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P1)

1. You see the white smoke when you open a bottle of champagne because when the cork pops, the gas expands to push the cork, which is work done by the system. There is no time for the Heat to change so U=0. Since internal energy = Q-W, therefore the internal energy is decreased by the work done. Since internal energy is a function of temperature, the temperature drops creating mist aka the white smoke.
2. State Functions covered so far include Mass, pressure, internal energy, temperature, volume, and entropy.
3. The second law of thermodynamics in terms of entropy is or If a process occurs in a closed system, the entropy of the system increases for irreversible processes, and remains constant for reversible processes. It never decreases.
4. A reversible process is one where the change in entropy is 0. If entropy changes, then the process is irreversible as entropy can never decrease.
5. A degree of freedom is an independent way in which the molecule can store energy, mainly translational and rotational.
6. The Equipartition theorem is every kind of molecule has a certain number of degrees of freedom, which are independent ways in which the molecule can store energy. Simply, energy is shared equally amongst all energetically accessible degrees of freedom of a system, and each share is ½ kT.
7. Ranked largest to smallest
8. Engraved upon Ludwig Boltzmann’s tombstone is the equation S= klog(W), where log stands for the natural logarithm and K stands for Boltzmann’s constant

P2)

1. V\_avg =
2. V\_rms =
3. V\_p

P3) Suppose a container is full of oxygen gas and is kept at room temp (300 K). Calculate the fraction of molecules that have speeds between 599 and 601 m/s. Molar Mass M is 0.0320 kg/mol.

P4) Assume 1.0 mol of nitrogen gas is confined to the left of the container, when the valve opens volume doubles. This is irreversible. What is the entropy change of the ideal gas?

P5) Consider a Carnot cycle that fluctuates between the temperatures T\_H =850 K and T\_L =300 K. It performs 1.2 kJ of work each cycle. The duration of the cycle is 0.25s. What is the entropy change of the working substance due to energy delivered from the high temperature reservoir? And from the low-temperature reservoir?

Efficiency

P6) Construct a table for eight molecules

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Label | N\_1 | N\_2 | Multiplicity W | Calculation of W | Entropy 10^-23 J/K |
| I | 8 | 0 | 1 | 8!/(8! 0!) =1 | 0 |
| II | 7 | 1 | 8 | 8!/(7! 1!)=8 | 2.87 |
| III | 6 | 2 | 28 | 8!/(6! 2!)= 28 | 4.60 |
| IV | 5 | 3 | 56 | 8!/(5! 3!)=56 | 5.55 |
| V | 4 | 4 | 70 | 8!/(4! 4!)=70 | 5.86 |
| VI | 3 | 5 | 56 | 8!/(3! 5!)=56 | 5.55 |
| VII | 2 | 6 | 28 | 8!/(2! 6!)=28 | 4.60 |
| VIII | 1 | 7 | 8 | 8!/(1! 7!)=8 | 2.87 |
| IX | 0 | 8 | 1 | 8!/(0! 8!)=1 | 0 |