

# CYL501 Molecular Thermodynamics

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July 26, 2010

*Good students are not those who display the trappings of studiousness (perfect attendance, rapt attention, meticulous work). Good students are those who learn. Whatever their preconceptions, barriers, or deficits - whatever their story - they take new information and new experiences and, to the best of their ability, make them tools for transforming themselves and their world. -M. Cohan*

## 1 Contacts

My office is # MS 733-IIG2, telephone # is 1378, and e-mail address is [nkurur@chemistry.iitd.ac.in](mailto:nkurur@chemistry.iitd.ac.in). I find e-mail to be a convenient way to transact business and it is only a matter of time before you realize the same because catching me in my office is often difficult. I will only reply to course related mails when sent from your official institute account. In case you do not already know about your institute email account and how to use it, find out from your friends or talk to me, if all else fails.

## 2 Attendance

The ground rules for attendance are laid out in the *Courses of Study* which is reproduced here. *All students must attend every lecture, tutorial and practical class. However, to account for late registration, sickness or other contingencies, the attendance requirement will be a minimum of 75% of the classes actually held.* In plain english this means that you have to convince me that there was a contingency (oversleeping is not one of them) if you miss a class. Official reasons aside, I believe that attending classes is an integral part of the learning process. In addition, it is also well documented that there is a strong correlation between attendance and performance in courses. The bottom line - "Miss classes and pay the price." I also insist that you are present in the class IN TIME.

## 3 Syllabus

The course contents in the *Courses of Study* reads **Review of first, second, and third law of thermodynamics. Ideal and non-ideal solutions. Electrolyte solutions. Equilibrium electrochemistry. Postulates of statistical thermodynamics, ensembles, monoatomic and polyatomic ideal gases, molar heat capacities. Classical statistical mechanics.**

The syllabus given in the previous paragraph is for official purposes. From a practical standpoint, I would like that you are well-enough trained TO ATTEMPT AND ANSWER CORRECTLY THE QUESTIONS IN THESE PORTIONS IN A COMPETITIVE EXAMINATION LIKE CSIR/GATE/GRE.

## 4 Books

The number of textbooks in thermodynamics is mind boggling. You will find shelves in the chemistry, physics, and engineering sections in the Central Library with thermodynamics books. We will use "Molecular Thermodynamics" (MT for short) by McQuarrie and Simon. This book is available an a low-priced Indian edition for Rs. 495 (I am sorry I haven't figured out how to get the brand new Rupee symbol into my typesetting software). Large portions of MT can be found in the book "Physical Chemistry" by the same authors, a superb book to learn physical chemistry from. There are many other physical chemistry textbooks that you could use profitably for portions of this course. The book by Atkins is popular both locally and world-wide. Others include those by Alberty and Silbey, Castellan,

Moore, Engel and Reid, Laidler and Meiser, Ball ... I almost forgot to mention the extremely popular 5-volume book by KLKapoor.

For those of you who might care to read from specialized books on thermodynamics and statistical mechanics here is a far from complete list (only author names) : Glasstone, Klotz and Rosenberg, Lewis and Randall, Wall, Honig, Rock, Guggenheim, Denbigh, Chandler, Hill, Widom ...

## 5 Teaching philosophy

Some quotes to set the tone:

*I hear and I forget. I see and I remember. I do and I understand.* –Confucius

*Unlike history or philosophy, chemistry cannot profitably be read chapter by chapter but must be vigorously attacked with a dozen sharp pencils and a ream of inexpensive paper close at hand. When information is used to solve problems, it rapidly becomes part of your knowledge.*  
–Source Unknown

I believe in active learning. Ask questions in the class - feel free to interrupt me! If you don't understand something I have said, it is likely that there are others who don't and they will be grateful to you for having asked the question. I realize there are a number of reasons to not ask questions but I am hoping that we can all get over such apprehensions because it is extremely important to clear up misunderstandings before they multiply.

Working problems is an essential ingredient to learning a subject. Do the problems in the book that you are reading as you come to them. They are there to enhance your understanding and learning of the particular topic they accompany. For additional practice, get another text or other source of problems if you can.

Finally, you must take responsibility for your own learning. An active, responsible learner seeks not to limit what she should know, but embraces and conceptually consumes as much material as possible. Knowledge is power; arm yourself with it! Whether or not you win the game depends upon your skill, your level of effort, and your dedication to the course.

## 6 Assessment

There will be regular homeworks during the semester which will contribute 20% to the overall grade. They are handed out on Friday and due in before class the following Friday. Since the homework contributes to your grades in more ways than one (like attendance, there is a strong correlation between those who do the homeworks and those who do well on exams and hence on the final grades), it is in your best interest to do all the homeworks assigned. Collaboration with classmates to discuss problem solving strategies is encouraged but, I prefer, that first you struggle through it by yourself. Outright copying constitutes academic dishonesty. The homework will not be corrected or graded for accuracy of the solutions but will be checked for completeness and effort. It will be given a grade.

Consider this quote:

*The difference between the amoeba and Einstein is that, although both make use of the methods of trial and error for elimination, the amoeba dislikes erring while Einstein is intrigued by it. He consciously searches for his errors in the hope of learning by his discovery and elimination.*–Karl Popper, an educational philosopher

Who do you wish you are closer to? An amoeba or Einstein?

GOOD LUCK!