

**XXVII. A PROPOSED COURSE IN LABORATORY
PHYSICS FOR OKLAHOMA HIGH SCHOOLS****DUANE E. ROLLER***From the Physics Laboratory, University of Oklahoma*

Present laboratory manuals for high school physics are not well adapted to the needs of Oklahoma high schools. A large amount of equipment is necessary, some of the apparatus is elaborate, and there are seemingly needless duplications of pieces. As a result, the average high school is unable to purchase the equipment necessary for a well-balanced course. Even in those schools which are fortunate enough to have ample funds one very often finds poorly equipped laboratories in which the perhaps abundant apparatus is either obsolescent, inadequately constructed for the purposes at hand, or poorly distributed with respect to the several branches of elementary physics. An immediate remedy for these conditions would be to devise a series of experiments calling for less expensive apparatus and to provide an apparatus list in which are described the best pieces of apparatus for each experiment.

The advantages to be gained by the revision of the laboratory course are numerous. Along with a reduction in the cost of equipment there can be effected a badly needed reorganization of the form and content of the course. Modern psychology offers plenty of justification for the belief that the traditional type of physics experiments is too abstract, and that experiments should be so revised that their central unifying ideas are concrete, specific, and within the realm of student experiences and interests. The element of choice should enter more fully into laboratory work; it should be made possible for the student to select from a large list of exercises the particular experiments which he wishes to perform. Thus the problem becomes one of providing an abundance of the right kind of experiments and, at the same time, one of reducing the total cost of apparatus.

In order to determine whether such a reorganization is possible the writer made a study of the apparatus used in the following twenty-four experiments in mechanics:

Dull: *Laboratory Exercises in Physics*. Exps. 5, 6, 9, 10, 12, 15, 16, 18, 19, 20, 21, 22, 23.

Good: *Laboratory Projects in Physics*. Exps. 6, 9, 11.

Ahrens, Harley and Burns: *Practical Physics Manual*. Exps. 6, 9, 10, 12, 13, 40.

Millikan, Gale and Bishop: *Laboratory Physics*. Exps. 5A, 10.

These experiments use and illustrate the following principles:

densities of liquids and solids by various methods, fluid pressure, Boyle's law, coefficient of friction, principle of moments, simple machines, mechanical advantage, efficiency of machines, composition and resolution of forces, acceleration due to gravity, periodic motion, and the molecular constitution of matter.

Lists were made of the apparatus specified for each experiment by its author and these lists were examined with the view of eliminating needless duplications of pieces and of substituting less costly and more durable materials wherever possible. In the revised list, inclined planes, composition of force boards and wooden blocks are to be made in the manual training shop of the school or by a local carpenter. All of these pieces are so simple and so completely described that they can be made by first year manual training students. Important pieces of apparatus included in the revised list are:

Beam balances, spring balances, vernier calipers, hydrometers, siphons, manometers, pycnometers, simple pendulum, metronome, levers, pulleys, inclined planes, composition of force boards, barometer, tripods, rods and clamps.

The average cost of the apparatus for each of the twenty-four experiments in this revised list is \$1.77 for a two-pupil set. Assuming that the average student can perform sixteen of these experiments in the time usually allotted for mechanics, the total cost of the mechanics equipment necessary for the performing of sixteen experiments by a class of twelve students, working in pairs, would be \$170.00.

That this a very material reduction in the cost of mechanics apparatus is evident from a comparison of the cost of the apparatus specified as minimum requirements by the authors of various manuals:

Chute, fourteen experiments	\$ 441.00
Milliken and Gale (red binding) fourteen exps.	\$ 413.00
Hoadley, ten experiments	\$ 355.00
Millikan, Gale and Bishop, fourteen experiments	\$ 323.00
Tentative Oklahoma list, sixteen experiments	\$ 170.00

It is the purpose of the writer to devise a series of about thirty-two groups of experiments, each group having three or four experiments. These experiments will be so classified that any student completing one experiment from each of the thirty-two groups will have covered what are commonly considered to be the essential principles of high school physics. Schools having ample funds will be able to buy the equipment for the

one hundred odd experiments in the list; schools not possessing adequate funds can select one experiment from each of the thirty-two groups.

It seems safe to assume that the cost of equipment can be reduced and that the element of choice can be introduced into laboratory work. In so doing, the opportunity will be afforded for a revision of the form and content of the laboratory work, and laboratory physics may be taught by methods determined by local conditions and the needs and interests of the students.