Physics 103

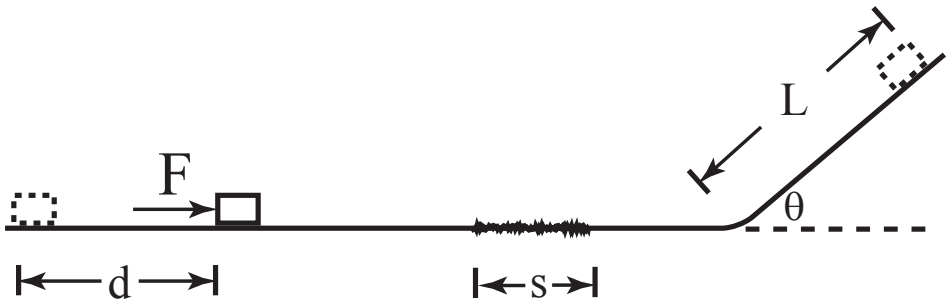
Final Exam - Take Home Portion

The following problem comprises one-quarter of the final exam. This one problem may be done at your leisure, prior to the scheduled final exam, which is Wednesday 13 December, 2006, at 8:00am. Please bring your solution to the attached problem with you when you come to the exam room at that time. Your solution will be consolidated with the three additional problems on the final exam, which you will have 2.5 hours to complete, and will be graded in conjunction with those problems. Return to me at that time also the "Affidavit of Honesty", properly affixed with your signature. Before beginning the exam, please read that document and comply with it.

Each of the four final exam problems, including the one take-home problem attached, has five parts. Thus, there will be 20 parts in in total when the exam is completed on Wednesday. Each part is worth five points, supplying a total of 100 points. You may use your class notes, the textbook, the internet, and any other printed matter you desire to complete these problems. You may not discuss this test with anyone other than me, your dutiful instructor.

IMPORTANT: Bring to the final exam the Grade Assessment sheet which I gave you in class on Wednesday 6 December. If any of the grades on that sheet were listed erroneously, AND if I verified to you via email that the grade would be amended, then write the amended grades on the sheet in red pen. Otherwise DO NOT alter the grade assessment sheet in any way, at risk of serious jeopardy to your grade. I will collect this sheet at the end of the exam period along with the take-home problem and the three problems given during that period.

Problem One (Take-Home Problem)



A box having mass $M = 20$ kg starts from rest, and is then pushed horizontally with a constant force $F = 50$ N over a distance $d = 5$ m, whereupon the force ceases. The box then slides without friction towards the right. Shortly thereafter, the box encounters a rough patch, having a length $s = 1$ m, in which the coefficient of kinetic friction between the box and the surface is $\mu_K = 0.2$. After traversing the rough patch, the box continues to slide to the right, again without friction, eventually encountering a frictionless upward incline, tipped an angle θ from the horizontal. The box continues for a distance $L = 1$ m along the inclinve before stopping and then sliding back down the incline. Use the diagram above as a reference. Treat the box as a point particle.

a) What is the velocity of the box just before it encounters the rough patch?

b) How much work is done on the box by friction as the box traverses the rough patch from left to right?

c) What is the velocity of the box just after it passes the rough patch?

d) What is the angle θ?

e) After the box slides back down the ramp it continues sliding to the left, eventually encountering the rough patch again. Does the box make it all the way across the rough patch when it is moving to the left, or does it stop on the patch? If it stops on the patch, how many centimeters of rough surface does it pass before stopping?

Affidavit of Honesty

By affixing a signature below, the examinee attests faithfully and honestly that he/she has neither shown this examination to any other human being, even for mere amusement purposes, nor has consulted with any individual, either attending this class or not, regarding any matter associated with the material covered on this examination. The examinee furthermore attests that not less than 100 percent of the submitted work, including all reasoning and all computations, were accomplished entirely by the examinee, using only printed and electronic resources which were available prior to receiving this examination.