Req: Find Evolved gas Volume @ STP from one Burned Cell. Based on Test measured numbers (Temp, Press, Vol.)

Given: STP $T_0 = 20°C = 293°K$ $P_0 = 101325\ Pa$

Press V. volume (SW) $= 399.536\ in^3$

Interior Parts —

	1 cc		
Knot Twist (M)	$.427\ in^3$	1	$.427\ in^3$
Wire Conns (SW)	$.457\ in^3$	5	$2.285\ in^3$
C-Clamps (SW)	$.378\ in^3$	2	$.756\ in^3$
18650 Batt. (SW)	$1.079\ in^3$	1	1.079
Hex Standoff (SW)	$.660\ in^3$	1	.660
P-201581-13 (SW)	$.730\ in^3$	1	.730
Burn Block (SW)	$2.162\ in^3$	2	4.324
Chassis (SW)	$5.769\ in^3$	1	5.769
			$16.03\ in^3$

Net Interior Vol. (PV_{NET})

$399.536 - 16.03 = 383.506\ in^3 = .006284537\ m^3$ or

Max Chamber Temp

$T_{max} = 382.6°C + 273 = 655.6°K$

max chamber Press @(T_{max})

$P_{max} = 44.54\ psig = 307092.489\ Pa_{gauge}$

$- 101325.\ Pa$

$205767.489\ Pa$ (absolute)

Find number of moles of gas pre-existing in PV at STP

$P_{0\,abs} = 101325\ Pa$

$T_0 = 20°C = 293°K$

$R = 8.3144621\ \frac{J}{mole\ °K}$

$$n_0 = \frac{P_{0\,abs}\, PV_{Net}}{RT_0}$$

$$= \frac{(.00628453\,7\ m^3)(101325\ Pa)}{(8.3144621)(293°K)}$$

$n_0 = 0.26139$ moles @ STP

Assume: Generated Gas mixes w/ air in PV To Common Chamber Pressure & Temp.

Then

$$T_{max} = \frac{n_0(293°K) + n_1(962.5°C + 273°K)}{n_0 + n_1}$$

($962.5°C$: max cell Temp)

(T_{max}: maximum chamber Atr. Temp)

Re-arranging

$$(655.6°K)(n_0 + n_1) = n_0(293°K) + n_1(1{,}235.5°K)$$

$$(655.6°K)n_0 - (293°K)n_0 = n_1(1235.5°K) - (655.6°K)n_1$$

$$94.78001 = (579.9)n_1$$

then

$$n_1 = \frac{94.7001}{579.9} \qquad n_1 = .16344 \text{ moles}$$

Find the Vol of n_1 @ STP $\quad [P_o V = n_1 R T_o]$

$$V = \frac{n_1 R T_o}{P_o}$$

$$= \frac{(.16344)(8.3144621)(293°K)}{(101325\ Pa)}$$

$$V = .003929604\ m^3$$

$$\boxed{V = 3.929\ \ell}$$

Alternately: Change in Chamber Press & Temp is Contribution of chamber Air (n_0) & Gas generated (n_1)

Then

$$\Delta P\, V_{NET} = (n_0 + n_1) R \Delta T$$

$$(307092\ Pa - 101325\ Pa)(.00628453\ 7) = (n_0 + n_1) R \Delta T$$

$$(205767)(.00628453\ 7) = (n_1 + n_0)(8.3144621)(65.6 - 293)$$

$$0.428931 = (n_1 + .26139)$$

$$\boxed{0.167541 = n_1}$$

@ STP the Volume is:

$$(101325)(V) = (.167541)(R)(293^\circ K)$$

$$V = .00402815\ m^3$$

$$\boxed{V = 4.028\ l}$$