KU Physics Department
PHYS 101 Laboratory

Quiz #3 Key

Group a(Thu B1):

Q1. *What's the experimental setup?*

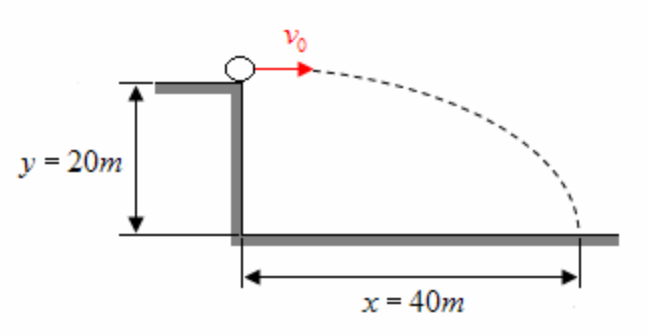
The experimental setup is composed of:

- Computer
- Signal Interface
- Two Photogates
- Projectile Launcher and Plastic Balls
- Measuring Tape
- Carbon Paper, White Paper
- Time of Flight Accessory
- Graph Paper

Q2. *Neglecting the air resistance what's the <u>only</u> factor affecting the motion of the projectile?*

Gravitational acceleration which is directed towards the Earth and does not depend on the velocity.

Q3. *Calculate the initial velocity v_0, of the horizontally launched projectile shown below, if x=40m and y=20m.*
(Take g=10m/s^2 for convenience.)



$$|y| = \frac{1}{2}\cdot g\cdot t^2 \Rightarrow t = \sqrt{\frac{2\cdot y}{g}}$$

$$t = \sqrt{\frac{2\cdot(20m)}{10m/s^2}} = 2s$$

$$x = v_0\cdot t \Rightarrow v_0 = \frac{x}{t}$$

$$v_0 = \frac{x}{t} = \frac{40m}{2s} = 20m/s$$

Group b(Thu B2):

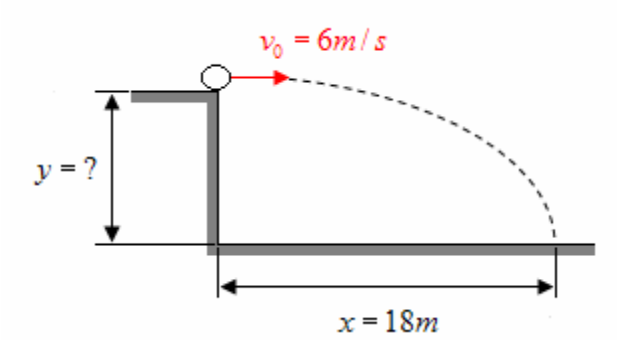
Q1. *In which part of the experiment, the Time of Flight Accessory (Landing Pad) is used? For what purpose?*

Time of Flight Accessory (Landing Pad) is used in part D of the experiment for measuring the time of flight.

Q2. *If a projectile is launched with an initial velocity of v_0 and an angle θ, what are the x and y components of the velocity initially? After a time t?*

$$v_{0x} = v_0 \cdot \cos\theta$$
$$v_{0y} = v_0 \cdot \sin\theta$$
$$v_{tx} = v_0 \cdot \cos\theta$$
$$v_{ty} = v_0 \cdot \sin\theta - gt$$

Q3. *Calculate y, the vertical distance travelled by the horizontally launched projectile shown below, if initial velocity v_0=6m/s and x=18m.*
(Take g=10m/s^2 for convenience.)



$$t = \frac{18m}{6m/s} = 3s$$
$$|y| = \frac{1}{2} \cdot g \cdot t^2 = \frac{1}{2} \cdot (10m/s^2) \cdot (3s)^2 = 45m$$

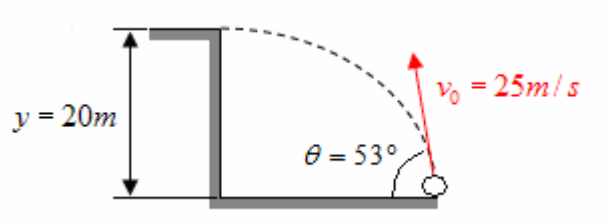
Group d(Thu B4):

Q1. *What should be the distance between the photogates?*
10cm

Q2. *If a projectile is launched horizontally with, how can the time of flight and the initial velocity be found, knowing x and y, the horizontal and vertical distances travelled?*

$$t = \sqrt{\frac{2 \cdot y}{g}}$$
$$v_0 = \frac{x}{t}$$

Q3. *Calculate t, the time of flight of the projectile launched with an angle of θ=53° shown below, if the initial velociy v_0=25m/s and y=20m.*
(Take g=10m/s^2 for convenience.)



$$y = (v_0 \cdot \sin\theta) \cdot t - \frac{1}{2} \cdot g \cdot t^2$$
$$20m = ((25m/s) \cdot 0.8) \cdot t - \frac{1}{2} \cdot (10m/s^2) \cdot t^2$$
$$t^2 - 4 \cdot t + 4 = 0 \Rightarrow t = 2s$$

Group d(Thu B6):

Q1. *What's a projectile?*

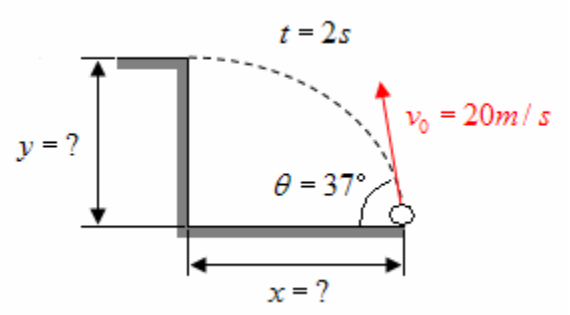
A projectile is the ball fired from the Projectile Launcher. It is an object, with a certain initial velocity that moves under the effect of gravitational force.

Q2. *If a projectile is launched with an initial velocity of v_0 and an angle θ , what are the horizontal and vertical distances traveled after a time t?*

$$x = (v_0 \cdot \cos\theta) \cdot t$$

$$y = (v_0 \cdot \sin\theta) \cdot t - \frac{1}{2} \cdot g \cdot t^2$$

Q3. *Calculate x and y for the projectile launched with an angle of $\theta=37^\circ$ shown below, if the initial velociy $v_0=20m/s$ and time of flight $t=2s$.*
(Take $g=10m/s^2$ for convenience.)



$$x = (v_0 \cdot \cos\theta) \cdot t$$

$$x = ((20m/s) \cdot 0.8) \cdot (2s) = 32m$$

$$y = (v_0 \cdot \sin\theta) \cdot t - \frac{1}{2} \cdot g \cdot t^2$$

$$y = ((20m/s) \cdot 0.6) \cdot (2s) - \frac{1}{2} \cdot (10m/s^2) \cdot (2s)^2 = 4m$$