You may assume the following formulae without proof:

The partial-wave expansion of a plane wave is

$$\mathrm{e}^{\mathrm{i}kz} = \sum_l \sqrt{4\pi(2l+1)}\,\mathrm{i}^l\, j_l(kr)\, Y_{l0}(\theta),$$

where the regular spherical Bessel functions have the asymptotic forms for large x

$$j_l(x) \to \frac{\sin(x - l\pi/2)}{x}.$$

The differential cross section for elastic scattering in the centre-of-mass frame is

$$\frac{\mathrm{d}\sigma}{\mathrm{d}\Omega} = |f(\theta,\phi)|^2$$

where, for a central interaction,

$$f(\theta,\phi) = \frac{1}{k}\sum_l \sqrt{4\pi(2l+1)}\,\mathrm{e}^{\mathrm{i}\delta_l}\sin\delta_l\, Y_{l0}(\theta).$$

Here the Y_{l0} are normalised spherical harmonics,

$$Y_{l0}(\theta) = \sqrt{\frac{2l+1}{4\pi}}P_l(\cos\theta),$$

with

$$P_0(\cos\theta) = 1, \quad P_1(\cos\theta) = \cos\theta, \quad P_2(\cos\theta) = \frac{1}{2}(3\cos^2\theta - 1).$$

In terms of the amplitudes η_l for the outgoing waves, the elastic-scattering and reaction cross sections are

$$\sigma_{\mathrm{el}} = \frac{\pi}{k^2}\sum_l (2l+1)|1-\eta_l|^2, \qquad \sigma_{\mathrm{re}} = \frac{\pi}{k^2}\sum_l (2l+1)\left(1 - |\eta_l|^2\right).$$

The spherical Bessel functions $j_l(x)$ have maxima at the values of x given in the table below.

$l=0$	$l=1$	$l=2$	$l=3$	$l=4$
0.00	2.08	3.34	4.51	5.65
4.49	5.94	7.29	8.58	9.84
7.73	9.20	10.61	11.97	13.30

The energy of the Gamow peak is

$$E_0 = 1.22(Z_a^2 Z_b^2 \mu T_6^2)^{1/3}\,\mathrm{keV}, \text{ where } T = T_6 \times 10^6\,\mathrm{K} \text{ and } \mu \text{ has units of u.}$$

The reaction cross section in the sharp-cut-off model is

$$\sigma_{\mathrm{sco}} = \pi R^2\left(1 - \frac{E_b}{E}\right).$$

The atomic mass unit is 1 u = 931.5 MeV/c^2.