

Combined Gas Law Problems - Solutions

- 1) If I initially have a gas at a pressure of 12 atm, a volume of 23 liters, and a temperature of 200 K, and then I raise the pressure to 14 atm and increase the temperature to 300 K, what is the new volume of the gas?
29.6 L
- 2) A gas takes up a volume of 17 liters, has a pressure of 2.3 atm, and a temperature of 299 K. If I raise the temperature to 350 K and lower the pressure to 1.5 atm, what is the new volume of the gas? 30.5 L
- 3) A gas that has a volume of 28 liters, a temperature of 45 °C, and an unknown pressure has its volume increased to 34 liters and its temperature decreased to 35 °C. If I measure the pressure after the change to be 2.0 atm, what was the original pressure of the gas?
2.51 atm
- 4) A gas has a temperature of 14 °C, and a volume of 4.5 liters. If the temperature is raised to 29 °C and the pressure is not changed, what is the new volume of the gas? 4.74 L
- 5) If I have 17 liters of gas at a temperature of 67 °C and a pressure of 88.89 atm, what will be the pressure of the gas if I raise the temperature to 94 °C and decrease the volume to 12 liters? 136 atm
- 6) I have an unknown volume of gas at a pressure of 0.5 atm and a temperature of 325 K. If I raise the pressure to 1.2 atm, decrease the temperature to 320 K, and measure the final volume to be 48 liters, what was the initial volume of the gas? 117 L
- 7) If I have 21 liters of gas held at a pressure of 78 atm and a temperature of 900 K, what will be the volume of the gas if I decrease the pressure to 45 atm and decrease the temperature to 750 K? 30.3 L
- 8) If I have 2.9 L of gas at a pressure of 5 atm and a temperature of 50 °C, what will be the temperature of the gas if I decrease the volume of the gas to 2.4 L and decrease the pressure to 3 atm? 160 K
- 9) I have an unknown volume of gas held at a temperature of 115 K in a container with a pressure of 60 atm. If by increasing the temperature to 225 K and decreasing the pressure to 30 atm causes the volume of the gas to be 29 liters, how many liters of gas did I start with? 7.41 L

KEY

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

Combined Gas Law Problems

Use the combined gas law to solve the following problems:

- 1) If I initially have a gas at a pressure of 12 atm, a volume of 23 liters, and a temperature of 200 K, and then I raise the pressure to 14 atm and increase the temperature to 300 K, what is the new volume of the gas?

$$\frac{(12 \text{ atm})(23 \text{ L})}{200 \text{ K}} = \frac{(14 \text{ atm})(V_2)}{300 \text{ K}}$$

$$1.38 = 0.04667(V_2)$$

$$V_2 = 29.57 \text{ L}$$

sig figs = 30 L

- 2) A gas takes up a volume of 17 liters, has a pressure of 2.3 atm, and a temperature of 299 K. If I raise the temperature to 350 K and lower the pressure to 1.5 atm, what is the new volume of the gas?

$$\frac{(2.3 \text{ atm})(17 \text{ L})}{299 \text{ K}} = \frac{(1.5 \text{ atm})(V_2)}{350 \text{ K}}$$

$$0.13077 = 0.00429(V_2)$$

$$V_2 = 30.48 \text{ L}$$

sig figs = 3.0 x 10¹ L

- 3) A gas that has a volume of 28 liters, a temperature of 45 °C, and an unknown pressure has its volume increased to 34 liters and its temperature decreased to 35 °C. If I measure the pressure after the change to be 2.0 atm, what was the original pressure of the gas?

$$45^\circ\text{C} = 318 \text{ K}$$

$$35^\circ\text{C} = 308 \text{ K}$$

$$\frac{(P_1)(28 \text{ L})}{318 \text{ K}} = \frac{(2.0 \text{ atm})(34 \text{ L})}{308 \text{ K}}$$

$$0.088(P_1) = 0.22078$$

$$P_1 = 2.51 \text{ atm}$$

sig figs = 2.5 atm

- 4) A gas has a temperature of 14 °C, and a volume of 4.5 liters. If the temperature is raised to 29 °C and the pressure is not changed, what is the new volume of the gas? *[THIS IS A CHARLES' LAW PROBLEM]*

$$14^\circ\text{C} = 287 \text{ K}$$

$$29^\circ\text{C} = 302 \text{ K}$$

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

$$\frac{4.5 \text{ L}}{287 \text{ K}} = \frac{V_2}{302 \text{ K}}$$

$$V_2 = 4.73 \text{ L}$$

sig figs = 4.7 L

- 5) If I have 17 liters of gas at a temperature of 67°C and a pressure of 88.89 atm, what will be the pressure of the gas if I raise the temperature to 94°C and decrease the volume to 12 liters?

$$67^{\circ}\text{C} = 340\text{ K}$$

$$94^{\circ}\text{C} = 367\text{ K}$$

$$\frac{(88.89\text{ atm})(17\text{ L})}{340\text{ K}} = \frac{(P_2)(12\text{ L})}{367\text{ K}}$$

$$4.4445 = 0.0327(P_2)$$

$$P_2 = 135.72\text{ atm}$$

Sig
figs = 140 atm

- 6) I have an unknown volume of gas at a pressure of 0.5 atm and a temperature of 325 K. If I raise the pressure to 1.2 atm, decrease the temperature to 320 K, and measure the final volume to be 48 liters, what was the initial volume of the gas?

$$\frac{(0.5\text{ atm})(V_1)}{325\text{ K}} = \frac{(1.2\text{ atm})(48\text{ L})}{320\text{ K}}$$

$$0.00154(V_1) = 0.18$$

$$V_1 = 116.88\text{ L}$$

Sig
figs = 120 L

- 7) If I have 21 liters of gas held at a pressure of 78 atm and a temperature of 900 K, what will be the volume of the gas if I decrease the pressure to 45 atm and decrease the temperature to 750 K?

$$\frac{(78\text{ atm})(21\text{ L})}{900\text{ K}} = \frac{(45\text{ atm})(V_2)}{750\text{ K}}$$

$$1.82 = 0.06(V_2)$$

$$V_2 = 30.33\text{ L}$$

Sig
figs = 30 L

- 8) If I have 2.9 L of gas at a pressure of 5 atm and a temperature of 50°C , what will be the temperature of the gas if I decrease the volume of the gas to 2.4 L and decrease the pressure to 3 atm?

$$50^{\circ}\text{C} = 323\text{ K}$$

$$\frac{(5\text{ atm})(2.9\text{ L})}{323\text{ K}} = \frac{(3\text{ atm})(2.4\text{ L})}{T_2}$$

$$0.0449 = \frac{7.2}{T_2}$$

$$T_2 = 160.356\text{ K}$$

Sig
figs = 200 K

- 9) I have an unknown volume of gas held at a temperature of 115 K in a container with a pressure of 60 atm. If by increasing the temperature to 225 K and decreasing the pressure to 30 atm causes the volume of the gas to be 29 liters, how many liters of gas did I start with?

$$\frac{(60\text{ atm})(V_1)}{115\text{ K}} = \frac{(30\text{ atm})(29\text{ L})}{225\text{ K}}$$

$$0.522(V_1) = 3.8667$$

$$V_1 = 7.41\text{ L}$$

Sig
figs = 7 L