

APPARATUS NOTES

Bruce G. Eaton, *Editor*

School of Physics and Astronomy, University of Minneapolis, Minnesota 55455

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Domino "chain reaction"

Lorne A. Whitehead

Department of Physics, University of British Columbia, 2075 Wesbrook Mall, Vancouver, British Columbia, Canada V6T 1W5

We have developed a simple and dramatic demonstration of exponential growth, as in a nuclear chain reaction. The apparatus utilizes the fact that a domino can knock down another one which is about $1\frac{1}{2}$ times larger in all dimensions. Since the gravitational potential energy of an upright domino is proportional to the fourth power of its size, a very small amount of input energy can be amplified quickly to knock down an impressively big domino.

Our set, shown in Fig. 1, was made from standard thicknesses of commercial acrylic sheet, so that only the edges had to be machined. The larger ones are most cheaply made by laminating thinner sheet. Table I gives the dimensions used for our dominos. The dominos were sandblasted so as to have a uniform appearance, and are set up on a smooth surface, spaced so that each domino is approximately its own width from the next larger one.

It is easy to calculate that about $0.024 \mu\text{J}$ of input energy is required to topple the first domino. (This can be supplied by nudging it with a long wispy piece of cotton baton.) It is also easy to show that domino number 13 releases about 51 J of energy when it topples—an amplification factor of about 2 billion. A simple calculation shows that if the series were continued, domino number 32 could be the twin towers of the World Trade Center!



Fig. 1. Photo of dominos in mid-fall.

Table I. Dimensions for dominos in set.

Domino number	Thickness		Width		Height	
	(mm)	(in.)	(mm)	(in.)	(mm)	(in.)
1	1.19	(3/64)	4.76	(3/16)	9.53	(3/8)
2	1.59	(1/16)	6.35	(1/4)	12.70	(1/2)
3	2.38	(3/32)	9.53	(3/8)	19.10	(3/4)
4	3.18	(1/8)	12.70	(1/2)	25.40	(1)
5	4.76	(3/16)	19.10	(3/4)	38.10	(1 1/2)
6	6.35	(1/4)	25.40	(1)	50.80	(2)
7	9.53	(3/8)	38.10	(1 1/2)	76.20	(3)
8	12.70	(1/2)	50.80	(2)	102	(4)
9	19.10	(3/4)	76.20	(3)	152	(6)
10	25.40	(1)	102	(4)	203	(8)
11	38.10	(1 1/2)	152	(6)	305	(12)
12	50.80	(2)	203	(8)	406	(16)
13	76.20	(3)	305	(12)	610	(24)