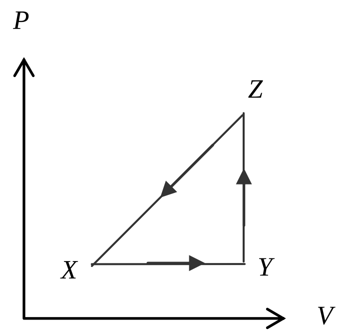
MULTIPLE CHOICE REVIEW: CHAPTERS 10 – 12

1984 – 50. An ideal gas confined in a box initially has pressure P. If the absolute temperature of the gas is doubled and the volume of the box is quadrupled, the pressure is . . .

a. $\frac{1}{8} \cdot P$. b. $\frac{1}{4} \cdot P$. c. $\frac{1}{2} \cdot P$. d. P. e. $2 \cdot P$.

1974 – 51. The hydrogen molecules in a container have the same root mean square velocity as the oxygen molecules in another container. Which of the following conclusions can be drawn?

a. The oxygen gas has the higher temperature.
b. The hydrogen gas has the higher temperature.
c. Both gases are at the same temperature.
d. The oxygen gas has the higher pressure.
e. Both gases are at the same pressure.



A thermodynamic system is taken from an initial state *X* along the path *XYZX* as shown in the *PV* diagram above.

1984 – 33. For the process $X \rightarrow Y$, ΔU is greater than zero and . . .

a. $Q < 0$ and $W = 0$.
b. $Q < 0$ and $W < 0$.
c. $Q > 0$ and $W > 0$.
d. $Q > 0$ and $W = 0$.
e. $Q > 0$ and $W < 0$.

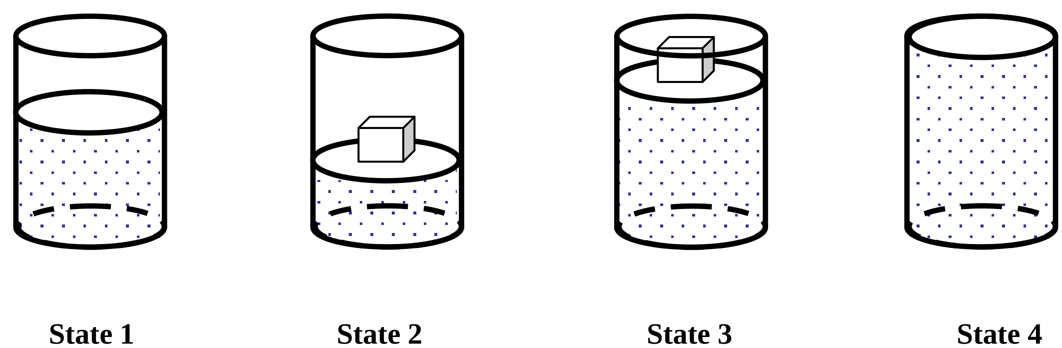
1984 – 34. For the process $Y \rightarrow Z$, Q is greater than zero and . . .

a. $W > 0$ and $\Delta U = 0$.
b. $W = 0$ and $\Delta U < 0$.
c. $W = 0$ and $\Delta U > 0$.
d. $W < 0$ and $\Delta U = 0$.
e. $W < 0$ and $\Delta U > 0$.

Free Response Review: Chapters 10 – 12

1984 – 3. A heating coil is placed in a thermally insulated tank of negligible heat capacity. The tank contains .1 kg of water and .01 kg of ice, both initially at a temperature of 0 °C. The power supplied by the heating coil is 100 Watts. Calculate each of the following quantities.

(a) The heat transferred to the water and ice by the heating coil in time t.
(b) The time t_1 necessary to melt all the ice. *(The latent heat of fusion of ice is 3.34×10^5 J/kg.)*
(c) The additional time t_2 necessary to bring the water to a boil. *(The specific heat of water is 4.19×10^3 J/kg·K.)*



2001 – 6. A cylinder is fitted with a freely moveable piston of area 1.20×10^{-2} m^2 and negligible mass. The cylinder below the piston is filled with a gas. At State 1, the gas has volume 1.50×10^{-3} m^3, pressure 1.02×10^5 Pa, and the cylinder is in contact with a water bath at a temperature of 0 °C. The gas is then taken through the following four-step process.

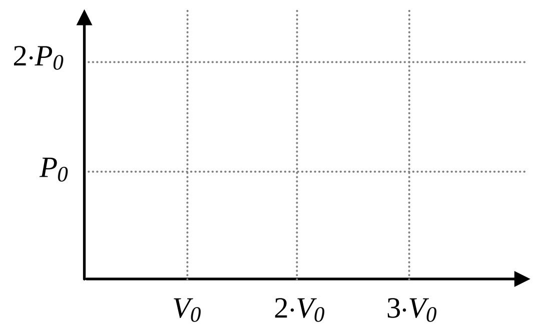
- **A 2.50 kg metal block is placed on top of the piston, compressing the gas to State 2, with the gas still at 0 °C.**
- **The cylinder is then brought in contact with a boiling water bath, raising the gas temperature to 100 °C at State 3.**
- **The metal block is removed and the gas expands to State 4, still at 100 °C.**
- **Finally, the cylinder is again placed in contact with the water bath at 0 °C, returning the system to State 1.**

(a) Determine the pressure of the gas in State 2.
(b) Determine the volume of the gas in State 2.
(c) Indicate whether the process from State 2 to State 3 is isothermal, isobaric, or adiabatic. Explain your reasoning.
(d) Is the process from State 4 to State 1 isobaric? Explain your reasoning.
(e) Determine the volume of the gas in State 4.

1989 – 4. An ideal gas initially has pressure P_0, volume V_0, and absolute temperature T_0. It then undergoes the following series of processes:

I. It is heated, at constant volume, until it reaches a pressure $2 \cdot P_0$.
II. It is heated, at constant pressure, until it reaches a volume $3 \cdot V_0$.
III. It is cooled, at constant volume, until it reaches a pressure P_0.
IV. It is cooled, at constant pressure, until it reaches a volume V_0.

(a) On the axes below:
 i. Draw the $P \cdot V$ diagram representing the series of processes.
 ii. Label each end point with the appropriate value of absolute temperature in terms of T_0.



(b) For this series of processes, determine the following in terms of P_0 and V_0.
 i. The net work done by the gas.
 ii. The net change in internal energy.
 iii. The net heat absorbed.
(c) Determine the heat transferred in terms of P_0 and V_0 during . . .
 i. Process I.
 ii. Process II.
(d) Determine the Carnot efficiency for this series of processes.
(e) Determine the actual efficiency for this series of processes.