

Technical Chemistry: Gas Laws

Name: _____

Match each example below with the appropriate gas property it illustrates.

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|--|---------------------------------|
| 1. the fragrance of perfume spreads through the room | a. compressibility |
| 2. smog forms over Atlanta during summer days | b. diffuses through other gases |
| 3. a cylinder of oxygen used in a hospital | c. exerts pressure |
| 4. the shrink wrap demonstration | d. fills container |
| 5. a balloon is inflated with helium | e. has mass |
| 6. a balloon filled with air weighs more than an empty balloon | |

Match the variables used to describe gases to the correct unit.

- | | |
|-----------------------------|----------------|
| _____ 7. kPa | a. pressure |
| _____ 8. °C | b. temperature |
| _____ 9. mL | c. volume |
| _____ 10. K | |
| _____ 11. mm Hg | |
| _____ 12. atmospheres (atm) | |
| _____ 13. L | |
| _____ 14. °F | |

Complete the following statements by writing "decreases," "increases," or "remains the same" on the line provided.

As a gas is compressed in a cylinder

15. its mass _____.
16. the number of gas molecules _____.
17. its pressure _____.
18. its volume _____.
19. the distance between gas molecules _____.
20. its density _____.

21. Boyle's Law states that the pressure of a gas is inversely proportional to its volume. Explain that statement. (Include the correct formula and examples)

Problems

21. A 7.0 liter balloon at room temperature (22°C) contains hydrogen gas. If the balloon is carried outside to where the temperature is -3.0°C , what volume will the balloon occupy?
22. A 5.0 liter tank of oxygen gas is at a pressure of 3 atm. What volume of oxygen will be available if the oxygen is used at standard pressure?
23. A 500 liter volume of helium gas is at a pressure of 750 mm Hg and has a temperature of 300K. What is the volume of the same gas at STP?
24. Nitrogen (80 kPa), oxygen (21.0 kPa), carbon dioxide (0.03 kPa), and water vapor (2.0 kPa) are the usual atmospheric components. What is the total atmospheric pressure in kPa?

Complete the following statements about the nature of gases as presented in the kinetic molecular theory by filling in the appropriate word (s) from the list below.

kinetic energy	no force	perfectly elastic	weak
potential energy	pressure	random motion	zero

25. Gas particles exert _____ on one another.
26. Gas molecules are said to be in _____.
27. The volume of gas particles themselves is said to be _____.
28. The collisions between gas particles are _____.
29. The temperature of a gas is a measure of the average _____ of the gas particles.

Home

Pre-AP Chemistry: Select Gas Law Questions

BOYLE'S LAW

1. 1.00 L of a gas at standard pressure (101.3 kPa) is compressed to $\frac{1}{3}$ mL. What is the new pressure of the gas?
2. In a thermonuclear device, the pressure of 0.050 liters of gas within the bomb casing reaches 4.0×10^7 kPa. When the bomb casing is destroyed by the explosion, the gas is released into the atmosphere where it reaches a pressure of 250 kPa. What is the volume of the gas after the explosion?
3. Synthetic diamonds can be manufactured at pressures of 6.00×10^7 kPa. If we took 2.00 liters of gas at 100 kPa and compressed it to a pressure of 6.00×10^7 kPa, what would the volume of that gas be?
4. The highest pressure ever produced in a laboratory setting was about 2.0×10^7 kPa. If we have a 1.0×10^{-2} liter sample of a gas at that pressure, then release the pressure until it is equal to 30 kPa, what would the new volume of that gas be?

CHARLES' LAW

1. The temperature inside my refrigerator is about 281K. If I place a balloon in my fridge that initially has a temperature of 295K and a volume of 0.5 liters, what will be the volume of the balloon when it is fully cooled by my refrigerator?
2. A man heats a balloon in the oven. If the balloon initially has a volume of 0.4 liters and a temperature of 293K, what will the volume of the balloon be after he heats it to a temperature of 523K?
3. 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 263K, and I leave it in my car which has a temperature of 333K, what will the new volume of the bag be?
4. A soda bottle is flexible enough that the volume of the bottle can change even without opening it. If you have an empty soda bottle (volume of 2 L) at room temperature (25 °C) and put it in your freezer overnight and find the volume of the bottle has become 1.81L, then how cold (°C) is your freezer?

COMBINED LAW

1. I initially have a gas at a pressure of 1200 kPa , a volume of 23 liters , and a temperature of 200 K , and then I raise the pressure to 1400 kPa and increase the temperature to 300 K . What is the new volume of the gas?
2. A gas takes up a volume of 17 liters , has a pressure of 1300 Pa , and a temperature of 299 K . If I raise the temperature to 350 K and lower the pressure to 150 kPa , what is the new volume of the gas?
3. A gas that has a volume of 28 liters , a temperature of 15°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 200 kPa , what was the original pressure of the gas?
4. A gas has a temperature of 29°K , and a volume of 4.5 liters . If the temperature is raised to 302 K and the pressure is not changed ($P_1 = P_2$), what is the new volume of the gas? Which other gas law could answer this?

IDEAL LAW

1. If I have 4 moles of a gas at a pressure of 560 kPa and a volume of 12 liters , what is the temperature?
2. If I have an unknown quantity of gas at a pressure of 120 kPa , a volume of 31 liters , and a temperature of 87°C , how many moles of gas do I have?
3. If I contain 3 moles of gas in a container with a volume of 60 liters and at a temperature of 400 K , what is the pressure inside the container?
4. If I have 7.7 moles of gas at a pressure of 9 kPa and at a temperature of 56°C , what is the volume of the container that the gas is in?
5. If I have 17 moles of gas at a temperature of 67°C , and a volume of 88.89 liters , what is the pressure of the gas?