

44 Gas Problems

ANSWERS

1. At constant temperature, the pressure on 8.0 liters of a gas is increased from 1.0 atm. to 4.0 atm. What will be the new volume of this gas?

$$P_1V_1 = P_2V_2 \quad (1.0 \text{ atm})(8.0 \text{ L}) = (4.0 \text{ atm})(V_2) \quad V_2 = 2.0 \text{ Liters}$$

2. If the pressure on 36.0 milliliters of neon at STP is changed to 0.250 atm. at constant temperature, what will be the new volume of the neon?

$$P_1V_1 = P_2V_2 \quad (1 \text{ atm})(36 \text{ mL}) = (0.25 \text{ atm})(V_2) \quad V_2 = 144 \text{ milliliters}$$

3. The pressure on 200. liters of xenon is decreased at constant temperature from 130. kPa to 120. kPa, what is the new volume of xenon in liters?

$$P_1V_1 = P_2V_2 \quad (130. \text{ kPa})(200. \text{ L}) = (120. \text{ kPa})(V_2) \quad V_2 = 217 \text{ Liters}$$

4. The pressure on 150 milliliters of nitrogen gas at constant temperature is changed from 50.65 kPa to 101.3 kPa. What is the new volume of nitrogen?

$$P_1V_1 = P_2V_2 \quad (50.65 \text{ kPa})(150 \text{ mL}) = (101.3 \text{ kPa})(V_2) \quad V_2 = 75 \text{ milliliters}$$

5. A 114.5 liter sample of oxygen is held at standard temperature while the pressure is changed from normal to just 560. mm of Hg. What is the new volume in liters?

$$P_1V_1 = P_2V_2 \quad (760 \text{ mm Hg})(114.5 \text{ L}) = (560. \text{ mm Hg})(V_2) \quad V_2 = 155 \text{ Liters}$$

6. A sample of gas has a volume of 6.0 liters at 0°C and 50.65 kPa. What will be its volume when the pressure is changed to 101.3 kPa at constant temperature?

$$P_1V_1 = P_2V_2 \quad (50.65 \text{ kPa})(6.0 \text{ L}) = (101.3 \text{ kPa})(V_2) \quad V_2 = 3.0 \text{ Liters}$$

7. The volume of a sample of hydrogen gas at STP is 1.00 liters. As the temperature decreases, the pressure remains constant, the volume of this gas will _____. **To do this, make up an example with some of your own numbers, see how what changes and make a decision.**

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \frac{1.00 \text{ L}}{273 \text{ K}} = \frac{V_2}{223 \text{ K}} \quad V_2 = \frac{223}{273} \quad V_2 = .817 \text{ Liters} \quad \text{volume DECREASES}$$

8. A gas at STP has a volume of 22.4 liters. If the volume is held constant but the temperature changes to 373K, what is the new pressure on this gas? **VOLUME CONSTANT**

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \quad \frac{101.3 \text{ kPa}}{273 \text{ K}} = \frac{P_2}{373 \text{ K}} = 273X = 37784.9 \quad P_2 = 138.4 \text{ kPa}$$

9. A sample of gas occupies 6.00 liters at a temperature of 200K. if the pressure is held constant while the temperature is raised up to 600K, the new volume of gas would be ___?

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \frac{6.00 \text{ L}}{200 \text{ K}} = \frac{V_2}{600 \text{ K}} \quad 200X = 3600 \quad V_2 = 18.0 \text{ Liters}$$

10. A bottle of radon gas fills a 36.0 mL space at standard pressure. If the pressure changes to 0.250 atm what is the new volume on the gas if temperature is 0°C?

$$P_1V_1 = P_2V_2 \quad (1.0 \text{ atm})(36.0 \text{ mL}) = (0.250 \text{ atm})(V_2) \quad \frac{36.0}{0.250} = V_2 \quad V_2 = 144 \text{ mL}$$

11. A sample of gas is at 10.0°C. If pressure remains constant, the volume will increase when the temperature is changed to: 283K or 273K or 293K or 263K? **Make up a volume and temperature and fit them into the formula to see what happens.**

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \frac{100 \text{ L}}{283 \text{ K}} = \frac{V_2}{293 \text{ K}} \quad 29300 = 283X \quad V_2 = 103.5 \text{ L}$$

12. At constant pressure, 205 mL of argon is at 10.0°C is heated to 27.0°C. The new volume of the gas in mL, is equal to ___?

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \frac{205 \text{ mL}}{283 \text{ K}} = \frac{V_2}{300 \text{ K}} \quad 283X = 61500 \quad V_2 = 217.3 \text{ mL}$$

13. hahaha gas law is excellent stuff

14. Under the same conditions of temperature and pressure, which gas would behave most like an ideal gas? **helium**

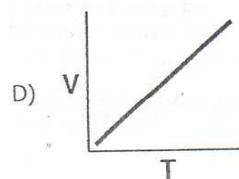
15. Which gas will most closely resemble an ideal gas at STP? **hydrogen**

16. Under what conditions does a real gas behave most like an ideal gas?
A. high temp & low pressure

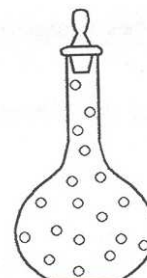
17. **A real gas behaves most like an ideal gas at high temperature and low pressure because it is least likely to turn into a liquid (or solid) when the particles are banging into each other so hard (won't stick together), or when they hardly bump into each other (low pressure).**

18. At constant pressure, which graph shows the correct relationship between the volume of a gas and its temperature?

Volume and Temperature (in Kelvin!) are directly proportional. The graph that shows this is D:



19. **Increase in temp = Increase in KE. That makes the particles have more and stronger collisions leading to greater pressure. Temperature and Pressure are directly proportional.**



20. Equal volumes of sulfur dioxide gas and nitrogen monoxide gas at the same temperature and pressure would have the same **B . number of molecules**
21. Samples of SO₂ and N₂ contain equal numbers of molecules. If the gases are at STP, the samples have **C. equal volumes (Avogadro's Hypothesis backwards)**
22. A sample of H₂ and N₂ at STP contain the same number of molecules. Each sample must have **C. same volume and different mass**
23. A one liter flask of carbon dioxide gas and another one liter flask of hydrogen gas are both at STP. The ratio of the number of molecules of CO₂ to the number of molecules of H₂ in these flasks is: **C. 1:1 Avogadro's Hypothesis again**
24. At STP, 3.0 liters of hydrogen gas and 3.0 liters of helium gas have the same **C. number of particles (are you getting the point here?)**
25. If the pressure on a given mass of gas in an enclosed system is decreased and the temperature remains constant, the volume of the gas will
B. increase **Make up some numbers if you don't "SEE" it already.**

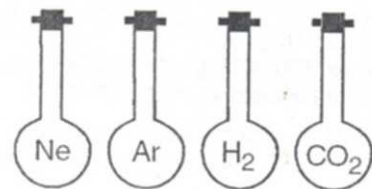
Temp Constant, so $P_1V_1 = P_2V_2$ (1 atm)(22.4 L) = (0.50 atm)(X L) X = 44.8 L
so, the volume of the gas will INCREASE, Pressure and Volume are inversely proportional.

26. The diagram here represents four 500 mL flasks containing the gases neon, argon, hydrogen and carbon dioxide, at STP. Each flask contains the same number of

D. particles

The flasks contain atoms, atoms, molecules, and molecules, in that order.

The only answer that is correct is PARTICLES.



27. When the average kinetic energy of a gaseous system is increased, the average molecular velocity of the system **B. increases and the molecular mass remains the same**
Increasing kinetic energy leads to increased molecular motion, but has no effect on mass.
28. The volume of a given mass of an ideal gas at constant pressure is **D. directly proportional to Kelvin Temp**
29. A gas at STP has a volume of 1.0 liters. If the pressure is doubled and the temperature remains constant, the new volume of the gas will be **C. 0.50 L**
- $P_1V_1 = P_2V_2$ (temp constant) (1 atm)(1.0 L) = (2 atm)(X L) X = 0.50 L
30. As the pressure on a given sample of gas increases at constant temperature, the mass of the sample of gas **C. remains the same (mass not affected by P, V, or T)**

31. **When temperature increases, so does kinetic energy. Higher KE means stronger and more frequent particle collisions. Collisions make the pressure. Temperature and Pressure are directly proportional.**

32. A sample of gas A was stored in a container at 50°C and 0.50 atm. Compared to a gas B, stored at STP, gas A had a: **C. higher temp and lower pressure**
Make a chart and just LOOK

GAS A	GAS B
323 kelvin	273 kelvin
0.50 atm	1.0 atm

33. What pressure, in atmospheres, is equal to 152 kPa?

$$\frac{152 \text{ kPa}}{1} \times \frac{1 \text{ atm}}{101.3 \text{ kPa}} = 1.50 \text{ atm (A)}$$

34. The average kinetic energy of the molecules of an ideal gas is directly proportional to **C. temperature in Kelvin (Temp and KE go hand in hand)**

35. Which change must result in an increase in the average kinetic energy of the molecules of a given sample of nitrogen gas?

A. temperature change from 20 to 30 degrees centigrade (this is hotter. Kelvin is needed for MATH PROBLEMS, this is just which is getting hotter?)

36. When a gas is heated at constant pressure, the average kinetic energy of its molecules **D. increases and the volume of the gas increases**

37. A gas has a pressure of 40.0 kPa, a temperature of 400. Kelvin and a volume of 50.0 mL. What volume will the gas have at a pressure of 20.0 kPa and 200. Kelvin?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \frac{(40.0 \text{ kPa})(50.0 \text{ mL})}{400 \text{ K}} = \frac{(20.0 \text{ kPa})(V_2)}{200 \text{ K}} \quad V_2 = 50.0 \text{ mL}$$

38. A sample of carbon monoxide occupies 15.0 liters at 4.00 atm and 300. Kelvin. What is the new volume of the CO if the pressure changes to 2.00 atm and the temperature is increased to 400. Kelvin?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \frac{(4.00 \text{ atm})(15.0 \text{ L})}{300 \text{ K}} = \frac{(2.00 \text{ atm})(V_2)}{400 \text{ K}} \quad V_2 = 40.0 \text{ L}$$

39. At a temperature of 273K, a 409 mL gas sample has a pressure of 101.3 kPa. If the pressure is changed to 50.65 kPa, at what temperature will the gas sample have a volume of 609 mL?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \quad \frac{(101.3 \text{ kPa})(409 \text{ mL})}{273 \text{ K}} = \frac{(50.65 \text{ kPa})(609 \text{ mL})}{X \text{ Kelvin}} \quad X = 203 \text{ Kelvin}$$

40. A gas has a volume of 1400 mL at 20.0 K and 101.3 kPa. What will be the volume when the temperature changes to 40.0 K and pressure is changed to 50.65 kPa?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \quad \frac{(101.3 \text{ kPa})(1400 \text{ mL})}{20.0 \text{ K}} = \frac{(50.65 \text{ kPa})(V_2)}{40.0 \text{ K}} \quad V_2 = 5600 \text{ mL}$$

41. One reason that a real gas deviates from an ideal gas is that the molecules of a real gas have
D. forces of attraction for each other
42. Which gas under high pressure and low temperature will behave most like an ideal gas?
D. H₂ - Hydrogen is the smallest particle and most likely to behave ideally.
43. **Real gases are not ideal because they do form liquids under low temps and high pressures, and they do have some attraction or repulsion from each other as well.**
44. When a sample of gas is heated at constant pressure, the average kinetic energy of its molecules
D. increases and the volume of the gas increases