

S205

# Ball Roller Coaster

ボールコースター

## ■ Purpose of Exhibition

In this exhibition, a ball is rolled on rails.  
In the middle of the course, there are many obstacles,  
and you can enjoy the movements of a ball.



## ■ Additional Knowledge

The following physical phenomenon is related to the obstacles in the path of the ball.

Article by Yoshitaka Yamada, curator

### [Loop]

A ball comes from a high place. It rolls into the loop and makes a vertical turn. If it does not roll over a certain speed, the balls cannot pass through. If it rolls slowly, the ball falls out of the loop. To get up the speed to pass through the loop, the ball must be dropped from a height of more than 2.5 times the radius of the loop. If the ball departs from below that point, it cannot pass through the loop. The same height as the loop is 2 times the radius, but if the ball is rolled from that height it cannot pass through the loop.

However, a height of 2.5 times is an ideal condition in which there is no air resistance and friction. In fact, the speed is moderated by friction and air resistance.

Therefore the ball cannot pass through the loop if it is not rolled from this particular height.

### [Pendulum Collision]

When a rolling ball hits a pendulum, the speed becomes almost zero, and sometimes it falls on the lower rail. Not one, but three pendulums are hung in a row. When the rolling ball hits a pendulum on one of the left edges, the left pendulum ball which came into contact and the neighboring (middle) pendulum ball remain still, and the pendulum ball on the right edge oscillates toward the right side. Such physical phenomenon is described in the law of 'conservation of momentum'.

### [Parabolic Motion]

There is a place where the rolling ball separates from the rail and flies up in the air. Here, the ball makes a parabolic motion. Literally, parabolic motion is the motion of an object when being thrown. In physics, there is uniform motion in which the speed does not change in the horizontal direction, and on the other hand, there is motion in which the movement is accelerated downward by gravity in the vertical direction. We consider that motion of objects is divided into two directions.

According to this, you can calculate the motion of objects in ideal conditions. In fact, according to air resistance, it moves differently from ideal conditions.