propane

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g) \quad ; \Delta H = -2043\ kJ$$

Calculate the volume of propane gas at 25.0 C and 1.08 atm required to provide 565 kJ of heat using the reaction above.

Start with the 565 kJ of energy required. From the point of view of the chemical reaction, this process is EXOTHERMIC -so we use a NEGATIVE value here: -565 kJ

$$-2043\ kJ = 1\ mol\ C_3H_8$$

$$-565\ kJ \times \frac{1\ mol\ C_3H_8}{-2043\ kJ} = 0.27655\ mol\ C_3H_8$$

Now, find the volume of the propane gas using the ideal gas equation.

$$PV = nRT$$

$$V = \frac{nRT}{P}$$

$n = 0.27655\ mol\ C_3H_8$

$R = 0.08206\ \frac{L\text{-}atm}{mol\text{-}K}$

$T = 25^\circ C = 298.2\ K$

$P = 1.08\ atm$

$$V = \frac{(0.27655\ mol\ C_3H_8)\left(0.08206\ \frac{L\text{-}atm}{mol\text{-}K}\right)(298.2\ K)}{(1.08\ atm)}$$

$$= \boxed{6.27\ L}$$