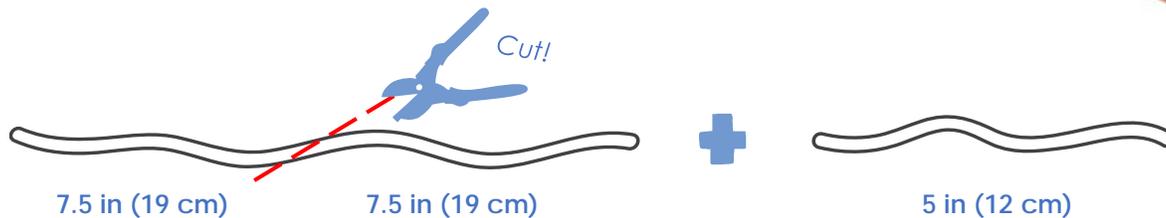


Tee Connectors

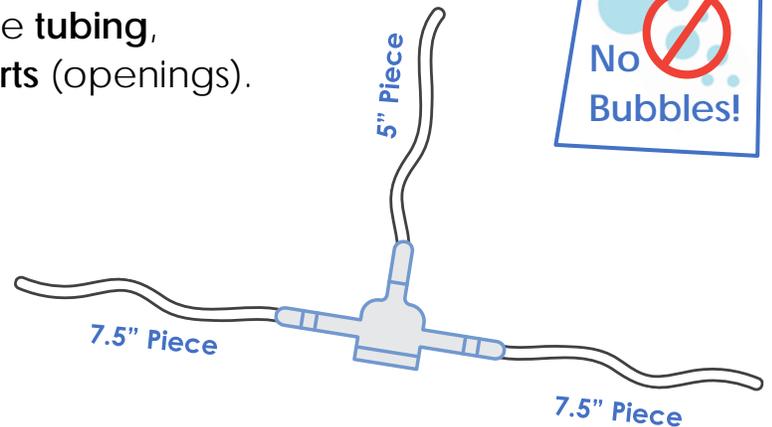
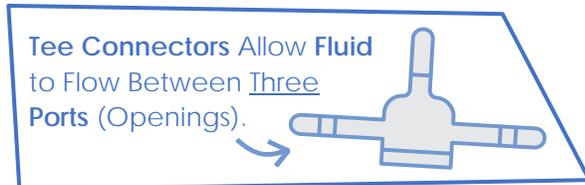


Add a Tee Connector

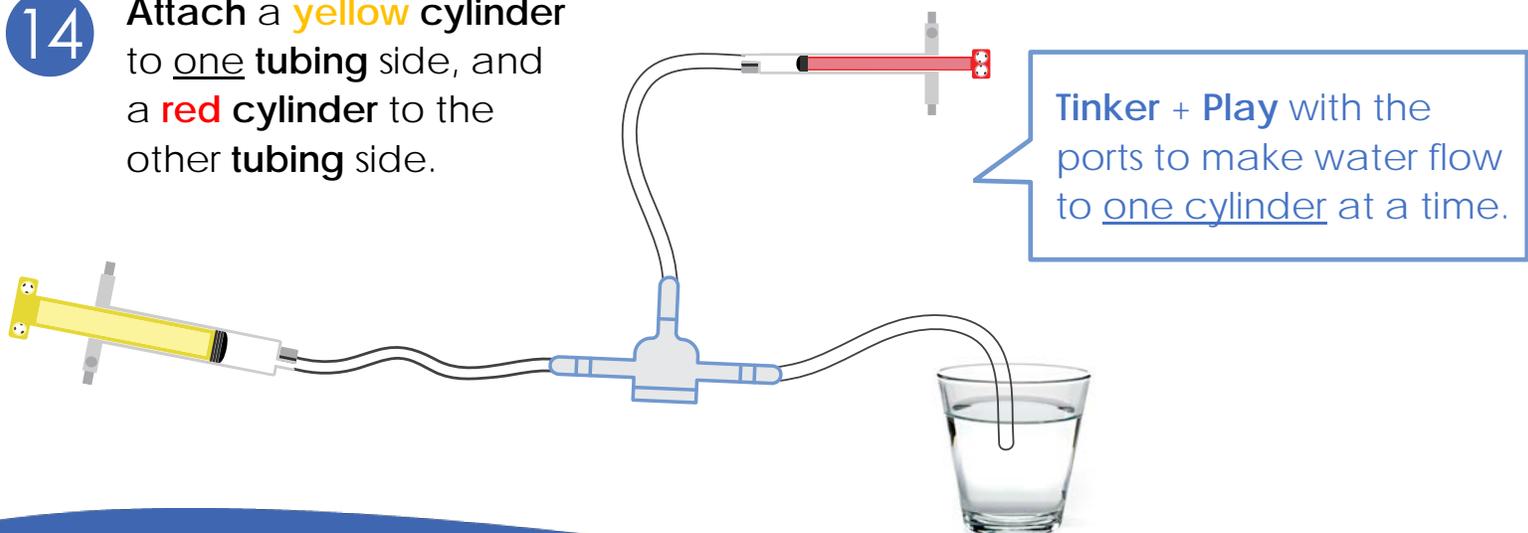
- 12** Cut a 15 in (38 cm) piece of vinyl **tubing** in half. Take the 5 in (12 cm) **tubing** piece from **Step 9**. Now you'll have three pieces.



- 13** Grab one tee connector. Attach the **tubing**, one piece for each of the three **ports** (openings).



- 14** Attach a **yellow** cylinder to one **tubing** side, and a **red** cylinder to the other **tubing** side.





Make a Pump

Make a Water Pump

Pumps move **water** from one place to another, through **pushes** and **pulls** (+ **gravity** and **pressure**.)



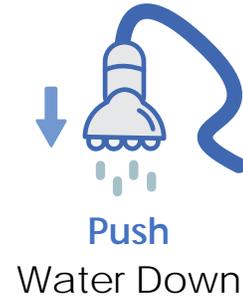
They can:



Stop + Start
Water Flow

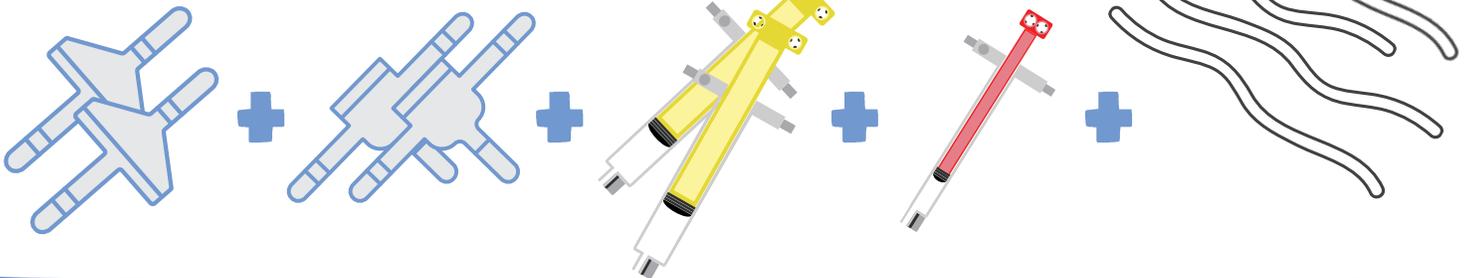


Pull
Water Up



Push
Water Down

Use These Materials to Start:



A sturdy glass or water bin won't tip over.



Use recycling materials to make a handle or base for your pump.

Tinker, Experiment, Play!



Pump Challenges



Pump It Up, Up, Up!

Just how **high** can you spray water into the sky?

Build a pump with TeacherGeek + recycled components.

All **pump pistons** must line up at the same level, hands *only* on pistons.

Mark three separate sprays, improving the design between each one.



Measure with a **yardstick** or tape on the wall in a waterproof room.

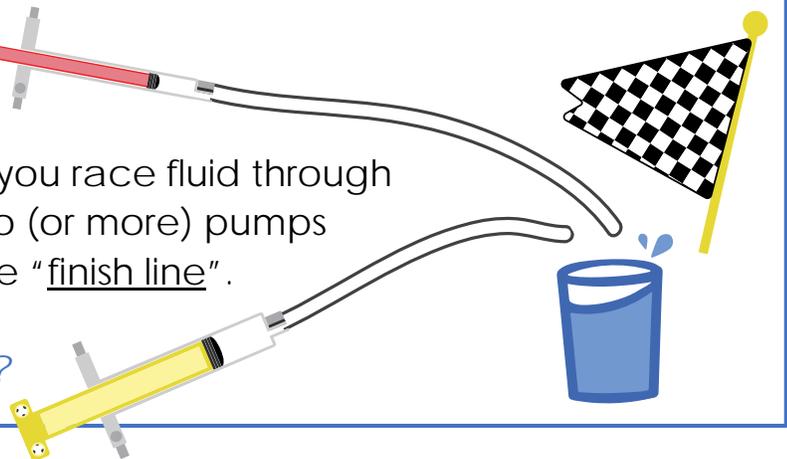


Hydraulic Race

Try big and small cylinders!

Tubing can become a **race track** as you race fluid through unique cylinder mechanisms. Line two (or more) pumps side-by-side, a **bin** or sturdy **cup** at the "finish line".

Ready, set... *Who can fill the cup first?*



Fluid Mixology

Valves + connectors control how fluid move!

Design a pump to **mix** different fluids together (**colored water** or even **soda pop flavors**), controlling just how much and where each type of fluid ends up!

With supervision, try **colored water** to see how fluid is *pushed* and *pulled*.



Can you mix **blue** and **yellow** to make **green**?

