

SPINOFFS

Spinoffs are relatively short learning modules inspired by the LTAs. They can be easily implemented to support student learning in courses ranging from prealgebra through calculus. The Spinoffs typically give students an opportunity to use mathematics in a real world context.

LTA - SPINOFF 11A

Newton's Law of Cooling and Heating:
Vaporization of Liquid Helium

LTA - SPINOFF 11B

The Combined Gas Law

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SPINOFF 11B

The Combined Gas Law

Boyle's Law relates the pressure exerted by a gas and the volume in which it is enclosed. The relationship is an inverse proportion. Charles' Law relates the volume of a gas to the Kelvin temperature of the gas. The relationship is a direct proportion. Another gas law, one that we have not seen, is Gay-Lussac's Law. It states that the relationship between pressure and temperature is a direct proportion. Mathematically,

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

We can now derive a gas law that includes all three of the above. You can do it by simply following these steps:

Step 1 Write Boyle's Law:

Step 2 Multiply the two sides of the equation in Step 1 by the respective sides of Charles' Law:

Step 3 Multiply the two sides of the equation in Step 2 by the respective sides of Gay-Lussac's Law:

Step 4 Take the square root of both sides of the equation in Step 3 to get the Combined Gas Law:

The equation in Step 4 gives the Combined Gas Law. This law can be used to determine the effect on a gas when two of the variables volume, pressure, and temperature change. Here are a couple of problems to try.

Exercises

- 1) 500.0 liters of a gas are prepared at 700.0 mm Hg and 200.0° C. The gas is placed into a tank under high pressure. When the tank cools to 20.0° C, the pressure of the gas is 30 atm. What is the volume of the gas? (hint: 1.00 atm = 760.0 mm Hg)
- 2) A gas has a volume of 800 mL at – 23° C and 300 torr. What is the pressure of 800 mL of the gas at 227° C? (hint: 1 torr = 1 mm Hg)
- 3) What is the final temperature of a gas sample at 22° C that is subjected to a volume change from 400 mL to 822 mL and a pressure change from 700 mm Hg to 350 mm Hg?