AP Physics B

Lab Activity: Predicting the Launch Angle of a Projectile

Due Date_____

Purpose: To predict the launch angle necessary to launch a projectile into a specified target.

Background:

- kinematic equations can be applied to *x*- and *y*-directions independently:

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$v = v_0 + at$$

$$v^2 = v_0{}^2 + 2a(x - x_0)$$

- specified target is 40 m away
- trig identity: $2\sin\theta\cos\theta = \sin 2\theta$
- assumptions:
  - air resistance is negligible
  - initial launch velocity is consistent from trial to trial
  - projectiles have identical mass and shape
  - launch point and landing point are at the same vertical position

Materials: Kulik Kannon 3000 (with adjustable base), grapes, meter stick, stopwatches, trundle wheel, inflatable SpongeBob, etc.

Procedure:

1) Measure and then use the "hang time" of the grapes when they are launched with a pressure of 10 psi straight upwards to determine the initial launch velocity.
2) Calculate the launch angle necessary to launch the grapes into a target 40 m away.
3) Place the inflatable SpongeBob at the target point, and set the Kulik Kannon to the predicted launch angle. Launch grapes to test the prediction.

Data:

Table 1. Hang times for grapes launched straight upwards

	Time 1 (s)	Time 2 (s)	Time 3 (s)	Time 4 (s)	Time 5 (s)	Average Time (s)
Trial 1						
Trial 2						
Trial 3						
					Overall average hang time, *t*:	

Table 2. Horizontal launch distances for the predicted launch angle

	Horizontal launch distance, *x* (m)
Trial 1	
Trial 2	
Trial 3	
AVERAGE	

Questions:

1) At what angle should the grapes be launched to strike a target 40 m away?
2) At what angle do the grapes strike the ground when they land?