Gas Laws: Avogadro's law & Combined Gas Law.

1) Calculate the volume occupied by 4.11 kg of methane gas (CH_4) at STP.

convert mols

$$4.11\,kg \times \frac{1000\ g}{1\ kg} \times \frac{1\ mol\ CH_4}{16.04\ g} \times \frac{22.4\ L}{1\ mol} = \boxed{5.74 \times 10^3\ L}$$

2) A sealed can with an internal pressure of 721 torr at 25°C is thrown into an incinerator operating at 755°C. What will be the pressure inside the can?

$P_1 = 721\ torr \quad T_1 = 25^\circ C + 273 = 298\ K$

$P_2 = ? \quad T_2 = 755^\circ C + 273 = 1028\ K.$

$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2} \qquad \frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$P_2 = \frac{P_1T_2}{T_1} = \frac{721\ torr \times 1028\ K}{298\ K} = 2487\ torr = \boxed{3.5 \times 10^3\ torr}$$

3) If a fixed amount of gas occupies $2.53\ m^3$ at a temp. of −15°C and 191 torr, what volume will it occupy at 25°C and 1142 torr?

$V_1 = 2.53\ m^3 \quad T_1 = -15^\circ C + 273 = 258\ K \quad P_1 = 191\ torr.$

$V_2 = ? \quad T_2 = 25^\circ C + 273 = 298\ K. \quad P_2 = 1142\ torr.$

$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2} \qquad V_2 = \frac{P_1V_1T_2}{P_2T_1} = \frac{191\ torr \times 2.53\ m^3 \times 298\ K}{1142\ torr \times 258\ K}$$

$$= 0.4887 = \boxed{0.49\ m^3}$$