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Having taught physical science for two years at the high school level, my new assignment to teach seventh grade science was met with mixed emotions. I had heard that junior high students were very energetic (mostly for mischief) and were very limited in learning ability, due to a low reading level and a lack of mathematical skills. I know I had also wondered, like many of you in high school and college teaching, just why did high school age students have such poor concepts of motion, energy, light, sound and graph interpretation and use. Wasn't it due in part to poor teaching of these concepts at the elementary and junior high level,

After teaching junior high science now for two years, I have learned that the misgivings I had are true to varying degrees, and it is only by realizing the various limitations and strong points of these students that one can effectively teach the concepts and skills required. For instance, I have found that these students:

1) Tune out to lectures of any type over 10 minutes in length,
2) Rarely do reading assignments of more than two pages,
3) Resent having to just sit during class time,
4) Feel that math and science are alien to each other,
5) Respond quite favorably to success—no matter how minor it may seem to the instructor,
6) Actually bring their texts to class—I give open book quizzes,
7) Are relatively poor readers but may be encouraged to read filmstrips,
8) Are fairly good artists when required to draw,
9) Need visual aids to help grasp verbal and conceptual ideas,
10) Lack experience and discipline in a lab situation,
11) Are *highly* motivated by things made interesting to them.

I picked out one example which illustrates that verbal explanations are not enough when presenting new words and ideas. One student understood the distillation apparatus quite well and listened carefully, but my failure to spell all the new terms is quite evident. (Figure 1). Note that the bunsen

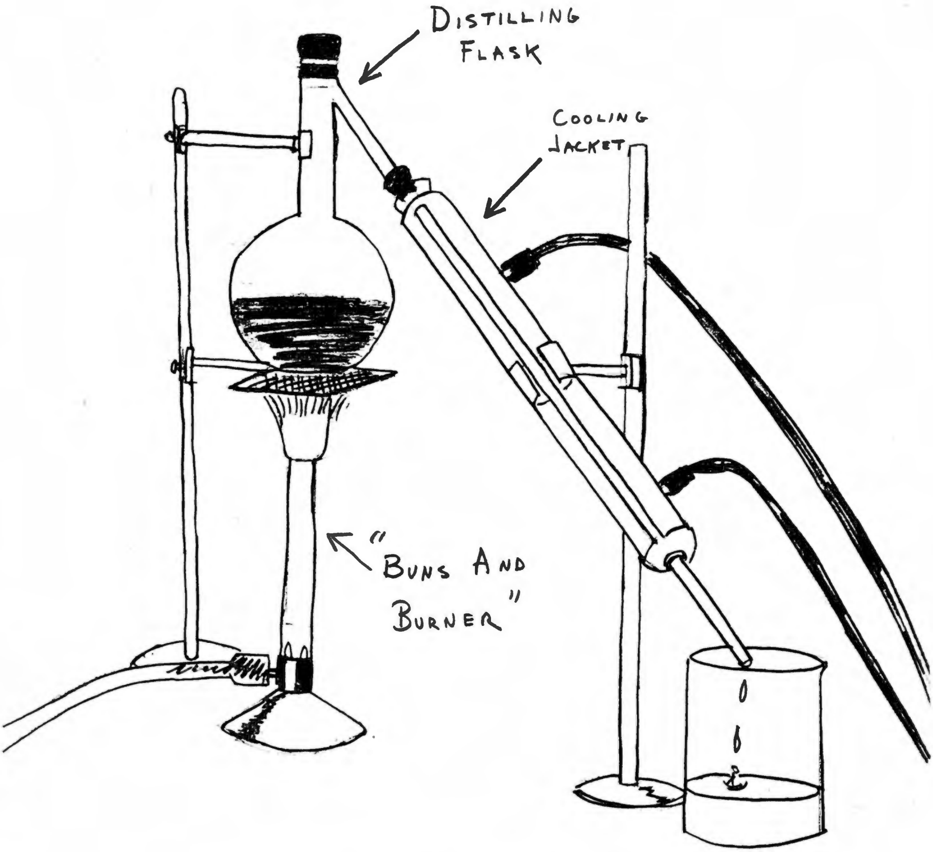


Fig. 1

burner to him was "buns and burner." Who knows if this error would have ever been corrected?

The rule of thumb I now generally use with my junior high classes in science is that if I can demonstrate a concept we happen to be studying, with fairly inexpensive equipment, I scrounge around for enough equipment to enable the entire class to do it themselves, working in groups of two or three.

I would like to share one such lab with you. The first year I taught simple machines and mechanical advantage, I did a lot of demonstrations which involved most of the students, but only three or four at a time. Trying to arrange a rotating system resulted in many students coming in after school, which, in turn, resulted in establishing another rotating system to enable all those interested to have a turn. This last year I divided each class of approximately 30 students into lab groups of two or three and assigned each group a #1, #2 or #3. Group #1 worked on levers the first day, pulleys the second day and inclined planes the third day. Group #2 started on pulleys the first day, inclined planes the second day and levers the third day. And yes, Group #3 started on inclined planes the first day, levers the second day and pulleys the third day. In this way I only needed five complete set ups of any given area. A fourth day was taken to finish up any parts of any of the areas not finished.

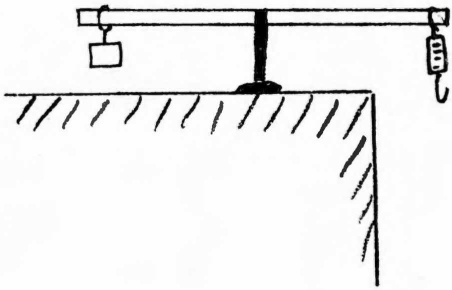
The features of this lab were:

1) Plenty of time to have both failures and eventual successes,
2) Periodic check points,
3) Periodic success reinforcements,
4) Opportunity to physically feel mechanical advantage,
5) Requirement to make two graphs,
6) Accessibilty to a set of 10 filmstrips on simple machines,
7) A fourth "free day" to explore new ideas.

These are sections of the lab done:

The following are your lab sheets on simple machines. Each lab partner is to fill in his or her own lab sheets. We will be taking four days for this lab, so *take your time.*

Levers—1st, 2nd, 3rd



Check list of materials

........One meter stick
........One fulcrum
........One support
........Two four-inch strings
........One unknown mass
(approximately equal to 200 grams)
........One spring balance

If the mass of your weight is unknown, use the spring balance to balance its weight.
Mass of unknown weight ....grams

1) Balance the meter stick
2) Tie loops in the two pieces of strings
3) Hang the weight from the 100 cm. mark
4) Balance this weight by using the spring balance at the following positions:

0 cm. .... spring balance reading
25 cm. .... spring balance reading
40 cm. .... spring balance reading

5) Now put the spring balance at the 100 cm. mark and put the weight at the following marks:

0 cm. .... spring balance reading
25 cm. .... spring balance reading
40 cm. .... spring balance reading

True or false

................When the spring balance and the weight are the same distance from the fulcrum, the reading on the spring balance should be the same as the mass of the weight.

................When the weight is twice as far from the fulcrum as the spring balance, the reading of the spring balance is about one half the mass of the unknown weight.

................It is easier to balance the weight when it is closer to the fulcrum.

................The weight always moves the same way as the spring balance is pulled.

State here what you learned about a first class lever

................Checked by instructor

The students were also asked to construct a second and a third class lever and answer similar questions as those asked about the first class lever.

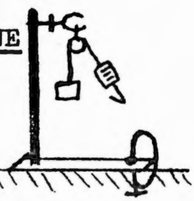
Pulley Lab—Four Different Set Ups

Check list

........One spring balance
........One ring stand
........One C-clamp
........One ring stand clamp
........One two-foot length of string
........One unknown weight (at least 500 gms.)
........One single pulley
........Two double pulleys
........One triple pulley
........One block and tackle

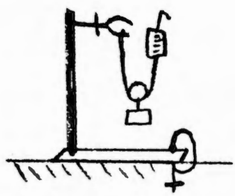
Spring balance mass of weight ....gm.

SET UP ONE



Spring balance reading to hold weight .... gms.

SET UP TWO



Spring balance reading to hold weight .... gms.

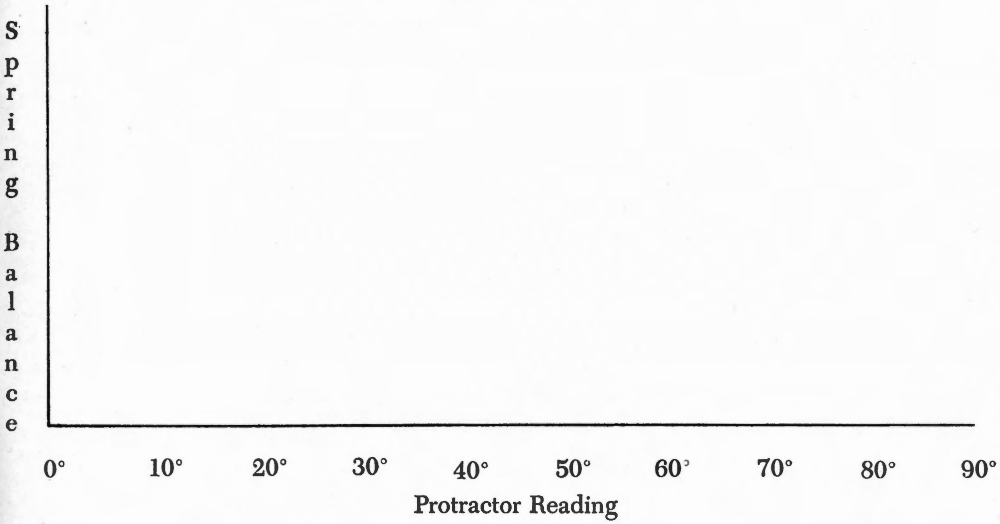
In which set up is it easier to lift the weight? 1 2

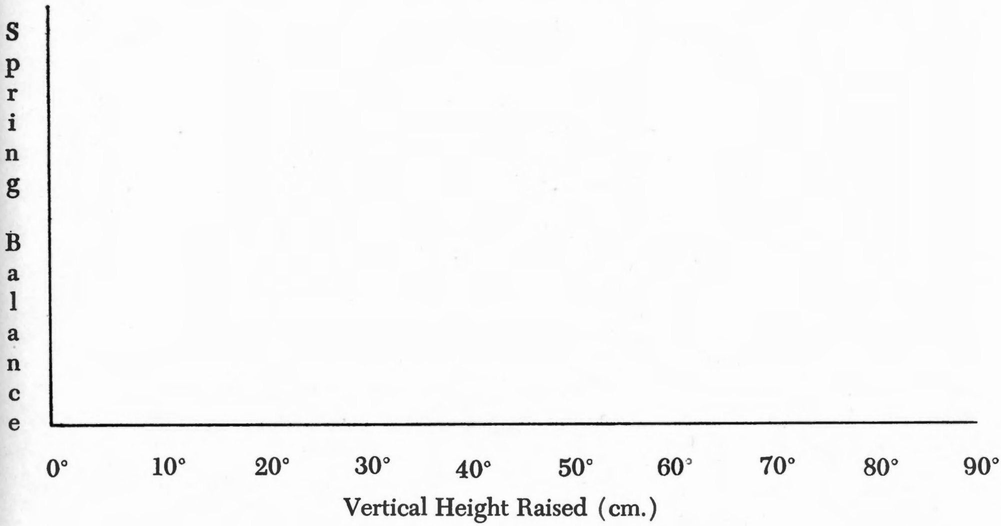
In which set up does the weight move less distance than the spring balance? 1 2

................Checked by instructor

In this pulley lab a set up trying the two double pulleys and a block and tackle set up was done.

Required Graphs for the Inclined Plane Lab





................Checked by instructor

Fig. 2
Inclined Plane Lab

Check list

........One spring balance
........One big weight (provided)
........One inclined plane
........One meter stick
........One protractor
........One sheet of graph paper
........Patience

In this lab you are going to pull the weight up different inclines. Each time you pull the weight, pull it through the same distance.

Length of inclined plane .... cm.
Mass of weight used .... gms

Protractor reading	*Vertical height raised*	*Spring balance reading*
0		
↓		
90		

................Checked by instructor

From this data the students were required to make two graphs. (Figure 2). Most students noticed the similarity of both graphs.

In summary, the lab was rather hectic to run because one instructor had to check 30 students and their work. But I'm sure the students enjoyed this particular lab, as well as did their instructor.

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