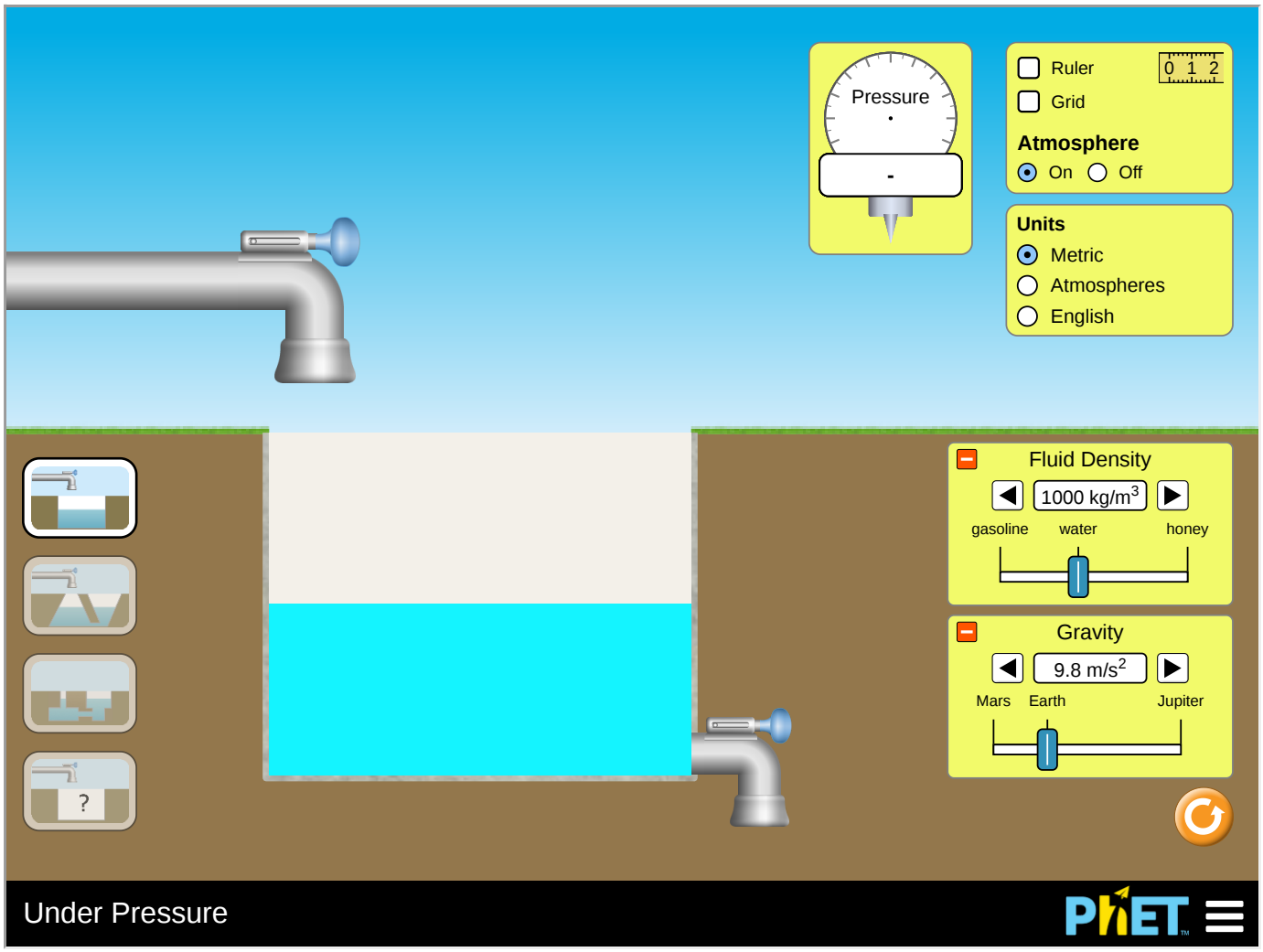
15.4.1: Hydrostatics

Objectives

- Determine the relationship between pressure and depth.
- Determine the relationship between pressure and density.
- Determine the density of an unknown fluid.



Directions for depth dependence

1. Start with the default settings (water density and Earth's gravity).
2. Fill the tank with water by pulling the valve on the spigot.
3. Select “Ruler”, and move the ruler so that zero is the surface.
4. Move the pressure gauge toward the water. Measure the pressure in the water at every 0.50 m from the surface to the bottom. Record your results in a table like the one below. Note that the simulation will give you kPa. Convert to Pa before entering the values on the table.
5. Use Excel or Python, to make a graph of pressure vs depth. We saw in this chapter that pressure can be described $P_1 = P_0 + \rho g h$.
   a. What is the physical meaning of the slope of your graph?
   b. What is the physical meaning of the y-intercept of your graph?
   c. Add a theoretical model to your graph using the equation above.

Depth (m)	Pressure (Pa = N/m^2)
0.5	
1.0	
1.5	

2.0	

Directions for density dependence

1. Now, pick a depth and vary the fluid density from 700 to 1,400 kg/m3. Record your results in a table like the one below. Note that the simulation will give you kPa. Convert to Pa before entering the values on the table.
2. Record your chosen depth.
3. Use Excel or Python, to make a graph of pressure vs density. We saw in this chapter that pressure can be described $P_1 = P_0 + \rho g h$.
    a. What is the physical meaning of the slope of your graph?
    b. What is the physical meaning of the y-intercept of your graph?
    c. Add a theoretical model to your graph using the equation above.

Density (kg/m^3)	Pressure (Pa = N/m^2)
700	
900	
1100	
1300	

Further questions to test

1. How would your two graphs differ if you gathered data from Mars? Jupiter? Explain why. Write a hypothesis and then test it.
2. Click on the icon with the question mark on the sink to access the mystery fluid portion. Determine the density of a mystery fluid. Describe your method and results.
3. Based on your results in this activity, how does the model work for determining the pressure in a fluid?
