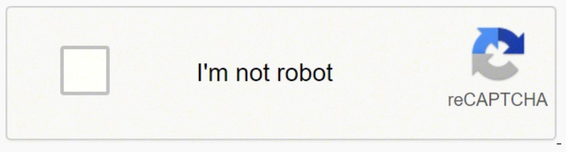

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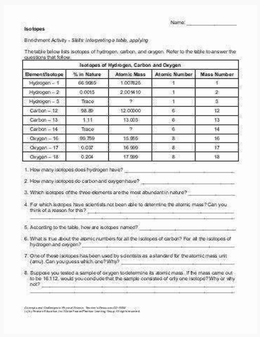


Name: _____

Isotopes

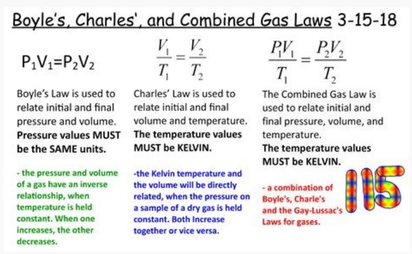
Enrichment Activity – Skills: interpreting a table, applying

The table below lists isotopes of hydrogen, carbon, and oxygen. Refer to the table to answer the questions that follow.

Isotopes of Hydrogen, Carbon and Oxygen

Element/Isotope	% in Nature	Atomic Mass	Atomic Number	Mass Number
Hydrogen – 1	99.9885	1.007825	1	1
Hydrogen – 2	0.0015	2.004410	1	2
Hydrogen – 3	Trace	?	1	3
Carbon – 12	98.89	12.00000	6	12
Carbon – 13	1.11	13.003	6	13
Carbon – 14	Trace	?	6	14
Oxygen – 16	99.759	15.995	8	16
Oxygen – 17	0.037	16.999	8	17
Oxygen – 18	0.204	17.999	8	18

1. How many isotopes does hydrogen have? _____
2. How many isotopes do carbon and oxygen have? _____
3. Which isotopes of the three elements are the most abundant in nature? _____
4. For which isotopes have scientists not been able to determine the atomic mass? Can you think of a reason for this? _____
5. According to the table, how are isotopes named? _____
6. What is true about the atomic numbers for all the isotopes of carbon? For all the isotopes of hydrogen and oxygen? _____
7. One of these isotopes has been used by scientists as a standard for the atomic mass unit (amu). Can you guess which one? Why? _____
8. Suppose you tested a sample of oxygen to determine its atomic mass. If the mass came out to be 16.112, would you conclude that the sample contained of only one isotope? Why or why not? _____



Boyle's, Charles', and Combined Gas Laws 3-15-18

$P_1V_1=P_2V_2$

Boyle's Law is used to relate initial and final pressure and volume. **Pressure values MUST be the SAME units.**

- the pressure and volume of a gas have an inverse relationship, when temperature is held constant. When one increases, the other decreases.

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

Charles' Law is used to relate initial and final volume and temperature. **The temperature values MUST be KELVIN.**

-the Kelvin temperature and the volume will be directly related, when the pressure on a sample of a dry gas is held constant. Both Increase together or vice versa.

$\frac{P_1V_1}{T_1}=\frac{P_2V_2}{T_2}$

The Combined Gas Law is used to relate initial and final pressure, volume, and temperature. **The temperature values MUST be KELVIN.**

- a combination of Boyle's, Charle's and the Gay-Lussac's Laws for gases.

5.) 350.0 liters of argon gas is held at 165°C and 6.64 atm. What temperature will this gas have if it exerts 5.50 atm in a 275.0 liters tank? (3 pts.)

350.0L · 6.64atm / 108°K = 275.0L · 5.50atm / x

163350 = 2324x

x = 70.3°K

6.) 22.0ml of a gas is held at STP. What volume will it occupy at -30.0°C and 570 torr? (3 pts.)

22.0mL · 760torr / 273°K = x · 570torr / 243°K

4662960 = 155610x

26.1mL

7.) 3.266 moles of phosphine gas occupies 25.0 liters at 2440 torr and 300.K. If 1.141 moles of the phosphine gas are lost, what temperature will the gas have to have in order to keep 20.0 liters and a pressure of $3.00x10^3$ torr? (4 pts.)

3.266 − 1.141

25.0L · 2440 / 3266 · 300K = 20.0L · $3.00x10^3$ / 2.125 · x

129625x = 58788000

454°K

181.°C

8.) A sample of a gas has a density of 2.17 g/L at 1.42 atm and 20.0°C. What will the density of this gas be at ~~2.00~~ torr and -30.0°C °C? ★ 881 (4 pts.)

1.42 / 1 = 2.17 / 1

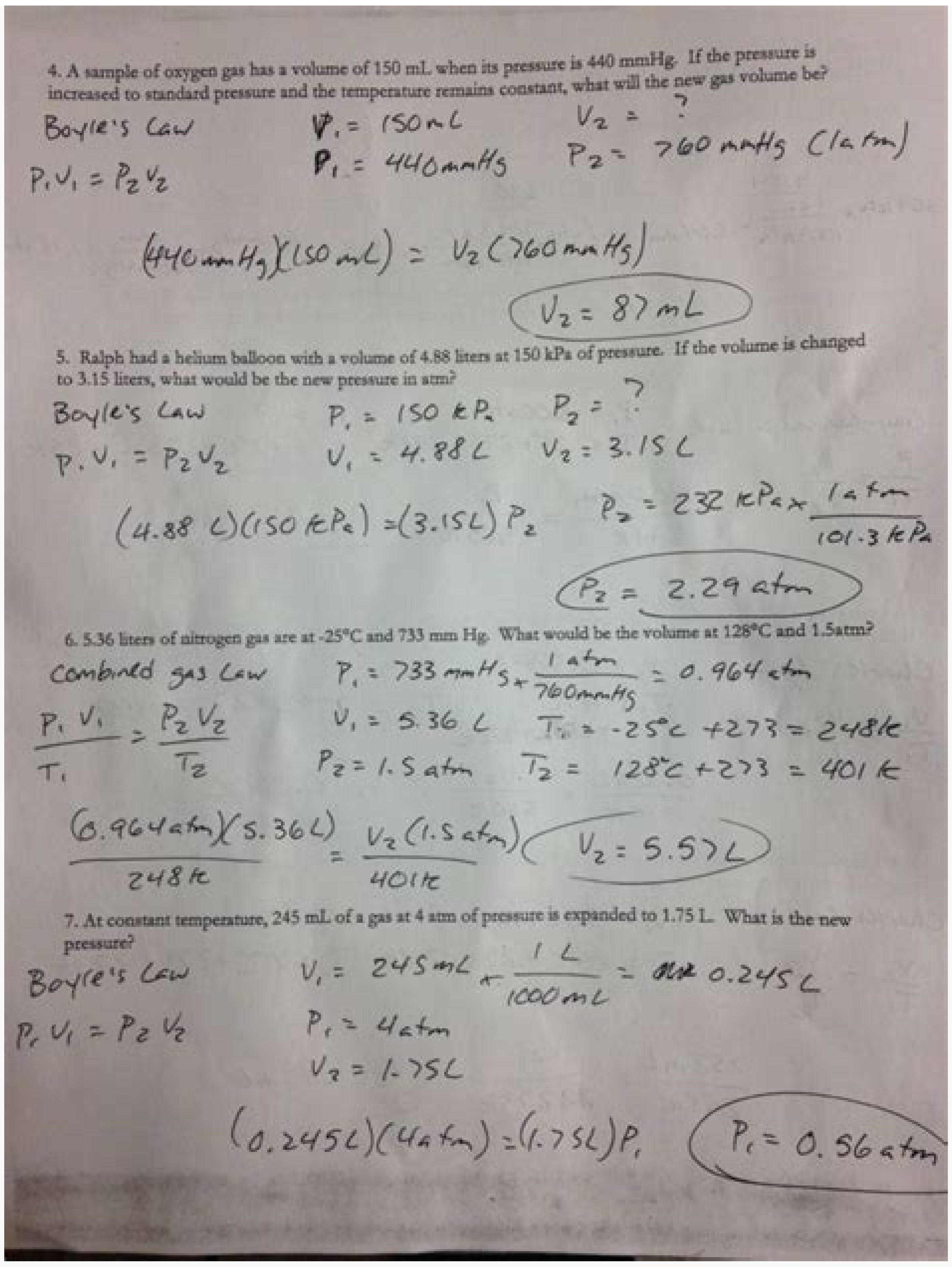
22.4L · 1042 / 1mole · 293 = x · 881 / 1mole · 243

46.608 / 22.57 = 2.14

587301.44 = 258.133x

9.) 400.0 ml of a gas exists at a certain temperature and pressure with moles held constant. What volume (in ml) will this gas occupy if its absolute temperature is reduced by a third and the pressure is doubled? (5 pts.)

400.0ml (T: 1/3)(P: 1/2) = 66.67 mL



4. A sample of oxygen gas has a volume of 150 mL when its pressure is 440 mmHg. If the pressure is increased to standard pressure and the temperature remains constant, what will the new gas volume be?

Boyle's Law
$P_1V_1 = P_2V_2$
$V_1 = 150\ mL$ $\quad V_2 = ?$
$P_1 = 440\ mmHg$ $\quad P_2 = 760\ mmHg\ (1\ atm)$

$(440\ mmHg)(150\ mL) = V_2(760\ mmHg)$

$V_2 = 87\ mL$

5. Ralph had a helium balloon with a volume of 4.88 liters at 150 kPa of pressure. If the volume is changed to 3.15 liters, what would be the new pressure in atm?

Boyle's Law
$P_1V_1 = P_2V_2$
$P_1 = 150\ kPa$ $\quad P_2 = ?$
$V_1 = 4.88\ L$ $\quad V_2 = 3.15\ L$

$(4.88\ L)(150\ kPa) = (3.15\ L)P_2$ $\quad P_2 = 232\ kPa \times \frac{1\ atm}{101.3\ kPa}$

$P_2 = 2.29\ atm$

6. 5.36 liters of nitrogen gas are at -25°C and 733 mm Hg. What would be the volume at 128°C and 1.5atm?

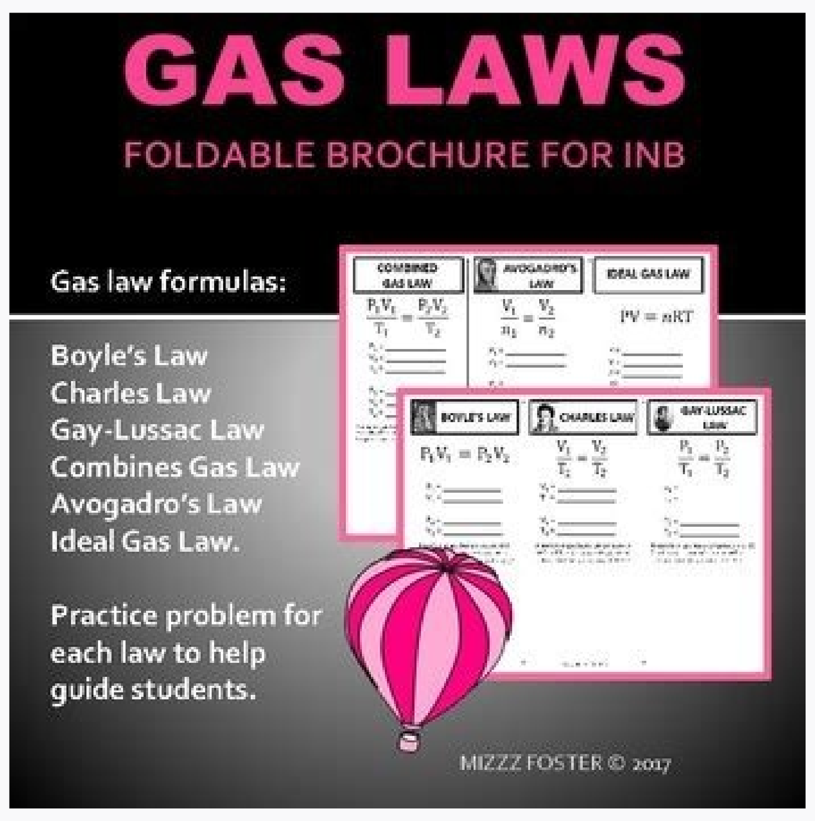
Combined gas Law
$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
$P_1 = 733\ mmHg \times \frac{1\ atm}{760\ mmHg} = 0.964\ atm$
$V_1 = 5.36\ L$ $\quad T_1 = -25°C + 273 = 248\ K$
$P_2 = 1.5\ atm$ $\quad T_2 = 128°C + 273 = 401\ K$

$\frac{(0.964\ atm)(5.36\ L)}{248\ K} = \frac{V_2(1.5\ atm)}{401\ K}$ $\quad V_2 = 5.57\ L$

7. At constant temperature, 245 mL of a gas at 4 atm of pressure is expanded to 1.75 L. What is the new pressure?

Boyle's Law
$P_1V_1 = P_2V_2$
$V_1 = 245\ mL \times \frac{1\ L}{1000\ mL} = 0.245\ L$
$P_1 = 4\ atm$
$V_2 = 1.75\ L$

$(0.245\ L)(4\ atm) = (1.75\ L)P_1$ $\quad P_1 = 0.56\ atm$



♪♪ ♪♪ ♪♪ ♪♪ ♪♪ ♪♪ ♪♪ ♪♪ ♪♪ ♪♪ ♪♪ ♪♪ ♪♪ ♪♪♪♪♪♪♪ ♪♪♪ of of energy of the system.You might also see a lower-case p for pressure. For Charles¢ÃÂÂ law, the equation is V1/T1=V2/T2. Unlike temperature, volume is an extensive property, which means that if the amount of matter that forms the system changes, the temperature would remain the same, but the volume would change. Answer Question What is another interpretation of the pressure? However, it is enough to study a limited amount of properties to characterise the system¢ÃÂÂs features completely. PressurePressure, usually denoted by the letter P, is the measure of the average force per unit of area exerted by the particles on the boundaries of the volume it occupies. If we increase the volume to 50m3, what is the final pressure of the gas?SolutionIf we use Boyle¢ÃÂÂs law, the final volume will beExample 2Consider an ideal gas occupying a volume of 10m3. If we increase the pressure to 100N/m2, what is the final temperature of the gas?SolutionIf we use Gay-Lussac¢ÃÂÂs law, the final temperature will beExample 3Consider an ideal gas at 50N/m2 of pressure. It was only later that they were theoretically understood as parts of a general combined law for ideal gases. Answer The Maxwell-Boltzmann distribution. Question What is the name of the distribution that specifies the spread of the kinetic energy of the particles of an ideal gas? This means that 0K is the lowest possible temperature (where particles have no kinetic energy), which is equal to -273,15Ã°ÂC. Answer Question What is the name of a process where the volume is kept constant? The above three laws were discovered experimentally in laboratories. Question Among the three gas laws, which one looks mathematically different from the other two? Gases are some of the more widely studied systems because of the freedom of their particles.An approximation of gases allows us to model their properties simply. It is the sum of the volumes of all the particles that constitute a system or total space volume occupied by random motion particles. Answer The absolute temperature is measured in Kelvin (K) degrees. For Gay-Lussac law, the equation is P1/T1=P2/T2. The typical distribution of ideal gases follows a law called James Clerk Maxwell and Ludwig Boltzmann, namely the Maxwell-Boltzmann distribution. Maxwell-Boltzmann distribution for different gases, commons.wikimedia.orgVolumeVolume is denoted by letter V. Answer The laws of ideal gases are valid if the amount of substance remains constant. Since thermodynamics is the statistical study of systems with many particles, all thermodynamic properties are statistical characteristics that emerge from the microscopic structure. Temperature The temperature is a measure of the average kinetic energy of particles in a system. This approach is called the approximation of ideal gases. It is usually enough to use three thermodynamic properties: temperature, pressure and volume. Question Are the system's statistical properties thermodynamic quantities? This model can accurately describe the behavior of many gases in certain conditions. Thermodynamic properties of gases The exhaustive thermodynamic study of different systems involves many properties that have different meanings. If we lower the temperature to 10K, what is the final volume occupied by the gas? If we use Charles' law, the final volume will be Gas Laws - Takeaways Keys Thermodynamics is the statistical study of the systems of many particles. In the case of ideal gases, these properties are temperature, pressure and volume. It is noted by the letter T. Gases is one of the basic types of systems that we can study from a thermodynamic point of view. Example 1Consider an ideal gas with a temperature of 100K. This model is called the modelideal, and laws that capture the relationship between thermodynamic properties are called ideal gas laws. Its expression is P·V=n·R·T El El El El ElThe ideal gas laws are Boyle's law, Charles' law and Gay-Lussac's law. Answer The three ideal gas laws can be derived from the combined law for ideal gases. Answer Yes, thermodynamic quantities are system statistical properties. Question of reply What is the name of a process where the pressure remains constant? For Boyle's law, the equation is P1 · V1 = P2 '· V2. Since R is a constant, and if we keep the number of particles constant, we can rewrite the Ashere equation, we can see that if we fix the pressure, volume or temperature, we can derive the three laws of this expression The equations of the GAS law are some examples of use of each law in the calculations. Question What is the name of a process in which the temperature remains constant? The response pressure and temperature are intensive quantities and the volume is an extensive amount. Answer Boyle's law is mathematically different because it implies an inverse dependence. Answer Question What units Are Absolute Temperature Measured? In general, all particles have different kinetic energies (associated with their state of movement). Each law shows the relationship between two properties with one third that remains constant. Answer Another interpretation of the pressure is that it is the energy density of a system. Question What unit is the absolute temperature measured? The general gas law is the equation that relates temperature, pressure and volume to the content of particles of an ideal gas. Usually we don't see gases around us (our atmosphere is made of transparent gases), but if you observe a cloud of smoke, you can see that the gases are made of particles that move freely (which may seem random). Both P and P and P are used, but always keep what your master/book uses. y y selaedi sag ed seyel saL The case of ideal gases, three laws capture the relations between temperature, pressure and volume, namely Boyle's law, Charles's law and Gay-Lussac's law. Note that the temperature is measured in K, the pressure is measured in N/m2, and the volume is measured in m3. We start with the gas at 50n/m2 and 10m3. We have three laws that capture the relationship between these amounts for ideal gases, namely Boyle's law, Charles's law and Gay-Lussac's law. There is a general law for the ideal gases that expresses the relationship between the three quantities and the amount of substance of the system. The mathematical expression for this law is or where K is a constant, and 1 and 2 indicate two different configurations of the system. Gay-Lussac's law indicates that when the volume of an ideal gas remains constant, the pressure is directly proportional to temperature (and vice versa). Check out our explanation on PV diagrams, which are diagrams used to represent the thermodynamic stages of a process. The ideal gas laws are the laws that capture the relationship between the thermodynamic properties. However, imposing several restrictions on the type of interaction between particles (without energy) and approaching the particles of an infinitely small body, we can obtain a simple model for the evolution of gases under certain thermal conditions. The mathematical expression for this law is or where K is a constant, and 1 and 2 indicate two different configurations of the system. Carlos's law indicates that when the pressure of an ideal gas remains constant, the volume is directly proportional to temperature (and vice versa). Gay-Lussac Law The Gay-Lussac law captures the relationship between pressure and temperature for an isocypic process (constant volume). Ask Choose the correct answer. This will help you connect the values easily in the right. equation. equation.

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