UNITED SCIENTIFIC SUPPLIES, INC.

Cavendish Gravitational Balance

- **Demonstrates the existence of gravitational forces between masses**
- **Measures the Universal Gravitational Constant, G**
- **Verifies the Inverse Square Law for gravitational forces**

T**his innovative apparatus,** developed from the traditional Cavendish pattern, is substantially less expensive than earlier models, making the measurement of the tiny but significant Universal Gravitational Constant more accessible to students. It is precisely constructed and allows measurements of G to be made to better than 15% relative error using either the initial acceleration method or the equilibrium displacement method.

In the initial acceleration method, the value of G is derived from the angular acceleration of the balance during the first 90 seconds after moving the large attracting lead spheres mounted on the swivel from one side of the apparatus to the other (see diagram.)

The equilibrium displacement method derives G from the change in the equilibrium rest position of the balance after a reversal of the position of large attracting spheres from one side to the other. This yields a more accurate result, but takes much longer to accomplish because of the long period of the balance (about 10 minutes) and the tiny forces involved. The built-in oil damping system greatly reduces the settling time of the balance to about one hour from the more than two hours needed by the undamped system.

The pendulum system consists essentially of a suspended central rod carrying a small mirror for the optical lever detection system, a light aluminum cross-piece with two 20g lead balls 10cm apart, and a light damping vane. The suspension wire is a very fine beryllium bronze torsion wire 15cm long. This configuration gives the pendulum a torsional period of 590 ± 10 seconds.

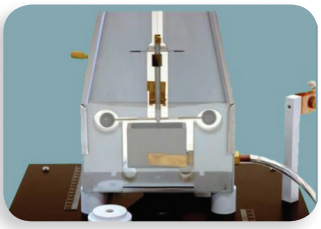
The system is mounted in a massive aluminum case, 25mm thick, with glass windows to eliminate drafts. An adjustment screw with an angle scale at the top of the housing allows the pendulum's rest position to be centered before adding the attracting masses. A supplied magnet uses the diamagnetic properties of lead to speed the settling process when centering. A fork operated by an outside screw secures the pendulum against the housing to protect the sensitive suspension during transportation. Damping oil is added to the internal system from an outside glass reservoir. Silicone damping oil is supplied.

The large attracting masses are two 1.5 kg plastic-coated lead balls that rest atop light aluminum cylinders. The cylinders fit onto a swivel that enables the balls to be swung from one side to the other of the apparatus, or they can also be placed onto two circular sliding mounts on the base that allow the distance between the pendulum and the attracting masses to be varied for Inverse Square Law investigations. The base rests on three leveling feet. The unit operates on 110V/60 Hz.

Overall dimensions are 30 x 30 x 42cm, weight is 12 kg.

Accessories needed:

- Laser pointer, scale and windup tape for the optical lever
- Balance (2000g capacity) and vernier caliper for determining the exact masses and diameters of the lead balls
- Stop watch for timing the oscillation in the initial acceleration method



The innovative pendulum system uses a central rod carrying a small mirror.

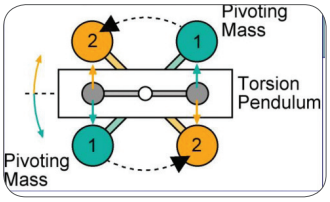
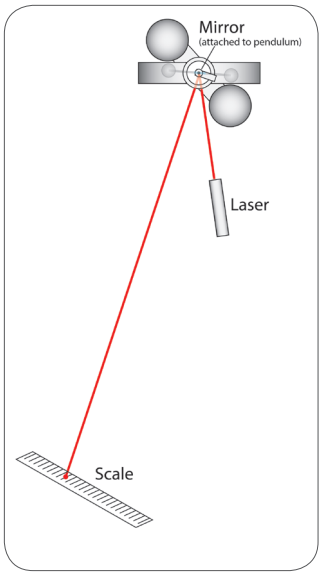


Illustration shows the equilibrium displacement method.



Optical lever arrangement for Cavendish Balance.

Item No.	Description
CGB001	Cavendish Gravitational Balance

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