Screws
1) Use the right screw length. The screw should be the shortest to get the job done (only 3-4 threads are connected).

2) Always tighten screws in a cross-tightening pattern - this means tightening every screw a bit at a time rather than tightening one fully then another one fully, etc. You also don't tighten a screw that is next to the one you just tightened, instead you tighten the screw that is across from the screw you just tightened.

3) Always use washers with screws so you don't gouge a hole into your part with the screw head. Parts with recessed holes for the screws don't need washers.

4) Screws should have flat heads that fit flush to the washer and part. Screws with cone-shaped heads should only be used with parts that have cone-shaped recessed holes.

5) Use allen key (L-shaped allen wrench also called a hex key) to make sure screw is fully tightened - first with short lever, then with long lever so you can apply more torque. You want to guard against any movement of the optical component, which will lead to additional noise. Also, if you bump the optic by accident, it hopefully won't go anywhere if the screw is tight enough.

6) Be careful to make sure that your optical alignment is still good after you tighten a screw. It is easy to move the optical component out of alignment when you begin tightening.

7) A good alignment strategy is to leave a screw just tight enough so that it keeps the optic in place when aligning that optic. That way you can easily tighten and loosen it as you fix the alignment of the optical component. Then when you have the component in a good position you can tighten it all the way.

Optomechanical parts - Bases, post holders, posts
1) Align the set screw of the post holder so that when you tighten the set screw you don't shift the optical component out of alignment. Typically, this means that the set screw of the post holder is along the beam path, i.e., along z.

2) When screwing the base into the post holder make sure that the post holder is centered on the base. The hole in the base will be larger than the screw, creating some "slop" or "play" in the position of the base. So you have to center the base around the screw so that the component in the post holder will be aligned properly.

3) Pick a slop direction... Specifically, when you tighten the bases onto the optical breadboard there will be some slop because the slot in the base is bigger than the screw. So you are going to pick a direction and push the base toward that direction as you tighten the screws, removing the slop. All parts on the breadboard should be moved in this direction before tightening if there is slop. Note slop direction explicitly on breadboard (e.g. up and left). Make sure to use all of the same bases so that the slop will be the same.
**Irises/Apertures**

1) Set the height of all irises to be exactly the same. Specifically, use a digital caliper to set the height of a single iris. Then, to set the height of other irises to this exact height, center a laser beam on the iris that was set with a digital caliper. Next, take out the iris and add other irises, positioning them to the right height using the laser beam.

2) Once the height an iris is set, put tape over the set screw to remind yourself not to change the height of the iris. Or, an even better idea is to use a post collar to set the height of the iris.

3) Make sure to set the height of every iris using the same side of the iris. Some irises will close such that the position of the hole on one side is not the same as the position of the hole on the other side.

**Mirrors**

1) If the mirror is placed in a tip/tilt mount, then make sure the screws are in a neutral position such that the mirror is not tipped or tilted to start out.

2) When placing a mirror on an optical breadboard get a course alignment by moving the mirror back and forth in z and rotating the post attached to the mirror holder. The movement of the mirror mount back and forth in z will set the position of the beam, and rotating the post will set the angle. Fine alignment can be done with the tip/tilt knobs on the mirror mount.

3) Make sure the laser is not being clipped by the mirror. A good rule of thumb is that optics should have a diameter that is 3X the beam diameter (1/e^2 diameter).

4) Make sure the size of the post and post holder is appropriate. That is, that you have sufficient range of motion up and down (in y) and that at least half of the post is in the post holder at the height you want. A post collar can be used to fix the y position of the mount.

5) To align a beam so that it is incident on two irises, you need two mirrors that will allow you to "walk" the beam. The first mirror will be used to set the overall position of the beam and is therefore used to translate the beam to the position of the first iris. The second mirror controls the angle of the beam and is used to tilt the beam so that it hits the second iris. Repeating this process over and over again "walks" the beam into alignment. So remember that the first mirror aligns the beam to the first iris, and the second mirror aligns the beam to the second iris.

Checklist for mirror alignment:

- Beam is centered on mirror in y
- Beam is centered on mirror in x
- Beam is roughly centered on Iris 1 (by moving mirror back and forth along beam path)
- Beam is roughly centered on Iris 2 (by rotating the post that holds the mirror)
- Beam is well centered on the two irises using the knobs on the mirror mount to "walk" the beam to the right location

Remember to check the previous conditions again every time you do the next one (i.e. when you get beam roughly centered on iris, check that the beam is still well centered on mirror, etc.)
Lenses
1) Make sure the forward and back reflections of the lens are aligned to the beam path. The lens will need to be centered in 5 degrees of freedom ($x$, $y$, $z$, tip, tilt). The lens mount will make sure there is no tip. Translating stages can make lens alignment easier.

2) Aim for perfection in alignment and stability of each optic, but especially with lenses since misalignment even by a little bit can create a large shift of the beam.

3) For plano-convex (or plano-concave) lenses you will want to make sure each surface is refracting the light. So do not place the plano side of the plano-convex lens toward a collimated beam since no refraction will occur. Instead, place the convex side toward the collimated beam. A good rule of thumb is place the "curved" side toward the "flat" beam and the "flat" side toward the "curved" (converging or diverging) beam.

4) To collimate the beam, pick a spot on the wall >2 meter or so from your lens and try to focus the beam to that spot. This works because a collimated beam is a beam with a focus that is at infinity (very far away).

General Rules
1) Align at low power, not at high power!

2) Aim for perfection in alignment of each component before moving on to the next component.