Key

Boyle's, Charles's, Gay – Lussac's and Combined Practice Problems

Solve the following problems showing ALL units.

1. Synthetic diamonds can be manufactured at pressures of 6.00×10^4 atm. If we took 2.00 liters of a gas at 1.00 atm and compressed it to a pressure of 6.00×10^4 atm, what would the volume of that gas be?

2. If I have 21 L of gas held at a pressure of 78 atm and a temperature of 700 deg C, what will be the volume of the gas if I decrease the pressure to 45 atm and decrease the temperature to 600 deg C?

3. A sample of helium gas is at 122 kPa and 22 deg C. Assuming constant volume, what will the temperature be when the pressure is raised to 203 kPa?

4. A man heats a balloon in the oven. If the balloon initially has a volume of 0.4L and a temperature of 20 deg C, what will the volume of the balloon be after he heats it to a temperature of 250 deg C?

5. A gas that has a volume of 28 L, a temperature of 45 deg C, and an unknown pressure has its volume increased to 34 L and its temperature decreased to 35 deg C. If I increase its pressure to 1101 torr, what was original pressure?

6. 1.00 L of a gas at STP is compressed to 437 mL. What is the new pressure of the gas? (Careful with units)

7. On hot days, you may have noticed that potato chip bags seem to "inflate", even though they have not been opened. If I have a 250 mL bag at a temperature of 19 deg C, and I leave it in my car, which has a temperature of 60 deg C, what will the new volume of the bag be?

8. At 122 deg C, the pressure of a sample of nitrogen is 1.07 atm. What will the ~~pressure be at 205 deg C,~~ at constant volume?

Temperature be if pressure increases to 10.7 atm

Boyle's, Charles's, Gay-Lussac's & Combined

① $P_1 = 1.00$ atm
$V_1 = 2.00$ L
$P_2 = 6.00 \times 10^4$ atm
$V_2 = ?$

$P_1V_1 = P_2V_2$

$(1.00\text{ atm})(2.00\text{ L}) = (6.00 \times 10^4\text{ atm})(V_2)$

$\boxed{V_2 = 3.00 \times 10^{-4}\text{ L}}$

② $P_1 = 78$ atm
$V_1 = 21$ L
$T_1 = 700 + 273 = 973$ K
$P_2 = 45$ atm
$V_2 = ?$
$T_2 = 600 + 273 = 873$ K

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ or $P_1V_1T_2 = P_2V_2T_1$

$\frac{(78\text{ atm})(21\text{ L})}{973\text{ K}} = \frac{(45\text{ atm})V_2}{873\text{ K}}$

$\boxed{V_2 = 32.7\text{ L}}$

③ $P_1 = 122$ kPa
$T_1 = 22 + 273 = 295$ K
$P_2 = 203$ kPa
$T_2 = ?$

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

$\frac{122\text{ kPa}}{295\text{ K}} = \frac{203\text{ kPa}}{T_2}$

$\boxed{T_2 = 491\text{ K}}$

④ $V_1 = 0.4$ L
$T_1 = 293$ K
$V_2 = ?$
$T_2 = 523$ K

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{0.4\text{ L}}{293\text{ K}} = \frac{V_2}{523\text{ K}}$ $\boxed{V_2 = 0.714\text{ L}}$

$P_1 = ?$

$V_1 = 28\,L$

$T_1 = 45 + 273 = 318\,K$

$P_2 = 1101\ torr$

$V_2 = 34\,L$

$T_2 = 35 + 273 = 308\,K$

$P_1V_1T_2 = P_2V_2T_1$

$P_1(28\,L)(308\,K) = (1101\ torr)(34\,L)(318\,K)$

$\boxed{P_1 = 1380\ torr}$

6) $P_1 = 101.3\ kPa$

$V_1 = 1.00\,L$

$P_2 = ?$

$V_2 = 0.437\,L$

$P_1V_1 = P_2V_2$

$(101.3\ kPa)(1.00\,L) = P_2(0.437\,L)$

$\boxed{P_2 = 231.8\ kPa}$

7) $V_1 = 250\,mL$

$T_1 = 19 + 273 = 292\,K$

$V_2 = ?$

$T_2 = 60 + 273 = 333\,K$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{250\,mL}{292\,K} = \frac{V_2}{333\,K}$

$\boxed{V_2 = 285\,L}$

5) $P_1 = 1.07\ atm$

$T_1 = 395\,K$

$P_2 = 10.7\ atm$

$T_2 =$ ~~338 K~~

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

$\frac{1.07\ atm}{395\,K} = \frac{10.7\ atm}{T_2}$

$\boxed{T_2 = 3950\,K}$