**Scenarios:** [If the constraints listed are insufficient to coherently attack the problem, please let me know which constraints must be additionally specified, and then solve for all unique possibilities of that specification. If this is all too much work, let me know if you have any other ideas how I could get this information efficiently]

1. There is some unchanging amount of pressure applied to the top of the piston, which is otherwise free to move. There is perfect insulation on the vessel. 1/60s has passed with the Bunsen burner on blast. [hopefully the small change in t, when accrued over multiple frames is viable] What is the new state?

Assuming:

  A. The initial state is in the liquid region

  B. The initial state is in the two phase region

  C. The initial state is in the vapor region

  (Assume any other given starting info within the constraints listed)

2. Same as 1, except there is a clamp on the piston preventing it from moving.

Assuming:

  A. The initial state is in the liquid region

  B. The initial state is in the two phase region

  C. The initial state is in the vapor region

  (Assume any other given starting info within the constraints listed)

~~3. Same as 1, except there is some insulation (polytropic exponent between 1 and k) wrapping the vessel.  For parts A and B, it will be necessary to specify the amount of heat that is transferred out through the walls.  The polytropic exponent only applies to situations in the superheated vapor region.~~

~~Assuming:~~

~~A. The initial state is in the liquid region~~

~~B. The initial state is in the two phase region~~

~~C. The initial state is in the vapor region~~

~~(Assume any other given starting info within the constraints listed)~~

~~4. same as 2, except there is some insulation (polytropic exponent between 1 and k) wrapping the vessel.  For parts A and B, it will be necessary to specify the amount of heat that is transferred out through the walls.  The polytropic exponent only applies to situations in the superheated vapor region.~~

~~Assuming:~~

~~A. The initial state is in the liquid region~~

~~B. The initial state is in the two phase region~~

~~C. The initial state is in the vapor region~~

~~(Assume any other given starting info within the constraints listed)~~

5. The piston is free to move, with some previously constant amount of pressure applied. You (gently, but instantly) load up the top of the piston with 100Kg. The diameter of the piston is 0.10 m. (The equivalent increase of pressure is 125 kPa) There is no insulation whatsoever on the vessel. The temperature inside the vessel matches that outside the vessel. 1/60s has passed.

Assuming:

  A. The initial state is in the liquid region

  B. The initial state is in the two phase region

  C. The initial state is in the vapor region

  (Assume any other given starting info within the constraints listed)

6. Same as 5, except there is some insulation (polytropic exponent between 1 and k) wrapping the vessel. For parts A and B, it will be necessary to specify the amount of heat that is transferred out through the walls.  The polytropic exponent only applies to situations in the superheated vapor region. Specify final state at time = …

Assuming:

  A. The initial state is in the liquid region

  B. The initial state is in the two phase region

  C. The initial state is in the vapor region

  (Assume any other given starting info within the constraints listed)

7. Same as 5, except there is perfect insulation wrapping the vessel.

Assuming:

  A. The initial state is in the liquid region

  B. The initial state is in the two phase region

  C. The initial state is in the vapor region

  (Assume any other given starting info within the constraints listed)

?. Are there more operations/state transitions you'd be interested in exploring in the game? Would be most helpful if they could be illustrated in not-abstract terms (ie "attach a spigot and release fluid at a rate of x M^3/s")

Same as 1-4 but using a cooling coil instead of the burner.

Same as 5-7 but using the balloon rather than the ingot.

10. Free-moving piston, add or remove heat until piston comes in contact with a stop.  Continue to add or remove heat until P = (some fixed value). (perfect insulation) (Like scenario1 then scenario 2)

  A. The initial state is in the liquid region

  B. The initial state is in the two phase region

  C. The initial state is in the vapor region

11. Free-moving piston, add or remove heat until piston comes in contact with a stop.  Continue to add or remove (some fixed amount of) heat. (like scenario1 then scenario 2)

  A. The initial state is in the liquid region

  B. The initial state is in the two phase region

  C. The initial state is in the vapor region

12. Free-moving piston, initially resting on a stop and P\_inside < P\_outside.  Add (some fixed amount of) heat until and after P\_inside > P\_outside. (scenario 2, then scenario 1)

  A. The initial state is in the liquid region

  B. The initial state is in the two phase region

  C. The initial state is in the vapor region

13. Free-moving piston, initially pushing up against a stop and P\_inside > P\_outside.  Remove (some fixed amount of) heat until and after P\_inside < P\_outside. (scenario 2, then scenario 1)

  A. The initial state is in the liquid region

  B. The initial state is in the two phase region

  C. The initial state is in the vapor region

14. Free-moving piston, no insulation, initially above a stop, add pressure until piston hits the stop. Then remove heat until pressure = final pressure. (scenario 5, then scenario 2)

B. The initial state is in the two-phase region

C. The initial state is in the vapor region

15. Free-moving piston initially above a stop, perfect insulation, add pressure until piston hits the stop. Then remove heat until final pressure = initial pressure. (scenario 7, then scenario 2)

B. The initial state is in the two-phase region

C. The initial state is in the vapor region