

Experiment No# 3

Determination of Centre of Gravity of Irregular object using the Plumb-line Method

Objectives:

1. Correct tracing of plumb lines on the cardboard using a ruler and pencil
2. Critical observation of plumb lines
3. Correct location of intersection of plumb lines.

Equipment/Materials

Card-boards of different shapes, Thread, Nail, Pencil, Rule/straight edge, load (e.g. stone, wood, etc),

Other requirements

Notebook, pencil, pens for recording

Theory:

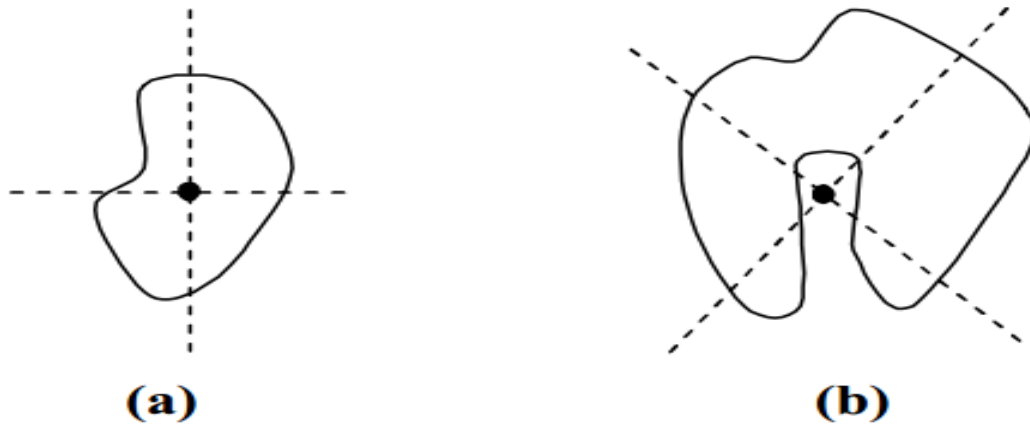
Definition: Centre of gravity of an object”

The point in the body at which the weight appears to be concentrated is called its center of gravity. All bodies are attracted towards the center of the earth with a force which is equal to its weight. The force of gravity acts on all bodies on earth. Every bit of mass in a body has weight. The whole weight seems to be concentrated at a point inside or outside the body. This point is the center of gravity of the body. The weight of a body or object acts through its center of gravity.

“The Centre of gravity of an object is the point through which the total weight of the body can be considered to act”.

The point where the total mass of the body seems to act is the center of gravity. The center of gravity of all bodies can be determined by balancing the body on a knife edge or by suspension with a plumb line from several points. In most cases, the center of gravity of a body lies in the body itself, but in few cases such as the

horse-shoe magnet, the retort stand, Bunsen burner, wine glass and conical flask, the center of gravity lies outside.



Diagrams showing (a) irregular lamina with centre of gravity in the body (b) an irregular lamina with the centre of gravity within the body.

For the centre of gravity to lie outside the body itself , as shown in Figure 1(b), the body will balance at any point along a vertical line passing through the centre of gravity of the body.

Importance of Centre of Gravity

1. Manufacturers often try to make their goods with the centre of gravity as low as possible in order to make them very stable. This is more common when it is the narrow part of the body that is intended for use, for example the retort stand, Bunsen burner, wine glass, conical flask, etc. They do this by making the goods heavy at the bottom and giving them a broad base.
2. A tight rope walker often carries a weighted pole or an umbrella to help keep his centre of gravity very low and vertically above the rope.
3. It helps in the designing of vehicles such as cars and buses by keeping their centre of gravity very low. This is done by placing the engine very low in the car.

4. Knowledge of the importance of keeping a low centre of gravity helps passengers in small boats realise that standing up in order to change seats can be dangerous as this raises the centre of gravity and can make the boat less stable.

Experimental Procedure

1. Cut an irregular shape from cardboard
2. Make three holes close to the edges of the irregularly shaped cardboard. Suspend the object to swing freely on a needle or nail through one of the created holes.

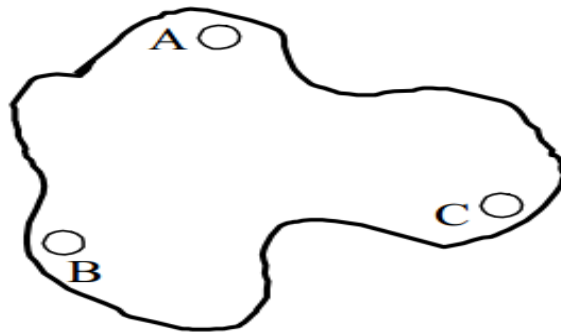
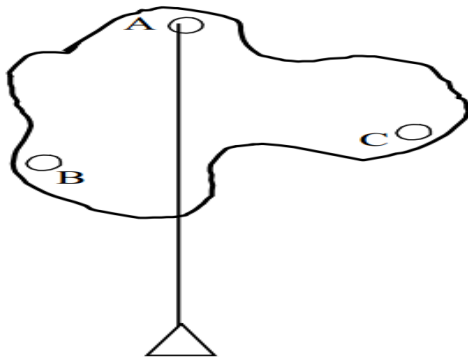


Figure 1: An irregular object.

4. Attach a plumb line to the needle or nail and mark its position on the cardboard with the help of a rule or a straight edge



5. Repeat steps 3 and 4 for the remaining holes, marking the positions of the plumb -lines carefully.

6. Locate the intersection of the three lines drawn; this indicates the centre of gravity of the object.

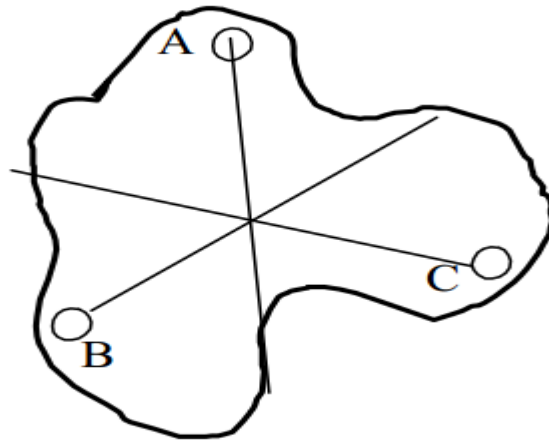


Figure 3: Intersection of lines to indicate center of gravity