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EXERCISE 2**Determination of the initial speed of a projectile in the horizontal projectile motion**

Objectives: In the present laboratory course students will determine the initial speed of a projectile, performing a horizontal projectile motion, measuring the height of the launching point from the floor and the horizontal distance the projectile covers from the launching point to the ground.

Theoretical background

We are going to determine the initial speed of a bullet which performs horizontal projectile motion. In addition, we'll obtain the time needed for the solid ball to reach the ground. The experimental setup is shown in Figure 1. A solid ball is placed at the end of a gun barrel, shown in blue color, and the spring is compressed by a distance x from its rest length. When the spring is released, the elastic potential energy stored in the spring is given to the ball in the form of kinetic energy. Let v_0 be the ball's initial speed when it is launched horizontally from the gun barrel. The ball hits the floor at a horizontal distance d from the launching point after a time interval $\Delta t_{fl} = t_{fl}$, where t_{fl} is the time, the ball is in the air. In the present analysis the air resistance is neglected.

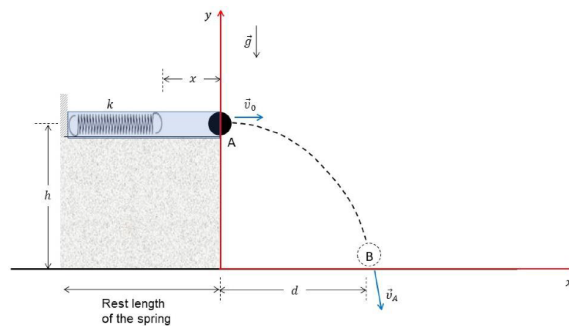


Figure 1: The horizontal projectile motion of an object from a point of height h above the ground.

We consider an Oxy orthogonal coordinate system, as shown in Figure 1. The position and velocity equations on the x and y axes are given respectively by

$$v_x = v_0 \quad (1)$$

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