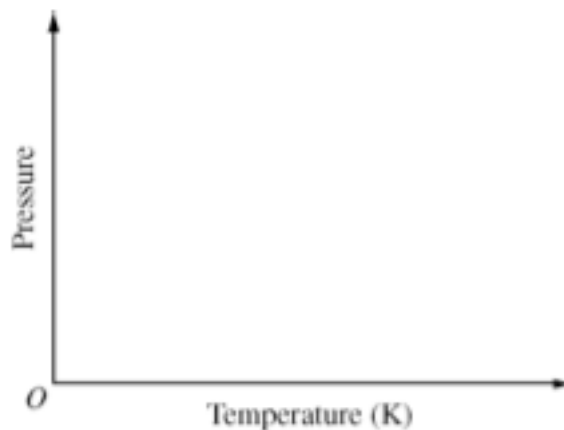


### Thermodynamics Practice Free Response

From AP Physics B, 2012, #4 (10 pt)

A cylindrical container is fitted with a frictionless piston that is initially locked in place. The cylinder contains a fixed amount of an ideal gas that is initially at room temperature and atmospheric pressure.

(a) The cylinder is placed in a hot-water bath. On the axes to the right, sketch a graph of pressure versus temperature for the process the gas undergoes as a result, and indicate the direction of the process on the graph.

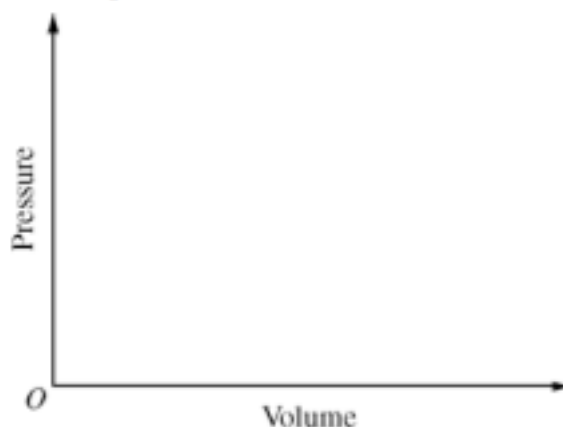


(b) The cylinder is removed from the hot-water bath. After equilibrium is reached, the lock is removed so the piston is free to move. Indicate whether the piston moves up, moves down, or remains stationary.

Moves up       Moves down       Remains stationary

Justify your answer.

(c) When the system is again at equilibrium, the piston is pushed down very slowly. On the axes to the right, sketch a graph of pressure versus volume for the process the gas undergoes as a result, and indicate the direction of the process on the graph. Label this process "C."

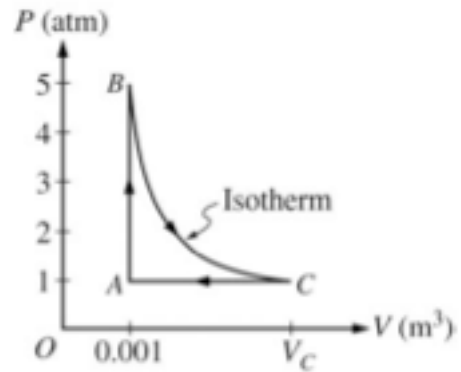


(d) Now the piston is pulled up quickly, so no heat is added to or removed from the gas during the process. On the axes above, sketch a graph of pressure versus volume for the process the gas undergoes as a result, and indicate the direction of the process on the graph. Label this process "D."

**2008 Form A, # 5 (10 pt)**

A 0.03 mol sample of helium is taken through the cycle shown in the diagram to the right.

The temperature of state  $A$  is 400 K.



(a) For each process in this cycle, indicate in the table below whether the quantities  $W$ ,  $Q$ , and  $\Delta U$  are positive (+), negative (-), or zero (0).  $W$  is the work done on the helium sample.

Process	$W$	$Q$	$\Delta U$
$A \rightarrow B$			
$B \rightarrow C$			
$C \rightarrow A$			

(b) Explain your response for the signs of the quantities for process  $A \rightarrow B$ .

(c) Calculate  $V_C$ .