Adiabatic and Isothermal Expansion/Compression of an Ideal Gas

Thermodynamics

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College of the Atlantic.

1. One mole of an ideal gas is isothermally compressed from a pressure of 3 atmosphere to a pressure of 10 atmospheres. Assume the process takes place at room temperature (300K). How much work must one do on the gas to achieve this compression?

2. You have an unopened bottle of Unicorn Kisses polar seltzer. (See Fig. 1.) There is a small amount of gas in the top of the bottle. Denote by V the volume of this gas. (This gas is mostly CO_2, which has 5 degrees of freedom.) The pressure in the bottle is 3 atmospheres. You open the seltzer, which is at room temperature, and the gas very quickly expands:

   (a) What is the volume of the gas after it expands?

   (b) What is the temperature of the gas after it expands?

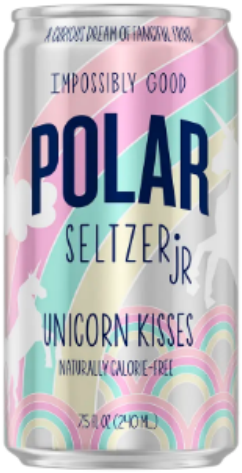

Figure 1: A can of Polar Unicorn Kisses Seltzer. "A mythic sparkling seltzer recipe that is full of fruity goodness and no weirdness (like sugar, sweeteners, or actual unicorns)." Figure source: `https://polarseltzer.com/seltzerjr/`.