

# Energy Inquiry

---

Purpose: Investigate the conservation of potential energy and kinetic energy, investigate the conservation of energy of a collision and investigate the conservation of energy of an explosion.

## Part I

- Use the CPO track with photogates (see figure below)
  - Place one photogate after the incline on the flat to measure the cart coming down the ramp and the other down the track about 30 cm or so.
  - Be sure to use the bubble to level the flat section.
  - Setup the Data Collector
    - Use CPO Timer mode; it will record the time it is blocked
- Compare the conservation of gravitational potential energy at the top of the incline to the kinetic energy at the bottom of the incline.
  - Measure the mass of the cart that is released
    - Choose any of the steel balls to include in the mass
  - Measure the height of the release from the plane of the flat part
  - Calculate the potential energy at the top of the ramp
  - Calculate the velocity the cart should have at the end of the ramp
  - Release the cart and record the time. Record 3 trials and average.
  - Change the mass and repeat.
  - Change the mass a 3<sup>rd</sup> time and repeat
  - Calculate the velocity using the time of the photogate sensor and the length of the sensor flag (measure with caliper).
  - Compare the velocities
    - Address any differences in your analysis
  - Use the measured velocity to calculate the kinetic energy at the bottom
  - Compare the potential energy and the kinetic energy
    - Address any differences in your analysis

## Part II

- Investigate the collision of the moving car with the stationary car.
  - Place a stationary cart before the far photogate
  - Use all 3 of the steel balls to vary the mass between the carts (measure the mass)
  - Release the top cart, as soon as it hits the stationary cart, stop it. Record the times
    - Complete at least 3 trials in a data table and average
  - Switch the steel balls around, and repeat. You should be able to get 4 combinations of masses.

- Find the percent of lost energy. Explain whether the collision was elastic or non-elastic and if non-elastic where the energy went. Note any trends in energy conservation compared to mass.

### Part III

- Investigate the explosion of two carts of different mass and relate it to conservation of energy.
  - Place the two carts within the photogates; minimize the distance the carts have to travel in order to go through the sensor.
  - One cart should have a rubber band. Use the 3 steel balls to distribute the mass between the carts. Measure and record the mass of each cart.
  - Use the cart link that connects the two carts whilst compressing the rubber band.
  - Ready the Data Collector, pull the link to allow the carts to move, record the time the sensor flag went through the sensor.
  - Get and record 2 trials for each mass distribution.
  - Redistribute the mass to test another combination. And repeat. You should be able 4 different combinations.
  - Calculate the initial kinetic energy and the final kinetic energy of each cart
  - Analyze the conservation of energy and account for any loss by calculating the percent loss and note any trends in energy conservation compared to mass.

