This package of materials have all been used in course instruction and are organized so instructors and students can select elements that support their work in studying Mechanics. The elements are organized by content topic.

The most significant aspect of studying Mechanics is developing the knowledge, skill and confidence to solve increasingly complex problems applying rigorous mathematics and an accurate understanding of the physics principles. Each online element included in this resource serves the needs of some students, and should be suggested or integrated into course work based on the self selection by students, or the wisdom and experience of the instructor.

The **Syllabus** is an example of a complex hybridization. It is not exemplary, it is only the first run of this course which was unique in that the required text was the **MIT ILEM-WIKI text**t, including the embedded LONCAPA problems. This is not currently available as an open source resource, however the first draft of this Interactive text is included. If you would like to discuss this resource and perhaps join our collaboration, please contact me directly and I will work with you in setting this up. Currently WAOL is not able to host this course, and we are using the MIT server (2011).

Sara Julin, Physics, Whatcom Community College sjulin@whatcom.ctc.edu

The folders in **LESSONS** , topically organized can be used to create student assignments, to integrate into lecture, to support students needing extra work, or as stand alone instructional resources. All of them are excellent and currently open source. I have included the URL for you to copy into a separate browser, as well as you can just click the hotlink to go to the site directly from WAOL-ANGEL.

The **PSET**s are included for you to use, read, throw away or modify. They are included to show the level of problem solving skill I endeavor to get my students up to. Mostly the PSETS are quite challenging for students.

The **ASSESSMENTS** fold contains WORD documents that you are free to use. These are in a format for students to work a set of problems, review the answers, figure out their weaknesses, work some more , review the answers etc. You can assign them for self diagnostics or copy and delete the answers, and use them in a variety of forms. I encourage the use of self diagnostics and any form of student self assessment because it begins to train them to recognize what they know and what they don't know. These resources are available for them to pursue better understanding of what they identify they don't know.

The required **WorkBook** that I suggest is Volume 1 of the Student Workbook to accompany Randall Knight's Physics for Scientists and Engineers (Pearson). These work book problems have helped my students develop their representational thinking and problem solving skills when traditional problems reward their avoidance of drawing, graphing, interpreting skills. I require them to work 80% of all of the workbook problems for any chapter we are studying the relevant material. I then require them to compare their answers to the posted answers (which are worked out solutions provided by the publisher in pdf format, which you must request as an instructor when you require the book), and then they record their self assessment as well as answer some other questions about the material. These assessment are posted in the WorkBook folders. The self assessment rubric is included in the Workbook section also.

The **ANDES PhysicsTutor** has undergone much improvement since I started this project and am now able to recommend it for your perusals. It is an open source MECHANICs interactive physics tutor with many applications problems built for student use. In addition to the immediate feedback-tutor support this problem solving option vastly improves the logic and precision discipline in student problem solving. ANDES must be engaged with in a very rigorous (not complicated) syntax that I have found is exactly the rigor that students need to get their cognitive approach to solving problems away from the random scatter of bits of equations and ideas written on a page with a random process of ultimately coming to some answers to a problem. Students tend to hold on to this poor form of problem solving if they are interacting with a computer for homework/problem solving. Since the norm is for the computer to accept final answers only, there is no incentive for students to clean up their logic, to follow a careful definition of terms, to make sure the logical steps follow from the preceding work. ANDES will assess this and give them feedback immediately when their is a logic error, when they have not defined terms clearly, and it will give them specific feedback about these issues. It works on Macs and PCs. I encourage you all to try this yourself. The advice to work their tutorial problem is absolutely necessary to get into the swing of things. ANDES is not built for intuitive problem solving; it is going for rigor.

My recommendation is to build a requirement at the start up of the course that students must complete some number (5-10) ANDES problems correctly for each unit/topic you cover. An easy way to document this is to require them to save a screen shot of their solution(including the tutorial on the right side), and turn that in. After they have struggled against the machine enough, they will get so they should be able to whip out 5 solutions straight away. After that amount of rigorous practice their skill on a piece of paper for an exam will be vastly improved, as will their incorporation of the simple rigor we all hope they adopt because we show them how.... (but they don't do it until THEY DO IT THEMSELVES). **ANDES** gives the feedback for the logic steps that we do no have time in a lifetime to give them.

My hope is these open source, high quality online resources will support your work with students at the calculus level Mechanics courses. There is much out there, and it is hard to find and review. Please use freely, add, delete. Contact me any time, as I am very interested in the ongoing improvement in teaching and learning for this level of university physics while reducing the cost to students and time costs to the community college faculty. "Good Luck, and Good Night" (e.r. morrow).

Sara Julin

sjulin@whatcom.ctc.edu

360-383-3525