

Name \_\_\_\_\_

Hour \_\_\_\_\_

AP Physics: Chapter 9  
Fluids

**Question A:**

Leatherback turtles can dive to a depth of about 3000 feet. Assume that the density of sea water is  $1024 \text{ kg/m}^3$  and that the air above exerts a pressure of 101.3 kPa.

- Calculate the absolute pressure at this depth.
- Calculate the total force exerted from above on the  $4.68 \text{ m}^2$  area of the leatherback's shell.

**Question B:**

A 5.0 kg irregularly shaped object is attached to a spring scale and completely submerged in water. The reading on the spring scale is 43.0 N. Calculate the volume of the object.

**Question C:**

A 0.60 kg basketball of radius .075 m is dropped from 10.0 m above the surface of a swimming pool.

- Calculate the buoyant force acting on the basketball as it falls through the water.
- Calculate the maximum depth reached by the basketball below the surface of the water.

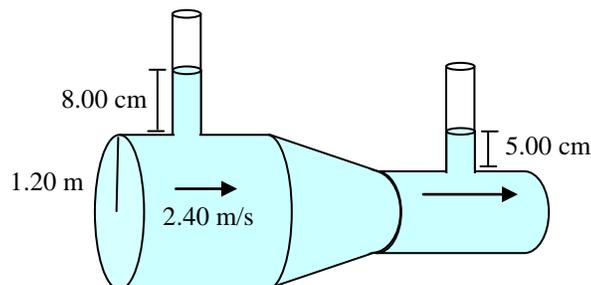
The basketball reaches its maximum depth and floats back to the surface.

- Draw a free body diagram of the forces acting on the basketball when it is below the surface of the water.
- Calculate the net force acting on the basketball when it is below the surface of the water.
- Calculate the time required for the basketball to float from its maximum depth back to the water's surface.

**Question D:**

Water flows with a velocity of 2.40 m/s through the larger portion of the horizontal pipe shown below. The pipe has an initial radius of 1.20 m and then narrows to a smaller radius. The water rises to a level of 8.00 cm above the larger portion of the pipe and to a level of 5.00 cm above the smaller portion of the pipe.

- Calculate the velocity of the water in the narrow section of pipe.
- Calculate the radius of the narrow section of pipe.
- Calculate the volume flow rate of the water through the pipe.



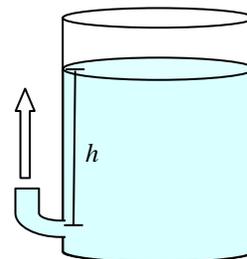
**Question E:**

Water at pressure of  $3.00 \times 10^5 \text{ Pa}$  flows through a horizontal pipe of radius  $r$  at a speed of 1.00 m/s. The pipe then narrows to a radius of  $\frac{1}{4} r$ .

- Calculate the flow speed in the narrow section of pipe.
- Calculate the pressure in the narrow section of pipe.

**Question F:**

The large tank shown at right has a spigot that is directed upwards. The tank is filled with water to a height  $h$  above the spigot and the valve opened, allowing water to spray up into the air. To what height will the stream of water reach before it begins to fall back downwards?



**Question G:**

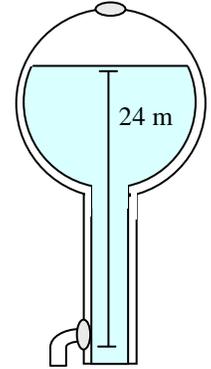
What is the net upward force on an airplane wing of area  $20.0 \text{ m}^2$  if air flows at 300.0 m/s across the top of the wing and 280.0 m/s across the bottom? (Assume an air density of  $1.20 \text{ kg/m}^3$ .)

**Question H:**

Calculate the velocity of hurricane winds that use a force of 92,500 N to lift the  $140 \text{ m}^2$  roof off of a house. Assume that the air density is  $1.29 \text{ kg/m}^3$  and that the air inside the house was at rest.

**Question I:**

A water tower is constructed using a very large tank, filled with water to a height of 24.0 m above a  $.284 \text{ m}^2$  valve. When the valve is closed, the water inside the water tower remains completely at rest. When the valve is open, water flows freely through the valve, but the velocity of the top surface of the water in the tower is negligible.



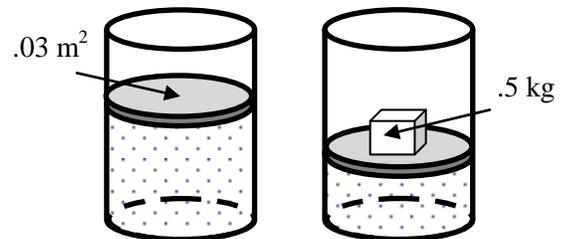
- Calculate the gauge pressure at the valve when it is closed.
- Calculate the force exerted on the valve when it is closed.
- Calculate the velocity at which water flows through the valve when it is open.
- Calculate the volume flow rate of the water through the valve when it is open.

**Question J:**

A stream of water runs out of a faucet, falling straight down with an initial velocity of  $.25 \text{ m/s}$ . How far does the water fall before the radius of the stream is reduced to one-half its initial value?

**Question K:**

A  $.500 \text{ kg}$  mass is used to compress the gas in a piston of cross-sectional area  $.030 \text{ m}^2$ , as shown at right. Determine the added pressure caused by the mass on the gas.

**Question L:**

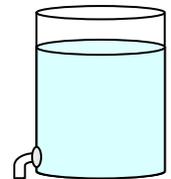
A deep sea diver descends to the ocean floor, 35.0 meters below the surface of the water. The density of the ocean water is  $1025 \text{ kg/m}^3$ .

- Determine the gauge pressure on the diver.
- Determine the absolute pressure on the diver.

**Question M:**

A lead fishing lure weighs  $.0045 \text{ N}$  and has a volume of  $4.0 \times 10^{-7} \text{ m}^3$ . The lure is cast into a fresh water lake.

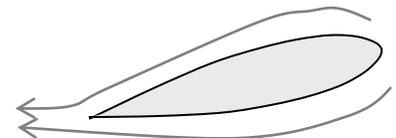
- Calculate the buoyant force acting on the lead fishing lure.
- What is the apparent weight of the fishing lure as it hangs on the fishing line under water?

**Question N:**

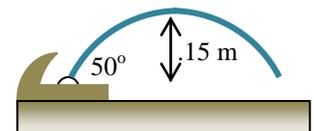
Water leaves the  $1.2 \times 10^{-4} \text{ m}^2$  spout of a cooler with a velocity of  $2.0 \text{ m/s}$ . Determine the flow rate of the spout.

**Question O:**

A model glider uses a  $2.50 \text{ m}^2$  airfoil at an angle to create a pressure difference between the top and bottom surfaces. The glider itself weighs  $48.0 \text{ N}$ . Calculate the required pressure difference to create enough lift to support the glider at a constant altitude.

**Question P:**

A drinking fountain projects water at an initial angle of  $50^\circ$  above the horizontal, and the water reaches a maximum height of  $0.150 \text{ m}$  above the point of exit. Assume air resistance is negligible.



- Calculate the speed at which the water leaves the fountain.
- The radius of the fountain's exit hole is  $4.00 \times 10^{-3} \text{ m}$ . Calculate the volume rate of flow of the water.
- The fountain is fed by a pipe that at one point has a radius of  $7.00 \times 10^{-3} \text{ m}$  and is  $3.00 \text{ m}$  below the fountain's opening. The density of water is  $1.0 \times 10^3 \text{ kg/m}^3$ . Calculate the gauge pressure in the feeder pipe at this point.