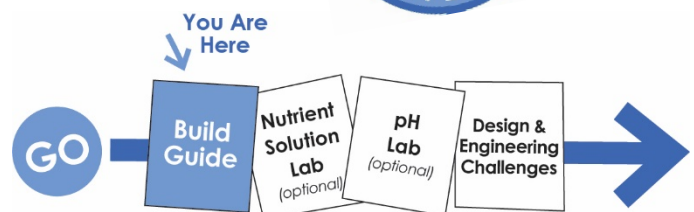


# MICRO HYDROPONICS BUILD GUIDE

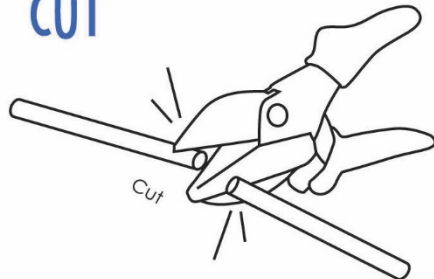


Download classroom documents at [teachergeek.com/learn](https://teachergeek.com/learn)

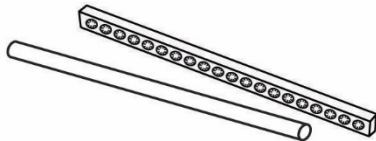
For use with TeacherGeek [Maker Cart](https://teachergeek.com/maker-cart)  
available at [teachergeek.com](https://teachergeek.com)

# BUILD GUIDE FOR MICRO HYDROPONICS

## CUT



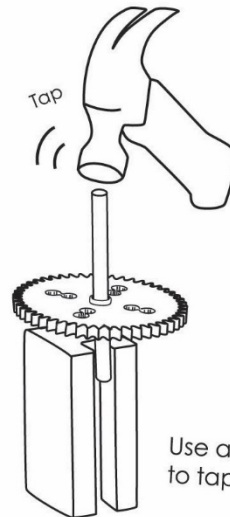
**Multi-Cutters** cut wood & plastic (like **dowels** and **connector strips**). They do not cut metal.



## PUSH, WIGGLE, TAP



Push, wiggle or tap **dowels** into holes.



Use a **hammer** and **slider block** to tap **dowels** farther through holes.

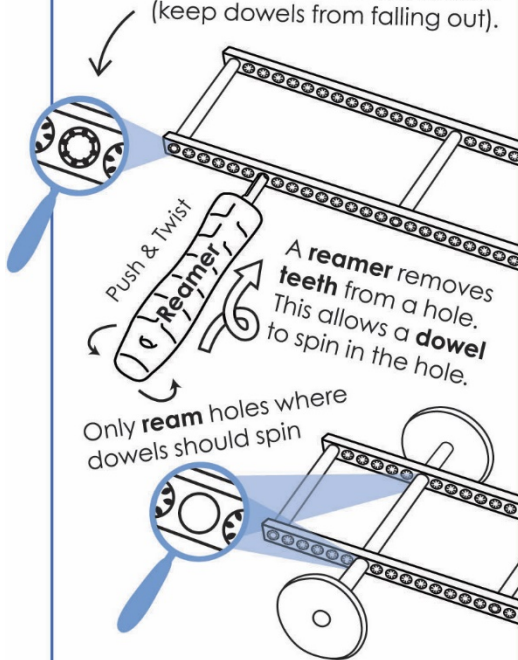
## QUICK TIP!



Use a **crayon** or **soap** on the end of a **dowel** to make building easier.

## REAM

Most parts have holes with **teeth**. The **teeth** hold **dowels** (keep dowels from falling out).



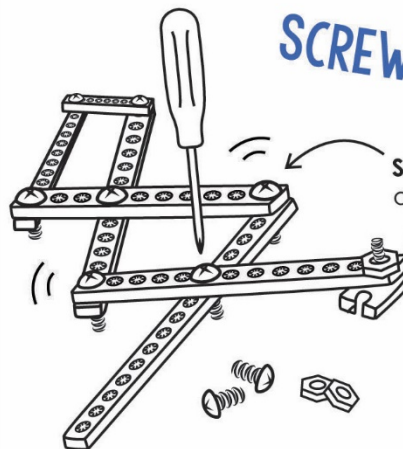
A **reamer** removes **teeth** from a hole. This allows a **dowel** to spin in the hole.

Only **ream** holes where dowels should spin

Never **ream** pulleys, gears, wheels, or any hole a **dowel** stays stuck into.

## SCREWS & NUTS

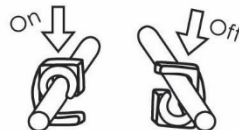
Do not **ream** holes you will put **screws** into.



**Screws (without nuts)** can connect parts, and allow them to rotate.

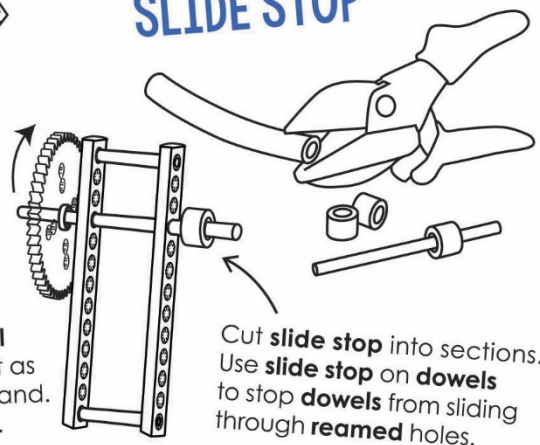
**Screws (with a nut)** can connect parts, and keep them from rotating.

## STOP CLIP



Press a **stop clip** onto a **dowel** to keep it from sliding or use it as a hook for a string / rubber band. It takes little force to get it on.

## SLIDE STOP



# BUILD GUIDE FOR MICRO HYDROPONICS

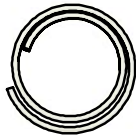


## TEACHERGEEK COMPONENTS

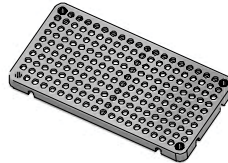
Components available in the TeacherGeek [Maker Cart](#), or at [teachergeek.com](http://teachergeek.com)



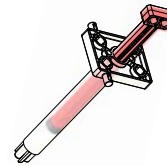
**4 - Barrels**  
14.5ml



**Vinyl Tubing**  
 $\frac{1}{8}$ "D x 38cm (15")L



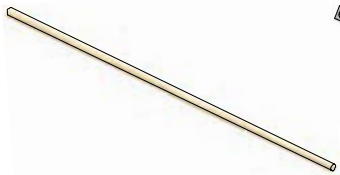
**1 - Hole Plate**



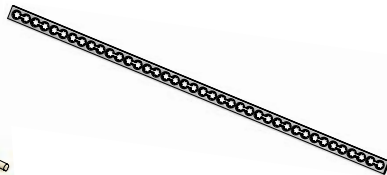
**1 - Cylinder**  
4.5 mL



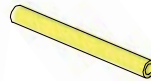
**Portion Cup**



**6 - Dowels**  
300mm (12")



**4 - Connector Strips**



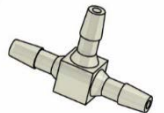
**1 - Slide Stop**  
7.6 cm (3")



**4 - Blocks**



**2 - Check  
Valves**



**1 -  
T-Connector**

## TEACHERGEEK TOOLS

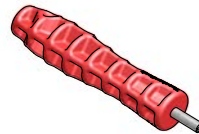
Tools can be shared between classes and groups.



**Multi-Cutter**



**Hammer**



**Reamer**

**Tip:** Save all your materials (even what you cut off). Keep them in a bag. They can be used later.

## MATERIALS YOU SUPPLY

Here are some non-TeacherGeek materials that you will need.



**Recycling Materials**  
Plastic, cardboard,  
food packaging.



**Growing Media**  
Piece of cloth, rockwool, cotton ball, etc.  
Needs to hold seedling in barrel,  
but still allow roots to grow.

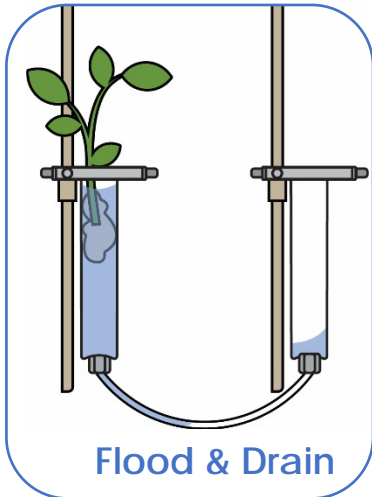


**Seeds**  
mung beans, tomatoes,  
lettuce, spinach, basil



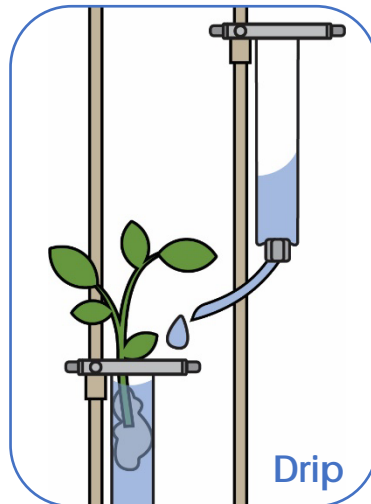
## HYDROPONICS

Use hydroponic systems to grow plants, soil free.  
With so many choices, which will you build?



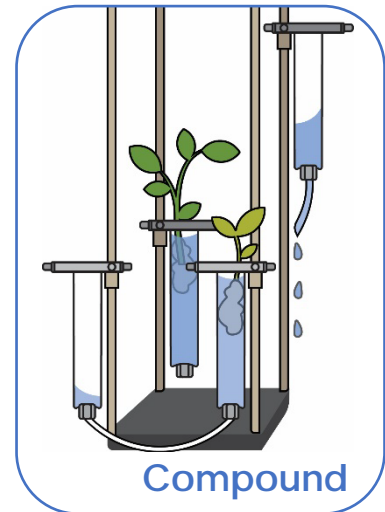
Flood your plants,  
then drain for reuse.  
*How long will your  
plant stay submerged?*

or



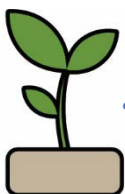
Drip water on plants,  
collect for reuse.  
*How many drip systems  
could you build at once?*

or



Mix and match to  
combine designs.  
*What system will you  
design for your plant?*

**This is not a step-by-step guide -**  
start with an example build, then  
design your own hydroponic system.  
The hole plate can fit **two systems**,  
so mix and match, add an optional  
check-valve, water aerator pump or  
enclose your system in a greenhouse.  
*There are no mistakes; just ways  
to make your design even better!*



**Now go, pick your system  
and get building!**



## PLANT PREP

Hydroponics require a neutral **growing medium** for support, while allowing **oxygen** and **water** in.



Try **rockwool**, cotton balls, perlite, peat plug or even an old clean sock.



cotton ball



rockwool



clean sock

Ideal hydroponic plants grow quickly, and don't require too much **surface area** to thrive.

- mung beans
- lettuce
- tomatoes
- basil



**1** Place your **seed** in the **growing media** and moisten with water. Store in a dark, warm place and re-moisten daily.

**2** Allow your seed to **germinate** (sprout) over the next few days into a **seedling** (green shoots and exposed leaves).  
*Now it's ready to be 'planted'.*



### Nutrient Solution Prep

*Feed me Seymour!* Plants require both **macro** and **micro-nutrients**, which you must prepare as a **nutrient solution** (water + nutrients).

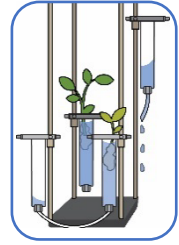
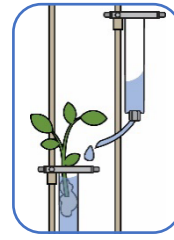
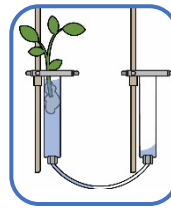
**Commercial Solutions** (e.g. FloraMicro, FloraGro) contain **Nitrogen, Potassium, Phosphorus** and trace minerals like calcium.

**DIY:** *Experiment with old tea bags or recycled fish tank water.*



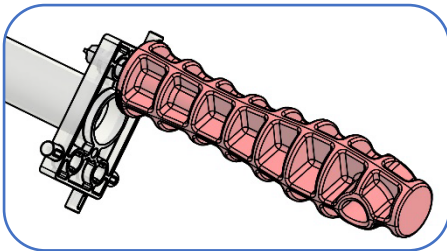
## (MICRO) FLOOD & DRAIN SYSTEM

Flood & Drain



1

Insert two **dowels** into a **hole plate** and push on two **barrels** as shown, one higher, one lower.

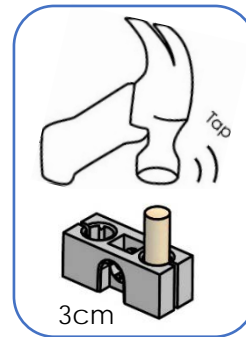


**Ream** the **barrel holes** very well, to allow easy adjustment on the dowels.

3

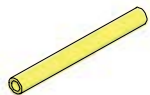
Cut a 3cm (1.1") **dowel** and tap or push it into a **block**.

Push the **block** onto an upright **dowel** and attach the **barrel** to the shorter dowel so it won't **slide**.

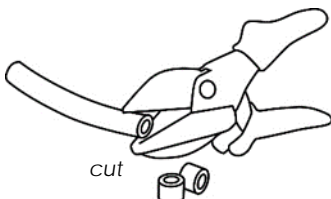


2

Cut a 3cm (1.1") piece of **slide stop**. Slide it 10 cm (3.9") from the bottom of a **dowel**.

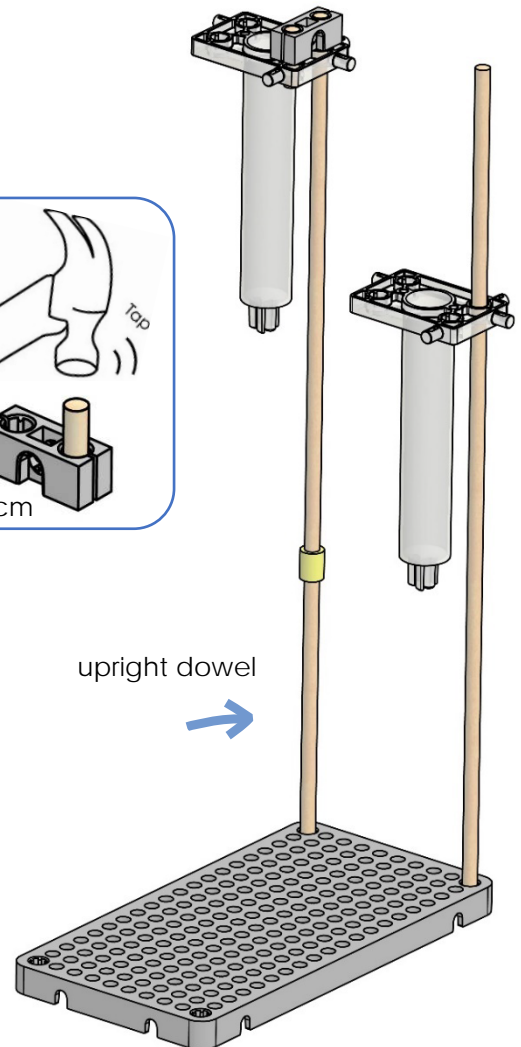


3cm slide stop



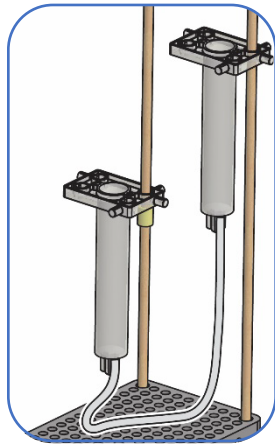
cut

upright dowel



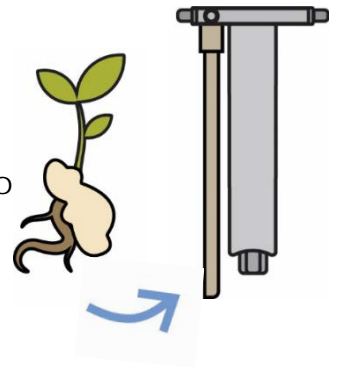
# BUILD GUIDE FOR MICRO HYDROPONICS

- 4** Attach 16cm (6") of **tubing** to connect your **barrels**. Make sure you can **adjust** your barrel up and down the **dowel**.



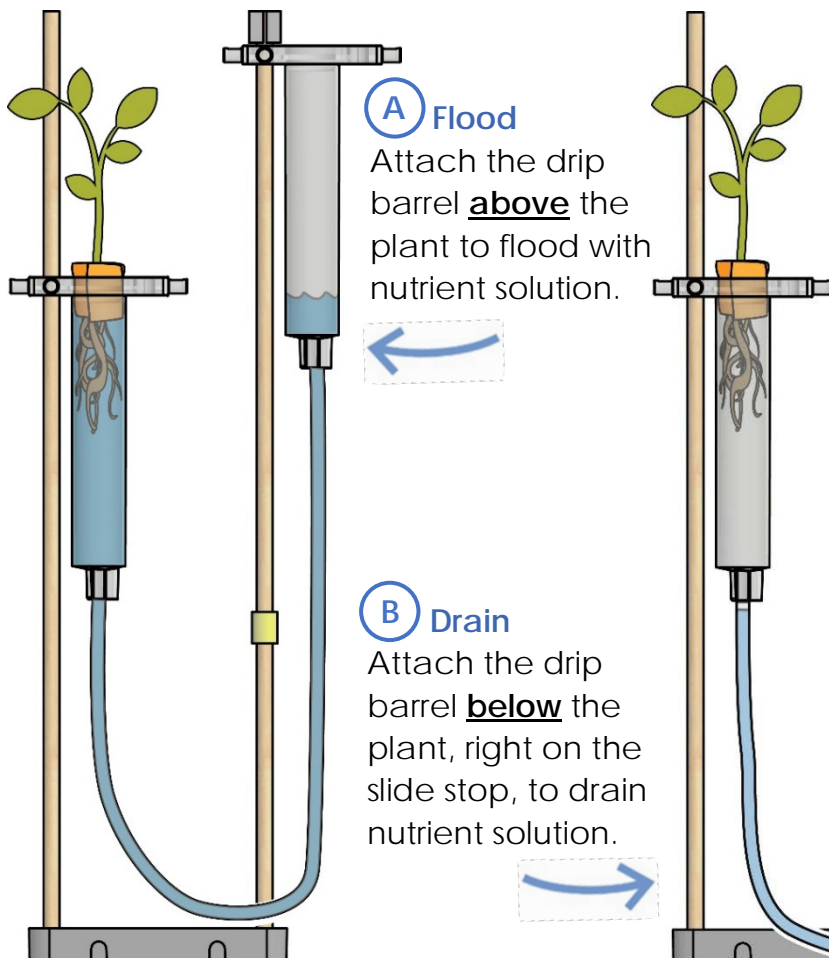
- 5** Place your **seedling** in the barrel **without** the **slide stop**.

Now you're ready to **Flood & Drain** your Hydroponic System.



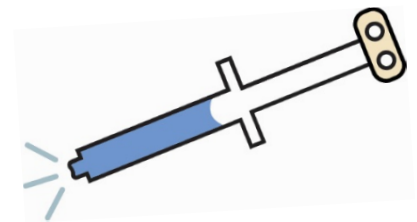
## Flood & Drain Options

Congratulations! You've built an example Flood & Drain System. It only works ok. You can make it so much better.



## Flood & Drain Systems

Rockwool and gravel **growing media** work best. Be careful not to **over-flood** your plant – this could lead to algae, or suffocate the plant. *How could you add oxygen to the solution?*



## (C) Fill

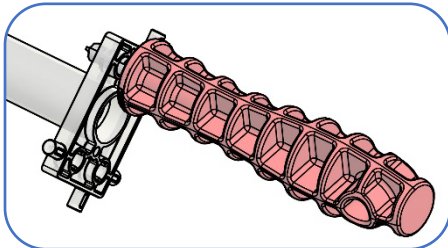
Use a **cylinder** or eye dropper to fill the barrels with fluid.



# BUILD GUIDE FOR MICRO HYDROPONICS

## (MICRO) DRIP SYSTEM

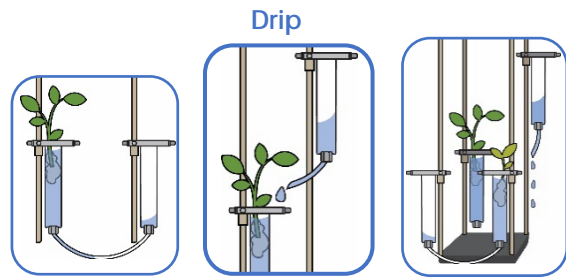
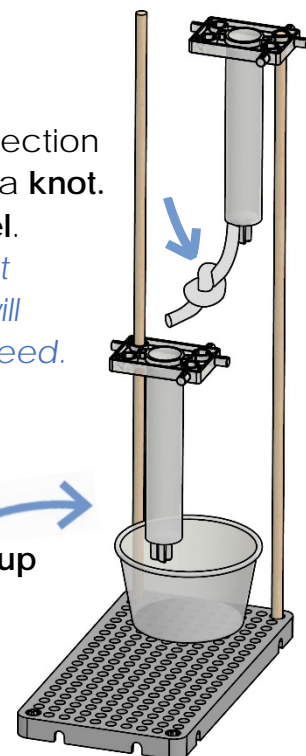
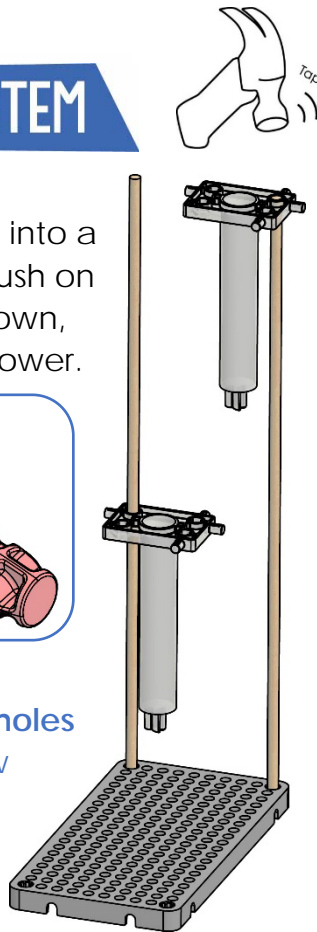
- 1** Insert two **dowels** into a **hole plate** and push on two **barrels** as shown, one higher, one lower.



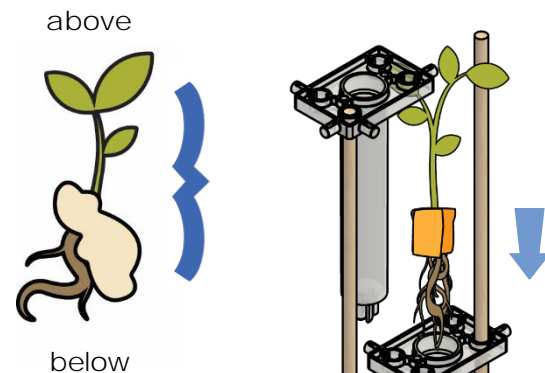
**Ream** the **barrel holes** very well, to allow easy adjustment on the dowels.

- 2** Cut an 8cm (3") section of **tubing** and tie a **knot**. Insert into a **barrel**. *How loose or tight you tie the knot will affect the drip speed.*

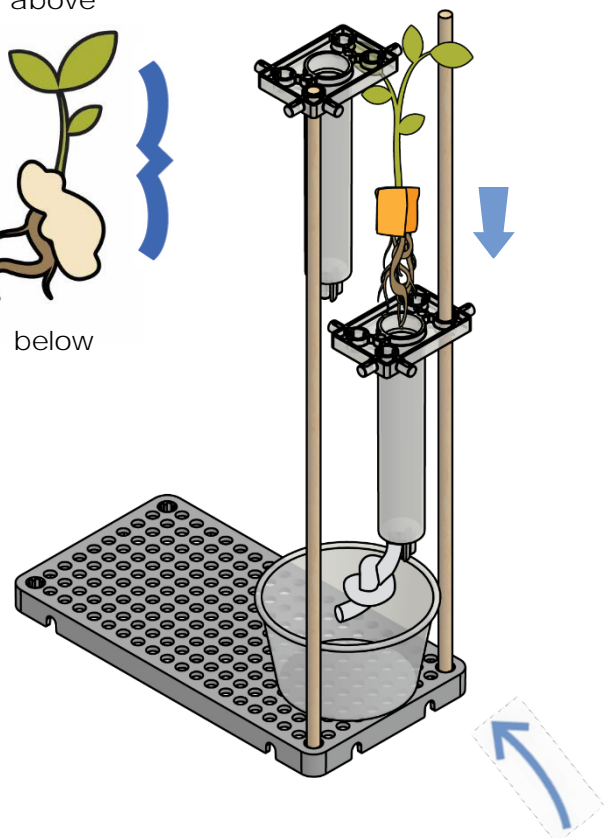
- 3** Place a **portion cup** below to collect water **runoff**.



- 4** Slide your **seedling** into the top of the **lower barrel**. If needed, adjust your **growing media** so the **roots** are exposed below and the **sprout** above.



- 5** Fill your **top barrel** with **water** to give your plant some much needed hydration. You can add **tubing** to your **lower barrel** for a **recovery drip system** into the **cup**.





# BUILD GUIDE FOR MICRO HYDROPONICS



## Drip Options

Congratulations! You've built an example Drip System. It only works ok. You can make it so much better.

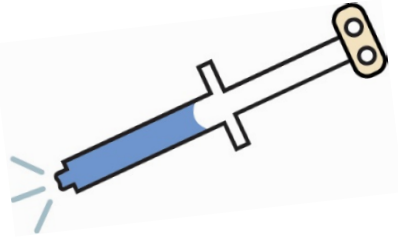
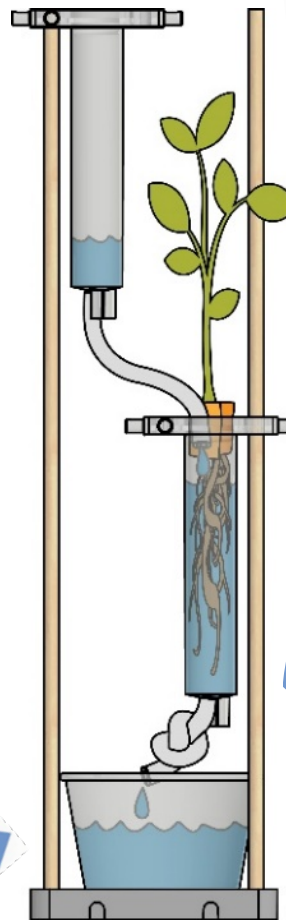
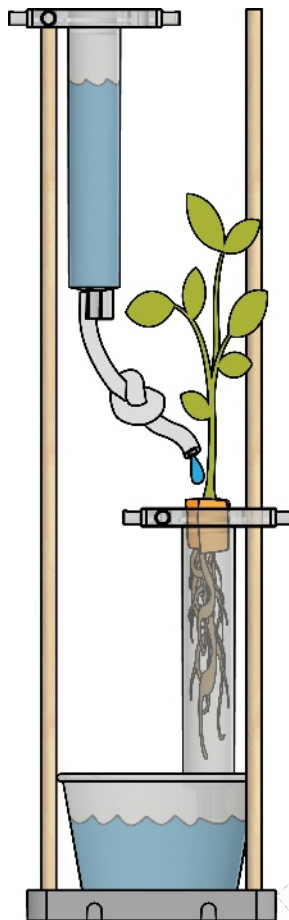
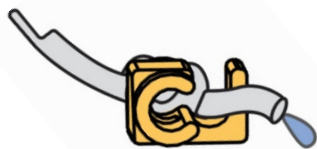
### Top Option

Insert the drip tube above the plant to slowly give water.



### Quick Tip:

Check the **knot** often to assure fluid is flowing through. Try a **clamp** as another method to control the drip.



### Fill

Use a **cylinder** or eye dropper to fill the barrels with fluid.

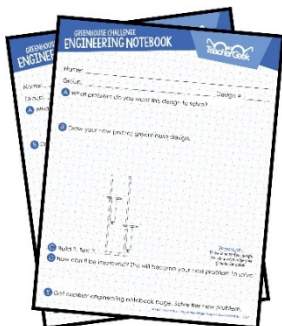
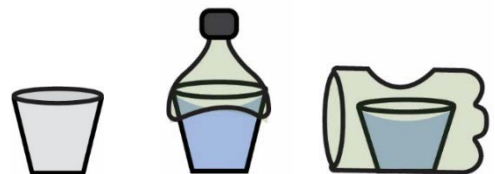
### Bottom Option

Insert the drip tube below the plant to slowly remove water.



### Recovery Drip System:

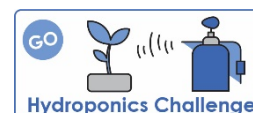
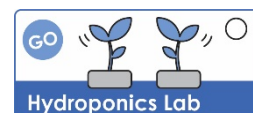
Collect excess water for re-use. What other **water conservation** designs can you create?



### Engineering Notebook:

Use engineering notebook pages to go through the Design Process. Sketch ideas, take notes and use them to compete in challenges!

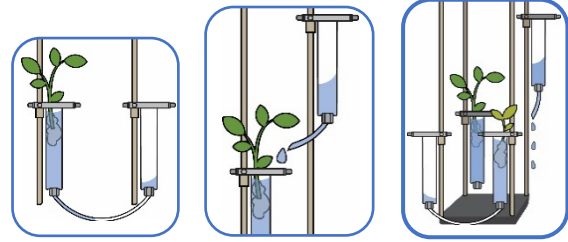
Documents at [teachergeek.com](https://www.teachergeek.com)



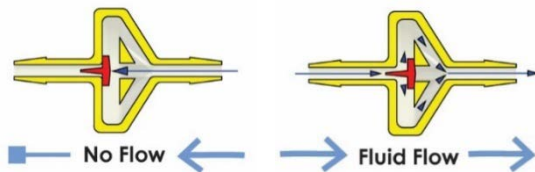
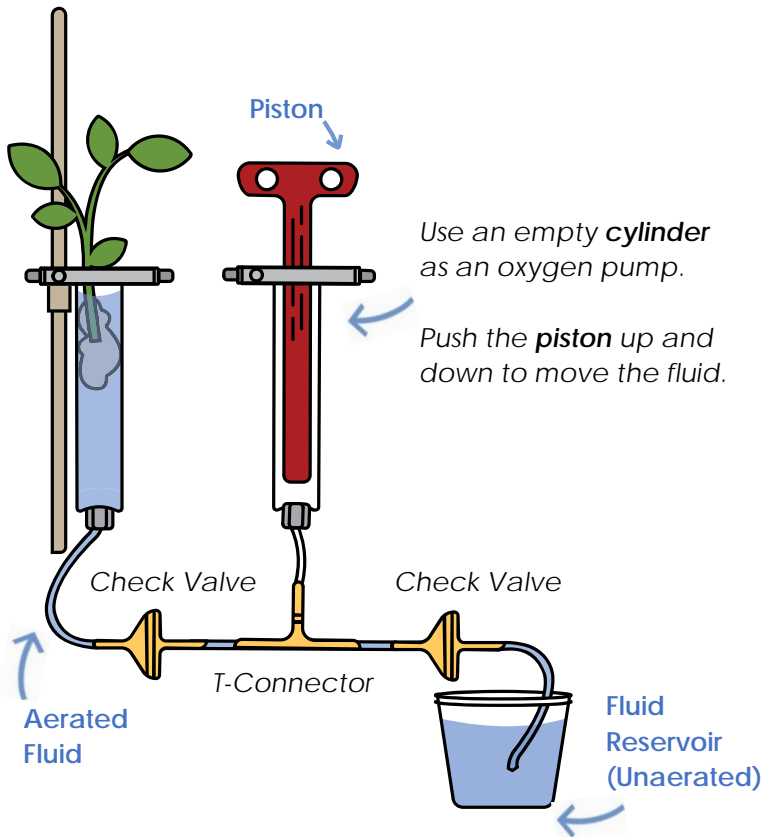
If you are going to do the optional Challenges and Labs, go there now.

Documents at [teachergeek.com/learn](https://www.teachergeek.com/learn)

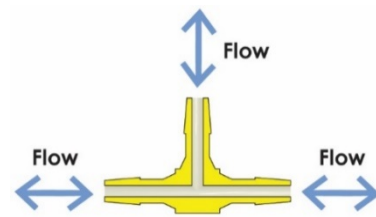
## Compound



## WATER AERATION



**Check Valves:** allow **fluid** flow (liquid or gas) in one direction.

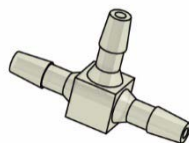


**T-Connectors:** allow fluid to flow between three **ports** (openings).

## Use These TeacherGeek Materials



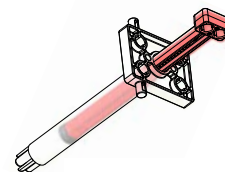
Check Valve



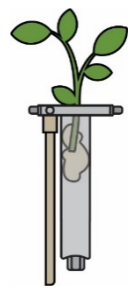
T-Connector



Two 600mm (2 ft) tubing sections



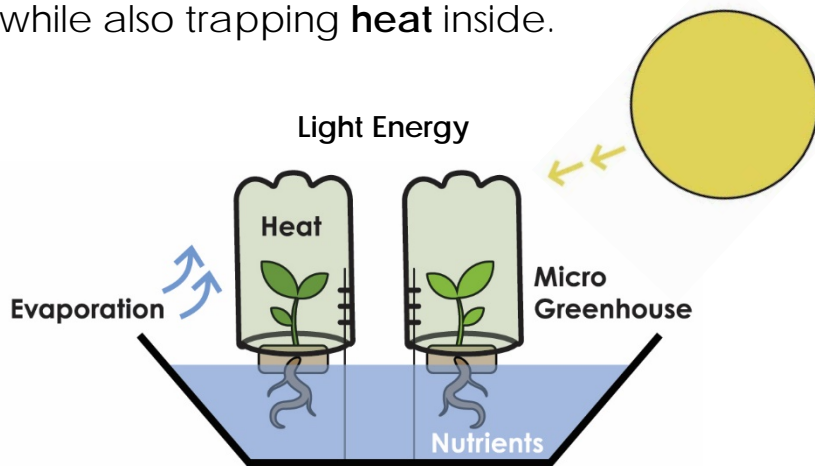
4.5 mL Cylinder



Your Hydroponic System Design

## (MICRO) GREENHOUSES

**Greenhouse:** an enclosed glass or transparent building for gardening, allowing in **sunlight**, while also trapping **heat** inside.



### Recycling With Purpose

Greenhouses are built out of all sorts of things. Plastic soda bottles make great materials to trap heat.

**Greenhouse Effect:** The earth's **atmosphere** acts like a giant greenhouse. **Greenhouse Gases** (water vapor, carbon dioxide, methane, ozone) absorb and trap heat, preventing the planet from freezing.



**Earth needs a careful balance –** too many greenhouse gases could make the climate too hot (due to **pollution**, **deforestation** and the burning of **fossil fuels**).





## DESIGN INSPIRATION



### DIY Greenhouse

**Greenhouses** can be built from more than just glass. Design a (micro)greenhouse. Try all sorts of transparent, recycled materials to trap heat and absorb light.

**Cut and paste** this inspiration, along with sketches and notes, in an *Engineering Notebook* page to improve your design.

