Additional material 4

Inelastic Collision

In this case, two objects make a common body during the collision and move on together. There are many examples of inelastic collisions around us like the kickback movement, but the most important are the decomposition processes (collisions seen from the end to the beginning) as: the radioactive decay and the break-up or an explosion of a meteorite.
Physics theory
The linear momentum is conserved for two balls having the masses m_1 and m_2, the initial velocities $\overrightarrow{v_1}$ and $\overrightarrow{v_2}$ and the final velocity $\overrightarrow{v_f}$:

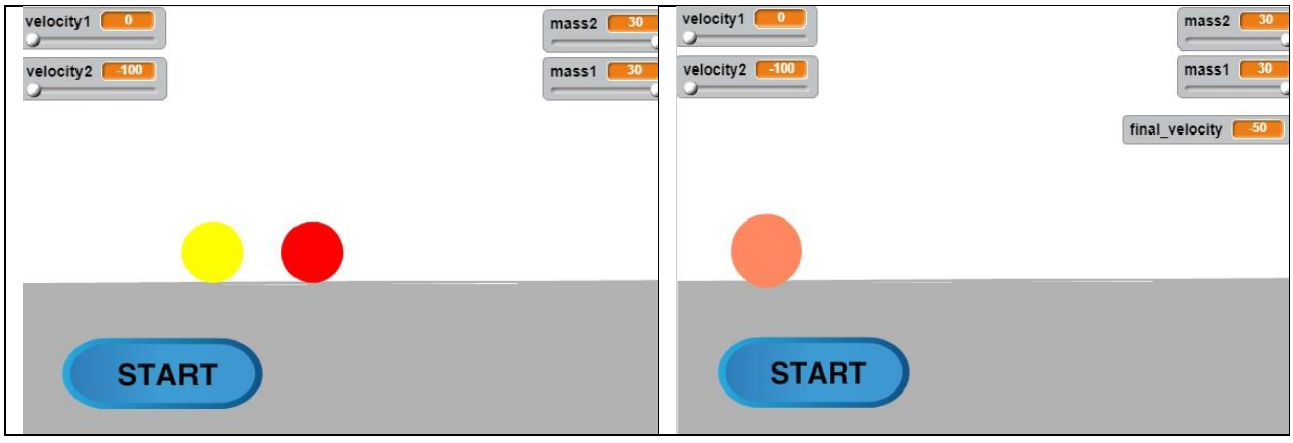
$$m_1\overrightarrow{v_1}+m_2\overrightarrow{v_2}=(m_1+m_2)\overrightarrow{v_f}$$

If all motion takes place along the same line (movement on Ox axis) we can use + or – signs to designate directions. Vector notation is not needed for straight-line collision case and the final velocity can be calculated from the following expression:

$$v_f=\frac{m_1v_1+m_2v_2}{m_1+m_2}$$

How to code and how the Scratch application works?
1. Choose two sprites for the balls (Ball1 and Ball2) and one sprite for the Start button (Start sprite).
2. Use variables: mass1, mass2, velocity1, velocity2 (the mass and the initial velocity) for each object. Make the variables – slider visible and set the minimum and maximum value for them.

3. Enter the masses and the initial velocities for each object.
4. Press the START button. At this time, the START sprite broadcast a message for the ball - sprites. When they receive the message, each ball is moving toward the other
5. Calculate the final velocity of the common body (after the collision) and move it with this velocity in the right way until it touches the edge and leaves the scene or stays on the meeting point if the final velocity is 0.



Interesting example: Find the condition to obtain the final velocity 0.
Challenge:
The students can create applications for one-dimensional or two-dimensional decomposition process of an object with the initial velocity equal 0.