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Chris Haslego  
President  
Cheresources, Inc.

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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.

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**Print out using direct EXCEL commands.**

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Consistent with GOOD ENGINEERING PRACTICE, the burden rests with the USER of these spreadsheets to review ALL calculations, and assumptions. The USER IS FULLY RESPONSIBLE for the results or decisions based on calculations.

This Spreadsheet Requires MACROS to be ENABLED to ASSURE proper operation. See the Workbook Help Sheet for Additional Instructions on Use.

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COMBINED CHARLES' and BOYLE'S GAS LAWS
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Equip: Sulfuric Acid Storage Tank  
 Gas/Vapor: Unload Compressed Air

**solve for P<sub>2</sub>....**

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

$$= 13.49375 \text{ psig}$$

Press 1:	20	psig
Temp 1:	100	°F
Temp 2:	100	°F
Vol 1:	533	ft <sup>3</sup>
Vol 2:	656	ft <sup>3</sup>

**solve for T<sub>2</sub>....**

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

$$= 99.925515 \text{ °F}$$

Temp 1:	100	°F
Press 1:	20	psig
Press 2:	13.49	psig
Vol 1:	533	ft <sup>3</sup>
Vol 2:	656	ft <sup>3</sup>

**solve for V<sub>2</sub>....**

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

$$= 175 \text{ ft}^3$$

Vol 1:	175	ft <sup>3</sup>
Press 1:	20	psig
Press 2:	20	psig
Temp 1:	100	°F
Temp 2:	100	°F

COMBINED CHARLES' and BOYLE'S GAS LAWS
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Equip: Sulfuric Acid Storage Tank  
 Gas/Vapor: Unload Compressed Air

**solve for P<sub>2</sub>....**

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

$$= 98.1125 \text{ kPa}$$

Press 1:	138	kPa
Temp 1:	38	°C
Temp 2:	38	°C
Vol 1:	15	meter <sup>3</sup>
Vol 2:	18	meter <sup>3</sup>

**solve for T<sub>2</sub>....**

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

$$= 37.824484 \text{ °C}$$

Temp 1:	38	°C
Press 1:	138	kPa
Press 2:	98	kPa
Vol 1:	15	meter <sup>3</sup>
Vol 2:	18	meter <sup>3</sup>

**solve for V<sub>2</sub>....**

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

$$= 18.010159 \text{ meter}^3$$

Vol 1:	15	meter <sup>3</sup>
Press 1:	138	kPa
Press 2:	98	kPa
Temp 1:	38	°C
Temp 2:	38	°C