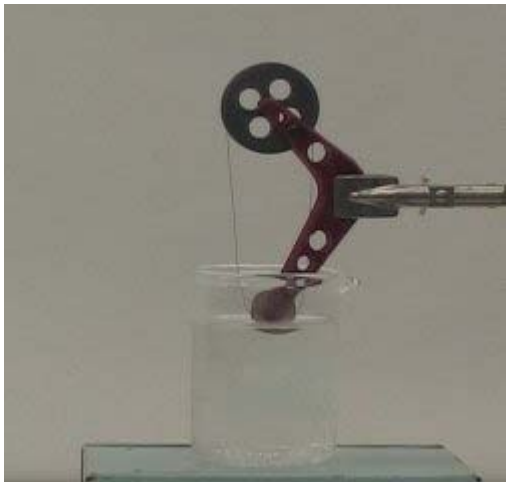
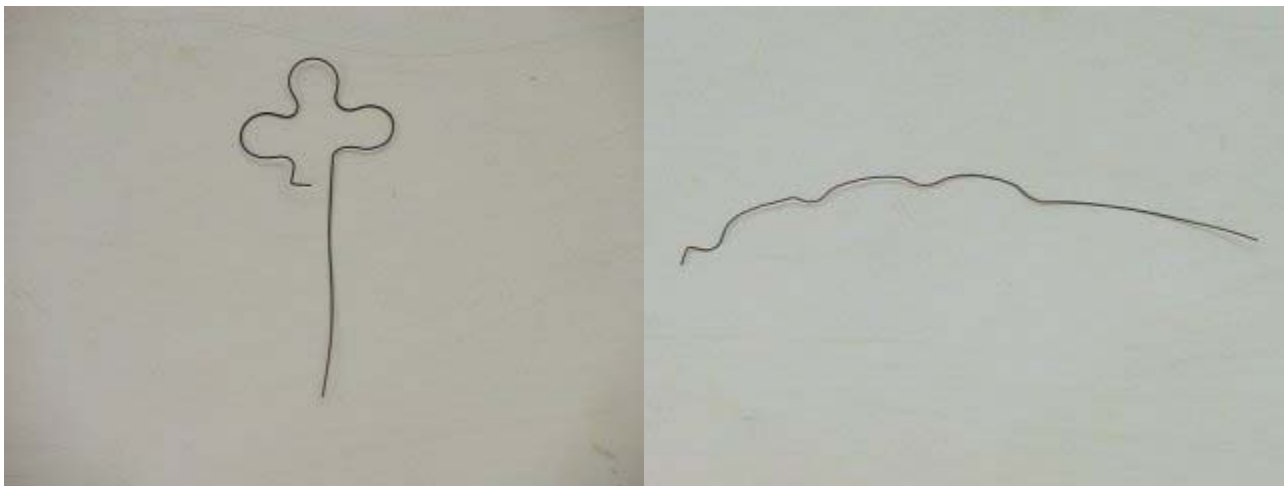
Answer #318

Part 1: The answer is (c): the wire will remain at rest, as seen in an mpeg video by clicking your mouse on the photograph below.



Part 2: The answer is (c): start the wire moving either direction, as seen in two videos by clicking your mouse on either clockwise or counterclockwise. In order to understand why the memory wire behaves in this manner, we should describe what it does.

Memory wire is prepared by heating it and forming it into some specific configuration, then allowing it too cool in that configuration. After it is cooled, it remains in its original configuration. However, it can be smoothly bent into other configurations, such as the clover shown in the two photographs below.



The clover is formed, as seen at the left, then stretched into more of a straight wire, as seen at the right. When it is heated, as seen by clicking your mouse on the photograph at the right, it returns to its original shape.

The original shape of the thermobile wire is straight, so when it is heated it will attempt to return to that shape, which in fact is its shape in the regions between the pulleys. When the lower pulley is inserted into the warm water, because it is symmetric it does not move, except if it has a flaw that

unbalances the forces on the two sides of the lower pulley. (Note that this does happen regularly because the wire tends to get bent and twisted when the device is handled.) When it is started into motion in *either* direction, the segment of the wire that is leaving the lower pulley will attempt to straighten, creating the force that then keeps it in motion.

Memory wire has interesting applications in space, where the effective gravitational field is negligible. Antennas, large solar reflectors, and other large frames can be constructed using memory wire and their geometry fixed in the fabrication process. They are then packed tightly, and released in space, where the heat from the sun causes them to expand to their desired size and shape. Because there is no gravity, the force on such structures is mimimal, and they will retain their shape almost indefinitely.

Question of the Week

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