

## DIY ASET & Ideal Scope Template



Even though I'm sharing this freely on the internet, please don't repost this on other websites or forums without [my permission](#). This is a free guide, so I hope you didn't pay for these instructions.

### Motivation

If you're reading this, you are probably interested in cut quality and light performance. When I was shopping for an engagement ring, I was looking at diamond options at local stores. Many of these local stores did not have ASET or Ideal Scopes, so I made my own. The reflector premise behind them is very simple but provides a lot of insight into how well a gemstone performs. Needless to say, I got some funny looks from sales staff when I pulled it out, but I don't mind looking foolish if it saves me a few thousand dollars.

Hopefully this will help you too.

### Disclaimer

This project is meant to be used as a way to mimic popular reflectors used to assess gemstone light performance. Although it provides similar functionality to ASET and Ideal Scopes, there is no substitute for the real thing. I highly respect Garry Holloway and AGS for inventing this technology, so I encourage you to purchase the official scopes at <http://ideal-scope.com/> if you are serious about purchasing multiple gemstones.

### Assumptions

I assume you already know what ASET and Ideal Scopes are and how to interpret them. If not, there are plenty of resources online.

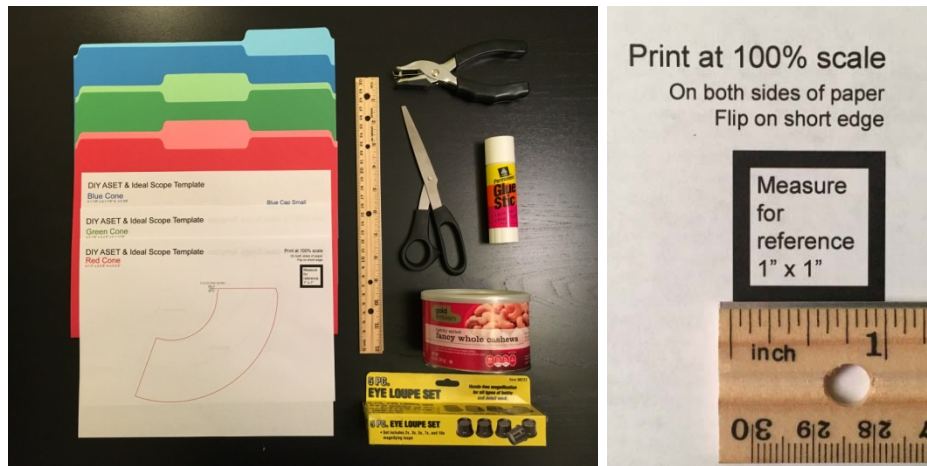
## Materials and Tools

Item	Source	Cost
10x Loupe	<a href="#">Harbor Freight</a>	\$4
Translucent White Lid (from a <a href="#">can of nuts</a> )	Anywhere, but I got mine from <a href="#">CVS</a>	\$0 - \$5
Colored folders or heavy paper (Red, Green, and Blue)	Office Supply Closet	Free
Small Paperclip	Office Supply Closet	Free
Ruler	Office Supply Closet	Free
Scissors	Office Supply Closet	Free
Glue Stick	Office Supply Closet	Free
Hole Punch (1/4") is standard	Office Supply Closet	Free
Access to a Printer	Office Printer	Free
Smartphone	Already Owned	Free
<b>TOTAL</b>		<b>\$4 / \$9</b>

# Instructions

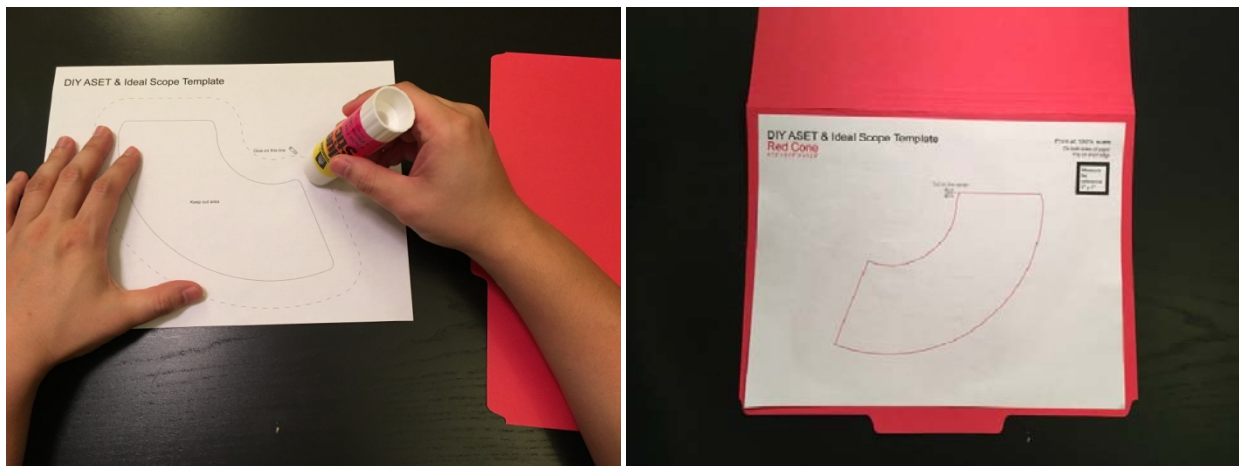
## Step 1 – Print the templates.

[Download and print the template.](#) Make sure the printer settings are set to print double-sided, flipped on short end, and scaled to 100%. This is important so that everything lines up and is correctly proportioned. After printing, verify the scale by measuring the 1" x 1" square on the page.



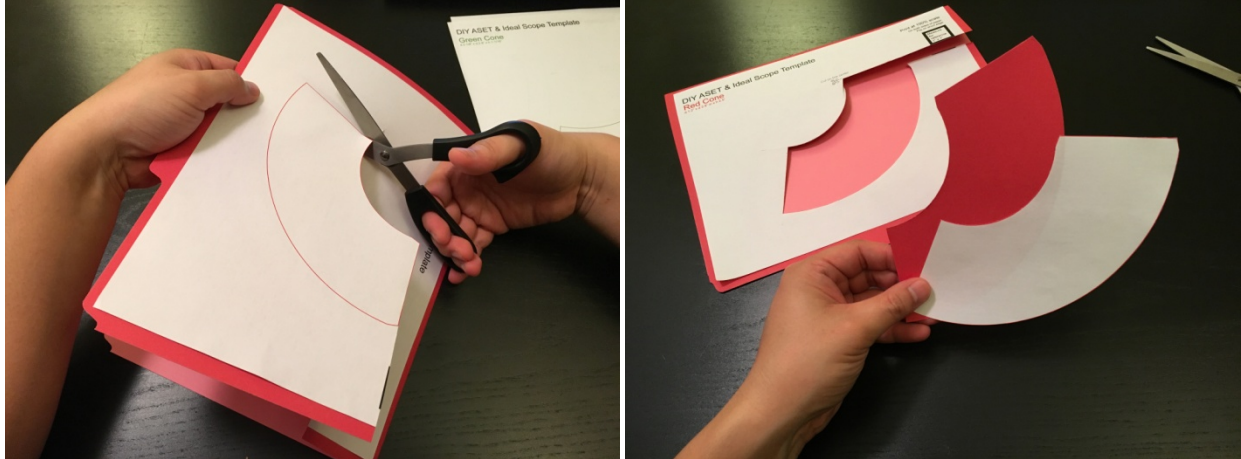
## Step 2 – Glue the red cone template to the red folder.

This step will transfer the printed templates to the colored folders. Glue along the dotted line of the back (gray) side and stick it to the red folder. Make sure to avoid gluing in the "keep out area," which should be big enough to account for any offsets from printing. The folder I'm using has a red and pink side, so press the template to the red side. This should keep the printed paper from slipping with the folder while cutting with scissors. You can skip this step if you are careful but it helped me.



### Step 3 – Cut out the red cone template.

Try to be as precise as possible when cutting along the line. Depending on your printer, the shapes on both sides of the page should line up with enough buffer to clear of any glue and separate cleanly. You won't need the transfer template and remaining folder pieces after this step.



### Step 4 – Form the red cone.

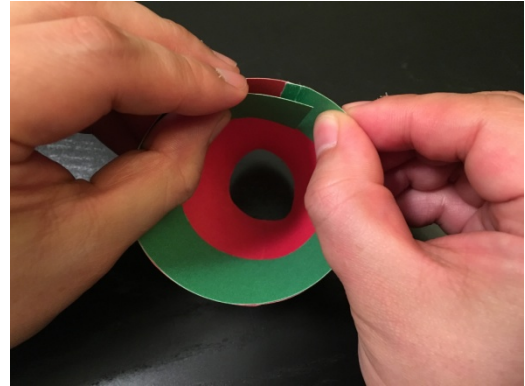
Form the cone so that the pink side of the cone is facing outward and the red side is facing inwards. Try to form the cone as precisely as possible, since it will also affect the shape of the green cone. It may help to use a pencil to lightly draw a line along the tab seam on the red side. Apply glue to the tab on the same side to avoid any residue from showing if the cone needs to be reshaped before it sets. This also ensures there is one straight seam on the inner (red) surface so it looks more "clean." You may need to hold the shape for a minute or two until the glue sets. Measure the height and two diameters with the ruler to ensure they match the dimensions on the template.



**Step 5 – Cut and form the green cone using the red cone as a guide.**

Use the green cone template to cut the shape out of the green folder in the same way you cut the red cone. Apply glue to the tab on the darker green side, as with the red cone, so the darker side is facing inwards.

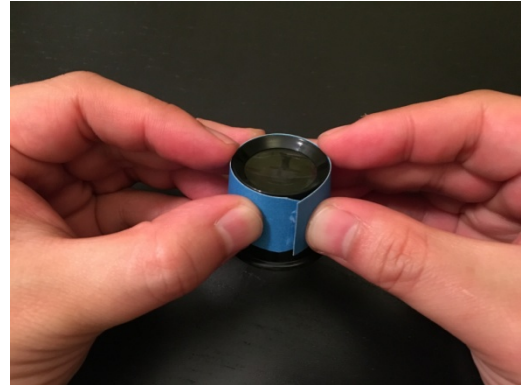
Since the green cone is meant to fit inside the red cone, it helps to use the red cone as a guide so it fits perfectly inside. Shaping it separately may cause them to be misaligned due to the thickness of the paper and any cutting imperfections.



**Step 6 – Cut and form the blue cone using the loupe as a guide.**

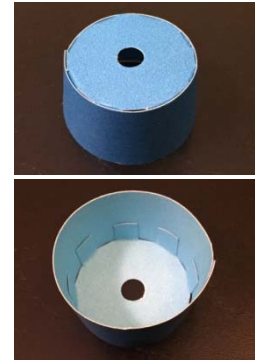
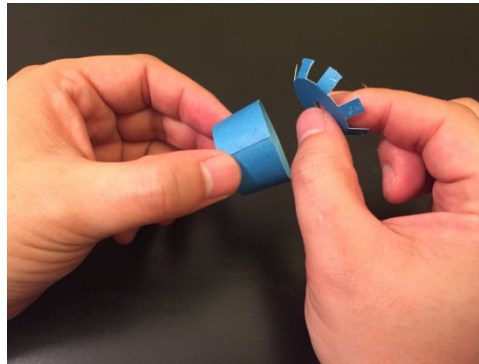
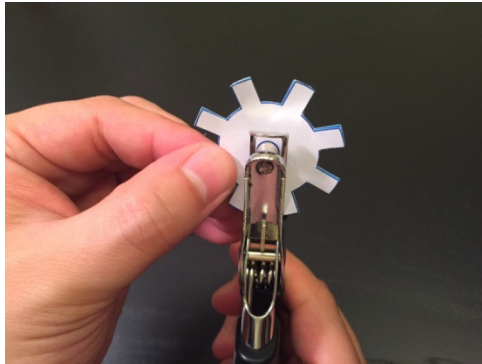
Use the blue cone template to cut the shape out of the blue folder in the same way you cut the other cones. Glue on the gray dotted lines for both the cone shape and the caps. When cutting, be careful to avoid the blue cap section, which will be used in Step 7.

Unlike the red and green cones, the darker blue side will face outwards instead of inwards. Since the blue cone is meant to fit around the loupe, it helps to use the loupe as a guide to ensure a good fit.



### Step 7 – Cut and form the blue cap using the blue cone as a guide.

Three cap templates are provided because the loupe may vary slightly in size, but most will use the Medium Cap. To determine which one to use, match the smaller side of the blue cone to the body circle of each star shape. The shape should be slightly smaller than the cone so it fits inside once the ends are folded up. Once cut out, use the 1/4" hole-punch for the center hole. Fold up the eight tabs and apply glue to the dark side of each. Glue into place so that it lines up with the bottom of the smaller circle in the blue cone.



### Step 8 – Put all the cones together.

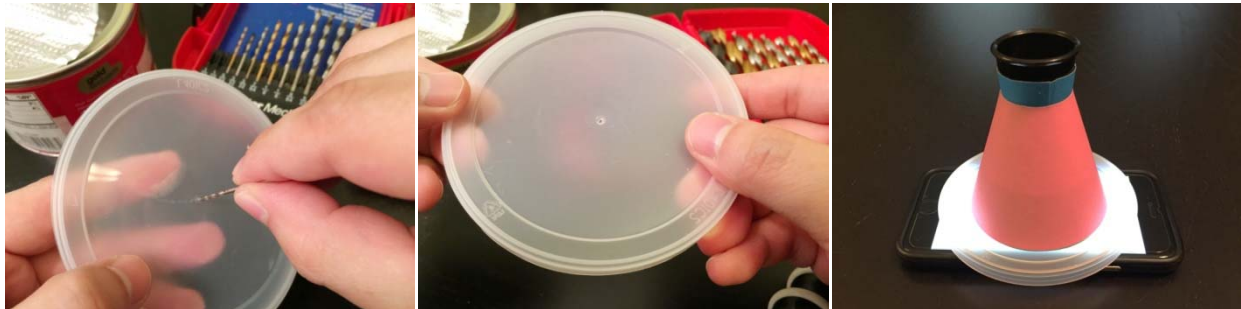
Once the glue is set on all the cones, put the loupe into the blue cone. Then put the blue cone assembly and the green cone into the red cone. Use the small paperclip to hold the green cone in place. Alternatively, the green cone can be glued directly to the red cone, but I like to keep it removable so I have the option to use it as an Ideal Scope instead. Alternatively, you can just make a second red cone to be used for the same purpose.



### Step 9 – Make a DIY Ideal Light.

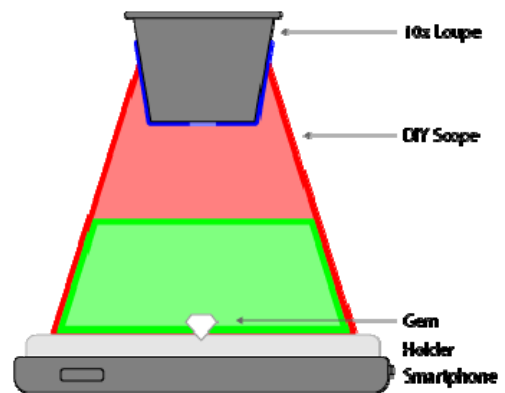
Now that the DIY ASET & Ideal Scopes are made, a light source is needed. The official "Ideal Light" is used as a way to get light the gemstone from the bottom up. Rather than holding the gemstone up to a window or lamp with tweezers, which can vary in light intensity, this provides a consistent way to light the gemstone in different locations and conditions. Luckily many of us carry a light source in our pockets every day – a smartphone. Pull up a [white background](#) and turn the screen to full brightness ([ios](#), [android](#)), which provides the consistent light source needed.

The gem needs to be held upright, which can be done using a translucent white lid. Since it is translucent, it also diffuses the light evenly. Simply poke a hole in the center with something sharp. I used a 1/16" drill bit. There should already be a notch where the piece was injection molded, so centering it should be easy. The size of the hole will depend on the size of the gem you're viewing. If your gemstone is already mounted on a ring, you will need to come up with a different holder.



### Step 10 – Test it out.

- Use the smartphone with a [white background](#) at full brightness ([ios](#), [android](#)).
- Center the holder on top of the smartphone.
- To avoid fingerprints, use tweezers to place the gem in the hole. Make sure the gem is straight up to get the correct "face up" view.
- Center the DIY Scope on the gemstone and look into the loupe.
- A camera or second smartphone can be used to take the ASET or Ideal Scope images.
- Look at some gems!

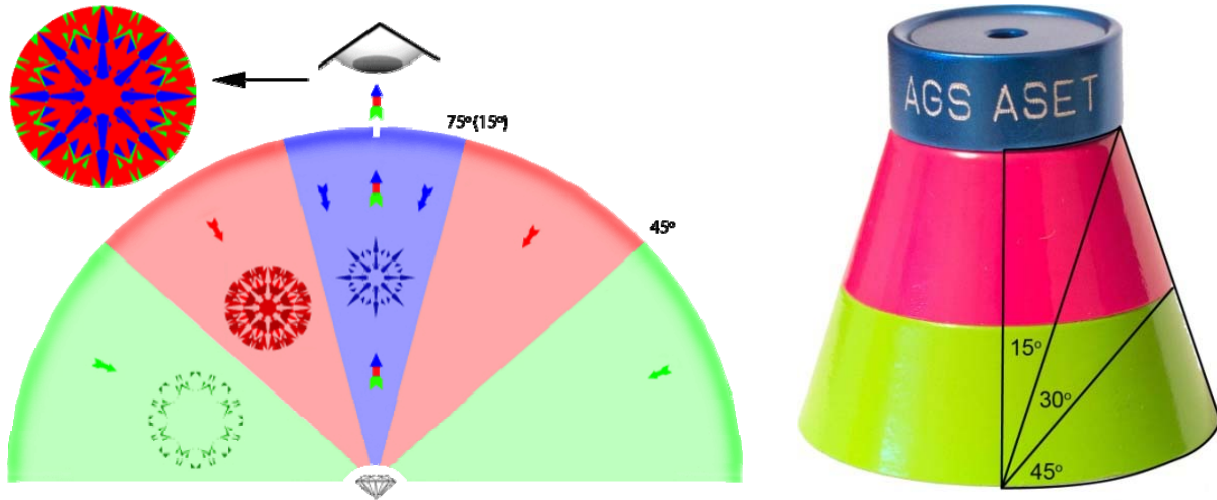


## FAQs

### 1. What is the accuracy compared to the official scopes?

The DIY Scope was designed to mimic the commercial ASET and Ideal Scopes as much as possible. The actual angles for each colored section of the DIY Scope are shown below.

#### COMMERCIAL ASET



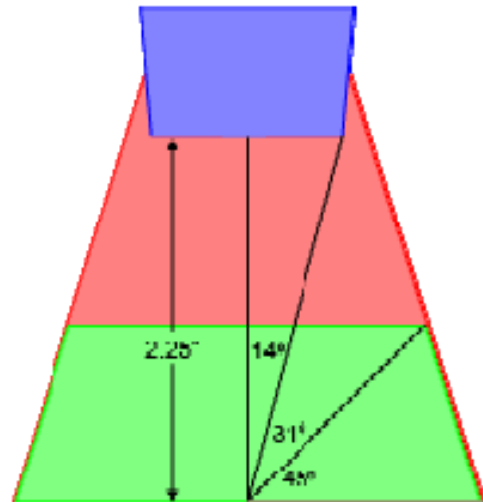
#### DIY SCOPE

Focus distance of Harbor Frieght 10x Loupe = 2¼"

$$\tan(\text{green}) = \frac{1''}{\frac{2''}{2}} \rightarrow \text{green} = 45^\circ$$

$$\tan(\text{blue}) = \frac{1\frac{1}{8}''}{2\frac{1}{4}''} \rightarrow \text{blue} = 14^\circ$$

$$\text{red} = 90^\circ - \text{green} - \text{blue} \rightarrow \text{red} = 31^\circ$$



So the DIY Scope is **1° off in the red and blue angles\***.  
Not bad if you ask me!

\* The deviation of the blue angle is driven by the loupe's focus distance. In order for the DIY Scope to exactly match the 45°, 30° and 15° angles of the commercial ASET scope, the loupe's focus distance would need to be 2.1". However, given the nature of hand cut shapes, tolerances are inherently loose and cone measurements may vary slightly, so getting exact angles would be difficult regardless. To make dimensions easier to verify, cones dimensions were designed using 1/8" increments so they can be checked with a common ruler.



## 2. Can I use different materials than the ones you listed?

The materials used for this design were selected because they were easily accessible to me. If you have other materials, feel free to use what you have available. This is just my humble design, so feel free to improve on it. If you have any suggestions for improvements, please send them to me. I'd love to get your feedback.

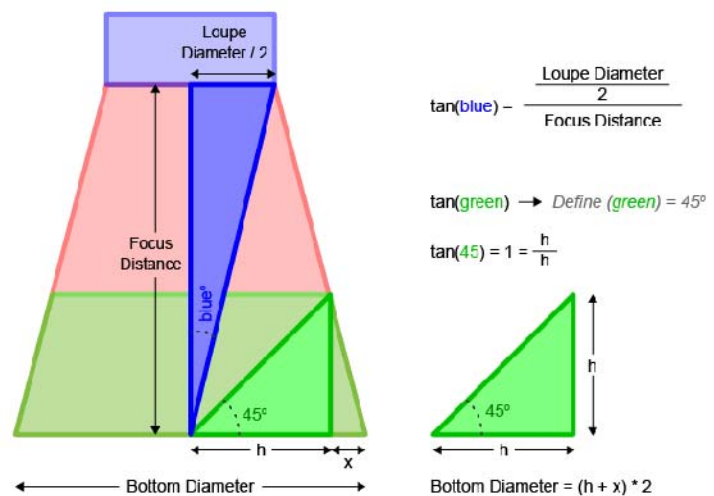
- **Loupe** – These measurements were designed specifically for the [Harbor Freight 10x loupe](#) because it was locally available and very affordable. Also since it comes in a 5 pack, the loupes can be stacked for additional magnification when inspecting inclusions. If you don't have access to a Harbor Freight, the lens from a traditional jeweler's loupe or Google Cardboard (or equivalent viewer) may also work for this project, although I haven't tried them myself.
- **Folders** – I used colored folders because they are stiffer and are able to hold their shape well after being glued. They were also free for me. You can substitute folders for heavier stock paper (card stock) if that is more accessible. Construction paper might work too, but may not hold its shape as well. Although red, green, and blue are standard, the actual colors don't really matter as long as all three are distinct and have high color contrast with each other. Shades of the same color would not work.
- **Ideal Light**– If you have a different type of plastic that will diffuse light evenly and can hold the gem upright, it should work just as well. I used the lid from a can of nuts because it was something I already had. Just make sure whatever you use lets light through and is has enough height/thickness to allow the gem to stand up straight.

## 3. Why is the DIY Scope bigger than the official ASET and Ideal Scope?

The size of the scope is driven by the focus distance of the loupe lens. The lens on the [Harbor Freight 10x loupe](#) has a roughly 2¼ " focus distance. The commercial scopes use different lenses, and therefore have different focus distances. As the focus distance increases, the rest of the dimensions scale up proportionally.

## 4. How can I design a scope with my own loupe?

If you use a different lens than the loupe I am using, the templates these measurements will not work for you. However, all you need to do is figure out the focus distance of your specific loupe and use some simple trigonometry to calculate the correct measurements for yourself. This image should help you get started. Once you've figured out the dimensions you need, simply [generate the shape templates](#) for each cone.



## 5. How can I store the DIY Scope?

If you've used the lid from the nut can, the can itself may be used to store the DIY Scope (after being cleaned). The lid-turned-holder may serve its original purpose as the can lid. When disassembled, all 5 loupes and 3 cones fit nicely inside. Store the can somewhere safe so it won't be accidentally thrown out as trash or opened by someone expecting nuts.

Alternatively, the DIY scope and holder can be stored in a small round take-out container, which is clear so the contents can be seen without opening it. The holder should also fit without a problem. Other storage options can be found in the snack aisle, as long as they have translucent or clear with white lids. From a quick trip to my local drug store, I found three other options that may work, each for \$1.00.

