Chem1311Ch5Ep1 Transcript

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Hello, and welcome to the first episode of gases and gas laws.

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In today's episode.

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We will explore some of the physical characteristics of gases.

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We will define pressure and carry out pressure unit conversions.

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And we will consider Boyle's.

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Charles', and Avogadro's laws

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Some of the notable characteristics of gases are that they take the shape and volume of their container.

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That they are highly compressible.

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That they mix completely when confined in the same container.

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And that they have extremely low densities.

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A gas' volume, temperature, and pressure affect each other and are subject to several gas laws.

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We will study in this episode.

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And also in the.

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One that follows.

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Pressure requires a short explanation.

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Pressure is defined as a force.

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Per unit area.

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You may already know that the force applied to an object will be proportional to the object's mass and the resulting acceleration.

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If you did not, you do now.

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There are several units of pressure that you should become familiar with.

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The Pascal is the official SI unit of pressure. It is equal to 1 Newton per square meter.

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This is actually a very small pressure.

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So often the kilopascal is used instead.

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Its abbreviation is Kpa.

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One atmosphere is equal to 760 millimeters mercury.

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And also 760 Torr.

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Because the millimeter, Mercury and the Torr are essentially the same unit by another name.

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One atmosphere is equal to 101,325 pascals.

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Or more often defined as 101.325 kilopascals

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The unit millimeter, mercury, is a historically significant unit.

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Mercury barometers were the first type of barometer ever used, and they were brought on board ships during the age of sail to provide advanced warning when a storm was imminent.

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A falling glass as they called it indicated bad weather was coming.

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This diagram shows how a.

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Mercury barometer works.

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There are two opposing forces acting on the Mercury column.

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The columns weight pushing down and the atmospheric pressure pushing up.

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The column will maintain its height when the two forces are equal.

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A higher mercury column indicates a higher atmospheric pressure.

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Atmospheric pressure, in turn, is caused by the weight of the air above an object or surface.

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Let's practice using the conversion factors in your reference materials to answer the following.

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Pause the video.

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Write down your answers.

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And then come right back.

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Welcome back.

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Your given quantity is 688 millimeters mercury.

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And the ask.

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Is how many atmospheres?

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We choose a conversion factor and place it in the 2nd frame so as to cancel millimeters mercury.

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And the answer to three significant digits is 0.905 atmospheres.

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Let's now try this other one example.

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Pause the video.

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Write down your answer and then come right back.

00:05:36

Welcome back.

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The given quantity is 732 millimeters mercury.

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And the ask is how many kilopascals?

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So we set.

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up the conversion factor in the 2nd frame.

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And the final.

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Answer is 97.6 Kpa

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A manometer is a device similar to a barometer used to measure the pressure of a contained gas.

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There are two variations of the device.

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The closed tube, or closed end manometer shows the pressure of the gas as the height of the column.

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The open tube or open-end manometer shows the pressure of the gas to be equal to the height of the column.

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Plus the atmospheric pressure at that particular time.

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The following variables all affect each other in a gas sample.

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Their symbols and units are included here as a reference.

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As you study the various gas laws, pay attention to which two variables remain constant in order to study the relationship between the other two.

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This diagram shows the relationship between the pressure and the volume of a gas.

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The amount of gas and its temperature remain unchanged during this experiment.

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Notice that as the pressure increases.

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The volume decreases.

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This is known as Boyle's Law.

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If both the temperature and the amount of gas remain constant.

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Then the pressure and the volume will be inversely proportional.

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To each other.

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Consequentially, the product of the pressure and the volume.

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Will remain constant.

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Which leads to this mathematical expression of Boyle's law.

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Initial pressure times initial volume will be equal to the final pressure times the final volume.

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This diagram shows an experiment that demonstrates the relationship between a gas' temperature.

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And its volume.

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In this experiment, both the amount of gas and the pressure are unchanged.

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As the temperature increases.

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The volume also increases.

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This is Charles and Gay-Lussac's law.

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More commonly, cold is simply Charles Law.

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And it states that when the pressure and the amount of gas remain constant.

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The volume and temperature.

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Will be directly proportional to each other.

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Consequentially, the ratio of the volume and temperature of the gas would.

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Remain constant.

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Which leads to the mathematical expression of Charles Law.

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Initial volume over initial temperature will be equal to final volume over final temperature.

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The one proviso is that the temperature must be expressed in Kelvin.

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We mentioned the reason for this back in Chapter 2.

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As there are no negative temperatures which would lead to an absurd answer.

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Next comes Avogadro's law.

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Which is also a little bit of common sense.

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Avogado’s law applies to gases having constant temperature and pressure.

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And it states that the volume.

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And the number of moles of gas will be proportional.

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To each other.

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Consequentially, the volume to more ratio of a gas is constant.

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And it results in this mathematical expression of Avogadro's law.

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Initial volume over initial number of moles will be equal to final volume over final number of moles.

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And that's all there is.

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There isn't anymore.