Horizontal Range - Predicted v/s Actual

Solution:

The correct answer is d.)

While it is true that the finite mass of the spring, the mass of the projectile and the friction inside the barrel (between the launching mechanism and the inner walls of the barrel) will each reduce the calculated and measured range relative to its *ideal* value, none of these affects the measured range relative to its predicted (calculated) value.

Horizontal Range - Predicted v/s Actual

The reason for this is that all of these factors affect the projectile *before* it leaves the barrel, so that the value of v_0 used in our prediction of horizontal range has already accounted for each of them.

The only factor *external* to the barrel is air resistance, which acts as a retarding (drag) force on the projectile when it is in flight. Clearly, the muzzle velocity v_0 does not account for air resistance and there are no other terms in the expression for horizontal range that do so.