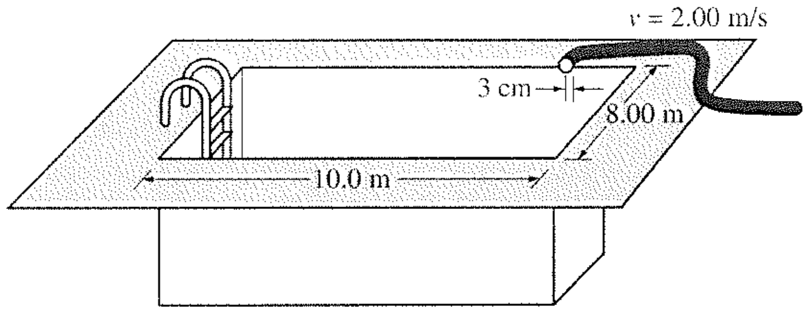
Fluids Review FR.



Note: Figure not drawn to scale.

2. (12 points, suggested time 25 minutes)

   Water flows at a speed v of 2.00 m/s through a hose of radius 3 cm and into a large empty rectangular pool. The pool has a level bottom and measures 10.0 m long by 8.00 m wide. The density of water is $1.00 \times 10^3\ \mathrm{kg/m^3}$ and atmospheric pressure is 1.01×10^5 Pa. Express all numerical answers to the following parts to at least three significant figures.

   (a) Calculate the total pressure exerted downward on the bottom of the pool after the water has been running for 3 hours.

   (b) A small ball is floating in the water as the pool fills. Indicate whether the buoyant force on the floating ball increases, decreases, or stays the same as the amount of water in the pool increases. Briefly explain your reasoning.

GO ON TO THE NEXT PAGE.

(c) A person gets impatient because it is taking too long to fill the pool. The person attaches a nozzle to the end of the hose that reduces the radius of the opening to 1.5 cm. Assume the speed of the water in the hose (before it reaches the nozzle) remains at 2.00 m/s. The person claims that the water now comes out of the nozzle faster than it did from the hose without the nozzle and therefore the pool will fill faster.

i. Do you agree that the pool will fill faster? Explain your reasoning in terms of conservation principles.

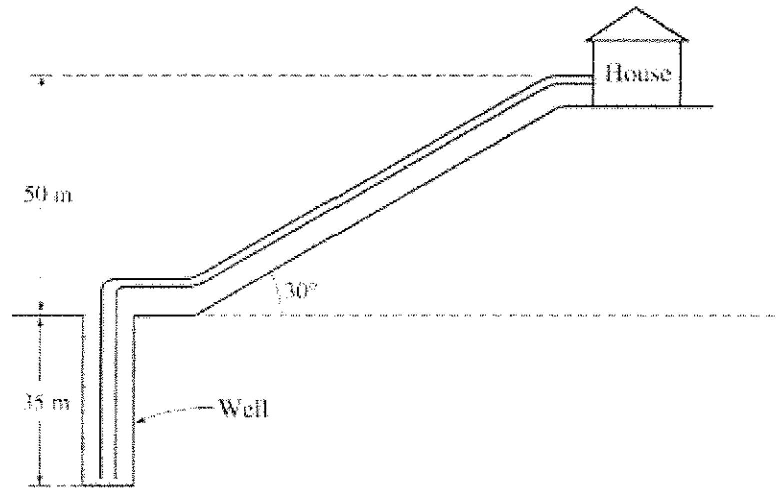
ii. Calculate the speed of the water as it leaves the nozzle. Explain how your calculation is consistent with the conservation principles used in part (c)(i).

(d) When the water in the pool is 1.50 m deep, the hose is turned off. A person who is 1.80 m tall then floats in the pool.

i. Is the net downward force exerted on the bottom of the pool now greater than, less than, or the same as it was before the person got into the pool? Explain your reasoning in terms of the forces exerted on the person.

ii. Would your answer to part (d)(i) be different if the person was standing on the bottom of the pool? Explain your reasoning.

(e) Consider the total pressure exerted by the water on the sides of the pool near the bottom of the pool. When the person floats in the pool, is this pressure greater than, less than, or the same as it was before the person got into the pool? Explain your reasoning.



#2 (B2003-B6)

A pump, submerged at the bottom of a well that is 35 m deep, is used to pump water uphill to a house that is 50 m above the top of the well, as shown above. The density of water is 1,000 kg/m^3. Neglect the effects of friction, turbulence, and viscosity.

(a) Residents of the house use 0.35 m^3 of water per day. The day's pumping is completed in 2 hours during the day.

i. Calculate the minimum work required to pump the water used per day

ii. Calculate the minimum power rating of the pump.

(b) In the well, the water flows at 0.50 m/s and the pipe has a diameter of 3.0 cm. At the house the diameter of the pipe is 1.25 cm.

i. Calculate the flow velocity at the house when a faucet in the house is open.

ii. Calculate the pressure at the well when the faucet in the house is open.

Student: ________________ AP Physics B Date _________________

FLUIDS

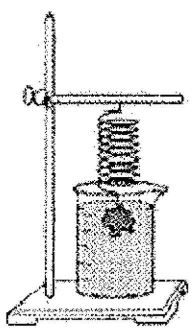
#1 (2002-B6)

In the laboratory, you are given a cylindrical beaker containing a fluid and you are asked to determine the density ρ of the fluid. You are to use a spring of negligible mass and unknown spring constant k attached to a stand. An irregularly shaped object of known mass *m* and density *D* (D >> ρ) hangs from the spring. You may also choose from among the following items to complete the task.

- A metric ruler
- A stopwatch
- String

(a) Explain how you could experimentally determine the spring constant *k*.

(b) The spring-object system is now arranged so that the object (but none of the spring) is immersed in the unknown fluid, as shown. Describe any changes that are observed in the spring-object system and explain why they occur.



(c) Explain how you could experimentally determine the density of the fluid.

(d) Show explicitly, using equations, how you will use your measurements to calculate the fluid density ρ. Start by identifying any symbols you use in your equations.

Symbol	Physical quantity