COMBINED GAS LAW

EQUATION:

- three laws are combined
  - > Boyle's Law (P,V)
  - > Charles' Law (T,V)
  - > Gay-Lussac's Law (P,T)

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

Jan 27-10:35 AM

COMBINED GAS LAW

TEMPERATURE:

-- ***measured*** in Celsius

-- ***calculated*** in Kelvin

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

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COMBINED GAS LAW

PRACTICE

A bread bag is inflated to a volume of 3.89 L at 111 kPA and 23 C. If the volume drops to 3.05 L at a temp of 4 C, what is the new pressure? (show all work)

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$P_1 = 111$ kPa

$V_1 = 3.89$ L

$T_1 = 23°C + 273 = 296$K

$P_2 = ?$ kPa

$V_2 = 3.05$ L

$T_2 = 4°C + 273 = 277$K

$\frac{111 \cdot 3.89}{296} = \frac{P_2 \cdot 3.05}{277}$

$72262 = P_2 \cdot 3.05 \cdot 296$

$111 \cdot 3.89 \cdot 277 = P_2 \cdot 3.05 \cdot 296$

$\frac{111 \cdot 3.89 \cdot 277}{3.05 \cdot 296} = P_2$

$= 132$ kPa

Jan 27-10:35 AM

COMBINED GAS LAW

PRACTICE

A volume of gas starts at 350 mL, 298 K and 1.5 atm. What is the new volume (in mL) if the temperature decreases to 255 K and the pressure frops ro ~~750 mm~~ Hg? (show all your work)

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$P_1 = 1.5$atm

$V_1 = 350$mL

$T_1 = 298$K

$P_2 = 750$ mm Hg $\times \frac{1\text{ atm}}{760\text{ mm Hg}} = .987$ atm

$V_2 = ?$ mL

$T_2 = 255$K

$\frac{1.5 \cdot 350}{298} = \frac{.987 \cdot V_2}{255}$

$1.5 \cdot 350 \cdot 255 = 298 \cdot .987 \cdot V_2$

$\frac{133875}{294.126} = \frac{294.126 \cdot V_2}{294.126}$

$V_2 = 455.16$mL

$= 460$mL

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$P_1 = 1\,atm$
$V_1 = 3.5\,L$
$T_1 = 273K$
$P_2 = 1.25atm$
$V_2 = 3.0L$
$T_2 = ?\,K$

$$\frac{1 \cdot 3.5}{273} = \frac{1.25 \cdot 3.0}{T_2}$$

$$1 \cdot 3.5 \cdot T_2 = 273 \cdot 1.25 \cdot 3.0$$

$$\frac{3.5 \cdot T_2}{3.5} = \frac{1023.75}{3.5}$$

$$= 292.5$$

$$= 293\,K$$

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