Now when we did these calculation, we saw that the kinetic energy in the ground frame was equal to the kinetic energy in the center of mass frame plus a constant term, m1 plus m2 times Vcm squared.

And this is a constant whether you're in the initial or the final picture.

So if we look at the change in kinetic energy in the ground frame, that's equal to the change in kinetic energy in the center of mass frame.

But this term is a constant.

So there's no change in that term.

And so we have a crucial result that the change in kinetic energy in the ground frame is equal to the change in kinetic energy in the center of mass frame.

Now let's look at an example of a collision that's completely inelastic.

So we have object one.

And it's coming in with V1 initial.

And object 2, let's make it at rest.

And afterwards object 1 and 2 stick together.

And they go off with V final.

So here's a collision in an inelastic frame.

Now in the center of mass frame, the two objects-- so here's our lab or ground frame.

I can call it the lab frame because that one is at rest.

And this is the cm frame.

And there we have V1 prime and V2 prime.

They're both moving.

And now in the center of mass frame, they're at rest at the end of the collision.

So in this collision, we can analyze it.

And now what I want to show is that the change in kinetic energy, recall from our previous calculation, that the kinetic energy in the center of mass frame was equal to 1/2 mu times the relative velocity squared.

So remember V1, 2 was equal to V1 minus V2.

And so the change in kinetic energy in the center of mass frame is the final kinetic energy is 0 minus 1/2 the kinetic energy in the initial state.

And what is this quantity initial?

Well, this was a reference frame independent concept.

So we can just look at the lab frame.

And right this as V1 initial i hat where that's i hat because this object is at rest.

And so right away we have that the change in kinetic energy is minus 1/2-- now remember mu was m1 m2 over m1 plus m2 times V1 initial mean squared.

And that's the same change in kinetic energy as the ground frame.

So by using our result here and our result there, we were able to very quickly assess how much kinetic energy is lost in this inelastic collision.

And where does that kinetic energy go?

It can go to a variety of places, deformation of objects.

It can go into sound.

It can go into thermal energy that diffuses into the environment.

However, that's how much is changed.