Try this Activity (Nelson 12, p. 23)

- ### Graphing Motion with Acceleration

- In this activity, students predict and graph the position-time, velocity-time, and acceleration time graphs for a cart moving up and then down a ramp as a result of an initial upward push. Time: 10 min

Teacher Preparation

- Teachers must be aware of the proper operation of the motion sensors and graphing software.
- Teachers may want to set up one complete apparatus ahead of time as a demonstration for students.
- If not using the electronic equipment, teachers should prepare the appropriate graphs on overheads ahead of time and display the graphs for the students at the conclusion of the activity

Material/Equipment	Quantity per station	Quantity for 16 stations
motion sensors and appropriate graphing software	1	16

Materials and Equipment Notes

- Prepare materials so the class can work in groups of 4 or less. This reduces the amount of equipment needed and minimizes the demands for help on the teacher among the groups.
- This activity is useful even if motion sensors and graphing software are not used.

Safety and Disposal

- Students must be careful to prevent damage to the motion sensors as the cart rolls back down the ramp

Student Preparation

- Students should be aware of the operation of motion sensors and the accompanying graphing software from previous science or mathematics courses, particularly in grade 9.

Teacher Suggestions

- It is important to have students predict the shapes of the graphs before performing the activity. They can then test their hypotheses.
- Take particular note of the acceleration-time graph since few students will properly predict its shape. Provide students with the example of throwing an object vertically upward and ask them about the acceleration of the object on the upward and downward portions of the trip, and at the top of the flight. Although the object is not moving, it is still accelerating.

Extensions/Modifications

- Students will determine that $a = g \sin \theta$, where $g = 9.8$ m/s2 and θ is the angle of elevation of the ramp. The measured acceleration is the component of the acceleration of gravity parallel to the ramp