

Virtual Lab – Fluid Basics

Fluid Pressure and Flow (1.02)

File Help

Pressure Flow Water

Get PhET Java app: Fluid Pressure and Flow

Pressure 101.305 kPa

Pressure 101.300 kPa

Ruler Grid

Atmosphere

On Off

Units

Metric Atmospheres English

Reset All

Use the first two “scenarios” :

1. Verify the relation $P = P_0 + \rho gh$ for different containers, depths, fluids, gravity, etc.
2. Use the same equation to determine the density of the air in the simulation – realistic?

Drag gauge to measure pressure at any point.

Virtual Ruler – shown here measuring height of the gauge. $P = 101.305$ kPa at $h = 3.17$ m above water surface.

Fluid Density 1000 kg/m³

gasoline water honey

Gravity 9.8 m/s²

low Earth high

3 meters

Fluids Statics – Piston and Cylinder

The simulation window displays a cross-section of a piston and cylinder. A pressure gauge is connected to the cylinder, showing a reading of 101.332 kPa. A vertical scale on the right indicates a height of 4 m. The cylinder contains a fluid with a density of 1000 kg/m³ and is subjected to a gravity of 9.8 m/s². The piston is supported by a 250 kg mass, and the cylinder contains a 500 kg mass and a 250 kg mass. A green box at the bottom right indicates a width of 3 meters. The simulation is titled 'Fluid Pressure and Flow (1.02)' and has tabs for 'Pressure', 'Flow', and 'Water Tower'. A 'PHET' logo is visible in the top right corner.

Use the first third “scenario”. Put masses into the cylinder and observe the effects on the fluid.

1. Verify that $P = F/A$. The force relates to the weight (mg) of the masses. Change F , measure P .
2. Use the same equation to determine the area of the masses. If the masses are cylindrical, is the value for area realistic?

Fluids Dynamics – Flow Rate, Continuity, Bernoulli's Equation

Fluid Pressure and Flow (1.02)

File Help

Pressure Flow Water Tower

Flow Rate: 5000 L/s

Speed: 1.6 m/s

Pressure: 101.302 kPa

Units: Metric

Friction: Flux meter:

Reset All

Leave Friction OFF at first.

Use measurements and calculations to verify flow rate $Q = Av$ for different diameters, flow rates, densities, etc.

Press the big red button to help visualize the flow and streamlines. Repeat with Friction turned ON (simulates the effect of viscosity). How does this affect the flow rate equation $Q = Av$?

Fluids Dynamics – Flow Rate, Continuity, Bernoulli's Equation

Fluid Pressure and Flow (1.02)

File Help

Pressure Flow Water Tower

Flow Rate: 3752 L/s

Speed 4.8 m/s

Speed -

Pressure 101.302 kPa

Pressure 130.656 kPa

Leave Friction OFF at first.

Optional: Try the "Flux meter". Convert to units to m/s. What does this equal?

Measure pressure in the flow – what variables affect it? In what way? Test Bernoulli's equation (make sure Friction is OFF). Measure pressure, speed, height for two different points and verify the relationship. What if friction is turned ON?

Flow Motion Normal

Fluids Dynamics – Torricelli's Theorem

File Help

Pressure Flow Water Tower

Manual Match Leakage

Speed 12.3 m/s

Pressure 101.127 kPa

Speed 100.979 kPa

Pressure 100.979 kPa

Fill

Speed 12.3 m/s

Pressure 101.127 kPa

Speed 100.979 kPa

Pressure 100.979 kPa

Units

Metric English

Hose

Reset All

+ Fluid Density

Experiment with the Hose turned ON. Try shooting water straight up and at an angle. How can you show that the simulated values are accurate?

Test Torricelli's Theorem by measuring height and speed and calculating: $v = \sqrt{2gh}$. This result can be derived from Bernoulli's equation by assuming the speed of the water is zero at the surface inside the tank. Is that assumption being used in the simulation? Devise a way to find out and test it.