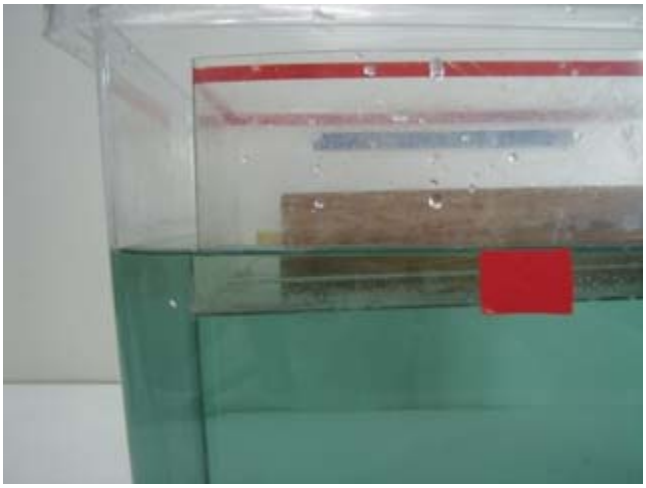
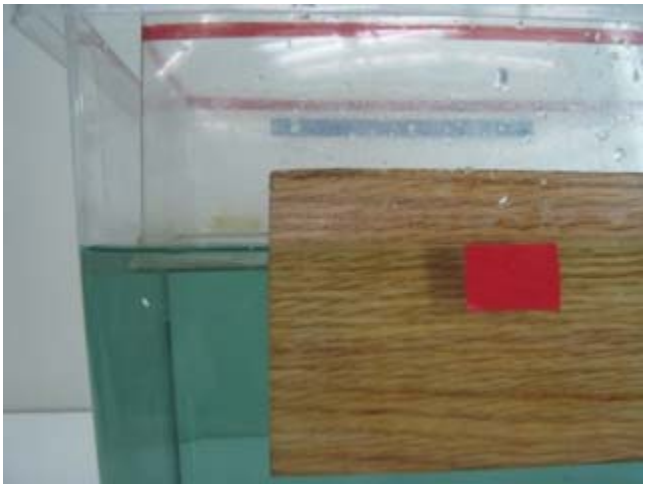
Answer #348

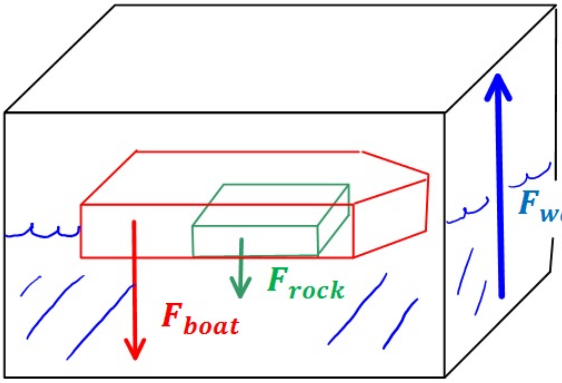
The answer is (c); the water level in the pond will remain the same as seen in the photograph at the right below. The original photograph with the rock *in* the boat is shown at the left for comparison.

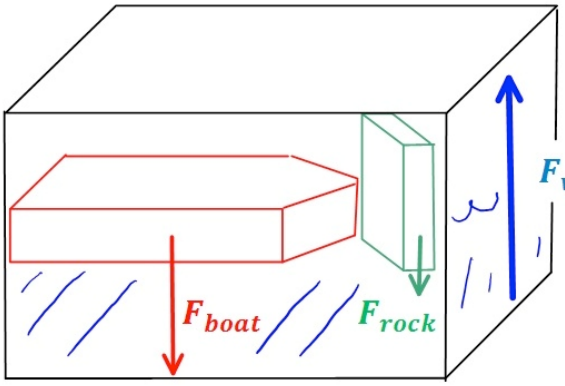
Since the "rock" (a piece of fine oak) is less dense than water, the object will float when tossed into the pond. Rather than the wood floating inside the boat, the two are floating side by side -- but both the rock and the boat are *still* floating. Therefore, the height of the water level will remain unchanged.

Free body diagrams work wonders in these situations. The force exerted on the water when the rock is inside the boat is the *(weight of the boat + weight of the rock)*. When the rock is tossed into the pond, both the boat and rock are still pushing on the water with the same force, since they are still floating; they are still *buoyant*.

Free Body Diagram
Rock in Boat



Free Body Diagram
Rock out of Boat



So whether the boat-and-rock-combined push on the water (as is before) or whether the boat and rock push on the water separately (as is after), the fact is the two still push on the water. It is this push that determines the water level, and with the push unchanged, the water level remains unchanged as well. This is the statement of Archimedes Principle.

As an alternative explanation, picture for example a "boat" comprised of two 2x4 wooden blocks stacked upon each other. If the top piece of wood is tossed aside into the pond, so that the two blocks float side by side, the combined force of two 2x4s are pushing on the water. (It is as if we have disassembled the boat, but the entire boat is still floating!) Since the combined force downwards on the water is the same, the floating objects will not displace any more water. Thus the water level will not rise.

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.