



How to Build a Plant Lighting System¹

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The publication provides detailed, easy-to-follow instructions for building an inexpensive, portable plant lighting system for hobby use, horticulture therapy programs, classrooms, etc.

Table 1 provides a list of supplies and tools required for assembly. The type of light fixture you use with this system depends on which plants you want to grow (Table 2) and the amount of light they need. To determine this, consider where they grow best - outdoors in full sun, part shade, or shade? Table 3 provides information on the various artificial lights used for growing plants and a brief explanation of their benefits and drawbacks.

All PVC pipe should be:

- 1 inch
- 10 foot lengths
- Schedule 40
- Without bell (flared) ends

All PVC fittings should be:

- 1 inch slip (not threaded)

- Schedule 40
- From the same manufacturer.

Casters can be 1 1/4", but select a larger size – such as 2" – if the cart will be frequently moved around. Select a drill bit that corresponds to the size indicated on the package. Casters are not necessary if the lighting system will not be moved.

How to Assemble

Step 1. Measure and mark each of the four, 10-foot lengths of PVC pipe at the following positions: 36", 57", 78", 91", 101", 111", 113", 115", and 117". Cut them with a PVC cutting tool. A hacksaw is not recommended because of inaccuracy, but if you must use one, a miter box will help keep the cuts straight.

Cuts at these positions will produce the following lengths from each pipe (See Figure 1):

- 1 - 36"; 2 - 21"; 1 - 13"; 2 - 10"; 3 - 2"

From the four lengths, this will give a grand total of:

- 4 - 36"; 8 - 21"; 4 - 13"; 8 - 10"; 12 - 2"

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A complete diagram of PVC parts is shown in Figure 2 including pieces cut to size and extra fittings, i.e., Ts (tees), Ls (ells), Xs (crosses) and caps.

Extra accessories, including casters, shelving strips, plastic ties, silicone caulk, PVC cement and timer, as well as a drill and a PVC cutter, are pictured in Figure 3.

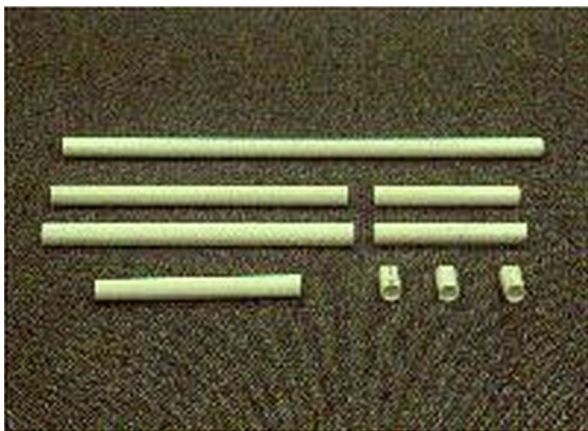


Figure 1.



Figure 2.



Figure 3.

Assemble the Top Frame

Step 2. Assemble four combinations of the PVC pipe and fittings in this order: an "L," a 2" piece of pipe, a "T," a 10" piece of pipe, and a second "T," as shown in Figure 4.

Notice that two of the assemblies are mirror-images of the other two. When joining the pieces, it is essential that the upright parts (Ts) are at a perfect 90 degree angle from the other Ts and Ls so the structure will be square and true. If necessary, line up the parts against a floor and wall known to be square (use a T-square if you have one) when gluing. If using PVC primer prior to gluing, read label instructions on primer first.

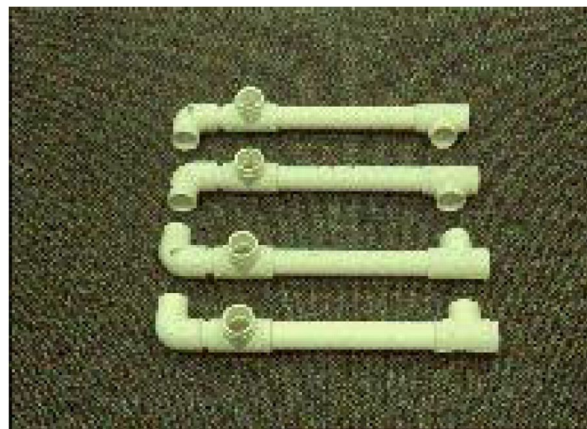


Figure 4.

Caution. PVC cement is extremely quick setting; once joined, parts cannot be separated. Make sure the PVC is aligned correctly before you glue: you won't get a second chance! Practice putting components together before you begin gluing.

Use just enough cement to hold components together. However, be sure to glue both the inside and outside portions of the components to be secured. Conspicuous color differences will result at joints where excessive amounts of PVC cement are used.

Step 3. Join the mirror image assemblies together using two of the 13" pipe lengths, as shown in Figure 5. If done correctly, the Ls on the ends of each assembly will face in the same direction.

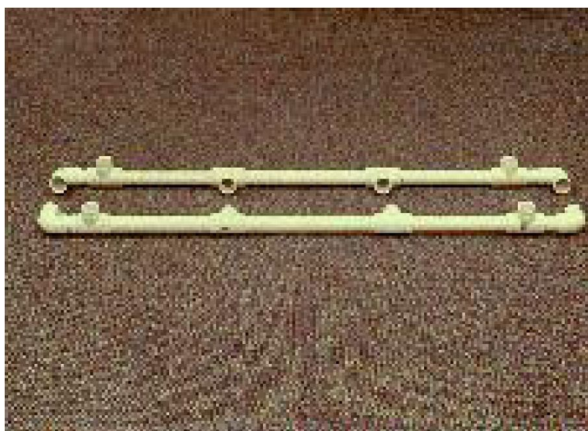


Figure 5.

Step 4. Join the two assemblies made in Step 3 together with four 21" pipe lengths, as shown in Figure 6. This completes the top frame of the lighting system.

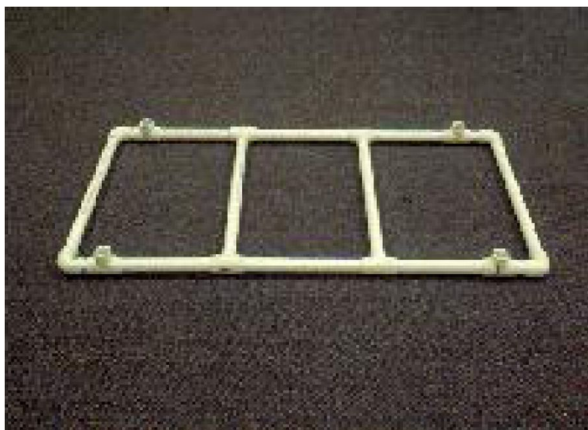


Figure 6.

Assemble the Bottom Frame

Step 5. To put together the bottom frame of the lighting system, assemble four sets of pvc pipe and fittings as follows: an "L," a 2" pipe length, an "X," a 10" pipe length and a "T" as shown in Figure 7. The four sets will be identical. **Caution:** It will be tricky, but it is important to make these parts join at perfect 90 degree angles.

Step 6. Similar to the procedure used for the top frame, join two of the assemblies from Step 5 together, each with a 13" pipe length. The Ls at the ends of each assembly should face in the same direction, as pictured in Figure 8 .

Step 7. Connect the two units from Step 6 together with four 21" pipe lengths. This completes the



Figure 7.

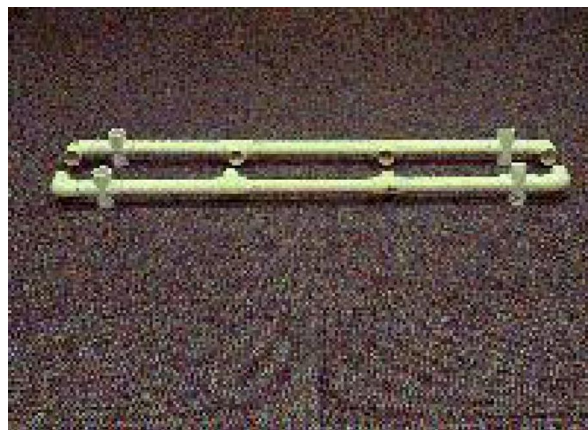


Figure 8.

bottom frame of the lighting system (Figure 9).

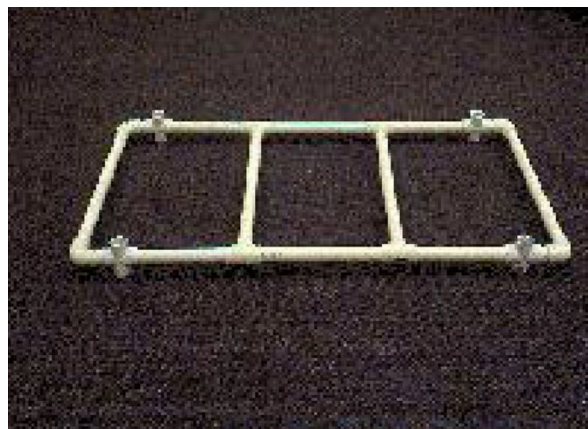


Figure 9.

Step 8. Join the bottom frame to the top frame with the four 36" pipe lengths (Figure 10). If you plan to transport the system from one location to another, the assemblies can simply be joined without cement so they can be taken apart, moved, and later reassembled.



Figure 10.

Step 9. If casters are not desired, add the 2" pipe lengths with caps attached unto the bottom frame. If casters are to be used, first drill the appropriate hole size in the four caps for the caster stem. Attach each cap to a 2" pipe length and insert the caster into the drilled hole. Insert each caster assembly into the bottom frame.

Complete the Lighting System

Step 10. Attach the lights you have chosen (see Table 3) to the frame according to manufacturer instructions (Figure 11). Bulbs should be installed after light fixtures are in position.



Figure 11.

Step 11. Connect the shelf strips to the bottom platform with plastic cable ties. Use silicone caulking generously at the ends of the shelving strips (Figure 12) because these may be sharp and could cause injury to young children. An alternative to caulking is to bevel the sharp corners and edges with a file. The completed lighting system is shown in Figure 13 .



Figure 12.



Figure 13.

Step 12. Connect your completed lighting system to a nearby wall outlet by means of an extension cord connected through a timer. Place plastic flats across the across the shelf strips. Small potted plants and/or cell packs of flowering annuals can then be placed inside the flats. Happily growing plants (such as the African Violet in (Figure 14), will be the end result of a well-constructed lighting system.



Figure 14.

References

Growing plants under fluorescent light. Union Electric Company: St. Louis, Missouri.

Pranis, E. and J. Hale. 1988, revised 2006. *GrowLab: A complete guide to gardening in the classroom.* National Gardening Association: Burlington, Vermont.

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[http://www.homeharvest.com/
whichgrowlightisrightforme.htm](http://www.homeharvest.com/whichgrowlightisrightforme.htm)

Table 1. Supplies and Tools Required

Supplies Required	
4	10' length, schedule 40, 1" PVC pipe (without "bell end" i.e., un-flared)
12	1" "T" (tee) fittings
8	1" 90 "L" (ell) fittings
4	1" "X" (cross) fittings
4	1" cap
1	9' heavy duty (grounded, 3-prong) extension cord with enough outlets to accommodate the light fixtures and the timer
1	small can PVC cement
1	small can of PVC primer (optional)
4	1 1/4" or 2" casters (optional)
1	small tube silicone caulking
2	48" shelf bracket strips (pilasters)
1	24 hour timer with grounded 3-prong outlet
1 pkg	8" cable ties
	Plastic flats or trays without drainage holes
Tools Required:	
PVC cutter, drill (if using casters - see caster package for size of drill bit required), slotted screwdriver, pliers, measuring tape, pencil.	

Table 2. Some suggested plants for growing indoors under artificial light; many other plants are also suitable. (Note: Some of these plants should not be planted outdoors due to their invasive growth habit.)

<i>Scientific Name</i>	Common Name	<i>Scientific Name</i>	Common Name
<i>Aglaonema</i> species	Chinese Evergreen	<i>Hoya carnosa</i>	Wax Plant
<i>Anthurium</i> species	Anthurium	<i>Impatiens</i> species	Impatiens
<i>Begonia</i> species	Begonia	<i>Peperomia</i> species	Pepper Face
<i>Chlorophytum elatum</i>	Spider Plant	<i>Philodendron</i> species	Philodendron
<i>Cissus rhombifolia</i>	Grape Ivy	<i>Platycerium</i> species	Staghorn Fern
<i>Crossandra</i> species	Crossandra	<i>Polyscias</i> species	Ming Aralias
<i>Dracaena</i> species .	Dracaena	<i>Rhoeo spathacea</i>	Moses-in-the-Cradle
<i>Dieffenbachia</i> species	Dumb Cane	<i>Saintpaulia ionantha</i>	African Violet
<i>Dizygotheca elegantissima</i>	False Aralia	<i>Sansevieria</i> species	Mother-in-law
<i>Epipremnum aureum</i>	Pothos	<i>Sinningia speciosa</i>	Gloxinia
<i>Exacum affine</i>	Persian Violet	<i>Spathiphyllum</i> species	Peace Lily
<i>Ficus</i> species	Figs	<i>Syngonium</i> species .	Nephthytis
<i>Fittonia verschaffeltii</i>	Polka Dot Plant	<i>Tradescantia</i> species	Wandering Jew
<i>Gynura sarmentosa</i>	Velvet Plant	<i>Zebrina pendula</i>	Wandering Jew
<i>Hedera helix</i>	English Ivy	Many other plants	

Table 3. Various artificial lights used for growing plants and a brief explanation of their benefits and drawbacks.

Type	Comments	Life of Bulb
Incandescent Bulb	Not a true "grow" light; generates heat which can damage plants	750 hours
Standard Fluorescent	Cool, efficient light; must be no farther than 4 inches from plants	20,000 hours
High Output Fluorescent (HOF)	Produces twice the light of standard fluorescent; cool	10,000 hours
Compact Fluorescent	Bulbs, not tubes; mounted in special reflectors; cool	10,000 hours
Fluorescent/HID Hybrid	Combines bright, cool light of (HOF) with broad, even coverage of high intensity discharge (HID)	10,000 hours
Metal Hylide (MH) HID	Output resembles sunlight in color; induces compact plant growth, flowering and fruiting	10,000 – 20,000 hours
High Pressure Sodium (HPS) HID	Enhances flowering and fruiting; plants will "stretch" and appear off-color due to yellow light of HPS	2 years
HPS/MH Combination	Two types of bulbs create an ideal growing light with high output; some fixtures allow switching from one type of light to the other	See above