Lab 8 – Conservation of Mechanical Energy

Station 1 - pendulum

lowest point

wall

**0 *GPE level***

15 cm

release point

**system: pendulum bob & string**

Record the mass of the pendulum bob: **mass of the pendulum bob = 25 grams**

Raise the pendulum bob until it is 15 cm above the height of its lowest point.

***(start in contact with wall)***

Release the bob from rest and let the bob swing through the photogate.

Measure & record the speed of the ball as it passes through the photogate the first time. ***measured speed \_\_\_\_\_\_\_\_\_\_\_\_ m/s***

Station 2 – rollercoaster

**0 *GPE level***

point R

point P

countertop

**System: ball**

Record the mass of the ball. **mass of the ball = 25 g**

Measure & record the height of the track above ***the countertop*** at points R & P.

***measured height R \_\_\_\_\_\_\_\_\_\_\_\_ m***  height P \_\_\_\_\_\_\_\_\_\_\_\_ m

Record the diameter of the ball. **Diameter of the ball is 1.92 cm**

Release the ball from rest at the top of the track, point R.

Record the time the ball spends in the photogate at point P. time in P \_\_\_\_\_\_ s

*speed of bal through P = diameter of ball divided by time in photogate = \_\_\_\_\_\_\_\_ m/s*

Station 3 – spring cart

before triggering

through photogate

**System: cart & spring**

Record the mass of the cart. **mass of cart = 1040 g**

Measure and record how far the plunger is compressed in “cocking” the cart spring. (**3 cm**)

The measured spring constant of the spring is **430 N/m.**

Fire the cart and record the speed of the cart through the photogate from the computer

program.

***measured speed \_\_\_\_\_\_\_\_\_\_\_\_ m/s***

Station 4 – glider & horizontal spring

glider

glider

release point

through photogate

**System: glider & spring**

Record the value of the spring constant of the spring. **Spring constant = 3.5 N/m**

Record the mass of the glider.

Pull the glider to the left until the glider is 30 cm from the equilibrium position. (labeled START on the airtrack)

Release the glider from rest.

Measure and record the speed of the glider at the equilibrium position as it passes through the photogate the first time.

mass glider \_\_\_\_\_\_\_\_\_\_\_\_ g 🡪 \_\_\_\_\_\_\_\_\_\_\_ kg

***measured speed \_\_\_\_\_\_\_\_\_\_\_\_ m/s***

Station 1 – **Assign the lowest point the pendulum reaches (at photogate)**

**as the zero *GPE*** **level.**

 1. What is the speed of the pendulum bob at the release position?

 2. What is the kinetic energy of the pendulum bob at the release position?

 3. How high above the zero GPE level is the pendulum bob at the release point?

 4. What is the gravitational potential energy of the pendulum bob at the release position?

 5. What is the mechanical energy of the pendulum bob at the release position?

 6. What external force(s) act on the pendulum bob as the bob moves from the release point to the lowest point?

 7. Does the mechanical energy of the pendulum bob at the lowest point equal the mechanical energy of the bob at the release point?

 8. What is the mechanical energy of the pendulum bob at the lowest point?

 9. How high above the zero GPE level is the pendulum bob at the lowest point?

10. What is the gravitational potential energy of the pendulum bob at the lowest point?

11. What is the kinetic energy of the pendulum bob at the lowest point?

12. What is the **calculated** speed of the pendulum bob at the lowest point?

13. What was the **measured** speed of the pendulum bob at the lowest point?

Station 2 – **Assign the countertop as the zero *GPE* level.**

For point P

 1. What is the speed of the ball at point P?

 2. What is the kinetic energy of the ball at point P?

 3. How high above the zero GPE level is the ball at point P?

 4. What is the gravitational potential energy of the ball at point P?

 5. What is the mechanical energy of the ball at point P?

 6. What external force(s) act on the ball as the ball goes from point R to point P?

7. Does the mechanical energy of the ball at point P equal the mechanical energy of the ball at point R?

For point R

 8. What is the mechanical energy of the ball at point R?

 9 What is the speed of the ball point P?

10. What is the kinetic energy of the ball at the point P?

11. What is the gravitational potential energy of the ball at point R?

12. What is the **calculated** height above the zero GPE level of the ball at point R?

13. What is the **measured** height of the ball at point R?

Station 3

 1. What was the speed of the cart as the cart went through the photogate?

 2. How much kinetic energy did the cart have as the cart went through the photogate?

 3. By how much is the spring compressed when the cart went through the photogate?

 4. How much elastic potential energy is stored in the spring when the cart went through the photogate?

 5. What is the mechanical energy of the cart and spring when the cart went through the photogate?

 6. What external force(s) act on the cart as the cart goes from triggering to the photogate?

 7. Does the mechanical energy of the cart and spring before triggering equal the mechanical energy of the cart and spring as the cart passes through the photogate?

 8. What is the mechanical energy of the cart and spring before triggering?

 9. What is the speed of the cart before triggering the cart?

10. What is the kinetic energy of the cart before triggering?

11. How much elastic potential energy is stored in the compressed spring before triggering?

12. By how much was the cart spring compressed before triggering?

13. What is the **calculated** size of the spring constant of the cart spring?

14. What is the **given or measured** size of the spring constant of the cart spring?

Station 4

 1. What is the speed of the glider before release?

 2. What is the kinetic energy of the glider before release?

 3. What is the size of the force constant of the spring?

 4. By how much is the spring displaced from its equilibrium position before release?

 5. How much elastic potential energy is stored in the spring before release?

 6. What is the mechanical energy of the system (glider and spring) before release?

 7. What forces act on the system as the glider moves from release to the equilibrium position of the spring?

 8. Does the mechanical energy of the system at the equilibrium position equal the mechanical energy of the system before release?

 9. What is the mechanical energy of the glider and spring at the equilibrium position?

10. By how much is the spring displaced from its equilibrium position when the glider passes through the equilibrium position?

10. How much EPE is stored in the spring when the glider passes through the equilibrium position?

11. How much kinetic energy does the glider have as the glider passes through the equilibrium position?

12. What is the **calculated** speed of the glider as the glider passes through the equilibrium position?

13. What is the **measured** speed of the glider as the glider passes through the equilibrium position?