

258. A bubble of carbon dioxide gas in some unbaked bread dough has a volume of  $1.15 \text{ cm}^3$  at a temperature of  $22^\circ\text{C}$ . What volume will the bubble have when the bread is baked and the bubble reaches a temperature of  $99^\circ\text{C}$ ?
259. A perfectly elastic balloon contains  $6.75 \text{ dm}^3$  of air at a temperature of  $40^\circ\text{C}$ . What is the temperature if the balloon has a volume of  $5.03 \text{ dm}^3$ ?
260. Calculate the unknown quantity in each of the following measurements of gases.

$P_1$	$T_1$	$P_2$	$T_2$
a. 0.777 atm	$^\circ\text{C}$	5.6 atm	$192^\circ\text{C}$
b. 152 kPa	302 K	? kPa	11 K
c. ? atm	$-76^\circ\text{C}$	3.97 atm	$27^\circ\text{C}$
d. 395 atm	$46^\circ\text{C}$	706 atm	$^\circ\text{C}$
e. ? atm	$-37^\circ\text{C}$	350. atm	$2050^\circ\text{C}$
f. 0.39 atm	263 K	0.058 atm	? K

261. A 2 L bottle containing only air is sealed at a temperature of  $22^\circ\text{C}$  and a pressure of 0.982 atm. The bottle is placed in a freezer and allowed to cool to  $-3^\circ\text{C}$ . What is the pressure in the bottle?
262. The pressure in a car tire is 2.50 atm at a temperature of  $33^\circ\text{C}$ . What would the pressure be if the tire were allowed to cool to  $0^\circ\text{C}$ ? Assume that the tire does not change volume.
263. A container filled with helium gas has a pressure of 127.5 kPa at a temperature of 290. K. What is the temperature when the pressure is 3.51 kPa?
264. Calculate the unknown quantity in each of the following measurements of gases.

$P_1$	$V_1$	$T_1$	$P_2$	$V_2$	$T_2$
a. 1.03 atm	1.65 L	$19^\circ\text{C}$	0.920 atm	? L	$46^\circ\text{C}$
b. 107.0 kPa	$3.79 \text{ dm}^3$	$73^\circ\text{C}$	? kPa	$7.58 \text{ dm}^3$	$217^\circ\text{C}$
c. 0.029 atm	249 mL	? K	0.098 atm	197 mL	293 K
d. 113 kPa	? $\text{mm}^3$	$12^\circ\text{C}$	149 kPa	$3.18 \times 10^3 \text{ mm}^3$	$-18^\circ\text{C}$
e. 1.15 atm	$0.93 \text{ m}^3$	$-22^\circ\text{C}$	1.01 atm	$0.85 \text{ m}^3$	$^\circ\text{C}$
f. ? atm	$156 \text{ cm}^3$	195 K	2.25 atm	$468 \text{ cm}^3$	585 K

265. A scientist has a sample of gas that was collected several days earlier. The sample has a volume of  $392 \text{ cm}^3$  at a pressure of 0.987 atm and a temperature of  $21^\circ\text{C}$ . On the day the gas was collected, the temperature was  $13^\circ\text{C}$  and the pressure was 0.992 atm. What volume did the gas have on the day it was collected?

266. Hydrogen gas is collected by water displacement. Total volume collected is 0.461 L at a temperature of  $17^\circ\text{C}$  and a pressure of 0.989 atm. What is the pressure of dry hydrogen gas collected?
267. One container with a volume of 1.00 L contains argon at a pressure of 1.77 atm, and a second container of 1.50 L volume contains argon at a pressure of 0.487 atm. They are then connected to each other so that the pressure can become equal in both containers. What is the equalized pressure? Hint: Each sample of gas now occupies the total space. Dalton's law of partial pressures applies here.
268. Oxygen gas is collected over water at a temperature of  $10^\circ\text{C}$  and a pressure of 1.02 atm. The volume of gas plus water vapor collected is 293 mL. What volume of oxygen at STP was collected?
269. A 500 mL bottle is partially filled with water so that the total volume of gases (water vapor and air) remaining in the bottle is  $325 \text{ cm}^3$ , measured at  $20^\circ\text{C}$  and 101.3 kPa. The bottle is sealed and taken to a mountaintop where the pressure is 76.24 kPa and the temperature is  $10^\circ\text{C}$ . If the bottle is upside down and the seal leaks, how much water will leak out? The key to this problem is to determine the pressure in the  $325 \text{ cm}^3$  space when the bottle is at the top of the mountain.
270. An air thermometer can be constructed by using a glass bubble attached to a piece of small-diameter glass tubing. The tubing contains a small amount of colored water that rises when the temperature increases and the trapped air expands. You want a  $0.20 \text{ cm}^3$  change in volume to equal a  $1^\circ\text{C}$  change in temperature. What total volume of air at  $20^\circ\text{C}$  should be trapped in the apparatus below the liquid?
271. A sample of nitrogen gas is collected over water, yielding a total volume of 62.25 mL at a temperature of  $22^\circ\text{C}$  and a total pressure of 97.7 kPa. At what pressure will the nitrogen alone occupy a volume of 50.00 mL at the same temperature?
272. The theoretical yield of a reaction that gives off nitrogen trifluoride gas is 844 mL at STP. What total volume of  $\text{NF}_3$  plus water vapor will be collected over water at  $25^\circ\text{C}$  and a total pressure of 1.017 atm?
273. A weather balloon is inflated with 2.94 kL of helium at a location where the pressure is 1.06 atm and the temperature is  $32^\circ\text{C}$ . What will be the volume of the balloon at an altitude where the pressure is 0.092 atm and the temperature is  $-35^\circ\text{C}$ ?
274. The safety limit for a certain can of aerosol spray is  $95^\circ\text{C}$ . If the pressure of the gas in the can is 2.96 atm when it is  $17^\circ\text{C}$ , what will the pressure be at the safety limit?
275. A chemistry student collects a sample of ammonia gas at a temperature of  $39^\circ\text{C}$ . Later, the student measures the volume of the ammonia as 108 mL, but its temperature is now  $21^\circ\text{C}$ . What was the volume of the ammonia when it was collected?
276. A quantity of  $\text{CO}_2$  gas occupies a volume of 624 L at a pressure of 1.40 atm. If this  $\text{CO}_2$  is pumped into a gas