Ideal Gas Law

Monday, January 27, 2014
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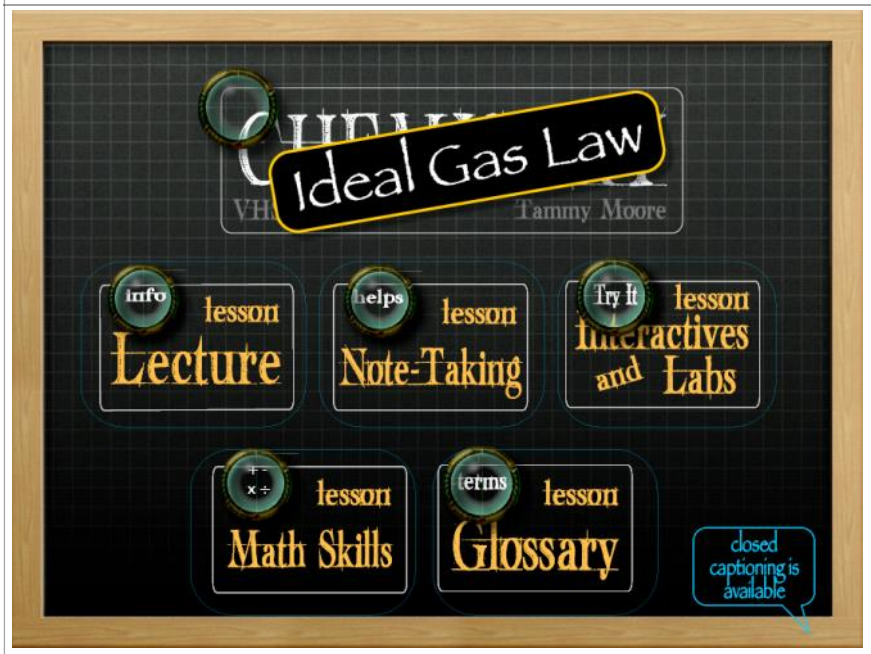
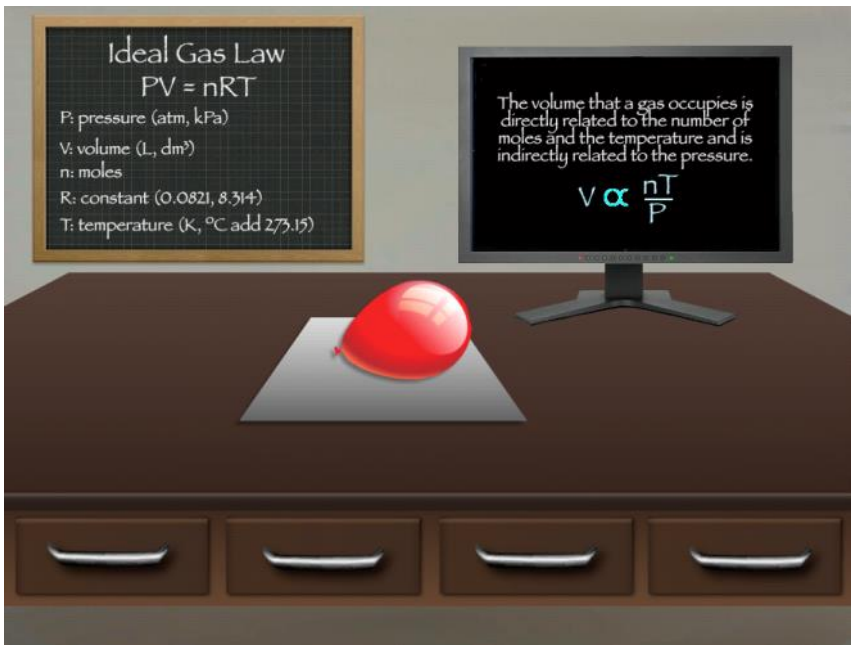
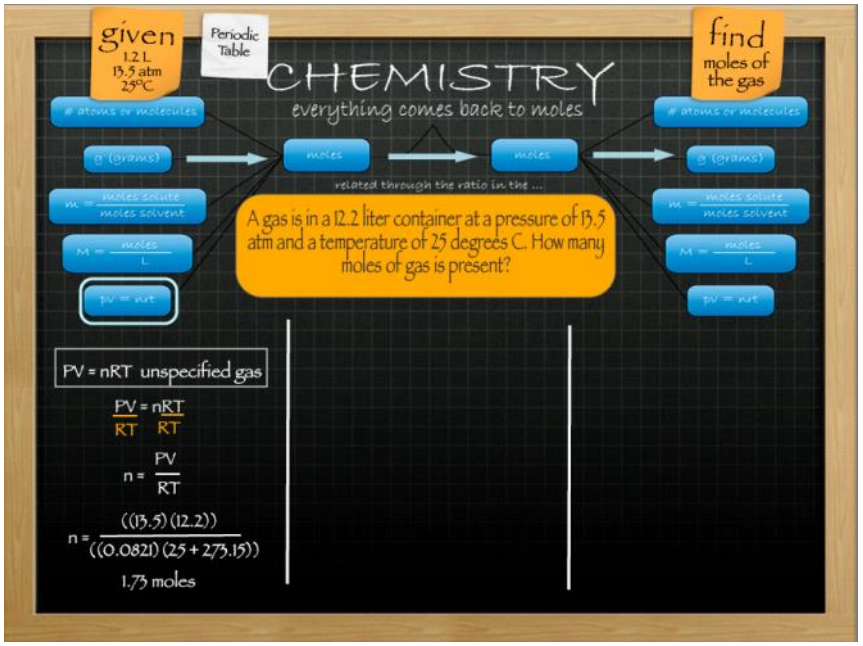
Slides	Notes
	Link to VHSG Interactive - http://www.virtualhomeschoolgroup.com/file.php/1/03_Science/04_Chemistry/General_Chemistry/M12_Gases/L3_Ideal_Gas_Law/Published/SWF_and_HTML5/multiscreen.html
	So far, you have learned about Boyle's Law, Charles' Law, and the Combined Gas Law. Now you will learn the Ideal Gas Law. Literally, the definition is "The volume that a gas occupies is directly related to the number of moles and the temperature and is indirectly related to the pressure. That should make sense if you think about it. Our balloon here will have greater volume if there is more of the gas, that is moles. It will also increase if it warms up. However, it will shrink if the pressure outside of it increases. Now, the proportionality isn't too useful in this form as far as working with the math goes. A little converting it to a form that we can use algebra on gives us PV = nRT. This is another take on expressing the relationships between pressure, volume and temperature. It really is quite ideal compared to the gas laws you have learned so far though. That is because it adds in yet one more variable, a very important one: moles. With the addition of moles in to the mix we can bring this concept in to the world of stoichiometry. More on that later in the lesson. Lets focus on the variables and the relationships for now. You already know some of the variables. Moles is represented by the letter "n". I know, I know, you are probably screaming, "What!" in your head. No matter, just memorize it despite the unlikely letter given to it. You will also need a constant for this one which is designated by the letter R. There actually are two available and you must choose the correct one to plug in. If the pressure is in atm and the volume in liters, then use the 0.0821 constant. If you have kPa and dm^3 use the 8.314 constant for R.



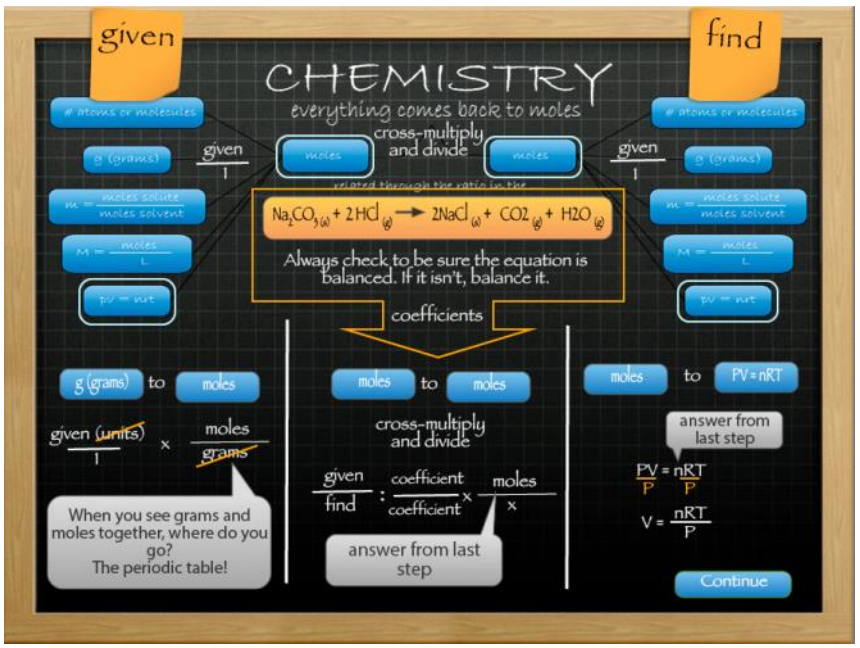
Let's try an example. A gas is in a 12.2 liter container at a pressure of 13.5 atm and a temperature of 25.0 degrees Celsius. How many moles of a gas is present?

You may have noticed that I have the full concept map from our studies of stoichiometry. Notice the PV=nRT is listed on each side. Remember that you only need to go all the way across the full concept map in your calculations when you are talking about more than one substance. That isn't the case here though, so we only need one of the three sections for our calculations.

We will start out with our equation. Since this problem is asking for the number of moles, we will algebraically shuffle the equation to solve for n.

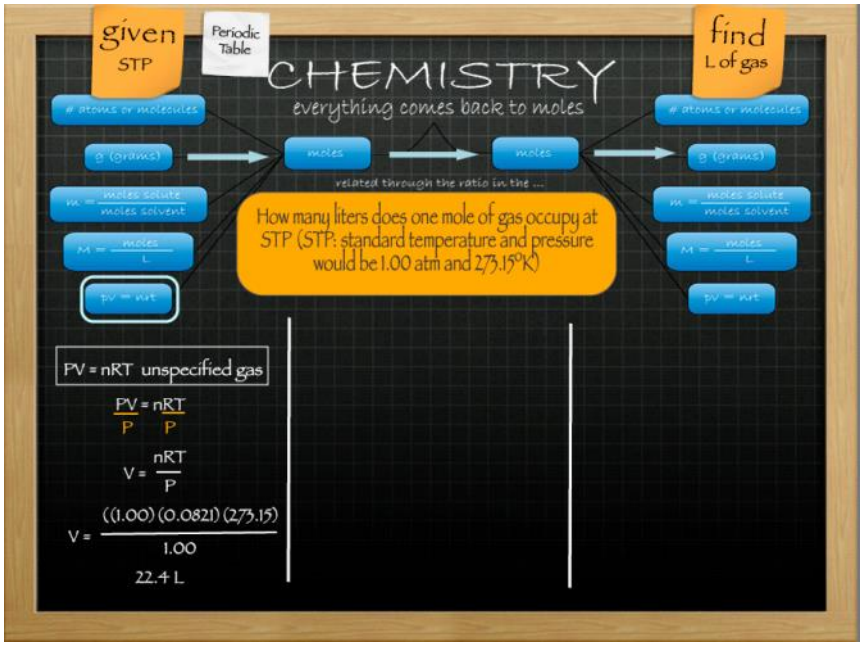
Now we will plug in our numbers from the problem and solve. Remember that your calculator can 'lie' because it never considers significant digits nor when you may need scientific notation. This problem needs three significant digits.

That is it. It isn't too difficult.

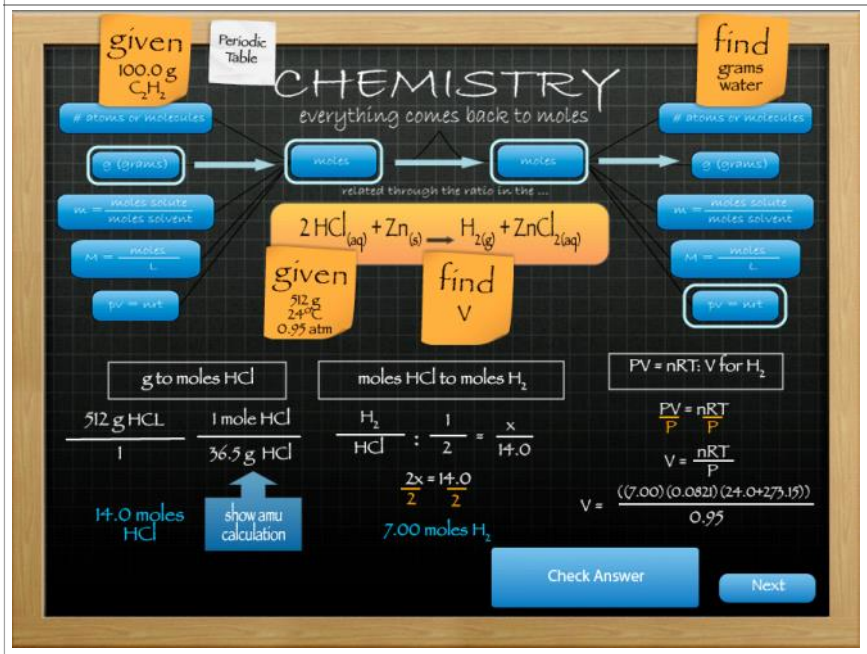


Stoichiometry - You knew would hit this before too long. Remember that you should always plot your path from the left side which is what you are given in the problem, to the right side which is all about what you are to find.

In this example, you are given the number of grams of one substance and asked to find the volume of another substance, a gas. PV = nRT only works with gasses. Just stay organized and work you way from your given to your find. Study this page for a bit until you feel warmed up on what you have learned in the past about stoichiometry and how the new skill of working with the Ideal Gas law fits in. Click "Continue" when you are ready to move on to the Try It section.


given
STP
Periodic Table
CHEMISTRY
everything comes back to moles
find
L of gas
atoms or molecules
g (grams)
moles
moles
g (grams)
atoms or molecules
related through the ratio in the ...
How many liters does one mole of gas occupy at STP (STP: standard temperature and pressure would be 1.00 atm and 273.15°K)
PV = nRT
PV = nRT unspecified gas
PV/P = nRT/P
V = nRT/P
V = ((1.00)(0.0821)(273.15))/1.00
22.4 L

Try It


given
100.0 g C2H2
Periodic Table
CHEMISTRY
everything comes back to moles
find
grams water
atoms or molecules
g (grams)
moles
moles
g (grams)
atoms or molecules
related through the ratio in the ...
2 HCl(aq) + Zn(s) → H2(g) + ZnCl2(aq)
given
512 g
24°C
0.95 atm
find
V
g to moles HCl
moles HCl to moles H2
PV = nRT: V for H2
512 g HCL / 1
1 mole HCl / 36.5 g HCl
14.0 moles HCl
show amu calculation
H2 / HCl : 1/2 = x/14.0
2x/2 = 14.0/2
7.00 moles H2
PV/P = nRT/P
V = nRT/P
V = ((7.00)(0.0821)(24.0+273.15))/0.95
Check Answer
Next

Try It

http://www.virtualhomeschoolgroup.com/mod/quiz/view.php?id=36698