1/5/11

STP standard temperature and pressure

P = 1.00 atm = 101.3 kPa = 760 mmHg = 760 torr
T = 273 K

$K = {}^\circ C + 273$
${}^\circ C = K - 273$

${}^\circ F = \frac{9}{5}{}^\circ C + 32$

${}^\circ C = ({}^\circ F - 32)\frac{5}{9}$

BOYLE'S
$P_1V_1 = P_2V_2$
INVERSE
constant T, n

Charles's
$\frac{V_1}{T_1} = \frac{V_2}{T_2}$
DIRECT
constant = P, n

Gay-Lussac's
$\frac{P_1}{T_1} = \frac{P_2}{T_2}$
DIRECT
constant = V, n

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$ COMBINED GAS LAW

A sample of a gas in a flexible container has a volume of 250 mL at room temperature (21°C) When the container is placed in the freezer, its volume shrinks to 217 mL, What is the celsius temperature in the freezer ?

$P_1 =$
$V_1 = 250\text{mL}$
$T_1 = 294\text{K}$
$P_2 =$
$V_2 = 217\text{mL}$
$T_2 = ?$

$\frac{V_1}{T_1} \times \frac{V_2}{T_2}$ $\frac{V_1T_2}{V_1} = \frac{V_2T_1}{V_1}$

$T_2 = \frac{(217\text{mL})(294\text{K})}{250\text{mL}} = 255\text{K}$
-273
$-18^\circ C$

1/5/11

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$T_2 = \frac{(217\ mL)(294\ K)}{250\ mL} = 255\ K$
-273
$\boxed{-18\ ^\circ C}$

If a rigid 30.0L tank filled with a gas at 22°C and 3.00 atm of pressure is heated to 100°C, what is the new pressure?

$P_1 = 3.00\,atm$
~~$V_1 = 30.0L$~~
$T_1 = 295K$
$P_2 = ?$
~~$V_2 = 30.0L$~~
$T_2 = 373K$

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

$P_2 = \frac{(3.00\,atm)(373K)}{295K} = \boxed{3.79\,atm}$

A 3.00L sample of a gas at STP has its volume increased to 8.00L and its pressure decreased to 500 mmHg. What is the new celsius temperature of the gas?

$P_1 = 760\,mmHg$
$V_1 = 3.00L$
$T_1 = 273K$
$P_2 = 500\,mmHg$
$V_2 = 8.00L$
$T_2 = ?$

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

$T_2 = \frac{(500\,mmHg)(8.00L)(273K)}{(760\,mmHg)(3.00L)}$

$T_2 = 479K$
-273
$\boxed{206°C}$