

Astronomy Demonstration Video – Pressure – Worksheet

to follow viewing of the astronomy demonstration video at <https://www.youtube.com/watch?v=qm8X3tlx4q4>



1. After hosting a birthday party for your 8-year old nephew, there is substantial cleanup to be done. This includes getting rid of all of the balloons taped to the walls. Evaluate how well each of the following objects would work for popping the balloons. Indicate (by circling) whether you think the following objects would (definitely work, kinda work, or definitely wouldn't work) and then fully explain the thinking underlying your decision making use of the equation $P = F/A$ (pressure equal force divided by area). The first is done for you.

a) A bowling pin – (definitely works, kinda works, **definitely wouldn't work**)

Justification: _____ I will argue with the equation $P=F/A$. You must apply a large force F over a small _____ area A to apply enough pressure to burst the balloon. The bowling pin has a large area A , which would _____ require too much force F . _____

b) a ruler – (definitely works, kinda works, definitely wouldn't work)

Justification: _____

c) a knitting needle – (definitely works, kinda works, definitely wouldn't work)

Justification: _____

d) a pipe cleaner – (definitely works, kinda works, definitely wouldn't work)

Justification: _____

2) Six solid aluminum blocks (density ρ of aluminum is 2700 kg/m^3) are sitting on a tabletop. The dimensions (length l x width w x height h) of each block are given in centimeters. Rank the six blocks based on each criterion provided (indicate ties by circling the tied values). The first ranking has been completed for you.

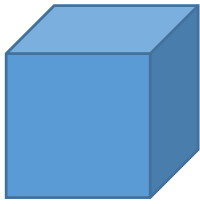
i) Rank the blocks in order of increasing length. **A C D F B E** _____

ii) Rank the blocks in order of increasing surface area in contact with the table. A sample calculation for area is shown for block A.

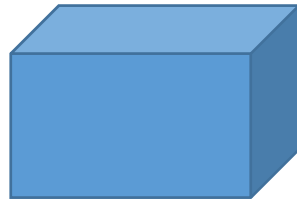
Ranking: _____

$$Area_A = l \cdot w = (20 \text{ cm})(20 \text{ cm}) = 400 \text{ cm}^2$$

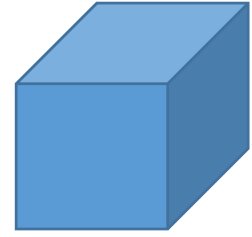
A) 20 x 20 x 20



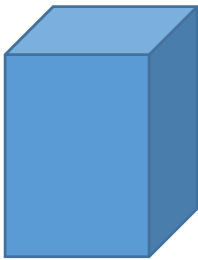
B) 30 x 20 x 20



C) 20 x 30 x 20



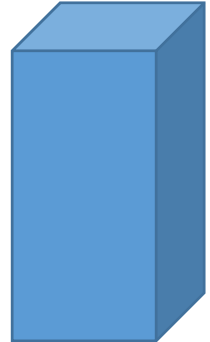
D) 20 x 20 x 30



E) 40 x 10 x 10



F) 20 x 20 x 40



- iii) Rank the blocks in order of increasing pressure they exert on the table. A sample calculation for pressure exerted on the table (in units of Pascals) is shown for block A. Please write out a short description of what is being accomplished by each circled step.) The first is done for you.

Ranking: _____

We have substituted the weight of the block (mass m times the acceleration of gravity g) for the force F applied.

$$Pressure_A = \frac{F}{A} = \frac{mg}{A} = \frac{\rho_{Al} V g}{A} = \frac{\rho_{Al} (l \cdot w \cdot h) g}{l \cdot w} = \frac{\rho_{Al} (l \cdot w \cdot h) g}{l \cdot w}$$

$$= \rho_{Al} g h = \left(2700 \frac{kg}{m^3} \right) \left(9.81 \frac{m}{s^2} \right) (0.2 m) = 5300 Pa$$

- iv) Note that the length l and the width w of block A don't enter into the tabletop pressure calculation shown above in part iii. Provide an explanation of why that is reasonable.
