

Ch 18 Heat & 1st Law of Thermodynamics

Season 1 Episode 5 - CONSERVACION DE ENERGIA

In this episode of LARC Physics 3B, we're going to . . .

- Praise **Conservation of Energy** as our lord & savior in the upcoming midterm.

Guided Practice

A 1.0 L volume of air, initially pressurized at 3.5 atm, is allowed to expand isothermally until the pressure reaches 1.0 atm. It is then compressed at constant pressure to its initial volume, and lastly is brought back to its original pressure by heating at constant volume.

- (i) Draw the process on a PV-diagram, making sure to label all pressure & volume quantities.
- (ii) Find the work done when the gas is compressed.
- (iii) Find the heat gained by the gas in the last process.

Answer: (ii) $W = 250 \text{ J}$ (iii) $Q = 375 \text{ J}$

Breakout-Room Activity

A hot 0.40 kg iron horseshoe is dropped into 1.05 L of water in a 0.30 kg iron pot initially at 20 °C. If the final equilibrium temperature is 25 °C, what was the initial temperature of the horseshoe.

Useful info: $c_{\text{iron}} = 450 \text{ J/kg}^\circ\text{C}$ and $c_{\text{water}} = 4186 \text{ J/kg}^\circ\text{C}$

Hint: How many objects are there in the system?

Answer: $T = 150^\circ\text{C}$

Breakout-Room Activity

A bicycle pump is a cylinder 22 cm long and 3.0 cm in diameter. The pump contains air at 20 °C and 1.0 atm. If the outlet at the base of the pump is blocked and the handle is pushed in very quickly, compressing the air to half of its original volume, how hot does the air in the pump become?

NOTE: Since this process occurs very rapidly, you may assume it is adiabatic. Also, air is made of mostly N₂ and O₂ which are diatomic molecules, so $\gamma = C_P/C_V = 7/5 = 1.4$

Answer: $T = 387^\circ\text{K}$ or 114°C