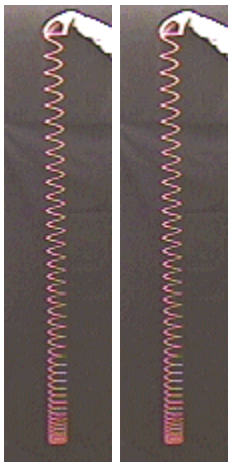
Answer #9

The answer is (c); The bottom end will remain motionless for some time after the top end is released. In fact, the bottom end will remain motionless until the entire SLINKY has totally collapsed to that point in space! Click your mouse on the photograph below to see an mpeg video of the action.



This one may be hard to see, so we give you two choices: orange spring on white background (left) or green spring on white background (right). It may help to use the frame grabber on your meg video player and move through the frames one at a time to slow down the motion.

Why does this interesting behavior occur? Before the bottom end of the SLINKY can move, something has to tell it the top end was released. That must be some sort of motion - either a wave or the collapse of the spring - that travels from the top to the bottom end of the SLINKY. Because the collapse of the SLINKY occurs at a faster speed than the speed of a wave along the SLINKY, it must collapse before the bottom end knows that anything has happened.

Just how, in fact, does it collapse? When the top end is released, the only part of the SLINKY that can tell is the first turn. The top turn notices that it was released when it feels an unbalanced force and begins to move. It is only after the first turn has collapsed that the second turn feels a similar unbalanced force and begins to move. In succession, then, each successive turn notices when the turn above it has collapsed. The inertia built up in the collapsed upper part of the SLINKY causes its velocity to be much greater than the speed of a wave in the spring, so the collapse occurs at a speed much greater than the SLINLY wave speed.

The SLINKY thus collapses one turn at a time, beginning at the top end, and the bottom end does not move until the entire SLINKY has collapsed to its compressed configuration.

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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.