Online Resources for Relativity

1. **Al’s Relativistic Adventure** <http://www.onestick.com/relativity/>

This is a slightly interactive animation that that looks like a cartoon for children, but don’t be fooled! The physics is completely correct and very well organized. You can give it to an interested grade 9 to view on their own or use it in grade 12 to introduce or review all of the following; frames of reference, time dilation, speed limit of c, space contraction, addition of velocities and the twin paradox. The only downside is that it is completely linear and you can’t just watch one part.

1. **Approaching** **the Speed of Light** <http://www.triumf.ca/home/multimedia/videos/speed-light>   
   This resource from TRIUMF lets your students do an experiment to determine that p = mv. It consists of a short video, teacher’s guide, student worksheets and data sheets to analyse.
2. **Finding the Mass of the Top Quark** <http://ed.fnal.gov/samplers/hsphys/activities/top_quark_intro.html>

This resource from Fermilab has the students use 2-D conservation of relativistic momentum with data from Fermilab to calculate the mass of the top quark. This activity has been simplified and is part of the latest resource from the Perimeter Institute – Particle Physics.

1. **GPS**: **An Application of Special and General Relativity**

[perimeterinstitute.ca/en/Perimeter\_Inspirations/General/Perimeter\_Inspirations/](http://perimeterinstitute.ca/en/Perimeter_Inspirations/General/Perimeter_Inspirations/)

This resource consists of a 4-minute video and several different activities for grades 9-12.

1. **Alice and Bob in Wonderland**

<http://www.perimeterinstitute.ca/Outreach/Alice_and_Bob_in_Wonderland/Alice_and_Bob_in_Wonderland/>

These are nine one-minute animations from the Perimeter Institute that ask some very big questions. There are three that are useful when exploring accelerating frames of reference and general relativity with the PI GPS resource above. They are:

Why doesn’t the moon fall down? (Freefall means orbits as well as falling down.)

What keeps us stuck to the Earth? (Gravity feels like an acceleration - the equivalence principle.)

Can we travel in time? (Gravity slows time as shown near a black hole.)

1. **Einstein Online**

<http://www.einstein-online.info/>

This site from the Max Planck Institute for Gravitational Physics has everything. It has stuff for the beginner and the very advanced. You can spend weeks learning from it. In particular there is a nice animation of real data of stars orbiting the super massive black hole in the center of our galaxy here <http://www.einstein-online.info/spotlights/milkyway_bh>

1. **TRIUMF: Life Sciences**

<http://www.triumf.ca/videos/life-sciences>

This is a 4-minute video that shows some of the uses of PET (Positron Emission Tomography.) a medical example of E = mc, where positrons and electrons annihilate to emit two photons moving in opposite directions.