

# The Kit and the <br> Pendulum 

Materials:

| $\circ$ | Stopwatch |
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| $\circ$ | Ringstand and clamp |
| $\circ$ | Zome System kit |
| $\circ$ | $\mathbf{1 / 1 6 "}$ rod and holder |

OBJECT: To construct a compound pendulum with period as close as possible to 2 seconds. The period of a compound pendulum is $T=2 \pi / \sqrt{M g d / I}$ where $M$ is the pendulum mass, $g$ is $9.8 \mathrm{~m} / \mathrm{s} / \mathrm{s}, d$ is the displacement from the center of mass, and $I$ is moment of inertia about the pivot point. The teams tune their pendulums using a stopwatch.

METHOD: Using the $1 / 16 "$ rod supported by the ringstand, construct a compound pendulum from the Zome kit; a one second period and a three second period pendulum are shown in the following photographs:


1 sec


The $1 / 16$ " rod can fit loosely through the Zome ball connectors, and can serve as the pendulum pivot. Avoid excess friction by judicious choice of pivot holes and by avoiding torques on the pivot by balancing the pendulum along the pivot axis. RULES:

- Only Zome components can be used (no added mass from tape, gum, etc.)
- The Zome components cannot be modified (cut, bent, whittled, etc.)
- The ringstand and $1 / 16$ " rod must be used to support the pendulum
- The pendulum must not be overdamped (three swings min. for photogate)
- A clear path is needed for scoring with the photogate (see photos)

SCORING: The pendulum period will be measured by the referees using a photogate timer. Three trials will be conducted, and the time closest to 2 seconds will be recorded as the result. The team with a pendulum period closest to 2.000 seconds will be declared "the winner".
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