

**Orient:** Imagine that you have water vapor in a container where you can control the temperature of the gas. The temperature and pressure axes show possible values of temperature and pressure for 1kg of water vapor.

1. Without pointing to it or marking it, have one member of your group select an arbitrary location (a “state”) on the page.
2. That person should now describe their state in words so that another member of the group can mark it.
3. How many pieces of information do you need to specify the state?

**Coordinate:** Now imagine you did an experiment where you measured the pressure,  $p$  of the water vapor as you varied the temperature,  $T$ , for several fixed values of entropy,  $S$ , and volume,  $V$ , and plotted these curves on the same set of axes. The new contour map shows these plots.

- Locate your state on the new graph.
- Specify your state in as many ways as possible.

**Explore:** Choose a second, nearby state and mark it on the graph. In as many different ways as you can, describe how to get from your old state to your new state.

Can you find a nearby state where the path involves holding one of the thermodynamic variables constant? 2 variables? 3 variables?

**New Representation:** Can you find the states you have been considering on these alternate representations:

1. A rubber sheet that can be stretched and squished so that the  $S$  and  $V$  contours are straight and perpendicular to each other square.
2. A plastic surface whose height represents the internal energy of the system.