Key

Unit 9: Problem Set 2

Directions: Name the gas law used to solve each problem. Then solve by showing the following: formula, assignment of variables, plug in numbers with labels, answer with label.

1. Exactly 10.0 L of O_2 at -25 °C is heated to 100.0 °C. What is the new volume if the pressure is kept constant?

1. $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ Charles

2. $V_1 = 10.0\,L$ $V_2 = x\,L$

$T_1 = -25.0\,°C + 273 = 248\,K$ $T_2 = 100.0\,°C + 273\,K = 373\,K$

3. $\frac{10.0\,L}{248\,K} = \frac{V_2}{373\,K}$

4. $V_2 = 15.0\,L$

2. A gas at a pressure of 501 kPa and a temperature of 25 °C occupies a volume of 5.2 L. When the gas is heated to 100.0 °C the volume increases to 7000 ml. What is the new pressure? Combined

1. $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

2. $P_1 = 501\,kPa$ $P_2 =$

$V_1 = 5.2\,L$ $V_2 = 7000\,ml \times \frac{1\,L}{1000\,ml} = 7.0\,L$

$T_1 = 25.0\,C + 273 = 298\,K$ $T_2 = 100.0\,°C + 273 = 373\,K$

3. $\frac{501\,kPa \cdot 5.2\,L}{298\,K} = \frac{P_2 \cdot 7.0\,L}{373\,K}$

4. (466) or 470 kPa

3. A sample of O_2 with an initial temperature of 50.0 °C and a volume of 105 L is cooled to -25.0 °C. The new pressure is 105.4 kPa and the new volume is 55.0 L. What was the initial pressure of the sample? Combined

1. $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

2. $P_1 = X$ $P_2 = 105.4\,kPa$

$V_1 = 105\,L$ $V_2 = 55.0\,L$

$T_1 = 50.0\,°C + 273 = 323\,K$ $T_2 = -25.0\,°C + 273 = 248\,K$

3. $\frac{X \cdot 105\,L}{323\,K} = \frac{105.4\,kPa \cdot 55.0\,L}{248\,K}$

4. 71.9 kPa

4. The gas in a closed container has a pressure of 3.00×10^2 kpa at 30 °C. What will the pressure be if the temperature is lowered to -172 °C? Gay Lussacs

1. $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

2. $P_1 = 3.00 \times 10^2\,kPa$ or 300 kPa

$T_1 = 30\,°C + 273 = 303\,K$

$P_2 = X$

$T_2 = -172\,°C + 273 = 101\,K$

3. $\frac{3.00 \times 10^2\,kPa}{303\,K} = \frac{P_2}{101\,K}$

4. $P_2 = 100\,kPa$

5. Calculate the volume of a gas (in L) at a pressure of 1.00×10^2 kpa if its volume at 1.20×10^2 kpa is 1.50×10^3 ml. Boyles

① $P_1V_1 = P_2V_2$

② $P_1 = 1.20 \times 10^2$ Kpa

$V_1 = 1.50 \times 10^3$ ml

$P_2 = 1.00 \times 10^2$ Kpa

$V_2 = X$

③ $(1.20 \times 10^2) \times (1.50 \times 10^3 \text{ ml}) = 1.00 \times 10^2 \text{ kpa} \cdot V_2$

④ $V_2 = 1.8 \times 10^3$ ml or 1800 ml

6. A gas with a volume of 4.0 L at 90.0 kpa expands until the pressure drops to .197 atmospheres. What is the new volume if the temperature does not change? Boyles

1. $P_1V_1 = P_2V_2$

2. $P_1 = 90.0$ Kpa

$V_1 = 4.0$ L

$P_2 = .197 \text{ atmo} \times \frac{101.3 \text{ Kpa}}{1 \text{ atm}} = 20.0$ Kpa

$V_2 = X$

3. $90.0 \text{ Kpa} \cdot 4.0 \text{ L} = 20.0 \text{ Kpa} \cdot V_2$

4. $V_2 = 18$ L

7. A gas with a volume of 3.00×10^2 ml at 150.0 ˚C is heated until its volume is 6.00 x 10^2 ml. What is the new temperature in ˚C if the pressure remains constant during the heating process? Charles

① $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

② $V_1 = 3.00 \times 10^2$ ml

$T_1 = 150.0\,°C + 273 = 423$ K

$V_2 = 6.00 \times 10^2$ ml

$T_2 = X$

③ $\frac{3.00 \times 10^2 \text{ ml}}{423 \text{ K}} = \frac{6.00 \times 10^3 \text{ ml}}{T_2}$

④ $T_2 = 846 \text{ K} - 273 = 573\,°C$

8. A sealed cylinder of gas contains nitrogen gas at 7500 mm Hg of pressure and a temperature of 20.0 ˚C. When the cylinder is left in the sun, the temperature of the gas increases to 50.0 ˚C. What is the new pressure of the gas in kpa? Gay Lussacs

① $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

2. $P_1 = \frac{7500 \text{ mm Hg}}{} \Big| \frac{101.3 \text{ kpa}}{760 \text{ mm Hg}} = 1000$ kpa

$T_1 = 20.0\,°C + 273 = 293$ K

$P_2 = X$

$T_2 = 50.0\,°C + 273 = 323$ K

③ $\frac{1000 \text{ kpa}}{293 \text{ K}} = \frac{P_2}{323 \text{ K}}$

④ $P_2 = 1102$ Kpa