Experiment 6 Determining the Acceleration Due to the Force of Gravity

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We taped multiple points on a wall using a ruler to measure the distances. we used an object to tap the wall at the point to start the phyphox acoustic timer while simultaneously dropping the ball to measure how long it takes a ball to fall some distance. We calculated the velocities and graphed them to get a graph which has acceleration as the slope. I got an acceleration of 8.943 which is 8.8% lower than the handbook value.

Results:

The experimental value was a little lower than gravity. The experimental value was 8.8% lower than the handbook value. This is all likely because the height markings were measured using rulers allowing any mistake early on to compound.

Questions for Discussion:

1. Make a list of the various sources which cause uncertainty in this experiment. Within your list state which source is a random uncertainty, and which source is a systematic uncertainty. Review the Uncertainty Analysis Information file to help answer this question.

Height markings being wrong: systematic

Dropping the ball: random

1. A time interval occurs between two time values, call them t2 and t1. At these points in time an object undergoing constant acceleration will have corresponding velocities of v2 and v1. Using the equation for the midpoint in time of a time interval being equal to (t2 +t1)/2, and the equation used in this experiment, v = at, show mathematically that the average velocity over a time interval is equal to the instantaneous velocity at the midpoint of that same time interval. Show all step-by-step work.

V=at

V1=at1, v2=at2, average velocity=(v1+v2+v3+…+vn)/n

Average velocity= (v1+v2)/2=a(t1+t2)/2

Velocity at midpoint=V=at=a(t2+t1)/2

Average velocity=(v1+v2)/2=a(t1+t2)/2=velocity at midpoint

1. Using your experimentally determined acceleration due to the force of gravity, determine with what velocity (including uncertainty) the ball would have if the ball was dropped (initial velocity of zero) a distance of 5 meters. Show all work.

V2=vo2+2a(d-do)

V=sqrt(vo2+2a(d-do))=sqrt(02+2(8.934)(5-0))=sqrt(2\*8.934\*5)=9.45m/s

Uncertainty: 9.45\*sqrt((8.616/8.934)2)=9.11

1. Explain why two objects of different masses fall with the same acceleration.

Because the earth is much more massive than either of the two objects, so any difference in acceleration is negligible.