KU Physics Department
PHYS 101 Laboratory

Quiz #2 Key

Groups a, b, d, f:

Q1. *(a,b,d,f) What's the aim/objective of the experiment?*

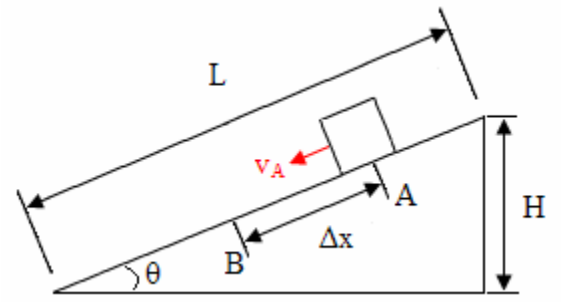
The aim/object ive of this experiment is to investigate the relationships between an object's position, velocity and acceleration when it is moving on a straight line. The experiment will be performed, on an ideally frictionless inclined plane, when there is a constant force (due to gravity) acting on the object.

Group a(Thu B1):

Q2. *What additional equipment will be used in this experiment different than experiment 1? For what purpose?*

The additional equipment used is a base and a support rod different than experiment 1. The purpose is to raise one end of the track so that an inclined plane is obtained.

Q3. *Calculate the velocity at point B, v_B.*
L=100cm, H=80cm, Δx=25cm and v_A=6cm/s.
(Take g=10m/s^2 for convenience.)



$$a = g \cdot \sin\theta = g \cdot \frac{H}{L} = (10m/s^2) \cdot \frac{0.8m}{1m} \Rightarrow a = 8m/s^2$$

$$v_B{}^2 - v_A{}^2 = 2 \cdot a \cdot \Delta x \Rightarrow v_B = \sqrt{2 \cdot a \cdot \Delta x + v_A{}^2}$$

$$v_B = \sqrt{2 \cdot (8m/s^2) \cdot (0.25m) + (0.06m/s)^2}$$

$$v_B = \sqrt{4.06}m/s$$

Group b(Thu B2):

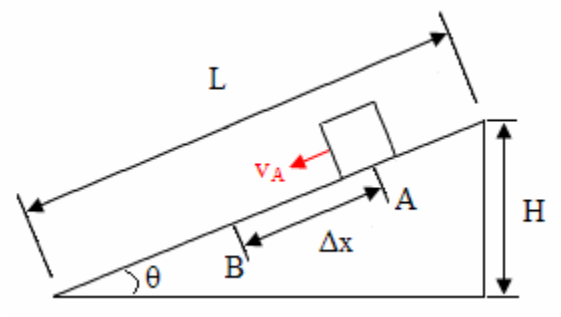
Q2. *What kind of motion will the cart have after being released?*

The cart will have an accelerated motion on an inclined plane after being released. Its speed will increase with a constant acceleration neglecting friction. The acceleration of the cart can be given as:

$a = g \cdot \sin\theta$

θ is the angle of inclination and g is the gravitational acceleration.

Q3. *Calculate the the height, H.*
L=20m, Δx=6m, v_A=2m/s and v_B=6m/s.
(Take g=10m/s^2 for convenience.)



$$v_B^{\,2} - v_A^{\,2} = 2 \cdot a \cdot \Delta x \Rightarrow a = \frac{v_B^{\,2} - v_A^{\,2}}{2 \cdot \Delta x}$$

$$a = \frac{(6m/s)^2 - (2m/s)^2}{2 \cdot (6m)} = \frac{32m^2/s^2}{12m} = \frac{8}{3} m/s^2$$

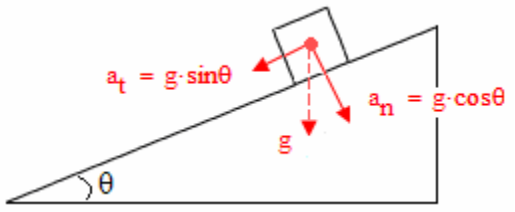
$$a = g \cdot \sin\theta \Rightarrow \sin\theta = \frac{H}{L} = \frac{a}{g}$$

$$H = \frac{a \cdot L}{g} = \frac{\left(\frac{8}{3} m/s^2\right) \cdot (20m)}{10 m/s^2} \Rightarrow H = \frac{16}{3} m$$

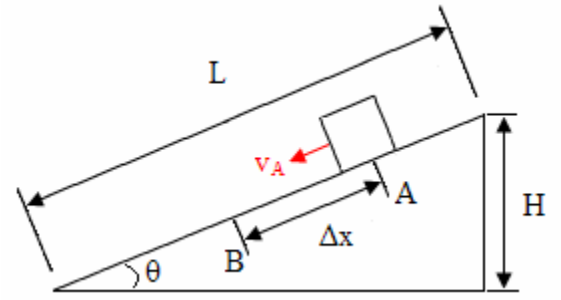
Group d(Thu B4):

Q2. *Draw a vectoral diagram for the acceleration components of the track on a frictionless surface with an inclination of θ.*

The vectoral diagram showing the acceleration components can be drawn as follows:



Q3. *Calculate the velocity at point A, v_A.*
t_A=3s, t_B=6s, θ=30° and v_B=20m/s.
(t_A and t_B are the times as the object passes from points A and B respectively.)
(Take g=10m/s^2 for convenience.)



$$a = g \cdot \sin\theta = (10 m/s^2) \cdot \sin(30) = 5 m/s^2$$

$$a = \frac{\Delta v}{\Delta t} = \frac{v_B - v_A}{t_B - t_A} \Rightarrow v_A = v_B - a \cdot (t_B - t_A)$$

$$v_A = (20m/s) - (5m/s) \cdot (6s - 3s) \Rightarrow v_A = 5 m/s^2$$

Group d(Thu B6):

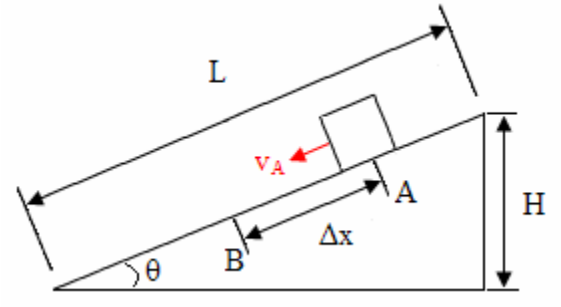
Q2. *What's the main cause of acceleration for a motion on an inclined plane without friction?*

The main cause of acceleration is gravity for a motion on an inclined plane without friction. The acceleration of the cart can be given as:

$a = g \cdot \sin\theta$

θ is the angle of inclination and g is the gravitational acceleration.

Q3. *Calculate the velocity at point B, v_B.*
t_A=4s, t_B=9s, θ=37° and v_A=2m/s.
(t_A and t_B are the times as the object passes from points A and B respectively.)
(Take g=10m/s^2 for convenience.)



$$a = g \cdot \sin\theta = (10m/s^2) \cdot \sin(37) = 6m/s^2$$

$$a = \frac{\Delta v}{\Delta t} = \frac{v_B - v_A}{t_B - t_A} \Rightarrow v_B = v_A + a \cdot (t_B - t_A)$$

$$v_B = (2m/s) + (6m/s) \cdot (9s - 4s) \Rightarrow v_A = 32m/s^2$$