(M1-3) Conservation of Total Energy of an Object

Aim of experiment

Determination of kinetic energy of a moving mass

Apparatus

Air Track Rail –Gliders of Different Masses – Pressure pump – 2 Photo Gates Attached to a Speed meter/Timer-Fixed Elastic Band

Theory of experiment

Air Track consists of a hollow extruded aluminum beam with small holes drilled into the upper surface. Compressed air is pumped into the beam and released through the holes. This forms a cushion of air supporting a glider on a nearly frictionless surface. The glider can move with almost frictionless horizontal motion, *figure 1.*

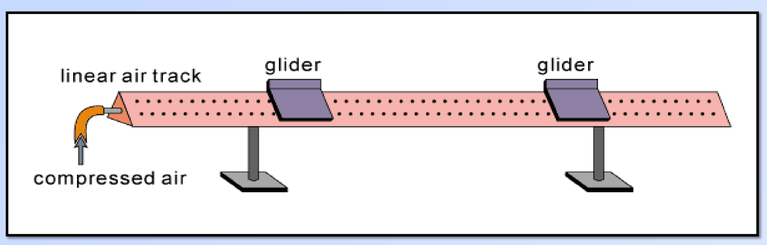

Figure 1. Basic Air Track device

In physics, the law of conservation of energy states that the total energy of an isolated system cannot change, it is said to be conserved over time. Energy can be neither created nor destroyed, but can change form; for instance, potential energy can be converted to kinetic energy. Kinetic energy is the energy of motion.

The potential energy (*PE*) of an object being pulled by elastic band or a spring of constant *k* is

$$PE = - kx$$

Where *x* is the elongation or compression distance of the spring. If an object of mass *m* is pushed by a compressed spring on a frictionless surface. Notice that *PE* is proportional to the displaced distance *x*. The potential energy will be given to the mass as a kinetic energy, according to the law of conservation of mechanical energy, so that

$$KE = ½ mv^2 = - kx$$

Where *v* is the speed of a body of mass, *m*

This equation shows that for no friction is detected and at constant potential energy; consequently the kinetic energy is constant, the increase of speed squared is inversely proportional to the mass, m; Then

$$v^2 = (2KE)/m$$

So at constant *KE*, the relation between *1/m* and speed squared, v^2 ,is linear and its slope is:

$$slope = (2KE)$$

Procedure

1. Turn on the air supply and increase the flow volume until the gliders are floating on a cushion of air. Level the air track by placing a glider in the center of the track and adjusting the leveling screws until the glider will remain at rest.
2. Connect the photo gates to speed meter and switch it on.
3. Attach the left hand glider of mass m_1 to the elastic band and push to certain distance to left side and leave it to move freely to the right hand side passing through the gates which record the mass speed, v_1.
4. Repeat step 2 two more times at least, and record the data in a table.
5. Repeat steps 2-3 with different masses and record the data in the table.
6. Draw a graph between 1/mass on x-axis and v^2 on y-axis and obtain the slope.
7. Calculate the *KE* from the relation: $slope = (2KE)$.

Results

Mass (kg)	*1/ m* $(kg)^{-1}$	V_1 (m/s)	V_2 (m/s)	V_3 (m/s)	V_{av} (m/s)	V_{av}^2 $(m/s)^2$

$$KE = slope/2$$

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