# Boyles Law ?s (Pressure units too)

1) $P_1 = 99\ kPa$ $\quad P_1V_1 = P_2V_2$

$V_1 = 300\ ml$

$P_2 = 188\ kPa$ $\quad \frac{P_1V_1}{P_2} = \frac{P_2V_2}{P_2}$

$V_2 = ?$

$$\frac{99\ kPa \times 300\ ml}{188\ kPa} = 158\ ml$$

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2) $P_1 = 0.958\ atm$ $\quad P_1V_1 = P_2V_2$

$V_1 = 1\ L$

$P_2 = ?$ $\quad \frac{P_1V_1}{V_2} = \frac{P_2V_2}{V_2}$

$V_2 = 2\ L$

$$\frac{0.958\ atm \times 1\ L}{2\ L} = 0.4194\ atm$$

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3) $P_1 = 1.08\ atm$ $\quad \frac{P_1V_1}{P_2} = V_2$

$V_1 = 145.7\ ml$

$P_2 = 1.43\ atm$

$V_2 = ?$

$$\frac{1.08\ atm \quad 145.7\ ml}{1.43\ atm} = 110\ ml \text{ or } 0.11\ L$$

4) $P_1 = ?$ $\quad P_1V_1 = P_2V_2$

$V_1 = 0.05\ L$

$P_2 = 0.98\ atm$ $\quad \frac{P_1V_1}{V_1} = \frac{P_2V_2}{V_1}$

$V_2 = 4.0\ L$

$$P_1 = \frac{0.98\ atm \times 4.0\ L}{0.05\ L} = 78.4\ atm$$

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5) $1\ atm = 101.3\ kPa$

$P_1 = 0.86\ atm \times 101.3\ kPa / 1\ atm = 87.1\ kPa$

$V_1 = 0.22\ L$

$P_2 = 29.2\ kPa$

$V_2 = ?$ $\quad V_2 = \frac{P_1V_1}{P_2} = \frac{87.1\ kPa \times 0.22\ L}{29.2\ kPa}$

$= 0.657\ L$

# Charles Law $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

6) $T_1 = 89°C + 273 = 362\ K$
$V_1 = 0.67\ L$
$T_2 = ?°C$
$V_2 = 1.12\ L$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\quad T_2 \frac{V_1}{T_1} = V_2$

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

$T_2 = \frac{1.12\ L \times 362\ K}{0.67\ L} = 605\ K$

$605\ K - 273 = 332°C$

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7) $V_1 = 3.0\ L$
$T_1 = 80°C + 273 = 353\ K$
$T_2 = 30°C + 273 = 303\ K$
$V_2 = ?$

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

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

$\frac{3.0\ L \times 303\ K}{353\ K} = 2.58\ L$

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8) $V_1 = 0.62\ L$
$T_1 = 25°C = 298\ K$
$T_2 = 273\ K$
$V_2 =$

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

$\frac{0.62\ L \times 273\ K}{298\ K} = 0.57\ L$

# Gay-Lussac's Law $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

a) $P_1 = 125\ kPa$
$T_1 = 30^\circ C = 303\ K$
$P_2 = 201\ kPa$
$T_2 = ?$

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

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

$\frac{201\ kPa \cdot 303\ K}{125\ kPa} = 487\ K$

$487 - 273 = 214^\circ C$

b) $P_1 = 1.88\ atm$
$T_1 = 25^\circ C = 298\ K$
$P_2 = ?$
$T_2 = 37^\circ C + 273 = 310\ K$

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

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

$\frac{1.88\ atm \cdot 310\ K}{298\ K} = 1.96\ atm$

c) $P_1 = 1.12\ atm$ Volume is a misleader!!
$T_1 = ?$
$P_2 = 2.56\ atm$
$T_2 = 36.5^\circ C + 273 = 309.5\ K$

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

$\frac{1.12\ atm \cdot 309.5\ K}{2.56\ atm} = 135.4\ K = -137.6^\circ C$

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

12) $P_1 = 30.7\ kPa$

$T_1 = 0^\circ C = 273\ K$

$P_2 = 28.4\ kPa$

$T_2 = \Delta ?$

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

$$\frac{28.4\ \cancel{kPa}\ 273\ K}{30.7\ \cancel{kPa}} = 252.5\ K$$

$$252.5\ K - 273\ K = 20.5^\circ = \text{change in temp}$$

13) $P_1 = 660\ torr$

$T_1 = 22^\circ C = 295\ K$

$P_2 = ?$

$T_2 = 44.6^\circ C = 317.6\ K$

$$\frac{P_1 T_2}{T_1} = P_2 = \frac{660\ torr\ 317.6\ \cancel{K}}{295\ \cancel{K}} = 711\ torr$$

$$711\ torr - 660\ torr$$

$\Delta P = 51\ torr$ more