Tips on Physics

Richard Feynman

Lecture #1

These three optional lectures are going to be dull: they go over the same material that we went over before, adding absolutely nothing. So I'm very surprised to see so many people here. Frankly, I had rather hoped there would be fewer of you, and that these lectures wouldn't be necessary.

The purpose of relaxing at this time is to give you time to think about things, to piddle around with the things that you heard about. That's by all odds the most effective way of learning the physics: it's not a good idea to come in and listen to some review; it's better to make up the review for yourself. So I'd advise you-if you're not too far lost, completely befud dled and confused-that you forget about these lectures and piddle around by yourself, and try to find out what's interesting without grinding down some particular track. You'll learn infinitely better and easier and more completely by picking a problem for yourself that you find interesting to fiddle around with-some kind of a thing that you heard that you don't understand, or you want to analyze further, or want to do some kind of a trick with-that's the best way to learn something.

The lectures that we have been giving so far are a new course, and have been designed to answer a problem we presumed existed Nobody knows how to teach physics, or to educate people. That’s a fact, and if you don't like the way it's being done, that's perfectly natural. It's impossible to teach satisfactorily: for hundreds of years, even more, people have been trying to figure out how to teach, and nobody has ever figured it out. So if this new course is not satisfactory, that's not unique.

Now, I am therefore imagining that one of you has come into my office and said, "Feynman, I listened to all the lectures, and I took that midterm exam, and I'm trying to do the problems, and I can't do anything, and I think I'm in the bottom of the class, and I don't know what to do." What would I say to you? The first thing I would point out is this: to come to Caltech is an advantage in certain ways, and in other ways a disadvantage. Some of the ways that it's an advantage you probably once knew, but now forget, and they have to do with the fact that the school has an excellent reputation, and the reputation is well deserved. There are pretty good courses. (I don't know about this particular physics course; of course I have my own opinion about it.)

The people who have come out the other end of Caltech, when they go into industry, or go to do work in research, and so forth, always say that they got a very good education here, and when they compare themselves with people who have gone to other schools (although many other schools are also very good) they never find themselves behind and missing something; they always feel they went to the best school of them all. So that's an advantage.

But there is also a certain disadvantage: because Caltech has such a good reputation, almost everybody who's the first or second in his high school class applies here. There are lots of high schools, and all the very best men [Caltech didn’t accept women in 1961, when Feynman was speaking. Boo.] apply. Now, we have tried to figure out a system of selection, with all kinds of tests, so that we get the best of the best. And so you guys have been very carefully picked out from all these schools to come here. But we' re still working on it, because we've found a very serious problem: no matter how carefully we select the men, no matter how patiently we make the analysis, when they get here something happens: it always turns out that approximately half of them are below average!

Of course you laugh at this because it's self-evident to the rational mind, but not to the emotional mind-the emotional mind can't laugh at this. When you've lived all the time as number one or number two (or even possibly number three) in high school science, and when you know that everybody who's below average in the science courses where you came from is a complete idiot, and now you suddenly discover that you are below average-and half of you guys are-it's a terrible blow, because you imagine that it means you're as dumb as those guys used to be in high school, relatively. That's the great disadvantage of Caltech: that this psychological blow is so difficult to take. Of course, I'm not a psychologist; I'm imagining all this. I don't know how it would really be, of course! The question is what to do if you find you're below average. There are two possibilities. In the first place, you could find that it's so difficult and annoying that you have to get out-that's an emotional problem. You can apply your rational mind to that and point out to yourself what I just pointed out to you: that half of the guys in this place are going to be below average, even though they're all tops, so it doesn't mean anything. You see, if you can stick out that nonsense, that funny feeling, for four years, then you'll go out into the world again, and you'll discover that the world is just like it used to be-that when, for example, you get a job somewhere, you'll find you're Number One Man again, and you'll get the great pleasure of being the expert they all come running to in this particular plant whenever they can't figure out how to convert inches to centimeters! It's true: the men who go out into industry, or go to a small school that doesn't have an excellent reputation in physics, even if they' ve been in the bottom third, the bottom fifth, the bottom tenth of the class-if they don't try to drive themselves (and I'll explain that in a minute), then they'll find themselves very much in demand, that what they learned here is very useful, and they're back where they were before: happy, Number One.

On the other hand you can make a mistake: some people may drive themselves to a point where they insist they have to become Number One, and in spite of everything they want to go to graduate school and they want to become the best Ph.D. in the best school, even though they're starting out at the bottom of the class here. Well, they are likely to be disappointed and to make themselves miserable for the rest of their lives being always at the bottom of a very first-rate group, because they picked that group. That's a problem, and that's up to you-it depends on your personality. (Remember, I'm talking to the guy who came into my office because he's in the lowest tenth; I'm not talking to the other fellows who are happy because they happen to be in the upper tenth — that's a minority anyway!)

So, if you can take this psychological blow-if you can say to yourself, "I'm in the lower third of the class, but a third of the guys are in the lower third of the class, because it's got to be that way! I was the top guy in high school, and I'm still a smart son-of-a-gun. We need scientists in the country, and I'm gonna be a scientist, and when I get out of this school I'll be all right, damn it! And I'll be a good scientist!"-then it'll be true: you will be a good scientist. The only thing is whether you can take the funny feelings during these four years, in spite of the rational arguments. If you find you can't take the funny feelings, I suppose the best thing to do is to try to go somewhere else. It's not a point of failure; it's simply an emotional thing.

Even if you' re one of the last couple of guys in the class, it doesn't mean you're not any good. You just have to compare yourself to a reasonable group, instead of to this insane collection that we've got here at Caltech. Therefore, I am making this review purposely for the people who are lost, so that they have still a chance to stay here a little longer to find out whether or not they can take it, okay?”