Mazur Clip 4 Transcript

ERIC MAZUR: Did anybody go over your part one?

STUDENT: Yes.

STUDENT: Yes.

ERIC MAZUR: OK, so I saw a lot of misconceptions about 1D. OK good, the work [INAUDIBLE] work, right?

STUDENT: Oh, yes.

ERIC MAZUR: Work is the change in energy. A lot of people wrote down work is the change in kinetic energy. Happens to be true here, because the only form of energy is kinetic energy. It's a particle. But in general terms, work is the change-- the work done on a system is the change in the energy of the system, which is what you wrote down here [INAUDIBLE] delta. Once you get to the end of two, have somebody--

STUDENT: We are.

ERIC MAZUR: You are? So should I go over it?

STUDENT: Sure.

ERIC MAZUR: Do you all agree about part two.

ALL: Yes.

ERIC MAZUR: Did you discuss it with each other?

ALL: Yes.

ERIC MAZUR: OK, so why don't I look at one-- you all have the same answers?

ALL: Yes.

ERIC MAZUR: I need to refresh my own memory, so bear with me. Diagram on top of your positively charged rod, right here. Point W and Y, and X and Z are equidistant. Draw electric field vectors. So they're pulling away from your rod. And a nearer point is longer than farther away. So W and Y should have equal arrows pointing away from the rod, as shown here. And X and Z shorter in the same direction.

A particle is charged, plus Q travels along a straight line from W to X. Work done by the electric field positive, negative, or zero. It's positive because F points in the same direction as displacement. Compare the work done by the electric field to that done from W to X to that from X to W. We flipped the displacement around. Force times [INAUDIBLE] direction. Work is the dot product of force and work. So it just flips sign.

The particle travels from X to Z along a circular arc. Zero, why is it zero?

STUDENT: It's path independent.

ERIC MAZUR: Forget about path independent. Let's say that I only want to talk about that pass. How can I argue that the work is zero?

STUDENT: Because it's essentially equal radius away from the positive charge at all points, so it's a-- what is it? [INAUDIBLE] potential line?

ERIC MAZUR: Yes, that's another way.

STUDENT: Travel along that, like--

ERIC MAZUR: But suppose we are trying to think about it purely in terms of mechanics. Here's the rod. And this is the circular arc.

STUDENT: So the distance is always--

ERIC MAZUR: The distance is always the same. That's right. So what do we know-- let's consider a few points here. Point one, point two, point three. What is the electric field at point one, and which way does it point? Straight away from here like that, right? What about point two?

STUDENT: [INAUDIBLE]

ERIC MAZUR: And how does that arrow-- same one, right? I didn't draw it completely right. And what about here? What do we know about those arrows compared to the path it takes?

STUDENT: It's the same or the--

ERIC MAZUR: Same magnitude. What about the direction?

STUDENT: They're all perpendicular to the path.

ERIC MAZUR: They're all perpendicular. This is perpendicular. This is perpendicular. Wherever we are it's perpendicular. So if you take a small displacement, D R-- this is the electrostatic force.

STUDENT: Is it the FD cosine [INAUDIBLE]?

ERIC MAZUR: What do we know about this? F dot DR. That's this times this, times the cosine of that angle, which is?

STUDENT: Zero.

ERIC MAZUR: So this is zero, always, everywhere.

STUDENT: Got it.

ERIC MAZUR: I mean, that's the best way of explaining it. The force is always perpendicular to the displacement. It's better to do that because they want you to use that answer later on and show that it's passive dependent. But it you put the conclusion in the beginning, you defeat the purpose. So zero network, because the force is always perpendicular to the displacement. Two vectors line up. And that's what you had in one.

Actually, let's go back to one. Let's go back to one. So I agree it was positive. I agree it was negative. What about zero? What did you draw being zero?

STUDENT: We drew no displacement.

STUDENT: But you could also draw it like this.

ERIC MAZUR: Yes.

STUDENT: Then it will be cosine--

ERIC MAZUR: Exactly. I'm glad I went over this.

STUDENT: Yes. It actually does make a lot more sense.