

Chemistry Laboratory Design

Introduction

The overall safety profile of your school would be greatly improved if the chemistry laboratory, preparation room and chemical stores area were properly designed in the first place. Many schools are now in the process of renovating or building new chemistry labs. As the chemistry teacher who will work in these labs, you want them properly designed. Where are you to learn about chemistry lab designs that work? Who knows which designs are best for your specific laboratory needs? The answer is simple—Flinn Scientific!

Typically a local architect is hired to design a new school or science lab. It's assumed that the architect will ask the right questions and will have all the correct answers. Unfortunately, the architect may have little or no experience designing a chemistry lab. Are architects upto-date on the specific needs of today's chem-



istry teacher and the laboratories they work in? Do they understand what is required to design a science lab in the 21st century? Do architects understand the need to have great laboratory ventilation, a separate room where you can safely store laboratory chemicals, ample preparation area, and ample space at student lab stations so overcrowded conditions won't cause accidents?

Forty-five Ideas, Tips, and Hints to Help You Design a Safe and Efficient Chemistry Laboratory

Chemistry Laboratory

- 1. Will the laboratory have a fume hood? Will the fume hood have gas, electricity, water, and a sink? Where will the fume hood be located in the laboratory? A good rule of thumb is to keep the fume hood location away from heavy student traffic areas and main exits.
- 2. Table tops should be black epoxy resin.
- 3. Floors should be vinyl tile. Properly installed they are easily cleaned and relatively chemical resistant. Consider using nonskid wax. Carpet should never be used in a chemistry laboratory!
- 4. A handicap access lab station should be provided in at least one chemistry lab.
- 5. Ventilation in the chemistry lab is a must. Each laboratory must have its own ventilation purge fan which removes at least 3200 cubic feet of air per minute. These fans should be vented directly to the out-of-doors and should not be interconnected between rooms. An on/off switch should be provided allowing the instructor to turn the fan on and off depending on the types of activities being conducted. The fans are not intended to be run all day long, but on an as-needed basis.

Your ultimate goal with a purge fan is to have a complete room air change in five minutes. Positioning of the fan will depend on your laboratory design. Remember fume hoods are not designed for general lab ventilation!

6. Make sure you have plenty of electrical outlets with ground fault interruption.

- 7. Will computer cables be run to each lab station for future use of computers?
- 8. Knowing that these labs are being built to last 30 or more years, should the lab be designed to include some common features so biology and physics may be taught there?
- 9. A fire blanket, fire extinguisher (ABC type), eyewash, and a shower or body drench (with drain) should be placed in labs where hazardous chemicals will be used. Depending on where the teacher's demonstration table is located in relationship to the general lab area, you may need two eyewashes, fire blankets and fire extinguishers.
- 10. Will you have a demonstration table? Will it have water, electricity, gas and a sink? A large sink is always nice to have in a demonstration table.
- 11. Master utility cut-off valves for gas and electricity are essential. Make sure they can be accessed easily in case of emergency.
- 12. Where will goggles be stored? Where will students hang or store their aprons?
- 13. Look at furniture designs which maximize student spacing at each lab station.
- 14. Good sight lines are critical for a chemistry teacher. Can you see most of the lab activity from one vantage point? Can you move easily from one lab station to another without going around student desks and chairs? Your ability to supervise students' lab activity must not be compromised.
- 15. Do you have ample storage for apparatus, hardware, equipment, etc.?
- 16. Are sinks a usable size? Do you want hot and cold water at each lab station?
- 17. All safety equipment must be marked with location placards/signs.
- 18. Do you need non-reactive waste receptacles? Fireproof trash cans?
- 19. Where will spill control materials be stored in the lab?
- 20. Do you want laboratory stools? For safety and space issues, stools are not used in many labs.
- 21. Do you want dry erase or chalkboards in the lab? Where do you want them located?
- 22. Does your state require two exits? If so, where will they be located?
- 23. Will the laboratory have ample lighting? 75 to 100 foot-candles is suggested at bench level.
- 24. Do exit doors have sturdy locks and self-closing return hardware?
- 25. Contact the five major laboratory furniture companies listed below. They are all fine companies and will provide free assistance in designing your labs. Their catalogs are valuable resources and provide lots of ideas. Make good use of these free resources.

Preparation/Chemical Storage Area

- 26. Will the prep area have gas, electricity, water and a sink?
- 27. The prep area should have a fire blanket, eyewash, fire extinguisher and possibly a body drench or shower.
- 28. Spill control materials should be located close to your main preparation area.
- 29. The prep/storage area should have a vinyl tile or concrete floor, double drywall ceiling and walls. The door should have self-return hardware with an automatic lock and a fire rated door. The door should swing out if it is your only exit. You don't want the door to be blocked from opening if an "event" were to occur in this area. Signs on the door should say "Authorized Personnel Only".
- 30. A stepladder should be provided to help retrieve items from the top shelves.
- 31. Will your prep area have a water still or water demineralizing system? If so, where will it be located?
- 32. Consider installing drying racks for glassware above the sink.
- 33. A good preparation area is just like your kitchen at home. You want plenty of counter and storage space.
- 34. Will a telephone or intercom system be available in case of emergency? You need a method to contact outside help.

- 35. There should be emergency lighting in the prep/chemical storage area should the power go out. If your labs do not have windows, emergency lighting should also be provided in the lab area.
- 36. Have smoke detectors installed in the chemical stores area and in an adjacent hallway. Both units should be line operated and go off together should fire/ smoke develop in this area. This smoke alarm system will alert others in the school that a problem has developed.
- 37. Some architects are now installing acid dilution basins in chemistry labs. These can create a potential problem. Dilution basins should be checked, cleaned and recharged every six months to a year. If not, they could turn into a "chemical dump" or "hazardous waste site" and cause costly problems, i.e., OSHA fines, cleanup costs, etc. Does your state's law require an acid dilution basin be put in the chemistry lab?
- 38. Will the prep area have a first aid kit?
- 39. Do you use laboratory carts? If so, the prep area should have an area where the carts can be stored when not in use.
- 40. Consider building a separate chemical stores area next to the preparation area. Contained and secured chemical storage solves lots of problems.
- 41. Approved flammable liquid and acid storage cabinets should be in the chemical stores area.
- 42. Shelves in the chemical stores area should be firmly secured to the walls. Shelves should have a lip on the front to prevent bottles from rolling off the shelves.
- 43. Chemicals should not be stored more than six feet above the floor.
- 44. The chemical storage door should be a solid-core, fire-rated door (preferably hinged out). Door should have a good lock and be labeled to identify hazardous contents to alert and protect firefighters. Interior walls and ceiling should be double drywall to make this a fire rated room.
- 45. Chemical storeroom ventilation is a must. Four air changes per hour is a minimum. Air should be "pulled" from floor level and be exhausted directly to the outdoors.

The proper design of a chemistry lab can be very time-consuming. Acquaint yourself with as many ideas as possible and decide which ideas best fit your needs. Consider visiting other schools to look at their chemistry labs. What do other chemistry teachers like or dislike about their labs?

Contact the five major laboratory furniture companies discussed in this article. Their resources and ideas are invaluable.

Finally, depend on Flinn Scientific for suggestions, advice and help. We know what it takes to design a new chemistry lab and will be more than happy to help you.

Laboratory Furniture Companies You Should Contact When Designing a Chemistry Laboratory

The list of laboratory furniture companies shown below is not exhaustive. All of the companies listed are large manufacturers offering complete lines of laboratory furnishings and have sales representation in almost every state. While the companies listed are all fine companies, this list should not be considered as a recommendation by Flinn Scientific, Inc.

Campbell Rhea

1865 N. Market Street, Pans, TN 38242 • (731) 642-4251 • www.campbellrhea.com

Diversified Woodcrafts, Inc. P.O. Box 160, Suring, WI 54174–0160 • (920) 842-2136 • www.diversifiedinc.com

Kewaunee Scientific Equipment Corporation P.O. Box 1842, Statesville, NC 28687 • (704) 873-7202 • www.kewaunee.com

Leonard Peterson P.O. Box 2277, Auburn, AL 36831-2277 • (334) 821-6832 • www.lpco.com

Sheldon Division, General Equipment Manufacturers P.O. Box 836, Crystal Springs, MS 39059 • (601) 892-2731 • www.sheldonlabs.com

Combination Classroom/Laboratory—Compact Room Size is $28' \times 34'$ 952 sq. ft.



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Combination Classroom/Laboratory—Divided $30' \times 40' - 1,200$ sq. ft.



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Perimeter Lab Tables Laboratory Only $28' \times 30'$ 7" approximately 840 sq. ft.



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Combination Classroom/Laboratory Room Size is $30' \times 40'$ —1,200 sq. ft.



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Combination Classroom/Laboratory—Flexible $38' \times 30' - 1,140$ sq. ft.



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SCIENTIFIC, INC Laboratory Design and Safety



Safety Supplies



Chemical Storage



Lab Furniture See pages 2-3

Design Services





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Lab Furniture

Need help designing your lab? Try Flinn's Free UDesign[™] Layout **Planner at flinnsci.com/udesign**





Instructor Demonstration Table, 8' AP6548 \$4589.40

Specifications: Overall Dimensions-96"L x 30"D x 36"H

One Black Epoxy Resin Sink Dimensions-18"W x 15"L x 12"H

Tabletop Surface -1" Black Epoxy Resin



\$5648.45

- One mixing water faucet • One 2-way gas fixture

Includes:

- Support rod and crossbar • One GFI duplex electrical receptacle
- · Locks for each cupboard and drawer

Instructor's Demo Table, **ADA-Compliant** AP7889

Specifications: Overall Dimensions-72"L x 30"D x 34"H

One Black Epoxy Resin Sink Dimensions-14"W x 10"L x 6"H

Tabletop Surface -1" Black Epoxy Resin

Includes: • One cold water

- combo/gas fixture
- One upright rod, one rod clamp, and a cross bar
- One GFI duplex electrical receptacle
- · Locks for each drawer

Surface Options





Wood Specie and Stain Options



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Lab Furniture



Island Student Lab Station AP7883, AP7885, AP7887 \$8335.00 - \$25004.00



Specifications:

Overall Dimensions— Four-Student Island Lab Station – $66"L \times 48"D \times 36"H$ One Black Epoxy Sink – $12"W \times 8"D \times 6"H$ Tabletop Surface – 1" Black Epoxy Resin

Includes:

- Two GFI duplex electrical receptacles
- Two cold water gooseneck faucets with two gas jets each
- Available with a flat top
- Locks on each drawer & cupboard



4-Student Perimeter Pier Lab Table AP6550 \$6034.40



Specifications:

Overall Dimensions—102"W × 36"H × 90"D One Black Epoxy Sink – 12"W × 8"D × 6"H Tabletop Surface – 1" Black Epoxy Resin

Includes:

• Two combination gas/water fixtures

Two GFI duplex electrical receptacles



Flinn Combination Classroom Table/Lab Bench AP6205 \$4337.00

Specifications:

Overall Dimensions—96"W × 50"D × 36"H One Black Epoxy Resin Sink – 12"L × 8"W × 6"D Tabletop Surface – 1" Black Epoxy Resin

Includes:

- Two GFI duplex electrical receptacles
- Two cold water gooseneck faucets with two gas jets each
- Available with a flat top
- Locks on each cupboard



Student Lab Table \$355.50 – \$1730.00

Top Options: plastic laminate, chemical resistant laminate, epoxy, solid phenolic

Height Options: 30", 34", 36", adjustable height

Apron Options: book compartment, electrical outlets, and/or plain

Casters: with or without

Size Options: see flinnsci.com for full range of size options

These and many more furniture options available at flinnsci.com!





Frequently Asked Safety and Design Questions

Q: How many students can my lab serve?

A: Lab/Classroom: 60 sq./ft. per occupant; Lab only: 50 sq./ft. per occupant (Per NFPA 101 Life Safety Code, Chapter 7.3.1.2. Occupant Load Factor)

Q: Can I use a ductless fume hood?

A: Ductless fume hoods are available, however, for most applications Flinn recommends using a fully ducted fume hood.

Q: How much does a new laboratory cost?

A: From various school projects we've helped out with and in discussion with architects, we have determined that a new science room costs about \$150.00 per sq. ft. For remodeling and renovation, we have been told \$80.00 per sq. ft.

Q: I need help building a new laboratory. Can you help?

A: Yes! Flinn offers free laboratory design services and has many additional resources to help you. Please call 800-452-1261 or email Flinn at flinn@flinnsci.com to speak with a representative.

Q: Do I need to ventilate my flammables cabinet?

A: Flinn and NFPA do not recommend venting a flammables cabinet. Local building codes may require you to ventilate, though.

Q: Why would I buy a wooden flammables cabinet—won't it burn?

A: Yes wood burns, but a cabinet constructed of one-inch plywood using specifications developed by both OSHA and NFPA (National Fire Protection Association) will meet all requirements for a flammables cabinet. The question is, how long will the wooden flammables cabinet protect the materials inside from the flame? The answer: Just as long, if not longer, than metal flammables cabinets.

Q: Why would I buy a wooden acid cabinet-metal is stronger than wood?

A: Corrosive vapors can rust the interior, shelf supports and hinges of a metal cabinet creating a potentially dangerous situation therefore limiting the working life of the cabinet. Alternatively, some SciMatCo cabinets produced over 20 years ago are still in service today. The SciMatCo corrosive cabinets are made entirely of wood which will not be affected by corrosive fumes and will provide long lasting benefits to the school.

Q: Am I required to have an eyewash and shower in my laboratory *and* prep room— Can I just have one?

A: Per OSHA 1910.151(c) and subsequently ANSI Z358.1 you need one in each *work area*. There can be no obstructions (stairs, ramps, doors, etc.) between the path of injury and safety equipment.

SciMatCo Flammables Cabinets Offer Superior Protection in a Fire!





SEE THE VIDEO www.flinnsci.com/BurnVideo



Flinn/SciMatCo Wooden Cabinets

Flinn/SciMatCo Wooden Cabinets— All Wood Construction Eliminates Corrosion and Guarantees Years of Safe Storage



- Customize a chemical storage center to meet your storage needs.
- Constructed of 1" thick, high density, 9-ply exterior grade plywood and finished with Super Chem-Tuff paint.
- All cabinets meet and exceed applicable NFPA and OSHA standards.



Acid Cabinet Features

- Unique and entirely wooden hinge assembly eliminates hinge deterioration and corrosion.
- Polypropylene lock assembly furnished with padlock and keys.
- Floor of each cabinet constructed as a liquid-tight 2" deep trough to contain spillage.

For a full description of these cabinets and to see Flinn's complete line of safety storage cabinets, visit: www.flinnsci.com.

"Your Safer Source for Science"



Flinn **5-Year**

Warranty

• These cabinets are constructed as a thermal insulator and will not rust.

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Laboratory Safety Equipment



Fume Hoods

Labconco Basic™ Fume Hoods

The Labconco Basic fume hood is simple in design yet will handle the most rigorous demands of your science laboratory.

- Solid, steel construction with chemical-resistant epoxy coating that resists corrosion from chemical fumes
- Tempered ³/₄" thick safety glass sash protects the user
- Vaporproof incandescent light illuminates the interior work area
- UL-approved
- •Removable motor blower mounts on top of the hood or at a remote roof location
- Two sizes of fume hoods are available
- Units are ETL listed

Labconco Basic[™] Fume Hoods

Catalog No.	Description	Price/Each
SE1900	Exterior Dimensions: 47"W \times 25"D \times 48"H \dagger Fume Hood Size: 4 foot	\$5248.80*
SE1901	Exterior Dimensions: 70"W \times 25"D \times 48"H \ddagger Fume Hood Size: 6 foot	6946.55*

†Height dimension is without blower.

Base Cabinets for Labconco Fume Hoods

Made of solid wooden construction with a chemical resistant Trespa work surface, hinged doors and an adjustable shelf.

Catalog No.	Description	Price/Each
SE1906	Exterior Dimensions: $47"W \times 30"D \times 36"H$ Fume Hood Size: 4 foot	\$1115.25*
SE1907	Exterior Dimensions: 70"W \times 30"D \times 36"H Fume Hood Size: 6 foot	1924.55*

* Must be shipped by motor truck freight.

Air and vacuum service fixture kits are available upon request.

We Can Help You Find the Right Fume Hood

Our product management team will gladly assist you in selecting the right unit for your laboratory. Flinn Scientific is also a full-line dealer for Laboraco which provides us with a variety of options. Contact us today to discuss your needs.

1-800-452-1261



A fume hood is a basic safety aid. It should capture, dilute and exhaust hazardous and noxious fumes. The Flinn fume hood has been designed to meet the requirements of a senior or middle school laboratory.

- Corrosion-resistant wooden construction coated with chemical resistant water-based epoxy paint
- ¹/₄" shatterproof, polycarbonate sash that can be moved to five positions
- UL approved vapor-proof light to illuminate the interior
- Blower set and electrical outlet are standard

Flinn Fume Hood, 36" (Shown with Optional Base Cabinet) SE8000



Flinn Fume Hood Specifications

Catalog No.	Description	Price/Each
SE8000	Flinn Fume Hood, 36" Includes motor blower set, vaporproof light and adjustable sash. Exterior Dimensions: 38¼"W × 23¼"D × 48"H Blower Specifications: 115 Volt, 60 cycle, 930 CFM @ .25 static pressure	\$1188.05*
SE9000	Flinn Fume Hood, 48" Includes motor blower set, vaporproof light and adjustable sash. Exterior Dimensions: 48¾"W × 23¼"D × 48"H Blower Specifications: 115 Volt, 60 cycle, 1400 CFM @ .25 static pressure	1695.55*

Flinn Base Cabinets for Fume Hoods

Catalog No.	Description	Price/Each
SE8003	Base Cabinet for 36" Flinn Fume Hood Includes Trespa® work surface, hinged doors and one adjustable shelf. Exterior Dimensions: 38½"W × 237%"D × 36½"H	\$ 853.10*
SE8004	Base Cabinet for 36" Flinn Fume Hood With Cupsink Includes Trespa® work surface, hinged doors and one adjustable shelf. Exterior Dimensions: 381/2"W × 237/6"D × 361/2"H	966.00*
SE9003	Base Cabinet for 48" Flinn Fume Hood Includes Trespa® work surface, hinged doors and one adjustable shelf. Exterior Dimensions: 49"W × 237/s"D × 361/2"H	1012.75*
SE9004	Base Cabinet for 48" Flinn Fume Hood With Cupsink Includes Trespa® work surface, hinged doors and one adjustable shelf. Exterior Dimensions: 49"W × 23%"D × 36½"H	1126.65*

Must be shipped by motor truck freight.



Flinn Lab Design Services

Flinn's free online UDesign^M Science Facilities Layout Planner is a great way to get your ideas down on paper! UDesign^M enables you to design a customized floor plan that you can easily modify, share, save and print.

You can select from popular pre-planned layouts or use your own room dimensions. Select from a library of furniture and equipment icons that you can drag into your on-screen layout. The convenient "Item Summary" feature provides a list of the furniture and equipment that you have added to your layout and includes cost information.





With UDesign[™] you can:

- · Compare a variety of lab designs and options
- Create a customized learning environment
- · Communicate your ideas to administrators

Flinn's experienced lab design experts can review your plan, offer design suggestions, provide a free safety review and answer all your questions about lab design. Flinn is your #1 choice for lab design!

www.flinnsci.com/UDesign

Free Lab Design Consultation

Allow the experienced lab design team at Flinn Scientific to help you get the new laboratory of your dreams!

Our lab design specialists will work with you, your administrator and your contractor/architect to assist with all aspects of the lab design process. Flinn can be your one source for furniture, safety equipment, chemical storage and lab equipment.

With 40 years of experience, Flinn is committed to providing schools with a new lab solution that will not break the budget. Let the team at Flinn handle your lab design needs so you can do what you love the most...teaching your students.

Contact Flinn and ask to speak to a Lab Design specialist today!

1-800-452-1261 Email: labdesign@flinnsci.com





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