# APSC 366 – Total Hip Replacements – Wear experiment (groups of 3)

**Purpose:** to describe factors that influence wear rates

**Materials:**

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| --- | --- |
| * Four foam blocks (sand on one narrow edge) | * Tape (to help secure sandpaper to desk) |
| * Two pieces of sandpaper (100 grit and 220 grit) | * Sanding guide (vertical) |
| * Calipers (linear measurement device) | * Calculator (on your phone is fine) |
| * Permanent marker (for use on foam blocks) |  |

**Method:**

1. Mark measurement location(s) on the foam block sides so you compare at the same place
2. Take initial measurements of the foam blocks before sanding at marked location(s). You may want to measure at several known locations and summarize (e.g. average).
3. Vary the following factors in different tests:
   * **surface roughness** (sandpaper grit – lower number means higher roughness)
   * **force applied** (how hard you push down on the block)

Expect to need 10-20 cycles to have a measureable change in thickness (outcome) per test. The sandpaper will get clogged with debris –move to new areas and/or clear the debris between cycles, so your wear rate remains constant over each cycle.

1. Measure thickness change(s) on your block.
2. Calculate wear rate (in inches/cycle):
3. Determine how each factor (surface roughness and force applied) influenced wear by comparing the wear rates in each case.

**Report:**

Be ready to discuss answers to the following questions:

1. **How do the factors you varied influence wear rate?**
2. **Which of these factors could we modify for a hip replacement?**
3. Many people aim for 10,000 steps a day, or 5,000 cycles per hip. **How much wear would 5,000 cycles cause, based on the largest wear rate you found?**
4. **What are the sources of error or variability in this experiment?**

**Clean-up:**

* Vacuum your work area (shop vac available)
* Return your calipers, markers, and sandpaper (and unused foam/tape)
* Deposit your used foam blocks and used tape in the garbage

**HINTS:**

* Use the sanding guide to help keep your block edges square (more accurate measurements)
* It can work better to pull rather than to push; watch for rounding on leading edge
* Clear debris from sandpaper, or sand on new areas each cycle
* Try not to compress the material too much when measuring; be sure calipers are flat against the surfaces; clean caliper jaws and sanded surface before measurements