Britney

[00:35:58.07]
I: I also brought a Fermi problem because- last semester we did a lot of Fermi problems and today I'm not expecting you to solve it and give me an answer. I'm just more interested in seeing you work through it but talk about how you're thinking about the problem. No pressure to give an answer.
B: I actually really like Fermi problems. We did one in English and I was like, Yes!, like oh let's make up a Fermi problem about this and I was like, I got this.

[00:36:50.19]
B: (Reads problem) First I would try to figure out what the question's asking- Four years of tuition. Being paid in soda cans. First estimate four year tuition. Typically one year is two semesters. Spring and Fall. Shoot how much? If it's over 14 credit hours... That strategy is not going to work. So What do I know? I think it costs like 30k/yr... or 30k people here... Does that make sense?
I: Yeah. I've heard so many different numbers doing this with you guys.
B: I'm going to go with this and say one year. Four years would cost twelve hundred thousand dollars. (rereads problem) One soda can is like five cents... Assume whatever state, they collected the cans in that state. Collection rate is 5c/can. Have to have twenty cans will give you one dollar. Wow, this is going to be a gigantic number. You have twelve hundred thousand dollars. Directly multiply them. I haven't done this kindof multiplication in so long I'm second guessing myself. 2.4 Million cans- required to pay for the tuition. Is this possible? I'm going to say it is because it's not given a time limit. Could have been doing this for fifteen years. No other information given.
[00:43:23.04]

I: Do you think the kind of reasoning that you were using to make sense of this problem, um, like would you use this kind of reasoning in other physics classes?
B: Probably, if I didn't know how to get to the answer, I'd probably just break it down as closely as I could to this to try and make sense of it. So it'd be like, if you if a ball is thrown off this cliff at this- and I'm like, say I don't know anything about it, I'm like okay well- I know it can't take bigger than this amount of time and this amount of time, it just doesn't work. So I probably could. Probably wouldn't get very very right, but I'd get sortof close ish.

I: Before you started this problem, you mentioned in one of your english classes you did a Fermi problem. How did that happen?
B: It was, she was trying to- So we were doing, I think as an example, we have a paper that we're writing and she was trying to make us take a board question and break it down into its constituent parts. So it was like, she gave us a Fermi problem to try to make us do that. It was like, how many mouthguards the NFL uses in a year. I was like, okay, well I don't know anything about football so we just kinda. So I think it was to make us think of the more detailed questions behind a paper because we had to write a paper with a big overarching question and inside break it down into other questions. Yeah. It was actually really hard. And then whoever made a claim in the class, like I think it's this number because of this, they had to support it using like, whatever they had to support it with and then we determined who was most credible, which

answer to pick over the other. We didn't do order of magnitude or anything, but it was a pretty good exercise, I thought.
I: That's interesting, I've never heard of that happening in an English class.
B: I was suprised but I liked it. I was like, I know how to do this!

[00:07:34.21]
I: I heard you earlier say something like Fermi problems are applicable to real life. I'm wondering if you can say a little more.
B: I actually have an example. I was walking with my roommate and she bought a hedgehog. So she was like. \I: Is that legal?\ Well, like, yeah you can have pet hedgehogs. They're really adorable.
I: I know they're illegal in california
B: Really? Oh man. Now I'm kinda curious. But I think they are.
I: I'll wipe this from the video
B: Thank you. Just in case.
[00:08:11.21]

B: They recently bought a hedgehog and she told me she was like, oh a hedgehog in its entire life eats an entire bag of cat food, er, no, it was that it eats a tablespoon of cat food in about a week. And she gave me some lifespan for it, for the hedgehog, and I can't remember the specific numbers now, and she's like oh well (her boyfriend) has a bag of cat food and said that by itself should last her whole life. And she was like, does that make sense? Should we get more? and I was like, Well, Here comes the Fermi problem. I was like, okay if you think, a cat food is like, a bag of cat food is like, I don't know, the size of like, three textb-, be like, 2 cm, 4cm? like 12, no, mm?, it's. I had specific dimensions at that time and I calculated it down a tablespoon is like this much of it and that would probably last this many weeks, er, no it was this many days and was like yeah, it should probably work. So in that circumstance, it did. Immediately after I was like, I just did a Fermi problem to figure out how much cat food would last a hedgehog's life. So yeah, very applicable. \I: That's interesting\ But I think that kindof a random coincidence.
I: That's cool though, that's cool. I'm glad that you guys feel like you can take things you've learned to your life.
B: Yeah. It did, I was like really proud and I was like, yeah that was awesome. I just did that. And before, I remember the first day that we- you presented- oh no- so I did the physics olympics in high school and we had Fermi problems and they gave us how many eggs the United States consumed and I was like, how do I even comprehend this problem? I don't even know where to begin so we just wrote down random numbers cause we didn't even know how to begin thinking about it but then like after this class, now I know how to approach that kind of problem. So like, it really - I'd say it's really helpful and life changing. (My roommate) wouldn't know how much cat food to get.

[00:43:30.25] By the way, I used, I couldn't get mad at the Fermi problems that we did because I used one in a real world situation once, I uhh, I'm in EWB- Engineers without borders, and we uh, we were doing a problem- I've actually used it a lot lately, but it's like, cause I don't really have, we just need to know how many nails do you need for like a 9.5x6 ft roof on a pavillion, and I was like, 'well- I don't know, I can't tell you an exact answer,' so we thought about how

many nails we need for each truss and how many of these across, and yadda yadda, and so we just came up with really rough estimates and we got magnitude and stuff, so I've had to use that a lot in like engineering real world applications.

I: Oh interesting. Huh. Are there any other places in your life that you feel like you're using them?
C: Umm, uhh, I used them with time. I don't know if that makes sense. But like, I kinda used it for like planning out a day. It's like okay, this is gonna take me 15 minutes, and I have to walk and I'll just round up to 10 minutes, and like plan using Fermi problem, like a -I guess. I don't know if that's a direct thing, but like, I use that. But I've used it a lot in the Engineering Without Borders.
I: Cool, that's good to know.
C: So if you wanted, if you need to put that in an application based thing. I do that.
I: Great.

[00:44:54.01] Solving Fermi Problem
C: Oh My Gosh, it's so broad! I don't understand. Umm
You want me to walk- like what I'm doing? or just \I: Sure\ Umm, first I wanna know how much the university requires. Paying for a four year university. And I'm just gonna use Maryland cause it's the best and it's gonna be in state cause Maryland's cool. So four years at 20,000 dollars per year. Um, he needed to collect $80,000 in cans. That's his target range. Cans are really cheap to turn in I'm pretty sure. So I think five cents per can. That's what I'm gonna say. Five cents per can. Umm. How many cans would it be? Okay. So if I did my orders right, he would need 1,600,000 cans. Which is a lot. I'm gonna say it's not possible cause if he does that, that'd be, even if I drop that down a magnitude that's a ton of cans. Is that right? 8 million divided by 5. That's right.
[00:47:59.26]
C: Yeah no, that's a lot of cans. Cause let's see. To prove that, that'd be 4 years, and that's 365 days per year. And he's gonna collect- you want cans per day is what you want. This would be. 360 days a year, just so you know. 1440- so he has 1440 days to collect that many cans. So that would be- I can't do that in my head. That's a ton of cans per day. Yeah that- let's just turn it into that's a thousand cans per day. Pretty much pretty much. I don't think he could do it. Personally, personally. Maybe if it was like 100 cans per day, I could see him going to like every dumpster and finding 100 cans per day but 1000 cans?
[00:49:56.04]
Well, let's see. How driven is he, is the question. Well. 30,000 kids on campus. Let's say a sixth of them use cans. 5,000 cans. It's possible. It might be.
Okay, I'm going to say possible. It is possible. And that's because, although he does need to collect 1000 cans, which is really hard. If- I think time would be a bigger issue. I guess. 30,000 people - that's only kids not even all the faculty and stuff yeah that's 30,000 people and only 1/6, one out of six of them drink a coke that day out of a can or something. I know people that drink like 2 cans of mountain dew in a day. So if that's 1/6 that's 5,000 cans right there. So if you checked every dumpster or every trash can, every day, he could easily get 5,000 cans. Alright. That's what I'm gonna say.

[00:52:03.02] Okay, so I think you, You mentioned earlier that you've used Fermi problem reasoning outside your classes, but do you see this kind of reasoning as being applicable to your physics classes?

Umm, I'm a man of pretty hard answers. So I don't like using Fermi problems, unless it's like, can't get an answer, you know what I mean? So, for this, I can't get an answer, it's not like, I don't have a rate at which he collects cans, I don't have how much he can, I don't have enough of that. But, uh, for most physics problems you always have enough information to solve it, but then if I apply that to my engineers, if I think about it like engineers without borders, we did find out how many nails you needed. The exact number after we figured out everything, but we guessed at how many we needed at first. You could apply that to physics and say, even if you knew enough information to solve problem, if you want to guess at what it's gonna be and kinda get a rough order of what you think the answer might be, it's pretty applicable yeah. I don't usually do it cause I want to get the problem done fast, but uh, if you wanna just double check your answers at the end of a test, instead of going through the whole work again, you could see if the order of magnitude is in the same spot, and that would probably be a really good way to double check a test.