

Course Evaluation HT2020: *Molecular driving forces and chemical bonding (KEMM30).*

Teachers:

- Peter Persson (quantum)
- Mikael Lund (statistical thermodynamics; python; *course responsible*)
- Jan Forsman (intermol. interactions)
- Donatas Zigmantas (spectroscopy)
- Jens Uhlig (python)

Number of students registered: 14

Grades: 5 st UK, 3 st G, 6 st VG

Summary

Detailed responses from the students are attached at the end of this document. We avoided asking for ranking using numbers, but instead requested text which we find much more constructive. The students were generous in giving constructive feedback which will be very useful for next years course.

The students were overall positive regarding the topics and execution of the course. Most respondents (**six in total**) find the topics relevant for their education, and report to have spend 30-40 hours per week. Here are a few selected excerpts from the students:

- *"This course had the best set of teachers that I have experienced during my studies in Lund!"*
- *"...this is the course that has been the most confusing, most stressful..."*
- *"I will use python over excel in the future"*
- *"Learning is more difficult when lectures are being presented with powerpoint"*

The teachers are satisfied with the 2020 event, particularly taking into account the pandemic challenges. The course was held mainly in the class-room, following all recommendations by the university. It is our perception that the majority of students took considerable interest in the presented topics; lectures, exercises, and labs were well visited. We are aware that the topics tend to be difficult, often due to mathematics, for many of our students, and that it can feel like four individual courses wrapped into one.

In previous years we used assistants on the statmek and intermolecular interaction exercise events. This year, the teachers attended all events which was positively received and has the added benefit that it is much easier to gauge the status of the students and correspondingly adjust learning activities.

Action plan for next course event

- Be more selective with exercises in statistical thermodynamics

- Use parts of Atkins also in Intermolecular Interactions?
- Review logistics of labs and ensure they are not too close to exam
- Communicate clearly what to read prior to lectures
- One student reported that an instructor could, at times, be talking in a "condescending fashion". This is unacceptable.

Detailed Student Feedback

Student feedback was given as a *Quiz* on Canvas which produces a human unreadable CSV file that we converted into MS Excel format. In the spirit of the course contents, we now process this into a human readable report using Pandas and Markdown.

```
In [1]: import pandas as pd # note that the `openpyxl` package is required to read the
from IPython.display import Markdown
def show_topic(topic):
    ''' display markdown of a topic (column) in the database '''
    txt = '# {}\n'.format(topic)
    for student, text in db[topic].items():
        txt = txt + '#### Student {}\n{}\n\n'.format(student+1, text)
    return txt
```

```
In [2]: db = pd.read_excel('canvas_quiz2020.xlsx')
print('Number of student responses = {}'.format(len(db)))
#db.T
```

Number of student responses = 6

```
In [3]: markdown_txt = ''
for topic in db.columns:
    markdown_txt += show_topic(topic)
display(Markdown(markdown_txt))
```

Lectures

Student 1

- I think it is a very good idea to have after-reading lectures. This way, we can focus more on the essence of the topic during the lectures, because we already have an understanding of it.
- In the stat. mech. and MI parts, this after-reading system was very successful, because we received the daily portions in advance. Also, I think these lectures were fantastic, the lecturers were very organized and well-prepared.
- In the QC and spectroscopy parts, we didn't receive a list about the daily topics in advance, though in the spectroscopy part, there was such a list but we received only at the end of day 1. I think in the spectroscopy part, it would have been better, if we had received the daily portions prior to the course. This being not the case, we were always one day behind the lectures, which is not good. For the QC part, we didn't receive a list of chapters from the Atkins book, because we didn't strictly follow the book. This is not a problem, but still, we could have received the topic list of the lectures in advance, so

we could have looked up the corresponding parts from the Atkins book and read it before the lecture.

Student 2

- Petter: a bit hard to follow sometimes (fast and mostly writing key words) but overall good.
- Mikael: easy to follow, very clear.
- Jan: good lectures, a bit challenging.
- Donatas: good lectures, mostly easy to follow

Student 3

- Good content
- Good progression within each part of the course
- It feels like it would make more sense to have spectroscopy connected to QM rather than with so long between
- Different parts of the course had very different pace

Student 4

QM:

- Good repetition
- Could be better structure on the board
- Not a lot of new stuff was introduced

Statmek:

- Good structure
- The lecture were often very "heavy" with new stuff

- The quick recap of the lecture from the day before was really good

MI:

- Good structure
- Still very hard to follow since it is a difficult subject
- Lecture with overhead was even harder to follow

Spectroscopy:

- Interesting lectures
- Learning is more difficult when lectures are being presented with powerpoint

Student 5

Good

- The lecturers were very good at explaining and very helpful.
- The lectures in MI and ST followed the course literature very well, which was good
- It was good that some of the parts had a full lecture in the end for repetition/going through old exam questions

Not so good

- The PP for the QM part was not helpful. It contained a lot of concepts that was never talked about, and the slides did little to help understanding, since they mainly contained names of different concepts without any explanation.

Student 6

Good:

- Spectroscopy: Very good. Explained well and seemed to really like what he was talking about which made it more interesting - Intramol: Tried to make sure everyone understood and took it at a good pace
 - Quantum - Went through a lot of old stuff which was helpful
- Stat. - Explained very well all of the parts
 - Bad:
 - Spectroscopy: There were a lot of parts and a lot of equations which were not used ever which made it confusing. Also some that was never explained. So in general, maybe just better focused on the stuff that is important and that is going to be used
 - Intramol: Very confusing subject and sometimes hard to understand
 - Stat. - Lectures were understandable but then when we were going to work with it, it was a million times harder so maybe match

the lecture more to how difficult the other stuff is Quantum - Hard to know what was important. Also didnt know what to read. Not a lot was understood at the end of the day with the new stuff

Exercises

Student 1

- The exercises were very good and useful. I think they really helped to understand how to apply the obtained theoretical knowledge. It was also good that the exam was problem-based, but you had to understand the theory to solve the exercises.
- The computer exercise for the QC part was also very interesting, and it was good that we received detailed feedback to our reports.

Student 2

The exercises were quite good but sometimes it was too stressful since there were too many/not enough time.

Donatas' section was best in terms of workload, with Mikael's part having too many exercises.

Jan's part probably could be used to set a critical point for maximum number of exercises, or there should be a more clear way to prioritize if many exercises are necessary.

Student 3

- In general, good
- Quantum mechanics part didn't have proper exercises which I would definitely have liked
- I'd prefer scheduling so that it is possible to go to the lecture, then do the tasks and then go to the exercise rather than, like now, either doing tasks before lecture or starting to do them during the exercise

Student 4

QM:

- The exercise was just an extra lecture. This was fine since most exercises were easy enough to do on our own and there was plenty of time to do it

Statmek:

- There was too many exercises. It was very stressful just to see amount. I did not even manage to finish half
- Extra stressful with the very difficult hand in beside the exercises

- Learned a lot from the solution/feedback for the hand ins

MI:

- Good amount of exercise made it possible to take the time needed to finish them. Even though they were very difficult since many of the concepts were new and there really wasn't any good guide
- The hand in exercises were close to impossible with the material we had
- I never saw the solution to any hand in so I did not learn anything.

Spectroscopy:

- Good amount of exercises
- Good to combine exercise and hand in
- Could have used more feedback/solutions

Student 5

Good:

- It was very good to have exercises to be able to work with the material and understand it
- It was good that the lecturers stayed longer than the one hour scheduled exercise so that there was more time to ask questions

Not so good

- The exercises in QM felt like a second lecture. I wanted a more "exercise-like" session so that I could understand the material by working with it.
- It would have been good to have the solutions (or at least the numerical answers) to the exercises on canvas.
- for next year in spectroscopy, it would be helpful to add exercise numbers for 11th edition Atkins

Student 6

Spectroscopy: GREAT! Helped a lot and they weren't overwhelming or too many. Intra: Difficult, and not all of them seemed good. But very nice lecturer that really wanted to help

Stat: SOOO HARD! Very many and very difficult

Quantum: Had no exercises so it was extremely difficult to know what you should study on. So it would have been nice to have exercises on the exercise time and not lectures then

Labs

Student 1

- There was only one real lab, in the case of spectroscopy. The lab itself was not very interesting, because I think everyone had done such measurements before during the BSc. However, I think the lab was particularly useful, because for the lab report it was very handy to apply our Jupyter and Python knowledge that we obtained during the first part of the course. Therefore, it was a good practice of data handling by Python, and also, the problems that we faced when writing the lab reports were very instructive.
- But there was a big problem with the lab, and it was its time. The lab was too close to the exam, and since writing the lab report took much time, it interfered with the exam preparation. The argument for why the lab practice was so late was that we had to reach the corresponding topic in the lectures. However, I think everyone had learnt UV/VIS/NIR spectroscopy during the BSc, so it wouldn't have been a problem to have the lab earlier, and it would have made our life much easier...

Student 2

*The computer labs were great. They contributed well.

*The wet lab was a bit disorganized and the data processing quite involved. It was way too much work to finish so close to the exam, and even if you didn't hand in until the second deadline, especially if you had no experience in coding prior to this course.

Student 3

Quantum mechanics computer lab was good

Spectroscopy lab:

- Too close to the exam, I believe most people turned it in after the next course had begun because we had to repeat the whole course before the exam in the same 4-5 days that we had to write the exam.
- Good programming practice but quite long after the programming part. Since the IM part had no programming and stat TD only a bit it was difficult to effectively start repeating the beginning of the course in the last week.
- Actual lab was quite boring and most of the spectrophotometers didn't work which meant that we mostly waited for our turn to take one measurement and then shared with each other.

Student 4

QM

- I learned a lot from the lecture and explanation in the lab by Eric
- I learned a lot from the feedback in the labrapport

Spectroscopy

- I did not know enough python to do the labrapport
- I could have used a lot of help with python
- The theory of the lab was no in the lecture or in the book
- I could not manage to do all the calculations needed, the math was to hard

Student 5

Good

- The computer lab was fun and the instructions were well-written
- The lab assistans were very helpful and easy to work with. They were also quick to correct the lab report, which was good

Bad (the following section is only about the spectroscopy lab)

- Scheduling the spectroscopy lab one week before the exam was simply stupid.
- The spectroscopy lab did not give any new insights in the subject. Neither did we learn any new experimental techniques, all master students have done dilution and UV-vis spectroscopy
- I accept that the corona situation and change of location made the spectroscopy lab a bit more chaotic than it was supposed to, but why didn't anyone check that the instruments worked before we used them? One out of eight instrument working is not optimal (to say the least)
- It could be useful with a more helpful lab instruction, that stated that we were supposed to use jupyter to fit gaussian curves to our data.

Student 6

Spectroscopy lab:

The lab itself was easy however the equipment wasn't checked so only one spectrometer worked and the lab instructor did at several times not really know what was going on. However, he was, without a doubt, the nicest instructor I have ever had! Genuinely seemed to care and wanted to do good, really nice person! For the report part I would describe it as CHAOS. Some parts were easy, some parts we didn't even do because there was no time to do it in the lab. And some parts noone in the course knew how to do or what we were supposed to do. The instructions were poor which made it even harder to execute. Some parts we had never done and instead of being a learning experience most of us felt stressful and panic about it. The lab also being just a week before the exam did not help. It's insane to have to do a lab report when you're supposed to study for the exam! There is much more to add about this lab that I was disappointed about but these are the main parts.

Material

Student 1

- I always read the chapters before the lecture, if I could (i. e., we were given the chapters before the lectures).
- In the stat. mech. and MI parts, this after-reading system was very successful, because we received the daily portions in advance. These lectures contained the most new knowledge for me. I think this knowledge is something that every chemist should need.
- In the QC and spectroscopy parts, we didn't receive a list about the daily topics in advance, though in the spectroscopy part, there was such a list that we received at the end of Day 1. I think in the spectroscopy part, it would have been better, if we had received the daily portions prior to the course. This being not the case, we were always one day behind the lectures, which is not good. For the QC part, we didn't receive a list of topics from the Atkins book, because we didn't strictly follow the book. This is not a problem, but still, we could have received the topic list of the lectures, so we could have looked up the corresponding parts from the Atkins book and read it before the lecture.
- In the material of the QC part, there was hardly any new knowledge for me. I think I had already learnt the ca. 80% of the material. The hand-out PowerPoint presentation was not very detailed and was not very useful for the exam, but I think they didn't intend to be so either.
- The spectroscopy lectures also contained much revision, especially in the beginning, but I think it was not a big problem because there were also some new things. Also, the lectures were not bad, but I didn't find the material of the last 2 lectures interesting. The hand-out PowerPoint presentation was quite detailed and most of it was useful for the exam.

Student 2

I tried to read before the lectures but sometimes I didn't have the time.

It was unclear what to read for Petter's part.

The Molecular driving forces book was very good.

Student 3

- Atkins is not very good, doesn't really matter if trying to read before or after lecture since it only helps for finding equations when I already know what to do.
- Dill was quite good, I mostly read chapters before lectures
- Handouts were good but could have been on canvas so you don't end up with so many papers to keep track of

Student 4

QM

- The relevant chapters in Atkins has already been read in two previous courses

- Lectures was enough as material

Statmek

- I never had time to read the book before any lecture or after
- I used the book when trying to figure out different exercises
- The statmek part in Atkins is actually really good, I read this before the exam and it was easier to learn from

IM

- I tried reading before every lecture but it was simply to difficult to really understand anything before the lecture
- Atkins had a good part with IM but did not bring up everything from the lectures and other book

Student 5

Good

- Molecular Driving Forces was a very good. I read the chapter before most of the lectures.
- It was nice to get handouts in the spectroscopy part
- The instruction for the programming part was good

Not so good

- Atkins' Physical Chemistry is not very helpful in my opinion

Student 6

The Dill book was a lot better than the Atkins book and there were some great examples. I read some of the chapters but sometimes it felt kinda confusing. Also, for the quantum part, we were just supposed to read something which made it hard to know where to find it and what was relevant even if you wanted to. The powerpoints in Spectro were very helpful but not those in quantum.

Communication

Student 1

- Communication was smooth most of the time, announcements were clear and on time.

- Teachers were ready to help with both exercises and questions about the lectures. However, this was not really true for Petter. He gave us exercises as exam preparation, I did these exercises and asked for an appointment to discuss my questions, but it never happened though he promised that he would help.

Student 2

Since the course was given on campus we didn't rely too much on communication through canvas. But it worked well enough.

Student 3

Teacher availability was good

Canvas was used well in general, only minor issues

Student 4

QM

- Lab was really good
- Since we didn't have exercises not much communication was needed with Petter

Statmek

- Really good with feedback

IM

- Could have used solutions/feedback

Spectroscopy

- Pavel was really helpful with the lab
- We got some useful tips on some of the exercises

Student 5

The teachers were very good at communicating and very listening to the students. They were also very willing to help. Very good!

Student 6

Communication was okay. They seemed to want to help, ofcourse some more than others but in general. Those who were sick for a while (either as a precaution or flu etc.) missed a lot of lectures and I think it was unfair that there were no online accommodation for them. Especially when we are in a pandemic where you are encouraged to stay at home with any sign of flu or covid. Apart from that they seemed to want to help out

Programming

Student 1

- I think it was a very useful (if not the most useful) part of the course. I'm sure most of us could use it in their future studies/research, and we could already use it when writing the lab report for the spectroscopy lab.
- I think the course is complete, I don't have other suggestions for the replacement of some topics. However, I think it would be interesting to learn more about lasers (not only one lecture) within the spectroscopy part and go into more detail in terms of the physics of laser operation. This could replace some part of the material of the last two lectures in the spectroscopy part which I didn't find interesting.

Student 2

It's a great part of the course and very relevant for data handling, I really enjoyed it. But I had previous experience coding. I wish there was some recommendation to take the Beräkningsprogrammering med Python 15hp course as one of the free choice courses in the bachelor program if you wish to continue with a master.

The hard part for beginners is probably knowing/remembering what you can do/what is possible. It would help to have a list of different commands with short descriptions to look at/flip through. Possibly also hints for a suggested path of commands for each exercise (mainly Jens's part). Ex. linspace/arange, function and plot. Hints for special cases should also be written out in the notebook (ex. rgb colours using arrays).

Student 3

I enjoyed it and think it was useful, I especially like that it did not overlap much with other course in python that I've taken at maths centre but introduced new use for programming.

I would like it if python was more common through the whole course so that there was some moment where it was used at least at some point in each part. Right now it was only used in stat- thermodynamics (for some handins and exercises) and spectroscopy (for the lab report).

Student 4

I really liked this part and find it very useful. All the teachers were really good. I will use python over excel in the future. I could have used even more days with python with more exercises. Sometimes it took a very long time to get help when stuck because the teacher was busy with other students.

Student 5

- The programming part was very nice. I thought that it was on a good level of difficulty, but I have been programming in java. I think that students without any experience in programming were struggling
- I think that programming is very relevant for my future studies.

- It was nice to use the programming knowledge in the spectroscopy lab, but I think it would be very useful if it was stated both in programming instruction and the lab instruction that the curve fitting should be used in the lab.

Student 6

The programming part was a bit confusing. Google was mostly used which was good and I learned a bit but I know that at the end of the day most of us don't really know how to do Python programming. The people who do, are the ones who took a python course previous to this course. So I see the relevance in it, but I don't believe you will learn enough in this short amount of time. It's not that relevant, I usually use other programs to plot data etc.

Also during this part, some were treated unfairly which was not appreciated and the instructor could be talking in a condescending fashion at times which was totally unnecessary. We are there to learn, not feel bad about ourselves.

Math

Student 1

The math was very easy

Student 2

Probably OK, but I have forgotten

Student 3

Not very well; several topics were new to me

Student 4

Probably OK, but I have forgotten

Student 5

My math skills were sufficient

Student 6

Not very well; several topics were new to me

Learning activities

Student 1

Keep current balance as is

Student 2

Keep current balance as is

Student 3

More exercises; keep lectures

Student 4

More exercises; less lectures

Student 5

More labs

Student 6

More exercises; less lectures

Exam

Student 1

- I think the allocated time was perfectly set to the extent of the exam. We had enough time to think about the questions.
- Instructions were clear.
- The questions reflected the learning activities.
- I mention only one problem about the exam regarding the spectroscopy part. The exercises were exactly the same as already handed out exercises throughout the course, only the numbers were different. I think the teacher could have been more creative to make the exam more challenging and interesting, this way it was only about manual calculations.

Student 2

It was good but a lot of work for the allotted time. Some questions were quite involved for the amount of points you got.

It should say on the exam how many points the questions are worth.

Also very confusing to put questions together in correct order when each section used a completely different numbering system. Extremely difficult to put together in a Word -> pdf within the time.

Student 3

Quantum mechanics questions were not similar to what was done during the course (or it was mentioned but only briefly in passing) and I had to try remember bachelor level inorganic instead of anything I had learned during this course.

For stat. TD some parts of questions felt as if you had to remember very specific parts from a single lecture, but this was manageable since we had so much material with us to the exam.

I think there was maybe a bit too much stuff on the exam and there was almost a risk of not managing due to time, i guess this is a consequence of having 4 distinct parts that had to be tested at the same time.

Student 4

QM

Some new stuff I never encountered.

Statmek:

relevant

Spectro/IM:

If an exam question contains material from a hand in-exercise that I did not manage to do and did not get any feedback or solution for, then the question is simply impossible for me to answer.

Student 5

- I think the system with hand-ins and bonus points are very nice
- The questions for the spectroscopy part was exactly the same as one of the hand-in and the previous exam. I appreciate the low hanging fruit, but using exactly the same questions is nothing but lazy.
- Maybe you could have numbered the questions from 1 to 8 with a, b and c parts. That would have made it easier for us, especially since we were supposed to photograph all the answers, and a page could easily be missed.

Student 6

Spectroscopy part and intramol. part I felt really reflected on the course.

Because I always felt that the statistical therm. was scattered, this was also harder to study for and some questions felt confusing.

There were no exercises to do for the quantum part so the exam questions fel like supprises.

Some of us discussed that an exam felt like the wrong way to examine a student in this course. I felt like it would have been a lot better having more hand-in questions or projects and labs to examine. I feel like I then would have learned a lot more than I actually did.

Workload

Student 1

30-40 hours

Student 2

30-40 hours

Student 3

30-40 hours

Student 4

30-40 hours

Student 5

30-40 hours

Student 6

20-30 hours

Relevance

Student 1

The majority of topics were relevant

Student 2

Many topics were relevant

Student 3

Many topics were relevant

Student 4

A few topics were relevant

Student 5

A few topics were relevant

Student 6

Irrelevant

Other

Student 1

I think I wrote down everything in the other sections.

Student 2

Bonus points should go towards getting a higher grade as well, perhaps half of the bonus points count above G if it seems too generous. And they should definitely be kept for re-exams.

The lab shouldn't be so close to the exam.

Student 3

This course seems like it's a mash of 2 courses: one with statistical thermodynamics and intermolecular interactions and one with quantum mechanics and spectroscopy. I think it would honestly feel more natural if it was 2 courses which were taken parallelly.

Different parts of the course required very varying amounts of work

- QM probably too easy, it was however possible to know all material and still be unprepared for the exam (see above)
- stat. TD I spent around 8 working hrs/day, good
- Intermolecular interactions a bit tough and I (and many others) didn't turn in hand-ins until halfway through spectroscopy
- Spectroscopy was good total workload but quite relaxed before lab and too tough after lab (see above)

However, I still liked the course and would recommend it

Student 4

nan

Student 5

- This course had the best set of teachers that I have experienced during my studies in Lund!
- I would have liked to have lectures from 8 to 10 and then exercise from 10-12.
- I think you should consider moving the spectroscopy part to directly after the QM part, since the QM and SP were similar, and ST and MI were similar to each other.
- It was very fascinating to see the laser labs. It was much appreciated!
- I am doing a master in synthetic and analytical chemistry. I do not really see the relevance of this course for an analytical or organic chemist.

Student 6

The lecturers are nice but I feel like this course needs to be to a large extent reevaluated and changed in many ways. Unfortunately, this is the course that has been the most confusing, most stressful but where I felt I can bring with me the least afterwards. Sorry for

the hard words, but I really want this course to be better and improved for next years student because I felt pretty drained after this course (in mind and spirit)..

In []: