

What pressure (atm) will be exerted by a tank of natural gas used for home heating if its volume is 19.6 L at STP and it is compressed to 6.58 L at 24 °C?

Combined Gas Law – Sample Problem ~ Answer KEY

For the following problem,

- Make a data table

$P_1 = 1 \text{ atm (760 torr)}$	$P_2 = ?$
$V_1 = 19.6 \text{ L}$	$V_2 = 6.58 \text{ L}$
$T_1 = 0 \text{ }^\circ\text{C (273 K)}$	$T_2 = 24 \text{ }^\circ\text{C (297 K)}$

- Check units & make necessary conversions

$$24 \text{ }^\circ\text{C} + 273 = 297 \text{ K}$$

- Write gas law equation

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

- Circle required variable

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

- Rearrange equation algebraically to isolate variable required

$$T_2 \times \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \times T_2$$

$$T_2 \times \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{V_2}$$

$$T_2 \times \frac{P_1 V_1}{T_1} = P_2 \quad \longrightarrow \quad P_2 = T_2 \times \frac{P_1 V_1}{T_1 V_2}$$

- Plug in numbers from data table

$$P_2 = 297 \text{ K} \times \frac{1 \text{ atm}}{1} \times \frac{1}{273 \text{ K}} \times \frac{19.6 \text{ L}}{6.58 \text{ L}}$$

- Calculate & report answer with correct sf

$$P_2 = 3.24 \text{ atm}$$