

RAFT IDEAS

Topics: Forces, Pressure

Materials List

- ✓ 2 pipette tip trays with pipettes
- ✓ Hot glue
- ✓ 2 pieces of matte board cut to the size of the tray.

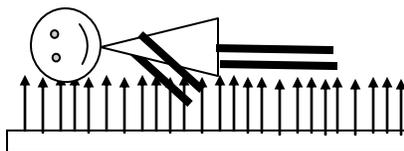
This Activity can be used to teach:

- Structure of Matter (Next Generation Science Standards: Grade 5, Physical Science 1-1)
- Forces & Motion (Next Generation Science Standards: Middle School, Physical Science 2-2)
- Science & Engineering Practices (Next Generation Science Standards: Grades 4-8)



BED OF NAILS- SAFETY VERSION

Feeling over-pressured?



The old “Bed-of-Nails” trick is a great attention-getter, but it is really not a trick at all. Rather, it is a demonstration of force distribution and pressure. In this miniature, “safety” version, students can investigate the decrease in pressure on their skin with the increase of contact points.

Assembly

1. For the “low-pressure” Bed-of-Nails, secure all of the pipette tips into the tray using hot glue, then hot glue the matte board to the bottom of the tray to make the apparatus more secure.
2. For the “high-pressure” Bed-of-Nails, remove every other pipette tip to create an apparatus with less contact points. Hot glue pipette tips into tray and glue on the matte board as with the “low-pressure” version.

To Do and Notice

1. Have students gently push against each of the Bed of Nails models with the palms of their hands. They should notice a difference in the pressure against their skin, with lower pressure being exerted by the Bed with more pipette tips.

Safety Note: Although the pipette tips are only plastic, they could still do damage if not handled correctly. Students should be supervised while handling the Bed of Nails models, and only one student should use them at a time.

The Science Behind the Activity

Pressure is force exerted over a given area ($\text{Pressure} = \text{force}/\text{area}$), measured in Newtons per cm^2 . Thus, the pressure is inversely proportional to the area: as the area goes down, the pressure goes up. For this demonstration, the formula could be thought of as $\text{pressure} = \text{force}/\text{pipette tip}$ (or $\text{pressure} = \text{force}/\text{nail}$). As the number of pipette tips goes up, the pressure exerted is distributed over more points and over a larger skin surface. The skin senses less pressure. Likewise, as the number of pipette tips goes down, the skin senses more pressure.

Pressure, as a concept, has a surprising number of applications, including atmospheric pressure (weather patterns, comparative planetary geology, space travel); anatomy (blood pressure, respiration, and the sense of touch); forces (Bernoulli principle, flight); and even oceanography (diving, life at extreme pressures). These bed-of-nails models can be used to introduce pressure or reinforce the concept for any of these topics.

Web Resources - (Visit www.raft.net/raft-idea?isid=298 for more resources!)