COMPILATION: ALPS kits, context-rich problems
[e-mail addresses updated 9-2002]

Date: Thu, 31 Aug 2000
From: Kathleen Andre Harper <harper.217@OSU.EDU>
Subject: ALPS Kits
Hi all,

Jane asked me to share information about Alan Van Heuvelen's ALPS kits, so here's a brief description.

ALPS are Active Learning Problem Sheets. Two packages of them are available - one for mechanics and one for E&M. They were developed while Alan was still in New Mexico, and he designed them to fit with his teaching strategy, in which he teaches concepts first, then adds the mathematical representations to the concept, and then has students use multiple representations to solve problems. The focus of these sheets is to help students develop useful ways of analyzing and solving physics problems.

The kits are not designed to be an exclusive resource, but are supplemental. They also are not designed in such a way that every single page needs to be completed - that would be overkill. The teacher can look through the sheets and determine which ones are most appropriate at a given time. We use them in interactive lectures, recitation sections, and as part of homework assignments.

There are several different sorts of sheets in the kits. I especially like the ones that are qualitative in nature, because they force the students to think about the concepts without relying on a mathematical crutch. The "Jeopardy" ones, which have the students work backwards from an equation to a free-body diagram or energy bar chart and then to a possible problem statement are really good, too. It takes the students a little while to get used to these, but I find them to be very helpful in getting students to learn how to reason with multiple representations. There are also standard sorts of physics exercises, but broken down into steps for the students to solve one at a time, including things like drawing a picture, motion diagram, energy bar chart, or motion map; applying appropriate equations; and various evaluation tools after an answer has been arrived at.

The version we use at OSU also includes many context-rich problems developed at the University of Minnesota, which are great for challenging groups of students to combine concepts and work together to solve a difficult problem in a somewhat realistic context. I don't know if these are part of the standard kit or not.

One of the DC modelers asked about the appropriate level for using these. We use them with both the regular and honors track introductory physics courses at OSU. I've worked primarily with an honors course for engineering students. Some of them complain that the conceptual sheets are too easy. The biggest benefit to me as a teacher, though, is that I can go over one of these sheets with a student who is having trouble and see exactly where in their problem solving process they are having difficulties. Many of the students come to appreciate the kits after they've used them for a while. I definitely think that AP students would be fine with these, and I suspect that a lot of the materials would also be useful at the non-AP level.

Several modelers have talked about trying these out in their classrooms, but I haven't heard much back on how they used them or how well it worked. Hopefully some of you can add your experiences to my advertisement. :)
Kathy Harper
OSU Physics Education Research Group
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Date: Thu, 31 Aug 2000
From: Jane Jackson <jane.jackson@ASU.EDU>
Subject: Re: ALPS Kits: how to order

Following up on Kathy Andre's post today: I downloaded the following ordering info for the ALPS Kits at

www.physics.ohio-state.edu/~physedu/

They are inexpensive. Since they're based in part on David Hestenes' Modeling Theory of Instruction, you'd probably like them. Alan Van Heuvelen's student FCI gains in his calculus-based course are excellent!

ACTIVE LEARNING PROBLEM SHEETS

The Active Learning Problem Sheets (the ALPS Kits) include inexpensive worksheets that can be used to enhance student conceptual understanding and problem solving expertise. They emphasize the multiple representation of processes and encourage active participation of students in all parts of their instruction. The ALPS Kits is a comprehensive product for use in introductory physics courses that emphasize problem solving (college calculus-based physics and algebra-based physics, and high school honors and AP physics).

The Mechanics ALPS Kit (about $8.00) includes all of mechanics including work-energy, impulse and momentum, and vibrations.

The Electricity and Magnetism Kit (about $8.00) includes electricity and magnetism.

Each unit has:
* qualitative concept development activities, and
* problems that emphasize the multiple representation of processes.

The ALPS Kits can be used in many ways:
* interactively in a lecture format,
* interactively in a recitation format, and
* for homework assignments to supplement book problems.

Date: Tue, 5 Sep 2000
From: Jane Jackson <jane.jackson@ASU.EDU>

You can easily download more than 200 context-rich problems from Ken and Pat Heller's web site at the University of Minnesota. (They aren't part of the ALPS Kits book.)

HOW TO DOWNLOAD CONTEXT-RICH PROBLEMS:

Go to: www.physics.umn.edu/groups/physed/
Click on CONTEXT-RICH PROBLEMS.
Then click on ON-LINE ARCHIVES.

You can download them easily into a word processor. (I did it. Here's how, for the benefit of beginners: on my Macintosh, with some context-rich problems on my screen, I scrolled down on "Edit" to "SELECT ALL", then again to "COPY". I pasted this into my word processor, then changed the font to "times" which is small enough that the lines fit well on the page.)

WHAT ARE ADVANTAGES OF CONTEXT-RICH PROBLEMS?
A Univ. of MN grad student-researcher told me,
"Context-Rich Problems were developed because students can often successfully solve traditional problems without understanding what they are doing. Context Rich Problems are written so that students have to understand the situation and the physics in order to successfully solve them."

HOW ARE CONTEXT-RICH PROBLEMS DIFFERENT FROM TRADITIONAL PROBLEMS?
(I downloaded the following discussion of this question from the U of Minn web page.)

Traditional Problem:
Cart A, which is moving with a constant velocity of 3 m/s, has an inelastic collision with cart B, which is initially at rest as shown in Figure 8.3. After the collision, the carts move together up an inclined plane. Neglecting friction, determine the vertical height h of the carts before they reverse direction. [a sketch was included.]

There are several parts of a traditional textbook problem that make it inappropriate for group work:
1.Unreal objects that do not tie physics to the real world.
2.Physics is clearly spelled out for the students, hence robbing the group of an important decision.
3.Assumptions are clearly spelled out, again robbing the groups of a decision.
4.A picture is included which denies the group a decision
5.Variables are pre-defined for the students.

The following context-rich problem is the same problem, only it avoids the pitfalls of the traditional problem.

Context-Rich Problem:
You are helping your friend prepare for her next skate board exhibition. For her program, she plans to take a running start and then jump onto her heavy duty 15-lb stationary skateboard. She and the skateboard will glide in a straight line along a short, level section of track, then up a sloped concrete wall. She wants to reach a height of at least 10 feet above where she started before she turns to come back down the slope. She has measured her maximum running speed to safely jump on the skateboard at 7 feet/second. She knows you have taken physics, so she wants you to determine if she can carry out her program as planned. She tells you that she weighs 100 lbs.

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Date: Thu, 7 Sep 2000
From: Kathleen Andre Harper <harper.217@OSU.EDU>

There have been a few questions regarding the ALPS and context rich problems that I wanted to answer.

1) There are no solution manuals for these materials.

2) Information for ordering the ALPS is available by contacting

Hayden McNeil Publishing Inc.
47461 Clipper
Plymouth, MI 48170
Phone: 734-455-7900
fax: 734-455-3901

3) Context-rich problems: In order to completely fit the definition of context-rich, a problem must satisfy the following criteria:

*It is written in second person (e.g., "You take a summer job at the jet propulsion lab....")

*It has a realistic or semi-realistic context (evaluating a stunt for the movies is often a popular one) with a plausible reason for wanting to do the calculation.

*It cannot be solved by simply plugging numbers into one equation. It requires combining multiple physics concepts to solve the problem.

*The physics question is not directly stated. The question in the problem statement might be "Is the design safe?" "Who was to blame in the traffic accident?" or "Will you make it home in time for supper?" Sometimes there won't even be a question mark in the problem statement.

*There are no diagrams or pictures given.

Once again, these problems are suitable for groups of students to solve together - they certainly promote discussion! They are too difficult to have students solve individually.

If there are additional questions about the ALPS or context-rich problems, just ask - I use both tools extensively in my teaching.
