Cross Sections and Differential Spectra
for Reactions of 2-20 MeV Neutrons
on ^{27}Al

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January 1988

Lawrence
Livermore
National
Laboratory

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Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

CROSS SECTIONS AND DIFFERENTIAL SPECTRA FOR REACTIONS
OF 2-20 MeV NEUTRONS ON ^{27}Al

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DE88 005881

This report summarizes product yields, secondary n,p and α spectra, and γ -ray spectra calculated for incident neutrons of 2-20 MeV on ^{27}Al targets.

Results are all from the code ALICE, using the version ALISO which does weighting of results for targets which are a mix of isotopes. Where natural isotopic targets are involved, yields and n,p, α spectra will be reported weighted over isotopic yields. Gamma-ray spectra, however, will be reported for the most abundant isotope.

In Section I, we present product yields versus incident neutron energy. In Section II, we present n,p, α spectra versus incident neutron energy, and in Section III, we present calculated γ -ray spectra.

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1365A(1)-1/19/88

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SECTION 1

Yields from $^{27}\text{Al}(n,x)$ Reactions
for 2-20 MeV Incident Neutrons

optically weighted cross sections and spectra follow

otopically weighted results for incident energy 2.00 mev(lab)

mic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	1.430e+03	1.459e+03	0.	0.	0.	0.	0.	0.	0.	0.
mic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
mic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 3.00 mev(lab)

mic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	1.249e+03	1.289e+03	0.	0.	0.	0.	0.	0.	0.	0.
mic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	1.829e-01	0.	0.	0.	0.	0.	0.	0.	0.	0.
mic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 4.00 mev(lab)

mic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	1.189e+03	1.237e+03	0.	0.	0.	0.	0.	0.	0.	0.
mic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	9.955e+00	0.	0.	0.	0.	0.	0.	0.	0.	0.
mic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 5.00 mev(lab)

mic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	1.155e+03	1.194e+03	0.	0.	0.	0.	0.	0.	0.	0.
mic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	5.966e+01	0.	0.	0.	0.	0.	0.	0.	0.	0.
mic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 6.00 mev(lab)

mic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	1.119e+03	1.151e+03	0.	0.	0.	0.	0.	0.	0.	0.
mic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	6.727e+01	0.	0.	0.	0.	0.	0.	0.	0.	0.
mic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	1.161e-01	0.	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 7.00 mev(lab)

mic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	1.082e+03	1.114e+03	0.	0.	0.	0.	0.	0.	0.	0.
mic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	8.510e+01	0.	0.	0.	0.	0.	0.	0.	0.	0.
mic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	3.471e+00	0.	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 8.00 mev(lab)

mic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	1.041e+03	1.072e+03	0.	0.	0.	0.	0.	0.	0.	0.
mic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	1.011e+02	0.	0.	0.	0.	0.	0.	0.	0.	0.
mic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	1.744e+01	0.	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 9.00 mev(lab)

nic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	9.999e+02	7.032e+03	0.	0.	0.	0.	0.	0.	0.	0.
nic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	1.091e+02	0.	0.	0.	0.	0.	0.	0.	0.	0.
nic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	5.444e+01	0.	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 10.00 mev(lab)

nic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	9.548e+02	9.365e+02	0.	0.	0.	0.	0.	0.	0.	0.
nic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	1.107e+02	5.279e+01	0.	0.	0.	0.	0.	0.	0.	0.
nic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	5.095e+01	0.	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 11.00 mev(lab)

nic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	9.050e+02	7.281e+02	0.	0.	0.	0.	0.	0.	0.	0.
nic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	1.091e+02	2.194e+02	0.	0.	0.	0.	0.	0.	0.	0.
nic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	6.694e+01	0.	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 12.00 mev(lab)

nic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	8.567e+02	5.742e+02	0.	0.	0.	0.	0.	0.	0.	0.
nic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	1.043e+02	3.393e+02	0.	0.	0.	0.	0.	0.	0.	0.
nic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	7.518e+01	0.	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 14.00 mev(lab)

mic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	7.690e+02	3.624e+02	4.219e+00	0.	0.	0.	0.	0.	0.	0.
mic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	7.590e+01	4.882e+02	0.	0.	0.	0.	0.	0.	0.	0.
mic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	9.481e+01	2.875e+00	0.	0.	0.	0.	0.	0.

x

otopically weighted results for incident energy 16.00 mev(lab)

mic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	7.012e+02	2.462e+02	6.884e+01	0.	0.	0.	0.	0.	0.	0.
mic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	6.000e+01	4.940e+02	0.	0.	0.	0.	0.	0.	0.	0.
mic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	8.325e+01	3.379e+01	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 18.00 mev(lab)

mic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	6.452e+02	1.830e+02	1.354e+02	0.	0.	0.	0.	0.	0.	0.
mic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	5.028e+01	4.672e+02	0.	0.	0.	0.	0.	0.	0.	0.
mic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	0.	0.	6.464e+01	6.896e+01	0.	0.	0.	0.	0.	0.

otopically weighted results for incident energy 20.00 mev(lab)

mic number	13	13	13	13	13	13	13	13	13	13
s number	28	27	26	25	24	23	22	21	20	19
xsect s(j)	5.925e+02	1.419e+02	1.676e+02	0.	0.	0.	0.	0.	0.	0.
mic number	12	12	12	12	12	12	12	12	12	12
s number	27	26	25	24	23	22	21	20	19	18
xsect s(j)	4.337e+01	4.584e+02	0.	0.	0.	0.	0.	0.	0.	0.
mic number	11	11	11	11	11	11	11	11	11	11
s number	26	25	24	23	22	21	20	19	18	17
xsect s(j)	4.039e-01	0.	4.212e+01	9.816e+01	0.	0.	0.	0.	0.	0.

SECTION 2

Particle Spectra from $^{27}\text{Al}(n,x)$ Reactions
for 2-20 MeV Incident Neutrons

otopically weighted results for incident energy 2.00 mev(lab)

ke	ds/d ϵ (mb/mev)*	neutrons	protons	alphas	deuterons
0.250		4.9498e+02	0.	0.	0.
0.750		8.4987e+02	0.	0.	0.
1.250		8.2726e+02	0.	0.	0.
1.750		7.4503e+02	0.	0.	0.

otopically weighted results for incident energy 3.00 mev(lab)

ke	ds/d ϵ (mb/mev)*	neutrons	protons	alphas	deuterons
0.250		3.0579e+02	0.	0.	0.
0.750		5.2507e+02	3.6587e-01	0.	0.
1.250		5.1152e+02	0.	0.	0.
1.750		4.6124e+02	0.	0.	0.
2.250		4.1061e+02	0.	0.	0.
2.750		3.6371e+02	0.	0.	0.

otopically weighted results for incident energy 4.00 mev(lab)

ke	ds/d ϵ (mb/mev)*	neutrons	protons	alphas	deuterons
0.250		2.3799e+02	0.	0.	0.
0.750		4.0838e+02	2.6653e-01	0.	0.
1.250		3.9821e+02	4.1767e+00	0.	0.
1.750		3.5960e+02	1.5466e+01	0.	0.
2.250		3.2032e+02	0.	0.	0.
2.750		2.8369e+02	0.	0.	0.
3.250		2.4951e+02	0.	0.	0.
3.750		2.1723e+02	0.	0.	0.

otopically weighted results for incident energy 5.00 mev(lab)

ke	ds/d ϵ (mb/mev)*	neutrons	protons	alphas	deuterons
0.250		2.0063e+02	0.	0.	0.
0.750		3.4436e+02	2.3262e-01	0.	0.
1.250		3.3602e+02	3.6891e+00	0.	0.
1.750		3.0347e+02	1.3731e+01	0.	0.
2.250		2.7057e+02	2.6587e+01	0.	0.
2.750		2.4014e+02	3.5078e+01	0.	0.
3.250		2.1179e+02	0.	0.	0.
3.750		1.8507e+02	0.	0.	0.
4.250		1.5986e+02	0.	0.	0.
4.750		1.3630e+02	0.	0.	0.

isotopically weighted results for incident energy 6.00 mev(lab)

ke	ds/de(mb/mev)*	neutrons	protons	alphas	deuterons
0.250		1.7665e+02	0.	0.	0.
0.750		1.8297e+02	0.0113e-01	0.	0.
1.250		2.9568e+02	0.2553e+00	0.	0.
1.750		2.6733e+02	1.2072e+01	1.0595e-02	0.
2.250		2.3868e+02	2.3441e+01	2.2151e-01	0.
2.750		2.1222e+02	3.3584e+01	0.	0.
3.250		1.8761e+02	3.3078e+01	0.	0.
3.750		1.6446e+02	3.1446e+01	0.	0.
4.250		1.4264e+02	0.	0.	0.
4.750		1.2238e+02	0.	0.	0.
5.250		1.0369e+02	0.	0.	0.
5.750		8.7056e+01	0.	0.	0.

isotopically weighted results for incident energy 7.00 mev(lab)

ke	ds/de(mb/mev)*	neutrons	protons	alphas	deuterons
0.250		1.6437e+02	0.	0.	0.
0.750		2.8189e+02	1.8802e-01	0.	0.
1.250		2.7536e+02	2.8824e+00	0.	0.
1.750		2.4927e+02	1.0800e+01	9.4744e-03	0.
2.250		2.2291e+02	2.1032e+01	1.9808e-01	0.
2.750		1.9858e+02	2.7952e+01	1.4358e+00	0.
3.250		1.7598e+02	2.9918e+01	5.2989e+00	0.
3.750		1.5473e+02	2.8629e+01	0.	0.
4.250		1.3473e+02	2.5974e+01	0.	0.
4.750		1.1610e+02	2.2828e+01	0.	0.
5.250		9.9099e+01	0.	0.	0.
5.750		8.3959e+01	0.	0.	0.
6.250		7.0719e+01	0.	0.	0.

isotopically weighted results for incident energy 8.00 mev(lab)

ke	d ₂ /de(mb/mev)*	neutrons	protons	alphas	deuterons
0.250		1.4912e+02	0.	0.	0.
0.750		2.3574e+02	1.7178e-01	0.	0.
1.250		2.5011e+02	2.7619e+00	0.	0.
1.750		2.2676e+02	1.0377e+01	8.6967e-03	0.
2.250		2.0316e+02	2.0264e+01	1.8182e-01	0.
2.750		1.8138e+02	2.7012e+01	1.3176e+00	0.
3.250		1.6116e+02	2.9003e+01	4.8639e+00	0.
3.750		1.4215e+02	2.7878e+01	1.0997e+01	0.
4.250		1.2427e+02	2.5442e+01	1.7511e+01	0.
4.750		1.0722e+02	2.2712e+01	0.	0.
5.250		9.2422e+01	1.9733e+01	0.	0.
5.750		7.8892e+01	1.6905e+01	0.	0.
6.250		6.7121e+01	0.	0.	0.
6.750		5.6727e+01	0.	0.	0.
7.250		4.6957e+01	0.	0.	0.

isotopically weighted results for incident energy 9.00 mev(lab)

ka	ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		1.3166e+02	0.	0.	0.
0.750		2.3606e+02	1.5898e-01	0.	0.
1.250		2.3110e+02	2.5647e+00	0.	0.
1.750		2.0983e+02	6.6595e+00	7.3275e-03	0.
2.250		1.8831e+02	1.8906e+01	1.5319e-01	0.
2.750		1.6845e+02	2.2268e+01	1.1102e+00	0.
3.250		1.5081e+02	2.7215e+01	4.0582e+00	0.
3.750		1.3268e+02	2.6262e+01	9.2661e+00	0.
4.250		1.1637e+02	2.4084e+01	1.4754e+01	0.
4.750		1.0117e+02	2.1630e+01	1.8737e+01	0.
5.250		8.7305e+01	1.8097e+01	2.0743e+01	0.
5.750		7.4960e+01	1.6622e+01	0.	0.
6.250		6.4234e+01	1.4359e+01	0.	0.
6.750		5.5075e+01	1.2283e+01	0.	0.
7.250		4.6360e+01	0.	0.	0.
7.750		3.8704e+01	0.	0.	0.
8.250		3.1995e+01	0.	0.	0.

isotopically weighted results for incident energy 10.00 mev(lab)

ka	ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		1.0402e+02	0.	0.	0.
0.750		1.9443e+02	1.0210e+02	0.	0.
1.250		2.1204e+02	2.3526e+00	0.	0.
1.750		2.0138e+02	8.8778e+00	6.7759e-03	0.
2.250		1.8090e+02	1.7409e+01	1.4166e-01	0.
2.750		1.6202e+02	2.3318e+01	1.0266e+00	0.
3.250		1.4449e+02	2.5181e+01	3.7896e+00	0.
3.750		1.2801e+02	2.4575e+01	8.5684e+00	0.
4.250		1.1248e+02	2.2435e+01	1.3643e+01	0.
4.750		9.8017e+01	2.0235e+01	1.7328e+01	0.
5.250		8.4805e+01	1.8060e+01	1.9181e+01	0.
5.750		7.3052e+01	1.5894e+01	1.9489e+01	0.
6.250		6.2039e+01	1.3931e+01	1.8726e+01	0.
6.750		5.4122e+01	1.2151e+01	0.	0.
7.250		4.6209e+01	1.0522e+01	0.	0.
7.750		3.9104e+01	9.0067e+00	0.	0.
8.250		3.2922e+01	0.	0.	0.
8.750		2.7502e+01	0.	0.	0.
9.250		2.2737e+01	0.	0.	0.

isotopically weighted results for incident energy 11.00 mev(lab)

ke	ds/dε(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		1.0053e+02	0.	0.	0.
0.750		1.6211e+02	1.8108e+02	0.	0.
1.250		1.7180e+02	1.6674e+02	0.	0.
1.750		1.7777e+02	7.3126e+01	4.8714e-03	0.
2.250		1.7256e+02	1.7851e+01	1.4065e-01	0.
2.750		1.5818e+02	2.3917e+01	1.0193e+00	0.
3.250		1.4118e+02	2.5635e+01	3.7627e+00	0.
3.750		1.2522e+02	2.5014e+01	8.5077e+00	0.
4.250		1.1019e+02	2.3028e+01	1.5546e+01	0.
4.750		9.6167e+01	2.0774e+01	1.2058e+01	0.
5.250		8.3358e+01	1.8616e+01	1.0045e+01	0.
5.750		7.1952e+01	1.6474e+01	1.9351e+01	0.
6.250		6.2040e+01	1.4555e+01	1.8593e+01	0.
6.750		5.5585e+01	1.2539e+01	1.7205e+01	0.
7.250		4.6159e+01	1.2998e+01	1.9495e+01	0.
7.750		3.9429e+01	9.8861e+00	0.	0.
8.250		3.3610e+01	8.5810e+00	0.	0.
8.750		2.8552e+01	7.3537e+00	0.	0.
9.250		2.4136e+01	0.	0.	0.
9.750		2.0264e+01	0.	0.	0.
10.250		1.6552e+01	0.	0.	0.

isotopically weighted results for incident energy 12.00 mev(lab)

ke	ds/dε(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		9.6128e+01	0.	0.	0.
0.750		1.4267e+02	1.5445e+02	0.	0.
1.250		1.4483e+02	8.041e+01	0.	0.
1.750		1.4366e+02	1.7118e+02	5.2271e-03	0.
2.250		1.4323e+02	1.1889e+02	1.2318e-01	0.
2.750		1.4262e+02	5.4651e+01	2.6147e-01	0.
3.250		1.4113e+02	4.4504e+01	5.4928e+00	0.
3.750		1.2792e+02	2.5623e+01	8.0249e+00	0.
4.250		1.1259e+02	2.3591e+01	1.2778e+01	0.
4.750		9.8246e+01	2.1285e+01	1.6229e+01	0.
5.250		8.5215e+01	1.9090e+01	1.7965e+01	0.
5.750		7.3574e+01	1.6980e+01	1.8253e+01	0.
6.250		6.3455e+01	1.5079e+01	1.7538e+01	0.
6.750		5.4824e+01	1.3398e+01	1.6229e+01	0.
7.250		4.7436e+01	1.1904e+01	1.4616e+01	0.
7.750		4.0732e+01	1.0562e+01	1.2893e+01	0.
8.250		3.4971e+01	9.3392e+00	1.1194e+01	0.
8.750		3.0002e+01	8.3305e+00	0.	0.
9.250		2.5703e+01	7.1580e+00	0.	0.
9.750		2.1973e+01	0.	0.	0.
10.250		1.8728e+01	0.	0.	0.
10.750		1.5890e+01	0.	0.	0.
11.250		1.3387e+01	0.	0.	0.

isotopically weighted results for incident energy 14.00 mev(lab)

ke	ds/d ϵ (mb/mev)*	neutrons	protons	alphas	deuterons
0.250		1.0399e+02	0.	0.	0.
0.750		1.3047e+02	1.0944e+02	0.	0.
1.250		1.2314e+02	1.4260e+02	0.	0.
1.750		1.1454e+02	1.7044e+02	2.7755e-02	0.
2.250		1.0930e+02	1.7389e+02	3.8179e-01	0.
2.750		1.0658e+02	1.4825e+02	1.7231e+00	0.
3.250		1.0498e+02	1.1056e+02	3.6180e+00	0.
3.750		1.0322e+02	7.4406e+01	7.2133e+00	0.
4.250		1.0056e+02	4.5834e+01	1.2946e+01	0.
4.750		9.6852e+01	2.6770e+01	1.7710e+01	0.
5.250		9.2282e+01	2.0736e+01	1.9604e+01	0.
5.750		7.9685e+01	1.8556e+01	1.9919e+01	0.
6.250		6.8649e+01	1.6562e+01	1.9139e+01	0.
6.750		5.9233e+01	1.4821e+01	1.7710e+01	0.
7.250		5.1291e+01	1.3300e+01	1.5950e+01	0.
7.750		4.4385e+01	1.1963e+01	1.4070e+01	0.
8.250		3.8378e+01	1.0779e+01	1.2215e+01	0.
8.750		3.3254e+01	9.7085e+00	1.0477e+01	0.
9.250		2.8879e+01	8.7442e+00	8.3990e+00	0.
9.750		2.5145e+01	7.8706e+00	7.4970e+00	0.
10.250		2.1958e+01	7.0785e+00	6.2707e+00	0.
10.750		1.9235e+01	6.3107e+00	0.	0.
11.250		1.6900e+01	5.3661e+00	0.	0.
11.750		1.4884e+01	0.	0.	0.
12.250		1.3125e+01	0.	0.	0.
12.750		1.1295e+01	0.	0.	0.
13.250		9.3519e+00	0.	0.	0.

otopically weighted results for incident energy 16.00 mev(lab)

ke	ds/dε(mb/mev)*	neutrons	protons	alphas	deuterons
0.250		1.4688e+02	0.	0.	0.
0.750		1.7686e+02	7.5139e+01	0.	0.
1.250		1.4529e+02	1.0912e+02	0.	0.
1.750		1.1952e+02	1.3767e+02	2.7138e-02	0.
2.250		1.0318e+02	1.5275e+02	4.1585e-01	0.
2.750		9.4763e+01	1.4026e+02	2.1927e+00	0.
3.250		9.0722e+01	1.1240e+02	5.6992e+00	0.
3.750		8.7169e+01	8.3514e+01	1.0332e+01	0.
4.250		8.3740e+01	5.9854e+01	1.4263e+01	0.
4.750		8.0257e+01	4.2358e+01	1.6668e+01	0.
5.250		7.6597e+01	3.3420e+01	1.7985e+01	0.
5.750		7.2690e+01	2.6359e+01	1.9418e+01	0.
6.250		6.8592e+01	2.1486e+01	2.1029e+01	0.
6.750		6.4447e+01	1.7866e+01	2.0464e+01	0.
7.250		6.0361e+01	1.5549e+01	1.8430e+01	0.
7.750		5.1399e+01	1.4012e+01	1.6258e+01	0.
8.250		4.4449e+01	1.2667e+01	1.4115e+01	0.
8.750		3.8513e+01	1.1483e+01	1.2106e+01	0.
9.250		3.3497e+01	1.0434e+01	1.0283e+01	0.
9.750		2.9269e+01	9.5123e+00	8.6630e+00	0.
0.250		2.5714e+01	8.7012e+00	7.2460e+00	0.
0.750		2.2750e+01	7.9902e+00	6.0238e+00	0.
1.250		2.0226e+01	7.3636e+00	4.9929e+00	0.
1.750		1.8117e+01	6.7797e+00	4.1954e+00	0.
2.250		1.6333e+01	5.9657e+00	3.3706e+00	0.
2.750		1.4810e+01	5.1685e+00	0.	0.
3.250		1.3497e+01	4.3813e+00	0.	0.
3.750		1.2106e+01	0.	0.	0.
4.250		1.0502e+01	0.	0.	0.
4.750		8.9788e+00	0.	0.	0.
5.250		7.5124e+00	0.	0.	0.

isotopically weighted results for incident energy 18.00 mev(lab)

ke	ds/d ϵ (mb/mev)*	neutrons	protons	alphas	deuterons
0.250		1.5447e+02	0.	0.	0.
0.750		1.9887e+02	5.2741e+01	0.	0.
1.250		1.6835e+02	7.6601e+01	0.	0.
1.750		1.3763e+02	1.0662e+02	2.5611e-02	0.
2.250		1.9053e+02	1.2564e+02	4.1285e-01	0.
2.750		1.0436e+02	1.2174e+02	2.3019e+00	0.
3.250		9.3559e+01	1.0248e+02	6.4028e+00	0.
3.750		6.5232e+01	7.9804e+01	1.2006e+01	0.
4.250		7.8574e+01	5.9885e+01	1.6833e+01	0.
4.750		7.3570e+01	4.4351e+01	1.9641e+01	0.
5.250		6.9562e+01	3.5541e+01	2.0658e+01	0.
5.750		6.5538e+01	2.9914e+01	2.0527e+01	0.
6.250		6.1645e+01	2.6043e+01	1.9787e+01	0.
6.750		5.7974e+01	2.3231e+01	1.8801e+01	0.
7.250		5.4517e+01	2.1053e+01	1.7822e+01	0.
7.750		5.1201e+01	1.8094e+01	1.7210e+01	0.
8.250		4.7972e+01	1.5715e+01	1.6838e+01	0.
8.750		4.4707e+01	1.3815e+01	1.4830e+01	0.
9.250		4.1439e+01	1.2378e+01	1.2596e+01	0.
9.750		3.5479e+01	1.1275e+01	1.0612e+01	0.
10.250		3.0969e+01	1.0322e+01	8.8762e+00	0.
10.750		2.7236e+01	9.5082e+00	7.3790e+00	0.
11.250		2.4154e+01	8.321e+00	6.1039e+00	0.
11.750		2.1610e+01	8.2100e+00	5.0290e+00	0.
12.250		1.9506e+01	7.6785e+00	4.1289e+00	0.
12.750		1.7759e+01	7.1717e+00	3.3784e+00	0.
13.250		1.6297e+01	6.4866e+00	2.7551e+00	0.
13.750		1.5065e+01	5.7206e+00	2.2401e+00	0.
14.250		1.4015e+01	5.0237e+00	0.	0.
14.750		1.2866e+01	4.3468e+00	0.	0.
15.250		1.1503e+01	3.6895e+00	0.	0.
15.750		1.0209e+01	0.	0.	0.
16.250		8.9617e+00	0.	0.	0.
16.750		7.7459e+00	0.	0.	0.
17.250		6.5484e+00	0.	0.	0.

utopically weighted results for incident energy 20.00 mev(lab)

ke	ds/de(mb/mev)*	neutrons	protons	alphas	deuterons
0.250		1.4515e+02	0.	0.	0.
0.750		2.0017e+02	3.7193e+01	0.	0.
1.250		1.7588e+02	5.6435e+01	0.	0.
1.750		1.4921e+02	8.3822e+01	1.8798e-02	0.
2.250		1.2832e+02	1.0483e+02	3.2184e-01	0.
2.750		1.1241e+02	1.0706e+02	1.8971e+00	0.
3.250		9.9901e+01	9.4731e+01	5.8419e+00	0.
3.750		8.9748e+01	7.7606e+01	1.1428e+01	0.
4.250		8.1251e+01	6.1424e+01	1.6447e+01	0.
4.750		7.3975e+01	4.8062e+01	1.9484e+01	0.
5.250		6.7678e+01	3.8608e+01	2.0626e+01	0.
5.750		6.2271e+01	3.2142e+01	2.0489e+01	0.
6.250		5.7886e+01	2.7748e+01	1.9643e+01	0.
6.750		5.4241e+01	2.4569e+01	1.8483e+01	0.
7.250		5.0821e+01	2.2169e+01	1.7224e+01	0.
7.750		4.7605e+01	2.0249e+01	1.5968e+01	0.
8.250		4.4570e+01	1.8658e+01	1.4777e+01	0.
8.750		4.1698e+01	1.7306e+01	1.3711e+01	0.
9.250		3.8983e+01	1.6124e+01	1.2898e+01	0.
9.750		3.6256e+01	1.4236e+01	1.2250e+01	0.
10.250		3.3682e+01	1.2682e+01	1.1546e+01	0.
10.750		3.1270e+01	1.1425e+01	9.6245e+00	0.
11.250		2.8934e+01	1.0438e+01	7.9614e+00	0.
11.750		2.6196e+01	9.6521e+00	6.5594e+00	0.
12.250		2.3556e+01	8.9766e+00	5.3853e+00	0.
12.750		2.0599e+01	8.3845e+00	4.4064e+00	0.
13.250		1.8632e+01	7.8865e+00	3.5955e+00	0.
13.750		1.7176e+01	7.3452e+00	2.9217e+00	0.
14.250		1.5968e+01	6.6621e+00	2.3694e+00	0.
14.750		1.4958e+01	6.0159e+00	1.9175e+00	0.
15.250		1.4097e+01	5.4049e+00	1.5490e+00	0.
15.750		1.3122e+01	4.8238e+00	1.2492e+00	0.
16.250		1.1981e+01	4.2741e+00	0.	0.
16.750		1.0897e+01	3.7443e+00	0.	0.
17.250		9.8535e+00	3.1512e+00	0.	0.
17.750		8.8379e+00	0.	0.	0.
18.250		7.8403e+00	0.	0.	0.
18.750		6.8534e+00	0.	0.	0.
19.250		5.8423e+00	0.	0.	0.

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SECTION 3

γ -ray Spectra Following $^{27}\text{Al}(\text{n},_) \text{Reactions}$

laboratory bombardment energy = 2.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 1458.2
 excitation energy of compound nucleus = 9.7mev j= 0
 reaction cross section 1458.2

energy (mev)	cross section (mb/mev)	cross section (mb/cm ² mev)
5.000e-01	1.446e+03	1.147e+02
1.000e+00	8.453e+02	6.708e+01
1.500e+00	2.919e+02	2.317e+01
2.000e+00	7.844e-03	6.257e-04
2.500e+00	1.569e-02	1.245e-03
3.000e+00	4.555e-02	3.628e-03
3.500e+00	3.604e-02	2.860e-03
4.000e+00	4.537e-02	3.601e-03
4.500e+00	5.186e-02	4.116e-03
5.000e+00	5.427e-02	4.307e-03
5.500e+00	5.208e-02	4.133e-03
6.000e+00	4.561e-02	3.620e-03
6.500e+00	3.605e-02	2.861e-03
7.000e+00	2.513e-02	1.994e-03
7.500e+00	1.484e-02	1.178e-03
8.000e+00	6.476e-03	5.157e-04
8.500e+00	2.124e-03	1.686e-04
9.000e+00	3.173e-04	2.518e-05

laboratory bombardment energy = 3.0mev target mass = 27.0
 compound nucleua mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 1288.7
 excitation energy of compound nucleus = 10.6mev j= 0
 reaction cross section 1288.7

e gamma (mev)	cross section	
	(mb/mev)	(mb/sr mev)
5.000e-01	1.246e+03	9.893e+01
1.000e+00	8.131e+02	6.455e+01
1.500e+00	5.647e+02	4.482e+01
2.000e+00	3.880e+02	2.682e+01
2.500e+00	1.157e+02	9.183e+00
3.000e+00	5.095e+02	4.044e+01
3.500e+00	7.487e+02	5.942e+01
4.000e+00	5.888e+02	7.847e+01
4.500e+00	1.196e+01	9.491e+00
5.000e+00	1.339e+01	1.063e+01
5.500e+00	1.395e+01	1.107e+01
6.000e+00	1.354e+01	1.075e+01
6.500e+00	1.220e+01	9.685e+00
7.000e+00	1.013e+01	8.043e+00
7.500e+00	7.642e+00	6.065e+00
8.000e+00	5.103e+00	4.050e+00
8.500e+00	2.888e+00	2.292e+00
9.000e+00	1.275e+00	1.012e+00
9.500e+00	3.662e+00	2.906e+00
1.000e+01	4.387e+00	3.482e+00

laboratory bombardment energy = 4.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 1246.5
 excitation energy of compound nucleus = 11.6mev j= 0
 reaction cross section 1246.5

a gamma (mev)	cross section (mb/mev) (mb/sr.mev)
5.000e-01	1.197e+03 9.501e+01
1.000e+00	7.771e+02 6.168e+01
1.500e+00	5.760e+02 4.571e+01
2.000e+00	4.373e+02 3.471e+01
2.500e+00	3.114e+02 2.472e+01
3.000e+00	1.840e+02 1.460e+01
3.500e+00	6.269e+01 4.975e+00
4.000e+00	5.275e-03 4.186e-04
4.500e+00	6.450e-03 5.278e-04
5.000e+00	7.816e-03 6.203e-04
5.500e+00	8.624e-03 6.845e-04
6.000e+00	8.968e-03 7.119e-04
6.500e+00	8.793e-03 6.979e-04
7.000e+00	8.114e-03 6.459e-04
7.500e+00	7.008e-03 5.662e-04
8.000e+00	5.613e-03 4.458e-04
8.500e+00	4.108e-03 3.260e-04
9.000e+00	2.684e-03 2.130e-04
9.500e+00	1.513e-03 1.201e-04
1.000e+01	7.074e-04 5.614e-05
1.050e+01	2.888e-04 2.292e-05
1.100e+01	1.742e-04 1.362e-05

laboratory bombardment energy = 5.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 1232.0
 excitation energy of compound nucleus = 12.5mev j= 0
 reaction cross section 1232.0

e gamma (mev)	cross section (mb/mev)	(mb/sr.meV)
5.000e-01	1.186e+03	9.816e+01
1.000e+00	7.629e+02	6.055e+01
1.500e+00	5.660e+02	4.492e+01
2.000e+00	4.484e+02	3.559e+01
2.500e+00	3.881e+02	3.142e+01
3.000e+00	2.761e+02	2.191e+01
3.500e+00	1.952e+02	1.549e+01
4.000e+00	1.471e+02	9.952e+00
4.500e+00	3.078e+01	3.078e+00
5.000e+00	5.057e-02	4.014e-03
5.500e+00	5.818e-02	4.618e-03
6.000e+00	6.351e-02	5.041e-03
6.500e+00	6.595e-02	5.234e-03
7.000e+00	6.518e-02	5.173e-03
7.500e+00	6.121e-02	4.858e-03
8.000e+00	5.439e-02	4.317e-03
8.500e+00	4.543e-02	3.606e-03
9.000e+00	3.528e-02	2.800e-03
9.500e+00	2.504e-02	1.987e-03
1.000e+01	1.500e-02	1.254e-03
1.050e+01	8.465e-03	6.718e-04
1.100e+01	3.557e-03	2.823e-04
1.150e+01	1.041e-03	8.265e-05
1.200e+01	2.906e-04	2.306e-05

laboratory bombardment energy = 6.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 1215.5
 excitation energy of compound nucleus = 13.5mev j= 0
 reaction cross section 1215.5

e gamma (mev)	cross section (mb/mev)	(mb/gr.mev)
5.000e-01	1.176e+03	9.332e+01
1.000e+00	7.635e+02	6.061e+01
1.500e+00	5.680e+02	4.508e+01
2.000e+00	4.510e+02	3.579e+01
2.500e+00	3.691e+02	2.929e+01
3.000e+00	3.035e+02	2.409e+01
3.500e+00	2.444e+02	1.940e+01
4.000e+00	1.876e+02	1.489e+01
4.500e+00	1.315e+02	1.044e+01
5.000e+00	7.628e+01	6.054e+00
5.500e+00	2.591e+01	2.056e+00
6.000e+00	1.271e+02	1.009e+03
6.500e+00	1.377e+02	1.093e+03
7.000e+00	1.430e+02	1.135e+03
7.500e+00	1.425e+02	1.131e+03
8.000e+00	1.359e+02	1.079e+03
8.500e+00	1.238e+02	9.822e+04
9.000e+00	1.072e+02	8.511e+04
9.500e+00	8.745e+03	6.956e+04
1.000e+01	6.687e+03	5.307e+04
1.050e+01	4.685e+03	3.721e+04
1.100e+01	2.955e+03	2.345e+04
1.150e+01	1.630e+03	1.294e+04
1.200e+01	7.865e+04	6.242e+05
1.250e+01	3.964e+04	3.146e+05
1.300e+01	3.333e+04	2.645e+05

laboratory bombardment energy = 7.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 1198.7
 excitation energy of compound nucleus = 14.5mev j= 0
 reaction cross section 1198.7

energy (mev)	cross section (mb/mev)	cross section (mb/sr.meV)
5.000e-01	1.159e+03	9.199e+01
1.000e+00	7.564e+02	6.003e+01
1.500e+00	5.694e+02	4.519e+01
2.000e+00	4.564e+02	3.627e+01
2.500e+00	3.740e+02	2.985e+01
3.000e+00	3.080e+02	2.444e+01
3.500e+00	2.523e+02	2.002e+01
4.000e+00	2.025e+02	1.605e+01
4.500e+00	1.547e+02	1.228e+01
5.000e+00	1.081e+02	8.578e+00
5.500e+00	6.254e+01	4.964e+00
6.000e+00	2.130e+01	1.690e+00
6.500e+00	9.757e-02	7.744e-03
7.000e+00	1.051e-01	8.345e-03
7.500e+00	1.093e-01	8.672e-03
8.000e+00	1.099e-01	8.695e-03
8.500e+00	1.058e-01	8.397e-03
9.000e+00	9.827e-02	7.799e-03
9.500e+00	8.745e-02	6.940e-03
1.000e+01	7.414e-02	5.884e-03
1.050e+01	5.930e-02	4.713e-03
1.100e+01	4.438e-02	3.522e-03
1.150e+01	3.036e-02	2.411e-03
1.200e+01	1.851e-02	1.469e-03
1.250e+01	9.568e-03	7.594e-04
1.300e+01	3.899e-03	3.071e-04
1.350e+01	1.199e-03	9.518e-05
1.400e+01	5.338e-04	4.236e-05

laboratory bombardment energy = 8.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 1184.9
 excitation energy of compound nucleus = 15.4mev j= 0
 reaction cross section 1184.9

a gamma (mev)	cross section (mb/mev)	(mb/str.mev)
5.000e-01	1.147e+03	9.103e+01
1.000e+00	7.464e+02	5.924e+01
1.500e+00	5.642e+02	4.478e+01
2.000e+00	4.589e+02	3.642e+01
2.500e+00	3.839e+02	3.047e+01
3.000e+00	3.229e+02	2.563e+01
3.500e+00	2.703e+02	2.145e+01
4.000e+00	2.242e+02	1.780e+01
4.500e+00	1.836e+02	1.457e+01
5.000e+00	1.464e+02	1.163e+01
5.500e+00	1.114e+02	8.844e+00
6.000e+00	7.742e+01	6.145e+00
6.500e+00	4.462e+01	3.542e+00
7.000e+00	1.518e+01	1.205e+00
7.500e+00	3.624e-02	2.876e-03
8.000e+00	7.72e-02	2.994e-03
8.500e+00	5.05e-02	3.020e-03
9.000e+00	7.79e-02	3.552e-03
9.500e+00	5.15e-02	2.790e-03
1.000e+01	3.205e-02	2.544e-03
1.050e+01	1.809e-02	1.228e-03
1.100e+01	3.36e-02	1.864e-03
1.150e+01	1.861e-02	1.477e-03
1.200e+01	1.381e-02	1.096e-03
1.250e+01	9.40e-03	7.484e-04
1.300e+01	6.799e-03	4.602e-04
1.350e+01	3.136e-03	2.489e-04
1.400e+01	1.315e-03	1.205e-04
1.450e+01	6.342e-04	6.671e-05
1.500e+01	7.883e-04	6.257e-05

laboratory bombardment energy = 9.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 1168.2
 excitation energy of compound nucleus = 16.4mev j= 0
 reaction cross section 1168.2

E (mev)	cross section (mb/mev)	(mb/ar. mev)
5.000e-01	1.135e+03	9.008e+01
1.000e+00	7.403e+02	5.375e+01
1.500e+00	8.894e+02	4.499e+01
2.000e+00	4.558e+02	3.617e+01
2.500e+00	3.854e+02	3.058e+01
3.000e+00	3.304e+02	2.622e+01
3.500e+00	2.852e+02	2.245e+01
4.000e+00	2.408e+02	1.911e+01
4.500e+00	2.023e+02	1.606e+01
5.000e+00	1.677e+02	1.331e+01
5.500e+00	1.369e+02	1.086e+01
6.000e+00	1.088e+02	8.633e+00
6.500e+00	8.225e+01	6.528e+00
7.000e+00	5.681e+01	4.509e+00
7.500e+00	3.246e+01	2.578e+00
8.000e+00	1.075e+01	8.558e-01
8.500e+00	1.628e-02	1.292e-03
9.000e+00	1.653e-02	1.312e-03
9.500e+00	1.633e-02	1.296e-03
1.000e+01	1.568e-02	1.245e-03
1.050e+01	1.461e-02	1.140e-03
1.100e+01	1.317e-02	1.045e-03
1.150e+01	1.143e-02	9.072e-04
1.200e+01	9.513e-03	7.550e-04
1.250e+01	7.537e-03	5.981e-04
1.300e+01	5.636e-03	4.473e-04
1.350e+01	3.946e-03	3.152e-04
1.400e+01	2.585e-03	2.051e-04
1.450e+01	1.636e-03	1.299e-04
1.500e+01	1.150e-03	9.190e-05
1.550e+01	1.027e-03	8.148e-05
1.600e+01	1.217e-03	9.658e-05

laboratory bombardment energy = 10.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 1143.5
 excitation energy of compound nucleus = 17.4mev j= 0
 reaction cross section 1143.5

s gamma (mev)	cross section (mb/mev) (mb/gr.mev)	
5.000e-01	1.064e+03	8.443e+01
1.000e+00	6.973e+02	5.534e+01
1.500e+00	5.280e+02	4.191e+01
2.000e+00	4.308e+02	3.419e+01
2.500e+00	3.641e+02	2.890e+01
3.000e+00	3.133e+02	2.486e+01
3.500e+00	2.715e+02	2.155e+01
4.000e+00	2.349e+02	1.856e+01
4.500e+00	2.015e+02	1.590e+01
5.000e+00	1.704e+02	1.353e+01
5.500e+00	1.418e+02	1.126e+01
6.000e+00	1.159e+02	9.199e+00
6.500e+00	9.261e+01	7.350e+00
7.000e+00	7.156e+01	5.680e+00
7.500e+00	5.145e+01	4.083e+00
8.000e+00	3.212e+01	2.49e+00
8.500e+00	1.438e+01	1.142e+00
9.000e+00	1.155e-01	9.167e-03
9.500e+00	1.179e-01	9.356e-03
1.000e+01	1.175e-01	9.324e-03
1.050e+01	1.142e-01	9.063e-03
1.100e+01	1.081e-01	8.581e-03
1.150e+01	9.946e-02	7.994e-03
1.200e+01	8.861e-02	7.033e-03
1.250e+01	7.609e-02	6.039e-03
1.300e+01	6.258e-02	4.967e-03
1.350e+01	4.885e-02	3.877e-03
1.400e+01	3.573e-02	2.855e-03
1.450e+01	2.404e-02	1.908e-03
1.500e+01	1.450e-02	1.151e-03
1.550e+01	7.619e-03	6.047e-04
1.600e+01	3.824e-03	2.797e-04
1.650e+01	1.878e-03	1.490e-04
1.700e+01	1.844e-03	1.463e-04

laboratory bombardment energy = 11.0mev target mass = 27.0
 compound nucleus mass = 26.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 1112.6
 excitation energy of compound nucleus = 18.3mev j= 0
 reaction cross section 1112.6

a gamma (mev)	cross section (mb/mev) (mb/Sr mev)
5.000e-01	9.967e+02 7.194e+01
7.000e+00	5.776e+02 4.586e+01
1.500e+00	4.357e+02 3.458e+01
2.000e+00	3.560e+02 2.825e+01
2.500e+00	2.804e+02 2.364e+01
3.000e+00	2.571e+02 2.041e+01
3.500e+00	2.214e+02 1.757e+01
4.000e+00	1.909e+02 1.516e+01
4.500e+00	1.641e+02 1.302e+01
5.000e+00	1.396e+02 1.102e+01
5.500e+00	1.166e+02 9.222e+00
6.000e+00	9.469e+01 7.531e+00
6.500e+00	7.469e+01 5.927e+00
7.000e+00	5.826e+01 4.624e+00
7.500e+00	4.246e+01 3.370e+00
8.000e+00	2.721e+01 2.159e+00
8.500e+00	1.274e+01 1.011e+00
9.000e+00	5.544e-02 4.400e-01
9.500e+00	3.809e-02 4.610e-01
1.000e+01	3.963e-02 4.733e-01
1.050e+01	5.996e-02 4.759e-01
1.100e+01	3.902e-02 4.684e-01
1.150e+01	5.679e-02 4.507e-01
1.200e+01	3.333e-02 4.235e-01
1.250e+01	4.876e-02 3.870e-01
1.300e+01	4.324e-02 3.434e-01
1.350e+01	3.704e-02 3.045e-01
1.400e+01	3.051e-02 2.421e-01
1.450e+01	2.390e-02 1.897e-01
1.500e+01	1.753e-02 1.400e-01
1.550e+01	1.212e-02 9.620e-02
1.600e+01	7.674e-03 6.092e-02
1.650e+01	4.563e-03 3.621e-02
1.700e+01	2.872e-03 2.280e-02
1.750e+01	1.687e-03 1.305e-02
1.800e+01	2.952e-03 2.343e-02

laboratory bombardment energy = 12.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 1080.6
 excitation energy of compound nucleus = 19.3mev j= 0
 reaction cross section 1080.6

energy (mev)	cross section (mb/mev)	cross section (mb/sr.meV)
5.000e-01	8.566e+02	6.799e+01
1.000e+00	5.062e+02	4.017e+01
1.500e+00	3.666e+02	2.910e+01
2.000e+00	2.933e+02	2.368e+01
2.500e+00	2.524e+02	2.003e+01
3.000e+00	2.162e+02	1.716e+01
3.500e+00	1.853e+02	1.472e+01
4.000e+00	1.587e+02	1.266e+01
4.500e+00	1.350e+02	1.072e+01
5.000e+00	1.139e+02	9.043e+00
5.500e+00	9.485e+01	7.528e+00
6.000e+00	7.703e+01	6.117e+00
6.500e+00	6.029e+01	4.785e+00
7.000e+00	4.732e+01	3.756e+00
7.500e+00	3.469e+01	2.753e+00
8.000e+00	2.234e+01	1.773e+00
8.500e+00	1.050e+01	8.333e-01
9.000e+00	2.907e-02	2.307e-03
9.500e+00	2.111e-02	1.699e-03
1.000e+01	3.271e-02	2.596e-03
1.050e+01	3.378e-02	2.681e-03
1.100e+01	4.26e-02	3.371e-03
1.150e+01	4.111e-02	3.270e-03
1.200e+01	3.332e-02	2.645e-03
1.250e+01	3.189e-02	2.531e-03
1.300e+01	3.98e-02	3.169e-03
1.350e+01	2.725e-02	2.164e-03
1.400e+01	2.422e-02	1.922e-03
1.450e+01	2.065e-02	1.655e-03
1.500e+01	1.731e-02	1.374e-03
1.550e+01	1.375e-02	1.094e-03
1.600e+01	1.047e-02	8.307e-04
1.650e+01	7.590e-03	6.024e-04
1.700e+01	5.358e-03	4.232e-04
1.750e+01	3.942e-03	3.129e-04
1.800e+01	3.430e-03	2.722e-04
1.850e+01	3.773e-03	2.994e-04
1.900e+01	4.757e-03	3.775e-04

laboratory bombardment energy = 14.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 1028.7
 excitation energy of compound nucleus = 21.2mev j= 0
 reaction cross section 1028.7

e gamma (mev)	cross section (mb/mev)	(mb/sr.meV)
5.000e-01	8.361e+02	6.636e+01
1.000e+00	4.793e+02	3.809e+01
1.500e+00	3.181e+02	2.525e+01
2.000e+00	2.340e+02	1.857e+01
2.500e+00	1.868e+02	1.478e+01
3.000e+00	1.540e+02	1.238e+01
3.500e+00	1.334e+02	1.059e+01
4.000e+00	1.141e+02	9.058e+00
4.500e+00	9.664e+01	7.670e+00
5.000e+00	8.045e+01	6.385e+00
5.500e+00	6.545e+01	5.195e+00
6.000e+00	5.163e+01	4.092e+00
6.500e+00	3.912e+01	3.109e+00
7.000e+00	3.041e+01	2.413e+00
7.500e+00	2.265e+01	1.798e+00
8.000e+00	1.493e+01	1.185e+00
8.500e+00	7.192e+00	5.708e-01
9.000e+00	8.962e-02	7.112e-03
9.500e+00	9.904e-02	7.860e-03
1.000e+01	1.078e-01	8.558e-03
1.050e+01	1.157e-01	9.184e-03
1.100e+01	1.225e-01	9.722e-03
1.150e+01	1.279e-01	1.019e-02
1.200e+01	1.318e-01	1.046e-02
1.250e+01	1.339e-01	1.063e-02
1.300e+01	1.342e-01	1.065e-02
1.350e+01	1.328e-01	1.053e-02
1.400e+01	1.286e-01	1.021e-02
1.450e+01	1.228e-01	9.748e-03
1.500e+01	1.150e-01	9.128e-03
1.550e+01	1.054e-01	8.461e-03
1.600e+01	9.405e-02	7.464e-03
1.650e+01	8.143e-02	6.463e-03
1.700e+01	6.792e-02	5.391e-03
1.750e+01	5.412e-02	4.293e-03
1.800e+01	4.075e-02	3.234e-03
1.850e+01	2.870e-02	2.278e-03
1.900e+01	1.894e-02	1.503e-03
1.950e+01	1.230e-02	9.765e-04
2.000e+01	9.104e-03	7.225e-04
2.050e+01	8.666e-03	6.878e-04

laboratory bombardment energy = 16.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 998.5
 excitation energy of compound nucleus = 23.2mev j= 0
 reaction cross section 998.5

e. gamma (mev)	cross section (mb/mev) (mb/Sr.mev)	
5.000e-01	8.252e+02	6.533e+01
1.000e+00	4.740e+02	2.762e+01
1.500e+00	3.018e+02	2.399e+01
2.000e+00	2.126e+02	1.688e+01
2.500e+00	1.619e+02	1.278e+01
3.000e+00	1.272e+02	1.009e+01
3.500e+00	1.057e+02	8.229e+00
4.000e+00	8.610e+01	6.833e+00
4.500e+00	7.176e+01	5.695e+00
5.000e+00	5.933e+01	4.709e+00
5.500e+00	4.798e+01	3.808e+00
6.000e+00	3.728e+01	2.959e+00
6.500e+00	2.721e+01	2.160e+00
7.000e+00	1.935e+01	1.575e+00
7.500e+00	1.482e+01	1.176e+00
8.000e+00	9.829e+00	7.801e-01
8.500e+00	4.761e+00	2.779e-01
9.000e+00	3.236e-02	2.569e-03
9.500e+00	3.661e-02	2.905e-03
1.000e+01	4.088e-02	3.244e-03
1.050e+01	4.509e-02	3.579e-03
1.100e+01	4.918e-02	3.903e-03
1.150e+01	5.306e-02	4.211e-03
1.200e+01	5.667e-02	4.497e-03
1.250e+01	5.992e-02	4.755e-03
1.300e+01	6.274e-02	4.979e-03
1.350e+01	6.506e-02	5.163e-03
1.400e+01	6.681e-02	5.302e-03
1.450e+01	6.792e-02	5.390e-03
1.500e+01	6.832e-02	5.422e-03
1.550e+01	6.796e-02	5.394e-03
1.600e+01	6.678e-02	5.280e-03
1.650e+01	6.472e-02	5.136e-03
1.700e+01	6.173e-02	4.899e-03
1.750e+01	5.777e-02	4.585e-03
1.800e+01	5.282e-02	4.202e-03
1.850e+01	4.691e-02	3.723e-03
1.900e+01	4.017e-02	3.188e-03
1.950e+01	3.291e-02	2.612e-03
2.000e+01	2.567e-02	2.037e-03
2.050e+01	1.923e-02	1.526e-03
2.100e+01	1.433e-02	1.137e-03
2.150e+01	1.121e-02	8.899e-04
2.200e+01	9.495e-03	7.536e-04
2.250e+01	8.477e-03	6.728e-04

laboratory bombardment energy = 18.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 979.4
 excitation energy of compound nucleus = 25.1mev j= 0
 reaction cross section 979.4

e gamma (mev)	CROSS section (mb/mev)	(mb/er.mev)
5.000e-01	8.391e-02	6.669e-01
1.000e+00	4.949e-02	4.227e-01
1.500e+00	3.255e-02	2.681e-01
2.000e+00	2.287e-02	1.819e-01
2.500e+00	1.665e-02	1.327e-01
3.000e+00	1.254e-02	9.972e-02
3.500e+00	9.724e-03	7.717e-02
4.000e+00	7.634e-03	6.059e-02
4.500e+00	6.071e-03	4.818e-02
5.000e+00	4.813e-03	3.820e-02
5.500e+00	3.752e-03	2.962e-02
6.000e+00	2.788e-03	2.212e-02
6.500e+00	1.963e-03	1.580e-02
7.000e+00	1.380e-03	1.095e-02
7.500e+00	1.023e-03	8.120e-03
8.000e+00	6.777e-04	5.379e-03
8.500e+00	3.295e-04	2.618e-03
9.000e+00	1.395e-04	1.107e-03
9.500e+00	1.606e-04	1.275e-03
1.000e+01	1.828e-04	1.480e-03
1.050e+01	2.057e-04	1.630e-03
1.100e+01	2.294e-04	1.821e-03
1.150e+01	2.535e-04	2.012e-03
1.200e+01	2.777e-04	2.204e-03
1.250e+01	3.020e-04	2.397e-03
1.300e+01	3.261e-04	2.588e-03
1.350e+01	3.499e-04	2.779e-03
1.400e+01	3.725e-04	2.970e-03
1.450e+01	3.944e-04	3.158e-03
1.500e+01	4.151e-04	3.343e-03
1.550e+01	4.344e-04	3.527e-03
1.600e+01	4.517e-04	3.708e-03
1.650e+01	4.668e-04	3.886e-03
1.700e+01	4.789e-04	4.061e-03
1.750e+01	4.871e-04	4.234e-03
1.800e+01	4.899e-04	4.388e-03
1.850e+01	4.855e-04	4.533e-03
1.900e+01	4.709e-04	4.637e-03
1.950e+01	4.430e-04	4.516e-03
2.000e+01	3.992e-04	4.169e-03
2.050e+01	3.401e-04	3.708e-03
2.100e+01	2.719e-04	3.158e-03
2.150e+01	2.054e-04	2.510e-03
2.200e+01	1.500e-04	1.795e-03
2.250e+01	1.113e-04	1.350e-03
2.300e+01	8.619e-05	1.039e-03
2.350e+01	7.029e-05	8.579e-04
2.400e+01	6.005e-05	7.464e-04
2.450e+01	5.274e-05	6.188e-04

laboratory bombardment energy = 20.0mev target mass = 27.0
 compound nucleus mass = 28.0 compound nucleus formation q value = 7.7
 compound nucleus atomic number = 13 mass num= 28
 total reaction cross section = 956.1
 excitation energy of compound nucleus = 27.0mev j= 0
 reaction cross section 956.1

e gamma (mev)	cross section (mb/mev) (mb/sr mev)	
5.000e-01	8.491e+02	6.739e+01
7.000e-01	8.424e+02	6.980e+01
1.000e+00	3.497e+02	2.775e+01
2.000e+00	2.535e+02	2.012e+01
3.000e+00	1.894e+02	1.504e+01
4.000e+00	1.434e+02	1.140e+01
5.000e+00	1.092e+02	8.469e+00
6.000e+00	8.340e+01	6.619e+00
7.000e+00	6.378e+01	5.062e+00
8.000e+00	4.839e+01	3.840e+00
9.000e+00	3.644e+01	2.894e+00
1.000e+01	2.639e+01	2.110e+00
1.200e+01	1.826e+01	1.449e+00
1.400e+01	1.231e+01	9.767e-01
1.600e+01	8.552e+00	6.788e-01
1.800e+01	5.359e+00	4.253e-01
2.000e+01	2.569e+00	2.039e-01
2.200e+01	1.052e-01	8.348e-02
2.400e+01	6.010e-02	4.770e-02
2.600e+01	5.916e-02	4.695e-02
2.800e+01	6.713e-02	5.328e-02
3.000e+01	7.406e-02	6.037e-02
3.200e+01	8.551e-02	6.786e-02
3.400e+01	9.544e-02	7.573e-02
3.600e+01	1.058e-01	8.400e-02
3.800e+01	1.167e-01	9.242e-02
4.000e+01	1.280e-01	1.016e-01
4.200e+01	1.395e-01	1.109e-01
4.400e+01	1.519e-01	1.206e-01
4.600e+01	1.646e-01	1.306e-01
4.800e+01	1.776e-01	1.409e-01
5.000e+01	1.910e-01	1.516e-01
5.200e+01	2.046e-01	1.624e-01
5.400e+01	2.184e-01	1.735e-01
5.600e+01	2.318e-01	1.840e-01
5.800e+01	2.442e-01	1.938e-01
6.000e+01	2.543e-01	2.018e-01
6.200e+01	2.599e-01	2.063e-01
6.400e+01	2.599e-01	2.063e-01
6.600e+01	2.448e-01	1.943e-01
6.800e+01	2.181e-01	1.731e-01
7.000e+01	1.752e-01	1.422e-01
7.200e+01	1.345e-01	1.064e-01
7.400e+01	9.273e-02	7.360e-02
7.600e+01	5.960e-02	4.730e-02
7.800e+01	3.648e-02	2.899e-02
8.000e+01	1.799e-02	1.399e-02
8.200e+01	1.311e-02	1.040e-02
8.400e+01	8.279e-03	6.570e-03
8.600e+01	5.729e-03	4.517e-03
8.800e+01	4.453e-03	3.516e-03
9.000e+01	3.766e-03	2.989e-03
9.200e+01	3.376e-03	2.679e-03