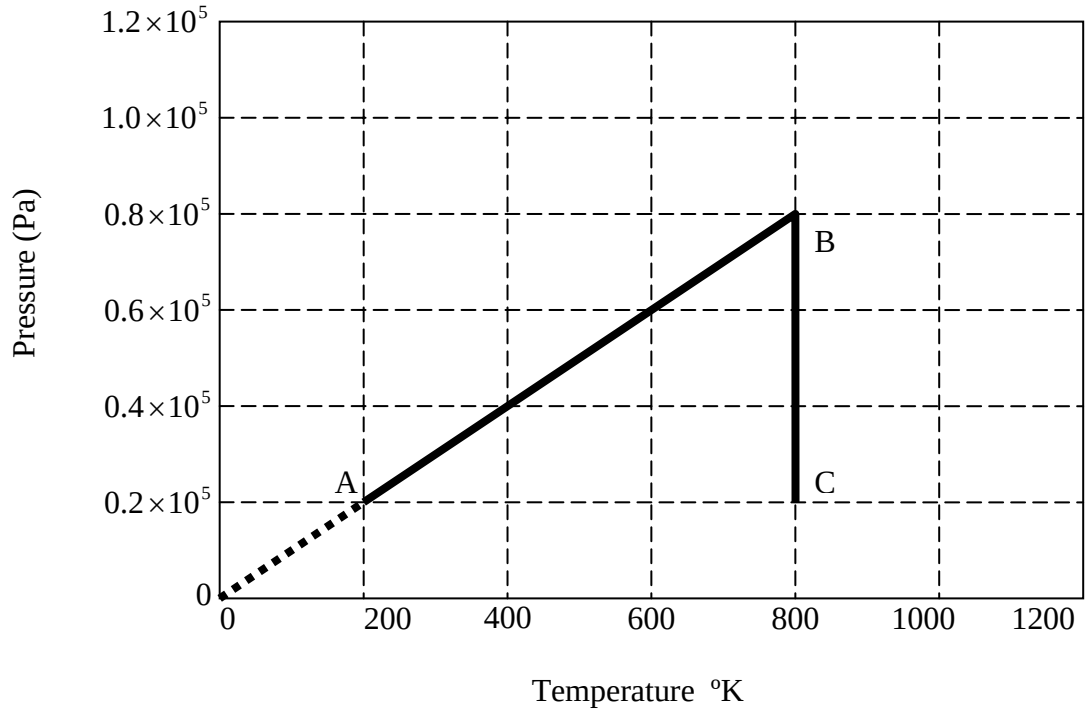
1. Which of the following is true when a box **is sliding down** a frictional slope?
(a) its acceleration increases.
(b) its potential energy increase.
(c) its mechanical energy increases.
(d) its kinetic energy increases.

Answer: d
Note that all forces are constant, it is a constant acceleration process! Don't mistake a as correct answer here.

2. The internal energy of an ideal gas is _____
(a) proportional to the pressure and inversely proportional to the volume of the gas.
(b) independent of the number of moles of the gas.
(c) proportional to the Kelvin temperature of the gas.
(d) dependent on both the pressure and the temperature of the gas.
(e) a constant that is independent of pressure, volume or temperature.

Answer: c
Keep in mind, the internal energy is only characterized by **temperature**, and it is dependent on nothing else! (well, of cause the amount of the gas - the mole number)

In a **closed** ideal gas system, The ideal gas is undergoing two thermal processes: (1) from A to B, then (2) from B to C. Answer following questions.



(a) Identify all processes.
(b) Which point(s), among A, B and C, has the highest temperature?
(c) Which point(s), among A, B and C, has the largest volume?
(d) When (if ever) the gas is doing work to the external world?
(e) When (if ever) the gas is absorbing heat from the external world?

Answer:

(a) process 1 is an isochoric process. process 2 is an isothermal process.

Because we have a closed system, n is hold constant. From the curve A to B, we observed that pressure is proportional to the temperature, which means P/T=constant=nR/V. Therefore, V is constant from A to B.

Because the temperature from B to C is always 800 K, as shown in the graph. Therefore, T is constant from B to C.

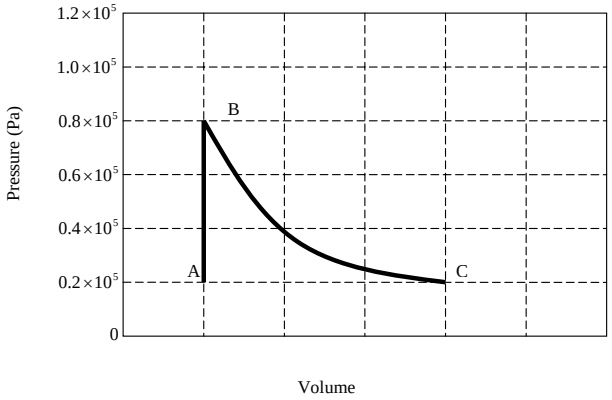
(b)B and C have the same temperature, larger than A.

(From the graph, both B and C has the temperature of 800 Kelvin, which is larger than the temperature of A, 200 K)

(c) C has the largest volume..

From part (a), we know that A to B is an isochoric process, which means they have the same volume. Also from part (a), we know from B to C is isothermal process,

which means PV=nRT=constant. State C has a smaller pressure than that of B, therefore, state C has a larger volume.
(d)Process 2 is doing negative work.(work to external)
We first translate the P-T graph into a P-V graph, as following. Process 1 is isochoric process, which is correspondent to the vertical line A to B and process 2 is isothermal, which will be a curve as shown below.
The work equals to the area underneath the ***P-V*** *curve. Therefore, in process 1, there is no work done. In process 2, there is work. In process 2, the system move from state B to C, whose volume is increasing, therefore, the work is from the gas system to external world.*



(e)Both.
Using equation $\Delta U + W = Q$*, in process 1, temperature goes up,(check back with part b) therefore* $\Delta U > 0$*, and* $W = 0$*, (in part d), so,* $Q > 0$*.*
In process 2, temperature is same (isothermal), $\Delta U = 0$*, and* $W > 0$*, so* $Q > 0$*.*