37.1 Using a Model to Describe Gases

Chemistry

Summarize main points from each video.

Video Title / topic

Video Title / topic

Video Title / topic

Topic Introduction

Summarize your understanding of each paragraph.

Models are basically a representation of something people want to know more about. Physical models are probably the easiest to understand. Physical models are sometimes bigger than the actual object being represented – like a model of an atom or a molecule.

Physical models are sometimes smaller than the actual object (or, objects) being represented – like a model of the solar system. At times, models take “artistic liberty” when it comes to the proportions of a model compared to the original object.

In this topic – models include drawings, mathematical relationships, and similar devices. Here, a model is considered successful if it explains known behavior and correctly predicts the results of future experiments.

A simple model that explains much of the behavior an ideal gas is the kinetic molecular theory. This model is based on “*best-guesses*” about the behavior of the individual particles in a gas. Note: “*individual particles*” might be atoms or molecules of gas.

Read/Summarize Text

1. **Read the passage.**
2. **Underline key expressions in each sentence.**
3. **Re-write each word (or expression) you underlined.**
4. **Summarize the passage.**

What? The Ideal Gas Law doesn't always apply?

1

2

While the most useful of the gas laws is the ideal gas equation, under certain conditions, gases do not obey the ideal gas equation.

In particular, at high pressures and/or low temperatures, the properties of gases can deviate significantly from the predictions of the ideal gas equation.

Scientists must sometimes factor-in the characteristics of the individual gas particles (in their calculations). These characteristics influence a gas to behave as it does.

Honeycutt Science. Virtual, online chemistry book.

Re-write words you underlined

3

Using a complete sentence, summarize or rephrase the passage

4

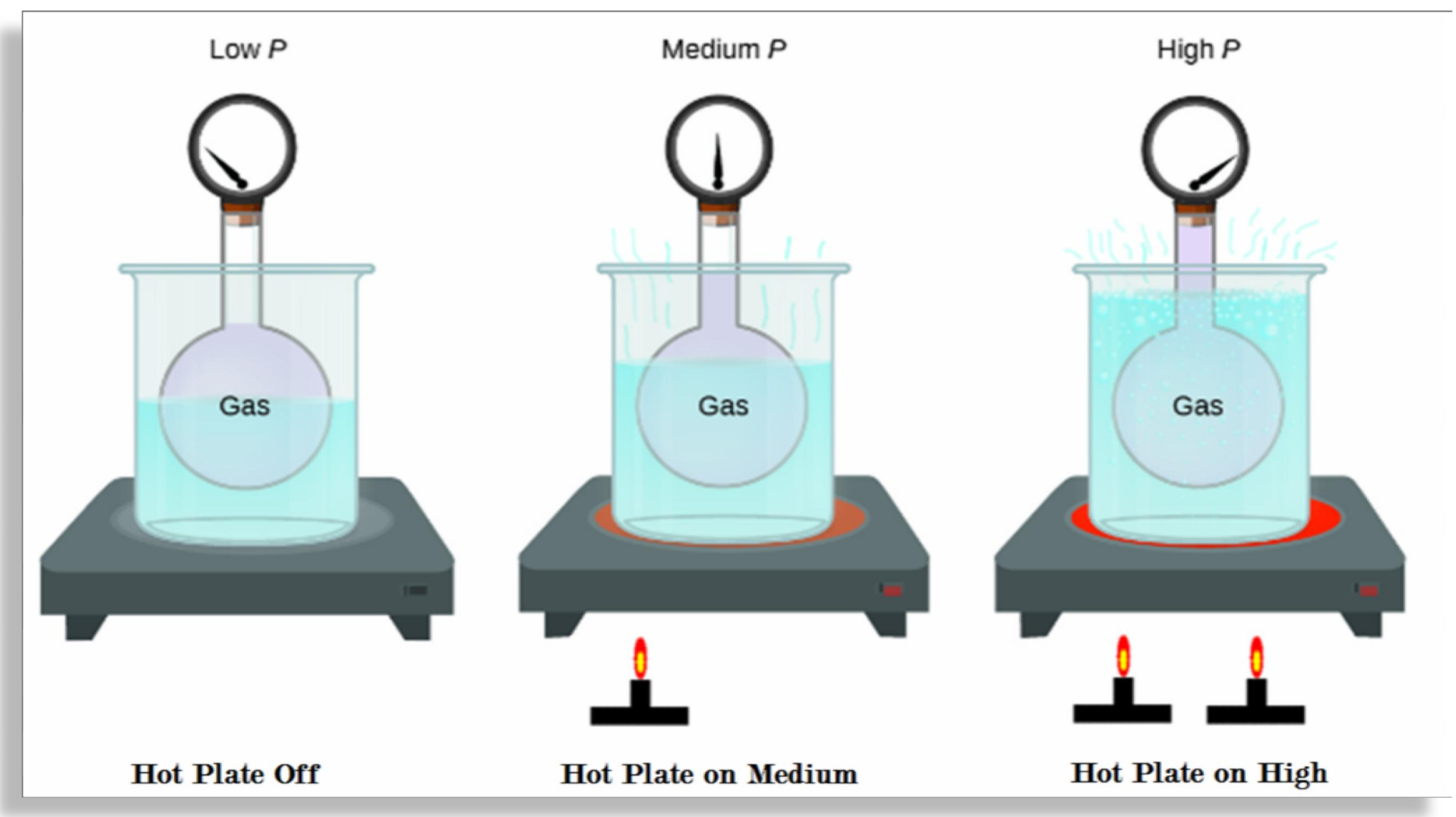
Read and Examine

Read and examine this modified extract from OpenStax https://opentextbc.ca/chemistry.
Inclusion of this material does not imply licensor endorses Honeycutt Science.

Pressure and Temperature: Amontons's Law

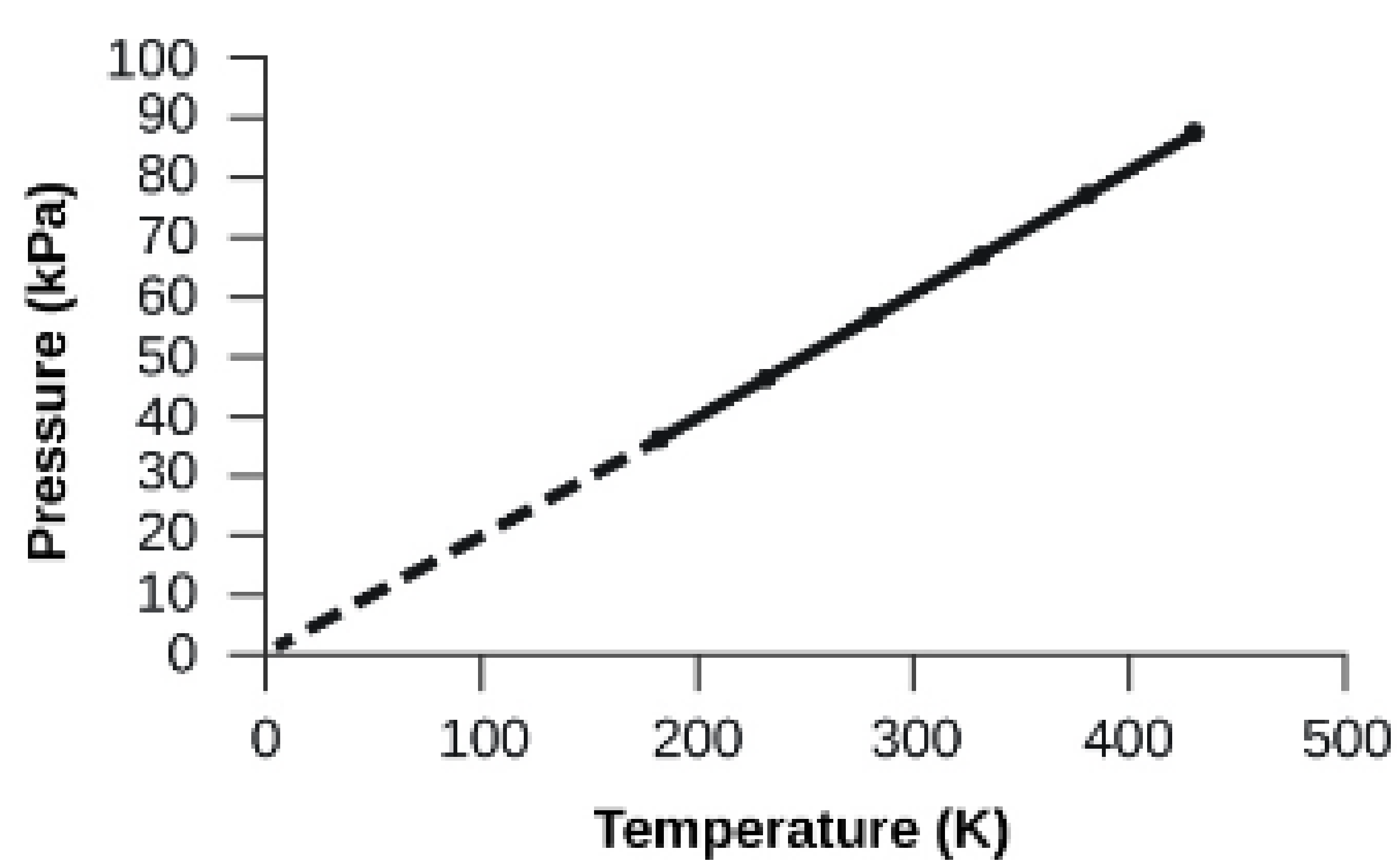
The diagram below illustrates the filling of a rigid container. Attached to the container is a pressure gauge. The system is sealed so that no gas escapes.

When the container is cooled, the gas inside also looses heat (gets colder). The pressure is observed to decrease. Since the container is rigid and tightly sealed, both the volume and number of moles of gas remain constant. If the container (and gas inside the container) is heated again – the pressure will increase.



Graphing the Relationship

This relationship between temperature and pressure is observed for any sample of gas confined to a constant volume. An example of experimental pressure-temperature data is shown for a sample of air under these conditions in the graph.



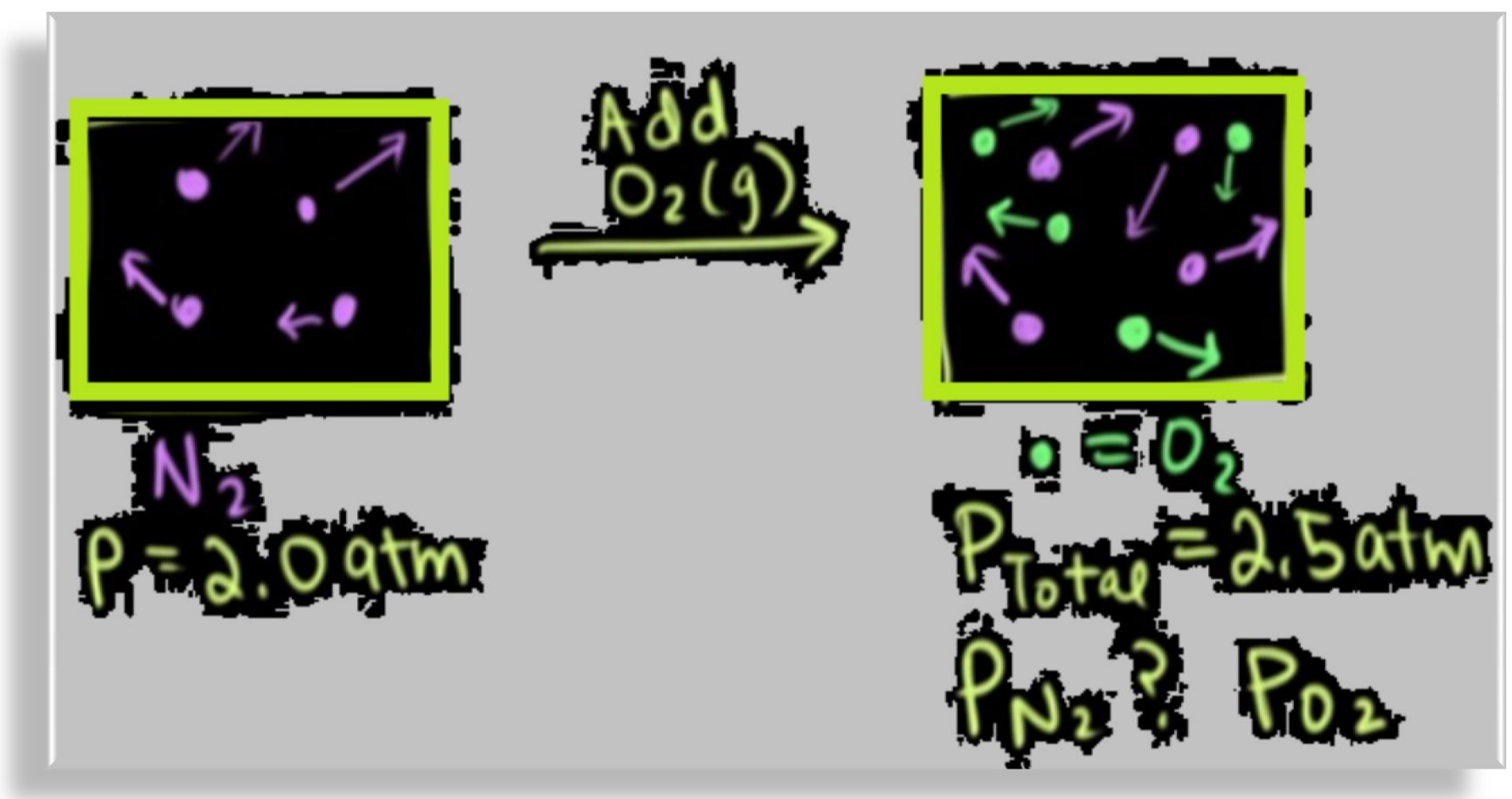
Adapted from: https://opentextbc.ca/chemistry

Examine then Draw Model

Copy and Label the Illustration in the Space Provided

The sum of partial pressure of each individual gas in a mixture equals the total pressure.

In this illustration, the partial pressure of N_2 is 2.0 atm. The partial pressure of 0_2 is 0.5 atm. The total pressure is 2.5 atm.



Adapted from: https://www.khanacademy.org/science/chemistry/

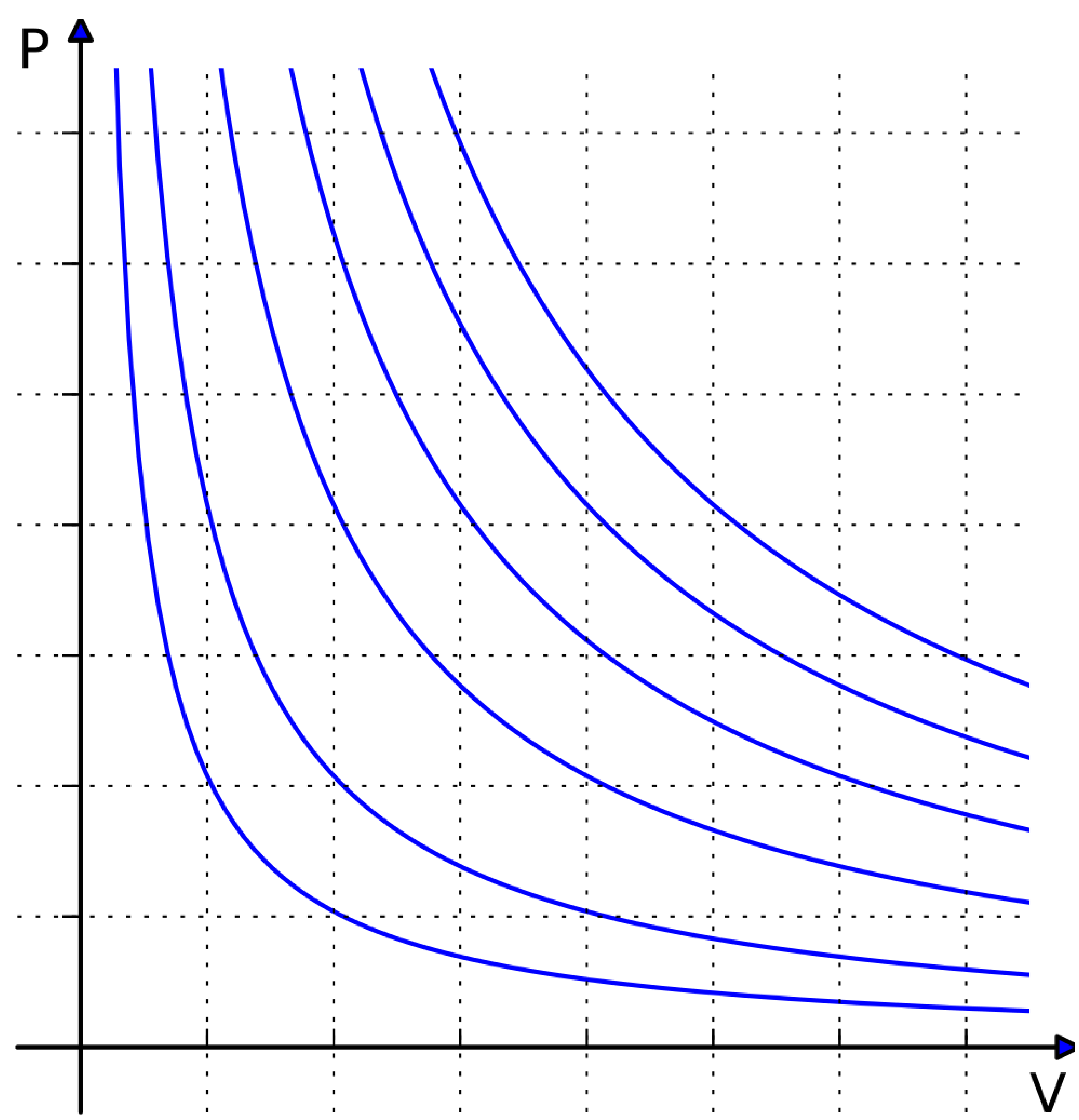
Duplicate the drawing (model). *This depicts starting out with 2.0 atmospheres of pressure of nitrogen gas (N_2) … then adding 0.5 atmospheres of pressure with oxygen (O_2).*

Examine a Graph

Extract from Wikipedia

Isotherms of an ideal gas. The curved lines represent the relationship between pressure (on the vertical axis) and volume (on the horizontal axis) for an ideal gas at different temperatures: lines that are farther away from the origin (that is, lines that are nearer to the top right-hand corner of the diagram) represent higher temperatures.

https://en.wikipedia.org/wiki/Ideal_gas_law



Note: Partially because there is no "scale" given for the P and V values, this graph might be considered a type of model. Recall from an earlier page in this topic that "… *a model is considered successful if it explains known behavior and correctly predicts the results of future experiments*."

Question: Do you anticipate this model would correctly predict results of an experiment using gas?

Show-Off Your Smarts!

Instructions

- Complete as an individual or small group.
- Discuss your ideas/answers/responses in a small group.
- Select one person to present your responses to the class.

Q1. Explain the difference between a Law and a Theory.

Q2. In what way can a science model be used to convey concepts of a science theory?

Q3. In your opinion, does a text description or a visual “model” description convey more information? Why?

Sketch a Gas Model

A kinetic molecular theory (KMT) is a model based on properties of individual gas components that explains the relationship of P, V, T, and *n* for an ideal gas.

Sketch a model that conveys this same information in an illustration or graphic. Make sure to use a title for your illustration.