UCID- 21310

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

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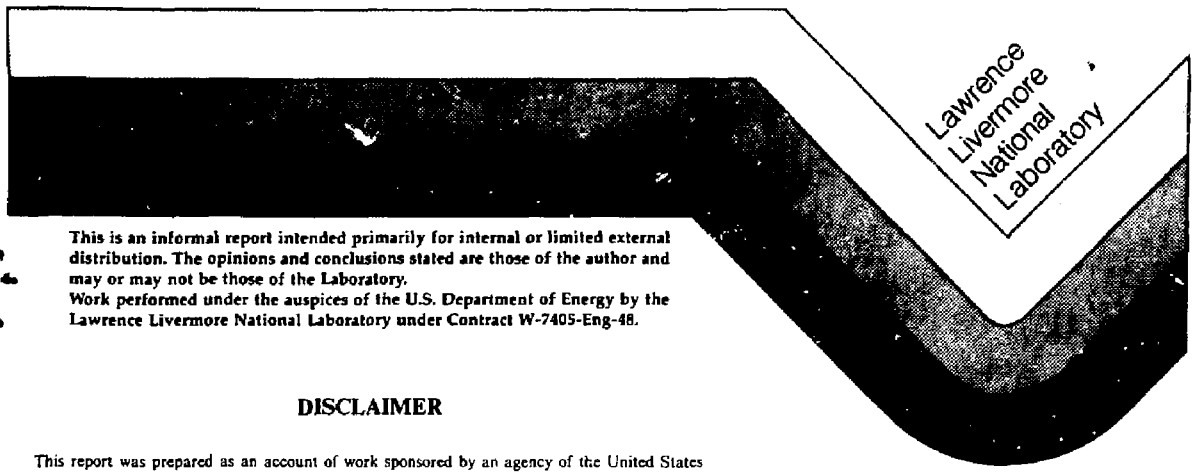
January 1988



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

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DE88 006246

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

This work was performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract number W-7405-ENG-48.

SECTION 1

Yields from $^{nat}Cr(n,x)$ Reactions for 2-20 MeV Incident Neutrons

isotopically weighted results for incident energy 2.00 mev(lab)

Oatomic number	24	24	24	24	24	24	24	24	24	24	24
mass number	55	54	53	52	51	50	49	48	47	46	45
er xsect s(j)	2.071e+03	2.083e+03	0.	0.	0.	0.	0.	0.	0.	0.	0.
Oatomic number	23	23	23	23	23	23	23	23	23	23	23
mass number	54	53	52	51	50	49	48	47	46	45	44
er xsect s(j)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Oatomic number	22	22	22	22	22	22	22	22	22	22	22
mass number	53	52	51	50	49	48	47	46	45	44	43
er xsect s(j)	0.	0.	4.911e-04	0.	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 3.00 mev(lab)

Oatomic number	24	24	24	24	24	24	24	24	24	24	24
mass number	55	54	53	52	51	50	49	48	47	46	45
er xsect s(j)	1.714e+03	1.740e+03	0.	0.	0.	0.	0.	0.	0.	0.	0.
Oatomic number	23	23	23	23	23	23	23	23	23	23	23
mass number	54	53	52	51	50	49	48	47	46	45	44
er xsect s(j)	9.317e-01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Oatomic number	22	22	22	22	22	22	22	22	22	22	22
mass number	53	52	51	50	49	48	47	46	45	44	43
er xsect s(j)	0.	0.	2.072e-03	0.	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 4.00 mev(lab)

Oatomic number	24	24	24	24	24	24	24	24	24	24	24
mass number	55	54	53	52	51	50	49	48	47	46	45
er xsect s(j)	1.559e+03	1.591e+03	0.	0.	0.	0.	0.	0.	0.	0.	0.
Oatomic number	23	23	23	23	23	23	23	23	23	23	23
mass number	54	53	52	51	50	49	48	47	46	45	44
er xsect s(j)	4.595e+00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Oatomic number	22	22	22	22	22	22	22	22	22	22	22
mass number	53	52	51	50	49	48	47	46	45	44	43
er xsect s(j)	0.	0.	2.901e-02	0.	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 5.00 mev(lab)

Oatomic number	24	24	24	24	24	24	24	24	24	24	24
mass number	55	54	53	52	51	50	49	48	47	46	45
er xsect s(j)	1.505e+03	1.551e+03	0.	0.	0.	0.	0.	0.	0.	0.	0.
Oatomic number	23	23	23	23	23	23	23	23	23	23	23
mass number	54	53	52	51	50	49	48	47	46	45	44
er xsect s(j)	9.922e+00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Oatomic number	22	22	22	22	22	22	22	22	22	22	22
mass number	53	52	51	50	49	48	47	46	45	44	43
er xsect s(j)	0.	0.	1.597e-01	0.	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 6.00 mev(lab)

0atomic number	24	24	24	24	24	24	24	24	24	24	24
mass number	55	54	53	52	51	50	49	48	47	46	45
σr xsect s(j)	1.474e+03	1.536e+03	0.	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	23	23	23	23	23	23	23	23	23	23	23
mass number	54	53	52	51	50	49	48	47	46	45	44
σr xsect s(j)	1.533e+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	22	22	22	22	22	22	22	22	22	22	22
mass number	53	52	51	50	49	48	47	46	45	44	43
σr xsect s(j)	0.	0.	4.963e-01	0.	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 7.00 mev(lab)

0atomic number	24	24	24	24	24	24	24	24	24	24	24
mass number	55	54	53	52	51	50	49	48	47	46	45
σr xsect s(j)	1.440e+03	1.506e+03	0.	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	23	23	23	23	23	23	23	23	23	23	23
mass number	54	53	52	51	50	49	48	47	46	45	44
σr xsect s(j)	2.639e+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	22	22	22	22	22	22	22	22	22	22	22
mass number	53	52	51	50	49	48	47	46	45	44	43
σr xsect s(j)	0.	0.	1.202e+00	0.	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 8.00 mev(lab)

0atomic number	24	24	24	24	24	24	24	24	24	24	24
mass number	55	54	53	52	51	50	49	48	47	46	45
σr xsect s(j)	1.388e+03	1.457e+03	0.	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	23	23	23	23	23	23	23	23	23	23	23
mass number	54	53	52	51	50	49	48	47	46	45	44
σr xsect s(j)	4.512e+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	22	22	22	22	22	22	22	22	22	22	22
mass number	53	52	51	50	49	48	47	46	45	44	43
σr xsect s(j)	0.	0.	2.868e+00	0.	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 9.00 mev(lab)

0atomic number	24	24	24	24	24	24	24	24	24	24	24
mass number	55	54	53	52	51	50	49	48	47	46	45
σr xsect s(j)	1.329e+03	1.374e+03	2.627e+01	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	23	23	23	23	23	23	23	23	23	23	23
mass number	54	53	52	51	50	49	48	47	46	45	44
σr xsect s(j)	6.176e+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	22	22	22	22	22	22	22	22	22	22	22
mass number	53	52	51	50	49	48	47	46	45	44	43
σr xsect s(j)	0.	0.	5.824e+00	0.	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 10.00 mev(lab)

0atomic number	24	24	24	24	24	24	24	24	24	24	24
mass number	55	54	53	52	51	50	49	48	47	46	45
er xsect s(j)	1.268e+03	1.291e+03	5.770e+01	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	23	23	23	23	23	23	23	23	23	23	23
mass number	54	53	52	51	50	49	48	47	46	45	44
er xsect s(j)	7.430e+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	22	22	22	22	22	22	22	22	22	22	22
mass number	53	52	51	50	49	48	47	46	45	44	43
er xsect s(j)	0.	0.	8.951e+00	0.	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 11.00 mev(lab)

0atomic number	24	24	24	24	24	24	24	24	24	24	24
mass number	55	54	53	52	51	50	49	48	47	46	45
er xsect s(j)	1.216e+03	1.226e+03	8.275e+01	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	23	23	23	23	23	23	23	23	23	23	23
mass number	54	53	52	51	50	49	48	47	46	45	44
er xsect s(j)	7.908e+01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	22	22	22	22	22	22	22	22	22	22	22
mass number	53	52	51	50	49	48	47	46	45	44	43
er xsect s(j)	3.218e-03	0.	1.148e+01	0.	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 12.00 mev(lab)

0atomic number	24	24	24	24	24	24	24	24	24	24	24
mass number	55	54	53	52	51	50	49	48	47	46	45
er xsect s(j)	1.166e+03	1.167e+03	1.012e+02	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	23	23	23	23	23	23	23	23	23	23	23
mass number	54	53	52	51	50	49	48	47	46	45	44
er xsect s(j)	8.941e+01	2.709e+00	0.	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	22	22	22	22	22	22	22	22	22	22	22
mass number	53	52	51	50	49	48	47	46	45	44	43
er xsect s(j)	9.599e-03	0.	1.295e+01	4.396e-06	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 14.00 mev(lab)

0atomic number	24	24	24	24	24	24	24	24	24	24	24
mass number	55	54	53	52	51	50	49	48	47	46	45
er xsect s(j)	1.076e+03	8.316e+02	2.494e+02	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	23	23	23	23	23	23	23	23	23	23	23
mass number	54	53	52	51	50	49	48	47	46	45	44
er xsect s(j)	1.174e+02	2.059e+01	0.	0.	0.	0.	0.	0.	0.	0.	0.
0atomic number	22	22	22	22	22	22	22	22	22	22	22
mass number	53	52	51	50	49	48	47	46	45	44	43
er xsect s(j)	5.967e-02	0.	1.856e+01	1.130e-02	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 16.00 mev(lab)

tomic number	24	24	24	24	24	24	24	24	24	24	24
ass number	55	54	53	52	51	50	49	48	47	46	45
r xsect s(j)	1.008e+03	4.776e+02	5.817e+02	0.	0.	0.	0.	0.	0.	0.	0.
tomic number	23	23	23	23	23	23	23	23	23	23	23
ass number	54	53	52	51	50	49	48	47	46	45	44
r xsect s(j)	1.112e+02	6.942e+01	0.	0.	0.	0.	0.	0.	0.	0.	0.
tomic number	22	22	22	22	22	22	22	22	22	22	22
ass number	53	52	51	50	49	48	47	46	45	44	43
r xsect s(j)	4.928e-01	0.	2.506e+01	1.259e+00	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 18.00 mev(lab)

tomic number	24	24	24	24	24	24	24	24	24	24	24
ass number	55	54	53	52	51	50	49	48	47	46	45
r xsect s(j)	9.295e+02	5.051e+02	7.030e+02	0.	0.	0.	0.	0.	0.	0.	0.
tomic number	23	23	23	23	23	23	23	23	23	23	23
ass number	54	53	52	51	50	49	48	47	46	45	44
r xsect s(j)	8.414e+01	1.470e+02	0.	0.	0.	0.	0.	0.	0.	0.	0.
tomic number	22	22	22	22	22	22	22	22	22	22	22
ass number	53	52	51	50	49	48	47	46	45	44	43
r xsect s(j)	1.335e+00	0.	2.231e+01	1.261e+01	0.	0.	0.	0.	0.	0.	0.

isotopically weighted results for incident energy 20.00 mev(lab)

tomic number	24	24	24	24	24	24	24	24	24	24	24
ass number	55	54	53	52	51	50	49	48	47	46	45
r xsect s(j)	8.423e+02	2.118e+02	7.142e+02	8.158e-01	0.	0.	0.	0.	0.	0.	0.
tomic number	23	23	23	23	23	23	23	23	23	23	23
ass number	54	53	52	51	50	49	48	47	46	45	44
r xsect s(j)	6.780e+01	2.078e+02	0.	0.	0.	0.	0.	0.	0.	0.	0.
tomic number	22	22	22	22	22	22	22	22	22	22	22
ass number	53	52	51	50	49	48	47	46	45	44	43
r xsect s(j)	2.381e+00	0.	1.416e+01	3.056e+01	0.	0.	0.	0.	0.	0.	0.

SECTION 2

Particle Spectra from $^{nat}Cr(n,x)$ Reactions for 2-20 MeV Incident Neutrons

sotopically weighted results for incident energy 2.00 mev(lab)

ke ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250	7.2973e+02	0.	0.	0.
0.750	1.1186e+03	0.	0.	0.
1.250	1.2335e+03	0.	0.	0.
1.750	1.0836e+03	0.	0.	0.
3.750	0.	0.	9.8226e-04	0.

sotopically weighted results for incident energy 3.00 mev(lab)

ke ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250	4.4691e+02	0.	0.	0.
0.750	6.8530e+02	0.	0.	0.
1.250	7.5629e+02	0.	0.	0.
1.750	6.6572e+02	3.5264e-01	0.	0.
2.250	5.2656e+02	1.5307e+00	0.	0.
2.750	3.9936e+02	0.	0.	0.
3.750	0.	0.	5.5076e-04	0.
4.250	0.	0.	3.5930e-03	0.

sotopically weighted results for incident energy 4.00 mev(lab)

ke ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250	3.5332e+02	0.	0.	0.
0.750	5.4240e+02	0.	0.	0.
1.250	5.9934e+02	0.	0.	0.
1.750	5.2851e+02	2.3777e-01	0.	0.
2.250	4.1923e+02	1.0986e+00	0.	0.
2.750	3.1952e+02	2.8167e+00	0.	0.
3.250	2.4047e+02	3.0364e+00	0.	0.
3.750	1.8002e+02	0.	1.0681e-03	0.
4.250	0.	0.	5.0675e-03	0.
4.750	0.	0.	1.3130e-02	0.
5.250	0.	0.	4.0747e-02	0.

sotopically weighted results for incident energy 5.00 mev(lab)

ke ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250	3.1808e+02	0.	0.	0.
0.750	4.8857e+02	0.	0.	0.
1.250	5.4025e+02	0.	0.	0.
1.750	4.7714e+02	2.0288e-01	0.	0.
2.250	3.7946e+02	9.3599e-01	0.	0.
2.750	2.9063e+02	2.2518e+00	0.	0.
3.250	2.2044e+02	4.0309e+00	0.	0.
3.750	1.6715e+02	5.6671e+00	8.8328e-04	0.
4.250	1.2630e+02	6.7548e+00	5.9243e-03	0.
4.750	9.3926e+01	0.	2.6139e-02	0.
5.250	0.	0.	7.6105e-02	0.
5.750	0.	0.	8.6295e-02	0.
6.250	0.	0.	1.6406e-01	0.

sotopically weighted results for incident energy 6.00 mev(lab)

ke	ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		2.9997e+02	0.	0.	0.
0.750		4.6157e+02	0.	0.	0.
1.250		5.1076e+02	0.	0.	0.
1.750		4.5181e+02	6.8898e-01	0.	0.
2.250		3.6017e+02	3.1780e+00	0.	0.
2.750		2.7663e+02	1.9554e+00	0.	0.
3.250		2.1106e+02	3.2562e+00	0.	0.
3.750		1.6145e+02	4.5865e+00	4.4232e-03	0.
4.250		1.2368e+02	5.4770e+00	2.9621e-02	0.
4.750		9.4425e+01	5.8304e+00	2.2970e-02	0.
5.250		7.1363e+01	5.6946e+00	7.3521e-02	0.
5.750		5.0298e+01	0.	1.3172e-01	0.
6.250		0.	0.	1.5117e-01	0.
6.750		0.	0.	2.3268e-01	0.
7.250		0.	0.	2.9440e-01	0.

sotopically weighted results for incident energy 7.00 mev(lab)

ke	ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		2.8554e+02	0.	0.	0.
0.750		4.3952e+02	0.	0.	0.
1.250		4.8700e+02	0.	0.	0.
1.750		4.3123e+02	6.3919e-01	0.	0.
2.250		3.4391e+02	2.9441e+00	0.	0.
2.750		2.6464e+02	7.5324e+00	0.	0.
3.250		2.0253e+02	1.3385e+01	0.	0.
3.750		1.5563e+02	4.3873e+00	4.0933e-03	0.
4.250		1.2012e+02	4.8952e+00	2.7408e-02	0.
4.750		9.2809e+01	5.2205e+00	1.2052e-01	0.
5.250		7.1479e+01	5.1057e+00	3.8467e-01	0.
5.750		5.3788e+01	4.6571e+00	1.6292e-01	0.
6.250		3.8889e+01	4.0212e+00	3.2110e-01	0.
6.750		2.5431e+01	0.	5.1426e-01	0.
7.250		0.	0.	2.7576e-01	0.
7.750		0.	0.	3.0102e-01	0.
8.250		0.	0.	2.9298e-01	0.

isotopically weighted results for incident energy 8.00 mev(lab)

ke	ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		2.6668e+02	0.	0.	0.
0.750		4.1584e+02	0.	0.	0.
1.250		4.6111e+02	0.	0.	0.
1.750		4.0859e+02	6.3947e-01	0.	0.
2.250		3.2639e+02	2.9519e+00	0.	0.
2.750		2.5178e+02	7.5708e+00	0.	0.
3.250		1.9332e+02	1.3492e+01	0.	0.
3.750		1.4826e+02	1.8814e+01	3.9897e-03	0.
4.250		1.1599e+02	5.2197e+01	1.6722e-02	0.
4.750		9.0485e+01	5.4407e+00	1.1754e-01	0.
5.250		7.0673e+01	4.9156e+00	3.7527e-01	0.
5.750		5.5168e+01	4.4887e+00	9.2398e-01	0.
6.250		4.2161e+01	3.8823e+00	1.8129e+00	0.
6.750		3.1107e+01	3.2282e+00	4.6801e-01	0.
7.250		2.1992e+01	2.6157e+00	6.2259e-01	0.
7.750		1.3052e+01	0.	9.0988e-01	0.
8.250		0.	0.	2.5384e-01	0.
8.750		0.	0.	2.2778e-01	0.
9.250		0.	0.	1.9307e-01	0.

sotopically weighted results for incident energy 9.00 mev(lab)

ke	ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		2.8747e+02	0.	0.	0.
0.750		3.9757e+02	0.	0.	0.
1.250		4.3434e+02	0.	0.	0.
1.750		3.8904e+02	6.0195e-01	0.	0.
2.250		3.1121e+02	2.7839e+00	0.	0.
2.750		2.4055e+02	7.1347e+00	0.	0.
3.250		1.8522e+02	1.2749e+01	0.	0.
3.750		1.4355e+02	1.7834e+01	3.4950e-03	0.
4.250		1.1212e+02	2.1118e+01	2.4734e-02	0.
4.750		8.8082e+01	2.2300e+01	1.0873e-01	0.
5.250		6.9485e+01	2.1464e+01	3.4380e-01	0.
5.750		5.4915e+01	1.8536e+01	8.5355e-01	0.
6.250		4.3628e+01	1.4357e+01	1.6736e+00	0.
6.750		3.3878e+01	9.0333e+00	2.6614e+00	0.
7.250		2.5727e+01	4.4690e+00	3.5060e+00	0.
7.750		1.8998e+01	1.9826e+00	4.6224e-01	0.
8.250		1.3197e+01	1.5838e+00	6.6988e-01	0.
8.750		6.7459e+00	0.	6.2438e-01	0.
9.250		0.	0.	2.0877e-01	0.
9.750		0.	0.	1.6992e-01	0.
10.250		0.	0.	1.3425e-01	0.

otopically weighted results for incident energy 10.00 mev(lab)

ke	ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		2.8804e+02	0.	0.	0.
0.750		3.9489e+02	0.	0.	0.
1.250		4.2096e+02	0.	0.	0.
1.750		3.7708e+02	5.6791e-01	0.	0.
2.250		2.9754e+02	2.6298e+00	0.	0.
2.750		2.5275e+02	6.7699e+00	0.	0.
3.250		1.7958e+02	1.2122e+01	0.	0.
3.750		1.3956e+02	1.6946e+01	3.4587e-03	0.
4.250		1.0941e+02	2.0130e+01	2.5140e-02	0.
4.750		8.6374e+01	2.1340e+01	1.0167e-01	0.
5.250		6.8550e+01	2.0837e+01	3.2421e-01	0.
5.750		5.4689e+01	1.9140e+01	7.9730e-01	0.
6.250		4.3929e+01	1.6853e+01	1.5624e+00	0.
6.750		3.5483e+01	3.2820e+00	2.4835e+00	0.
7.250		2.8055e+01	2.5455e+00	3.2695e+00	0.
7.750		2.2020e+01	1.8919e+00	3.6875e+00	0.
8.250		1.7004e+01	1.5206e+00	3.7045e+00	0.
8.750		1.2642e+01	1.2258e+00	6.1235e-01	0.
9.250		8.6881e+00	9.9581e-01	5.3741e-01	0.
9.750		5.6494e+00	0.	4.5279e-01	0.
0.250		0.	0.	1.4509e-01	0.
0.750		0.	0.	1.1210e-01	0.
1.250		0.	0.	8.5125e-02	0.

isotopically weighted results for incident energy 11.00 mev(lab)

ke	ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		2.5756e+02	0.	0.	0.
0.750		3.8610e+02	0.	0.	0.
1.250		4.1844e+02	0.	0.	0.
1.750		3.6630e+02	4.9378e-01	0.	0.
2.250		2.9226e+02	2.3341e+00	0.	0.
2.750		2.2753e+02	6.1305e+00	0.	0.
3.250		1.7740e+02	1.0992e+01	0.	0.
3.750		1.3959e+02	1.5448e+01	3.3377e-03	0.
4.250		1.0960e+02	1.8407e+01	2.2432e-02	0.
4.750		8.6699e+01	1.9514e+01	9.8489e-02	0.
5.250		6.9011e+01	1.9155e+01	3.1384e-01	0.
5.750		5.5279e+01	1.7717e+01	7.7123e-01	0.
6.250		4.4644e+01	1.5733e+01	1.5102e+00	0.
6.750		3.6956e+01	1.3664e+01	2.5986e+00	0.
7.250		2.9673e+01	1.1522e+01	3.1554e+00	0.
7.750		2.4033e+01	2.1155e+00	3.5562e+00	0.
8.250		1.9464e+01	1.4125e+00	3.5702e+00	0.
8.750		1.5615e+01	1.1480e+00	3.3016e+00	0.
9.250		1.2316e+01	9.4193e-01	2.8822e+00	0.
9.750		8.9463e+00	7.8310e-01	4.6498e-01	0.
10.250		5.6795e+00	6.4865e-01	3.7927e-01	0.
10.750		2.1691e+00	0.	3.0261e-01	0.
11.250		0.	0.	9.7627e-02	0.
11.750		0.	0.	7.3129e-02	0.
12.250		0.	0.	5.4173e-02	0.

isotopically weighted results for incident energy 12.00 mev(lab)

ke	ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		2.1859e+02	0.	0.	0.
0.750		3.3178e+02	0.	0.	0.
1.250		3.8965e+02	0.	0.	0.
1.750		3.7484e+02	5.7369e+00	0.	0.
2.250		3.0444e+02	2.3001e+00	0.	0.
2.750		2.3559e+02	6.0352e+00	0.	0.
3.250		1.8306e+02	1.1032e+01	0.	0.
3.750		1.4404e+02	1.5798e+01	3.1324e-03	0.
4.250		1.1454e+02	1.8839e+01	2.1255e-02	0.
4.750		9.1686e+01	2.0073e+01	9.5000e-02	0.
5.250		7.3011e+01	1.9730e+01	3.0426e-01	0.
5.750		5.8534e+01	1.8192e+01	7.4692e-01	0.
6.250		4.7343e+01	1.6203e+01	1.4611e+00	0.
6.750		3.8749e+01	1.4127e+01	2.3181e+00	0.
7.250		3.2018e+01	1.2121e+01	3.0464e+00	0.
7.750		2.6386e+01	1.0300e+01	3.4300e+00	0.
8.250		2.1907e+01	8.7620e+00	3.4403e+00	0.
8.750		1.8257e+01	1.4950e+00	3.1788e+00	0.
9.250		1.5201e+01	9.3024e-01	2.7728e+00	0.
9.750		1.2601e+01	7.7737e-01	2.3214e+00	0.
10.250		1.0080e+01	6.5787e-01	1.8607e+00	0.
10.750		7.2170e+00	5.5146e-01	3.1563e-01	0.
11.250		4.5279e+00	4.6417e-01	2.4690e-01	0.
11.750		1.4756e+00	0.	1.9062e-01	0.
12.250		0.	0.	6.3491e-02	0.
12.750		0.	0.	4.6605e-02	0.
13.250		0.	0.	3.3958e-02	0.

isotopically weighted results for incident energy 14.00 mev(lab)

ke ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250	3.8154e+02	0.	0.	0.
0.750	3.2421e+02	0.	0.	0.
1.250	3.1678e+02	0.	0.	0.
1.750	3.0760e+02	1.2516e+01	0.	0.
2.250	2.7220e+02	1.2159e+01	0.	0.
2.750	2.3378e+02	1.0939e+01	0.	0.
3.250	1.9955e+02	1.3172e+01	0.	0.
3.750	1.7124e+02	1.9290e+01	6.0626e-03	0.
4.250	1.3512e+02	2.2730e+01	2.6668e-02	0.
4.750	1.0805e+02	2.4480e+01	1.1221e-01	0.
5.250	8.7047e+01	2.4328e+01	3.6361e-01	0.
5.750	7.0675e+01	2.2770e+01	9.1059e-01	0.
6.250	5.7673e+01	2.0164e+01	1.8123e+00	0.
6.750	4.7348e+01	1.7474e+01	2.9279e+00	0.
7.250	3.9055e+01	1.5040e+01	3.8512e+00	0.
7.750	3.2502e+01	1.2772e+01	4.3305e+00	0.
8.250	2.7385e+01	1.1022e+01	4.3562e+00	0.
8.750	2.3417e+01	9.6263e+00	4.0039e+00	0.
9.250	2.0261e+01	8.5161e+00	3.4866e+00	0.
9.750	1.7733e+01	7.6229e+00	2.9176e+00	0.
10.250	1.5664e+01	6.8742e+00	2.3681e+00	0.
10.750	1.3926e+01	1.0092e+00	1.8794e+00	0.
11.250	1.2419e+01	5.5018e-01	1.4661e+00	0.
11.750	1.0263e+01	4.8025e-01	1.1282e+00	0.
12.250	8.0993e+00	4.2294e-01	8.4697e-01	0.
12.750	5.9605e+00	3.7491e-01	1.3498e-01	0.
13.250	3.6331e+00	3.3358e-01	1.0114e-01	0.
13.750	0.	0.	7.5359e-02	0.
14.250	0.	0.	2.5297e-02	0.
14.750	0.	0.	1.8127e-02	0.
15.250	0.	0.	1.2936e-02	0.

isotopically weighted results for incident energy 16.00 mev(lab)

ke	ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		4.9880e+02	0.	0.	0.
0.750		5.0742e+02	0.	0.	0.
1.250		4.5668e+02	0.	0.	0.
1.750		3.6086e+02	8.9984e+00	0.	0.
2.250		2.7557e+02	1.4811e+01	0.	0.
2.750		2.1727e+02	2.1415e+01	0.	0.
3.250		1.8098e+02	2.5393e+01	0.	0.
3.750		1.5733e+02	2.6241e+01	9.8044e-03	0.
4.250		1.3749e+02	2.6691e+01	4.7332e-02	0.
4.750		1.2034e+02	2.7588e+01	1.6843e-01	0.
5.250		1.0482e+02	2.9175e+01	4.8136e-01	0.
5.750		9.0986e+01	2.9237e+01	1.1590e+00	0.
6.250		7.9033e+01	2.5435e+01	2.4047e+00	0.
6.750		5.9396e+01	2.2064e+01	3.7945e+00	0.
7.250		4.8928e+01	1.8988e+01	5.0825e+00	0.
7.750		4.0852e+01	1.6278e+01	5.8403e+00	0.
8.250		3.4420e+01	1.3937e+01	5.9614e+00	0.
8.750		2.9333e+01	1.2113e+01	5.6116e+00	0.
9.250		2.5317e+01	1.0705e+01	4.8940e+00	0.
9.750		2.2233e+01	9.5033e+00	4.0871e+00	0.
10.250		1.9842e+01	8.6715e+00	3.3127e+00	0.
10.750		1.7960e+01	8.0168e+00	2.6255e+00	0.
11.250		1.6449e+01	7.4769e+00	2.0453e+00	0.
11.750		1.5204e+01	6.9824e+00	1.5719e+00	0.
12.250		1.4150e+01	6.5424e+00	1.1948e+00	0.
12.750		1.2604e+01	8.1761e-01	9.0000e-01	0.
13.250		1.0846e+01	4.1943e-01	6.7296e-01	0.
13.750		9.1043e+00	3.8547e-01	5.0007e-01	0.
14.250		7.2582e+00	3.5627e-01	3.6472e-01	0.
14.750		5.1149e+00	3.3042e-01	5.8732e-02	0.
15.250		2.9067e+00	3.0694e-01	4.7998e-02	0.
15.750		0.	0.	3.1388e-02	0.
16.250		0.	0.	1.1314e-02	0.
16.750		0.	0.	7.9957e-03	0.
17.250		0.	0.	5.6357e-03	0.

isotopically weighted results for incident energy 18.00 mev(lab)

ke	ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		4.2849e+02	0.	0.	0.
0.750		5.0733e+02	0.	0.	0.
1.250		5.0036e+02	0.	0.	0.
1.750		4.2031e+02	5.8431e+00	0.	0.
2.250		3.2956e+02	1.1661e+01	0.	0.
2.750		2.5578e+02	2.0678e+01	0.	0.
3.250		2.0162e+02	2.9873e+01	0.	0.
3.750		1.6288e+02	3.6305e+01	8.5364e-03	0.
4.250		1.3520e+02	3.9141e+01	4.7440e-02	0.
4.750		1.1527e+02	3.8386e+01	1.8944e-01	0.
5.250		1.0020e+02	3.5242e+01	5.7938e-01	0.
5.750		8.8165e+01	3.1228e+01	1.4019e+00	0.
6.250		7.7264e+01	2.7697e+01	2.7496e+00	0.
6.750		6.7497e+01	2.4753e+01	4.4443e+00	0.
7.250		5.8795e+01	2.2608e+01	6.0757e+00	0.
7.750		5.1278e+01	1.9905e+01	7.3270e+00	0.
8.250		4.2314e+01	1.6966e+01	7.7510e+00	0.
8.750		3.5585e+01	1.4660e+01	7.3358e+00	0.
9.250		3.0471e+01	1.2879e+01	6.5300e+00	0.
9.750		2.6552e+01	1.1480e+01	5.5862e+00	0.
10.250		2.3507e+01	1.0345e+01	4.6229e+00	0.
10.750		2.1107e+01	9.4743e+00	3.7452e+00	0.
11.250		1.9213e+01	8.7993e+00	2.9221e+00	0.
11.750		1.7743e+01	8.1564e+00	2.2432e+00	0.
12.250		1.6580e+01	7.7293e+00	1.7033e+00	0.
12.750		1.5640e+01	7.3443e+00	1.2817e+00	0.
13.250		1.4855e+01	6.9984e+00	9.5744e-01	0.
13.750		1.3653e+01	6.3374e+00	7.1077e-01	0.
14.250		1.2292e+01	5.6722e+00	5.2486e-01	0.
14.750		1.0945e+01	5.1761e+00	3.8581e-01	0.
15.250		9.5220e+00	4.6798e+00	2.8249e-01	0.
15.750		8.0689e+00	3.4711e+00	2.0614e-01	0.
16.250		6.2501e+00	3.2864e+00	1.4792e-01	0.
16.750		4.3821e+00	2.9914e+00	2.5716e-02	0.
17.250		2.4556e+00	2.6378e+00	1.8594e-02	0.
17.750		0.	0.	1.3423e-02	0.
18.250		0.	0.	4.7841e-03	0.
18.750		0.	0.	3.3511e-03	0.
19.250		0.	0.	2.3430e-03	0.

isotopically weighted results for incident energy 20.00 mev(1/mb)

ke	ds/de(mb/mev)=	neutrons	protons	alphas	deuterons
0.250		3.5301e+02	0.	0.	0.
0.750		4.5931e+02	0.	0.	0.
1.250		4.7888e+02	0.	0.	0.
1.750		4.1752e+02	4.1674e+00	0.	0.
2.250		3.3644e+02	9.7245e+00	0.	0.
2.750		2.6649e+02	1.9327e+01	0.	0.
3.250		2.1322e+02	3.0372e+01	0.	0.
3.750		1.7377e+02	3.9518e+01	7.4431e-03	0.
4.250		1.4414e+02	4.4954e+01	4.4427e-02	0.
4.750		1.2119e+02	4.6279e+01	1.8696e-01	0.
5.250		1.0286e+02	4.4259e+01	5.9396e-01	0.
5.750		8.7924e+01	4.0081e+01	1.4853e+00	0.
6.250		7.5709e+01	3.4985e+01	3.0024e+00	0.
6.750		6.5757e+01	2.9529e+01	4.9783e+00	0.
7.250		5.7559e+01	2.5477e+01	6.9905e+00	0.
7.750		5.0727e+01	2.1886e+01	8.2563e+00	0.
8.250		4.4797e+01	1.9181e+01	8.8652e+00	0.
8.750		3.9591e+01	1.7140e+01	8.8305e+00	0.
9.250		3.5072e+01	1.5602e+01	8.3847e+00	0.
9.750		3.1256e+01	1.3974e+01	7.7445e+00	0.
10.250		2.6898e+01	1.2362e+01	6.7247e+00	0.
10.750		2.3822e+01	1.1130e+01	5.4605e+00	0.
11.250		2.1486e+01	1.0177e+01	4.3451e+00	0.
11.750		1.9691e+01	9.4206e+00	3.4148e+00	0.
12.250		1.8280e+01	8.7972e+00	2.6442e+00	0.
12.750		1.7144e+01	8.3060e+00	2.0291e+00	0.
13.250		1.6236e+01	7.8983e+00	1.5146e+00	0.
13.750		1.5504e+01	7.4364e+00	1.1236e+00	0.
14.250		1.4891e+01	7.0764e+00	8.2907e-01	0.
14.750		1.3874e+01	6.9421e+00	6.0898e-01	0.
15.250		1.2841e+01	6.0179e+00	4.4557e-01	0.
15.750		1.1814e+01	5.5006e+00	3.2490e-01	0.
16.250		1.0737e+01	4.9780e+00	2.3619e-01	0.
16.750		9.6514e+00	6.3162e-01	1.7123e-01	0.
17.250		8.5270e+00	3.2914e-01	1.2383e-01	0.
17.750		6.9861e+00	3.0486e-01	8.9363e-02	0.
18.250		5.4196e+00	2.7899e-01	6.3550e-02	0.
18.750		3.8228e+00	2.5208e-01	1.0366e-02	0.
19.250		2.0086e+00	2.2651e-01	7.4334e-03	0.
19.750		0.	0.	5.3254e-03	0.
20.250		0.	0.	1.8941e-03	0.
20.750		0.	0.	1.3182e-03	0.
21.250		0.	0.	9.1622e-04	0.

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SECTION 3

γ-ray Spectra Following $^{nat}Cr(n,\_)$ Reactions

laboratory bombardment energy = 2.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 2084.5

excitation energy of compound nucleus = 9.9mev j= 0

reaction cross section 2084.5

e gamma (mev)	cross section (mb/mev)	(mb/sr-mev)
5.000e-01	2.139e+03	1.617e+02
1.000e+00	1.140e+03	9.048e+01
1.500e+00	4.145e+02	3.289e+01
2.000e+00	5.915e+00	4.694e-01
2.500e+00	1.191e+01	9.454e-01
3.000e+00	1.967e+01	1.561e+00
3.500e+00	2.820e+01	2.238e+00
4.000e+00	3.620e+01	2.873e+00
4.500e+00	4.232e+01	3.359e+00
5.000e+00	4.550e+01	3.611e+00
5.500e+00	4.510e+01	3.579e+00
6.000e+00	4.112e+01	3.263e+00
6.500e+00	3.418e+01	2.713e+00
7.000e+00	2.546e+01	2.021e+00
7.500e+00	1.649e+01	1.308e+00
8.000e+00	8.763e+00	6.955e-01
8.500e+00	3.400e+00	2.698e-01
9.000e+00	7.090e-01	5.627e-02
9.500e+00	1.257e-02	9.976e-04

laboratory bombardment energy = 3.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1740.6

excitation energy of compound nucleus = 10.9mev j= 0

reaction cross section 1740.6

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.790e+03	1.421e+02
1.000e+00	1.200e+03	9.527e+01
1.500e+00	7.997e+02	6.347e+01
2.000e+00	4.370e+02	3.468e+01
2.500e+00	1.608e+02	1.276e+01
3.000e+00	1.166e+01	9.254e-01
3.500e+00	1.738e+01	1.379e+00
4.000e+00	2.333e+01	1.851e+00
4.500e+00	2.875e+01	2.282e+00
5.000e+00	3.290e+01	2.611e+00
5.500e+00	3.518e+01	2.792e+00
6.000e+00	3.520e+01	2.794e+00
6.500e+00	3.292e+01	2.612e+00
7.000e+00	2.859e+01	2.269e+00
7.500e+00	2.262e+01	1.811e+00
8.000e+00	1.642e+01	1.303e+00
8.500e+00	1.030e+01	8.177e-01
9.000e+00	5.317e+00	4.220e-01
9.500e+00	1.998e+00	1.586e-01
1.000e+01	3.972e-01	3.152e-02
1.050e+01	5.704e-03	4.527e-04

laboratory bombardment energy = 4.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1594.3

excitation energy of compound nucleus = 11.9mev j= 0

reaction cross section 1594.3

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.628e+03	1.292e+02
1.000e+00	1.111e+03	8.815e+01
1.500e+00	8.442e+02	6.700e+01
2.000e+00	6.335e+02	5.028e+01
2.500e+00	4.258e+02	3.379e+01
3.000e+00	2.291e+02	1.818e+01
3.500e+00	8.071e+01	6.406e+00
4.000e+00	5.811e-01	4.612e-02
4.500e+00	7.447e-01	5.910e-02
5.000e+00	8.917e-01	7.077e-02
5.500e+00	1.005e+00	7.976e-02
6.000e+00	1.071e+00	8.504e-02
6.500e+00	1.081e+00	8.581e-02
7.000e+00	1.032e+00	8.189e-02
7.500e+00	9.274e-01	7.360e-02
8.000e+00	7.792e-01	6.184e-02
8.500e+00	6.046e-01	4.798e-02
9.000e+00	4.244e-01	3.368e-02
9.500e+00	2.607e-01	2.069e-02
1.000e+01	1.319e-01	1.047e-02
1.050e+01	4.878e-02	3.871e-03
1.100e+01	9.949e-03	7.896e-04
1.150e+01	1.093e-03	8.673e-05

laboratory bombardment energy = 5.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1558.1

excitation energy of compound nucleus = 12.8mev j= 0

reaction cross section 1558.1

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.595e+03	1.266e+02
1.000e+00	1.088e+03	8.633e+01
1.500e+00	8.432e+02	6.692e+01
2.000e+00	6.812e+02	5.406e+01
2.500e+00	5.427e+02	4.307e+01
3.000e+00	4.072e+02	3.232e+01
3.500e+00	2.712e+02	2.153e+01
4.000e+00	1.458e+02	1.157e+01
4.500e+00	5.269e+01	4.198e+00
5.000e+00	3.468e+00	2.752e-01
5.500e+00	4.066e+00	3.227e-01
6.000e+00	4.535e+00	3.599e-01
6.500e+00	4.827e+00	3.831e-01
7.000e+00	4.908e+00	3.895e-01
7.500e+00	4.763e+00	3.780e-01
8.000e+00	4.599e+00	3.491e-01
8.500e+00	3.847e+00	3.053e-01
9.000e+00	3.159e+00	2.507e-01
9.500e+00	2.403e+00	1.907e-01
1.000e+01	1.658e+00	1.316e-01
1.050e+01	1.002e+00	7.956e-02
1.100e+01	4.988e-01	3.959e-02
1.150e+01	1.799e-01	1.428e-02
1.200e+01	3.407e-02	2.704e-03
1.250e+01	1.974e-03	1.566e-04

laboratory bombardment energy = 6.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1548.9

excitation energy of compound nucleus = 13.8mev j= 0

reaction cross section 1548.9

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.591e+03	1.262e+02
1.000e+00	1.091e+03	8.655e+01
1.500e+00	8.520e+02	6.762e+01
2.000e+00	7.006e+02	5.560e+01
2.500e+00	5.822e+02	4.621e+01
3.000e+00	4.776e+02	3.790e+01
3.500e+00	3.781e+02	3.001e+01
4.000e+00	2.801e+02	2.223e+01
4.500e+00	1.842e+02	1.462e+01
5.000e+00	9.770e+01	7.754e+00
5.500e+00	3.432e+01	2.724e+00
6.000e+00	6.247e-01	4.958e-02
6.500e+00	6.917e-01	5.490e-02
7.000e+00	7.363e-01	5.843e-02
7.500e+00	7.539e-01	5.984e-02
8.000e+00	7.424e-01	5.892e-02
8.500e+00	7.015e-01	5.567e-02
9.000e+00	6.338e-01	5.030e-02
9.500e+00	5.443e-01	4.319e-02
1.000e+01	4.403e-01	3.494e-02
1.050e+01	3.310e-01	2.627e-02
1.100e+01	2.263e-01	1.796e-02
1.150e+01	1.361e-01	1.080e-02
1.200e+01	6.781e-02	5.382e-03
1.250e+01	2.530e-02	2.008e-03
1.300e+01	6.472e-03	5.137e-04
1.350e+01	3.066e-03	2.433e-04

laboratory bombardment energy = 7.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1531.0

excitation energy of compound nucleus = 14.8mev j= 0

reaction cross section 1531.0

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.574e+03	1.249e+02
1.000e+00	1.085e+03	8.612e+01
1.500e+00	8.552e+02	6.787e+01
2.000e+00	7.112e+02	5.644e+01
2.500e+00	6.008e+02	4.768e+01
3.000e+00	5.066e+02	4.021e+01
3.500e+00	4.222e+02	3.351e+01
4.000e+00	3.443e+02	2.732e+01
4.500e+00	2.705e+02	2.146e+01
5.000e+00	1.993e+02	1.582e+01
5.500e+00	1.313e+02	1.042e+01
6.000e+00	7.098e+01	5.633e+00
6.500e+00	2.716e+01	2.156e+00
7.000e+00	4.030e+00	3.199e-01
7.500e+00	4.294e+00	3.408e-01
8.000e+00	4.427e+00	3.513e-01
8.500e+00	4.415e+00	3.504e-01
9.000e+00	4.253e+00	3.375e-01
9.500e+00	3.947e+00	3.133e-01
1.000e+01	3.515e+00	2.789e-01
1.050e+01	2.983e+00	2.367e-01
1.100e+01	2.391e+00	1.898e-01
1.150e+01	1.784e+00	1.416e-01
1.200e+01	1.212e+00	9.621e-02
1.250e+01	7.234e-01	5.741e-02
1.300e+01	3.554e-01	2.821e-02
1.350e+01	1.263e-01	1.002e-02
1.400e+01	2.488e-02	1.955e-03
1.450e+01	4.355e-03	3.440e-04

laboratory bombardment energy = 8.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q va'ue = 7.9

compound nucleus atomic number = 24 mass numa 53

total reaction cross section = 1501.2

excitation energy of compound nucleus = 15.8mev j= 0

reaction cross section 1501.2

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.548e+03	1.228e+02
1.000e+00	1.071e+03	8.499e+01
1.500e+00	8.484e+02	6.733e+01
2.000e+00	7.108e+02	5.641e+01
2.500e+00	6.064e+02	4.813e+01
3.000e+00	5.182e+02	4.112e+01
3.500e+00	4.398e+02	3.491e+01
4.000e+00	3.692e+02	2.930e+01
4.500e+00	3.050e+02	2.421e+01
5.000e+00	2.463e+02	1.955e+01
5.500e+00	1.916e+02	1.520e+01
6.000e+00	1.399e+02	1.110e+01
6.500e+00	9.126e+01	7.243e+00
7.000e+00	4.856e+01	3.854e+00
7.500e+00	1.760e+01	1.397e+00
8.000e+00	1.181e+00	9.370e-02
8.500e+00	1.225e+00	9.725e-02
9.000e+00	1.236e+00	9.813e-02
9.500e+00	1.212e+00	9.617e-02
1.000e+01	1.151e+00	9.136e-02
1.050e+01	1.057e+00	8.388e-02
1.100e+01	9.337e-01	7.410e-02
1.150e+01	7.884e-01	6.257e-02
1.200e+01	6.302e-01	5.001e-02
1.250e+01	4.702e-01	3.731e-02
1.300e+01	3.203e-01	2.542e-02
1.350e+01	1.924e-01	1.527e-02
1.400e+01	9.624e-02	7.638e-03
1.450e+01	3.665e-02	2.909e-03
1.500e+01	1.106e-02	8.775e-04
1.550e+01	7.679e-03	6.095e-04

laboratory bombardment energy = 9.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1464.3

excitation energy of compound nucleus = 16.8mev j= 0

reaction cross section 1464.3

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.515e+03	1.202e+02
1.000e+00	1.055e+03	8.370e+01
1.500e+00	8.413e+02	6.677e+01
2.000e+00	7.092e+02	5.629e+01
2.500e+00	6.089e+02	4.832e+01
3.000e+00	5.243e+02	4.161e+01
3.500e+00	4.498e+02	3.569e+01
4.000e+00	3.829e+02	3.039e+01
4.500e+00	3.227e+02	2.561e+01
5.000e+00	2.687e+02	2.133e+01
5.500e+00	2.203e+02	1.748e+01
6.000e+00	1.766e+02	1.401e+01
6.500e+00	1.365e+02	1.083e+01
7.000e+00	9.919e+01	7.872e+00
7.500e+00	6.448e+01	5.118e+00
8.000e+00	3.416e+01	2.711e+00
8.500e+00	1.216e+01	9.648e-01
9.000e+00	4.393e-01	3.486e-02
9.500e+00	4.482e-01	3.557e-02
1.000e+01	4.461e-01	3.541e-02
1.050e+01	4.327e-01	3.434e-02
1.100e+01	4.081e-01	3.239e-02
1.150e+01	3.730e-01	2.961e-02
1.200e+01	3.290e-01	2.611e-02
1.250e+01	2.782e-01	2.208e-02
1.300e+01	2.234e-01	1.773e-02
1.350e+01	1.681e-01	1.334e-02
1.400e+01	1.163e-01	9.232e-03
1.450e+01	7.205e-02	5.718e-03
1.500e+01	3.888e-02	3.086e-03
1.550e+01	1.899e-02	1.507e-03
1.600e+01	1.190e-02	9.446e-04
1.650e+01	1.354e-02	1.075e-03

laboratory bombardment energy = 10.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1426.2

excitation energy of compound nucleus = 17.8mev j= 0

reaction cross section 1426.2

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.480e+03	1.174e+02
1.000e+00	1.038e+03	8.235e+01
1.500e+00	8.351e+02	6.628e+01
2.000e+00	7.101e+02	5.636e+01
2.500e+00	6.140e+02	4.873e+01
3.000e+00	5.319e+02	4.221e+01
3.500e+00	4.590e+02	3.643e+01
4.000e+00	3.939e+02	3.126e+01
4.500e+00	3.358e+02	2.665e+01
5.000e+00	2.839e+02	2.253e+01
5.500e+00	2.378e+02	1.888e+01
6.000e+00	1.971e+02	1.565e+01
6.500e+00	1.611e+02	1.279e+01
7.000e+00	1.291e+02	1.025e+01
7.500e+00	1.001e+02	7.944e+00
8.000e+00	7.332e+01	5.819e+00
8.500e+00	4.855e+01	3.853e+00
9.000e+00	2.692e+01	2.137e+00
9.500e+00	1.119e+01	8.881e-01
1.000e+01	2.767e+00	2.196e-01
1.050e+01	2.794e+00	2.217e-01
1.100e+01	2.760e+00	2.191e-01
1.150e+01	2.664e+00	2.115e-01
1.200e+01	2.507e+00	1.990e-01
1.250e+01	2.292e+00	1.819e-01
1.300e+01	2.025e+00	1.608e-01
1.350e+01	1.719e+00	1.364e-01
1.400e+01	1.387e+00	1.101e-01
1.450e+01	1.047e+00	8.311e-02
1.500e+01	7.233e-01	5.741e-02
1.550e+01	4.399e-01	3.491e-02
1.600e+01	2.215e-01	1.758e-02
1.650e+01	8.469e-02	6.721e-03
1.700e+01	2.779e-02	2.206e-03
1.750e+01	2.186e-02	1.735e-03

laboratory bombardment energy = 11.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1393.0

excitation energy of compound nucleus = 18.7mev j= 0

reaction cross section 1393.0

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.448e+03	1.149e+02
1.000e+00	1.022e+03	8.110e+01
1.500e+00	8.303e+02	6.590e+01
2.000e+00	7.131e+02	5.659e+01
2.500e+00	6.222e+02	4.938e+01
3.000e+00	5.432e+02	4.311e+01
3.500e+00	4.718e+02	3.744e+01
4.000e+00	4.070e+02	3.230e+01
4.500e+00	3.487e+02	2.767e+01
5.000e+00	2.969e+02	2.356e+01
5.500e+00	2.511e+02	1.993e+01
6.000e+00	2.109e+02	1.673e+01
6.500e+00	1.756e+02	1.394e+01
7.000e+00	1.448e+02	1.149e+01
7.500e+00	1.178e+02	9.350e+00
8.000e+00	9.398e+01	7.459e+00
8.500e+00	7.252e+01	5.756e+00
9.000e+00	5.276e+01	4.187e+00
9.500e+00	3.446e+01	2.735e+00
1.000e+01	1.841e+01	1.461e+00
1.050e+01	6.841e+00	5.429e-01
1.100e+01	1.258e+00	9.982e-02
1.150e+01	1.264e+00	1.003e-01
1.200e+01	1.247e+00	9.898e-02
1.250e+01	1.205e+00	9.564e-02
1.300e+01	1.138e+00	9.032e-02
1.350e+01	1.047e+00	8.307e-02
1.400e+01	9.330e-01	7.404e-02
1.450e+01	8.000e-01	6.350e-02
1.500e+01	6.530e-01	5.183e-02
1.550e+01	4.992e-01	3.962e-02
1.600e+01	3.482e-01	2.764e-02
1.650e+01	2.147e-01	1.704e-02
1.700e+01	1.115e-01	8.850e-03
1.750e+01	4.966e-02	3.941e-03
1.800e+01	2.703e-02	2.145e-03

laboratory bombardment energy = 12.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1369.1

excitation energy of compound nucleus = 19.7mev j= 0

reaction cross section 1369.1

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.427e+03	1.133e+02
1.000e+00	1.012e+03	8.028e+01
1.500e+00	8.278e+02	6.570e+01
2.000e+00	7.164e+02	5.686e+01
2.500e+00	6.302e+02	5.002e+01
3.000e+00	5.543e+02	4.399e+01
3.500e+00	4.845e+02	3.845e+01
4.000e+00	4.201e+02	3.334e+01
4.500e+00	3.614e+02	2.868e+01
5.000e+00	3.087e+02	2.450e+01
5.500e+00	2.621e+02	2.081e+01
6.000e+00	2.214e+02	1.757e+01
6.500e+00	1.860e+02	1.476e+01
7.000e+00	1.553e+02	1.233e+01
7.500e+00	1.287e+02	1.021e+01
8.000e+00	1.056e+02	8.381e+00
8.500e+00	8.547e+01	6.783e+00
9.000e+00	6.768e+01	5.372e+00
9.500e+00	5.159e+01	4.094e+00
1.000e+01	3.664e+01	2.908e+00
1.050e+01	2.278e+01	1.808e+00
1.100e+01	1.166e+01	9.251e-01
1.150e+01	4.272e+00	3.391e-01
1.200e+01	6.773e-01	5.375e-02
1.250e+01	6.818e-01	5.411e-02
1.300e+01	6.752e-01	5.359e-02
1.350e+01	6.568e-01	5.213e-02
1.400e+01	6.259e-01	4.968e-02
1.450e+01	5.821e-01	4.620e-02
1.500e+01	5.255e-01	4.170e-02
1.550e+01	4.564e-01	3.623e-02
1.600e+01	3.767e-01	2.989e-02
1.650e+01	2.897e-01	2.299e-02
1.700e+01	2.021e-01	1.604e-02
1.750e+01	1.242e-01	9.861e-03
1.800e+01	6.747e-02	5.355e-03
1.850e+01	3.701e-02	2.937e-03
1.900e+01	2.649e-02	2.102e-03

laboratory bombardment energy = 14.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1349.7

excitation energy of compound nucleus = 21.7mev j= 0

reaction cross section 1349.7

# gamma (mev)	cross section (mb/mev)	(mb/str.mev)
5.000e-01	1.141e+03	9.055e+01
1.000e+00	7.816e+02	6.203e+01
1.500e+00	6.310e+02	5.008e+01
2.000e+00	5.452e+02	4.327e+01
2.500e+00	4.789e+02	3.801e+01
3.000e+00	4.214e+02	3.344e+01
3.500e+00	3.684e+02	2.924e+01
4.000e+00	3.194e+02	2.535e+01
4.500e+00	2.743e+02	2.177e+01
5.000e+00	2.334e+02	1.852e+01
5.500e+00	1.970e+02	1.563e+01
6.000e+00	1.650e+02	1.310e+01
6.500e+00	1.374e+02	1.091e+01
7.000e+00	1.139e+02	9.040e+00
7.500e+00	9.417e+01	7.474e+00
8.000e+00	7.793e+01	6.185e+00
8.500e+00	6.392e+01	5.073e+00
9.000e+00	5.175e+01	4.106e+00
9.500e+00	4.100e+01	3.254e+00
1.000e+01	3.128e+01	2.482e+00
1.050e+01	2.280e+01	1.810e+00
1.100e+01	1.531e+01	1.215e+00
1.150e+01	8.542e+00	6.779e-01
1.200e+01	2.475e+00	1.965e-01
1.250e+01	2.607e+00	2.069e-01
1.300e+01	2.722e+00	2.160e-01
1.350e+01	2.817e+00	2.236e-01
1.400e+01	2.889e+00	2.293e-01
1.450e+01	2.932e+00	2.327e-01
1.500e+01	2.937e+00	2.331e-01
1.550e+01	2.894e+00	2.297e-01
1.600e+01	2.785e+00	2.210e-01
1.650e+01	2.587e+00	2.053e-01
1.700e+01	2.278e+00	1.808e-01
1.750e+01	1.847e+00	1.466e-01
1.800e+01	1.331e+00	1.056e-01
1.850e+01	8.231e-01	6.533e-02
1.900e+01	4.277e-01	3.395e-02
1.950e+01	1.871e-01	1.485e-02
2.000e+01	7.190e-02	5.706e-03
2.050e+01	2.894e-02	2.297e-03
2.100e+01	1.705e-02	1.353e-03

laboratory bombardment energy = 16.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1345.1

excitation energy of compound nucleus = 23.6mev j= 0

reaction cross section 1345.1

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.148e+03	9.108e+01
1.000e+00	6.872e+02	5.454e+01
1.500e+00	4.691e+02	3.723e+01
2.000e+00	3.589e+02	2.849e+01
2.500e+00	2.966e+02	2.354e+01
3.000e+00	2.557e+02	2.029e+01
3.500e+00	2.229e+02	1.769e+01
4.000e+00	1.915e+02	1.519e+01
4.500e+00	1.634e+02	1.296e+01
5.000e+00	1.382e+02	1.097e+01
5.500e+00	1.157e+02	9.184e+00
6.000e+00	9.587e+01	7.609e+00
6.500e+00	7.848e+01	6.228e+00
7.000e+00	6.333e+01	5.026e+00
7.500e+00	5.055e+01	4.012e+00
8.000e+00	4.144e+01	3.289e+00
8.500e+00	3.370e+01	2.675e+00
9.000e+00	2.712e+01	2.155e+00
9.500e+00	2.135e+01	1.695e+00
1.000e+01	1.617e+01	1.283e+00
1.050e+01	1.167e+01	9.259e-01
1.100e+01	7.720e+00	6.127e-01
1.150e+01	4.161e+00	3.318e-01
1.200e+01	9.230e-01	7.325e-02
1.250e+01	1.008e+00	8.005e-02
1.300e+01	1.096e+00	8.701e-02
1.350e+01	1.187e+00	9.420e-02
1.400e+01	1.280e+00	1.016e-01
1.450e+01	1.374e+00	1.090e-01
1.500e+01	1.467e+00	1.164e-01
1.550e+01	1.554e+00	1.234e-01
1.600e+01	1.627e+00	1.291e-01
1.650e+01	1.667e+00	1.323e-01
1.700e+01	1.647e+00	1.307e-01
1.750e+01	1.534e+00	1.218e-01
1.800e+01	1.309e+00	1.039e-01
1.850e+01	9.965e-01	7.909e-02
1.900e+01	6.719e-01	5.333e-02
1.950e+01	4.060e-01	3.222e-02
2.000e+01	2.248e-01	1.784e-02
2.050e+01	1.166e-01	9.254e-03
2.100e+01	5.826e-02	4.624e-03
2.150e+01	2.951e-02	2.342e-03
2.200e+01	1.665e-02	1.322e-03
2.250e+01	1.148e-02	9.107e-04
2.300e+01	9.485e-03	7.527e-04

laboratory bombardment energy = 18.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1319.4

excitation energy of compound nucleus = 25.6mev j= 0

reaction cross section 1319.4

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.216e+03	9.653e+01
1.000e+00	7.596e+02	6.029e+01
1.500e+00	5.234e+02	4.154e+01
2.000e+00	3.776e+02	2.997e+01
2.500e+00	2.781e+02	2.207e+01
3.000e+00	2.085e+02	1.655e+01
3.500e+00	1.601e+02	1.271e+01
4.000e+00	1.272e+02	1.009e+01
4.500e+00	1.039e+02	8.244e+00
5.000e+00	8.655e+01	6.871e+00
5.500e+00	7.191e+01	5.707e+00
6.000e+00	5.929e+01	4.706e+00
6.500e+00	4.831e+01	3.834e+00
7.000e+00	3.876e+01	3.076e+00
7.500e+00	3.054e+01	2.423e+00
8.000e+00	2.491e+01	1.977e+00
8.500e+00	2.016e+01	1.600e+00
9.000e+00	1.648e+01	1.308e+00
9.500e+00	1.333e+01	1.058e+00
1.000e+01	1.058e+01	8.396e-01
1.050e+01	8.231e+00	6.532e-01
1.100e+01	6.209e+00	4.928e-01
1.150e+01	4.429e+00	3.515e-01
1.200e+01	2.825e+00	2.242e-01
1.250e+01	3.168e+00	2.514e-01
1.300e+01	3.542e+00	2.811e-01
1.350e+01	3.952e+00	3.137e-01
1.400e+01	4.405e+00	3.496e-01
1.450e+01	4.904e+00	3.892e-01
1.500e+01	5.450e+00	4.325e-01
1.550e+01	6.037e+00	4.791e-01
1.600e+01	6.637e+00	5.267e-01
1.650e+01	7.186e+00	5.703e-01
1.700e+01	7.556e+00	5.996e-01
1.750e+01	7.950e+00	5.992e-01
1.800e+01	6.978e+00	5.538e-01
1.850e+01	5.626e+00	4.424e-01
1.900e+01	4.367e+00	3.466e-01
1.950e+01	2.981e+00	2.366e-01
2.000e+01	1.895e+00	1.504e-01
2.050e+01	1.144e+00	9.077e-02
2.100e+01	6.619e-01	5.253e-02
2.150e+01	3.682e-01	2.922e-02
2.200e+01	1.963e-01	1.558e-02
2.250e+01	9.990e-02	7.929e-03
2.300e+01	5.862e-02	5.059e-03
2.350e+01	2.329e-02	1.848e-03
2.400e+01	1.204e-02	9.558e-04
2.450e+01	7.774e-03	6.170e-04
2.500e+01	6.419e-03	5.095e-04

laboratory bombardment energy = 20.0mev target mass = 52.0

compound nucleus mass = 53.0 compound nucleus formation q value = 7.9

compound nucleus atomic number = 24 mass num= 53

total reaction cross section = 1275.0

excitation energy of compound nucleus = 27.6mev j= 0

reaction cross section 1275.0

e gamma (mev)	cross section (mb/mev)	(mb/sr.mev)
5.000e-01	1.226e+03	9.729e+01
1.000e+00	7.942e+02	6.303e+01
1.500e+00	5.712e+02	4.533e+01
2.000e+00	4.302e+02	3.414e+01
2.500e+00	3.263e+02	2.590e+01
3.000e+00	2.467e+02	1.958e+01
3.500e+00	1.847e+02	1.466e+01
4.000e+00	1.370e+02	1.087e+01
4.500e+00	1.001e+02	7.946e+00
5.000e+00	7.313e+01	5.804e+00
5.500e+00	5.356e+01	4.275e+00
6.000e+00	4.045e+01	3.210e+00
6.500e+00	3.110e+01	2.468e+00
7.000e+00	2.421e+01	1.922e+00
7.500e+00	1.872e+01	1.486e+00
8.000e+00	1.500e+01	1.191e+00
8.500e+00	1.186e+01	9.409e-01
9.000e+00	9.520e+00	7.555e-01
9.500e+00	7.559e+00	5.999e-01
1.000e+01	5.875e+00	4.663e-01
1.050e+01	4.451e+00	3.533e-01
1.100e+01	3.234e+00	2.567e-01
1.150e+01	2.167e+00	1.720e-01
1.200e+01	1.210e+00	9.606e-02
1.250e+01	1.384e+00	1.098e-01
1.300e+01	1.580e+00	1.254e-01
1.350e+01	1.803e+00	1.431e-01
1.400e+01	2.059e+00	1.634e-01
1.450e+01	2.352e+00	1.867e-01
1.500e+01	2.690e+00	2.135e-01
1.550e+01	3.072e+00	2.438e-01
1.600e+01	3.494e+00	2.773e-01
1.650e+01	3.926e+00	3.116e-01
1.700e+01	4.301e+00	3.413e-01
1.750e+01	4.498e+00	3.570e-01
1.800e+01	4.374e+00	3.472e-01
1.850e+01	3.867e+00	3.069e-01
1.900e+01	3.093e+00	2.455e-01
1.950e+01	2.274e+00	1.804e-01
2.000e+01	1.574e+00	1.250e-01
2.050e+01	1.049e+00	8.328e-02
2.100e+01	6.823e-01	5.415e-02
2.150e+01	4.357e-01	3.458e-02
2.200e+01	2.737e-01	2.172e-02
2.250e+01	1.691e-01	1.342e-02
2.300e+01	1.025e-01	8.137e-03
2.350e+01	6.098e-02	4.840e-03
2.400e+01	3.570e-02	2.834e-03
2.450e+01	2.085e-02	1.655e-03
2.500e+01	1.255e-02	9.948e-04
2.550e+01	8.172e-03	6.486e-04
2.600e+01	6.067e-03	4.815e-04
2.650e+01	5.133e-03	4.074e-04
2.700e+01	4.719e-03	3.742e-04