Physics 3210 Final Exam format guide

What to expect when you’re expecting... a final exam:

The final exam will be similar to our midterms; however, there will be two important differences.

1.) There will be more questions with fewer parts.

2.) I won’t always choose the generalized coordinates for you.

About half of the exam will consist of descriptions of physical systems where I ask you to find the Lagrangian. What sort of physical systems?

- Particles sliding on curvy surfaces
- Beads sliding on spinning wires bent into various shapes
- Cylinders rolling down planes or unwinding strings
- Multiple pendulums or a pendulum moving in 3 dimensions
- Several masses on springs
- Combinations of pendulums and springs
- Pairs of particles interacting through central forces

In the midterms it was possible to pass the exam when getting the kinetic and potential energy wrong by surviving on the partial credit available on the remainder of the question. On this exam, you will need to be confident and correct in writing kinetic and potential energies in generalized coordinates.

The rest of the exam will be designed to test some of the following:

can you find / do you know:

- the Lagrange equations of motion given the Lagrangian
- the Hamiltonian given the Lagrangian
- when a quantity is conserved, particularly the Hamiltonian itself
- when the Hamiltonian is equal to the energy
- static solutions and determine stability of those solutions
- the frequency of small oscillations
- the structure of phase space and the meaning of canonical transformations
- Hamilton’s equations of motion
- the normal mode frequencies and normal mode vectors of coupled particles
- the center of mass and moment of inertia tensor of a body
- when angular momentum is conserved or when components of angular velocity are conserved
- equations of motion in a rotating reference frame