Physics Learning Goals relevant for Week 10 Exam

Broadly speaking, these learning goals are tied to scientific reasoning, graphical analysis, lens optics, motion, and special relativity – our main areas in our work with conceptual physics. You should be prepared to do the following on the fall quarter final exam, which is based on material you've engaged with in reading, lectures, workshops, and homework assignments:

1) Use graphs to explore the relationship between quantities, analyze experimental uncertainties, and draw conclusions.

2) For single lenses, use ray diagrams and/or the thin-lens equation to relate focal length, object distance, and image distance.

3) Describe and critique Galileo's experiments and conclusions about the relationship of the period of a pendulum to its swing angle, mass, and length.
4) Given the length and period of a particular pendulum, determine the length of a different pendulum given its period or the period given its length.

5) Interpret, transform between, and create a) tables of time and position data, b) motion diagrams, c) position vs. time graphs, and d) space-time diagrams.

6) In constant speed situations, apply the relationship between distance, time, and speed so that if given any two, the third can be determined.

7) Apply Galileo's law of falling bodies, especially as it compares the motion of freely falling objects.

8) Identify, compare, and contrast uniform motion (constant speed motion) and uniformly accelerated motion.
9) Explain and apply Galileo's conclusion that projectile motion can be decomposed into uniform motion and uniformly accelerated motion and that the combination is a parabola.

10) Convert distance, time, or speed in one set of units into a different set of units, including relativistic units.

11) Relate the speeds of objects or of reference frames using the velocity transformations.

12) Relate time intervals in two different reference frames using the proper time relation if one of the observers is at both events.
13) Relate length and distance measurements in two different reference frames using the length contraction relation if one of the observers is at rest with respect to the distance/length being measured.

14) Calculate a spacetime interval between two events, classify the interval as space-like, time-like or light-like, and determine whether or not the two events are causally linked.
15) Use the invariance of the interval to relate distance and time intervals in one reference frame to those in a different frame.
16) Draw and/or interpret a spacetime diagram, and use this diagram to determine time- and spatial-ordering of events, including whether or not events are simultaneous or at the same location in particular reference frames.