You want to raise the temperature of a fixed amount of gas using the smallest amount of heat. Should you use a process that keeps the gas at constant volume or a process that keeps the gas at constant pressure?

What is required to keep a gas at constant pressure?

The gas should be kept at a constant pressure because keeping constant volume while the gas is expanding from being heated will cause the gas to do more work on the container by increasing pressure. The more work the gas does, the less energy the gas will have and so it will take more heat to raise the temperature.

How much work is done by a gas at constant volume? None!

Constant volume. This is because when volume changes work is being done so energy is being used to do work. Whereas if there is no volume change then no work is being done so all the energy is being used to raise the temperature.

The difference specific heat capacities reflect this difference

The process that keeps the gas at a constant volume should be used, this is because the specific heat capacity is lower at constant volume than constant pressure. The constant volume is in a fixed state so that all the heat goes to raise temperature and no work is done, compared to the constant pressure that does work while also distributing heat to raise temperature.

Estimate the volume of ordinary air that must be compressed to fill your tires of your car to three times atmospheric pressure. Explain your reasoning.

True, but I wanted an actual numerical value!

Assuming the tire is originally at 1 atm, since volume and pressure are indirectly (dp – "inversely") proportional, the volume needs to be compressed to 1/3 of what it originally was to make the pressure three times the atmospheric pressure.

Stated assumption here is 25 liters. Is that reasonable?

Using the Ideal Gas law, we will compare the initials pressure (P1) and volume (V1) of air with the final pressure (P2) and volume(V2) of air.

$P_1V_1=P_2V_2$

$P_1 = 1$ atm

$P_2 = 3 (P_1) = 3$ atm

$V_2 = 25$ liters

$V_1 = ?$

$P_1V_1=P_2V_2$

$(1\text{atm})(?) =(3\text{ atm}) (25\text{ liters})$

$V_1 = 75$ liters

There would need to be initial 75 liters of air at atmospheric pressure compressed into the volume of the tires to fill the car to three times the atmospheric pressure .

If you know a thermodynamic process is neither isobaric nor isothermal nor isovolumetric, then what kind of process must it be?
a. Isochoric
b. Adiabatic
c. Isolated
d. None of these