Avogadro Goes to Court

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Introduction

The case study that follows was inspired by a novel assignment that Pace University Professor Carroll Zahn gave to his introductory computer class. The result of this assignment was certainly far different than anything that either the professor or his class could ever have predicted on the day that the assignment was given (Felsenthal, 1995).

One fateful day, Professor Zahn decided to challenge his class by asking them to calculate the cost of a single aluminum atom in a roll of aluminum foil that he had recently purchased. The information that he provided the class included the cost and size of the roll, the atomic mass of aluminum, and the value of Avogadro's number. After that they were on their own. Two students, Peter Broome and Marina Andre, became quite upset with the problem they were assigned, withdrew from the course, and, after failing to resolve their complaints to their satisfaction through standard academic channels, launched a lawsuit against Pace University. Their case was heard by New York State judge Thomas Dickerson who ruled in the students' favor, awarding them a full tuition refund for the course and $1,000 each in compensatory damages. The judge reportedly commented that, "Students are consumers—there is nothing holy or sacred about educational institutions." Pace University is reportedly appealing Judge Dickerson's decision.

At the risk of finding myself in court, Professor Schroeder, a fictional character in the case study that follows, is going to give you virtually the same assignment that Professor Zahn gave his class. A significant difference, however, is that you will be given the opportunity to design and perform simple laboratory experiments to obtain whatever information you deem necessary to solve the problem.

You are to work in groups to calculate the cost of a single aluminum atom in a roll of aluminum foil. As Professor Schroeder directs, your answer should be correct to three significant figures, should be documented with a detailed unit analysis, and should be reported using scientific notation. Use the cost information given in the case study. You will be given a piece of aluminum foil similar to that which our fictional Professor Schroeder gives to his students. Any experiments you may decide are necessary should be done using this piece of aluminum foil. All other necessary information is contained in your text.

Have fun, good luck, and, above all, let's work together to stay away from the legal system!

Avogadro Goes to Court—The Case Study

On a sunny Wednesday morning Professor Ken Schroeder entered his classroom and said, "Good morning, everyone. Isn't this a beautiful day?" Getting a minimal response from his students, he moved on. "I have decided to give you a different kind of assignment today, one that I hope you will enjoy and find instructive."

Dave Barton, a student who had been in another of Professor Schroeder's classes said, "I hope this isn't going to be another of your 'brain teasers,' Professor Schroeder."

"No, this is actually quite straightforward. I don't think that you'll have any trouble with it, and it should be interesting for you."

"It's the 'interesting' part that has us worried," said Kathleen Terry, a young woman who seldom spoke in class.

"Well, I assure you that you have nothing to worry about, Miss Terry. All that I shall ask you to do is to calculate the cost in dollars of a single aluminum atom in the roll of aluminum foil that I purchased today. Your answer should be correct to three significant figures and should be reported using scientific notation."

Dave Barton asked, "How are we supposed to do that?"

"I'll tell you the cost of the roll of aluminum foil and give you some additional information. The rest, including any measurements that you may wish to make, is up to you.

"The roll cost $1.59. The area of the roll as listed on the box is 6.96 square meters. I will give you an approximately 8 inch by 8 inch section of the roll that I have cut out for your use."

"That's all that we get?" asked a young woman in the back of the room.

"How much aluminum is in the roll?" asked a student in the third row.

"You should be able to determine that. Remember, Avogadro's number is central to your calculations."

"What's Avogadro's number?" asked another student.

Peter Brower asked, "Would you explain exactly what you mean by 'three significant figures'?"

"All of the information you need is either in your text or available to you if you make some measurements," said Professor Schroeder.

"You are to work on this as a group project outside of class. Start soon because your report is due one week from today. Be sure your report includes all of the details of your calculation, including a complete dimensional analysis."

"Professor Schroeder, some of us, at least, don't have a clue how to do this. We need some help," said Kathleen Terry.

"Just get started, Miss Terry. As you work together things will become much clearer to you."

From the nature of the conversations that ensued, it soon became clear that the class was confused and annoyed by this assignment. Professor Schroeder ignored this, however, and moved on to his lecture for that day.

At each of the next two classes the students peppered Professor Schroeder with questions about the aluminum atom problem. He consistently referred their questions back to them, telling them that they had access to all of the information that they needed, and that they had to state the problem properly in order to succeed. The students made little progress with the assignment, and became increasingly frustrated and angry as time went by.

One of the students suggested that they visit the Chemistry Department chairperson to complain about the lack of help that they were receiving from Professor Schroeder.

Professor Nancy O' Sullivan, the Chair of the Chemistry Department, met with the students later that same day. "Professor Schroeder has explained the nature of the assignment that he has given your class. It sounds reasonable to me, but I understand that you feel that you are being treated unfairly, is that right?"

"Yes," said Dave Barton, "we need help and Professor Schroeder won't answer our questions; he keeps telling us that we can find the answers in our text, and that we need to work together to solve the problem."

"Well, Professor Schroeder is right," said Dr. O'Sullivan. "All of the information is there for you. You need to work together, find it and get started on the problem. I'm afraid that I can't agree that Professor Schroeder is doing anything wrong. I'd advise you to get on with your assignment."

A subsequent visit to the Dean led to yet another rebuff and left the students frustrated and angry. After an additional attempt by a number of Professor Schroeder's students to petition the Dean led nowhere, the students angrily concluded that their only remaining recourse would be to the legal system. This seemed like a big step, but these are litigious times, and emboldened by a similar case that they had read about in the media, several of the students joined together to sue Professor Schroeder and his university.

When their case was heard in court, however, things went quite differently than the students had anticipated. The judge listened carefully and sympathetically to the arguments of both sides, but after some deliberation he ruled that the professor and his university were not at fault, and that the students did not have a valid case. He further ruled that the problem that Professor Schroeder had assigned was a good example of interactive group learning and a reasonable assignment.

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Portrait of Amedeo Avogadro
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