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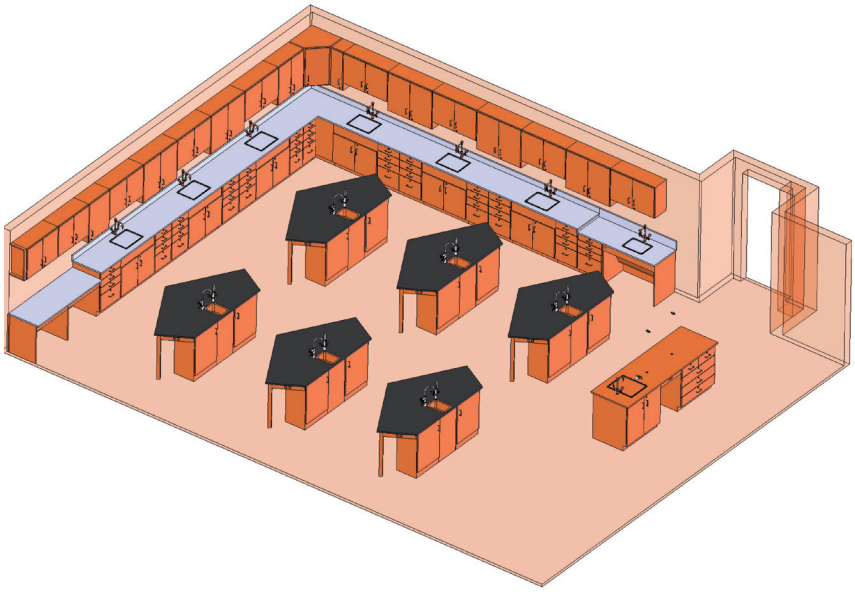
Chemistry Laboratory Design

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 up-to-date on the specific needs of today's chemistry 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 non-skid 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

