

Course Overview: In this course you will be introduced to the techniques of scientific glassblowing useful for repairing and modifying laboratory glassware. After taking this course you will not be a skilled glassblower. However, you should be capable of replacing broken parts and fixing cracks in existing glassware. Think of this course as a survival guide for the glassware using laboratory scientist. The skills you will learn in this course are also a good place to start if you are interested in artistic glasswork. Most classes will consist of some technique demonstrations and time for you to practice the techniques. Your grade will be determined by the skills you become proficient at and the quality of the final glass project you produce.

Important Course Rules:

- No student may be in the glass shop unless the instructor (Dr. Gutow) is present.
- You must follow safe procedures at all times. Failure to do so will result in your removal from the course.
- Production of any objects that could be interpreted as drug paraphernalia is prohibited.
- At the end of the class you may take your artistic glass objects with you. However, any scientific glass products must stay in the glass shop. If you produce something for a research project, your advisor must make arrangements with the instructor for transfer of the glassware to their laboratory.

Instructor: Dr. Gutow Office: HS-412 Phone: 424 – 1324

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Office Hours: Open shop (HS 001) M & Th 1:50 – 3:10; Regular (HS 412) T 10:20 – 11:20, WF 12 – 1 or by appointment.

Textbook: the website <http://www.ilpi.com/glassblowing/index.html>

Optional printed texts for long term reference:

- [*Scientific Glass Blowing: An Introduction by Clair Ivan Colvin*](#) (inexpensive, ~\$13).
- [*Glassblowing: An Introduction to Artistic and Scientific Flameworking by Edward Carberry \(3rd Ed\)*](#) (expensive, > \$50, and very extensive).

Prerequisites: Two years (4 semesters) of chemistry and consent of instructor.

Class Times: W 1:50 – 5:10 (HS 001)

Homework: Limited reading assignments primarily as listed in the tentative schedule later in this syllabus. Optional glassblowing practice during specified office hours (open shop times).

Tentative Schedule:

Typical class day: 2 – 3 technique demonstrations each followed by about 15 minutes of practice, remainder of class time for practice of techniques of your choice and general glass play. You must be actively working with glass for the whole period.

The best way to become proficient is to spend time handling the glass to learn how it behaves. Try making little (1 – 2 cm across) do-dads. Things that look like pictures in coloring books for young children are good targets.

Week: Class Day	Topics	Reading at http://www.ilpi.com/glassblowing/index.html
1: 2/3	Cutting glass, torch safety, torch safety certification , fire polishing, rod play, stress and annealing	From <i>General Information</i> : About this site; What is scientific glassblowing?; Stress and Strain. From the <i>Basic Tutorials</i> : 1 – 6, 8 – 9
2: 2/10	Crack repair, hole repair	
3: 2/17	test tube ends, tube bending, rod re-enforcing, baubles	<i>Basic Tutorials</i> : 10 and 13.
4: 2/24	Butt seals, T-seal, lathe demo, lathe rotation	<i>Basic Tutorials</i> : 11 – 12
5: 3/2	Tapered butt seals, lathe rotation continued	<i>Basic Tutorials</i> : 11
6: 3/9	Seal-offs (ambient and evacuated), Glass saw, lapping, lathe rotation continued	<i>Basic Tutorials</i> : 15
7: 3/16	Ring seals, lathe rotation, practice	<i>Basic Tutorials</i> : 16
	Spring Break	
8: 3/30	Practice, skills certification	
9: 4/6	Practice, skills certification, begin projects if certified in all skills.	
10: 4/13	Practice, skills certification, projects	
11: 4/20	Practice, skills certification, projects, baubles	
12: 4/27	Practice, skills certification, projects, baubles	
13: 5/4	Projects, baubles	
14: 5/11	Projects, baubles	

Grading: Your grade will be calculated on a four point scale. It will be based 66% on your demonstrated proficiency at 12 skills as described below. The remaining 34% of the grade will be determined by your final project, which will be graded as specified below.

More than one missed lab or routinely not making use of the full scheduled lab period will result in a grade of F. Lab time missed because of illness can be made up with consent of the instructor during the scheduled open lab (office hour) times.

The rough grading cutoffs will be: A/A- > 3.5, B+/B/B- > 2.5, C+/C/C- > 1.5, D+/D > 0.8, F < 0.8. The instructor will not adjust the cutoffs upwards, but reserves the right to lower them.

Skills (66% of grade) – listed roughly in the order easiest to hardest. Each of these skills will be graded based on your performance on a certification test which you can take as soon after spring break as you feel ready. You must use materials supplied by the instructor for certification in each of these skills.

Level (pts)	%	Advanced (4)	Intermediate/Proficient (3)	Novice (0)
Torch Safety	8	Exhibits skills with specialty torches.	Safely handles lit torch and follows proper lighting and shutoff procedures	Is hazard to others or self.
Crack Repair	10	Unable to tell crack location	Crack sealed but location visible	Unable to seal crack
Hole Repair	10	Unable to tell hole location	Hole sealed but location visible	Unable to seal hole
90 deg Bend	10	Wall thickness even and internal diameter consistent	Wall thickness uneven	Not 90 degrees or internal diameter grossly uneven
Hand Annealing (will be checked on T-seal)	10	Polarimeter shows minimal stress	Joint can be handled	Joint cracks with handling stress
Seal-Off(10 mm)	8	Neither too much nor too little glass.	Sealed	Not sealed
Test Tube End	8	Even thickness	Sealed, but too thick or thin	Not sealed
Butt Seal	10	Nearly invisible	Sealed but uneven	Not sealed
Tapered Seal	8	Evenly tapered joint	Sealed but uneven	Not sealed
T - Seal	10	Even symmetric joint	Sealed but uneven	Not sealed
Rod Re-enforcing	8	Firm smooth attachments and smoothly bent or straight rod	Firm but not completely melded attachments. Rod may not be smoothly bent.	Attachments incompletely melded and weak
Ring Seal (8mm inner, 16 mm outer)	0	Smooth even thickness seal	Sealed	Not sealed

Project (34% of grade) – Plan your certifications so that you have a minimum of two weeks to work on this. You cannot start without an intermediate (proficient) rating on all skills except for the ring seal. The project must be done using tubing of at least 10 mm diameter. There must be at least one fire-polished open end that can be used to fill the project with water or pressurize it. The instructor will provide at least one option for people who are not comfortable designing the project on their own.

Points	%	4	3	2	1	0
Test Tube End	12	≥ 1 perfect	1 thick	1 thin	1 airtight	missing
Butt Seal	12	≥ 1 perfect	uneven	Obvious bubbles	1 airtight	missing
Tapered Seal	12	≥ 1 perfect	uneven	Obvious bubbles	1 airtight	missing
T - Seal	12	≥ 1 perfect	uneven	Obvious bubbles	1 airtight	missing
90 deg Bend	10	≥ 2 perfect	≥ 2 flawed	1 perfect	1 flawed	missing
Rod Re-enforcing	10	≥ 1 perfect	Bends not even or straight sections not straight	Firm but not completely melded attachments	Weak attachments	missing
Seal-Off	10	1 perfect	Excessive glass	Too fragile	Not sealed	missing
Open end	12	Undistorted, fire-polished	Distorted fire-polished	Undistorted no polish	Distorted or chipped no polish	missing
Ring Seal	10	1 airtight		1 attempted		missing