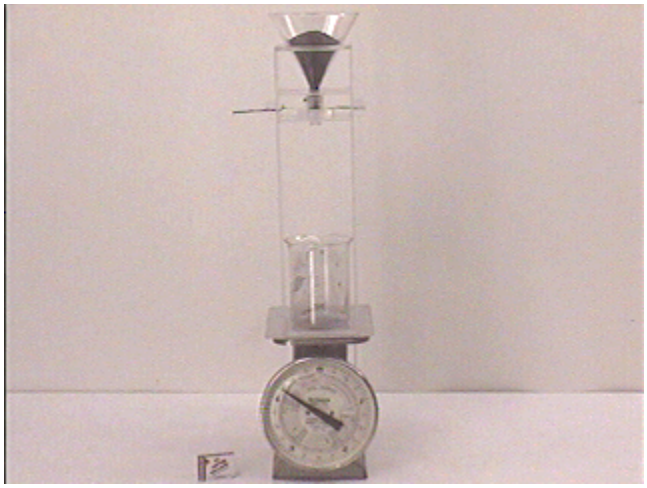
Question #66

The question this week involves the famous demonstration known as the "hourglass problem," or "Galileo's water bucket."

An hourglass sits on a weight scale as seen in the photograph below. The sand is kept in the top section of the hourglass by an invisible massless membrane. Well, actually this is not an hourglass, but it is close enough.



At time t=0 a Maxwell demon (invisible and massless, of course) pulls away the membrane, allowing the sand to fall through the opening at the bottom of the upper container (a glass funnel) into the lower container (a glass beaker). At time t=T the last drop of sand falls into the lower container. The demon creates no forces on the system when it (notice the politically correct neutral gender) rapidly removes the membrane, so the only effect is that at time t=0 the sand begins to fall out of the upper part of the hourglass into the lower part. The value W, seen in the photograph, is the weight of the hourglass with its sand before the sand is released at time t=0 and after all of the sand has fallen at time t=T (Why must these two cases be same?).

The question involves what the scale will read between the times t=0 and t=T, during which the sand is falling. You are to select from the list below any answers that are correct. This week we will deal with what might happen just after the sand is released and just before it finishes falling into the lower container. Next week we will deal with what might happen during the steady state falling situation.

Which of the following are correct results for the "hourglass problem?"

- (a) the scale reading will rise just after t=0.
- (b) the scale reading will fall just after t=0.
- (c) the scale reading will remain at the value W just after t=0.
- (d) the scale reading will rise just before t=T.
- (e) the scale reading will fall just before t=T.
- (f) the scale reading will remain at the value W just before t=T.

Click here for Answer #66 after May 28, 2001.

Question of the Week

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For questions and comments regarding the *Question of the Week* contact Dr. Richard E. Berg by e-mail or using phone number or regular mail address given on the Lecture-Demonstration Home Page.