# ACTIVITY

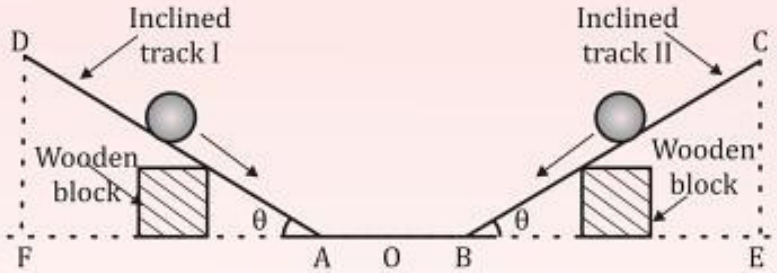
## AIM

**To study the conservation of energy of a ball rolling down on inclined plane (using a double inclined plane).**

## MATERIAL REQUIRED

A double inclined track (plane), two blocks made of wood each having a height of about 2.5 cm two 1 kg weights, two steel balls each of diameter about 15 cm, a meter scale, a plumb line and a spirit level stop clock/stopwatch.

## DIAGRAM




Double inclined track (plane)

## THEORY

**Law of conservation of energy:**

Energy can neither be destroyed nor created. However, it can be changed from one form to another. Hence, the sum of all forms of energy in the universe remains constant.

**For mechanical energy:**

The sum of kinetic energy and potential energy of a moving body remains constant provided there is no dissipation of energy due to air resistance or friction.

When a ball is at rest at the top of a track it has potential energy only and zero kinetic energy. When ball rolls down the track, its P.E. decreases and K.E. increases. At the bottom of the track, energy is all kinetic and zero potential energy.

Now, if the same ball rolls up the second track, its K.E. decreases but P.E. increases and at the top of second track, it has P.E. only and zero kinetic energy.

In the absence of friction in the track, the sum of K.E. and P.E. will remain conserved throughout.

## PROCEDURE

1. Using a spirit level ensures that the working table in laboratory is horizontal. If not so, make it horizontal by applying suitable packing under its legs.
2. Keep the double inclined track on the tabletop and make it stable by putting weights on its wings.

3. Wipe/clean the double inclined plane thoroughly with the help of a piece of cotton or tissue paper.
4. Hold a steel ball at position D and release it gently. The ball will roll down the incline DA and then rises up the second incline up to a point C. Mark the position of point C carefully with a sketch pen.
5. With the help of a plumb line measure the heights of point D and that of the point C from the tabletop, i.e., DF and CE.
6. Change the angle or position of D and repeat steps 4 and 5 three times.
7. Record the observations in the table as given below.

## OBSERVATION

| S. No. of observations | Position of mark | | Vertical Height | | Difference (DF – CE) |
|---|---|---|---|---|---|
| | D on track I | C on track II | DF | CF | |
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |
| 4. | | | | | |

The last column of the observation table shows that within the experimental error the vertical height DF and CE are the same.

## RESULT

From above, the sum of mechanical (i.e., kinetic + potential) energy possessed by a body rolling down an inclined plane remains constant. However, during motion, potential energy is being converted into kinetic energy and vice versa.

## PRECAUTIONS

1. The ball and the track both should be cleaned thoroughly by a tissue paper or by cotton soaked in pure carbon tetrachloride so that no frictional force should act on the ball.
2. Make up stable the entire set up of apparatus because any shaking of the apparatus may cause a lot of energy dissipation.
3. The inclination of the track to the horizontal is required to the same.
4. If there is a gap between the joint of two inclined plane, then put a glass rod of suitable diameter to remove the discontinuity.

## SOURCES OF ERROR

1. Tracks may not be frictionless.
2. The highest point on the right track may not be marked correctly.

## VIVA VOCE

**Q1. What do you mean by energy of a body?**

**Ans.** It is defined as its capacity to do work.

**Q2. Define kinetic energy and write its expression.**

**Ans.** The energy of a body due to its motion is called its kinetic energy.

$$\text{K. E.} = \frac{1}{2}mv^2$$

Where, m is the mass and v are velocity of the body.

**Q3. Define potential energy and write its expression.**

**Ans.** The energy due to the position or configuration of the body is known as its P.E.
Expression for P.E. of a body, P.E. = m × g × h where, m is the mass of the body, g is the acceleration due to gravity at that place and h is the height of the body.

**Q4. State law of conservation of energy.**

**Ans.** The total energy of an isolated system remains constant, in whatever way the components of the system may change. One form of energy can be converted to another form.

**Q5. State law of conservation of energy of mechanical system.**

**Ans.** Total mechanical energy, i.e., sum of kinetic and potential energy of the body or system remains constant.

**Q6. Give an example of the above law.**

**Ans.** A body falling freely or an oscillating pendulum shows the law of conservation of energy.

**Q7. State one example where kinetic energy is conserved.**

**Ans.** During elastic collision, K.E. of the system remains constant.