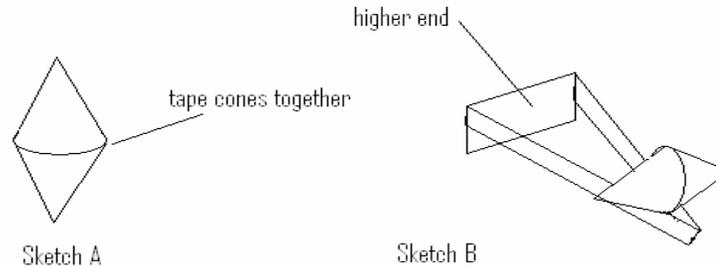


## ROLLING UPHILL?

**A. Question:** *In what direction does gravity act?*



**B. Materials Needed:**

1. Strips of cardboard (about 3cm wide).
2. Paper cards and cello tape.

**C: Procedure:**

1. Make a cardboard ramp in the shape of a narrow V, and tape a wider cardboard strip to the open end of the V, so that this end will be about 2cm higher.
2. Construct two identical cones from the paper cards and tape them together. Make sure that the surface of the double cone is smooth (especially where it is taped).
3. Place the double cone on the lower end of the V-shaped ramp and give it a starting push toward the higher end.

**D: Anticipated Results:**

Students should be observant and see that the double cone is rolling downhill and not uphill.

**E: Thought Questions for Class Discussion:**

1. How can an object roll uphill?
2. Does the double cone actually end up higher above the table?
3. Would a cylinder roll up the V-shaped ramp?
4. What force made the double cone roll toward the open end of the V?
5. What would a sphere do on the V-shape ramp?

**F: Explanation:**

This demonstration invites the students to be very observant. It gives the illusion of the double cone rolling uphill. The fact that the double cone actually rolls downhill. It started higher above the table at the lower end of the V-shaped ramp and ends up lower above the table at the higher end of the ramp. It can be observed by fixing the eye on the tip of the double cone or actually measuring the distance between this point and the table top before and after the rolling.

It is because of the shape of the double cone and that of the ramp, that the object's center of gravity slightly gets lowered when rolling from the tip to the open end of the V-shaped ramp. A cylindrical shaped object would not be able to roll "uphill" on this ramp. A spherical shaped object, like a ball for instance, would be able to roll towards the higher end of the ramp, but drops down much sooner between the legs of the V-shaped ramp.