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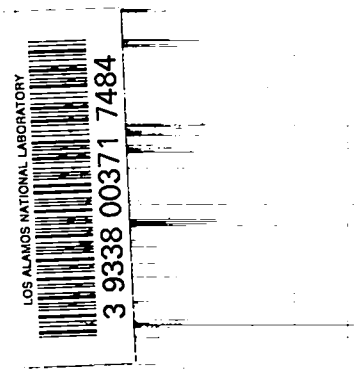


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by

L. B. Engle
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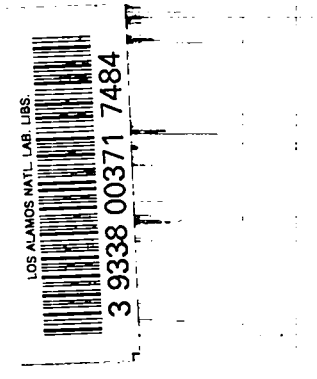

# CRITICAL DIMENSIONS OF HOMOGENEOUS SPHERES CONTAINING $^{235}U$, $^{238}U$, AND CARBON FOR VARIOUS $C/^{235}U$ RATIOS AND $^{235}U$ ENRICHMENTS

by

L. B. Engle and W. R. Stratton

ABSTRACT

The critical dimensions of homogeneous spheres containing $^{235}U$, $^{238}U$, and carbon at various $C/^{235}U$ moderating ratios and $^{235}U$ enrichments are presented. Some values of $k_\infty$ for these mixtures are included.

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A parametric study of the radii of bare homogeneous spheres containing $^{235}U$, $^{238}U$, and carbon in various mixtures is presented. Critical radii were computed by utilizing the DTF code[1] and the Hansen-Roach 16-group cross sections.[2]

A given uranium-graphite mixture was created by assuming that graphite density ($\rho_c$ = 1.90 g/cm$^3$) was reduced by the volume occupied by the uranium. For this purpose the density of uranium enriched to 93.5% $^{235}U$ was taken to be 18.83 g/cm$^3$. With these assumptions the relationship between $^{235}U$ density: $^{235}U$ enrichment, E; and $C/^{235}U$ atomic ratio is

$$\rho\ ^{235}U = 37.208/(C/^{235}U + 1.976\ E)\ .$$

Critical radii were computed for $C/^{235}U$ values ranging from $10^0$ to $10^5$ and for various $^{235}U$ enrichments. The results of this survey are presented in Figs. 1 through 4 and in Table I. (Critical radii for E = 93.5‰ were taken from Ref. 3.) Because of the critically unbounded region for $C/^{235}U$ ratios between $10^2$ and $10^3$ and for low $^{235}U$ enrichments, special effort was expended to fill in this region through the computation of critical radii at closely spaced intervals and of $k_\infty$ values. These latter data are presented in Fig. 5 and Table II. Interpolations for $k_\infty$ = 1.0 were obtained as shown in Fig. 5, and the enrichment for $k_\infty$ = 1.0 is plotted in Fig. 6 as a function of the $C/^{235}U$ atom ratio. The minimum critical enrichment for the metal end point is calculated to be 5.694‰. (This value can be compared with experimental values of 5.5‰[4] and 5.3‰[5] )

A comparable study was completed by Safanov[6] in 1952. Comparisons of critical radii show considerable differences, especially in the $C/^{235}U$ atom ratio between $10^2$ and $10^3$. These discrepancies are attributed primarily to Safanov's use of an extremely small plateau value of 0.8 barn for the $^{238}U$ capture cross section in the resonance region.

Acknowledgments

We appreciate the helpful discussions and suggestions of G. E. Hansen and H. C. Paxton, and Laura Stone's assistance with the digital computer calculations.

References

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4. J. J. Neuer, and C. B. Stewart, "Preliminary Survey of Uranium Metal Exponential Columns," Los Alamos Scientific Laboratory report LA-2023, 1956.
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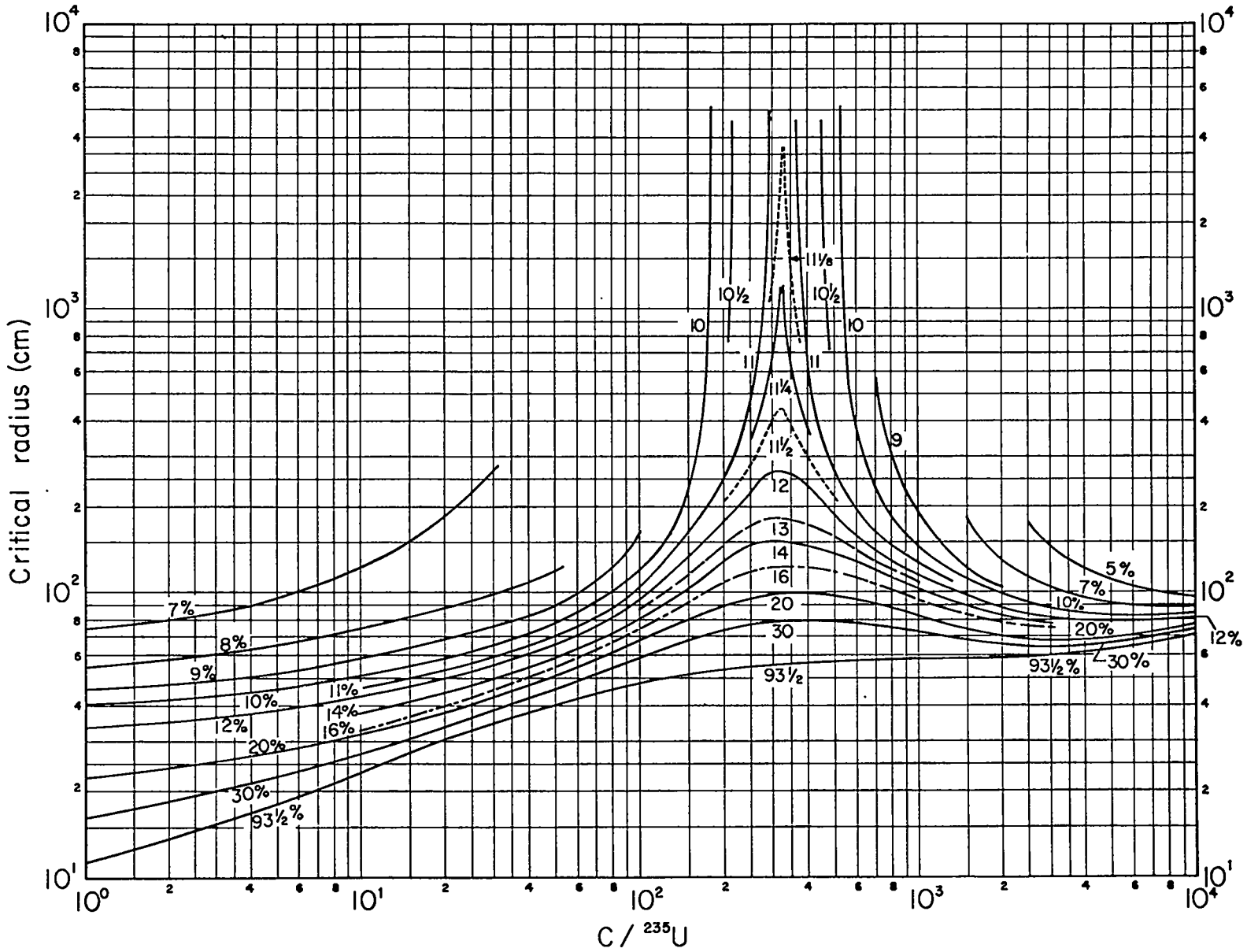


Fig. 1. Critical radii of homogeneous spheres containing $^{235}U$, $^{238}U$, and carbon vs $C/^{235}U$ atom ratios for various $^{235}U$ enrichments.

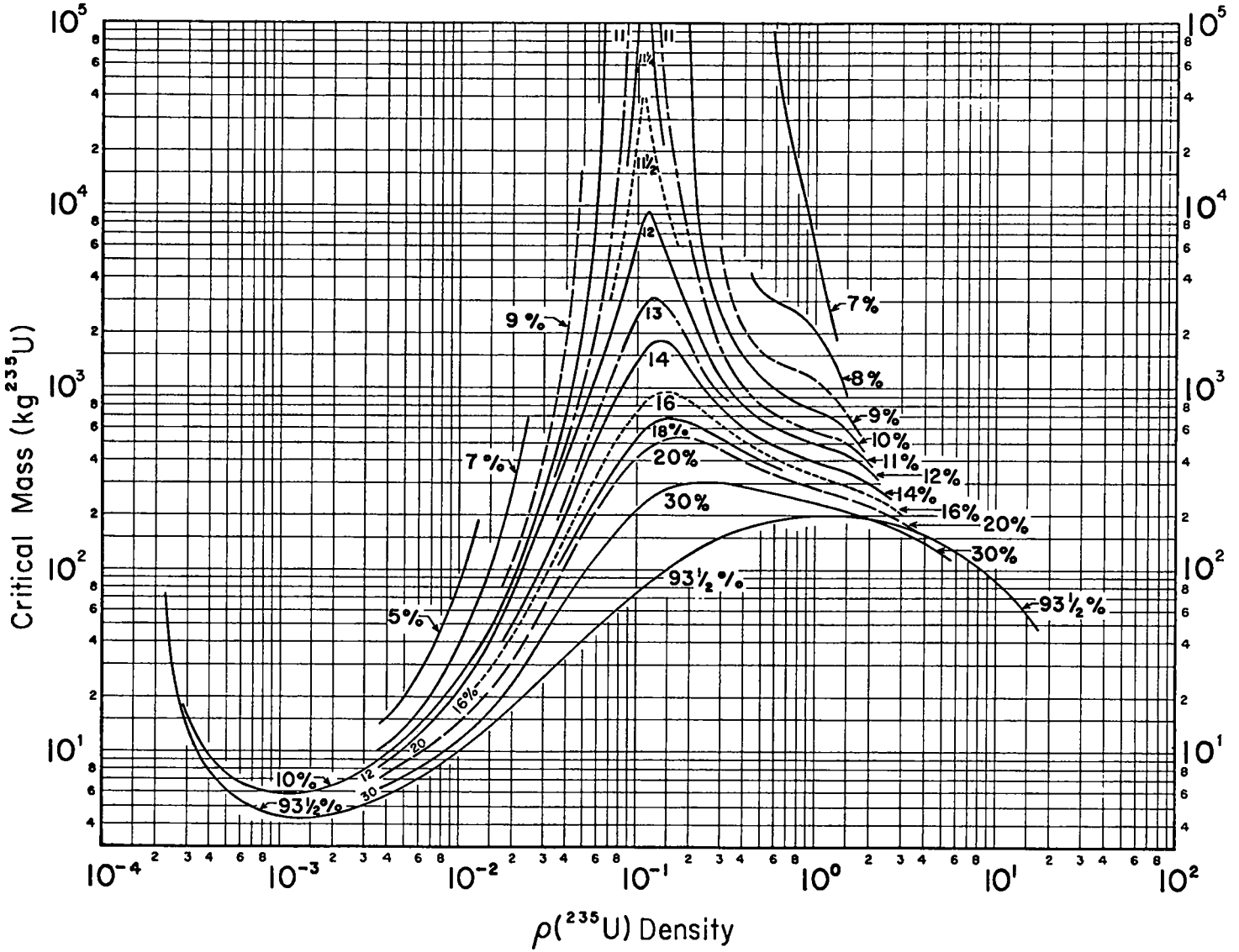


Fig. 2. Critical mass (kg $^{235}$U) of homogeneous spheres containing $^{235}$U, $^{238}$U, and carbon vs $^{235}$U density for various $^{235}$U enrichments.

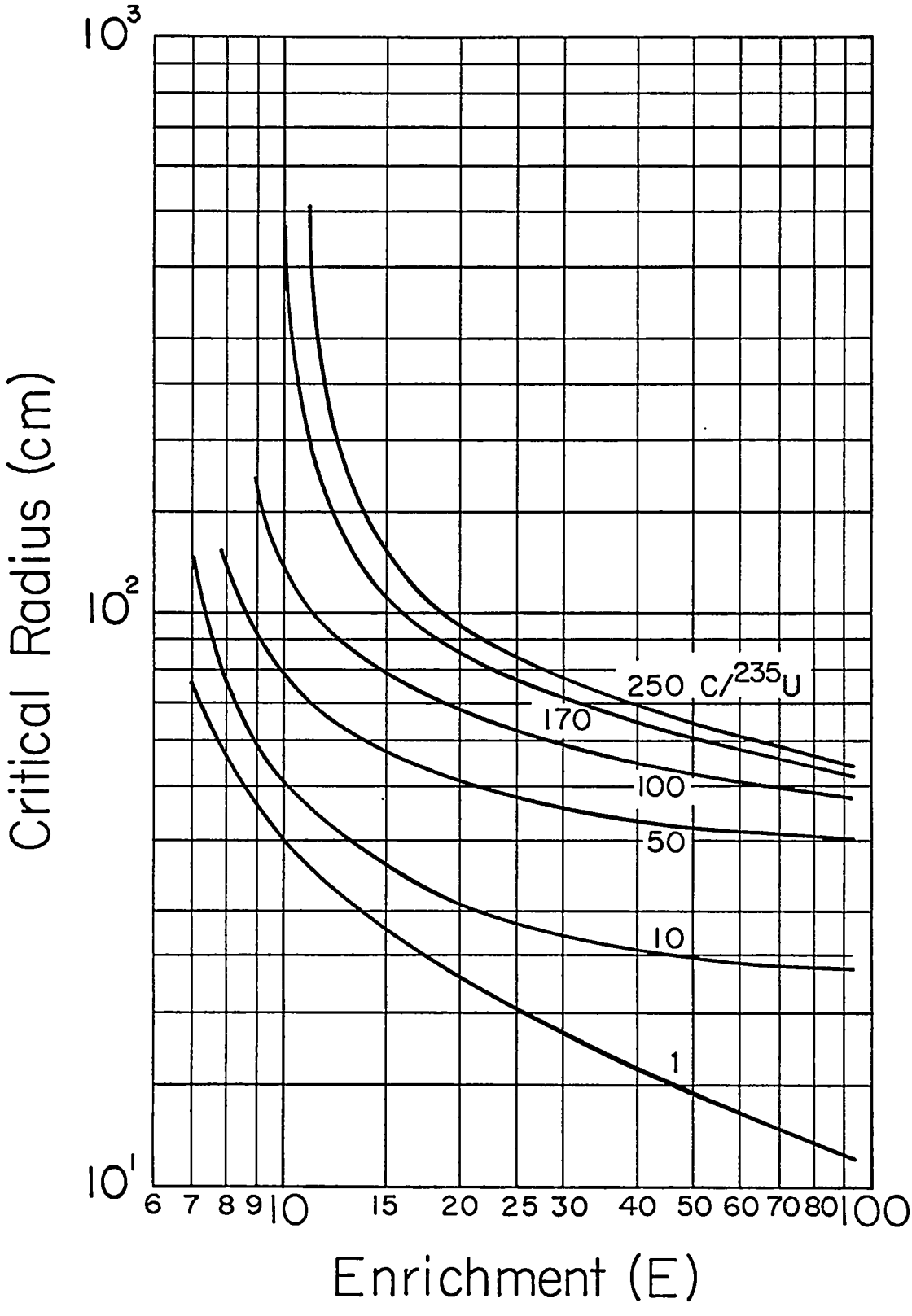


Fig. 3. Critical radii of homogeneous spheres containing $^{235}U$, $^{238}U$, and carbon vs $^{235}U$ enrichment for various C/$^{235}U$ atom ratios.

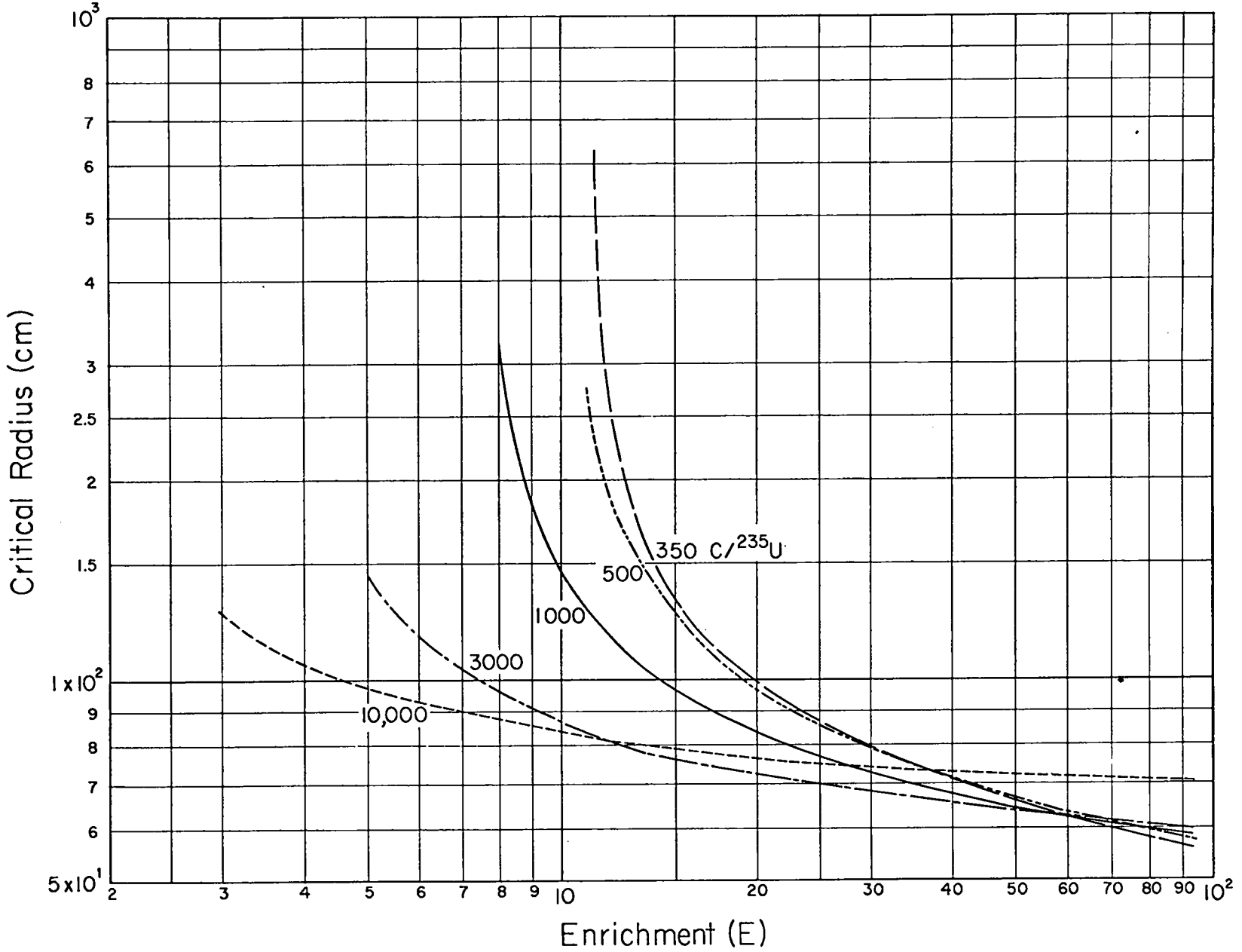


Fig. 4. Critical radii of homogeneous spheres containing $^{235}U$, $^{238}U$, and carbon vs $^{235}U$ enrichment for various C/$^{235}U$ atom ratios.

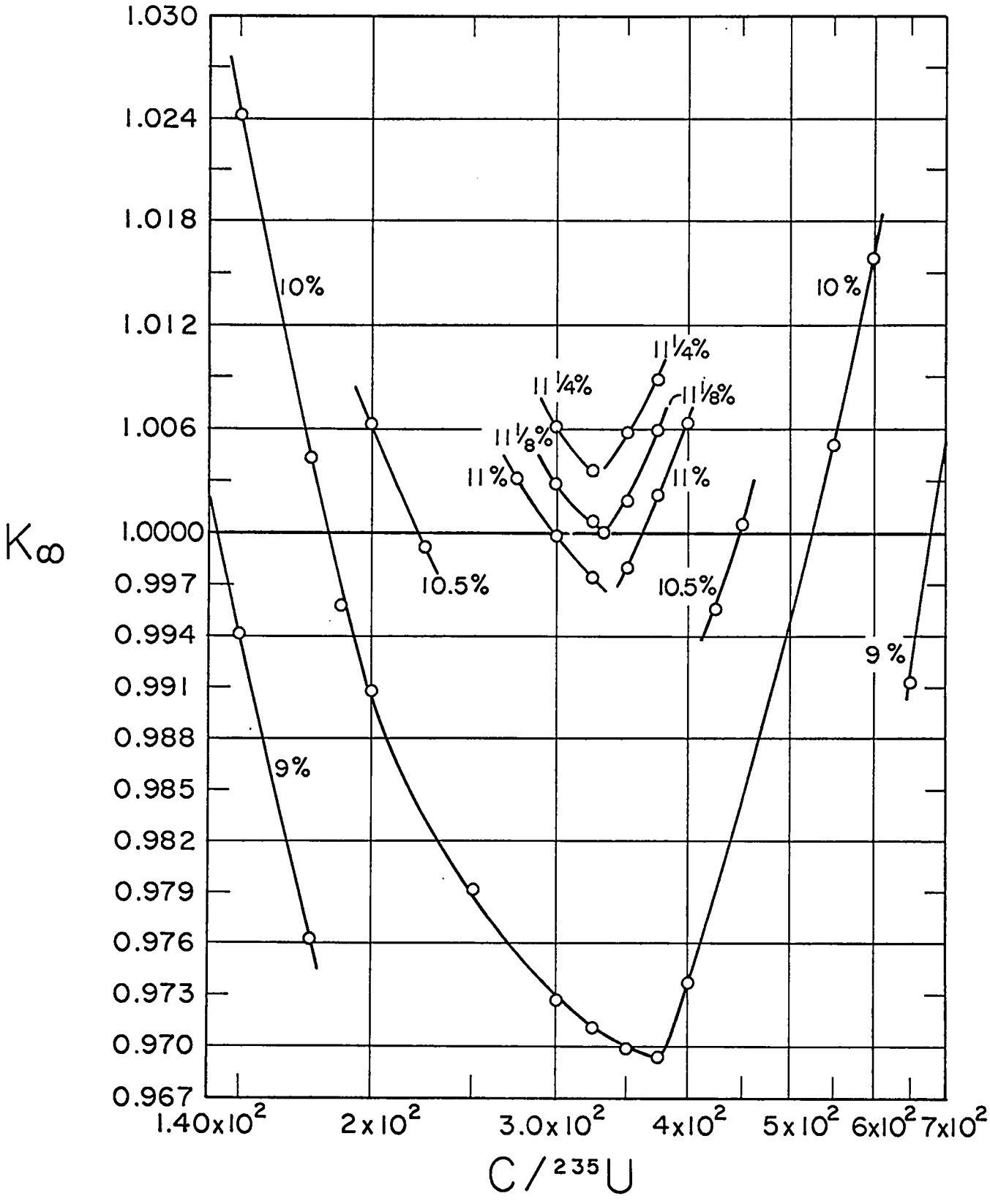


Fig. 5. Values of $k_\infty$ vs $C/^{235}U$ atom ratios for low $^{235}U$ enrichments.

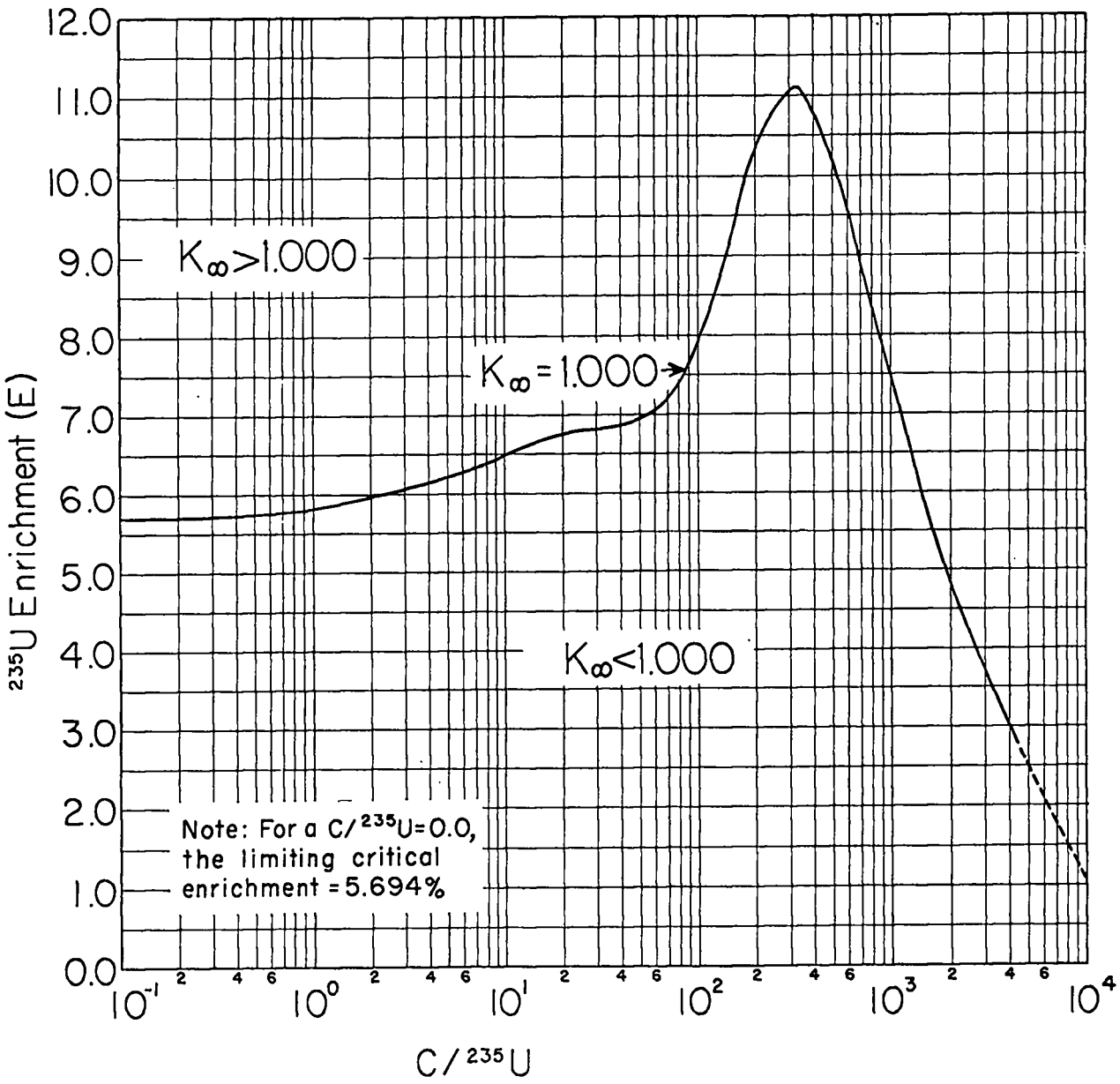


Fig. 6. Values of $k_\infty$ = 1.00 for a given $^{235}$U enrichment vs C/$^{235}$U atom ratio.

TABLE I

Criticality Data for $^{235}U$, $^{238}U$, and Carbon Homogeneous Spheres

| $C/^{235}U$ | $^{235}U$ Density ($g/cm^3$) | Critical Radius (cm) | Critical Mass (kg $^{235}U$) |
|---|---|---|---|
| | 93.5% $^{235}U$ Enrichment | | |
| 0.00+0 | 1.760+1 | 8.652+0 | 4.774+1 |
| 9.40-1 | 1.220+1 | 1.122+1 | 7.216+1 |
| 2.85+0 | 7.480+0 | 1.514+1 | 1.088+2 |
| 7.83+0 | 3.740+0 | 2.180+1 | 1.623+2 |
| 1.00+1 | 3.070+0 | 2.378+1 | 1.729+2 |
| 1.78+1 | 1.870+0 | 2.926+1 | 1.963+2 |
| 3.77+1 | 9.350-1 | 3.699+1 | 1.983+2 |
| 7.75+1 | 4.680-1 | 4.472+1 | 1.753+2 |
| 1.00+2 | 3.642-1 | 4.754+1 | 1.638+2 |
| 1.57+2 | 2.340-1 | 5.118+1 | 1.314+2 |
| 3.16+2 | 1.170-1 | 5.546+1 | 8.355+1 |
| 6.35+2 | 5.840-2 | 5.721+1 | 4.581+1 |
| 1.00+3 | 3.711-2 | 5.819+1 | 3.062+1 |
| 1.27+3 | 2.920-2 | 5.819+1 | 2.410+1 |
| 2.54+3 | 1.460-2 | 5.973+1 | 1.303+1 |
| 5.09+3 | 7.300-3 | 6.352+1 | 7.836+0 |
| 1.00+4 | 3.711-3 | 7.043+1 | 5.429+0 |
| 1.02+4 | 3.650-3 | 7.075+1 | 5.415+0 |
| 2.04+4 | 1.830-3 | 8.301+1 | 4.383+0 |
| 4.07+4 | 9.130-4 | 1.055+2 | 4.490+0 |
| 8.15+4 | 4.570-4 | 1.529+2 | 6.842+0 |
| 1.00+5 | 3.718-4 | 1.759+2 | 8.483+0 |
| 1.63+5 | 2.280-4 | 4.256+2 | 7.330+1 |
| | 30.0% $^{235}U$ Enrichment | | |
| 0.00+0 | 5.649+0 | 1.685+1 | 1.130+2 |
| 1.00+0 | 4.904+0 | 1.826+1 | 1.250+2 |
| 1.00+1 | 2.243+0 | 2.688+1 | 1.820+2 |
| 5.00+1 | 6.575-1 | 4.508+1 | 2.520+2 |
| 1.00+2 | 3.491-1 | 5.893+1 | 2.990+2 |
| 1.70+2 | 2.107-1 | 7.003+1 | 3.030+2 |
| 2.50+2 | 1.450-1 | 7.655+1 | 2.724+2 |
| 3.50+2 | 1.044-1 | 7.890+1 | 2.147+2 |
| 1.00+3 | 3.697-2 | 7.263+1 | 5.930+1 |
| 3.00+3 | 1.238-2 | 6.368+1 | 1.338+0 |
| 1.00+4 | 3.718-3 | 7.383+1 | 6.270+0 |
| | 20.0% $^{235}U$ Enrichment | | |
| 0.00+0 | 3.766+0 | 2.176+1 | 1.624+2 |
| 1.00+0 | 3.420+0 | 2.294+1 | 1.728+2 |
| 1.00+1 | 1.872+0 | 3.117+1 | 2.374+2 |
| 5.00+1 | 6.214-1 | 5.061+1 | 3.373+2 |
| 1.00+2 | 3.386-1 | 6.726+1 | 4.315+2 |
| 1.70+2 | 2.069-1 | 8.491+1 | 5.303+2 |
| 2.50+2 | 1.432-1 | 9.466+1 | 5.085+2 |
| 3.50+2 | 1.034-1 | 9.919+1 | 4.225+2 |
| 5.00+2 | 7.298-2 | 9.689+1 | 2.780+2 |
| 1.00+3 | 3.684-2 | 8.331+1 | 8.920+1 |
| 2.00+3 | 1.851-2 | 7.042+1 | 2.710+1 |
| 1.00+4 | 3.717-3 | 7.677+1 | 7.052+0 |
| 1.00+1 | 1.774+0 | 3.266+1 | 2.588+2 |
| 5.00+1 | 6.102-1 | 5.242+1 | 3.680+2 |
| 1.00+2 | 3.353-1 | 7.082+1 | 4.989+2 |
| 1.70+2 | 2.056-1 | 9.044+1 | 6.369+2 |
| 2.50+2 | 1.426-1 | 1.037+2 | 6.630+2 |
| 3.50+2 | 1.031-1 | 1.079+2 | 5.424+2 |
| 5.00+2 | 7.282-2 | 1.042+2 | 3.446+2 |
| 1.00+3 | 3.680-2 | 8.788+1 | 1.046+2 |
| | 16.0% $^{235}U$ Enrichment | | |
| 0.00+0 | 3.013+0 | 2.545+1 | 2.080+2 |
| 1.00+1 | 1.665+0 | 3.468+1 | 2.908+2 |
| 5.00+1 | 5.968-1 | 5.496+1 | 4.149+2 |
| 1.00+2 | 3.312-1 | 7.522+1 | 5.903+2 |
| 1.70+2 | 2.041-1 | 9.892+1 | 8.272+2 |
| 2.50+2 | 1.418-1 | 1.174+2 | 9.600+2 |
| 3.50+2 | 1.027-1 | 1.216+2 | 7.729+2 |
| 5.00+2 | 7.266-2 | 1.161+2 | 4.756+2 |
| 1.00+3 | 3.675-2 | 9.360+1 | 1.262+2 |
| 3.00+3 | 1.235-2 | 7.575+1 | 2.248+2 |
| | 14.0% $^{235}U$ Enrichment | | |
| 0.00+0 | 2.636+0 | 2.822+1 | 2.481+2 |
| 1.00+1 | 1.543+0 | 3.761+1 | 3.438+2 |
| 5.00+1 | 5.803-1 | 5.878+1 | 4.936+2 |
| 1.00+2 | 3.261-1 | 8.168+1 | 7.444+2 |
| 1.70+2 | 2.021-1 | 1.140+2 | 1.254+3 |
| 2.50+2 | 1.409-1 | 1.454+2 | 1.814+3 |
| 3.00+2 | 1.185-1 | 1.503+2 | 1.683+3 |
| 3.50+2 | 1.022-1 | 1.496+2 | 1.432+3 |
| 5.00+2 | 7.237-2 | 1.377+2 | 7.914+2 |
| 1.00+3 | 3.669-2 | 1.015+2 | 1.609+2 |
| 3.00+3 | 1.235-2 | 7.669+1 | 2.332+1 |
| | 13.0% $^{235}U$ Enrichment | | |
| 1.00+2 | 3.230-1 | 8.665+1 | 8.649+2 |
| 1.70+2 | 2.009-1 | 1.274+2 | 1.739+3 |
| 2.50+2 | 1.403-1 | 1.692+2 | 2.847+3 |
| 3.00+2 | 1.181-1 | 1.832+2 | 3.040+3 |
| 3.50+2 | 1.019-1 | 1.797+2 | 2.475+3 |
| 5.00+2 | 7.222-2 | 1.555+2 | 1.137+3 |
| 1.00+3 | 3.665-2 | 1.076+2 | 1.911+2 |
| | 12.0% $^{235}U$ Enrichment | | |
| 0.00+0 | 2.260+0 | 3.223+1 | 3.169+2 |
| 1.00+0 | 2.130+0 | 3.341+1 | 3.327+2 |
| 1.00+1 | 1.406+0 | 4.224+1 | 4.437+2 |
| 5.00+1 | 5.598-1 | 6.477+1 | 6.369+2 |
| 1.00+2 | 3.195-1 | 9.345+1 | 1.092+3 |

TABLE I (Continued)

Criticality Data for $^{235}U$, $^{238}U$, and Carbon Homogeneous Spheres

| $C/^{235}U$ | $^{235}U$ Density ($g/cm^3$) | Critical Radius (cm) | Critical Mass (kg $^{235}U$) |
|---|---|---|---|
| | 12.0% $^{235}U$ Enrichment | | |
| 1.70+2 | 1.995-1 | 1.505+2 | 2.848+3 |
| 2.50+2 | 1.396-1 | 2.207+2 | 6.289+3 |
| 3.00+2 | 1.176-1 | 2.662+2 | 9.285+3 |
| 3.50+2 | 1.015-1 | 2.489+2 | 6.552+3 |
| 5.00+2 | 7.204-2 | 1.868+2 | 1.966+3 |
| 1.00+3 | 3.661-2 | 1.162+2 | 2.402+2 |
| 3.00+3 | 1.234-2 | 8.174+1 | 2.821+1 |
| 1.00+4 | 3.715-3 | 8.140+1 | 8.392+0 |
| | 11.5% $^{235}U$ Enrichment | | |
| 2.00+2 | 1.713-1 | 2.060+2 | 6.272+3 |
| 2.50+2 | 1.393-1 | 2.796+2 | 1.275+4 |
| 3.00+2 | 1.173-1 | 4.020+2 | 3.191+4 |
| 3.25+2 | 1.087-1 | 4.411+2 | 3.908+4 |
| 3.50+2 | 1.013-1 | 3.835+2 | 2.394+4 |
| 5.00+2 | 7.194-2 | 2.163+2 | 3.049+3 |
| | 11.25% $^{235}U$ Enrichment | | |
| 2.50+2 | 1.391-1 | 3.476+2 | 2.446+4 |
| 3.00+2 | 1.172-1 | 6.485+2 | 1.338+5 |
| 3.25+2 | 1.086-1 | 1.234+3 | 8.554+5 |
| 3.50+2 | 1.012-1 | 6.290+2 | 1.055+5 |
| 4.00+2 | 8.911-2 | 3.815+2 | 2.071+4 |
| | 11.125% $^{235}U$ Enrichment | | |
| 3.00+2 | 1.171-1 | 1.274+3 | 1.016+6 |
| 3.25+2 | 1.086-1 | 3.190+3 | 1.475+7 |
| 3.75+2 | 9.474-2 | 7.596+2 | 1.739+5 |
| | 11.0% $^{235}U$ Enrichment | | |
| 0.00+0 | 2.071+0 | 3.502+1 | 3.725+2 |
| 1.00+1 | 1.331+0 | 4.576+1 | 5.340+2 |
| 5.00+1 | 5.475-1 | 6.959+1 | 7.727+2 |
| 1.00+2 | 3.154-1 | 1.039+2 | 1.482+3 |
| 1.70+2 | 1.980-1 | 2.038+2 | 7.014+3 |
| 2.50+2 | 1.389-1 | 4.855+2 | 6.664+4 |
| 2.75+2 | 1.270-1 | 9.752+2 | 4.933+5 |
| 2.92+2 | 1.120-1 | 4.348+3 | 3.858+7 |
| 3.67+2 | 9.655-2 | 4.518+3 | 3.733+7 |
| 4.00+2 | 8.902-2 | 6.707+2 | 1.125+5 |
| 4.50+2 | 7.951-2 | 3.407+2 | 1.317+4 |
| 4.75+2 | 7.548-2 | 2.988+2 | 8.435+3 |
| 5.00+2 | 7.184-2 | 2.693+2 | 5.872+3 |
| 1.00+3 | 3.655-2 | 1.286+2 | 3.257+2 |
| | 10.5% $^{235}U$ Enrichment | | |
| 2.00+2 | 1.700-1 | 5.971+2 | 1.516+5 |
| 2.155+2 | 1.588-1 | 3.502+3 | 2.855+7 |
| 4.500+2 | 7.937-2 | 4.611+3 | 3.259+7 |
| 4.75+2 | 7.535-2 | 9.209+2 | 2.465+5 |
| 0.00+0 | 1.883+0 | 3.874+1 | 4.570+2 |
| 1.00+1 | 1.792+0 | 4.013+1 | 4.850+2 |
| 1.00+1 | 1.250+0 | 5.089+1 | 6.860+2 |
| 4.00+1 | 6.226-1 | 7.055+1 | 9.740+2 |
| 8.00+1 | 3.730-1 | 1.013+2 | 1.619+3 |
| 1.00+2 | 3.107-1 | 1.217+2 | 2.345+3 |
| 1.10+2 | 2.868-1 | 1.349+2 | 2.949+3 |
| 1.30+2 | 2.485-1 | 1.698+2 | 5.092+3 |
| 1.50+2 | 2.192-1 | 2.320+2 | 1.146+4 |
| 1.75+2 | 1.911-1 | 6.741+2 | 2.451+5 |
| 1.79+2 | 1.872-1 | 1.913+3 | 5.490+6 |
| 5.50+2 | 6.531-2 | 7.301+2 | 1.064+5 |
| 6.00+2 | 6.004-2 | 3.568+2 | 1.142+4 |
| 7.00+2 | 5.170-2 | 2.362+2 | 2.853+3 |
| 9.00+2 | 4.045-2 | 1.623+2 | 7.247+2 |
| 1.00+3 | 3.649-2 | 1.457+2 | 4.720+2 |
| 3.00+3 | 1.232-2 | 8.662+1 | 3.354+1 |
| 6.00+3 | 6.181-3 | 8.147+1 | 1.399+1 |
| 1.00+4 | 3.714-3 | 8.354+1 | 9.070+0 |
| 2.00+4 | 1.859-3 | 9.313+1 | 6.288+0 |
| 4.00+4 | 9.298-4 | 1.145+2 | 5.847+0 |
| 6.00+4 | 6.199-4 | 1.370+2 | 6.680+0 |
| 8.00+4 | 4.650-4 | 1.621+2 | 8.294+0 |
| 1.00+5 | 3.720-4 | 1.914+2 | 1.092+1 |
| 1.10+5 | 3.382-4 | 2.083+2 | 1.280+1 |
| 1.30+5 | 2.862-4 | 2.498+2 | 1.729+1 |
| | 9.0% $^{235}U$ Enrichment | | |
| 0.00+0 | 1.695+0 | 4.407+1 | 6.076+2 |
| 1.00+0 | 1.621+0 | 4.572+1 | 6.488+2 |
| 9.00+0 | 1.202+0 | 5.761+1 | 9.625+2 |
| 2.455+1 | 8.001-1 | 7.210+1 | 1.256+3 |
| 5.00+1 | 5.171-1 | 8.965+1 | 1.560+3 |
| 1.00+2 | 3.051-1 | 1.634+2 | 5.572+3 |
| 7.50+2 | 4.820-2 | 4.270+2 | 1.572+4 |
| 8.00+2 | 4.527-2 | 3.147+2 | 5.908+3 |
| 2.00+3 | 1.840-2 | 1.043+2 | 8.743+1 |
| | 8.0% $^{235}U$ Enrichment | | |
| 0.00+0 | 1.506+0 | 5.263+1 | 9.196+2 |
| 1.00+0 | 1.448+0 | 5.487+1 | 1.002+3 |
| 6.00+0 | 1.212+0 | 6.613+2 | 1.468+3 |
| 1.20+1 | 1.014+0 | 7.804+2 | 2.018+3 |
| 3.50+1 | 6.233-1 | 1.042+2 | 2.951+3 |
| 5.00+1 | 4.981-1 | 1.189+2 | 3.508+3 |
| 1.30+3 | 2.809-2 | 1.757+2 | 6.380+2 |
| | 7.00% $^{235}U$ Enrichment | | |
| 0.00+0 | 1.318+0 | 6.985+1 | 1.882+3 |
| 1.00+0 | 1.273+0 | 7.476+1 | 2.228+3 |
| 4.00+0 | 1.155+0 | 8.863+1 | 3.366+3 |
| 1.00+1 | 9.733-1 | 1.248+2 | 7.931+3 |
| 3.00+1 | 6.390-1 | 2.659+2 | 5.031+4 |

TABLE I (Continued)

Criticality Data for $^{235}U$, $^{238}U$, and Carbon Homogeneous Spheres

| $C/^{235}U$ | $^{235}U$ Density ($g/cm^3$) | Critical Radius (cm) | Critical Mass (kg $^{235}U$) | $C/^{235}U$ | $^{235}U$ Density ($g/cm^3$) | Critical Radius (cm) | Critical Mass (kg $^{235}U$) |
|---|---|---|---|---|---|---|---|
| | 7.00% $^{235}U$ Enrichment | | | | 6.00% $^{235}U$ Enrichment | | |
| 1.50+3 | 2.435-2 | 1.843+2 | 6.382+2 | 0.00+0 | 1.130+0 | 1.455+2 | 1.457+4 |
| 3.00+3 | 1.229-2 | 1.044+2 | 5.855+1 | | | | |
| 1.00+4 | 3.710-3 | 8.920+1 | 1.101+1 | | 5.00% $^{235}U$ Enrichment | | |
| | | | | 3.00+3 | 1.224-2 | 1.444+2 | 1.544+2 |
| | | | | 1.00+4 | 3.706-3 | 9.729+1 | 1.430+1 |

TABLE II

$k_\infty$ for a Given $C/^{235}U$ Ratio and Enrichment

| $C/^{235}U$ | $^{235}U$ Density ($g/cm^3$) | $k_\infty$ | $C/^{235}U$ | $^{235}U$ Density ($g/cm^3$) | $k_\infty$ |
|---|---|---|---|---|---|
| | 11.25% $^{235}U$ Enrichment | | | 10.0% $^{235}U$ Enrichment | |
| 3.00+2 | 1.172-1 | 1.006+0 | 3.00+2 | 1.164-1 | 9.7270-1 |
| 3.25+2 | 1.086-1 | 1.0036+0 | 3.25+2 | 1.087-1 | 9.7100-1 |
| 3.50+2 | 1.012-1 | 1.0058+0 | 3.50+2 | 1.006-1 | 9.6996-1 |
| 3.75+2 | 9.478-2 | 1.0098+0 | 3.75+2 | 9.426-2 | 9.6949-1 |
| | | | 4.00+2 | 8.864-2 | 9.7370-1 |
| | 11.125% $^{235}U$ Enrichment | | | | |
| | | | 5.50+2 | 6.531-2 | 1.0051+0 |
| 3.00+2 | 1.172-1 | 1.0029+0 | 6.00+2 | 6.004-2 | 1.0159+0 |
| 3.25+2 | 1.086-1 | 1.0006+0 | | | |
| 3.32+2 | 1.064-1 | 1.0000+0 | | 9.0% $^{235}U$ Enrichment | |
| 3.50+2 | 1.012-1 | 1.0019+0 | | | |
| 3.75+2 | 9.474-2 | 1.0060+0 | 1.00+2 | 3.051-1 | 1.0411+0 |
| | | | 1.50+2 | 2.164-1 | 9.9439-1 |
| | 11.0% $^{235}U$ Enrichment | | 1.75+2 | 1.889-1 | 9.7635-1 |
| 2.75+2 | 1.279-1 | 1.0031+0 | 6.50+2 | 5.537-2 | 9.9147-1 |
| 3.00+2 | 1.170-1 | 9.9991-1 | 7.50+2 | 4.820-2 | 1.0129+0 |
| 3.25+2 | 1.085-1 | 9.9749-1 | 8.00+2 | 4.527-2 | 1.0220+0 |
| 3.50+2 | 1.011-1 | 9.9800-1 | | | |
| 3.75+2 | 9.469-2 | 1.0022+0 | | 8.0% $^{235}U$ Enrichment | |
| 4.00+2 | 8.902-2 | 1.0064+0 | 8.00+1 | 3.554-1 | 1.0257+0 |
| | | | 9.00+1 | 3.244-1 | 1.0136+0 |
| | 10.5% $^{235}U$ Enrichment | | 1.05+2 | 2.869-1 | 9.9785-1 |
| | | | 8.50+2 | 4.254-1 | 9.9360-1 |
| 2.00+2 | 1.700-1 | 1.0063+0 | | | |
| 2.25+2 | 1.526-1 | 9.9921-1 | 1.00+3 | 3.631-2 | 1.0227+0 |
| 4.25+2 | 8.384-2 | 9.9562-1 | 1.15+3 | 3.168-2 | 1.0546+0 |
| 4.50+2 | 7.937-2 | 1.0005+0 | 1.30+3 | 2.809-2 | 1.0743+0 |
| | 10.0% $^{235}U$ Enrichment | | | 7.5% $^{235}U$ Enrichment | |
| 1.50+2 | 2.192-1 | 1.0243+0 | 4.20+1 | 5.444-1 | 1.0365+0 |
| 1.75+2 | 1.911-1 | 1.0044+0 | 5.00+1 | 4.874-1 | 1.0322+0 |
| 1.87+2 | 1.800-1 | 9.9580-1 | 6.00+1 | 4.309-1 | 1.0241+0 |
| 2.00+2 | 1.700-1 | 9.9080-1 | | | |
| 2.50+2 | 1.379-1 | 9.7910-1 | 7.00+1 | 3.862-1 | 1.0146+0 |
| | | | 8.00+1 | 3.499-1 | 1.0042+0 |
| | | | 9.00+1 | 3.198-1 | 9.9317-1 |

TABLE II (Continued)

$k_\infty$ for a Given $C/^{235}U$ Ratio and Enrichment

| $C/^{235}U$ | $^{235}U$ Density ($g/cm^3$) | $k_\infty$ |
|---|---|---|
| | 7.125 $^{235}U$ Enrichment | |
| 2.00+1 | 7.795-1 | 1.0235+0 |
| 3.00+1 | 6.445-1 | 1.0185+0 |
| 5.00+1 | 4.787-1 | 1.0114+0 |
| | 7.00‰ $^{235}U$ Enrichment | |
| 2.00+1 | 7.715-1 | 1.0156+0 |
| 3.00+1 | 6.390-1 | 1.0108+0 |
| 4.20+1 | 5.298-1 | 1.0072+0 |
| 5.00+1 | 4.756-1 | 1.0042+0 |
| 6.00+1 | 4.217-1 | 9.9820-1 |
| 7.00+1 | 3.788-1 | 9.8998-1 |
| 1.00+3 | 3.619-2 | 9.7751-1 |
| 1.20+3 | 3.029-2 | 1.0148+0 |
| 1.30+3 | 2.801-2 | 1.0341+0 |
| 1.40+3 | 2.605-2 | 1.0521+0 |
| 1.65+3 | 2.217-2 | 1.0911+0 |
| | 6.9‰ $^{235}U$ Enrichment | |
| 4.00+1 | 5.421-1 | 1.0018+0 |
| 6.00+1 | 4.198-1 | 9.9280-1 |
| | 6.8‰ $^{235}U$ Enrichment | |
| 2.00+1 | 7.584-1 | 1.0028+0 |
| 4.00+1 | 5.388-1 | 9.9560-1 |
| | 6.7‰ $^{235}U$ Enrichment | |
| 1.50+1 | 8.363-1 | 1.0030+0 |
| 2.50+1 | 6.828-1 | 9.9310-1 |
| | 6.6‰ $^{235}U$ Enrichment | |
| 1.15+1 | 8.979-1 | 9.9460-1 |
| 1.60+1 | 8.099-1 | 1.0042+0 |
| | 6.5‰ $^{235}U$ Enrichment | |
| 9.00+0 | 9.444-1 | 1.0055+0 |
| 1.00+1 | 9.210-1 | 1.0019+0 |
| | 6.4‰ $^{235}U$ Enrichment | |
| 5.00+0 | 1.037+0 | 1.0167+0 |
| 1.00+1 | 9.102-1 | 9.9510-1 |
| | 6.2‰ $^{235}U$ Enrichment | |
| 1.00+0 | 1.132+0 | 1.0309+0 |
| 1.00+1 | 8.887-1 | 9.8100-1 |
| | 6.0‰ $^{235}U$ Enrichment | |
| 1.00+0 | 1.097+0 | 1.0155+0 |
| 1.00+1 | 8.667-1 | 9.6710-1 |

| $C/^{235}U$ | $^{235}U$ Density ($g/cm^3$) | $k_\infty$ |
|---|---|---|
| | 5.8‰ $^{235}U$ Enrichment | |
| 1.00+0 | 1.061+0 | 9.9960-1 |
| 6.00+0 | 9.286-1 | 9.6780-1 |
| | 5.75‰ $^{235}U$ Enrichment | |
| 4.00-1 | 1.070+0 | 1.0009+0 |
| 1.00+0 | 1.052+0 | 9.9560-1 |
| | 5.71‰ $^{235}U$ Enrichment | |
| 1.00-1 | 1.072+0 | 1.0004+0 |
| 6.00-2 | 1.073+0 | 1.0007+0 |
| | 5.705‰ $^{235}U$ Enrichment | |
| 1.00-1 | 1.071+0 | 1.0000+0 |
| 6.00-2 | 1.072+0 | 1.0004+0 |
| | 5.70‰ $^{235}U$ Enrichment | |
| 4.00-2 | 1.072+0 | 1.0002+0 |
| 5.75-2 | 1.072+0 | 9.9999-1 |
| 6.00-2 | 1.072+0 | 9.9997-1 |
| 1.00-1 | 1.070+0 | 9.9956-1 |
| | 5.695‰ $^{235}U$ Enrichment | |
| 0.00+0 | 1.072+0 | 1.0001+0 |
| 5.00-3 | 1.072+0 | 1.0000+0 |
| 7.00-3 | 1.072+0 | 1.0000+0 |
| 1.00-2 | 1.072+0 | 9.9997-1 |
| 1.50-2 | 1.071+0 | 9.9996-1 |
| 3.00-2 | 1.071+0 | 9.9982-1 |
| 4.00-2 | 1.071+0 | 9.9971-1 |
| | 5.68‰ $^{235}U$ Enrichment | |
| 1.00-2 | 1.069+0 | 9.9873-1 |
| 1.35-2 | 1.069+0 | 9.9873-1 |
| | 5.60‰ $^{235}U$ Enrichment | |
| 4.00-2 | 1.053+0 | 9.9190-1 |
| 1.00-1 | 1.052+0 | 9.9130-1 |
| 5.00-1 | 1.039+0 | 9.8770-1 |
| 1.00+0 | 1.025+0 | 9.8350-1 |
| | 5.00‰ $^{235}U$ Enrichment | |
| 1.65+3 | 2.202-2 | 9.64870-1 |
| 1.75+3 | 2.079-2 | 9.8078-1 |
| 1.95+3 | 1.8702-2 | 1.0094+0 |
| | 3.0‰ $^{235}U$ Enrichment | |
| 2.85+3 | 1.276-2 | 9.0560-1 |
| 4.40+3 | 8.332-3 | 1.0231+0 |
| 4.63+3 | 7.924-3 | 1.0382+0 |
| 7.00+3 | 5.266-3 | 1.1450+0 |