Answer #337

The answer is (b): the water stream will deflect in the same direction, as seen in an mpeg video by clicking your mouse on the photograph below.

There are two common explanations for this phenomenon: (1) *Polarization:* The charged rod creates a non-uniform electric field in the vicinity of the water stream. Water molecules, being *polar*, rotate in the non-uniform electric field with the charge opposite to that of the rod closer to the rod. The molecules thereby experience a net force toward the rod, pulling the water stream toward the rod. This force is attractive whether the rod is either positively or negatively charged. (2) *Induction:* Due to the very small conductivity of the water, the charged rod *induces* the opposite charge into the water in the region of the rod, so the water experiences a net force toward the rod. The force is attractive whether the rod is either positively or negatively charged.

If the net charge induced on the rod according to the *induction* theory is about one electron per water molecule, the force due to induction is many orders of magnitude greater than the *polarization* force. Further, carefully collecting the water in an electrically isolated container verifies that the water has a net charge. This leads one to the conclusion that, although the polarization effect may be real, the induction effect is clearly the reason why this experiment works.

See the demonstration J4-11: POLAR AND NONPOLAR LIQUIDS for further discussion of how and why this phenomenon occurs.

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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.