October 9, 2003

(Reading from page on overhead).

Teacher: I really want u to do the homework, as you will see this stuff on the test. In high school, teachers may give you busy work, but I don’t. I give you these things and will ask you those things on the test. We have next week and then the following Tuesday is our exam. The exams get more difficult as we go on.

Any questions?

Some people made comments about the CSB, but it was 1 point per chapter. 16 is kinetics I think and then 17, 18, acids and bases, which I wont finish here. Those are due the Friday after the exam.

You have responsibilities to us in the lab. We have the right to ask you to leave the classroom if we feel you are being disruptive. If you refuse then we can and will call security to have u removed. Basically, everyone just needs to get along. There was a problem with a TA and I had to work through some of these issues.

Okay last time we were doing theory, so lets do some examples now.
Chapter 17

In this chapter all the examples are in the gaseous phase. If you aren’t told, assume it is in the gaseous state.

(Example on board.) We have a 2-liter container holding an equilibrium mixture. At equilibrium, these concentrations are not changing. It is a dynamic equilibrium, as these are banging into each other. We want to be able to calculate the equilibrium constant. We have $K_c$, where $c$ is convention or concentration. All the coefficients were one; so all the exponents are one as well. We are using the double arrow…

Remember that $K_c$ can be big or little, (Example on board.), if its big, we have mostly products. Why or how? Because we know that it is $B$ over $A$. Also, if $K_c$ is little, we still know that it is $B$ over $A$, (Example on board.); we see we have a lot of reactants.

I want to talk about heterogeneous equilibrium for a second. Only gases and aqueous species are included in equilibrium expressions. In this example, (Example on board.), the $K_c$ would be $D$ over $A*B^2$.

In this example, (Example on board.), we don’t have 3 things at equilibrium. Lets put 1 mol of pcl5 in the container, and let the system go to equilibrium. At that point, point 60 of pcl3 was measured. What is $K_c$?
This is a new process. We will talk about the system then talk about time. Initially, we have 1 mol over 1 liter which equals 1 M… At equilibrium, that means we added point 6 mol pcl3 to our system. How much cl2 got added? That means we got point 6 mol of plc2… We end up with point 4 M. This is the kind of thought process we are going to be doing. At equilibrium, you have some of each thing. This depends on the stoich coeff. Remember also that Kc has no units.

Lets look at ammonia, (Example on board.), here. Calculate Kc. Write out the equilibrium and look at what you have initially, Tzero, then the end. They gave us Mols, but were nice enough to give us a 1-liter container. Remember equilibrium is written with the double arrow. At equilibrium, 2 mol of ammonia was found; we started with 0, so we know we gained 2 M. Knowing this, we know we had to lose something else. We lost point 1 M of N and point 3 M of nitrogen. So, our Kc is ammonia squared divided by our nitrogen and hydrogen cubed… Should end with point 266

At this point, we were giving you enough information to work it out. Now, let give you K and let you work backwards. I am going to do this differently than the notes.

The equilibrium const for the following right is 3 at a given T. If 1 mol of so3 and 1 mol of no in a 2 point 0 liter container and the system is allowed to reach equilibrium.
What is the concentration of all species?

Remember what we have initially and also remember that at equilibrium we have to have something in each. We are given the Kc for this at equilibrium. So, you write it as products over reactants. This does not matter if we are going frontward or backwards. What we lose and gain will be the same values, we just don’t know what that is so its x, which is written differently then my times sign.

Then (Example on board.) those values we stick them into the equation and solve (Example on board.). You can do this as quadratics or you can take the square of both sides. Multiply by x... you will have x is (point 5) divided by (2 point 73) and is (point 183). After doing the algebra, you then have the end as (point 317 M).

Lets look at a new example. The Kc for the following rxn is 24. Initially, we have (point 6 mol C) and (point 2 mols D) in a 2-liter container.

What are final concentrations of A, B, C, and D?

Gain ⇐ lose; we have A + B (double arrow) C + D

Kc = [C] [D] over [A] [B] = 24
See example (Example on board.) as written. Our numerator is multiplied by x-squared. I will move all of this to get my zero over here.

(Example on board.) You will never have negative concentrations, so this is a stupid answer. That is the x we will use… A = b = x = (point 028 M); C = (point 30 – x) = (point 27 M); D = (point 10 – x) = (point 07 M).

Let’s look at another system, Reaction Quotient, Q.

Q looks like K, in that it’s the products over the reactants. For K, [concentrations] are in equilibrium, but for Q, [concentrations] may not be so… If Q=K, you are at equilibrium. If Q is greater, >, than K, you have too many products and the rxn will go to make more reactants until q=k at equilibrium. If q is less than, <, K, you have too many reactants; the rxn will go until q=k.

In this example (Example on board.) we have a closed container. In this one, Q < K, meaning we have too many reactants. Sometimes you have to wait for equilibrium. The system is going in that direction to make more products until q=k. You don’t always have to do this until you have 0. We figured out q and know we have to lose from over on the left and gain on the right. Our Kc was 49… We have 2x because of the 1 and 1 over here and you add them up. Remember you are looking at the coefficients.
Write it out, so you won't forget the $^2$ in the problem.

You have the $K_c = [HI]^2 \over [h2][i2] = \sqrt{49} = \sqrt{(point\ 66 + 2x)^2 \over (point\ 22 - x)^2}$...

Take out paper...

Quiz 6...

All are gases:

$A + 2B \leftrightarrow \text{double arrow} \rightarrow 2C + D$

a. Write equilibrium expression
b. If we start out with a 2 mol of each compound in a 2 liter container and when the system gets to equilibrium, we have $[A] = 1 point\ 4\ M$.
c. Find $Q_c$; is $Q_c >, = or < K$ initially?

What is $K_c$?
Products over reactants then raised to their coefficients. I told you that you have 1 M of each of those in a 2-liter container. So Q is 1. Then I said, when the system got to equilibrium, it was at 1.4, so we had to gain on the left and lose on the right. From the info, you knew you gained (point 4) over here, and then you lost it over here. Same with the (point 8) lost and gained to get to equilibrium.

Think your way through the problems…