**Final Exam Review Answers – Topics**

1. Let’s say that for some unspecified reason I have 0.45 liters of helium at a pressure of 0.85 atm at a temperature of 270 C. Given this information, how many moles of helium are in this container? (R = 0.08206 L atm/mol K)

*Because this mentions both “moles” and gives the value for R, this is solved using the ideal gas law, PV=nRT, where P is pressure, V is volume, n is moles, R is 0.08206 Latm/molK, and T is the temperature* ***in Kelvin*** *(get that by adding 273 to the temperature in degrees Celsius. To answer this question then, you solve:*

*PV = nRT*

*(0.85 atm)(0.45 L) = n (0.08206 Latm/molK)(300 K)*

***n = 0.016 mol***

*One question that many students have is whether an answer like 0.016 mol is the same as the answer 0.0155 mol. Yes, it is. If you can imagine your answer rounded to the same number of decimal places as I use, you’ll be fine.*

1. If I were to heat this helium-filled container until the temperature of the gas was 350C, what would the new volume of this container be?

*There’s no number of moles and there’s no R, so this is a combined gas law problem, where PV1/T1 = P2V2/T2. Because pressure is never mentioned in this problem, we can leave it out of the equation, which give us the equation V1/T1 = V2/T2. Using V1 = 0.45 L from the last problem, T1 = 300 K, V2 as unknown, and T2 at 308 K, we find a new volume of* ***0.462 L.***

1. Is helium an ideal gas? Explain why or why not.

*No. There is no such thing as an ideal gas.*

1. What are the four assumptions made in the kinetic molecular theory?

* *Gas molecules are infinitely small.*
* *Gas molecules move constantly in random directions.*
* *Gas molecules don’t interact with each other.*
* *The speed of gas molecules is proportional to their temperature in Kelvin.*

1. Using the kinetic molecular theory, explain why heating a gas causes its pressure to increase.

*When you heat a gas, the particles move faster. When the particles move faster, they hit the sides of their container harder. Because the force with which they collide with the sides of their container is the same thing as pressure, this means the pressure increases.*

1. What is an acid, and how can you tell it is an acid from its formula?

*An acid gives off H+ions in water. The formula starts with H.*

1. What is the pH of a 0.0080 M solution of NaOH?

*For a base, subtract the -log of the concentration from 14. In this case:*

*-log(0.0080) = 2.10. Subtract this from 14 and find the pH to be 11.90.*

1. What is the pH of a 2.3 x 10-4 M solution of HNO3?

*For an acid, pH = -log of the concentration. -log(0.00023) = 3.63.*

1. I’m going to do a titration:
2. What is a titration?

*It’s how you find the concentration of an acid or base using a neutralization reaction.*

1. I have a beaker that contains 500 mL of a base that has an unknown concentration. If it takes 340 mL of 1.5 M HCl to neutralize this base, what is the concentration of this base?

*M­­1V1 = M2V2*

*(1.5 M)(340 mL) = x (500 mL)*

***x = 0.102 M***

1. What is the pH of this base?

*-log(0.102) = 0.99. 14 – 0.99 =* ***13.001****.*

1. Why would it have been impossible for me to perform the titration in 9b using KOH instead of HCl? Explain

*Because you can’t neutralize a base with another base. You can only neutralize bases with acids.*

1. How did I know when to stop this titration?

*There must have been an indicator in the container that changed color when the pH was 7.*

1. The solution we titrated in part d was a base. What are some properties you might expect this solution to have, based on the general properties of bases?

* *slippery*
* *reacts well with oils and grease*
* *bitter taste*
* *has a pH greater than 7*