

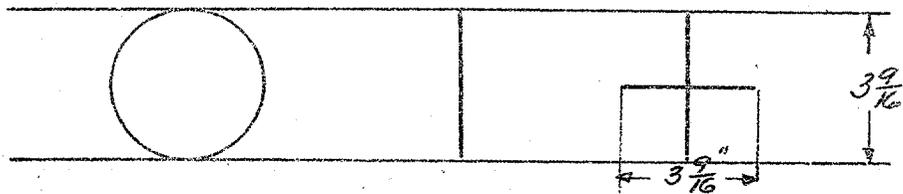
PHYSICS GROUP VI

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Comparison of Control Rod Shapes

An experiment was performed to determine the efficiency of various control rod shapes. Three shapes were tried, all having the same maximum dimensions. The shapes and dimensions are shown in the figure:



All were made of cadmium sheet and were 60" long. The circular one was wrapped around a steel tube. The rods were inserted to their full length in a 4" x 4" hole in the side of the Argonne pile. The inner end of each rod was placed against the end of the hole. The table gives the results of the experiment.

Shape	Critical Position of Control Rod	Inhours from Pile Calibration Curve	<i>l</i>
+	3.5204 meters	87.0	36.9
1	3.5914	90.7	33.2
0	3.4787	84.8	39.1
no. Cd	4.2666	125.9	0

Thus it can be seen that the ratio of the effectiveness of the cross shaped rod to the flat rod is: $\frac{+}{1} = 1.11$

and for the circular rod: $\frac{0}{1} = 1.18$.

Cross Section of O^{18}

A rough measurement of the cross section for neutron capture of O^{18} was made. 9 cm³ of distilled water was placed close to the center of the pile and irradiated for approximately 68.5 sec at an intensity of 2.55×10^6 LI or 6.4×10^4 watts. The water was then placed in a tray under a counter and the decay was followed. It decayed with approximately a 30 second half life and extrapolated to a counting rate of 10560/minute at the end of irradiation. For infinite irradiation it would have been 13500 counts/min. The counter was then calibrated by dissolving UO₂ in HNO₃ and diluting until the equivalent concentration of U₃O₈ would have been 13.9 mg/cm³. This gave a counting rate of 57.6 counts/sec. Using the value of 10.65 disintegrations/sec mg of U₃O₈, we find that it is necessary to multiply the observed counting rate by 2.57 to get the number of disintegrations/sec in 1 cm³ of solution. If we assume that the γ -rays of UX₂ are like those of O^{19} then there would be 578 disintegrations/sec/cm³ at the end of an infinite irradiation at this power. At this position in the Argonne pile $n_v = .969 \times 10^4$ LI, so that n_v was 2.5×10^{10} /cm²/sec. Then the cross section of 1 cm³ of water for this process is