

Student Practice for Proficiency
Ideal Gas Law Calculations

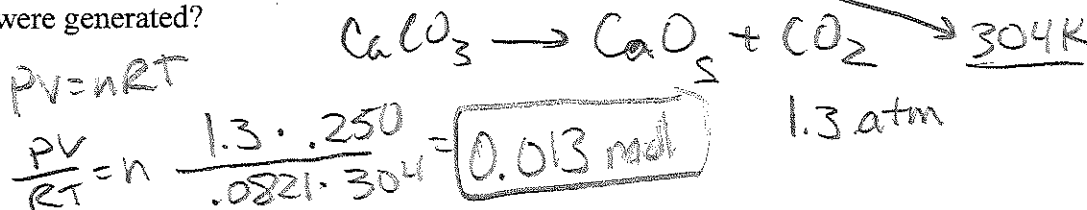
$$37 + 273 = 310$$

$$20 + 273 = 293$$

1. Anesthetic gas is normally given to a patient when the room temperature is 20.0°C and the patient's body temperature is 37.0°C. how would the volume change as a result of this temperature change if the initial volume is 1.60L and the pressure is constant.

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \frac{V_1 T_2}{T_1} = V_2 \quad \frac{1.6L \cdot 310}{293} = \boxed{1.69L}$$

2. Calcium carbonate, $\text{CaCO}_3(\text{s})$ decomposes upon heating to give $\text{CaO}(\text{s})$ and $\text{CO}_2(\text{g})$. A sample of CaCO_3 is decomposed, and the carbon dioxide is collected in a 250mL flask. After the decomposition is complete, the gas has a pressure of 1.3atm at a temperature of 31°C. How many moles of CO_2 gas were generated?



3. The safety air bags in automobiles are inflated by nitrogen gas generated by the rapid decomposition of sodium azide, NaN_3 . $2\text{NaN}_3(\text{s}) \rightarrow 2\text{Na}(\text{s}) + 3\text{N}_2(\text{g})$ If the air bag has a volume of 36L and is to be filled with nitrogen gas at a pressure of 1.15 atm at a temperature of 26.0°C, how many grams of NaN_3 must be decomposed?

$$PV = nRT$$

$$\frac{PV}{RT} = n \quad \frac{1.15 \cdot 36}{.0821 \cdot 299} = \boxed{1.68L} \quad 299K$$

4. The gas pressure in an aerosol can is 1.5atm at 25°C. Assuming that the gas inside obeys the ideal-gas equation, what would the pressure be if the can were heated to 450°C.

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \frac{P_1 T_2}{T_1} = P_2 \quad \frac{1.5 \cdot 723}{298} = \boxed{3.6 \text{ atm}}$$

5. An inflated balloon has a volume of 6.0L at sea level (1atm) and is allowed to ascend in altitude until the pressure is 0.45 atm. During the temperature of the gas falls from 22°C to -21°C. Calculate the volume of the balloon at its final altitude.

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \frac{P_1 V_1 T_2}{T_1 P_2} = V_2 \quad \frac{1.6 \cdot 252}{295 \cdot .45} = \boxed{11.3L}$$

$$35 + 273 = 308$$

6. A sample of argon is trapped in a glass bulb at a pressure of 760torr when the volume is 100mL and the temperature is 35.0°C. The pressure is altered to 720torr;

- a. On a kinetic molecular level, why is the pressure increasing? — more collisions w/ inside wall containing.
- b. What is the new temperature causing this change?
- $$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad T_2 = \frac{T_1 P_2 V_1}{P_1 V_2} \quad \frac{308 \cdot 720 \cdot V_1}{760 \cdot V_2} = 291K (18^\circ C)$$
- $$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$
- $$V = \text{constant}$$