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*Content Based*
*Chemical Engineering*

# COMBINED CHARLES' and BOYLE'S GAS LAWS

**REFERENCES:** Marks' Mechanical Engineers Handbook; Perry'S Chemical Engineers Handbook

**LIMITATIONS:** Always begin a new case by retrieving the original file. Direct entry of data in cells that originally contain table lookups could cause functions to be lost, or incorrect calculations. I format cells requiring entry colored **RED**; calculated values are black.

**NOTE:** The form of the equations in the spreadsheet combines Charles' and Boyle's Laws to cover variation of all variables.

1.) To determine a variation in pressure input the following:
- @ cell G9 input the pressure of the initial state
- @ cell G10 input the temperature of the initial state
- @ cell G11 input the temperature of the final state
- @ cell G12 input the volume of the initial state
- @ cell G13 input volume of the final state

2.) The final pressure state is calculated and shown @ D13.

3.) To determine a variation in temperature input the following:
- @ cell G17 input the temperature of the initial state
- @ cell G18 input the pressure of the initial state
- @ cell G19 input the pressure of the final state
- @ cell G20 input the volume of the initial state
- @ cell G21 input volume of the final state

4.) The final temperature state is calculated and shown @ D21.

5.) To determine a variation in volume input the following:
- @ cell G25 input the volume of the initial state
- @ cell G26 input the pressure of the initial state
- @ cell G27 input the pressure of the final state
- @ cell G28 input the temperature of the initial state
- @ cell G29 input temperature of the final state

6.) The final volume state is calculated and shown @ D29.

**Print out using direct Excel commands. This application is provided by Chemical Engineers Resource Website, visit ( cheresources.com for additional selections.**

**Print out using direct EXCEL commands.**



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04/17/04

# COMBINED CHARLES' and BOYLE'S GAS LAWS

Equip: Sulfuric Acid Storage Tank
Gas/Vapor: Unload Compressed Air

**solve for $P_2$....**

$$P_2 := \left(\frac{P_1 \cdot V_1}{V_2}\right) \cdot \frac{T_2}{T_1}$$

$= 13.49375$ psig

| | | |
|---|---|---|
| Press 1: | 20 | psig |
| Temp 1: | 100 | ºF |
| Temp 2: | 100 | ºF |
| Vol 1: | 533 | $ft^3$ |
| Vol 2: | 656 | $ft^3$ |

**solve for $T_2$....**

$$T_2 := \left(\frac{P_2 \cdot V_2}{P_1 \cdot V_1}\right) \cdot T_1$$

$= 99.925515$ ºF

| | | |
|---|---|---|
| Temp 1: | 100 | ºF |
| Press 1: | 20 | psig |
| Press 2: | 13.49 | psig |
| Vol 1: | 533 | $ft^3$ |
| Vol 2: | 656 | $ft^3$ |

**solve for $V_2$....**

$$V_2 := \left(\frac{P_1 \cdot V_1}{P_2}\right) \cdot \frac{T_2}{T_1}$$

$= 175$ $ft^3$

| | | |
|---|---|---|
| Vol 1: | 175 | $ft^3$ |
| Press 1: | 20 | psig |
| Press 2: | 20 | psig |
| Temp 1: | 100 | ºF |
| Temp 2: | 100 | ºF |

04/17/04

# COMBINED CHARLES' and BOYLE'S GAS LAWS

Equip: Sulfuric Acid Storage Tank
Gas/Vapor: Unload Compressed Air

**solve for $P_2$....**

$$P_2 := \left(\frac{P_1 \cdot V_1}{V_2}\right) \cdot \frac{T_2}{T_1}$$

$= 98.1125$ kPa

| | | |
|---|---|---|
| Press 1: | 138 | kPa |
| Temp 1: | 38 | °C |
| Temp 2: | 38 | °C |
| Vol 1: | 15 | meter$^3$ |
| Vol 2: | 18 | meter$^3$ |

**solve for $T_2$....**

$$T_2 := \left(\frac{P_2 \cdot V_2}{P_1 \cdot V_1}\right) \cdot T_1$$

$= 37.824484$ °C

| | | |
|---|---|---|
| Temp 1: | 38 | °C |
| Press 1: | 138 | kPa |
| Press 2: | 98 | kPa |
| Vol 1: | 15 | meter$^3$ |
| Vol 2: | 18 | meter$^3$ |

**solve for $V_2$....**

$$V_2 := \left(\frac{P_1 \cdot V_1}{P_2}\right) \cdot \frac{T_2}{T_1}$$

$= 18.010159$ meter$^3$

| | | |
|---|---|---|
| Vol 1: | 15 | meter$^3$ |
| Press 1: | 138 | kPa |
| Press 2: | 98 | kPa |
| Temp 1: | 38 | °C |
| Temp 2: | 38 | °C |