Samples Ideal Gas Equation SOLUTIONS

1. The number of moles of the gas remains constant, so $\dfrac{P_1V_1}{T_1} = \dfrac{P_2V_2}{T_2}$

$\therefore\ T_2 = P_2V_2 \times \dfrac{T_1}{P_1V_1}$

Here,

$P_1 = 68.1\text{kPa}$	$P_2 = 45.4\text{kPa}$
$V_1 = 6.70 \times 10^{-3}\text{m}^3$	$V_2 = 10.86 \times 10^{-3}\text{m}^3$
$T_1 = 11°\text{C} + 273 = 284\text{K}$	$T_2 =?$

So $T_2 = \dfrac{45.4\text{kPa} \cdot 10.86 \times 10^{-3}\text{m}^3 \cdot 284\text{K}}{68.1\text{kPa} \cdot 6.70 \times 10^{-3}\text{m}^3} = 307\text{K}$

and converting this to Celsius gives $T_2 = 307\text{K} - 273 = 34°\text{C}$

2. The number of moles of the gas remains constant, so $\dfrac{P_1V_1}{T_1} = \dfrac{P_2V_2}{T_2}$

$\therefore\ V_2 = \dfrac{P_1V_1}{T_1} \times \dfrac{T_2}{P_2}$

Here,

$P_1 = 56.5\text{kPa}$	$P_2 = 60.2\text{kPa}$
$T_1 = 6°\text{C} + 273 = 279\text{K}$	$T_2 = 10°\text{C} + 273 = 283\text{K}$
$V_1 = 13.70 \times 10^{-3}\text{m}^3$	$V_2 =?$

So $V_2 = \dfrac{56.5\text{kPa} \cdot 13.70 \times 10^{-3}\text{m}^3 \cdot 283\text{K}}{279\text{K} \cdot 60.2\text{kPa}} = 13.04 \times 10^{-3}\text{m}^3$

3. The number of moles of the gas remains constant, so $\dfrac{P_1V_1}{T_1} = \dfrac{P_2V_2}{T_2}$

$\therefore\ V_2 = \dfrac{P_1V_1}{T_1} \times \dfrac{T_2}{P_2}$

Here,

$P_1 = 29.2\text{kPa}$	$P_2 = 67.7\text{kPa}$
$T_1 = 33°\text{C} + 273 = 306\text{K}$	$T_2 = 24°\text{C} + 273 = 297\text{K}$
$V_1 = 6.40 \times 10^{-3}\text{m}^3$	$V_2 =?$

So $V_2 = \dfrac{29.2\text{kPa} \cdot 6.40 \times 10^{-3}\text{m}^3 \cdot 297\text{K}}{306\text{K} \cdot 67.7\text{kPa}} = 2.68 \times 10^{-3}\text{m}^3$