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Unit 2 Worksheet 4

Relationship of Pressure to Number of Particles

From your lab you discovered that pressure (P) is related to number of particles (n) by a direct relationship when temperature and volume are constant.

Notes: If so, then P is proportional to n, and when P increases n should also increase.

Problems to solve:

1. If the original pressure (P1) is 3 atm and number of particles goes from 20 particles (n1) to 60 particles (n2), what is the new pressure?
2. The number of particles in a given volume of gas is very large. For instance one mL of carbon dioxide contains 2.7 x 1019 molecules at standard pressure. How many molecules are in 10 mL of carbon dioxide?

If you reduce the 10 ml of carbon dioxide at 1 atm, to 5 ml, what is the new pressure?

If volume is held constant, but the number of molecules increases from 2.7 x 1019 to 7.2 x 1019, how many times has the pressure increased?

1. A balloon is inflated to a pressure of 2 atm by blowing 20 puffs of air. If half the air escapes, what is the new pressure in the balloon?
2. Your car doesn’t seem to be accelerating very well. Your thinking maybe based on chemistry class, it’s not generating enough pressure of during gas combustion. Using the particle model, explain why you are thinking pressure might be a problem. (You might have to research how a piston works!)

How might you increase the pressure in your piston cylinder?

You use a pressure gauge to measure your cars piston cylinder pressure. It measures 35 psi, about 5 psi below the manufacturer’s expectations. What increase in number of particles would improve the performance of your vehicle?

1. One of the ways to increase the power output of an engine is to use a device to increase the gas pressure in the piston cylinder. One such device is a turbocharger, which pumps more gas into the piston cylinder to increase pressure. In our normal engine, the cylinder pressure is 40 psi. What new pressure must we have to boost the performance of the engine by 10 percent? If there were 5.0 x 1021 molecules of gas in the piston cylinder in the regular engine, what number is present in the turbocharged engine?