MECHANICS DEMOS

FOOD – ICEBOX CAKE

- **Chladni**
  Rubber diaphragm stretched over large watering can - sprinkle sand on rubber - sing into spout to make patterns.
- Monkey in the Tree
- Drop objects off roof
- Drop string with washers at 1,4,9 length intervals
- **PENDULA:**
  - **Science:** Galileo: Law of Pendulum is that it has **CONSTANT PERIOD**
  - **Technology:** Given Science of Law of Pendulum: *all Pendula are CLOCKS (mechanical & electronic, crystal, computers, bridges, buildings)*
  - **Engineering:** build Small, Medium, and Large Pendulum (45 minutes) verify constant period, then discover mathematics formula
  - **Mathematics:** derive formula: [Length ~ $Period_2$]
    - SMALL PENDULUM
      get a string and the nearest weight in the room (coin, pen, cell phone)
      hold string by hand
      change length of string and watch time decrease
      change how far you swing it and watch time stay the same
      change weight and watch time stay the same
    - MEDIUM PENDULUM
      get a plumb bob from a hardware store (for seeing if a house wall is vertically straight or "plumb")
      hang it from as high a point as you can
      watch it slowly go in ellipses that slowly decrease
      if you can let it touch sand or water, it makes beautiful patterns
      if you hang a second small pendulum off the bottom, they trade motion (first upper has more swing, then lower)
      if you use a slinky or spring for the string it goes up and down while swinging and while rotating
    - LARGE PENDULUM
      get a bowling ball, drill it, stick a bolt through it, and hang it with a chain
      hold the bowling ball to your face, let go and try to not to flinch when it swings back at you (it can't hit you - it must swing less each swing)
    - Cool thoughts about pendula:
      - weight and swing distance doesn't change timing, just length
      - therefore this is how we make clocks: because they keep time
      - look in your mind at every clock you've ever seen: they all have a pendulum somewhere
      - grandfather's is obvious
      - old pocket watches have little pendulum (if you open up the back you can see it)
      - a guitar string gives off a steady note because it is a pendulum keeping that rate, tune it by changing the length
      - a "crystal" watch has a quartz crystal that vibrates at a constant rate because the vibrating sliver of crystal is a pendulum
        - the swing at the playground was a constant time per swing
      - **1,4,9 length intervals (& waltz in 2/3 time)**
      - **Law of the Pendulum: L2 ~ T**

        - **Pendulum Magnet:** Swing magnet over others - watch varied motions.
        - **Sand Pendulum:** Construct sand in funnel, colored water, or pointer in sand to make Lissajous figures.
        - **Swinging Square U (done huge with suspended platform)** Join about 1 foot x 1/4" x 2" flat piece of aluminum to 2 foot piece - attach another 1 foot piece with swivel - attach center of 2 foot piece to walt swivel - will swing long time, exchanging motion from 1 foot piece to L piece.

- plate & tablecloth
- metals balls on tracks:
    - momentum conservation before/after collisions
    - energy conservation – same heights, different tracks
- run in gym to wall and try to make right turn
- sweeping bowling ball race
- socks vs. shoes tug of war
- levers:
    - giant lever
    - Law of the Lever: wt1 * d1 = wt2 * d2
- throw egg against sheet
- pail of water swung over head
- bicycle wheel flywheel