Charles's Law Problems

1) **A container holds 50.0 mL of nitrogen at 25° C and a pressure of 736 mm Hg. What will be its volume if the temperature increases by 35° C?**

2) **A sample of oxygen occupies a volume of 160 dm^3 at 91° C. What will be volume of oxygen when the temperature drops to 0.00° C?**

3) **A sample of hydrogen has an initial temperature of 50.° C. When the temperature is lowered to -5.0° C, the volume of hydrogen becomes 212 cm^3. What was the initial volume of the hydrogen in dm^3?**

4) **568 cm^3 of chlorine at 25° C will occupy what volume at -25° C while the pressure remains constant?**

5) **A sample of helium has a volume of 521 dm^3 at a pressure of 75 cm Hg and a temperature of 18° C. When the temperature is increased to 23° C, what is the volume of the helium?**

Solutions

1) P_1 = 736 mm Hg P_2 = 736 mm Hg

V_1 = 50.0 mL V_2 = ?

T_1 = 25° C + 273 = 298 K T_2 = 25° C + 35° C + 273 = 333 K

$V_1/T_1 = V_2/T_2$

$V_2 = V_1 \times T_2/T_1$

V_2 = 50.0 mL x 333 $\cancel{K}$/298 $\cancel{K}$ = 55.9 mL N_2

2) V_1 = 160 dm^3 V_2 = ?

T_1 = 91° C + 273 = 364 K T_2 = 0.00° C + 273 = 273 K

$V_1/T_1 = V_2/T_2$

$V_2 = V_1 \times T_2/T_1$

V_2 = 160 dm^3 x 273 $\cancel{K}$/364 $\cancel{K}$ = 120 dm^3 O_2

3) V_1 = ? V_2 = 212 cm^3

T_1 = 50.° C + 273 = 323 K T_2 = -5.0° C + 273 = 268 K

$V_1/T_1 = V_2/T_2$

$V_1 = V_2 \times T_1/T_2$

V_1 = 212 $\cancel{cm^3}$ x 1 $dm^3/10^3$ $\cancel{cm^3}$ x 323 $\cancel{K}$/268 $\cancel{K}$ = 0.256 dm^3 H_2

4) $V_1 = 568\ cm^3$ $V_2 = ?$

$T_1 = 25°\ C + 273 = 298\ K$ $T_2 = -25°\ C + 273 = 248\ K$

$V_1/ T_1 = V_2/T_2$

$V_2 = V_1 \times T_2/T_1$

$V_2 = 568\ cm^3 \times 248\ \cancel{K}/298\ \cancel{K} = 473\ cm^3\ Cl_2$

5) $P_1 = 75\ cm\ Hg$ $P_2 = 75\ cm\ Hg$

$V_1 = 521\ dm^3$ $V_2 = ?$

$T_1 = 18°\ C + 273 = 291\ K$ $T_2 = 23°\ C + 273 = 296\ K$

$V_1/ T_1 = V_2/T_2$

$V_2 = V_1 \times T_2/T_1$

$V_2 = 521\ dm^3 \times 296\ \cancel{K}/291\ \cancel{K} = 530.\ dm^3\ He$