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Article

Understanding Super Heavy Stable Mass Numbers and Maximum Binding Energy of Any Mass Number with Revised Strong and Electroweak Mass Formula

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Abstract: In our recent publications, based on strong and electroweak interactions, we have developed a completely new formula for estimating nuclear binding energy. With reference to currently believed Semi Empirical Mass Formula (SEMF), we call our formula as 'Strong and Electroweak Mass Formula' (SEWMF). Our formula constitutes 4 simple terms and only one energy coefficient of magnitude 10.1 MeV. First term is a volume term, second term seems to be a representation of free nucleons associated with electroweak interaction, third term is a radial term and fourth one is an asymmetry term about the mean stable mass number. In this paper, we make an attempt to understand and estimate the maximum binding energy associated with any mass number. It can be expressed as, for $A > 4$, $(BE)_A \cong \left\{ A - 0.000935A^2 - A^{1/3} - A^{-1/2} \right\} 10.1 \text{ MeV}$. We are working on refining the 4th term with even-odd corrections, shell corrections and other microscopic corrections. Proceeding further, stable mass numbers and super heavy mass numbers can be understood with a relation of the form, $A_s \cong \left[\text{RoundOff} \left\{ (Z + 2.9464)^{1.2} - 1.7165 \right\} + [0,1] \right] \pm 2n$ where $n \cong 0, 1, 2$. It needs a review with respect to even-odd proton numbers and other microscopic corrections. Very interesting point to be noted is that based on the concept of "binding energy per nucleon", the most complicated Avogadro number and Unified atomic mass unit can be estimated in a unified approach.

Keywords: semi empirical mass formula (SEMF); strong and electroweak mass formula (SEWMF); free nucleons; light house like stable mass number; super heavy mass numbers; revised electroweak term; maximum binding energy of any mass number; avogadro number; unified atomic mass unit

1. Introduction

Based on 4G model of final unification, in our recent publications [1-10], we have clearly shown that, strong and weak interactions, play a vital role in basic nuclear structure. With our strong and electroweak mass formula, nuclear binding energy can be estimated with one unified energy coefficient having 4 simple terms. In this paper, considering our contribution pertaining to DAE-BRNS 2023 symposium proceedings [1] and recent journal publication [2], we make a minor change for understanding the maximum binding energy associated with any mass number. It can be refined with further study. Proceeding further, we discuss on estimating stable mass numbers having relatively long living time. In this context, considering proton number as an input, we have developed a simple power law applicable for the whole range of periodic table. Based on the data fit for lower, medium and heavy stable nuclides, we are sure to say that, it will certainly help in designing and developing new experimental set ups for producing stable and unstable super heavy atomic nuclides. With further research, atomic nuclides suitable for safe nuclear energy production and suitable for medical applications can be produced with ease and confidence. Proceeding further, Unified atomic mass unit and Avogadro number can be estimated in a unified approach.

2. Three Assumptions of 4G Model of Final Unification

Following our 4G model of final unification [1-10]

- (1) There exists a characteristic electroweak fermion of rest energy, $M_{wf}c^2 \cong 584.725 \text{ GeV}$. It can be considered as the zygote of all elementary particles.
- (2) There exists a nuclear elementary charge in such a way that, $\left(\frac{e}{e_n}\right)^2 \cong \alpha_s \cong 0.1152 = \text{Strong}$ coupling constant [11] and $e_n \cong 2.9464e$.
- (3) Each atomic interaction is associated with a characteristic large gravitational coupling constant. Their fitted magnitudes are,

$$G_e \cong \text{Electromagnetic gravitational constant} \cong 2.374335 \times 10^{37} \text{ m}^3 \text{kg}^{-1} \text{sec}^{-2}$$

$$G_n \cong \text{Nuclear gravitational constant} \cong 3.329561 \times 10^{28} \text{ m}^3 \text{kg}^{-1} \text{sec}^{-2}$$

$$G_w \cong \text{Electroweak gravitational constant} \cong 2.909745 \times 10^{22} \text{ m}^3 \text{kg}^{-1} \text{sec}^{-2}$$

It may be noted that,

- (1) Weak interaction point of view, following our assumptions, Fermi's weak coupling constant [11] can be fitted with the following relations.

$$\left. \begin{aligned} G_F &\cong \left(\frac{m_e}{m_p}\right)^2 \hbar c R_0^2 \cong G_w M_{wf}^2 R_w^2 \cong 1.44021 \times 10^{-62} \text{ J.m}^3 \\ \text{where, } \left\{ \begin{aligned} R_0 &\cong \frac{2G_n m_p}{c^2} \cong 1.24 \times 10^{-15} \text{ m} \\ R_w &\cong \frac{2G_w M_{wf}}{c^2} \cong 6.75 \times 10^{-19} \text{ m} \end{aligned} \right. \end{aligned} \right\} \quad (1)$$

- (2) In a unified approach, most important point to be noted is that, $\hbar c \equiv G_w M_{wf}^2$. Clearly

speaking, based on the electroweak interaction, the well believed quantum constant $\hbar c$ seems to have a deep inner meaning [10]. It needs further study with respect to condensed matter physics.

3. Free Nucleons and the Electroweak Term

With reference to our strong and electroweak mass formula [1-10],

- (3) Nuclear volume can be split into 'core inner' and 'core outer'.
- (4) Nucleons residing in nuclear inner core help in increasing nuclear binding energy.
- (5) Nucleons residing in outer core will not involve in nuclear binding.
- (6) Outer core nucleons can be called as free or electroweak nucleons.
- (7) Proportionality coefficient being $\frac{m_p}{M_{wf}} \cong \frac{938.272 \text{ MeV}}{584725 \text{ MeV}} \cong 0.001605$, free nucleon number is

proportional to half of the sum of squared proton number and squared mass number.

- (8) Considering light and heavy atomic nuclides, by considering a correction factor $\left[2 - \left(\frac{N}{Z}\right)\right]$, in our recent publications, we expressed our first approximate relation for free nucleon number

$$\text{as, } A_{free} \cong \left[2 - \left(\frac{N}{Z}\right)\right] + \left[0.0016 \left(\frac{Z^2 + A^2}{2}\right)\right] \cong \left[2 - \left(\frac{N}{Z}\right)\right] + \left[0.0008 (Z^2 + A^2)\right].$$

- (9) For medium and heavy proton numbers and their isotopes, equality of excess neutron number and free nucleon number can be considered as an index of possible stability. It needs a review at fundamental level.

4. Nuclear radius and Radial term

- (1) Interesting observation is that, nuclear binding energy seems to decrease with increasing radius.
- (2) As nuclear volume is proportional the mass number, it is possible to understand the decreasing nuclear binding energy with cube root of the mass number $A_{rad} \cong A^{1/3}$.

5. Stable Mass Number and Asymmetry Term

- (1) Even though it is not exact stable mass number, we understood that, the ratio of nuclear charge and elementary charge and electroweak interaction seem to play a crucial role in understanding and estimating the approximate stable mass number of any atomic nuclide having a proton number Z . This is one best practical application of our proposed nuclear charge and electroweak fermion.
- (2) Stable mass number seems to play a crucial role in estimating the binding energy of other isotopes of Z .
- (3) Our estimated mass number close to stability can be called as 'light house (like) mass number' where one can find the beginning of relatively long living isotopes of Z .
- (4) Keeping light and heavy atomic nuclides in view, we suggest a common and simple relation of the form [2,6],

$$A_s \cong \text{RoundOff} \left\{ \left(Z + \left(\frac{e_n}{e} \right) \right)^{1.2} - \sqrt{\frac{e_n}{e}} \right\} \cong \text{RoundOff} \left\{ (Z + 2.9464)^{1.2} - 1.7165 \right\} \quad (2A)$$

$$\text{where } \left(\frac{e_n}{e} \right)^{\frac{1}{6}} \cong \left(\frac{1}{\alpha_s} \right)^{\frac{1}{12}} \cong 1.19733 \cong 1.2$$

It may be noted that, right selection of stable mass number greatly helps in minimizing the error in estimating nuclear binding energy. Especially, for light atomic nuclides, whose stable mass number is very close to $2Z$, estimated binding energy seems to be on lower side compared to actual binding energy. Hence, it seems better to select stable mass number of Z based on their relative time of living. Considering even-odd corrections, above relation can be refined for a better understanding in the following way. It can be reviewed in a better way with further study.

- (1) If Z is even and obtained A_s is odd, then, $A_s \cong A_s + 1$.
- (2) If Z is even and obtained A_s is even, then, $A_s \cong A_s$.
- (3) If Z is odd and obtained A_s is odd, then, $A_s \cong A_s$.
- (4) If Z is odd and obtained A_s is even, then, $A_s \cong A_s + 1$.

See Table 1 for a better understanding.

$$A_s \cong \text{RoundOff} \left\{ (Z + 2.9464)^{1.2} - 1.7165 \right\} + \text{EO correction} \cong [0,1] \quad (2B)$$

Following this relation, for odd elements, their best possible three mass numbers can be expressed as,

$$A_s \cong \left[\text{RoundOff} \left\{ (Z + 2.9464)^{1.2} - 1.7165 \right\} + [0,1] \right] + 2n \quad (2C)$$

where $n = 0,1,2$

We are working on the possibility of considering $(-2n)$ for increasing the estimated range of heavy mass numbers on lower side [12-16]. Thus, relation (2C) can be expressed as,

$$A_s \cong \left[\text{RoundOff} \left\{ (Z + 2.9464)^{1.2} - 1.7165 \right\} + [0,1] \right] \pm 2n \quad (2D)$$

where $n = 0,1,2$

In Table 1, we have presented the estimated light house like mass numbers of $Z = 6$ to 118.

Table 1. Estimated light house like stable mass numbers of $Z=5$ to118.

Proton numb er	Estimated stable mass number	Estimated mass number with EO corrections	Proton numb er	Estimated stable mass number	Estimated mass number with EO corrections	Proton numb er	Estimated stable mass number	Estimated mass number with EO corrections
5	10	11	43	97	97	81	202	203
6	12	12	44	100	100	82	205	206
7	14	15	45	102	103	83	208	209
8	16	16	46	105	106	84	211	212
9	18	19	47	107	107	85	214	215
10	20	20	48	110	110	86	217	218
11	22	23	49	113	113	87	219	219
12	24	24	50	115	116	88	222	222
13	26	27	51	118	119	89	225	225
14	28	28	52	121	122	90	228	228
15	30	31	53	123	123	91	231	231
16	32	32	54	126	126	92	234	234
17	35	35	55	129	129	93	237	237
18	37	38	56	131	132	94	240	240
19	39	39	57	134	135	95	243	243
20	41	42	58	137	138	96	246	246
21	43	43	59	140	141	97	249	249
22	46	46	60	142	142	98	252	252
23	48	49	61	145	145	99	255	255
24	50	50	62	148	148	100	258	258
25	53	53	63	151	151	101	261	261
26	55	56	64	153	154	102	264	264
27	57	57	65	156	157	103	268	269
28	60	60	66	159	160	104	271	272
29	62	63	67	162	163	105	274	275
30	65	66	68	165	166	106	277	278
31	67	67	69	167	167	107	280	281
32	69	70	70	170	170	108	283	284
33	72	73	71	173	173	109	286	287
34	74	74	72	176	176	110	289	290
35	77	77	73	179	179	111	292	293
36	79	80	74	182	182	112	295	296
37	82	83	75	185	185	113	298	299
38	84	84	76	187	188	114	301	302
39	87	87	77	190	191	115	304	305
40	89	90	78	193	194	116	308	308
41	92	93	79	196	197	117	311	311
42	94	94	80	199	200	118	314	314

Following the above points, super heavy atomic nuclides' possible mass number range can be understood. Here we would like to highlight the point that compared to other mass numbers, these mass numbers can have relatively long living time. It needs further study, experimental design, set up and observations. For example,

- (1) Mass numbers of $Z=100$: 254 to 262
- (2) Mass numbers of $Z=101$: 257 to 265
- (3) Mass numbers of $Z=102$: 260 to 268
- (4) Mass numbers of $Z=103$: 265 to 273
- (5) Mass numbers of $Z=104$: 268 to 276
- (6) Mass numbers of $Z=105$: 271 to 279
- (7) Mass numbers of $Z=106$: 274 to 282
- (8) Mass numbers of $Z=107$: 277 to 285
- (9) Mass numbers of $Z=108$: 280 to 288
- (10) Mass numbers of $Z=109$: 283 to 291
- (11) Mass numbers of $Z=110$: 286 to 294
- (12) Mass numbers of $Z=111$: 289 to 297
- (13) Mass numbers of $Z=112$: 292 to 300
- (14) Mass numbers of $Z=113$: 295 to 303
- (15) Mass numbers of $Z=114$: 298 to 306
- (16) Mass numbers of $Z=115$: 302 to 309
- (17) Mass numbers of $Z=116$: 304 to 312
- (18) Mass numbers of $Z=117$: 307 to 315
- (19) Mass numbers of $Z=118$: 310 to 318

For the case of currently believed heavy magic proton number, $Z=114$, its estimated mass number range is 298 to 306. Here it is quite interesting to note that, lower mass number is 298 and its corresponding neutron number is $298-114=184$ and is nicely matching with the currently believed heavy magic neutron number at 184. Thus, $Z=114$ and $A=298$ can be given a strong priority for its experimental identification as a doubly magic super heavy atomic nuclide [16].

- (5) Number 0.0016 plays a very interesting role in estimating the free nucleon number as,

$$A_{free} \cong \left[2 - \left(\frac{N}{Z} \right) \right] + 0.0016 \left[\left(Z^2 + N^2 + \left(\frac{Z^2}{N} \right)^2 \right) - ZN \left(\frac{N-Z}{N+Z} \right)^2 \right] \quad (3)$$

$$\cong \left[2 - \left(\frac{N}{Z} \right) \right] + 0.0016 \left[\left(Z^2 + N^2 + \left(\frac{Z^2}{N} \right)^2 \right) - ZN \left(\frac{A-2Z}{A} \right)^2 \right]$$

where $\left[2 - \left(\frac{N}{Z} \right) \right]$ is a correction factor that needs a review.

- (6) Here, very interesting point to be noted is that, the number 0.0016 can also be understood as a ratio of the mean mass of pions to the mean mass of electroweak bosons. It can be expressed as,

$$\frac{m_p}{M_{wf}} \cong \left(\frac{\sqrt{(m_\pi c^2)^0 (m_\pi c^2)^{\pm}}}{\sqrt{(m_z c^2)^0 (m_w c^2)^{\pm}}} \right) \cong \left(\frac{\sqrt{134.98 \times 139.57} \text{ MeV}}{\sqrt{80379.0 \times 91187.6} \text{ MeV}} \right) \cong 0.0016032 \quad (4)$$

Based on this unique observation, we are very confident to say that, strong and weak interactions play a vital role exploring the secrets of nuclear structure.

(7) Independent of proton number, approximate asymmetry term can be expressed as,

$$A_{\text{asym}} \cong \frac{(A_s - A)^2}{A_s} \quad (5)$$

It may be noted that, even though it is an approximate relation, it greatly helps in estimating the binding energy of isotopes for the entire range of atomic nuclides. It seems essential to work on this kind of relations.

6. Unique Binding Energy Coefficient

We would like to emphasize the point that, nuclear binding energy can be understood with only one fixed energy coefficient. It can be understood in two different ways as expressed in following way.

Considering Up and Down quark masses [11],

$$\begin{aligned} B_0 &\cong \frac{1}{2} \left[(2m_u c^2 + m_d c^2) + (m_u c^2 + 2m_d c^2) \right] \\ &\cong \frac{3}{2} (m_u c^2 + m_d c^2) \cong 10.1 \text{ MeV (Our fit)} \quad (6) \end{aligned}$$

$$\text{where } \begin{cases} m_u \cong 2.16^{+0.49}_{-0.26} \text{ MeV}/c^2 \\ m_d \cong 4.67^{+0.48}_{-0.17} \text{ MeV}/c^2 \end{cases}$$

Considering strong coupling constant and reduced Compton wavelength of proton,

$$\begin{aligned} B_0 &\cong - \left(\frac{1}{\sqrt{\alpha_s}} \right) \frac{e^2}{8\pi\epsilon_0 (\hbar/m_p c)} \cong - \frac{e_n^2}{8\pi\epsilon_0 (G_n m_p / c^2)} \cong -10.1 \text{ MeV} \\ \text{where } &\begin{cases} \alpha_s = \text{Strong coupling constant} \cong 0.115 \text{ to } 0.12 \\ \hbar/m_p c = \text{Reduced Compton wavelength of proton} \\ G_n m_p / c^2 \cong 0.62 \times 10^{-15} \text{ m} \end{cases} \quad (7A) \end{aligned}$$

Considering B_0 as a form of total energy, it is possible to define its corresponding potential energy as,

$$E_{\text{pot}} \cong - \frac{e_n^2}{4\pi\epsilon_0 (G_n m_p / c^2)} \cong -20.2 \text{ MeV} \quad (7B)$$

Using this energy unit, various energy coefficients of the currently beloved semi empirical mass can be fitted.

7. Revised and Reference Formulae for Nuclear Binding Energy

The most famous and most advanced SEMF that follows isospin concept can be expressed as [17-21],

$$\begin{aligned} BE &\cong \left\{ \left[1 + \left(\frac{4k_v}{A^2} \right) |T_z| (|T_z| + 1) \right] a_v * A \right\} + \left\{ \left[1 + \left(\frac{4k_s}{A^2} \right) |T_z| (|T_z| + 1) \right] a_s * A^{\frac{2}{3}} \right\} \\ &\quad + \left\{ a_c * \left(\frac{Z^2}{A^{1/3}} \right) \right\} + \left\{ f_p * \frac{Z^2}{A} \right\} + E_p \quad (8) \end{aligned}$$

where, $T_z \cong 3\text{rd component of isospin} = \frac{1}{2}(Z - N)$

$$\left\{ \begin{array}{l} a_v = -15.4963 \text{ MeV} \cong -20.2(1 - 2\alpha_s) \cong -15.546 \text{ MeV} \\ a_s = 17.7937 \cong -20.2(1 - \alpha_s) \cong -17.873 \text{ MeV} \\ k_v = -1.8232 \cong - \left[2 - \frac{(1 + \alpha_s)^2}{(1 - \alpha_s)} \right] \alpha_s \cong -(2 - 0.183) \cong -1.817 \\ k_s = -2.2593 \cong - \left[2 + \frac{(1 + \alpha_s)^2}{(1 - \alpha_s)} \right] \alpha_s \cong -(2 + 0.183) \cong -2.183 \\ a_c = 0.7093 \cong 0.71 \text{ MeV} \\ f_p = -1.2739 \text{ MeV} \cong - \frac{20.2\alpha_s}{2} \cong -1.1635 \text{ MeV} \\ \left. \begin{array}{l} d_n = 4.6919 \text{ MeV}, d_p = 4.7230 \text{ MeV} \\ d_n \cong d_p \cong 2 * 20.2\alpha_s \cong 4.6541 \text{ MeV} \end{array} \right\} \\ d_{np} = -6.4920 \text{ MeV} \cong -3 * 20.2\alpha_s \cong -6.981 \text{ MeV} \end{array} \right\}$$

$$\text{and } \left\{ \begin{array}{l} \text{for } (Z, N) \text{ Odd, } E_p \cong \frac{d_n}{N^{1/3}} + \frac{d_p}{Z^{1/3}} + \frac{d_{np}}{A^{2/3}} \\ \text{for } (\text{Odd } Z, \text{ Even } N), E_p \cong \frac{d_p}{Z^{1/3}} \\ \text{for } (\text{Even } Z, \text{ Odd } N), E_p \cong \frac{d_n}{N^{1/3}} \\ \text{for } (\text{Even } Z, \text{ Even } N), E_p \cong 0 \end{array} \right\}$$

For $Z=6$ to 118, replacing the factor $\left[2 - \left(\frac{N}{Z} \right) \right]$, by $\left(\frac{1}{2} \right)$, we express our revised binding energy relation as,

$$BE \cong \left\{ A - \left\{ \left(\frac{1}{2} \right) + 0.0016 \left[\left(Z^2 + N^2 + \left(\frac{Z^2}{N} \right)^2 \right) - N^2 \left(\frac{N - Z}{N + Z} \right)^2 \right] \right\} - A^{1/3} - \frac{(A_s - A)^2}{A_s} \right\} 10.1 \text{ MeV} \quad (9)$$

where, $\sqrt{\left(\frac{N - Z}{N + Z} \right)^2} \cong \beta \dots (\text{say})$

See Table 2. For the estimated binding energy of isotopes of $Z=6$ to 121 in steps of $Z=6, 11, 16, \dots$. One can understand its best possible scope by considering $Z=121$ and $A=399$. Its estimated binding energy is 2432.9 MeV and reference binding energy is 2427.8 MeV.

Table 2. Estimated binding energy of isotopes of $Z=6, 11, 16, 121$.

Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
6	8	2	-4	12	0.50000	1.08	36.22	37.61	1.39
6	9	3	-3	12	0.33333	0.80	54.23	49.07	-5.16
6	10	4	-2	12	0.20000	0.71	68.68	65.11	-3.58
6	11	5	-1	12	0.09091	0.68	80.93	73.32	-7.61
6	12	6	0	12	0.00000	0.67	91.28	85.36	-5.92
6	13	7	1	12	0.07692	0.68	99.86	90.71	-9.15
6	14	8	2	12	0.14286	0.69	106.72	99.66	-7.06
6	15	9	3	12	0.20000	0.71	111.87	102.72	-9.15
6	16	10	4	12	0.25000	0.73	115.33	109.24	-6.09
6	17	11	5	12	0.29412	0.75	117.10	110.47	-6.63
6	18	12	6	12	0.33333	0.78	117.19	115.09	-2.10

6	19	13	7	12	0.36842	0.80	115.59	114.85	-0.74
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
11	18	7	-4	23	0.22222	1.25	131.77	123.17	-8.60
11	19	8	-3	23	0.15790	1.16	146.21	139.47	-6.74
11	20	9	-2	23	0.10000	1.11	159.41	151.41	-8.00
11	21	10	-1	23	0.04762	1.09	171.50	164.74	-6.75
11	22	11	0	23	0.00000	1.08	182.54	174.18	-8.36
11	23	12	1	23	0.04348	1.09	192.61	185.06	-7.54
11	24	13	2	23	0.08333	1.10	201.71	192.42	-9.29
11	25	14	3	23	0.12000	1.12	209.88	201.26	-8.62
11	26	15	4	23	0.15385	1.15	217.12	206.86	-10.26
11	27	16	5	23	0.18519	1.18	223.45	213.98	-9.47
11	28	17	6	23	0.21429	1.22	228.87	218.08	-10.79
11	29	18	7	23	0.24138	1.25	233.40	223.74	-9.65
11	30	19	8	23	0.26667	1.30	237.02	226.56	-10.46
11	31	20	9	23	0.29032	1.34	239.75	230.96	-8.79
11	32	21	10	23	0.31250	1.38	241.59	232.67	-8.92
11	33	22	11	23	0.33333	1.43	242.54	235.98	-6.56
11	34	23	12	23	0.35294	1.48	242.61	236.73	-5.88
11	35	24	13	23	0.37143	1.53	241.79	239.09	-2.70
11	36	25	14	23	0.38889	1.58	240.08	238.98	-1.10
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
16	28	12	-4	32	0.14286	1.86	228.26	217.38	-10.88
16	29	13	-3	32	0.10345	1.80	240.87	230.01	-10.86
16	30	14	-2	32	0.06667	1.76	252.61	245.52	-7.09
16	31	15	-1	32	0.03226	1.74	263.53	256.10	-7.43
16	32	16	0	32	0.00000	1.73	273.67	269.53	-4.15
16	33	17	1	32	0.03030	1.73	283.07	278.33	-4.74
16	34	18	2	32	0.05882	1.75	291.74	289.94	-1.80
16	35	19	3	32	0.08571	1.77	299.71	297.19	-2.53
16	36	20	4	32	0.11111	1.80	306.98	307.21	0.23
16	37	21	5	32	0.13514	1.84	313.57	313.09	-0.48
16	38	22	6	32	0.15790	1.88	319.48	321.73	2.25
16	39	23	7	32	0.17949	1.93	324.72	326.40	1.68
16	40	24	8	32	0.20000	1.98	329.30	333.80	4.50
16	41	25	9	32	0.21951	2.03	333.21	337.40	4.18
16	42	26	10	32	0.23810	2.09	336.47	343.69	7.22
16	43	27	11	32	0.25581	2.14	339.08	346.34	7.26
16	44	28	12	32	0.27273	2.20	341.03	351.65	10.62
16	45	29	13	32	0.28889	2.27	342.33	353.43	11.10
16	46	30	14	32	0.30435	2.33	342.99	357.86	14.87
16	47	31	15	32	0.31915	2.40	343.00	358.87	15.87
16	48	32	16	32	0.33333	2.47	342.36	362.49	20.13
16	49	33	17	32	0.34694	2.54	341.09	362.80	21.71
16	50	34	18	32	0.36000	2.61	339.17	365.70	26.53
16	51	35	19	32	0.37255	2.68	336.60	365.37	28.77
16	52	36	20	32	0.38462	2.76	333.40	367.61	34.20
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
21	38	17	-4	43	0.10526	2.74	316.30	303.09	-13.22
21	39	18	-3	43	0.07692	2.68	328.81	318.91	-9.90
21	40	19	-2	43	0.05000	2.64	340.64	331.40	-9.24
21	41	20	-1	43	0.02439	2.62	351.84	345.46	-6.38
21	42	21	0	43	0.00000	2.62	362.43	356.36	-6.07
21	43	22	1	43	0.02326	2.62	372.43	368.84	-3.59
21	44	23	2	43	0.04545	2.64	381.86	378.32	-3.54
21	45	24	3	43	0.06667	2.66	390.74	389.39	-1.34
21	46	25	4	43	0.08696	2.70	399.07	397.60	-1.47

21	47	26	5	43	0.10638	2.74	406.87	407.41	0.54
21	48	27	6	43	0.12500	2.78	414.14	414.46	0.33
21	49	28	7	43	0.14286	2.83	420.89	423.12	2.23
21	50	29	8	43	0.16000	2.89	427.13	429.14	2.01
21	51	30	9	43	0.17647	2.95	432.85	436.76	3.90
21	52	31	10	43	0.19231	3.01	438.07	441.83	3.75
21	53	32	11	43	0.20755	3.08	442.79	448.50	5.71
21	54	33	12	43	0.22222	3.15	447.01	452.70	5.69
21	55	34	13	43	0.23636	3.22	450.73	458.51	7.78
21	56	35	14	43	0.25000	3.30	453.96	461.93	7.97
21	57	36	15	43	0.26316	3.38	456.70	466.95	10.25
21	58	37	16	43	0.27586	3.46	458.94	469.64	10.69
21	59	38	17	43	0.28814	3.54	460.70	473.93	13.23
21	60	39	18	43	0.30000	3.62	461.97	475.95	13.98
21	61	40	19	43	0.31148	3.71	462.75	479.57	16.82
21	62	41	20	43	0.32258	3.80	463.05	480.98	17.93
21	63	42	21	43	0.33333	3.89	462.86	483.98	21.12
21	64	43	22	43	0.34375	3.98	462.19	484.82	22.63
21	65	44	23	43	0.35385	4.08	461.04	487.25	26.21
21	66	45	24	43	0.36364	4.17	459.41	487.56	28.16
21	67	46	25	43	0.37313	4.27	457.29	489.46	32.17
21	68	47	26	43	0.38235	4.36	454.70	489.28	34.59
21	69	48	27	43	0.39130	4.46	451.62	490.68	39.06
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
26	48	22	-4	56	0.08333	3.86	397.55	391.95	-5.61
26	49	23	-3	56	0.06122	3.81	410.65	404.88	-5.77
26	50	24	-2	56	0.04000	3.77	423.21	420.38	-2.83
26	51	25	-1	56	0.01961	3.75	435.25	431.93	-3.32
26	52	26	0	56	0.00000	3.74	446.79	446.01	-0.79
26	53	27	1	56	0.01887	3.75	457.86	456.28	-1.58
26	54	28	2	56	0.03704	3.77	468.46	469.07	0.61
26	55	29	3	56	0.05455	3.79	478.61	478.18	-0.43
26	56	30	4	56	0.07143	3.83	488.31	489.78	1.47
26	57	31	5	56	0.08772	3.87	497.58	497.83	0.25
26	58	32	6	56	0.10345	3.92	506.43	508.36	1.93
26	59	33	7	56	0.11864	3.97	514.85	515.43	0.58
26	60	34	8	56	0.13333	4.03	522.86	524.96	2.10
26	61	35	9	56	0.14754	4.10	530.47	531.14	0.67
26	62	36	10	56	0.16129	4.17	537.66	539.75	2.09
26	63	37	11	56	0.17460	4.24	544.46	545.10	0.64
26	64	38	12	56	0.18750	4.32	550.85	552.86	2.01
26	65	39	13	56	0.20000	4.40	556.86	557.45	0.59
26	66	40	14	56	0.21212	4.48	562.47	564.43	1.96
26	67	41	15	56	0.22388	4.57	567.69	568.30	0.62
26	68	42	16	56	0.23529	4.66	572.52	574.55	2.03
26	69	43	17	56	0.24638	4.76	576.96	577.76	0.80
26	70	44	18	56	0.25714	4.85	581.02	583.34	2.32
26	71	45	19	56	0.26761	4.95	584.70	585.94	1.24
26	72	46	20	56	0.27778	5.05	587.99	590.88	2.89
26	73	47	21	56	0.28767	5.15	590.91	592.91	2.00
26	74	48	22	56	0.29730	5.26	593.44	597.25	3.81
26	75	49	23	56	0.30667	5.37	595.60	598.75	3.15
26	76	50	24	56	0.31579	5.48	597.38	602.54	5.17
26	77	51	25	56	0.32468	5.59	598.78	603.54	4.76
26	78	52	26	56	0.33333	5.70	599.81	606.82	7.01
26	79	53	27	56	0.34177	5.81	600.46	607.34	6.88
26	80	54	28	56	0.35000	5.93	600.74	610.13	9.39
26	81	55	29	56	0.35803	6.04	600.64	610.22	9.57
26	82	56	30	56	0.36585	6.16	600.18	612.55	12.37
26	83	57	31	56	0.37349	6.28	599.34	612.22	12.88
26	84	58	32	56	0.38095	6.40	598.13	614.12	16.00

26	85	59	33	56	0.38824	6.52	596.54	613.40	16.86
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
31	58	27	-4	67	0.06897	5.23	481.72	472.08	-9.64
31	59	28	-3	67	0.05085	5.17	494.68	487.85	-6.83
31	60	29	-2	67	0.03333	5.14	507.17	500.75	-6.43
31	61	30	-1	67	0.01639	5.12	519.21	515.24	-3.97
31	62	31	0	67	0.00000	5.11	530.82	526.97	-3.85
31	63	32	1	67	0.01587	5.12	542.00	540.30	-1.71
31	64	33	2	67	0.03125	5.14	552.78	550.94	-1.84
31	65	34	3	67	0.04615	5.16	563.16	563.19	0.03
31	66	35	4	67	0.06061	5.20	573.15	572.83	-0.31
31	67	36	5	67	0.07463	5.24	582.76	584.07	1.32
31	68	37	6	67	0.08824	5.29	591.99	592.79	0.80
31	69	38	7	67	0.10145	5.35	600.86	603.10	2.24
31	70	39	8	67	0.11429	5.41	609.37	610.96	1.59
31	71	40	9	67	0.12676	5.48	617.52	620.40	2.88
31	72	41	10	67	0.13889	5.55	625.32	627.46	2.14
31	73	42	11	67	0.15069	5.63	632.76	636.09	3.33
31	74	43	12	67	0.16216	5.72	639.87	642.40	2.53
31	75	44	13	67	0.17333	5.81	646.63	650.28	3.66
31	76	45	14	67	0.18421	5.90	653.05	655.88	2.84
31	77	46	15	67	0.19481	5.99	659.13	663.06	3.93
31	78	47	16	67	0.20513	6.09	664.88	668.01	3.13
31	79	48	17	67	0.21519	6.19	670.29	674.52	4.23
31	80	49	18	67	0.22500	6.30	675.37	678.86	3.48
31	81	50	19	67	0.23457	6.41	680.13	684.75	4.62
31	82	51	20	67	0.24390	6.52	684.55	688.50	3.95
31	83	52	21	67	0.25301	6.63	688.65	693.82	5.16
31	84	53	22	67	0.26191	6.75	692.43	697.03	4.60
31	85	54	23	67	0.27059	6.87	695.88	701.79	5.91
31	86	55	24	67	0.27907	6.99	699.01	704.49	5.48
31	87	56	25	67	0.28736	7.11	701.82	708.73	6.92
31	88	57	26	67	0.29546	7.24	704.30	710.95	6.64
31	89	58	27	67	0.30337	7.36	706.47	714.70	8.23
31	90	59	28	67	0.31111	7.49	708.32	716.46	8.14
31	91	60	29	67	0.31868	7.62	709.85	719.76	9.91
31	92	61	30	67	0.32609	7.76	711.06	721.08	10.02
31	93	62	31	67	0.33333	7.89	711.96	723.94	11.98
31	94	63	32	67	0.34043	8.02	712.54	724.85	12.31
31	95	64	33	67	0.34737	8.16	712.80	727.30	14.49
31	96	65	34	67	0.35417	8.30	712.75	727.82	15.07
31	97	66	35	67	0.36083	8.44	712.39	729.87	17.49
31	98	67	36	67	0.36735	8.58	711.71	730.03	18.32
31	99	68	37	67	0.37374	8.72	710.72	731.71	20.99
31	100	69	38	67	0.38000	8.87	709.42	731.52	22.10
31	101	70	39	67	0.38614	9.01	707.80	732.84	25.04
31	102	71	40	67	0.39216	9.16	705.87	732.32	26.45
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
36	68	32	-4	80	0.05882	6.83	558.41	554.20	-4.20
36	69	33	-3	80	0.04348	6.78	571.72	567.44	-4.28
36	70	34	-2	80	0.02857	6.75	584.61	583.05	-1.57
36	71	35	-1	80	0.01408	6.73	597.11	595.22	-1.89
36	72	36	0	80	0.00000	6.72	609.22	609.74	0.52
36	73	37	1	80	0.01370	6.73	620.96	620.92	-0.05
36	74	38	2	80	0.02703	6.74	632.34	634.42	2.08
36	75	39	3	80	0.04000	6.77	643.37	644.67	1.30
36	76	40	4	80	0.05263	6.81	654.06	657.24	3.18
36	77	41	5	80	0.06494	6.85	664.41	666.62	2.21
36	78	42	6	80	0.07692	6.90	674.42	678.29	3.87

36	79	43	7	80	0.08861	6.96	684.12	686.86	2.74
36	80	44	8	80	0.10000	7.03	693.49	697.71	4.22
36	81	45	9	80	0.11111	7.10	702.56	705.51	2.96
36	82	46	10	80	0.12195	7.18	711.31	715.58	4.27
36	83	47	11	80	0.13253	7.26	719.76	722.67	2.91
36	84	48	12	80	0.14286	7.35	727.90	732.01	4.11
36	85	49	13	80	0.15294	7.44	735.75	738.42	2.68
36	86	50	14	80	0.16279	7.54	743.29	747.07	3.77
36	87	51	15	80	0.17241	7.64	750.55	752.85	2.30
36	88	52	16	80	0.18182	7.75	757.51	760.84	3.33
36	89	53	17	80	0.19101	7.86	764.19	766.02	1.83
36	90	54	18	80	0.20000	7.97	770.57	773.40	2.83
36	91	55	19	80	0.20879	8.09	776.68	778.01	1.34
36	92	56	20	80	0.21739	8.21	782.49	784.81	2.32
36	93	57	21	80	0.22581	8.33	788.03	788.89	0.86
36	94	58	22	80	0.23404	8.46	793.29	795.14	1.86
36	95	59	23	80	0.24211	8.59	798.26	798.71	0.45
36	96	60	24	80	0.25000	8.72	802.96	804.44	1.48
36	97	61	25	80	0.25773	8.85	807.38	807.53	0.15
36	98	62	26	80	0.26531	8.99	811.53	812.77	1.24
36	99	63	27	80	0.27273	9.13	815.40	815.40	0.00
36	100	64	28	80	0.28000	9.27	819.00	820.16	1.17
36	101	65	29	80	0.28713	9.41	822.32	822.36	0.04
36	102	66	30	80	0.29412	9.56	825.38	826.68	1.31
36	103	67	31	80	0.30097	9.70	828.16	828.47	0.31
36	104	68	32	80	0.30769	9.85	830.67	832.36	1.69
36	105	69	33	80	0.31429	10.00	832.91	833.76	0.85
36	106	70	34	80	0.32076	10.16	834.89	837.25	2.36
36	107	71	35	80	0.32710	10.31	836.59	838.27	1.68
36	108	72	36	80	0.33333	10.46	838.03	841.38	3.35
36	109	73	37	80	0.33945	10.62	839.20	842.04	2.84
36	110	74	38	80	0.34546	10.78	840.10	844.78	4.68
36	111	75	39	80	0.35135	10.94	840.74	845.10	4.37
36	112	76	40	80	0.35714	11.10	841.11	847.49	6.38
36	113	77	41	80	0.36283	11.26	841.21	847.49	6.27
36	114	78	42	80	0.36842	11.43	841.06	849.53	8.48
36	115	79	43	80	0.37391	11.59	840.63	849.23	8.59
36	116	80	44	80	0.37931	11.76	839.94	850.95	11.01
36	117	81	45	80	0.38462	11.93	838.99	850.34	11.35
36	118	82	46	80	0.38983	12.10	837.78	851.76	13.98
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
41	78	37	-4	93	0.05128	8.68	632.58	627.91	-4.67
41	79	38	-3	93	0.03797	8.63	646.14	643.74	-2.40
41	80	39	-2	93	0.02500	8.59	659.33	656.98	-2.34
41	81	40	-1	93	0.01235	8.57	672.15	671.81	-0.34
41	82	41	0	93	0.00000	8.57	684.64	684.12	-0.51
41	83	42	1	93	0.01205	8.57	696.78	698.02	1.24
41	84	43	2	93	0.02381	8.59	708.60	709.45	0.86
41	85	44	3	93	0.03529	8.62	720.09	722.46	2.37
41	86	45	4	93	0.04651	8.66	731.28	733.07	1.79
41	87	46	5	93	0.05747	8.70	742.16	745.25	3.09
41	88	47	6	93	0.06818	8.75	752.74	755.08	2.34
41	89	48	7	93	0.07865	8.82	763.03	766.48	3.45
41	90	49	8	93	0.08889	8.88	773.03	775.57	2.54
41	91	50	9	93	0.09890	8.96	782.75	786.23	3.48
41	92	51	10	93	0.10870	9.04	792.19	794.63	2.44
41	93	52	11	93	0.11828	9.13	801.35	804.59	3.24
41	94	53	12	93	0.12766	9.22	810.24	812.34	2.09
41	95	54	13	93	0.13684	9.32	818.87	821.63	2.76
41	96	55	14	93	0.14583	9.42	827.22	828.75	1.53
41	97	56	15	93	0.15464	9.53	835.31	837.42	2.11

41	98	57	16	93	0.16327	9.64	843.15	843.95	0.81
41	99	58	17	93	0.17172	9.76	850.72	852.03	1.31
41	100	59	18	93	0.18000	9.88	858.04	858.00	-0.03
41	101	60	19	93	0.18812	10.00	865.10	865.51	0.41
41	102	61	20	93	0.19608	10.13	871.91	870.95	-0.96
41	103	62	21	93	0.20388	10.26	878.46	877.92	-0.55
41	104	63	22	93	0.21154	10.40	884.77	882.85	-1.92
41	105	64	23	93	0.21905	10.53	890.83	889.31	-1.52
41	106	65	24	93	0.22642	10.67	896.65	893.77	-2.88
41	107	66	25	93	0.23365	10.82	902.22	899.74	-2.48
41	108	67	26	93	0.24074	10.96	907.54	903.73	-3.81
41	109	68	27	93	0.24771	11.11	912.62	909.24	-3.38
41	110	69	28	93	0.25455	11.26	917.46	912.80	-4.67
41	111	70	29	93	0.26126	11.42	922.06	917.86	-4.20
41	112	71	30	93	0.26786	11.57	926.42	921.00	-5.42
41	113	72	31	93	0.27434	11.73	930.54	925.64	-4.90
41	114	73	32	93	0.28070	11.89	934.42	928.38	-6.04
41	115	74	33	93	0.28696	12.06	938.06	932.61	-5.45
41	116	75	34	93	0.29310	12.22	941.47	934.97	-6.50
41	117	76	35	93	0.29915	12.39	944.64	938.82	-5.82
41	118	77	36	93	0.30509	12.56	947.57	940.81	-6.76
41	119	78	37	93	0.31092	12.73	950.27	944.29	-5.98
41	120	79	38	93	0.31667	12.90	952.74	945.94	-6.80
41	121	80	39	93	0.32231	13.07	954.97	949.06	-5.91
41	122	81	40	93	0.32787	13.25	956.97	950.37	-6.60
41	123	82	41	93	0.33333	13.43	958.74	953.15	-5.59
41	124	83	42	93	0.33871	13.60	960.27	954.14	-6.13
41	125	84	43	93	0.34400	13.78	961.57	956.59	-4.98
41	126	85	44	93	0.34921	13.97	962.65	957.27	-5.37
41	127	86	45	93	0.35433	14.15	963.49	959.42	-4.07
41	128	87	46	93	0.35938	14.33	964.10	959.80	-4.30
41	129	88	47	93	0.36434	14.52	964.48	961.64	-2.84
41	130	89	48	93	0.36923	14.71	964.63	961.74	-2.89
41	131	90	49	93	0.37405	14.89	964.55	963.29	-1.26
41	132	91	50	93	0.37879	15.08	964.24	963.12	-1.12
41	133	92	51	93	0.38346	15.27	963.71	964.39	0.69
41	134	93	52	93	0.38806	15.47	962.94	963.95	1.01
41	135	94	53	93	0.39259	15.66	961.95	964.96	3.01
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
46	88	42	-4	106	0.04545	10.76	704.29	703.09	-1.21
46	89	43	-3	106	0.03371	10.72	718.05	716.60	-1.44
46	90	44	-2	106	0.02222	10.68	731.46	732.35	0.89
46	91	45	-1	106	0.01099	10.66	744.54	745.00	0.46
46	92	46	0	106	0.00000	10.66	757.30	759.86	2.56
46	93	47	1	106	0.01075	10.66	769.75	771.69	1.94
46	94	48	2	106	0.02128	10.68	781.89	785.72	3.82
46	95	49	3	106	0.03158	10.71	793.74	796.77	3.02
46	96	50	4	106	0.04167	10.74	805.31	810.00	4.69
46	97	51	5	106	0.05155	10.79	816.59	820.32	3.73
46	98	52	6	106	0.06122	10.85	827.60	832.81	5.20
46	99	53	7	106	0.07071	10.91	838.34	842.42	4.09
46	100	54	8	106	0.08000	10.98	848.81	854.20	5.39
46	101	55	9	106	0.08911	11.06	859.02	863.15	4.13
46	102	56	10	106	0.09804	11.14	868.98	874.25	5.27
46	103	57	11	106	0.10680	11.23	878.68	882.58	3.90
46	104	58	12	106	0.11539	11.33	888.13	893.03	4.90
46	105	59	13	106	0.12381	11.43	897.34	900.76	3.43
46	106	60	14	106	0.13208	11.54	906.30	910.61	4.31
46	107	61	15	106	0.14019	11.65	915.02	917.76	2.75
46	108	62	16	106	0.14815	11.76	923.50	927.02	3.53
46	109	63	17	106	0.15596	11.89	931.74	933.64	1.89

46	110	64	18	106	0.16364	12.01	939.75	942.34	2.59
46	111	65	19	106	0.17117	12.14	947.53	948.44	0.90
46	112	66	20	106	0.17857	12.28	955.08	956.61	1.53
46	113	67	21	106	0.18584	12.42	962.40	962.21	-0.19
46	114	68	22	106	0.19298	12.56	969.50	969.88	0.38
46	115	69	23	106	0.20000	12.70	976.36	975.01	-1.36
46	116	70	24	106	0.20690	12.85	983.01	982.19	-0.82
46	117	71	25	106	0.21368	13.00	989.43	986.87	-2.56
46	118	72	26	106	0.22034	13.16	995.63	993.59	-2.04
46	119	73	27	106	0.22689	13.32	1001.61	997.83	-3.78
46	120	74	28	106	0.23333	13.48	1007.38	1004.11	-3.27
46	121	75	29	106	0.23967	13.64	1012.92	1007.94	-4.98
46	122	76	30	106	0.24590	13.81	1018.25	1013.79	-4.46
46	123	77	31	106	0.25203	13.98	1023.36	1017.22	-6.14
46	124	78	32	106	0.25807	14.15	1028.26	1022.67	-5.59
46	125	79	33	106	0.26400	14.32	1032.94	1025.72	-7.22
46	126	80	34	106	0.26984	14.50	1037.41	1030.77	-6.64
46	127	81	35	106	0.27559	14.68	1041.67	1033.46	-8.21
46	128	82	36	106	0.28125	14.86	1045.71	1038.14	-7.58
46	129	83	37	106	0.28682	15.04	1049.55	1040.48	-9.07
46	130	84	38	106	0.29231	15.23	1053.17	1044.79	-8.38
46	131	85	39	106	0.29771	15.41	1056.59	1046.79	-9.79
46	132	86	40	106	0.30303	15.60	1059.79	1050.76	-9.03
46	133	87	41	106	0.30827	15.79	1062.79	1052.44	-10.35
46	134	88	42	106	0.31343	15.98	1065.58	1056.08	-9.50
46	135	89	43	106	0.31852	16.18	1068.16	1057.44	-10.72
46	136	90	44	106	0.32353	16.37	1070.53	1060.76	-9.78
46	137	91	45	106	0.32847	16.57	1072.70	1061.83	-10.88
46	138	92	46	106	0.33333	16.77	1074.66	1064.83	-9.83
46	139	93	47	106	0.33813	16.97	1076.42	1065.61	-10.81
46	140	94	48	106	0.34286	17.17	1077.97	1068.32	-9.65
46	141	95	49	106	0.34752	17.38	1079.32	1068.82	-10.50
46	142	96	50	106	0.35211	17.58	1080.46	1071.24	-9.22
46	143	97	51	106	0.35664	17.79	1081.40	1071.47	-9.92
46	144	98	52	106	0.36111	17.99	1082.13	1073.62	-8.52
46	145	99	53	106	0.36552	18.20	1082.66	1073.59	-9.07
46	146	100	54	106	0.36986	18.41	1082.99	1075.47	-7.52
46	147	101	55	106	0.37415	18.62	1083.12	1075.20	-7.92
46	148	102	56	106	0.37838	18.84	1083.04	1076.81	-6.23
46	149	103	57	106	0.38255	19.05	1082.76	1076.30	-6.46
46	150	104	58	106	0.38667	19.27	1082.28	1077.67	-4.61
46	151	105	59	106	0.39073	19.48	1081.60	1076.92	-4.68
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
51	98	47	-4	119	0.04082	13.09	773.59	770.20	-3.40
51	99	48	-3	119	0.03030	13.04	787.50	786.13	-1.36
51	100	49	-2	119	0.02000	13.01	801.08	799.68	-1.40
51	101	50	-1	119	0.00990	12.99	814.36	814.79	0.43
51	102	51	0	119	0.00000	12.98	827.34	827.56	0.22
51	103	52	1	119	0.00971	12.99	840.02	841.88	1.86
51	104	53	2	119	0.01923	13.01	852.43	853.91	1.48
51	105	54	3	119	0.02857	13.04	864.56	867.48	2.93
51	106	55	4	119	0.03774	13.07	876.42	878.81	2.39
51	107	56	5	119	0.04673	13.12	888.02	891.67	3.65
51	108	57	6	119	0.05556	13.18	899.36	902.32	2.96
51	109	58	7	119	0.06422	13.24	910.45	914.51	4.06
51	110	59	8	119	0.07273	13.31	921.29	924.52	3.24
51	111	60	9	119	0.08108	13.39	931.89	936.07	4.18
51	112	61	10	119	0.08929	13.48	942.24	945.47	3.23
51	113	62	11	119	0.09735	13.57	952.36	956.39	4.03
51	114	63	12	119	0.10526	13.67	962.25	965.21	2.96
51	115	64	13	119	0.11304	13.77	971.91	975.55	3.64

51	116	65	14	119	0.12069	13.89	981.34	983.81	2.47
51	117	66	15	119	0.12821	14.00	990.55	993.59	3.04
51	118	67	16	119	0.13559	14.12	999.53	1001.31	1.78
51	119	68	17	119	0.14286	14.25	1008.30	1010.55	2.25
51	120	69	18	119	0.15000	14.38	1016.85	1017.77	0.92
51	121	70	19	119	0.15703	14.52	1025.18	1026.49	1.31
51	122	71	20	119	0.16393	14.66	1033.30	1033.22	-0.08
51	123	72	21	119	0.17073	14.80	1041.21	1041.45	0.24
51	124	73	22	119	0.17742	14.95	1048.91	1047.71	-1.20
51	125	74	23	119	0.18400	15.10	1056.40	1055.47	-0.94
51	126	75	24	119	0.19048	15.26	1063.69	1061.28	-2.41
51	127	76	25	119	0.19685	15.42	1070.77	1068.58	-2.19
51	128	77	26	119	0.20313	15.58	1077.64	1073.96	-3.68
51	129	78	27	119	0.20930	15.75	1084.32	1080.83	-3.49
51	130	79	28	119	0.21539	15.92	1090.79	1085.79	-5.00
51	131	80	29	119	0.22137	16.09	1097.06	1092.24	-4.82
51	132	81	30	119	0.22727	16.27	1103.14	1096.81	-6.33
51	133	82	31	119	0.23308	16.45	1109.01	1102.85	-6.16
51	134	83	32	119	0.23881	16.63	1114.69	1107.04	-7.65
51	135	84	33	119	0.24444	16.81	1120.17	1112.70	-7.48
51	136	85	34	119	0.25000	17.00	1125.46	1116.52	-8.94
51	137	86	35	119	0.25547	17.19	1130.55	1121.80	-8.75
51	138	87	36	119	0.26087	17.38	1135.45	1125.27	-10.18
51	139	88	37	119	0.26619	17.57	1140.16	1130.19	-9.96
51	140	89	38	119	0.27143	17.77	1144.67	1133.32	-11.35
51	141	90	39	119	0.27660	17.97	1148.99	1137.90	-11.09
51	142	91	40	119	0.28169	18.17	1153.12	1140.69	-12.43
51	143	92	41	119	0.28671	18.37	1157.06	1144.94	-12.12
51	144	93	42	119	0.29167	18.57	1160.81	1147.42	-13.39
51	145	94	43	119	0.29655	18.78	1164.38	1151.34	-13.03
51	146	95	44	119	0.30137	18.99	1167.75	1153.52	-14.23
51	147	96	45	119	0.30612	19.20	1170.94	1157.13	-13.80
51	148	97	46	119	0.31081	19.41	1173.93	1159.02	-14.92
51	149	98	47	119	0.31544	19.63	1176.75	1162.33	-14.42
51	150	99	48	119	0.32000	19.84	1179.37	1163.93	-15.44
51	151	100	49	119	0.32450	20.06	1181.81	1166.95	-14.86
51	152	101	50	119	0.32895	20.28	1184.06	1168.27	-15.79
51	153	102	51	119	0.33333	20.50	1186.13	1171.02	-15.11
51	154	103	52	119	0.33766	20.72	1188.01	1172.07	-15.94
51	155	104	53	119	0.34194	20.94	1189.71	1174.55	-15.16
51	156	105	54	119	0.34615	21.17	1191.22	1175.35	-15.87
51	157	106	55	119	0.35032	21.40	1192.55	1177.56	-14.99
51	158	107	56	119	0.35443	21.62	1193.70	1178.11	-15.59
51	159	108	57	119	0.35849	21.85	1194.66	1180.07	-14.59
51	160	109	58	119	0.36250	22.08	1195.44	1180.38	-15.06
51	161	110	59	119	0.36646	22.32	1196.04	1182.10	-13.94
51	162	111	60	119	0.37037	22.55	1196.46	1182.18	-14.28
51	163	112	61	119	0.37423	22.78	1196.69	1183.66	-13.04
51	164	113	62	119	0.37805	23.02	1196.75	1183.51	-13.24
51	165	114	63	119	0.38182	23.26	1196.62	1184.76	-11.86
51	166	115	64	119	0.38554	23.49	1196.31	1184.39	-11.91
51	167	116	65	119	0.38922	23.73	1195.82	1185.42	-10.40
51	168	117	66	119	0.39286	23.97	1195.15	1184.84	-10.30
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
56	108	52	-4	132	0.03704	15.66	840.49	838.49	-2.00
56	109	53	-3	132	0.02752	15.61	854.51	852.27	-2.25
56	110	54	-2	132	0.01818	15.58	868.24	868.16	-0.08
56	111	55	-1	132	0.00901	15.56	881.67	881.20	-0.47
56	112	56	0	132	0.00000	15.55	894.83	896.35	1.52
56	113	57	1	132	0.00885	15.56	907.71	908.69	0.98
56	114	58	2	132	0.01754	15.58	920.32	923.12	2.80

56	115	59	3	132	0.02609	15.60	932.67	934.79	2.12
56	116	60	4	132	0.03448	15.64	944.77	948.54	3.77
56	117	61	5	132	0.04274	15.69	956.63	959.58	2.95
56	118	62	6	132	0.05085	15.75	968.23	972.68	4.44
56	119	63	7	132	0.05882	15.81	979.60	983.10	3.49
56	120	64	8	132	0.06667	15.88	990.74	995.57	4.83
56	121	65	9	132	0.07438	15.96	1001.64	1005.40	3.76
56	122	66	10	132	0.08197	16.05	1012.32	1017.28	4.96
56	123	67	11	132	0.08943	16.15	1022.78	1026.56	3.78
56	124	68	12	132	0.09677	16.25	1033.02	1037.86	4.85
56	125	69	13	132	0.10400	16.36	1043.04	1046.60	3.56
56	126	70	14	132	0.11111	16.47	1052.84	1057.36	4.51
56	127	71	15	132	0.11811	16.59	1062.44	1065.58	3.14
56	128	72	16	132	0.12500	16.72	1071.83	1075.81	3.98
56	129	73	17	132	0.13178	16.85	1081.01	1083.53	2.52
56	130	74	18	132	0.13846	16.98	1089.98	1093.26	3.27
56	131	75	19	132	0.14504	17.13	1098.76	1100.51	1.75
56	132	76	20	132	0.15152	17.27	1107.33	1109.75	2.41
56	133	77	21	132	0.15790	17.42	1115.71	1116.54	0.83
56	134	78	22	132	0.16418	17.58	1123.89	1125.31	1.42
56	135	79	23	132	0.17037	17.73	1131.88	1131.67	-0.21
56	136	80	24	132	0.17647	17.90	1139.67	1139.99	0.32
56	137	81	25	132	0.18248	18.06	1147.27	1145.92	-1.35
56	138	82	26	132	0.18841	18.23	1154.69	1153.81	-0.87
56	139	83	27	132	0.19425	18.41	1161.91	1159.34	-2.57
56	140	84	28	132	0.20000	18.59	1168.94	1166.81	-2.13
56	141	85	29	132	0.20567	18.77	1175.79	1171.94	-3.85
56	142	86	30	132	0.21127	18.95	1182.46	1179.02	-3.44
56	143	87	31	132	0.21678	19.14	1188.93	1183.77	-5.16
56	144	88	32	132	0.22222	19.33	1195.23	1190.46	-4.77
56	145	89	33	132	0.22759	19.52	1201.34	1194.85	-6.49
56	146	90	34	132	0.23288	19.72	1207.27	1201.17	-6.11
56	147	91	35	132	0.23810	19.92	1213.03	1205.21	-7.82
56	148	92	36	132	0.24324	20.12	1218.60	1211.16	-7.44
56	149	93	37	132	0.24832	20.32	1223.99	1214.86	-9.13
56	150	94	38	132	0.25333	20.53	1229.21	1220.47	-8.74
56	151	95	39	132	0.25828	20.74	1234.24	1223.84	-10.40
56	152	96	40	132	0.26316	20.95	1239.10	1229.11	-9.99
56	153	97	41	132	0.26797	21.16	1243.79	1232.17	-11.61
56	154	98	42	132	0.27273	21.38	1248.30	1237.12	-11.18
56	155	99	43	132	0.27742	21.60	1252.63	1239.87	-12.76
56	156	100	44	132	0.28205	21.82	1256.79	1244.51	-12.29
56	157	101	45	132	0.28662	22.04	1260.78	1246.96	-13.81
56	158	102	46	132	0.29114	22.27	1264.59	1251.29	-13.30
56	159	103	47	132	0.29560	22.49	1268.23	1253.47	-14.77
56	160	104	48	132	0.30000	22.72	1271.70	1257.50	-14.20
56	161	105	49	132	0.30435	22.95	1275.00	1259.40	-15.60
56	162	106	50	132	0.30864	23.18	1278.13	1263.15	-14.98
56	163	107	51	132	0.31288	23.42	1281.08	1264.78	-16.30
56	164	108	52	132	0.31707	23.65	1283.87	1268.25	-15.62
56	165	109	53	132	0.32121	23.89	1286.49	1269.63	-16.86
56	166	110	54	132	0.32530	24.13	1288.93	1272.83	-16.10
56	167	111	55	132	0.32934	24.37	1291.21	1273.96	-17.26
56	168	112	56	132	0.33333	24.61	1293.32	1276.90	-16.42
56	169	113	57	132	0.33728	24.86	1295.26	1277.78	-17.48
56	170	114	58	132	0.34118	25.10	1297.04	1280.48	-16.55
56	171	115	59	132	0.34503	25.35	1298.64	1281.12	-17.52
56	172	116	60	132	0.34884	25.60	1300.08	1283.58	-16.50
56	173	117	61	132	0.35260	25.85	1301.35	1283.99	-17.36
56	174	118	62	132	0.35632	26.10	1302.46	1286.21	-16.24
56	175	119	63	132	0.36000	26.35	1303.40	1286.41	-16.99
56	176	120	64	132	0.36364	26.60	1304.17	1288.39	-15.77
56	177	121	65	132	0.36723	26.86	1304.78	1288.37	-16.40

56	178	122	66	132	0.37079	27.12	1305.22	1290.14	-15.08
56	179	123	67	132	0.37430	27.37	1305.49	1289.91	-15.58
56	180	124	68	132	0.37778	27.63	1305.60	1291.46	-14.14
56	181	125	69	132	0.38122	27.89	1305.55	1291.03	-14.52
56	182	126	70	132	0.38462	28.15	1305.33	1292.37	-12.97
56	183	127	71	132	0.38798	28.42	1304.95	1291.74	-13.21
56	184	128	72	132	0.39130	28.68	1304.40	1292.87	-11.53
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
61	118	57	-4	145	0.03390	18.46	904.99	899.04	-5.95
61	119	58	-3	145	0.02521	18.42	919.11	915.10	-4.01
61	120	59	-2	145	0.01667	18.39	932.95	928.92	-4.03
61	121	60	-1	145	0.00826	18.37	946.52	944.27	-2.25
61	122	61	0	145	0.00000	18.36	959.82	957.42	-2.40
61	123	62	1	145	0.00813	18.37	972.85	972.09	-0.76
61	124	63	2	145	0.01613	18.38	985.64	984.60	-1.04
61	125	64	3	145	0.02400	18.41	998.18	998.62	0.44
61	126	65	4	145	0.03175	18.45	1010.47	1010.51	0.04
61	127	66	5	145	0.03937	18.50	1022.53	1023.91	1.38
61	128	67	6	145	0.04688	18.56	1034.36	1035.21	0.85
61	129	68	7	145	0.05426	18.62	1045.96	1048.02	2.06
61	130	69	8	145	0.06154	18.70	1057.34	1058.75	1.41
61	131	70	9	145	0.06870	18.78	1068.50	1070.98	2.48
61	132	71	10	145	0.07576	18.87	1079.44	1081.17	1.73
61	133	72	11	145	0.08271	18.96	1090.17	1092.85	2.68
61	134	73	12	145	0.08955	19.07	1100.69	1102.51	1.82
61	135	74	13	145	0.09630	19.18	1111.01	1113.66	2.65
61	136	75	14	145	0.10294	19.30	1121.12	1122.82	1.70
61	137	76	15	145	0.10949	19.42	1131.04	1133.46	2.43
61	138	77	16	145	0.11594	19.55	1140.75	1142.13	1.38
61	139	78	17	145	0.12230	19.68	1150.27	1152.29	2.02
61	140	79	18	145	0.12857	19.82	1159.59	1160.49	0.90
61	141	80	19	145	0.13475	19.97	1168.73	1170.17	1.44
61	142	81	20	145	0.14085	20.12	1177.67	1177.93	0.25
61	143	82	21	145	0.14685	20.27	1186.43	1187.15	0.72
61	144	83	22	145	0.15278	20.43	1195.00	1194.48	-0.53
61	145	84	23	145	0.15862	20.60	1203.39	1203.26	-0.13
61	146	85	24	145	0.16438	20.77	1211.60	1210.17	-1.43
61	147	86	25	145	0.17007	20.94	1219.62	1218.53	-1.09
61	148	87	26	145	0.17568	21.12	1227.47	1225.03	-2.43
61	149	88	27	145	0.18121	21.30	1235.13	1232.99	-2.14
61	150	89	28	145	0.18667	21.48	1242.62	1239.10	-3.52
61	151	90	29	145	0.19205	21.67	1249.94	1246.66	-3.28
61	152	91	30	145	0.19737	21.86	1257.08	1252.40	-4.68
61	153	92	31	145	0.20261	22.06	1264.04	1259.58	-4.46
61	154	93	32	145	0.20779	22.26	1270.84	1264.95	-5.89
61	155	94	33	145	0.21290	22.46	1277.46	1271.76	-5.70
61	156	95	34	145	0.21795	22.66	1283.91	1276.79	-7.13
61	157	96	35	145	0.22293	22.87	1290.19	1283.24	-6.95
61	158	97	36	145	0.22785	23.08	1296.31	1287.93	-8.38
61	159	98	37	145	0.23270	23.29	1302.26	1294.04	-8.22
61	160	99	38	145	0.23750	23.51	1308.04	1298.39	-9.64
61	161	100	39	145	0.24224	23.73	1313.65	1304.17	-9.48
61	162	101	40	145	0.24691	23.95	1319.10	1308.21	-10.89
61	163	102	41	145	0.25153	24.18	1324.38	1313.67	-10.71
61	164	103	42	145	0.25610	24.40	1329.50	1317.40	-12.10
61	165	104	43	145	0.26061	24.63	1334.46	1322.54	-11.91
61	166	105	44	145	0.26506	24.86	1339.25	1325.98	-13.28
61	167	106	45	145	0.26946	25.10	1343.88	1330.82	-13.06
61	168	107	46	145	0.27381	25.33	1348.35	1333.96	-14.39
61	169	108	47	145	0.27811	25.57	1352.66	1338.51	-14.15
61	170	109	48	145	0.28235	25.81	1356.81	1341.38	-15.44

61	171	110	49	145	0.28655	26.05	1360.80	1345.64	-15.16
61	172	111	50	145	0.29070	26.30	1364.63	1348.23	-16.40
61	173	112	51	145	0.29480	26.55	1368.30	1352.22	-16.08
61	174	113	52	145	0.29885	26.79	1371.81	1354.55	-17.26
61	175	114	53	145	0.30286	27.04	1375.17	1358.28	-16.89
61	176	115	54	145	0.30682	27.30	1378.36	1360.35	-18.01
61	177	116	55	145	0.31073	27.55	1381.40	1363.81	-17.59
61	178	117	56	145	0.31461	27.81	1384.29	1365.64	-18.65
61	179	118	57	145	0.31844	28.06	1387.01	1368.85	-18.16
61	180	119	58	145	0.32222	28.32	1389.58	1370.44	-19.15
61	181	120	59	145	0.32597	28.58	1392.00	1373.40	-18.59
61	182	121	60	145	0.32967	28.85	1394.26	1374.76	-19.50
61	183	122	61	145	0.33333	29.11	1396.36	1377.48	-18.88
61	184	123	62	145	0.33696	29.38	1398.31	1378.61	-19.70
61	185	124	63	145	0.34054	29.64	1400.11	1381.11	-19.00
61	186	125	64	145	0.34409	29.91	1401.75	1382.01	-19.74
61	187	126	65	145	0.34759	30.18	1403.24	1384.28	-18.95
61	188	127	66	145	0.35106	30.45	1404.57	1384.97	-19.60
61	189	128	67	145	0.35450	30.73	1405.76	1387.03	-18.73
61	190	129	68	145	0.35790	31.00	1406.78	1387.51	-19.27
61	191	130	69	145	0.36126	31.28	1407.66	1389.35	-18.31
61	192	131	70	145	0.36458	31.55	1408.39	1389.63	-18.75
61	193	132	71	145	0.36788	31.83	1408.96	1391.27	-17.69
61	194	133	72	145	0.37113	32.11	1409.38	1391.35	-18.03
61	195	134	73	145	0.37436	32.39	1409.65	1392.78	-16.87
61	196	135	74	145	0.37755	32.67	1409.77	1392.67	-17.10
61	197	136	75	145	0.38071	32.96	1409.73	1393.91	-15.82
61	198	137	76	145	0.38384	33.24	1409.55	1393.61	-15.94
61	199	138	77	145	0.38694	33.53	1409.21	1394.66	-14.56
61	200	139	78	145	0.39000	33.81	1408.73	1394.18	-14.55
61	201	140	79	145	0.39304	34.10	1408.09	1395.04	-13.06
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
66	128	62	-4	160	0.03125	21.51	959.99	960.60	0.61
66	129	63	-3	160	0.02326	21.47	974.40	974.61	0.21
66	130	64	-2	160	0.01538	21.43	988.54	990.65	2.11
66	131	65	-1	160	0.00763	21.41	1002.43	1004.03	1.60
66	132	66	0	160	0.00000	21.41	1016.06	1019.42	3.37
66	133	67	1	160	0.00752	21.41	1029.44	1032.19	2.75
66	134	68	2	160	0.01493	21.43	1042.58	1046.96	4.38
66	135	69	3	160	0.02222	21.46	1055.49	1059.13	3.64
66	136	70	4	160	0.02941	21.50	1068.16	1073.30	5.14
66	137	71	5	160	0.03650	21.55	1080.62	1084.91	4.29
66	138	72	6	160	0.04348	21.60	1092.85	1098.50	5.66
66	139	73	7	160	0.05036	21.67	1104.86	1109.56	4.70
66	140	74	8	160	0.05714	21.75	1116.66	1122.60	5.94
66	141	75	9	160	0.06383	21.83	1128.26	1133.14	4.88
66	142	76	10	160	0.07042	21.92	1139.65	1145.64	5.99
66	143	77	11	160	0.07692	22.02	1150.83	1155.67	4.84
66	144	78	12	160	0.08333	22.13	1161.82	1167.66	5.83
66	145	79	13	160	0.08966	22.24	1172.62	1177.20	4.59
66	146	80	14	160	0.09589	22.36	1183.22	1188.69	5.47
66	147	81	15	160	0.10204	22.49	1193.63	1197.77	4.14
66	148	82	16	160	0.10811	22.62	1203.85	1208.77	4.92
66	149	83	17	160	0.11409	22.76	1213.89	1217.39	3.51
66	150	84	18	160	0.12000	22.90	1223.74	1227.94	4.20
66	151	85	19	160	0.12583	23.05	1233.41	1236.12	2.71
66	152	86	20	160	0.13158	23.20	1242.91	1246.22	3.32
66	153	87	21	160	0.13726	23.36	1252.22	1253.98	1.76
66	154	88	22	160	0.14286	23.53	1261.36	1263.65	2.29
66	155	89	23	160	0.14839	23.70	1270.33	1271.00	0.67
66	156	90	24	160	0.15385	23.87	1279.12	1280.25	1.13

66	157	91	25	160	0.15924	24.05	1287.75	1287.20	-0.54
66	158	92	26	160	0.16456	24.23	1296.20	1296.05	-0.15
66	159	93	27	160	0.16981	24.42	1304.49	1302.62	-1.86
66	160	94	28	160	0.17500	24.61	1312.61	1311.08	-1.53
66	161	95	29	160	0.18012	24.81	1320.56	1317.29	-3.28
66	162	96	30	160	0.18519	25.00	1328.35	1325.36	-2.99
66	163	97	31	160	0.19018	25.21	1335.98	1331.21	-4.77
66	164	98	32	160	0.19512	25.41	1343.44	1338.92	-4.52
66	165	99	33	160	0.20000	25.62	1350.75	1344.42	-6.33
66	166	100	34	160	0.20482	25.83	1357.89	1351.78	-6.11
66	167	101	35	160	0.20958	26.05	1364.88	1356.95	-7.93
66	168	102	36	160	0.21429	26.27	1371.71	1363.96	-7.75
66	169	103	37	160	0.21894	26.49	1378.38	1368.80	-9.58
66	170	104	38	160	0.22353	26.72	1384.89	1375.48	-9.41
66	171	105	39	160	0.22807	26.95	1391.25	1380.01	-11.24
66	172	106	40	160	0.23256	27.18	1397.45	1386.37	-11.09
66	173	107	41	160	0.23699	27.41	1403.50	1390.59	-12.92
66	174	108	42	160	0.24138	27.65	1409.40	1396.63	-12.77
66	175	109	43	160	0.24571	27.89	1415.15	1400.56	-14.59
66	176	110	44	160	0.25000	28.13	1420.74	1406.30	-14.44
66	177	111	45	160	0.25424	28.37	1426.18	1409.94	-16.24
66	178	112	46	160	0.25843	28.62	1431.47	1415.39	-16.09
66	179	113	47	160	0.26257	28.87	1436.61	1418.74	-17.87
66	180	114	48	160	0.26667	29.12	1441.61	1423.91	-17.70
66	181	115	49	160	0.27072	29.37	1446.45	1426.99	-19.45
66	182	116	50	160	0.27473	29.63	1451.14	1431.88	-19.27
66	183	117	51	160	0.27869	29.89	1455.69	1434.70	-20.99
66	184	118	52	160	0.28261	30.15	1460.09	1439.31	-20.77
66	185	119	53	160	0.28649	30.41	1464.34	1441.88	-22.46
66	186	120	54	160	0.29032	30.68	1468.45	1446.23	-22.21
66	187	121	55	160	0.29412	30.94	1472.41	1448.56	-23.85
66	188	122	56	160	0.29787	31.21	1476.22	1452.65	-23.57
66	189	123	57	160	0.30159	31.48	1479.89	1454.73	-25.16
66	190	124	58	160	0.30526	31.75	1483.42	1458.58	-24.84
66	191	125	59	160	0.30890	32.03	1486.80	1460.42	-26.37
66	192	126	60	160	0.31250	32.30	1490.03	1464.03	-26.01
66	193	127	61	160	0.31606	32.58	1493.13	1465.65	-27.48
66	194	128	62	160	0.31959	32.86	1496.08	1469.02	-27.06
66	195	129	63	160	0.32308	33.14	1498.88	1470.41	-28.47
66	196	130	64	160	0.32653	33.42	1501.55	1473.55	-28.00
66	197	131	65	160	0.32995	33.71	1504.07	1474.73	-29.34
66	198	132	66	160	0.33333	33.99	1506.45	1477.65	-28.80
66	199	133	67	160	0.33668	34.28	1508.69	1478.62	-30.07
66	200	134	68	160	0.34000	34.57	1510.79	1481.32	-29.47
66	201	135	69	160	0.34328	34.86	1512.75	1482.08	-30.66
66	202	136	70	160	0.34654	35.15	1514.56	1484.57	-29.99
66	203	137	71	160	0.34975	35.44	1516.24	1485.14	-31.10
66	204	138	72	160	0.35294	35.74	1517.77	1487.42	-30.35
66	205	139	73	160	0.35610	36.03	1519.17	1487.79	-31.38
66	206	140	74	160	0.35922	36.33	1520.43	1489.87	-30.55
66	207	141	75	160	0.36232	36.63	1521.54	1490.05	-31.49
66	208	142	76	160	0.36539	36.93	1522.52	1491.94	-30.58
66	209	143	77	160	0.36842	37.23	1523.36	1491.93	-31.43
66	210	144	78	160	0.37143	37.53	1524.06	1493.63	-30.43
66	211	145	79	160	0.37441	37.84	1524.62	1493.45	-31.18
66	212	146	80	160	0.37736	38.14	1525.04	1494.96	-30.09
66	213	147	81	160	0.38028	38.45	1525.33	1494.59	-30.73
66	214	148	82	160	0.38318	38.76	1525.48	1495.92	-29.55
66	215	149	83	160	0.38605	39.06	1525.49	1495.39	-30.10
66	216	150	84	160	0.38889	39.37	1525.36	1496.54	-28.82
66	217	151	85	160	0.39171	39.69	1525.09	1495.84	-29.25

Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
71	138	67	-4	173	0.02899	24.80	1019.62	1014.69	-4.93
71	139	68	-3	173	0.02158	24.75	1034.08	1030.87	-3.21
71	140	69	-2	173	0.01429	24.72	1048.29	1044.94	-3.35
71	141	70	-1	173	0.00709	24.70	1062.25	1060.51	-1.74
71	142	71	0	173	0.00000	24.70	1075.97	1073.98	-1.98
71	143	72	1	173	0.00699	24.70	1089.44	1088.96	-0.49
71	144	73	2	173	0.01389	24.72	1102.69	1101.86	-0.83
71	145	74	3	173	0.02069	24.75	1115.71	1116.26	0.55
71	146	75	4	173	0.02740	24.79	1128.51	1128.62	0.11
71	147	76	5	173	0.03401	24.84	1141.09	1142.47	1.38
71	148	77	6	173	0.04054	24.89	1153.46	1154.30	0.84
71	149	78	7	173	0.04698	24.96	1165.62	1167.61	1.99
71	150	79	8	173	0.05333	25.04	1177.57	1178.92	1.35
71	151	80	9	173	0.05960	25.12	1189.33	1191.72	2.39
71	152	81	10	173	0.06579	25.21	1200.88	1202.55	1.66
71	153	82	11	173	0.07190	25.32	1212.24	1214.84	2.60
71	154	83	12	173	0.07792	25.42	1223.41	1225.19	1.78
71	155	84	13	173	0.08387	25.54	1234.40	1237.01	2.61
71	156	85	14	173	0.08974	25.66	1245.19	1246.90	1.71
71	157	86	15	173	0.09554	25.79	1255.80	1258.25	2.44
71	158	87	16	173	0.10127	25.92	1266.23	1267.69	1.46
71	159	88	17	173	0.10692	26.06	1276.49	1278.59	2.10
71	160	89	18	173	0.11250	26.21	1286.56	1287.61	1.04
71	161	90	19	173	0.11801	26.36	1296.46	1298.07	1.61
71	162	91	20	173	0.12346	26.52	1306.19	1306.67	0.48
71	163	92	21	173	0.12883	26.69	1315.75	1316.72	0.96
71	164	93	22	173	0.13415	26.86	1325.14	1324.91	-0.23
71	165	94	23	173	0.13939	27.03	1334.36	1334.55	0.18
71	166	95	24	173	0.14458	27.21	1343.42	1342.36	-1.07
71	167	96	25	173	0.14970	27.39	1352.31	1351.60	-0.72
71	168	97	26	173	0.15476	27.58	1361.05	1359.03	-2.02
71	169	98	27	173	0.15976	27.77	1369.62	1367.88	-1.73
71	170	99	28	173	0.16471	27.97	1378.02	1374.95	-3.08
71	171	100	29	173	0.16959	28.17	1386.28	1383.43	-2.84
71	172	101	30	173	0.17442	28.38	1394.37	1390.14	-4.23
71	173	102	31	173	0.17919	28.59	1402.31	1398.27	-4.04
71	174	103	32	173	0.18391	28.80	1410.09	1404.64	-5.46
71	175	104	33	173	0.18857	29.02	1417.72	1412.41	-5.31
71	176	105	34	173	0.19318	29.24	1425.20	1418.45	-6.75
71	177	106	35	173	0.19774	29.46	1432.52	1425.89	-6.64
71	178	107	36	173	0.20225	29.69	1439.70	1431.59	-8.10
71	179	108	37	173	0.20670	29.92	1446.72	1438.70	-8.02
71	180	109	38	173	0.21111	30.15	1453.60	1444.10	-9.50
71	181	110	39	173	0.21547	30.39	1460.32	1450.89	-9.43
71	182	111	40	173	0.21978	30.63	1466.90	1455.98	-10.92
71	183	112	41	173	0.22404	30.87	1473.33	1462.46	-10.87
71	184	113	42	173	0.22826	31.12	1479.62	1467.25	-12.37
71	185	114	43	173	0.23243	31.36	1485.76	1473.43	-12.33
71	186	115	44	173	0.23656	31.62	1491.76	1477.94	-13.82
71	187	116	45	173	0.24064	31.87	1497.61	1483.83	-13.79
71	188	117	46	173	0.24468	32.13	1503.32	1488.05	-15.28
71	189	118	47	173	0.24868	32.39	1508.89	1493.65	-15.24
71	190	119	48	173	0.25263	32.65	1514.32	1497.60	-16.71
71	191	120	49	173	0.25655	32.91	1519.60	1502.93	-16.67
71	192	121	50	173	0.26042	33.18	1524.74	1506.62	-18.13
71	193	122	51	173	0.26425	33.45	1529.75	1511.68	-18.07
71	194	123	52	173	0.26804	33.72	1534.61	1515.10	-19.51
71	195	124	53	173	0.27180	33.99	1539.33	1519.90	-19.43
71	196	125	54	173	0.27551	34.27	1543.92	1523.08	-20.84
71	197	126	55	173	0.27919	34.55	1548.37	1527.62	-20.75

71	198	127	56	173	0.28283	34.83	1552.68	1530.55	-22.12
71	199	128	57	173	0.28643	35.11	1556.85	1534.85	-22.00
71	200	129	58	173	0.29000	35.40	1560.88	1537.54	-23.34
71	201	130	59	173	0.29353	35.68	1564.78	1541.59	-23.19
71	202	131	60	173	0.29703	35.97	1568.54	1544.06	-24.49
71	203	132	61	173	0.30049	36.26	1572.17	1547.88	-24.29
71	204	133	62	173	0.30392	36.55	1575.66	1550.11	-25.55
71	205	134	63	173	0.30732	36.85	1579.02	1553.70	-25.32
71	206	135	64	173	0.31068	37.14	1582.24	1555.72	-26.52
71	207	136	65	173	0.31401	37.44	1585.33	1559.08	-26.24
71	208	137	66	173	0.31731	37.74	1588.28	1560.89	-27.39
71	209	138	67	173	0.32057	38.04	1591.10	1564.03	-27.06
71	210	139	68	173	0.32381	38.34	1593.79	1565.63	-28.16
71	211	140	69	173	0.32701	38.65	1596.34	1568.56	-27.78
71	212	141	70	173	0.33019	38.95	1598.76	1569.95	-28.81
71	213	142	71	173	0.33333	39.26	1601.05	1572.68	-28.37
71	214	143	72	173	0.33645	39.57	1603.21	1573.87	-29.33
71	215	144	73	173	0.33954	39.88	1605.23	1576.40	-28.83
71	216	145	74	173	0.34259	40.19	1607.12	1577.40	-29.72
71	217	146	75	173	0.34562	40.50	1608.88	1579.73	-29.16
71	218	147	76	173	0.34862	40.82	1610.51	1580.54	-29.98
71	219	148	77	173	0.35160	41.14	1612.01	1582.67	-29.34
71	220	149	78	173	0.35455	41.45	1613.38	1583.30	-30.09
71	221	150	79	173	0.35747	41.77	1614.62	1585.24	-29.38
71	222	151	80	173	0.36036	42.09	1615.73	1585.69	-30.04
71	223	152	81	173	0.36323	42.41	1616.71	1587.45	-29.26
71	224	153	82	173	0.36607	42.74	1617.56	1587.72	-29.84
71	225	154	83	173	0.36889	43.06	1618.28	1589.30	-28.98
71	226	155	84	173	0.37168	43.39	1618.87	1589.40	-29.47
71	227	156	85	173	0.37445	43.71	1619.33	1590.81	-28.52
71	228	157	86	173	0.37719	44.04	1619.67	1590.74	-28.93
71	229	158	87	173	0.37991	44.37	1619.87	1591.97	-27.89
71	230	159	88	173	0.38261	44.70	1619.95	1591.74	-28.21
71	231	160	89	173	0.38528	45.03	1619.89	1592.81	-27.08
71	232	161	90	173	0.38793	45.37	1619.71	1592.42	-27.30
71	233	162	91	173	0.39056	45.70	1619.40	1593.32	-26.08
71	234	163	92	173	0.39316	46.04	1618.97	1592.77	-26.20
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
76	148	72	-4	188	0.02703	28.33	1069.32	1069.66	0.34
76	149	73	-3	188	0.02013	28.28	1084.00	1083.89	-0.11
76	150	74	-2	188	0.01333	28.25	1098.44	1100.08	1.65
76	151	75	-1	188	0.00662	28.23	1112.64	1113.76	1.12
76	152	76	0	188	0.00000	28.22	1126.60	1129.37	2.77
76	153	77	1	188	0.00654	28.23	1140.34	1142.50	2.16
76	154	78	2	188	0.01299	28.25	1153.85	1157.56	3.71
76	155	79	3	188	0.01935	28.28	1167.15	1170.16	3.01
76	156	80	4	188	0.02564	28.32	1180.23	1184.68	4.45
76	157	81	5	188	0.03185	28.36	1193.10	1196.77	3.67
76	158	82	6	188	0.03797	28.42	1205.77	1210.78	5.01
76	159	83	7	188	0.04403	28.49	1218.24	1222.38	4.14
76	160	84	8	188	0.05000	28.57	1230.51	1235.88	5.37
76	161	85	9	188	0.05590	28.65	1242.59	1247.00	4.42
76	162	86	10	188	0.06173	28.75	1254.48	1260.02	5.55
76	163	87	11	188	0.06748	28.85	1266.17	1270.68	4.51
76	164	88	12	188	0.07317	28.96	1277.69	1283.23	5.55
76	165	89	13	188	0.07879	29.08	1289.02	1293.45	4.43
76	166	90	14	188	0.08434	29.20	1300.18	1305.54	5.37
76	167	91	15	188	0.08982	29.33	1311.15	1315.33	4.17
76	168	92	16	188	0.09524	29.47	1321.96	1326.98	5.02
76	169	93	17	188	0.10059	29.61	1332.59	1336.34	3.76
76	170	94	18	188	0.10588	29.76	1343.05	1347.57	4.52

76	171	95	19	188	0.11111	29.92	1353.34	1356.53	3.19
76	172	96	20	188	0.11628	30.08	1363.47	1367.34	3.87
76	173	97	21	188	0.12139	30.25	1373.44	1375.91	2.47
76	174	98	22	188	0.12644	30.42	1383.24	1386.32	3.08
76	175	99	23	188	0.13143	30.60	1392.88	1394.50	1.62
76	176	100	24	188	0.13636	30.78	1402.36	1404.53	2.16
76	177	101	25	188	0.14124	30.97	1411.69	1412.34	0.65
76	178	102	26	188	0.14607	31.16	1420.86	1421.99	1.12
76	179	103	27	188	0.15084	31.36	1429.88	1429.44	-0.44
76	180	104	28	188	0.15556	31.56	1438.74	1438.72	-0.02
76	181	105	29	188	0.16022	31.77	1447.45	1445.83	-1.63
76	182	106	30	188	0.16484	31.98	1456.02	1454.75	-1.27
76	183	107	31	188	0.16940	32.20	1464.43	1461.52	-2.91
76	184	108	32	188	0.17391	32.42	1472.69	1470.09	-2.60
76	185	109	33	188	0.17838	32.64	1480.81	1476.53	-4.28
76	186	110	34	188	0.18280	32.87	1488.78	1484.77	-4.01
76	187	111	35	188	0.18717	33.10	1496.61	1490.89	-5.72
76	188	112	36	188	0.19149	33.33	1504.29	1498.81	-5.49
76	189	113	37	188	0.19577	33.57	1511.83	1504.61	-7.22
76	190	114	38	188	0.20000	33.81	1519.23	1512.21	-7.02
76	191	115	39	188	0.20419	34.06	1526.49	1517.72	-8.77
76	192	116	40	188	0.20833	34.30	1533.61	1525.01	-8.60
76	193	117	41	188	0.21244	34.56	1540.58	1530.22	-10.36
76	194	118	42	188	0.21650	34.81	1547.42	1537.21	-10.22
76	195	119	43	188	0.22051	35.07	1554.12	1542.13	-11.99
76	196	120	44	188	0.22449	35.33	1560.69	1548.83	-11.86
76	197	121	45	188	0.22843	35.59	1567.11	1553.48	-13.64
76	198	122	46	188	0.23232	35.86	1573.40	1559.89	-13.52
76	199	123	47	188	0.23618	36.13	1579.56	1564.27	-15.29
76	200	124	48	188	0.24000	36.40	1585.58	1570.40	-15.18
76	201	125	49	188	0.24378	36.67	1591.47	1574.51	-16.95
76	202	126	50	188	0.24753	36.95	1597.22	1580.38	-16.85
76	203	127	51	188	0.25123	37.23	1602.84	1584.24	-18.61
76	204	128	52	188	0.25490	37.51	1608.33	1589.84	-18.50
76	205	129	53	188	0.25854	37.80	1613.69	1593.45	-20.24
76	206	130	54	188	0.26214	38.08	1618.91	1598.79	-20.13
76	207	131	55	188	0.26570	38.37	1624.01	1602.15	-21.86
76	208	132	56	188	0.26923	38.66	1628.97	1607.25	-21.73
76	209	133	57	188	0.27273	38.96	1633.81	1610.38	-23.43
76	210	134	58	188	0.27619	39.25	1638.51	1615.22	-23.29
76	211	135	59	188	0.27962	39.55	1643.09	1618.12	-24.97
76	212	136	60	188	0.28302	39.85	1647.54	1622.73	-24.81
76	213	137	61	188	0.28639	40.15	1651.86	1625.40	-26.45
76	214	138	62	188	0.28972	40.46	1656.05	1629.78	-26.27
76	215	139	63	188	0.29302	40.76	1660.12	1632.24	-27.88
76	216	140	64	188	0.29630	41.07	1664.05	1636.39	-27.67
76	217	141	65	188	0.29954	41.38	1667.87	1638.63	-29.24
76	218	142	66	188	0.30275	41.69	1671.55	1642.56	-28.99
76	219	143	67	188	0.30594	42.01	1675.11	1644.59	-30.53
76	220	144	68	188	0.30909	42.32	1678.55	1648.30	-30.24
76	221	145	69	188	0.31222	42.64	1681.85	1650.13	-31.73
76	222	146	70	188	0.31532	42.96	1685.04	1653.63	-31.41
76	223	147	71	188	0.31839	43.28	1688.10	1655.26	-32.84
76	224	148	72	188	0.32143	43.60	1691.03	1658.56	-32.48
76	225	149	73	188	0.32444	43.93	1693.85	1659.99	-33.86
76	226	150	74	188	0.32743	44.25	1696.53	1663.09	-33.45
76	227	151	75	188	0.33040	44.58	1699.10	1664.33	-34.77
76	228	152	76	188	0.33333	44.91	1701.54	1667.23	-34.31
76	229	153	77	188	0.33625	45.24	1703.86	1668.28	-35.57
76	230	154	78	188	0.33913	45.57	1706.05	1671.00	-35.06
76	231	155	79	188	0.34199	45.91	1708.13	1671.87	-36.26
76	232	156	80	188	0.34483	46.24	1710.08	1674.39	-35.69
76	233	157	81	188	0.34764	46.58	1711.91	1675.09	-36.82

76	234	158	82	188	0.35043	46.92	1713.62	1677.43	-36.19
76	235	159	83	188	0.35319	47.26	1715.20	1677.95	-37.26
76	236	160	84	188	0.35593	47.60	1716.67	1680.11	-36.56
76	237	161	85	188	0.35865	47.94	1718.01	1680.46	-37.55
76	238	162	86	188	0.36135	48.28	1719.24	1682.45	-36.79
76	239	163	87	188	0.36402	48.63	1720.34	1682.63	-37.71
76	240	164	88	188	0.36667	48.97	1721.33	1684.45	-36.87
76	241	165	89	188	0.36930	49.32	1722.19	1684.47	-37.72
76	242	166	90	188	0.37190	49.67	1722.93	1686.12	-36.81
76	243	167	91	188	0.37449	50.02	1723.56	1685.99	-37.57
76	244	168	92	188	0.37705	50.37	1724.06	1687.47	-36.59
76	245	169	93	188	0.37959	50.72	1724.45	1687.18	-37.26
76	246	170	94	188	0.38211	51.08	1724.71	1688.51	-36.20
76	247	171	95	188	0.38462	51.43	1724.86	1688.06	-36.79
76	248	172	96	188	0.38710	51.79	1724.89	1689.23	-35.65
76	249	173	97	188	0.38956	52.14	1724.79	1688.64	-36.16
76	250	174	98	188	0.39200	52.50	1724.59	1689.65	-34.93
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
81	158	77	-4	203	0.02532	32.09	1116.29	1117.41	1.12
81	159	78	-3	203	0.01887	32.05	1131.16	1133.73	2.57
81	160	79	-2	203	0.01250	32.02	1145.80	1148.03	2.23
81	161	80	-1	203	0.00621	32.00	1160.20	1163.80	3.60
81	162	81	0	203	0.00000	31.99	1174.38	1177.56	3.19
81	163	82	1	203	0.00613	32.00	1188.34	1192.80	4.47
81	164	83	2	203	0.01220	32.02	1202.08	1206.06	3.98
81	165	84	3	203	0.01818	32.04	1215.61	1220.78	5.17
81	166	85	4	203	0.02410	32.08	1228.93	1233.54	4.60
81	167	86	5	203	0.02994	32.13	1242.06	1247.76	5.70
81	168	87	6	203	0.03571	32.19	1254.98	1260.04	5.06
81	169	88	7	203	0.04142	32.26	1267.71	1273.77	6.06
81	170	89	8	203	0.04706	32.34	1280.25	1285.59	5.34
81	171	90	9	203	0.05263	32.42	1292.60	1298.86	6.26
81	172	91	10	203	0.05814	32.52	1304.77	1310.23	5.46
81	173	92	11	203	0.06358	32.62	1316.76	1323.04	6.28
81	174	93	12	203	0.06897	32.73	1328.56	1333.97	5.40
81	175	94	13	203	0.07429	32.85	1340.19	1346.34	6.14
81	176	95	14	203	0.07955	32.98	1351.65	1356.85	5.19
81	177	96	15	203	0.08475	33.11	1362.94	1368.79	5.85
81	178	97	16	203	0.08989	33.25	1374.06	1378.89	4.83
81	179	98	17	203	0.09497	33.40	1385.01	1390.41	5.40
81	180	99	18	203	0.10000	33.55	1395.80	1400.11	4.31
81	181	100	19	203	0.10497	33.71	1406.43	1411.23	4.81
81	182	101	20	203	0.10989	33.87	1416.90	1420.55	3.65
81	183	102	21	203	0.11475	34.04	1427.20	1431.28	4.07
81	184	103	22	203	0.11957	34.22	1437.36	1440.22	2.86
81	185	104	23	203	0.12432	34.40	1447.35	1450.57	3.21
81	186	105	24	203	0.12903	34.59	1457.20	1459.14	1.94
81	187	106	25	203	0.13369	34.78	1466.89	1469.12	2.23
81	188	107	26	203	0.13830	34.98	1476.43	1477.34	0.90
81	189	108	27	203	0.14286	35.18	1485.83	1486.96	1.13
81	190	109	28	203	0.14737	35.39	1495.07	1494.83	-0.24
81	191	110	29	203	0.15183	35.60	1504.18	1504.10	-0.07
81	192	111	30	203	0.15625	35.82	1513.13	1511.64	-1.49
81	193	112	31	203	0.16062	36.04	1521.94	1520.57	-1.37
81	194	113	32	203	0.16495	36.27	1530.61	1527.78	-2.83
81	195	114	33	203	0.16923	36.50	1539.14	1536.39	-2.76
81	196	115	34	203	0.17347	36.73	1547.53	1543.28	-4.25
81	197	116	35	203	0.17767	36.97	1555.78	1551.56	-4.22
81	198	117	36	203	0.18182	37.21	1563.89	1558.14	-5.75
81	199	118	37	203	0.18593	37.45	1571.87	1566.11	-5.76
81	200	119	38	203	0.19000	37.70	1579.71	1572.40	-7.31

81	201	120	39	203	0.19403	37.95	1587.41	1580.06	-7.35
81	202	121	40	203	0.19802	38.21	1594.98	1586.05	-8.93
81	203	122	41	203	0.20197	38.47	1602.41	1593.42	-9.00
81	204	123	42	203	0.20588	38.73	1609.72	1599.12	-10.60
81	205	124	43	203	0.20976	39.00	1616.89	1606.20	-10.69
81	206	125	44	203	0.21359	39.27	1623.93	1611.63	-12.30
81	207	126	45	203	0.21739	39.54	1630.83	1618.42	-12.41
81	208	127	46	203	0.22115	39.81	1637.61	1623.58	-14.03
81	209	128	47	203	0.22488	40.09	1644.26	1630.10	-14.16
81	210	129	48	203	0.22857	40.37	1650.78	1634.99	-15.79
81	211	130	49	203	0.23223	40.65	1657.17	1641.24	-15.93
81	212	131	50	203	0.23585	40.94	1663.44	1645.88	-17.56
81	213	132	51	203	0.23944	41.23	1669.58	1651.87	-17.71
81	214	133	52	203	0.24299	41.52	1675.59	1656.25	-19.34
81	215	134	53	203	0.24651	41.82	1681.48	1661.99	-19.49
81	216	135	54	203	0.25000	42.11	1687.24	1666.13	-21.11
81	217	136	55	203	0.25346	42.41	1692.87	1671.62	-21.26
81	218	137	56	203	0.25688	42.72	1698.39	1675.52	-22.87
81	219	138	57	203	0.26027	43.02	1703.78	1680.76	-23.02
81	220	139	58	203	0.26364	43.33	1709.04	1684.43	-24.61
81	221	140	59	203	0.26697	43.64	1714.19	1689.44	-24.75
81	222	141	60	203	0.27027	43.95	1719.21	1692.88	-26.33
81	223	142	61	203	0.27354	44.26	1724.11	1697.65	-26.45
81	224	143	62	203	0.27679	44.58	1728.89	1700.87	-28.01
81	225	144	63	203	0.28000	44.90	1733.54	1705.42	-28.12
81	226	145	64	203	0.28319	45.22	1738.08	1708.42	-29.66
81	227	146	65	203	0.28634	45.54	1742.50	1712.75	-29.74
81	228	147	66	203	0.28947	45.86	1746.79	1715.54	-31.25
81	229	148	67	203	0.29258	46.19	1750.97	1719.66	-31.31
81	230	149	68	203	0.29565	46.52	1755.03	1722.24	-32.79
81	231	150	69	203	0.29870	46.85	1758.97	1726.15	-32.82
81	232	151	70	203	0.30172	47.18	1762.79	1728.53	-34.27
81	233	152	71	203	0.30472	47.51	1766.50	1732.22	-34.27
81	234	153	72	203	0.30769	47.85	1770.08	1734.41	-35.67
81	235	154	73	203	0.31064	48.19	1773.55	1737.90	-35.65
81	236	155	74	203	0.31356	48.53	1776.90	1739.89	-37.01
81	237	156	75	203	0.31646	48.87	1780.13	1743.19	-36.94
81	238	157	76	203	0.31933	49.21	1783.25	1744.99	-38.26
81	239	158	77	203	0.32218	49.55	1786.25	1748.10	-38.15
81	240	159	78	203	0.32500	49.90	1789.14	1749.72	-39.42
81	241	160	79	203	0.32780	50.25	1791.91	1752.64	-39.27
81	242	161	80	203	0.33058	50.60	1794.57	1754.07	-40.49
81	243	162	81	203	0.33333	50.95	1797.10	1756.81	-40.30
81	244	163	82	203	0.33607	51.30	1799.53	1758.07	-41.46
81	245	164	83	203	0.33878	51.65	1801.84	1760.62	-41.22
81	246	165	84	203	0.34146	52.01	1804.04	1761.71	-42.33
81	247	166	85	203	0.34413	52.37	1806.12	1764.09	-42.03
81	248	167	86	203	0.34677	52.72	1808.08	1765.00	-43.08
81	249	168	87	203	0.34940	53.08	1809.94	1767.21	-42.73
81	250	169	88	203	0.35200	53.44	1811.68	1767.96	-43.72
81	251	170	89	203	0.35458	53.81	1813.30	1770.00	-43.30
81	252	171	90	203	0.35714	54.17	1814.82	1770.59	-44.23
81	253	172	91	203	0.35968	54.54	1816.22	1772.46	-43.76
81	254	173	92	203	0.36221	54.90	1817.51	1772.89	-44.62
81	255	174	93	203	0.36471	55.27	1818.68	1774.60	-44.08
81	256	175	94	203	0.36719	55.64	1819.75	1774.88	-44.87
81	257	176	95	203	0.36965	56.01	1820.70	1776.43	-44.27
81	258	177	96	203	0.37209	56.38	1821.54	1776.55	-44.99
81	259	178	97	203	0.37452	56.76	1822.26	1777.95	-44.32
81	260	179	98	203	0.37692	57.13	1822.88	1777.92	-44.96
81	261	180	99	203	0.37931	57.50	1823.38	1779.16	-44.22
81	262	181	100	203	0.38168	57.88	1823.78	1778.99	-44.79
81	263	182	101	203	0.38403	58.26	1824.06	1780.08	-43.98

81	264	183	102	203	0.38636	58.64	1824.23	1779.77	-44.46
81	265	184	103	203	0.38868	59.02	1824.29	1780.72	-43.57
81	266	185	104	203	0.39098	59.40	1824.24	1780.26	-43.98
81	267	186	105	203	0.39326	59.78	1824.08	1781.06	-43.02
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
86	168	82	-4	218	0.02381	36.10	1160.61	1165.96	5.35
86	169	83	-3	218	0.01775	36.06	1175.64	1180.41	4.76
86	170	84	-2	218	0.01176	36.03	1190.45	1196.75	6.30
86	171	85	-1	218	0.00585	36.01	1205.03	1210.68	5.66
86	172	86	0	218	0.00000	36.00	1219.39	1226.50	7.12
86	173	87	1	218	0.00578	36.01	1233.54	1239.95	6.41
86	174	88	2	218	0.01149	36.02	1247.47	1255.27	7.80
86	175	89	3	218	0.01714	36.05	1261.21	1268.24	7.03
86	176	90	4	218	0.02273	36.09	1274.74	1283.07	8.33
86	177	91	5	218	0.02825	36.14	1288.08	1295.58	7.50
86	178	92	6	218	0.03371	36.20	1301.23	1309.94	8.71
86	179	93	7	218	0.03911	36.27	1314.18	1322.00	7.81
86	180	94	8	218	0.04444	36.35	1326.95	1335.90	8.95
86	181	95	9	218	0.04972	36.44	1339.54	1347.52	7.98
86	182	96	10	218	0.05495	36.53	1351.95	1360.98	9.03
86	183	97	11	218	0.06011	36.64	1364.19	1372.18	7.99
86	184	98	12	218	0.06522	36.75	1376.24	1385.21	8.96
86	185	99	13	218	0.07027	36.87	1388.13	1395.99	7.86
86	186	100	14	218	0.07527	37.00	1399.85	1408.60	8.75
86	187	101	15	218	0.08021	37.13	1411.41	1418.99	7.58
86	188	102	16	218	0.08511	37.27	1422.80	1431.19	8.39
86	189	103	17	218	0.08995	37.42	1434.03	1441.19	7.16
86	190	104	18	218	0.09474	37.58	1445.10	1452.99	7.89
86	191	105	19	218	0.09948	37.74	1456.01	1462.61	6.60
86	192	106	20	218	0.10417	37.91	1466.77	1474.03	7.27
86	193	107	21	218	0.10881	38.08	1477.37	1483.29	5.92
86	194	108	22	218	0.11340	38.26	1487.82	1494.33	6.51
86	195	109	23	218	0.11795	38.45	1498.13	1503.23	5.10
86	196	110	24	218	0.12245	38.64	1508.28	1513.91	5.63
86	197	111	25	218	0.12690	38.83	1518.29	1522.46	4.18
86	198	112	26	218	0.13131	39.04	1528.15	1532.79	4.64
86	199	113	27	218	0.13568	39.24	1537.86	1541.00	3.14
86	200	114	28	218	0.14000	39.45	1547.44	1550.98	3.54
86	201	115	29	218	0.14428	39.67	1556.87	1558.86	1.99
86	202	116	30	218	0.14852	39.89	1566.16	1568.51	2.34
86	203	117	31	218	0.15271	40.12	1575.32	1576.07	0.75
86	204	118	32	218	0.15686	40.35	1584.33	1585.39	1.05
86	205	119	33	218	0.16098	40.58	1593.21	1592.63	-0.58
86	206	120	34	218	0.16505	40.82	1601.96	1601.63	-0.32
86	207	121	35	218	0.16908	41.07	1610.57	1608.58	-1.99
86	208	122	36	218	0.17308	41.31	1619.04	1617.27	-1.78
86	209	123	37	218	0.17703	41.57	1627.39	1623.91	-3.48
86	210	124	38	218	0.18095	41.82	1635.60	1632.30	-3.30
86	211	125	39	218	0.18483	42.08	1643.68	1638.66	-5.03
86	212	126	40	218	0.18868	42.34	1651.64	1646.75	-4.89
86	213	127	41	218	0.19249	42.61	1659.46	1652.82	-6.64
86	214	128	42	218	0.19626	42.88	1667.16	1660.63	-6.53
86	215	129	43	218	0.20000	43.15	1674.73	1666.43	-8.30
86	216	130	44	218	0.20370	43.43	1682.17	1673.95	-8.22
86	217	131	45	218	0.20737	43.71	1689.49	1679.48	-10.00
86	218	132	46	218	0.21101	43.99	1696.68	1686.73	-9.95
86	219	133	47	218	0.21461	44.28	1703.74	1692.00	-11.74
86	220	134	48	218	0.21818	44.57	1710.69	1698.98	-11.71
86	221	135	49	218	0.22172	44.86	1717.51	1703.99	-13.51
86	222	136	50	218	0.22523	45.16	1724.21	1710.71	-13.50
86	223	137	51	218	0.22870	45.46	1730.78	1715.48	-15.31

86	224	138	52	218	0.23214	45.76	1737.24	1721.94	-15.30
86	225	139	53	218	0.23556	46.06	1743.58	1726.47	-17.11
86	226	140	54	218	0.23894	46.37	1749.79	1732.68	-17.11
86	227	141	55	218	0.24229	46.68	1755.89	1736.96	-18.92
86	228	142	56	218	0.24561	46.99	1761.86	1742.93	-18.93
86	229	143	57	218	0.24891	47.30	1767.72	1746.99	-20.73
86	230	144	58	218	0.25217	47.62	1773.46	1752.72	-20.74
86	231	145	59	218	0.25541	47.94	1779.09	1756.55	-22.54
86	232	146	60	218	0.25862	48.26	1784.59	1762.05	-22.54
86	233	147	61	218	0.26180	48.59	1789.98	1765.65	-24.33
86	234	148	62	218	0.26496	48.92	1795.26	1770.93	-24.33
86	235	149	63	218	0.26809	49.24	1800.41	1774.32	-26.10
86	236	150	64	218	0.27119	49.58	1805.46	1779.37	-26.09
86	237	151	65	218	0.27426	49.91	1810.38	1782.54	-27.84
86	238	152	66	218	0.27731	50.25	1815.20	1787.38	-27.82
86	239	153	67	218	0.28034	50.58	1819.90	1790.35	-29.55
86	240	154	68	218	0.28333	50.92	1824.48	1794.97	-29.51
86	241	155	69	218	0.28631	51.27	1828.96	1797.74	-31.22
86	242	156	70	218	0.28926	51.61	1833.32	1802.15	-31.17
86	243	157	71	218	0.29218	51.96	1837.56	1804.72	-32.84
86	244	158	72	218	0.29508	52.30	1841.70	1808.93	-32.77
86	245	159	73	218	0.29796	52.65	1845.72	1811.31	-34.41
86	246	160	74	218	0.30081	53.01	1849.63	1815.32	-34.31
86	247	161	75	218	0.30364	53.36	1853.43	1817.51	-35.93
86	248	162	76	218	0.30645	53.72	1857.12	1821.32	-35.80
86	249	163	77	218	0.30924	54.07	1860.70	1823.33	-37.37
86	250	164	78	218	0.31200	54.43	1864.17	1826.95	-37.22
86	251	165	79	218	0.31474	54.79	1867.52	1828.77	-38.75
86	252	166	80	218	0.31746	55.16	1870.77	1832.21	-38.56
86	253	167	81	218	0.32016	55.52	1873.91	1833.85	-40.06
86	254	168	82	218	0.32284	55.89	1876.94	1837.11	-39.83
86	255	169	83	218	0.32549	56.25	1879.86	1838.58	-41.28
86	256	170	84	218	0.32813	56.62	1882.67	1841.66	-41.01
86	257	171	85	218	0.33074	56.99	1885.37	1842.96	-42.42
86	258	172	86	218	0.33333	57.37	1887.97	1845.86	-42.11
86	259	173	87	218	0.33591	57.74	1890.45	1846.99	-43.46
86	260	174	88	218	0.33846	58.12	1892.83	1849.72	-43.11
86	261	175	89	218	0.34100	58.49	1895.10	1850.69	-44.41
86	262	176	90	218	0.34351	58.87	1897.27	1853.26	-44.01
86	263	177	91	218	0.34601	59.25	1899.32	1854.06	-45.26
86	264	178	92	218	0.34849	59.63	1901.27	1856.46	-44.81
86	265	179	93	218	0.35094	60.02	1903.11	1857.11	-46.00
86	266	180	94	218	0.35338	60.40	1904.85	1859.35	-45.50
86	267	181	95	218	0.35581	60.79	1906.48	1859.85	-46.63
86	268	182	96	218	0.35821	61.17	1908.00	1861.93	-46.08
86	269	183	97	218	0.36060	61.56	1909.42	1862.27	-47.15
86	270	184	98	218	0.36296	61.95	1910.73	1864.20	-46.53
86	271	185	99	218	0.36531	62.34	1911.94	1864.39	-47.54
86	272	186	100	218	0.36765	62.74	1913.04	1866.17	-46.87
86	273	187	101	218	0.36996	63.13	1914.03	1866.22	-47.81
86	274	188	102	218	0.37226	63.52	1914.92	1867.84	-47.08
86	275	189	103	218	0.37455	63.92	1915.71	1867.75	-47.95
86	276	190	104	218	0.37681	64.32	1916.39	1869.23	-47.16
86	277	191	105	218	0.37906	64.72	1916.96	1869.00	-47.96
86	278	192	106	218	0.38130	65.12	1917.43	1870.33	-47.10
86	279	193	107	218	0.38351	65.52	1917.80	1869.97	-47.83
86	280	194	108	218	0.38571	65.92	1918.06	1871.16	-46.90
86	281	195	109	218	0.38790	66.32	1918.22	1870.66	-47.56
86	282	196	110	218	0.39007	66.73	1918.27	1871.71	-46.56
86	283	197	111	218	0.39223	67.13	1918.23	1871.08	-47.14
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)

91	178	87	-4	231	0.02247	40.35	1210.63	1207.52	-3.11
91	179	88	-3	231	0.01676	40.30	1225.67	1223.97	-1.70
91	180	89	-2	231	0.01111	40.27	1240.49	1238.48	-2.01
91	181	90	-1	231	0.00552	40.25	1255.09	1254.44	-0.65
91	182	91	0	231	0.00000	40.25	1269.47	1268.47	-1.01
91	183	92	1	231	0.00546	40.25	1283.65	1283.94	0.29
91	184	93	2	231	0.01087	40.27	1297.62	1297.50	-0.12
91	185	94	3	231	0.01622	40.30	1311.39	1312.51	1.11
91	186	95	4	231	0.02151	40.34	1324.97	1325.62	0.65
91	187	96	5	231	0.02674	40.39	1338.36	1340.17	1.81
91	188	97	6	231	0.03191	40.45	1351.55	1352.84	1.29
91	189	98	7	231	0.03704	40.52	1364.57	1366.95	2.38
91	190	99	8	231	0.04211	40.60	1377.40	1379.20	1.80
91	191	100	9	231	0.04712	40.69	1390.05	1392.87	2.82
91	192	101	10	231	0.05208	40.78	1402.53	1404.71	2.18
91	193	102	11	231	0.05699	40.89	1414.83	1417.96	3.13
91	194	103	12	231	0.06186	41.00	1426.96	1429.39	2.43
91	195	104	13	231	0.06667	41.12	1438.93	1442.24	3.31
91	196	105	14	231	0.07143	41.25	1450.73	1453.28	2.55
91	197	106	15	231	0.07614	41.39	1462.37	1465.73	3.36
91	198	107	16	231	0.08081	41.53	1473.85	1476.39	2.54
91	199	108	17	231	0.08543	41.68	1485.17	1488.45	3.29
91	200	109	18	231	0.09000	41.84	1496.33	1498.74	2.41
91	201	110	19	231	0.09453	42.00	1507.34	1510.43	3.09
91	202	111	20	231	0.09901	42.18	1518.20	1520.36	2.16
91	203	112	21	231	0.10345	42.35	1528.91	1531.68	2.77
91	204	113	22	231	0.10784	42.54	1539.47	1541.26	1.79
91	205	114	23	231	0.11220	42.72	1549.88	1552.22	2.34
91	206	115	24	231	0.11651	42.92	1560.14	1561.45	1.31
91	207	116	25	231	0.12077	43.12	1570.27	1572.07	1.81
91	208	117	26	231	0.12500	43.33	1580.25	1580.97	0.72
91	209	118	27	231	0.12919	43.54	1590.09	1591.25	1.17
91	210	119	28	231	0.13333	43.75	1599.79	1599.82	0.04
91	211	120	29	231	0.13744	43.97	1609.35	1609.77	0.43
91	212	121	30	231	0.14151	44.20	1618.77	1618.03	-0.74
91	213	122	31	231	0.14554	44.43	1628.06	1627.66	-0.40
91	214	123	32	231	0.14953	44.67	1637.21	1635.60	-1.61
91	215	124	33	231	0.15349	44.91	1646.24	1644.92	-1.32
91	216	125	34	231	0.15741	45.15	1655.12	1652.56	-2.56
91	217	126	35	231	0.16129	45.40	1663.88	1661.57	-2.31
91	218	127	36	231	0.16514	45.65	1672.51	1668.92	-3.59
91	219	128	37	231	0.16895	45.91	1681.01	1677.63	-3.38
91	220	129	38	231	0.17273	46.17	1689.38	1684.69	-4.69
91	221	130	39	231	0.17647	46.44	1697.62	1693.11	-4.51
91	222	131	40	231	0.18018	46.71	1705.74	1699.89	-5.85
91	223	132	41	231	0.18386	46.98	1713.73	1708.03	-5.70
91	224	133	42	231	0.18750	47.26	1721.60	1714.53	-7.06
91	225	134	43	231	0.19111	47.54	1729.34	1722.39	-6.95
91	226	135	44	231	0.19469	47.82	1736.96	1728.63	-8.33
91	227	136	45	231	0.19824	48.11	1744.45	1736.22	-8.24
91	228	137	46	231	0.20175	48.40	1751.83	1742.20	-9.63
91	229	138	47	231	0.20524	48.70	1759.08	1749.52	-9.57
91	230	139	48	231	0.20870	49.00	1766.22	1755.24	-10.98
91	231	140	49	231	0.21212	49.30	1773.23	1762.30	-10.93
91	232	141	50	231	0.21552	49.60	1780.13	1767.78	-12.35
91	233	142	51	231	0.21888	49.91	1786.91	1774.59	-12.32
91	234	143	52	231	0.22222	50.22	1793.57	1779.82	-13.75
91	235	144	53	231	0.22553	50.53	1800.11	1786.38	-13.73
91	236	145	54	231	0.22881	50.85	1806.54	1791.37	-15.17
91	237	146	55	231	0.23207	51.17	1812.85	1797.69	-15.16
91	238	147	56	231	0.23529	51.49	1819.04	1802.45	-16.59
91	239	148	57	231	0.23849	51.81	1825.12	1808.54	-16.59
91	240	149	58	231	0.24167	52.14	1831.09	1813.07	-18.02

91	241	150	59	231	0.24481	52.47	1836.94	1818.92	-18.02
91	242	151	60	231	0.24793	52.80	1842.68	1823.23	-19.45
91	243	152	61	231	0.25103	53.14	1848.31	1828.86	-19.45
91	244	153	62	231	0.25410	53.47	1853.82	1832.95	-20.87
91	245	154	63	231	0.25714	53.81	1859.22	1838.36	-20.87
91	246	155	64	231	0.26016	54.15	1864.52	1842.24	-22.28
91	247	156	65	231	0.26316	54.50	1869.69	1847.42	-22.27
91	248	157	66	231	0.26613	54.85	1874.76	1851.10	-23.67
91	249	158	67	231	0.26908	55.20	1879.72	1856.07	-23.65
91	250	159	68	231	0.27200	55.55	1884.57	1859.54	-25.03
91	251	160	69	231	0.27490	55.90	1889.31	1864.31	-25.00
91	252	161	70	231	0.27778	56.26	1893.94	1867.58	-26.36
91	253	162	71	231	0.28063	56.61	1898.46	1872.14	-26.31
91	254	163	72	231	0.28347	56.97	1902.87	1875.22	-27.65
91	255	164	73	231	0.28628	57.34	1907.18	1879.59	-27.59
91	256	165	74	231	0.28906	57.70	1911.37	1882.47	-28.91
91	257	166	75	231	0.29183	58.07	1915.46	1886.64	-28.82
91	258	167	76	231	0.29457	58.43	1919.44	1889.33	-30.11
91	259	168	77	231	0.29730	58.80	1923.32	1893.32	-30.00
91	260	169	78	231	0.30000	59.18	1927.09	1895.83	-31.26
91	261	170	79	231	0.30268	59.55	1930.75	1899.62	-31.13
91	262	171	80	231	0.30534	59.93	1934.31	1901.95	-32.36
91	263	172	81	231	0.30799	60.30	1937.76	1905.57	-32.19
91	264	173	82	231	0.31061	60.68	1941.10	1907.72	-33.39
91	265	174	83	231	0.31321	61.06	1944.34	1911.15	-33.19
91	266	175	84	231	0.31579	61.45	1947.48	1913.13	-34.35
91	267	176	85	231	0.31835	61.83	1950.51	1916.39	-34.12
91	268	177	86	231	0.32090	62.22	1953.44	1918.20	-35.24
91	269	178	87	231	0.32342	62.60	1956.26	1921.29	-34.97
91	270	179	88	231	0.32593	62.99	1958.98	1922.94	-36.05
91	271	180	89	231	0.32841	63.38	1961.60	1925.85	-35.74
91	272	181	90	231	0.33088	63.78	1964.11	1927.34	-36.77
91	273	182	91	231	0.33333	64.17	1966.52	1930.09	-36.43
91	274	183	92	231	0.33577	64.57	1968.82	1931.41	-37.41
91	275	184	93	231	0.33818	64.96	1971.03	1934.00	-37.03
91	276	185	94	231	0.34058	65.36	1973.13	1935.17	-37.96
91	277	186	95	231	0.34296	65.76	1975.13	1937.60	-37.53
91	278	187	96	231	0.34532	66.17	1977.03	1938.61	-38.42
91	279	188	97	231	0.34767	66.57	1978.82	1940.88	-37.94
91	280	189	98	231	0.35000	66.97	1980.51	1941.75	-38.77
91	281	190	99	231	0.35231	67.38	1982.11	1943.87	-38.24
91	282	191	100	231	0.35461	67.79	1983.60	1944.58	-39.01
91	283	192	101	231	0.35689	68.20	1984.99	1946.55	-38.44
91	284	193	102	231	0.35916	68.61	1986.27	1947.12	-39.15
91	285	194	103	231	0.36140	69.02	1987.46	1948.94	-38.52
91	286	195	104	231	0.36364	69.43	1988.55	1949.37	-39.18
91	287	196	105	231	0.36585	69.84	1989.54	1951.05	-38.49
91	288	197	106	231	0.36806	70.26	1990.42	1951.34	-39.09
91	289	198	107	231	0.37024	70.68	1991.21	1952.87	-38.34
91	290	199	108	231	0.37241	71.09	1991.90	1953.02	-38.87
91	291	200	109	231	0.37457	71.51	1992.48	1954.42	-38.07
91	292	201	110	231	0.37671	71.93	1992.97	1954.44	-38.54
91	293	202	111	231	0.37884	72.36	1993.36	1955.69	-37.67
91	294	203	112	231	0.38095	72.78	1993.65	1955.58	-38.07
91	295	204	113	231	0.38305	73.20	1993.84	1956.70	-37.14
91	296	205	114	231	0.38514	73.63	1993.93	1956.46	-37.47
91	297	206	115	231	0.38721	74.05	1993.92	1957.45	-36.48
91	298	207	116	231	0.38926	74.48	1993.81	1957.07	-36.74
91	299	208	117	231	0.39130	74.91	1993.61	1957.93	-35.68
91	300	209	118	231	0.39333	75.34	1993.31	1957.44	-35.87
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)

96	188	92	-4	246	0.02128	44.84	1249.97	1249.80	-0.16
96	189	93	-3	246	0.01587	44.79	1265.14	1264.45	-0.69
96	190	94	-2	246	0.01053	44.76	1280.09	1280.93	0.83
96	191	95	-1	246	0.00524	44.74	1294.83	1295.11	0.27
96	192	96	0	246	0.00000	44.74	1309.37	1311.12	1.75
96	193	97	1	246	0.00518	44.74	1323.70	1324.85	1.15
96	194	98	2	246	0.01031	44.76	1337.84	1340.40	2.57
96	195	99	3	246	0.01538	44.79	1351.77	1353.70	1.92
96	196	100	4	246	0.02041	44.83	1365.52	1368.81	3.28
96	197	101	5	246	0.02538	44.88	1379.08	1381.68	2.60
96	198	102	6	246	0.03030	44.94	1392.46	1396.35	3.90
96	199	103	7	246	0.03518	45.01	1405.65	1408.81	3.16
96	200	104	8	246	0.04000	45.09	1418.67	1423.07	4.39
96	201	105	9	246	0.04478	45.18	1431.52	1435.12	3.61
96	202	106	10	246	0.04951	45.27	1444.19	1448.97	4.78
96	203	107	11	246	0.05419	45.38	1456.69	1460.63	3.94
96	204	108	12	246	0.05882	45.49	1469.03	1474.08	5.05
96	205	109	13	246	0.06341	45.62	1481.20	1485.36	4.16
96	206	110	14	246	0.06796	45.75	1493.21	1498.41	5.20
96	207	111	15	246	0.07246	45.89	1505.07	1509.32	4.26
96	208	112	16	246	0.07692	46.03	1516.76	1522.00	5.24
96	209	113	17	246	0.08134	46.18	1528.30	1532.55	4.25
96	210	114	18	246	0.08571	46.34	1539.69	1544.86	5.17
96	211	115	19	246	0.09005	46.51	1550.93	1555.05	4.12
96	212	116	20	246	0.09434	46.68	1562.02	1567.00	4.98
96	213	117	21	246	0.09859	46.86	1572.96	1576.85	3.89
96	214	118	22	246	0.10280	47.05	1583.76	1588.45	4.69
96	215	119	23	246	0.10698	47.24	1594.41	1597.96	3.55
96	216	120	24	246	0.11111	47.44	1604.92	1609.22	4.30
96	217	121	25	246	0.11521	47.64	1615.29	1618.41	3.11
96	218	122	26	246	0.11927	47.85	1625.52	1629.33	3.80
96	219	123	27	246	0.12329	48.07	1635.62	1638.20	2.58
96	220	124	28	246	0.12727	48.29	1645.58	1648.79	3.21
96	221	125	29	246	0.13122	48.51	1655.40	1657.35	1.95
96	222	126	30	246	0.13514	48.74	1665.09	1667.62	2.53
96	223	127	31	246	0.13901	48.98	1674.65	1675.88	1.23
96	224	128	32	246	0.14286	49.22	1684.07	1685.84	1.77
96	225	129	33	246	0.14667	49.46	1693.37	1693.80	0.43
96	226	130	34	246	0.15044	49.71	1702.54	1703.46	0.92
96	227	131	35	246	0.15419	49.97	1711.58	1711.13	-0.45
96	228	132	36	246	0.15790	50.23	1720.49	1720.49	0.00
96	229	133	37	246	0.16157	50.49	1729.28	1727.87	-1.40
96	230	134	38	246	0.16522	50.76	1737.94	1736.95	-0.99
96	231	135	39	246	0.16883	51.03	1746.48	1744.06	-2.42
96	232	136	40	246	0.17241	51.31	1754.89	1752.85	-2.04
96	233	137	41	246	0.17597	51.59	1763.19	1759.69	-3.50
96	234	138	42	246	0.17949	51.87	1771.36	1768.20	-3.16
96	235	139	43	246	0.18298	52.16	1779.41	1774.77	-4.64
96	236	140	44	246	0.18644	52.45	1787.34	1783.02	-4.32
96	237	141	45	246	0.18987	52.74	1795.16	1789.34	-5.82
96	238	142	46	246	0.19328	53.04	1802.85	1797.32	-5.53
96	239	143	47	246	0.19665	53.34	1810.43	1803.38	-7.05
96	240	144	48	246	0.20000	53.65	1817.89	1811.11	-6.79
96	241	145	49	246	0.20332	53.96	1825.24	1816.92	-8.32
96	242	146	50	246	0.20661	54.27	1832.47	1824.39	-8.08
96	243	147	51	246	0.20988	54.59	1839.59	1829.96	-9.62
96	244	148	52	246	0.21312	54.90	1846.59	1837.19	-9.40
96	245	149	53	246	0.21633	55.23	1853.48	1842.53	-10.95
96	246	150	54	246	0.21951	55.55	1860.25	1849.51	-10.74
96	247	151	55	246	0.22267	55.88	1866.92	1854.62	-12.30
96	248	152	56	246	0.22581	56.21	1873.47	1861.37	-12.10
96	249	153	57	246	0.22892	56.54	1879.91	1866.24	-13.67
96	250	154	58	246	0.23200	56.88	1886.24	1872.76	-13.48

96	251	155	59	246	0.23506	57.22	1892.46	1877.42	-15.04
96	252	156	60	246	0.23810	57.56	1898.57	1883.71	-14.86
96	253	157	61	246	0.24111	57.90	1904.57	1888.15	-16.42
96	254	158	62	246	0.24409	58.25	1910.47	1894.22	-16.25
96	255	159	63	246	0.24706	58.60	1916.25	1898.45	-17.80
96	256	160	64	246	0.25000	58.95	1921.93	1904.30	-17.63
96	257	161	65	246	0.25292	59.31	1927.50	1908.32	-19.18
96	258	162	66	246	0.25581	59.67	1932.96	1913.96	-19.00
96	259	163	67	246	0.25869	60.03	1938.32	1917.77	-20.54
96	260	164	68	246	0.26154	60.39	1943.57	1923.21	-20.36
96	261	165	69	246	0.26437	60.75	1948.71	1926.82	-21.89
96	262	166	70	246	0.26718	61.12	1953.75	1932.05	-21.70
96	263	167	71	246	0.26996	61.49	1958.69	1935.47	-23.22
96	264	168	72	246	0.27273	61.86	1963.52	1940.50	-23.02
96	265	169	73	246	0.27547	62.23	1968.25	1943.73	-24.51
96	266	170	74	246	0.27820	62.61	1972.87	1948.56	-24.31
96	267	171	75	246	0.28090	62.99	1977.39	1951.61	-25.78
96	268	172	76	246	0.28358	63.37	1981.80	1956.25	-25.56
96	269	173	77	246	0.28625	63.75	1986.12	1959.11	-27.01
96	270	174	78	246	0.28889	64.13	1990.33	1963.56	-26.77
96	271	175	79	246	0.29151	64.52	1994.44	1966.24	-28.20
96	272	176	80	246	0.29412	64.91	1998.44	1970.50	-27.94
96	273	177	81	246	0.29670	65.30	2002.35	1973.01	-29.34
96	274	178	82	246	0.29927	65.69	2006.15	1977.09	-29.06
96	275	179	83	246	0.30182	66.08	2009.86	1979.42	-30.44
96	276	180	84	246	0.30435	66.48	2013.46	1983.33	-30.13
96	277	181	85	246	0.30686	66.88	2016.96	1985.49	-31.47
96	278	182	86	246	0.30935	67.27	2020.37	1989.22	-31.14
96	279	183	87	246	0.31183	67.68	2023.67	1991.22	-32.45
96	280	184	88	246	0.31429	68.08	2026.87	1994.78	-32.09
96	281	185	89	246	0.31673	68.48	2029.97	1996.61	-33.36
96	282	186	90	246	0.31915	68.89	2032.98	2000.01	-32.97
96	283	187	91	246	0.32156	69.30	2035.88	2001.68	-34.21
96	284	188	92	246	0.32394	69.71	2038.69	2004.91	-33.78
96	285	189	93	246	0.32632	70.12	2041.40	2006.42	-34.98
96	286	190	94	246	0.32867	70.53	2044.01	2009.49	-34.52
96	287	191	95	246	0.33101	70.94	2046.52	2010.85	-35.67
96	288	192	96	246	0.33333	71.36	2048.93	2013.76	-35.17
96	289	193	97	246	0.33564	71.78	2051.25	2014.97	-36.28
96	290	194	98	246	0.33793	72.20	2053.47	2017.72	-35.75
96	291	195	99	246	0.34021	72.62	2055.59	2018.78	-36.81
96	292	196	100	246	0.34247	73.04	2057.62	2021.38	-36.23
96	293	197	101	246	0.34471	73.46	2059.54	2022.29	-37.25
96	294	198	102	246	0.34694	73.89	2061.38	2024.75	-36.63
96	295	199	103	246	0.34915	74.31	2063.11	2025.51	-37.60
96	296	200	104	246	0.35135	74.74	2064.75	2027.82	-36.93
96	297	201	105	246	0.35354	75.17	2066.29	2028.45	-37.84
96	298	202	106	246	0.35571	75.60	2067.74	2030.61	-37.13
96	299	203	107	246	0.35786	76.03	2069.09	2031.10	-37.99
96	300	204	108	246	0.36000	76.47	2070.35	2033.12	-37.23
96	301	205	109	246	0.36213	76.90	2071.51	2033.47	-38.04
96	302	206	110	246	0.36424	77.34	2072.57	2035.35	-37.23
96	303	207	111	246	0.36634	77.77	2073.54	2035.57	-37.97
96	304	208	112	246	0.36842	78.21	2074.42	2037.31	-37.11
96	305	209	113	246	0.37049	78.65	2075.20	2037.40	-37.80
96	306	210	114	246	0.37255	79.09	2075.89	2039.01	-36.88
96	307	211	115	246	0.37459	79.54	2076.48	2038.97	-37.51
96	308	212	116	246	0.37662	79.98	2076.98	2040.44	-36.54
96	309	213	117	246	0.37864	80.42	2077.38	2040.28	-37.10
96	310	214	118	246	0.38065	80.87	2077.69	2041.62	-36.07
96	311	215	119	246	0.38264	81.32	2077.90	2041.33	-36.58
96	312	216	120	246	0.38462	81.77	2078.03	2042.54	-35.48
96	313	217	121	246	0.38658	82.21	2078.05	2042.13	-35.92

96	314	218	122	246	0.38854	82.66	2077.99	2043.22	-34.77
96	315	219	123	246	0.39048	83.12	2077.83	2042.69	-35.14
96	316	220	124	246	0.39241	83.57	2077.58	2043.65	-33.93
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
101	198	97	-4	261	0.02020	49.57	1286.73	1285.29	-1.44
101	199	98	-3	261	0.01508	49.52	1302.02	1301.88	-0.15
101	200	99	-2	261	0.01000	49.49	1317.10	1316.58	-0.52
101	201	100	-1	261	0.00498	49.47	1331.97	1332.72	0.74
101	202	101	0	261	0.00000	49.46	1346.64	1346.98	0.35
101	203	102	1	261	0.00493	49.47	1361.11	1362.67	1.57
101	204	103	2	261	0.00980	49.49	1375.38	1376.52	1.13
101	205	104	3	261	0.01463	49.52	1389.47	1391.78	2.31
101	206	105	4	261	0.01942	49.56	1403.37	1405.21	1.84
101	207	106	5	261	0.02415	49.61	1417.08	1420.05	2.96
101	208	107	6	261	0.02885	49.67	1430.62	1433.07	2.45
101	209	108	7	261	0.03349	49.74	1443.98	1447.50	3.52
101	210	109	8	261	0.03810	49.82	1457.16	1460.13	2.97
101	211	110	9	261	0.04265	49.91	1470.17	1474.16	3.99
101	212	111	10	261	0.04717	50.00	1483.02	1486.41	3.39
101	213	112	11	261	0.05164	50.11	1495.70	1500.05	4.36
101	214	113	12	261	0.05607	50.23	1508.21	1511.93	3.71
101	215	114	13	261	0.06047	50.35	1520.57	1525.19	4.62
101	216	115	14	261	0.06481	50.48	1532.77	1536.70	3.93
101	217	116	15	261	0.06912	50.62	1544.81	1549.59	4.78
101	218	117	16	261	0.07339	50.77	1556.70	1560.75	4.05
101	219	118	17	261	0.07763	50.92	1568.43	1573.28	4.85
101	220	119	18	261	0.08182	51.08	1580.02	1584.08	4.06
101	221	120	19	261	0.08597	51.25	1591.46	1596.27	4.81
101	222	121	20	261	0.09009	51.43	1602.75	1606.73	3.98
101	223	122	21	261	0.09417	51.61	1613.90	1618.57	4.67
101	224	123	22	261	0.09821	51.80	1624.91	1628.71	3.80
101	225	124	23	261	0.10222	51.99	1635.77	1640.21	4.44
101	226	125	24	261	0.10620	52.20	1646.50	1650.02	3.52
101	227	126	25	261	0.11013	52.40	1657.09	1661.20	4.11
101	228	127	26	261	0.11404	52.62	1667.54	1670.69	3.15
101	229	128	27	261	0.11790	52.83	1677.86	1681.55	3.69
101	230	129	28	261	0.12174	53.06	1688.05	1690.74	2.69
101	231	130	29	261	0.12554	53.29	1698.10	1701.28	3.18
101	232	131	30	261	0.12931	53.52	1708.02	1710.17	2.15
101	233	132	31	261	0.13305	53.76	1717.81	1720.41	2.59
101	234	133	32	261	0.13675	54.01	1727.48	1729.00	1.52
101	235	134	33	261	0.14043	54.26	1737.02	1738.94	1.92
101	236	135	34	261	0.14407	54.51	1746.43	1747.25	0.82
101	237	136	35	261	0.14768	54.77	1755.71	1756.90	1.18
101	238	137	36	261	0.15126	55.04	1764.88	1764.92	0.04
101	239	138	37	261	0.15481	55.30	1773.92	1774.28	0.37
101	240	139	38	261	0.15833	55.58	1782.83	1782.03	-0.80
101	241	140	39	261	0.16183	55.86	1791.63	1791.12	-0.51
101	242	141	40	261	0.16529	56.14	1800.31	1798.60	-1.71
101	243	142	41	261	0.16872	56.42	1808.87	1807.41	-1.45
101	244	143	42	261	0.17213	56.71	1817.31	1814.63	-2.68
101	245	144	43	261	0.17551	57.01	1825.63	1823.18	-2.45
101	246	145	44	261	0.17886	57.30	1833.83	1830.14	-3.70
101	247	146	45	261	0.18219	57.61	1841.92	1838.42	-3.50
101	248	147	46	261	0.18548	57.91	1849.90	1845.13	-4.77
101	249	148	47	261	0.18876	58.22	1857.76	1853.16	-4.60
101	250	149	48	261	0.19200	58.53	1865.51	1859.62	-5.88
101	251	150	49	261	0.19522	58.85	1873.14	1867.40	-5.74
101	252	151	50	261	0.19841	59.17	1880.66	1873.62	-7.04
101	253	152	51	261	0.20158	59.49	1888.07	1881.16	-6.91
101	254	153	52	261	0.20472	59.82	1895.37	1887.15	-8.22

101	255	154	53	261	0.20784	60.15	1902.56	1894.44	-8.12
101	256	155	54	261	0.21094	60.48	1909.64	1900.20	-9.44
101	257	156	55	261	0.21401	60.82	1916.61	1907.26	-9.35
101	258	157	56	261	0.21705	61.16	1923.47	1912.79	-10.68
101	259	158	57	261	0.22008	61.50	1930.23	1919.62	-10.60
101	260	159	58	261	0.22308	61.84	1936.87	1924.93	-11.94
101	261	160	59	261	0.22605	62.19	1943.41	1931.54	-11.87
101	262	161	60	261	0.22901	62.54	1949.85	1936.63	-13.22
101	263	162	61	261	0.23194	62.90	1956.17	1943.01	-13.16
101	264	163	62	261	0.23485	63.25	1962.39	1947.89	-14.50
101	265	164	63	261	0.23774	63.61	1968.51	1954.06	-14.45
101	266	165	64	261	0.24060	63.98	1974.52	1958.73	-15.79
101	267	166	65	261	0.24345	64.34	1980.43	1964.69	-15.74
101	268	167	66	261	0.24627	64.71	1986.24	1969.16	-17.08
101	269	168	67	261	0.24907	65.08	1991.94	1974.91	-17.03
101	270	169	68	261	0.25185	65.45	1997.54	1979.17	-18.37
101	271	170	69	261	0.25461	65.83	2003.04	1984.72	-18.31
101	272	171	70	261	0.25735	66.20	2008.43	1988.79	-19.64
101	273	172	71	261	0.26007	66.58	2013.73	1994.14	-19.58
101	274	173	72	261	0.26277	66.96	2018.92	1998.02	-20.90
101	275	174	73	261	0.26546	67.35	2024.01	2003.17	-20.84
101	276	175	74	261	0.26812	67.74	2029.00	2006.86	-22.14
101	277	176	75	261	0.27076	68.12	2033.89	2011.82	-22.07
101	278	177	76	261	0.27338	68.52	2038.69	2015.32	-23.36
101	279	178	77	261	0.27599	68.91	2043.38	2020.10	-23.28
101	280	179	78	261	0.27857	69.31	2047.97	2023.42	-24.55
101	281	180	79	261	0.28114	69.70	2052.47	2028.01	-24.46
101	282	181	80	261	0.28369	70.10	2056.86	2031.15	-25.71
101	283	182	81	261	0.28622	70.50	2061.16	2035.56	-25.60
101	284	183	82	261	0.28873	70.91	2065.36	2038.53	-26.83
101	285	184	83	261	0.29123	71.31	2069.47	2042.76	-26.70
101	286	185	84	261	0.29371	71.72	2073.47	2045.56	-27.91
101	287	186	85	261	0.29617	72.13	2077.38	2049.62	-27.77
101	288	187	86	261	0.29861	72.54	2081.19	2052.24	-28.95
101	289	188	87	261	0.30104	72.96	2084.91	2056.13	-28.78
101	290	189	88	261	0.30345	73.37	2088.53	2058.59	-29.94
101	291	190	89	261	0.30584	73.79	2092.06	2062.31	-29.74
101	292	191	90	261	0.30822	74.21	2095.48	2064.61	-30.87
101	293	192	91	261	0.31058	74.63	2098.82	2068.17	-30.65
101	294	193	92	261	0.31293	75.05	2102.06	2070.31	-31.75
101	295	194	93	261	0.31525	75.48	2105.20	2073.70	-31.50
101	296	195	94	261	0.31757	75.90	2108.25	2075.69	-32.56
101	297	196	95	261	0.31987	76.33	2111.20	2078.92	-32.29
101	298	197	96	261	0.32215	76.76	2114.06	2080.75	-33.31
101	299	198	97	261	0.32442	77.19	2116.83	2083.83	-33.00
101	300	199	98	261	0.32667	77.63	2119.50	2085.51	-34.00
101	301	200	99	261	0.32890	78.06	2122.08	2088.43	-33.65
101	302	201	100	261	0.33113	78.50	2124.57	2089.96	-34.61
101	303	202	101	261	0.33333	78.93	2126.96	2092.74	-34.23
101	304	203	102	261	0.33553	79.37	2129.26	2094.12	-35.14
101	305	204	103	261	0.33771	79.81	2131.47	2096.75	-34.72
101	306	205	104	261	0.33987	80.26	2133.59	2097.99	-35.59
101	307	206	105	261	0.34202	80.70	2135.61	2100.47	-35.14
101	308	207	106	261	0.34416	81.15	2137.54	2101.58	-35.96
101	309	208	107	261	0.34628	81.59	2139.38	2103.91	-35.47
101	310	209	108	261	0.34839	82.04	2141.13	2104.88	-36.25
101	311	210	109	261	0.35048	82.49	2142.78	2107.07	-35.71
101	312	211	110	261	0.35256	82.94	2144.35	2107.90	-36.44
101	313	212	111	261	0.35463	83.39	2145.82	2109.96	-35.86
101	314	213	112	261	0.35669	83.85	2147.20	2110.66	-36.54
101	315	214	113	261	0.35873	84.30	2148.49	2112.58	-35.91
101	316	215	114	261	0.36076	84.76	2149.69	2113.14	-36.55
101	317	216	115	261	0.36278	85.22	2150.80	2114.93	-35.87

101	318	217	116	261	0.36478	85.67	2151.82	2115.37	-36.45
101	319	218	117	261	0.36677	86.13	2152.75	2117.02	-35.73
101	320	219	118	261	0.36875	86.60	2153.59	2117.34	-36.25
101	321	220	119	261	0.37072	87.06	2154.34	2118.86	-35.48
101	322	221	120	261	0.37267	87.52	2155.00	2119.05	-35.95
101	323	222	121	261	0.37461	87.99	2155.57	2120.45	-35.12
101	324	223	122	261	0.37654	88.45	2156.05	2120.51	-35.54
101	325	224	123	261	0.37846	88.92	2156.44	2121.79	-34.65
101	326	225	124	261	0.38037	89.39	2156.74	2121.73	-35.01
101	327	226	125	261	0.38226	89.86	2156.95	2122.88	-34.07
101	328	227	126	261	0.38415	90.33	2157.07	2122.70	-34.37
101	329	228	127	261	0.38602	90.81	2157.11	2123.73	-33.37
101	330	229	128	261	0.38788	91.28	2157.05	2123.44	-33.61
101	331	230	129	261	0.38973	91.75	2156.91	2124.35	-32.56
101	332	231	130	261	0.39157	92.23	2156.68	2123.95	-32.73
101	333	232	131	261	0.39339	92.71	2156.36	2124.74	-31.62
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
106	208	102	-4	278	0.01923	54.53	1312.15	1321.45	9.30
106	209	103	-3	278	0.01435	54.49	1327.66	1336.28	8.63
106	210	104	-2	278	0.00952	54.46	1342.95	1352.90	9.95
106	211	105	-1	278	0.00474	54.44	1358.05	1367.31	9.26
106	212	106	0	278	0.00000	54.43	1372.95	1383.49	10.55
106	213	107	1	278	0.00469	54.44	1387.65	1397.49	9.84
106	214	108	2	278	0.00935	54.46	1402.17	1413.25	11.09
106	215	109	3	278	0.01395	54.49	1416.50	1426.85	10.35
106	216	110	4	278	0.01852	54.52	1430.64	1442.20	11.56
106	217	111	5	278	0.02304	54.58	1444.61	1455.40	10.79
106	218	112	6	278	0.02752	54.64	1458.40	1470.36	11.96
106	219	113	7	278	0.03196	54.71	1472.02	1483.17	11.16
106	220	114	8	278	0.03636	54.79	1485.47	1497.74	12.28
106	221	115	9	278	0.04072	54.88	1498.75	1510.18	11.44
106	222	116	10	278	0.04505	54.98	1511.86	1524.37	12.51
106	223	117	11	278	0.04933	55.08	1524.81	1536.45	11.63
106	224	118	12	278	0.05357	55.20	1537.61	1550.26	12.65
106	225	119	13	278	0.05778	55.32	1550.25	1561.98	11.74
106	226	120	14	278	0.06195	55.46	1562.73	1575.43	12.71
106	227	121	15	278	0.06608	55.60	1575.06	1586.81	11.75
106	228	122	16	278	0.07018	55.75	1587.24	1599.90	12.67
106	229	123	17	278	0.07424	55.90	1599.27	1610.94	11.67
106	230	124	18	278	0.07826	56.07	1611.15	1623.69	12.54
106	231	125	19	278	0.08225	56.24	1622.89	1634.39	11.50
106	232	126	20	278	0.08621	56.41	1634.48	1646.80	12.32
106	233	127	21	278	0.09013	56.60	1645.94	1657.18	11.24
106	234	128	22	278	0.09402	56.79	1657.25	1669.26	12.01
106	235	129	23	278	0.09787	56.99	1668.43	1679.33	10.89
106	236	130	24	278	0.10170	57.19	1679.47	1691.09	11.61
106	237	131	25	278	0.10549	57.40	1690.38	1700.84	10.46
106	238	132	26	278	0.10924	57.62	1701.15	1712.28	11.13
106	239	133	27	278	0.11297	57.84	1711.80	1721.73	9.93
106	240	134	28	278	0.11667	58.07	1722.31	1732.87	10.56
106	241	135	29	278	0.12033	58.30	1732.69	1742.02	9.33
106	242	136	30	278	0.12397	58.54	1742.95	1752.85	9.91
106	243	137	31	278	0.12757	58.78	1753.08	1761.72	8.64
106	244	138	32	278	0.13115	59.03	1763.08	1772.26	9.18
106	245	139	33	278	0.13469	59.29	1772.96	1780.84	7.88
106	246	140	34	278	0.13821	59.54	1782.71	1791.09	8.37
106	247	141	35	278	0.14170	59.81	1792.35	1799.39	7.04
106	248	142	36	278	0.14516	60.08	1801.86	1809.36	7.50
106	249	143	37	278	0.14859	60.35	1811.25	1817.39	6.14
106	250	144	38	278	0.15200	60.63	1820.53	1827.08	6.56
106	251	145	39	278	0.15538	60.91	1829.68	1834.85	5.17

106	252	146	40	278	0.15873	61.20	1838.72	1844.27	5.55
106	253	147	41	278	0.16206	61.49	1847.65	1851.78	4.13
106	254	148	42	278	0.16535	61.79	1856.45	1860.94	4.48
106	255	149	43	278	0.16863	62.09	1865.15	1868.19	3.04
106	256	150	44	278	0.17188	62.39	1873.73	1877.09	3.36
106	257	151	45	278	0.17510	62.70	1882.20	1884.09	1.90
106	258	152	46	278	0.17830	63.01	1890.55	1892.74	2.19
106	259	153	47	278	0.18147	63.33	1898.80	1899.50	0.70
106	260	154	48	278	0.18462	63.65	1906.93	1907.89	0.96
106	261	155	49	278	0.18774	63.97	1914.95	1914.42	-0.54
106	262	156	50	278	0.19084	64.30	1922.87	1922.57	-0.30
106	263	157	51	278	0.19392	64.63	1930.67	1928.86	-1.82
106	264	158	52	278	0.19697	64.96	1938.37	1936.77	-1.60
106	265	159	53	278	0.20000	65.30	1945.96	1942.83	-3.14
106	266	160	54	278	0.20301	65.64	1953.45	1950.51	-2.94
106	267	161	55	278	0.20599	65.98	1960.83	1956.34	-4.49
106	268	162	56	278	0.20896	66.33	1968.10	1963.79	-4.31
106	269	163	57	278	0.21190	66.68	1975.27	1969.41	-5.86
106	270	164	58	278	0.21482	67.04	1982.34	1976.63	-5.70
106	271	165	59	278	0.21771	67.39	1989.30	1982.03	-7.26
106	272	166	60	278	0.22059	67.75	1996.15	1989.04	-7.12
106	273	167	61	278	0.22344	68.12	2002.91	1994.23	-8.68
106	274	168	62	278	0.22628	68.48	2009.56	2001.01	-8.55
106	275	169	63	278	0.22909	68.85	2016.12	2006.00	-10.12
106	276	170	64	278	0.23188	69.22	2022.57	2012.57	-9.99
106	277	171	65	278	0.23466	69.60	2028.92	2017.35	-11.56
106	278	172	66	278	0.23741	69.97	2035.17	2023.72	-11.45
106	279	173	67	278	0.24014	70.35	2041.32	2028.30	-13.02
106	280	174	68	278	0.24286	70.73	2047.37	2034.46	-12.90
106	281	175	69	278	0.24555	71.12	2053.32	2038.85	-14.47
106	282	176	70	278	0.24823	71.51	2059.17	2044.81	-14.36
106	283	177	71	278	0.25088	71.90	2064.93	2049.01	-15.92
106	284	178	72	278	0.25352	72.29	2070.58	2054.77	-15.81
106	285	179	73	278	0.25614	72.68	2076.14	2058.78	-17.37
106	286	180	74	278	0.25874	73.08	2081.61	2064.35	-17.25
106	287	181	75	278	0.26132	73.48	2086.97	2068.17	-18.80
106	288	182	76	278	0.26389	73.88	2092.24	2073.56	-18.68
106	289	183	77	278	0.26644	74.29	2097.42	2077.20	-20.22
106	290	184	78	278	0.26897	74.69	2102.50	2082.40	-20.10
106	291	185	79	278	0.27148	75.10	2107.48	2085.86	-21.62
106	292	186	80	278	0.27397	75.52	2112.37	2090.88	-21.49
106	293	187	81	278	0.27645	75.93	2117.17	2094.17	-23.00
106	294	188	82	278	0.27891	76.34	2121.87	2099.01	-22.86
106	295	189	83	278	0.28136	76.76	2126.47	2102.12	-24.35
106	296	190	84	278	0.28378	77.18	2130.99	2106.79	-24.20
106	297	191	85	278	0.28620	77.60	2135.40	2109.73	-25.67
106	298	192	86	278	0.28859	78.03	2139.73	2114.23	-25.51
106	299	193	87	278	0.29097	78.45	2143.96	2117.01	-26.96
106	300	194	88	278	0.29333	78.88	2148.11	2121.33	-26.78
106	301	195	89	278	0.29568	79.31	2152.16	2123.95	-28.21
106	302	196	90	278	0.29801	79.74	2156.11	2128.10	-28.01
106	303	197	91	278	0.30033	80.18	2159.98	2130.56	-29.41
106	304	198	92	278	0.30263	80.61	2163.75	2134.56	-29.19
106	305	199	93	278	0.30492	81.05	2167.43	2136.86	-30.57
106	306	200	94	278	0.30719	81.49	2171.03	2140.69	-30.33
106	307	201	95	278	0.30945	81.93	2174.53	2142.84	-31.69
106	308	202	96	278	0.31169	82.37	2177.94	2146.52	-31.42
106	309	203	97	278	0.31392	82.82	2181.26	2148.51	-32.74
106	310	204	98	278	0.31613	83.26	2184.49	2152.03	-32.46
106	311	205	99	278	0.31833	83.71	2187.63	2153.88	-33.75
106	312	206	100	278	0.32051	84.16	2190.68	2157.25	-33.43
106	313	207	101	278	0.32268	84.61	2193.64	2158.95	-34.69
106	314	208	102	278	0.32484	85.06	2196.52	2162.17	-34.35

106	315	209	103	278	0.32698	85.52	2199.30	2163.73	-35.57
106	316	210	104	278	0.32911	85.98	2201.99	2166.80	-35.20
106	317	211	105	278	0.33123	86.43	2204.60	2168.22	-36.38
106	318	212	106	278	0.33333	86.89	2207.12	2171.14	-35.98
106	319	213	107	278	0.33542	87.35	2209.55	2172.42	-37.13
106	320	214	108	278	0.33750	87.82	2211.89	2175.20	-36.69
106	321	215	109	278	0.33956	88.28	2214.15	2176.35	-37.80
106	322	216	110	278	0.34162	88.75	2216.31	2178.99	-37.32
106	323	217	111	278	0.34365	89.21	2218.39	2180.00	-38.39
106	324	218	112	278	0.34568	89.68	2220.38	2182.50	-37.88
106	325	219	113	278	0.34769	90.15	2222.29	2183.38	-38.91
106	326	220	114	278	0.34969	90.62	2224.11	2185.75	-38.36
106	327	221	115	278	0.35168	91.09	2225.84	2186.49	-39.34
106	328	222	116	278	0.35366	91.57	2227.48	2188.73	-38.75
106	329	223	117	278	0.35562	92.04	2229.04	2189.35	-39.69
106	330	224	118	278	0.35758	92.52	2230.51	2191.45	-39.06
106	331	225	119	278	0.35952	93.00	2231.90	2191.95	-39.95
106	332	226	120	278	0.36145	93.48	2233.20	2193.92	-39.28
106	333	227	121	278	0.36336	93.96	2234.41	2194.29	-40.12
106	334	228	122	278	0.36527	94.44	2235.54	2196.14	-39.40
106	335	229	123	278	0.36716	94.92	2236.58	2196.39	-40.20
106	336	230	124	278	0.36905	95.41	2237.54	2198.11	-39.43
106	337	231	125	278	0.37092	95.89	2238.41	2198.24	-40.17
106	338	232	126	278	0.37278	96.38	2239.20	2199.84	-39.36
106	339	233	127	278	0.37463	96.87	2239.90	2199.85	-40.05
106	340	234	128	278	0.37647	97.36	2240.52	2201.33	-39.19
106	341	235	129	278	0.37830	97.85	2241.05	2201.22	-39.83
106	342	236	130	278	0.38012	98.34	2241.50	2202.58	-38.92
106	343	237	131	278	0.38192	98.84	2241.87	2202.36	-39.50
106	344	238	132	278	0.38372	99.33	2242.15	2203.60	-38.54
106	345	239	133	278	0.38551	99.83	2242.34	2203.27	-39.07
106	346	240	134	278	0.38728	100.32	2242.45	2204.40	-38.05
106	347	241	135	278	0.38905	100.82	2242.48	2203.96	-38.52
106	348	242	136	278	0.39081	101.32	2242.42	2204.97	-37.45
106	349	243	137	278	0.39255	101.82	2242.28	2204.42	-37.86
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
111	218	107	-4	293	0.01835	59.74	1343.73	1350.99	7.26
111	219	108	-3	293	0.01370	59.70	1359.32	1367.71	8.39
111	220	109	-2	293	0.00909	59.67	1374.71	1382.61	7.89
111	221	110	-1	293	0.00452	59.65	1389.91	1398.90	9.00
111	222	111	0	293	0.00000	59.64	1404.90	1413.40	8.49
111	223	112	1	293	0.00448	59.65	1419.71	1429.29	9.57
111	224	113	2	293	0.00893	59.66	1434.33	1443.39	9.05
111	225	114	3	293	0.01333	59.69	1448.77	1458.88	10.10
111	226	115	4	293	0.01770	59.73	1463.04	1472.59	9.56
111	227	116	5	293	0.02203	59.78	1477.12	1487.70	10.58
111	228	117	6	293	0.02632	59.84	1491.03	1501.04	10.01
111	229	118	7	293	0.03057	59.92	1504.77	1515.76	10.99
111	230	119	8	293	0.03478	60.00	1518.34	1528.73	10.39
111	231	120	9	293	0.03896	60.09	1531.75	1543.09	11.33
111	232	121	10	293	0.04310	60.19	1545.00	1555.70	10.70
111	233	122	11	293	0.04721	60.29	1558.09	1569.69	11.60
111	234	123	12	293	0.05128	60.41	1571.02	1581.96	10.94
111	235	124	13	293	0.05532	60.54	1583.79	1595.59	11.80
111	236	125	14	293	0.05932	60.67	1596.41	1607.52	11.10
111	237	126	15	293	0.06329	60.81	1608.89	1620.81	11.92
111	238	127	16	293	0.06723	60.96	1621.21	1632.40	11.18
111	239	128	17	293	0.07113	61.12	1633.39	1645.35	11.96
111	240	129	18	293	0.07500	61.29	1645.42	1656.61	11.19
111	241	130	19	293	0.07884	61.46	1657.31	1669.23	11.92
111	242	131	20	293	0.08264	61.64	1669.06	1680.18	11.11

111	243	132	21	293	0.08642	61.82	1680.68	1692.47	11.80
111	244	133	22	293	0.09016	62.02	1692.15	1703.10	10.95
111	245	134	23	293	0.09388	62.22	1703.49	1715.09	11.60
111	246	135	24	293	0.09756	62.42	1714.69	1725.41	10.72
111	247	136	25	293	0.10122	62.64	1725.76	1737.08	11.32
111	248	137	26	293	0.10484	62.86	1736.70	1747.11	10.40
111	249	138	27	293	0.10843	63.08	1747.52	1758.48	10.96
111	250	139	28	293	0.11200	63.31	1758.20	1768.21	10.01
111	251	140	29	293	0.11554	63.55	1768.75	1779.28	10.53
111	252	141	30	293	0.11905	63.79	1779.18	1788.73	9.55
111	253	142	31	293	0.12253	64.04	1789.49	1799.51	10.03
111	254	143	32	293	0.12598	64.29	1799.67	1808.68	9.01
111	255	144	33	293	0.12941	64.55	1809.73	1819.18	9.45
111	256	145	34	293	0.13281	64.81	1819.67	1828.07	8.40
111	257	146	35	293	0.13619	65.08	1829.49	1838.29	8.81
111	258	147	36	293	0.13954	65.36	1839.19	1846.92	7.73
111	259	148	37	293	0.14286	65.63	1848.77	1856.87	8.10
111	260	149	38	293	0.14615	65.92	1858.24	1865.23	6.99
111	261	150	39	293	0.14943	66.21	1867.59	1874.91	7.32
111	262	151	40	293	0.15267	66.50	1876.82	1883.01	6.19
111	263	152	41	293	0.15589	66.79	1885.94	1892.43	6.49
111	264	153	42	293	0.15909	67.10	1894.95	1900.28	5.34
111	265	154	43	293	0.16226	67.40	1903.84	1909.45	5.61
111	266	155	44	293	0.16541	67.71	1912.63	1917.05	4.43
111	267	156	45	293	0.16854	68.03	1921.30	1925.97	4.67
111	268	157	46	293	0.17164	68.34	1929.86	1933.33	3.46
111	269	158	47	293	0.17472	68.67	1938.32	1941.99	3.68
111	270	159	48	293	0.17778	68.99	1946.66	1949.12	2.46
111	271	160	49	293	0.18081	69.32	1954.90	1957.54	2.64
111	272	161	50	293	0.18382	69.66	1963.03	1964.44	1.40
111	273	162	51	293	0.18681	69.99	1971.06	1972.63	1.57
111	274	163	52	293	0.18978	70.33	1978.97	1979.29	0.31
111	275	164	53	293	0.19273	70.68	1986.79	1987.25	0.46
111	276	165	54	293	0.19565	71.03	1994.50	1993.69	-0.81
111	277	166	55	293	0.19856	71.38	2002.10	2001.42	-0.69
111	278	167	56	293	0.20144	71.73	2009.61	2007.64	-1.97
111	279	168	57	293	0.20430	72.09	2017.01	2015.14	-1.86
111	280	169	58	293	0.20714	72.45	2024.31	2021.15	-3.16
111	281	170	59	293	0.20996	72.82	2031.50	2028.44	-3.07
111	282	171	60	293	0.21277	73.19	2038.60	2034.23	-4.37
111	283	172	61	293	0.21555	73.56	2045.60	2041.31	-4.29
111	284	173	62	293	0.21831	73.93	2052.49	2046.89	-5.60
111	285	174	63	293	0.22105	74.31	2059.29	2053.76	-5.53
111	286	175	64	293	0.22378	74.69	2065.99	2059.14	-6.85
111	287	176	65	293	0.22648	75.07	2072.59	2065.80	-6.79
111	288	177	66	293	0.22917	75.46	2079.09	2070.98	-8.11
111	289	178	67	293	0.23183	75.85	2085.49	2077.43	-8.06
111	290	179	68	293	0.23448	76.24	2091.80	2082.42	-9.38
111	291	180	69	293	0.23711	76.64	2098.01	2088.68	-9.33
111	292	181	70	293	0.23973	77.03	2104.13	2093.47	-10.66
111	293	182	71	293	0.24232	77.43	2110.15	2099.53	-10.61
111	294	183	72	293	0.24490	77.84	2116.07	2104.14	-11.93
111	295	184	73	293	0.24746	78.24	2121.90	2110.01	-11.89
111	296	185	74	293	0.25000	78.65	2127.63	2114.43	-13.20
111	297	186	75	293	0.25253	79.06	2133.27	2120.11	-13.16
111	298	187	76	293	0.25503	79.47	2138.82	2124.35	-14.47
111	299	188	77	293	0.25753	79.89	2144.27	2129.85	-14.43
111	300	189	78	293	0.26000	80.30	2149.64	2133.91	-15.73
111	301	190	79	293	0.26246	80.72	2154.90	2139.22	-15.68
111	302	191	80	293	0.26490	81.15	2160.08	2143.10	-16.97
111	303	192	81	293	0.26733	81.57	2165.16	2148.24	-16.92
111	304	193	82	293	0.26974	82.00	2170.15	2151.95	-18.20
111	305	194	83	293	0.27213	82.43	2175.05	2156.91	-18.14

111	306	195	84	293	0.27451	82.86	2179.86	2160.46	-19.41
111	307	196	85	293	0.27687	83.29	2184.58	2165.24	-19.34
111	308	197	86	293	0.27922	83.73	2189.21	2168.62	-20.59
111	309	198	87	293	0.28155	84.16	2193.75	2173.24	-20.51
111	310	199	88	293	0.28387	84.60	2198.19	2176.45	-21.74
111	311	200	89	293	0.28617	85.04	2202.55	2180.91	-21.65
111	312	201	90	293	0.28846	85.49	2206.82	2183.96	-22.87
111	313	202	91	293	0.29074	85.93	2211.00	2188.25	-22.75
111	314	203	92	293	0.29299	86.38	2215.09	2191.14	-23.95
111	315	204	93	293	0.29524	86.83	2219.09	2195.27	-23.83
111	316	205	94	293	0.29747	87.28	2223.01	2198.01	-25.00
111	317	206	95	293	0.29969	87.74	2226.83	2201.98	-24.86
111	318	207	96	293	0.30189	88.19	2230.57	2204.56	-26.01
111	319	208	97	293	0.30408	88.65	2234.22	2208.38	-25.85
111	320	209	98	293	0.30625	89.11	2237.79	2210.81	-26.98
111	321	210	99	293	0.30841	89.57	2241.26	2214.48	-26.79
111	322	211	100	293	0.31056	90.03	2244.65	2216.76	-27.89
111	323	212	101	293	0.31269	90.50	2247.96	2220.28	-27.68
111	324	213	102	293	0.31482	90.96	2251.17	2222.42	-28.76
111	325	214	103	293	0.31692	91.43	2254.30	2225.78	-28.52
111	326	215	104	293	0.31902	91.90	2257.35	2227.78	-29.57
111	327	216	105	293	0.32110	92.37	2260.31	2231.00	-29.31
111	328	217	106	293	0.32317	92.85	2263.18	2232.86	-30.32
111	329	218	107	293	0.32523	93.32	2265.97	2235.94	-30.03
111	330	219	108	293	0.32727	93.80	2268.67	2237.66	-31.01
111	331	220	109	293	0.32931	94.27	2271.29	2240.59	-30.70
111	332	221	110	293	0.33133	94.75	2273.82	2242.18	-31.64
111	333	222	111	293	0.33333	95.23	2276.27	2244.97	-31.29
111	334	223	112	293	0.33533	95.72	2278.63	2246.42	-32.21
111	335	224	113	293	0.33731	96.20	2280.91	2249.09	-31.83
111	336	225	114	293	0.33929	96.69	2283.11	2250.40	-32.70
111	337	226	115	293	0.34125	97.17	2285.22	2252.93	-32.29
111	338	227	116	293	0.34320	97.66	2287.25	2254.12	-33.12
111	339	228	117	293	0.34513	98.15	2289.19	2256.52	-32.67
111	340	229	118	293	0.34706	98.64	2291.05	2257.58	-33.47
111	341	230	119	293	0.34897	99.14	2292.83	2259.84	-32.98
111	342	231	120	293	0.35088	99.63	2294.52	2260.78	-33.74
111	343	232	121	293	0.35277	100.13	2296.13	2262.92	-33.22
111	344	233	122	293	0.35465	100.63	2297.66	2263.73	-33.93
111	345	234	123	293	0.35652	101.12	2299.11	2265.74	-33.37
111	346	235	124	293	0.35838	101.62	2300.47	2266.43	-34.04
111	347	236	125	293	0.36023	102.12	2301.75	2268.32	-33.43
111	348	237	126	293	0.36207	102.63	2302.95	2268.89	-34.06
111	349	238	127	293	0.36390	103.13	2304.07	2270.66	-33.41
111	350	239	128	293	0.36571	103.64	2305.10	2271.11	-33.99
111	351	240	129	293	0.36752	104.14	2306.06	2272.76	-33.30
111	352	241	130	293	0.36932	104.65	2306.93	2273.09	-33.84
111	353	242	131	293	0.37111	105.16	2307.72	2274.62	-33.10
111	354	243	132	293	0.37288	105.67	2308.43	2274.84	-33.59
111	355	244	133	293	0.37465	106.18	2309.06	2276.25	-32.80
111	356	245	134	293	0.37640	106.69	2309.60	2276.36	-33.24
111	357	246	135	293	0.37815	107.21	2310.07	2277.66	-32.41
111	358	247	136	293	0.37989	107.72	2310.45	2277.66	-32.79
111	359	248	137	293	0.38162	108.24	2310.76	2278.84	-31.92
111	360	249	138	293	0.38333	108.76	2310.98	2278.73	-32.25
111	361	250	139	293	0.38504	109.27	2311.12	2279.80	-31.32
111	362	251	140	293	0.38674	109.79	2311.18	2279.58	-31.60
111	363	252	141	293	0.38843	110.32	2311.17	2280.54	-30.62
111	364	253	142	293	0.39011	110.84	2311.07	2280.22	-30.85
111	365	254	143	293	0.39178	111.36	2310.89	2281.07	-29.82
111	366	255	144	293	0.39344	111.88	2310.63	2280.64	-29.99

Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
116	228	112	-4	308	0.01754	65.19	1372.82	1381.17	8.35
116	229	113	-3	308	0.01310	65.14	1388.49	1396.18	7.69
116	230	114	-2	308	0.00870	65.11	1403.97	1412.93	8.96
116	231	115	-1	308	0.00433	65.09	1419.25	1427.55	8.30
116	232	116	0	308	0.00000	65.09	1434.33	1443.90	9.57
116	233	117	1	308	0.00429	65.09	1449.24	1458.14	8.90
116	234	118	2	308	0.00855	65.11	1463.96	1474.10	10.15
116	235	119	3	308	0.01277	65.14	1478.50	1487.97	9.47
116	236	120	4	308	0.01695	65.18	1492.86	1503.55	10.69
116	237	121	5	308	0.02110	65.23	1507.05	1517.05	10.00
116	238	122	6	308	0.02521	65.29	1521.07	1532.26	11.19
116	239	123	7	308	0.02929	65.36	1534.92	1545.40	10.48
116	240	124	8	308	0.03333	65.45	1548.61	1560.25	11.64
116	241	125	9	308	0.03734	65.54	1562.13	1573.04	10.90
116	242	126	10	308	0.04132	65.64	1575.50	1587.53	12.03
116	243	127	11	308	0.04527	65.74	1588.71	1599.98	11.27
116	244	128	12	308	0.04918	65.86	1601.76	1614.12	12.37
116	245	129	13	308	0.05306	65.99	1614.66	1626.24	11.58
116	246	130	14	308	0.05691	66.12	1627.41	1640.04	12.64
116	247	131	15	308	0.06073	66.27	1640.01	1651.83	11.82
116	248	132	16	308	0.06452	66.42	1652.46	1665.30	12.84
116	249	133	17	308	0.06827	66.58	1664.78	1676.77	12.00
116	250	134	18	308	0.07200	66.74	1676.94	1689.92	12.97
116	251	135	19	308	0.07570	66.92	1688.97	1701.07	12.10
116	252	136	20	308	0.07937	67.10	1700.86	1713.90	13.04
116	253	137	21	308	0.08300	67.29	1712.61	1724.75	12.14
116	254	138	22	308	0.08661	67.48	1724.23	1737.27	13.04
116	255	139	23	308	0.09020	67.69	1735.71	1747.82	12.10
116	256	140	24	308	0.09375	67.89	1747.06	1760.03	12.96
116	257	141	25	308	0.09728	68.11	1758.28	1770.28	12.00
116	258	142	26	308	0.10078	68.33	1769.37	1782.19	12.82
116	259	143	27	308	0.10425	68.56	1780.33	1792.16	11.83
116	260	144	28	308	0.10769	68.79	1791.17	1803.78	12.61
116	261	145	29	308	0.11111	69.03	1801.88	1813.47	11.59
116	262	146	30	308	0.11450	69.28	1812.47	1824.80	12.33
116	263	147	31	308	0.11787	69.53	1822.93	1834.21	11.28
116	264	148	32	308	0.12121	69.79	1833.27	1845.26	11.99
116	265	149	33	308	0.12453	70.05	1843.49	1854.40	10.91
116	266	150	34	308	0.12782	70.32	1853.60	1865.18	11.58
116	267	151	35	308	0.13109	70.59	1863.58	1874.05	10.47
116	268	152	36	308	0.13433	70.87	1873.45	1884.56	11.11
116	269	153	37	308	0.13755	71.15	1883.20	1893.18	9.98
116	270	154	38	308	0.14074	71.44	1892.83	1903.42	10.58
116	271	155	39	308	0.14391	71.73	1902.36	1911.78	9.43
116	272	156	40	308	0.14706	72.03	1911.76	1921.76	10.00
116	273	157	41	308	0.15018	72.33	1921.06	1929.88	8.82
116	274	158	42	308	0.15329	72.64	1930.25	1939.61	9.36
116	275	159	43	308	0.15636	72.95	1939.32	1947.47	8.16
116	276	160	44	308	0.15942	73.27	1948.28	1956.95	8.67
116	277	161	45	308	0.16246	73.59	1957.14	1964.58	7.44
116	278	162	46	308	0.16547	73.91	1965.89	1973.82	7.93
116	279	163	47	308	0.16846	74.24	1974.53	1981.21	6.68
116	280	164	48	308	0.17143	74.57	1983.06	1990.21	7.15
116	281	165	49	308	0.17438	74.91	1991.49	1997.37	5.88
116	282	166	50	308	0.17731	75.25	1999.81	2006.13	6.32
116	283	167	51	308	0.18021	75.59	2008.03	2013.07	5.04
116	284	168	52	308	0.18310	75.94	2016.14	2021.60	5.45
116	285	169	53	308	0.18597	76.29	2024.16	2028.31	4.16
116	286	170	54	308	0.18881	76.65	2032.07	2036.62	4.55
116	287	171	55	308	0.19164	77.00	2039.87	2043.11	3.24

116	288	172	56	308	0.19444	77.37	2047.58	2051.20	3.62
116	289	173	57	308	0.19723	77.73	2055.18	2057.48	2.30
116	290	174	58	308	0.20000	78.10	2062.69	2065.34	2.65
116	291	175	59	308	0.20275	78.48	2070.10	2071.42	1.32
116	292	176	60	308	0.20548	78.85	2077.40	2079.07	1.66
116	293	177	61	308	0.20819	79.23	2084.61	2084.94	0.32
116	294	178	62	308	0.21088	79.61	2091.72	2092.37	0.65
116	295	179	63	308	0.21356	80.00	2098.74	2098.04	-0.70
116	296	180	64	308	0.21622	80.39	2105.65	2105.27	-0.38
116	297	181	65	308	0.21886	80.78	2112.47	2110.74	-1.73
116	298	182	66	308	0.22148	81.17	2119.20	2117.77	-1.43
116	299	183	67	308	0.22408	81.57	2125.83	2123.05	-2.78
116	300	184	68	308	0.22667	81.97	2132.36	2129.87	-2.49
116	301	185	69	308	0.22924	82.38	2138.80	2134.96	-3.84
116	302	186	70	308	0.23179	82.78	2145.15	2141.59	-3.55
116	303	187	71	308	0.23432	83.19	2151.40	2146.49	-4.91
116	304	188	72	308	0.23684	83.60	2157.56	2152.93	-4.63
116	305	189	73	308	0.23934	84.02	2163.62	2157.64	-5.98
116	306	190	74	308	0.24183	84.44	2169.60	2163.89	-5.70
116	307	191	75	308	0.24430	84.86	2175.48	2168.42	-7.06
116	308	192	76	308	0.24675	85.28	2181.27	2174.49	-6.78
116	309	193	77	308	0.24919	85.70	2186.97	2178.84	-8.13
116	310	194	78	308	0.25161	86.13	2192.58	2184.73	-7.85
116	311	195	79	308	0.25402	86.56	2198.09	2188.90	-9.19
116	312	196	80	308	0.25641	87.00	2203.52	2194.61	-8.91
116	313	197	81	308	0.25879	87.43	2208.86	2198.62	-10.24
116	314	198	82	308	0.26115	87.87	2214.11	2204.15	-9.96
116	315	199	83	308	0.26349	88.31	2219.26	2207.98	-11.28
116	316	200	84	308	0.26582	88.75	2224.33	2213.34	-11.00
116	317	201	85	308	0.26814	89.19	2229.32	2217.01	-12.31
116	318	202	86	308	0.27044	89.64	2234.21	2222.19	-12.01
116	319	203	87	308	0.27273	90.09	2239.01	2225.70	-13.31
116	320	204	88	308	0.27500	90.54	2243.73	2230.72	-13.01
116	321	205	89	308	0.27726	90.99	2248.36	2234.06	-14.30
116	322	206	90	308	0.27950	91.45	2252.90	2238.92	-13.98
116	323	207	91	308	0.28173	91.91	2257.36	2242.11	-15.25
116	324	208	92	308	0.28395	92.37	2261.73	2246.80	-14.93
116	325	209	93	308	0.28615	92.83	2266.01	2249.83	-16.18
116	326	210	94	308	0.28834	93.29	2270.21	2254.37	-15.84
116	327	211	95	308	0.29052	93.76	2274.32	2257.24	-17.08
116	328	212	96	308	0.29268	94.23	2278.35	2261.62	-16.73
116	329	213	97	308	0.29483	94.70	2282.29	2264.35	-17.94
116	330	214	98	308	0.29697	95.17	2286.15	2268.57	-17.57
116	331	215	99	308	0.29909	95.64	2289.92	2271.15	-18.76
116	332	216	100	308	0.30121	96.12	2293.60	2275.23	-18.38
116	333	217	101	308	0.30330	96.59	2297.21	2277.66	-19.55
116	334	218	102	308	0.30539	97.07	2300.73	2281.58	-19.14
116	335	219	103	308	0.30746	97.55	2304.16	2283.88	-20.28
116	336	220	104	308	0.30952	98.04	2307.51	2287.65	-19.86
116	337	221	105	308	0.31157	98.52	2310.78	2289.80	-20.98
116	338	222	106	308	0.31361	99.01	2313.96	2293.43	-20.53
116	339	223	107	308	0.31563	99.49	2317.07	2295.45	-21.62
116	340	224	108	308	0.31765	99.98	2320.08	2298.94	-21.15
116	341	225	109	308	0.31965	100.48	2323.02	2300.81	-22.21
116	342	226	110	308	0.32164	100.97	2325.87	2304.16	-21.71
116	343	227	111	308	0.32362	101.46	2328.65	2305.90	-22.74
116	344	228	112	308	0.32558	101.96	2331.34	2309.11	-22.22
116	345	229	113	308	0.32754	102.46	2333.94	2310.72	-23.22
116	346	230	114	308	0.32948	102.96	2336.47	2313.80	-22.67
116	347	231	115	308	0.33141	103.46	2338.91	2315.28	-23.64
116	348	232	116	308	0.33333	103.96	2341.28	2318.22	-23.06
116	349	233	117	308	0.33524	104.47	2343.56	2319.57	-23.99
116	350	234	118	308	0.33714	104.97	2345.76	2322.38	-23.38

116	351	235	119	308	0.33903	105.48	2347.88	2323.61	-24.27
116	352	236	120	308	0.34091	105.99	2349.92	2326.29	-23.63
116	353	237	121	308	0.34278	106.50	2351.88	2327.39	-24.49
116	354	238	122	308	0.34463	107.01	2353.76	2329.94	-23.82
116	355	239	123	308	0.34648	107.52	2355.56	2330.92	-24.64
116	356	240	124	308	0.34832	108.04	2357.28	2333.35	-23.93
116	357	241	125	308	0.35014	108.55	2358.92	2334.21	-24.71
116	358	242	126	308	0.35196	109.07	2360.48	2336.51	-23.97
116	359	243	127	308	0.35376	109.59	2361.96	2337.25	-24.71
116	360	244	128	308	0.35556	110.11	2363.36	2339.43	-23.93
116	361	245	129	308	0.35734	110.63	2364.68	2340.06	-24.63
116	362	246	130	308	0.35912	111.16	2365.93	2342.12	-23.81
116	363	247	131	308	0.36088	111.68	2367.09	2342.62	-24.47
116	364	248	132	308	0.36264	112.21	2368.18	2344.57	-23.61
116	365	249	133	308	0.36438	112.73	2369.18	2344.96	-24.22
116	366	250	134	308	0.36612	113.26	2370.11	2346.79	-23.32
116	367	251	135	308	0.36785	113.79	2370.96	2347.07	-23.89
116	368	252	136	308	0.36957	114.32	2371.73	2348.78	-22.95
116	369	253	137	308	0.37127	114.85	2372.42	2348.95	-23.47
116	370	254	138	308	0.37297	115.39	2373.04	2350.55	-22.49
116	371	255	139	308	0.37466	115.92	2373.58	2350.61	-22.96
116	372	256	140	308	0.37634	116.46	2374.04	2352.10	-21.94
116	373	257	141	308	0.37802	116.99	2374.42	2352.06	-22.36
116	374	258	142	308	0.37968	117.53	2374.72	2353.43	-21.29
116	375	259	143	308	0.38133	118.07	2374.95	2353.28	-21.67
116	376	260	144	308	0.38298	118.61	2375.10	2354.55	-20.55
116	377	261	145	308	0.38462	119.15	2375.17	2354.30	-20.88
116	378	262	146	308	0.38624	119.70	2375.17	2355.46	-19.71
116	379	263	147	308	0.38786	120.24	2375.09	2355.10	-19.98
116	380	264	148	308	0.38947	120.78	2374.93	2356.16	-18.77
116	381	265	149	308	0.39108	121.33	2374.69	2355.70	-18.99
116	382	266	150	308	0.39267	121.88	2374.38	2356.65	-17.73
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
121	238	117	-4	323	0.01681	70.88	1399.43	1404.88	5.45
121	239	118	-3	323	0.01255	70.83	1415.18	1421.73	6.55
121	240	119	-2	323	0.00833	70.80	1430.73	1436.80	6.08
121	241	120	-1	323	0.00415	70.78	1446.09	1453.26	7.18
121	242	121	0	323	0.00000	70.78	1461.26	1467.96	6.71
121	243	122	1	323	0.00412	70.78	1476.24	1484.04	7.80
121	244	123	2	323	0.00820	70.80	1491.05	1498.38	7.33
121	245	124	3	323	0.01224	70.83	1505.68	1514.08	8.40
121	246	125	4	323	0.01626	70.87	1520.14	1528.06	7.92
121	247	126	5	323	0.02024	70.92	1534.42	1543.41	8.98
121	248	127	6	323	0.02419	70.98	1548.54	1557.03	8.49
121	249	128	7	323	0.02811	71.05	1562.50	1572.02	9.53
121	250	129	8	323	0.03200	71.13	1576.29	1585.31	9.02
121	251	130	9	323	0.03586	71.23	1589.91	1599.95	10.04
121	252	131	10	323	0.03968	71.33	1603.39	1612.90	9.51
121	253	132	11	323	0.04348	71.44	1616.70	1627.20	10.50
121	254	133	12	323	0.04724	71.55	1629.87	1639.82	9.95
121	255	134	13	323	0.05098	71.68	1642.88	1653.79	10.91
121	256	135	14	323	0.05469	71.82	1655.75	1666.09	10.35
121	257	136	15	323	0.05837	71.96	1668.46	1679.74	11.27
121	258	137	16	323	0.06202	72.11	1681.04	1691.72	10.68
121	259	138	17	323	0.06564	72.27	1693.47	1705.05	11.58
121	260	139	18	323	0.06923	72.44	1705.76	1716.72	10.96
121	261	140	19	323	0.07280	72.62	1717.91	1729.74	11.83
121	262	141	20	323	0.07634	72.80	1729.93	1741.11	11.19
121	263	142	21	323	0.07985	72.99	1741.81	1753.82	12.02
121	264	143	22	323	0.08333	73.19	1753.55	1764.90	11.35
121	265	144	23	323	0.08679	73.39	1765.16	1777.31	12.15

121	266	145	24	323	0.09023	73.60	1776.65	1788.10	11.45
121	267	146	25	323	0.09363	73.82	1788.00	1800.21	12.21
121	268	147	26	323	0.09701	74.05	1799.22	1810.72	11.49
121	269	148	27	323	0.10037	74.28	1810.32	1822.54	12.22
121	270	149	28	323	0.10370	74.51	1821.30	1832.77	11.47
121	271	150	29	323	0.10701	74.76	1832.15	1844.32	12.17
121	272	151	30	323	0.11029	75.01	1842.87	1854.27	11.40
121	273	152	31	323	0.11355	75.26	1853.48	1865.54	12.06
121	274	153	32	323	0.11679	75.52	1863.96	1875.22	11.26
121	275	154	33	323	0.12000	75.79	1874.33	1886.22	11.89
121	276	155	34	323	0.12319	76.06	1884.58	1895.65	11.07
121	277	156	35	323	0.12635	76.33	1894.71	1906.38	11.67
121	278	157	36	323	0.12950	76.62	1904.73	1915.55	10.82
121	279	158	37	323	0.13262	76.90	1914.63	1926.02	11.39
121	280	159	38	323	0.13571	77.20	1924.42	1934.93	10.51
121	281	160	39	323	0.13879	77.49	1934.10	1945.15	11.05
121	282	161	40	323	0.14184	77.80	1943.66	1953.82	10.15
121	283	162	41	323	0.14488	78.10	1953.11	1963.78	10.67
121	284	163	42	323	0.14789	78.42	1962.46	1972.21	9.75
121	285	164	43	323	0.15088	78.73	1971.69	1981.93	10.23
121	286	165	44	323	0.15385	79.05	1980.82	1990.11	9.29
121	287	166	45	323	0.15679	79.38	1989.84	1999.59	9.75
121	288	167	46	323	0.15972	79.71	1998.75	2007.54	8.79
121	289	168	47	323	0.16263	80.04	2007.56	2016.78	9.23
121	290	169	48	323	0.16552	80.38	2016.26	2024.51	8.25
121	291	170	49	323	0.16839	80.72	2024.86	2033.52	8.66
121	292	171	50	323	0.17123	81.07	2033.35	2041.01	7.66
121	293	172	51	323	0.17406	81.42	2041.74	2049.79	8.05
121	294	173	52	323	0.17687	81.77	2050.03	2057.07	7.04
121	295	174	53	323	0.17966	82.13	2058.22	2065.63	7.41
121	296	175	54	323	0.18243	82.49	2066.30	2072.69	6.38
121	297	176	55	323	0.18519	82.86	2074.29	2081.02	6.73
121	298	177	56	323	0.18792	83.23	2082.18	2087.87	5.69
121	299	178	57	323	0.19064	83.60	2089.97	2095.99	6.03
121	300	179	58	323	0.19333	83.98	2097.66	2102.63	4.97
121	301	180	59	323	0.19601	84.36	2105.25	2110.54	5.29
121	302	181	60	323	0.19868	84.74	2112.74	2116.97	4.23
121	303	182	61	323	0.20132	85.13	2120.14	2124.67	4.53
121	304	183	62	323	0.20395	85.52	2127.44	2130.90	3.46
121	305	184	63	323	0.20656	85.91	2134.65	2138.40	3.75
121	306	185	64	323	0.20915	86.31	2141.76	2144.43	2.67
121	307	186	65	323	0.21173	86.71	2148.77	2151.72	2.95
121	308	187	66	323	0.21429	87.11	2155.70	2157.56	1.86
121	309	188	67	323	0.21683	87.52	2162.53	2164.65	2.13
121	310	189	68	323	0.21936	87.93	2169.26	2170.30	1.04
121	311	190	69	323	0.22187	88.34	2175.90	2177.20	1.30
121	312	191	70	323	0.22436	88.76	2182.45	2182.66	0.21
121	313	192	71	323	0.22684	89.18	2188.91	2189.37	0.46
121	314	193	72	323	0.22930	89.60	2195.28	2194.64	-0.64
121	315	194	73	323	0.23175	90.02	2201.55	2201.17	-0.39
121	316	195	74	323	0.23418	90.45	2207.74	2206.26	-1.48
121	317	196	75	323	0.23659	90.88	2213.84	2212.60	-1.24
121	318	197	76	323	0.23899	91.31	2219.84	2217.51	-2.33
121	319	198	77	323	0.24138	91.75	2225.76	2223.67	-2.09
121	320	199	78	323	0.24375	92.18	2231.58	2228.40	-3.18
121	321	200	79	323	0.24611	92.62	2237.32	2234.38	-2.94
121	322	201	80	323	0.24845	93.07	2242.97	2238.95	-4.03
121	323	202	81	323	0.25077	93.51	2248.53	2244.75	-3.78
121	324	203	82	323	0.25309	93.96	2254.01	2249.14	-4.86
121	325	204	83	323	0.25539	94.41	2259.40	2254.77	-4.62
121	326	205	84	323	0.25767	94.86	2264.70	2259.00	-5.69
121	327	206	85	323	0.25994	95.32	2269.91	2264.46	-5.45
121	328	207	86	323	0.26220	95.78	2275.04	2268.53	-6.51

121	329	208	87	323	0.26444	96.23	2280.08	2273.82	-6.26
121	330	209	88	323	0.26667	96.70	2285.03	2277.72	-7.31
121	331	210	89	323	0.26888	97.16	2289.90	2282.85	-7.05
121	332	211	90	323	0.27108	97.63	2294.69	2286.59	-8.09
121	333	212	91	323	0.27327	98.10	2299.39	2291.56	-7.83
121	334	213	92	323	0.27545	98.57	2304.00	2295.15	-8.86
121	335	214	93	323	0.27761	99.04	2308.53	2299.96	-8.58
121	336	215	94	323	0.27976	99.52	2312.98	2303.39	-9.59
121	337	216	95	323	0.28190	99.99	2317.35	2308.04	-9.30
121	338	217	96	323	0.28402	100.47	2321.63	2311.32	-10.30
121	339	218	97	323	0.28614	100.96	2325.82	2315.82	-10.00
121	340	219	98	323	0.28824	101.44	2329.94	2318.95	-10.98
121	341	220	99	323	0.29032	101.93	2333.97	2323.30	-10.67
121	342	221	100	323	0.29240	102.41	2337.92	2326.29	-11.63
121	343	222	101	323	0.29446	102.90	2341.78	2330.48	-11.30
121	344	223	102	323	0.29651	103.39	2345.57	2333.32	-12.24
121	345	224	103	323	0.29855	103.89	2349.27	2337.37	-11.90
121	346	225	104	323	0.30058	104.38	2352.89	2340.07	-12.82
121	347	226	105	323	0.30259	104.88	2356.43	2343.98	-12.45
121	348	227	106	323	0.30460	105.38	2359.89	2346.54	-13.35
121	349	228	107	323	0.30659	105.88	2363.27	2350.30	-12.97
121	350	229	108	323	0.30857	106.38	2366.57	2352.72	-13.84
121	351	230	109	323	0.31054	106.89	2369.78	2356.35	-13.44
121	352	231	110	323	0.31250	107.39	2372.92	2358.63	-14.29
121	353	232	111	323	0.31445	107.90	2375.98	2362.12	-13.86
121	354	233	112	323	0.31638	108.41	2378.95	2364.27	-14.69
121	355	234	113	323	0.31831	108.92	2381.85	2367.62	-14.23
121	356	235	114	323	0.32023	109.44	2384.67	2369.64	-15.03
121	357	236	115	323	0.32213	109.95	2387.41	2372.85	-14.55
121	358	237	116	323	0.32402	110.47	2390.07	2374.74	-15.32
121	359	238	117	323	0.32591	110.99	2392.65	2377.83	-14.82
121	360	239	118	323	0.32778	111.50	2395.15	2379.59	-15.56
121	361	240	119	323	0.32964	112.03	2397.57	2382.54	-15.03
121	362	241	120	323	0.33149	112.55	2399.92	2384.18	-15.74
121	363	242	121	323	0.33333	113.07	2402.18	2387.01	-15.18
121	364	243	122	323	0.33517	113.60	2404.37	2388.52	-15.85
121	365	244	123	323	0.33699	114.13	2406.48	2391.22	-15.26
121	366	245	124	323	0.33880	114.66	2408.52	2392.61	-15.91
121	367	246	125	323	0.34060	115.19	2410.47	2395.18	-15.29
121	368	247	126	323	0.34239	115.72	2412.35	2396.45	-15.90
121	369	248	127	323	0.34417	116.25	2414.15	2398.91	-15.24
121	370	249	128	323	0.34595	116.79	2415.87	2400.06	-15.82
121	371	250	129	323	0.34771	117.32	2417.52	2402.39	-15.13
121	372	251	130	323	0.34946	117.86	2419.09	2403.42	-15.66
121	373	252	131	323	0.35121	118.40	2420.58	2405.64	-14.95
121	374	253	132	323	0.35294	118.94	2422.00	2406.56	-15.44
121	375	254	133	323	0.35467	119.48	2423.34	2408.65	-14.69
121	376	255	134	323	0.35638	120.03	2424.60	2409.46	-15.15
121	377	256	135	323	0.35809	120.57	2425.79	2411.44	-14.35
121	378	257	136	323	0.35979	121.12	2426.90	2412.13	-14.77
121	379	258	137	323	0.36148	121.66	2427.94	2414.00	-13.94
121	380	259	138	323	0.36316	122.21	2428.90	2414.58	-14.32
121	381	260	139	323	0.36483	122.76	2429.78	2416.33	-13.45
121	382	261	140	323	0.36649	123.31	2430.59	2416.81	-13.78
121	383	262	141	323	0.36815	123.87	2431.33	2418.45	-12.88
121	384	263	142	323	0.36979	124.42	2431.99	2418.82	-13.17
121	385	264	143	323	0.37143	124.98	2432.57	2420.35	-12.22
121	386	265	144	323	0.37306	125.53	2433.08	2420.61	-12.47
121	387	266	145	323	0.37468	126.09	2433.51	2422.04	-11.47
121	388	267	146	323	0.37629	126.65	2433.87	2422.20	-11.68
121	389	268	147	323	0.37789	127.21	2434.16	2423.51	-10.64
121	390	269	148	323	0.37949	127.77	2434.37	2423.57	-10.80
121	391	270	149	323	0.38107	128.33	2434.50	2424.78	-9.72

121	392	271	150	323	0.38265	128.90	2434.56	2424.74	-9.83
121	393	272	151	323	0.38422	129.46	2434.55	2425.85	-8.70
121	394	273	152	323	0.38579	130.03	2434.46	2425.70	-8.76
121	395	274	153	323	0.38734	130.59	2434.30	2426.71	-7.59
121	396	275	154	323	0.38889	131.16	2434.07	2426.46	-7.61
121	397	276	155	323	0.39043	131.73	2433.76	2427.37	-6.39
121	398	277	156	323	0.39196	132.30	2433.38	2427.03	-6.35
121	399	278	157	323	0.39348	132.87	2432.92	2427.83	-5.09

Based on this relation (9), in a trial-error approach, we have developed another relation for estimating the maximum binding energy associated with any mass number. Very interesting point is that, it is independent of proton number, it can be expressed as [1,2],

$$BE \cong \left\{ A - \left(\sqrt{\frac{e}{e_n}} \right) 0.001605 A^2 - A^{1/3} - A^{-1/2} \right\} 10.1 \text{ MeV} \quad (10)$$
$$\cong \left\{ A - 0.000935 A^2 - A^{1/3} - A^{-1/2} \right\} 10.1 \text{ MeV}$$

Considering isobars and finding the maximum binding energy associated with each mass number, above relation can be verified. See the following Table.3 and Figure 1. Our proposal is failing for A=4, A= 202 to 212 and A >267. It needs a review with respect to shell effects and other microscopic corrections.

Table 3. Estimated maximum binding energy of any mass number.

Assumed mass number A	Estimated Max. Binding energy of A (MeV)	Estimated Max. Binding energy per nucleon (MeV)	Experimental Max. Binding energy of A (MeV)	Experimental Max. Binding energy per nucleon (MeV)	(Experimental - Estimated) Binding energy (MeV)
4	19.17	4.79	28.3	7.08	9.13
5	28.48	5.70	27.56	5.51	-0.92
6	37.78	6.30	31.99	5.33	-5.79
7	47.1	6.73	39.25	5.61	-7.85
8	56.42	7.05	56.5	7.06	0.08
9	65.76	7.31	58.16	6.46	-7.6
10	75.1	7.51	64.98	6.50	-10.12
11	84.45	7.68	76.2	6.93	-8.25
12	93.8	7.82	92.16	7.68	-1.64
13	103.15	7.93	97.11	7.47	-6.04
14	112.51	8.04	105.28	7.52	-7.23
15	121.86	8.12	115.49	7.70	-6.37
16	131.21	8.20	127.62	7.98	-3.59
17	140.55	8.27	131.76	7.75	-8.79
18	149.89	8.33	139.81	7.77	-10.08
19	159.22	8.38	147.8	7.78	-11.42
20	168.55	8.43	160.64	8.03	-7.91
21	177.87	8.47	167.41	7.97	-10.46
22	187.18	8.51	177.77	8.08	-9.41
23	196.48	8.54	186.56	8.11	-9.92
24	205.77	8.57	198.26	8.26	-7.51
25	215.05	8.60	205.59	8.22	-9.46
26	224.31	8.63	216.68	8.33	-7.63

27	233.57	8.65	224.95	8.33	-8.62
28	242.82	8.67	236.54	8.45	-6.28
29	252.05	8.69	245.01	8.45	-7.04
30	261.27	8.71	255.62	8.52	-5.65
31	270.48	8.73	262.92	8.48	-7.56
32	279.68	8.74	271.78	8.49	-7.9
33	288.86	8.75	280.96	8.51	-7.9
34	298.03	8.77	291.84	8.58	-6.19
35	307.19	8.78	298.82	8.54	-8.37
36	316.33	8.79	308.71	8.58	-7.62
37	325.46	8.80	317.1	8.57	-8.36
38	334.57	8.80	327.34	8.61	-7.23
39	343.67	8.81	333.94	8.56	-9.73
40	352.75	8.82	343.81	8.60	-8.94
41	361.82	8.82	351.62	8.58	-10.2
42	370.88	8.83	361.9	8.62	-8.98
43	379.91	8.84	369.83	8.60	-10.08
44	388.94	8.84	380.96	8.66	-7.98
45	397.95	8.84	388.37	8.63	-9.58
46	406.94	8.85	398.77	8.67	-8.17
47	415.92	8.85	407.26	8.67	-8.66
48	424.88	8.85	418.7	8.72	-6.18
49	433.82	8.85	426.85	8.71	-6.97
50	442.75	8.86	437.78	8.76	-4.97
51	451.67	8.86	445.85	8.74	-5.82
52	460.57	8.86	456.35	8.78	-4.22
53	469.45	8.86	464.29	8.76	-5.16
54	478.31	8.86	474.01	8.78	-4.3
55	487.16	8.86	482.08	8.77	-5.08
56	495.99	8.86	492.26	8.79	-3.73
57	504.81	8.86	499.91	8.77	-4.9
58	513.61	8.86	509.95	8.79	-3.66
59	522.39	8.85	517.31	8.77	-5.08
60	531.16	8.85	526.85	8.78	-4.31
61	539.91	8.85	534.67	8.77	-5.24
62	548.64	8.85	545.26	8.79	-3.38
63	557.36	8.85	552.1	8.76	-5.26
64	566.06	8.84	561.76	8.78	-4.3
65	574.74	8.84	569.21	8.76	-5.53
66	583.4	8.84	578.14	8.76	-5.26
67	592.05	8.84	585.41	8.74	-6.64
68	600.68	8.83	595.39	8.76	-5.29
69	609.3	8.83	602	8.72	-7.3
70	617.89	8.83	611.09	8.73	-6.8
71	626.47	8.82	618.95	8.72	-7.52
72	635.04	8.82	628.69	8.73	-6.35
73	643.58	8.82	635.47	8.71	-8.11
74	652.11	8.81	645.66	8.73	-6.45
75	660.62	8.81	652.57	8.70	-8.05

76	669.11	8.80	662.07	8.71	-7.04
77	677.59	8.80	669.59	8.70	-8
78	686.05	8.80	679.99	8.72	-6.06
79	694.49	8.79	686.95	8.70	-7.54
80	702.91	8.79	696.87	8.71	-6.04
81	711.32	8.78	704.37	8.70	-6.95
82	719.71	8.78	714.27	8.71	-5.44
83	728.08	8.77	721.74	8.70	-6.34
84	736.43	8.77	732.27	8.72	-4.16
85	744.77	8.76	739.38	8.70	-5.39
86	753.09	8.76	749.23	8.71	-3.86
87	761.39	8.75	757.86	8.71	-3.53
88	769.67	8.75	768.47	8.73	-1.2
89	777.93	8.74	775.54	8.71	-2.39
90	786.18	8.74	783.9	8.71	-2.28
91	794.41	8.73	791.09	8.69	-3.32
92	802.62	8.72	799.73	8.69	-2.89
93	810.82	8.72	806.46	8.67	-4.36
94	818.99	8.71	814.68	8.67	-4.31
95	827.15	8.71	821.63	8.65	-5.52
96	835.29	8.70	830.78	8.65	-4.51
97	843.41	8.69	837.6	8.64	-5.81
98	851.52	8.69	846.25	8.64	-5.27
99	859.61	8.68	852.75	8.61	-6.86
100	867.67	8.68	861.93	8.62	-5.74
101	875.73	8.67	868.73	8.60	-7
102	883.76	8.66	877.95	8.61	-5.81
103	891.77	8.66	884.19	8.58	-7.58
104	899.77	8.65	893.09	8.59	-6.68
105	907.75	8.65	900.13	8.57	-7.62
106	915.71	8.64	909.48	8.58	-6.23
107	923.66	8.63	916.02	8.56	-7.64
108	931.58	8.63	925.24	8.57	-6.34
109	939.49	8.62	931.72	8.55	-7.77
110	947.38	8.61	940.64	8.55	-6.74
111	955.25	8.61	947.62	8.54	-7.63
112	963.1	8.60	957.01	8.54	-6.09
113	970.94	8.59	963.55	8.53	-7.39
114	978.75	8.59	972.59	8.53	-6.16
115	986.55	8.58	979.4	8.52	-7.15
116	994.33	8.57	988.68	8.52	-5.65
117	1002.1	8.56	995.62	8.51	-6.48
118	1009.84	8.56	1004.95	8.52	-4.89
119	1017.57	8.55	1011.43	8.50	-6.14
120	1025.27	8.54	1020.54	8.50	-4.73
121	1032.96	8.54	1026.71	8.49	-6.25
122	1040.64	8.53	1035.52	8.49	-5.12
123	1048.29	8.52	1042.1	8.47	-6.19
124	1055.92	8.52	1050.69	8.47	-5.23

125	1063.54	8.51	1057.27	8.46	-6.27
126	1071.14	8.50	1066.37	8.46	-4.77
127	1078.72	8.49	1072.66	8.45	-6.06
128	1086.28	8.49	1081.44	8.45	-4.84
129	1093.83	8.48	1088.24	8.44	-5.59
130	1101.35	8.47	1096.91	8.44	-4.44
131	1108.86	8.46	1103.51	8.42	-5.35
132	1116.35	8.46	1112.45	8.43	-3.9
133	1123.82	8.45	1118.88	8.41	-4.94
134	1131.28	8.44	1127.43	8.41	-3.85
135	1138.71	8.43	1134.18	8.40	-4.53
136	1146.13	8.43	1142.77	8.40	-3.36
137	1153.53	8.42	1149.68	8.39	-3.85
138	1160.9	8.41	1158.29	8.39	-2.61
139	1168.27	8.40	1164.55	8.38	-3.72
140	1175.61	8.40	1172.69	8.38	-2.92
141	1182.93	8.39	1178.12	8.36	-4.81
142	1190.24	8.38	1185.28	8.35	-4.96
143	1197.53	8.37	1191.26	8.33	-6.27
144	1204.8	8.37	1199.08	8.33	-5.72
145	1212.05	8.36	1204.83	8.31	-7.22
146	1219.28	8.35	1212.4	8.30	-6.88
147	1226.5	8.34	1217.8	8.28	-8.7
148	1233.69	8.34	1225.39	8.28	-8.3
149	1240.87	8.33	1231.26	8.26	-9.61
150	1248.03	8.32	1239.24	8.26	-8.79
151	1255.17	8.31	1244.84	8.24	-10.33
152	1262.3	8.30	1253.1	8.24	-9.2
153	1269.4	8.30	1258.99	8.23	-10.41
154	1276.49	8.29	1266.93	8.23	-9.56
155	1283.55	8.28	1273.58	8.22	-9.97
156	1290.6	8.27	1281.59	8.22	-9.01
157	1297.63	8.27	1287.95	8.20	-9.68
158	1304.65	8.26	1295.89	8.20	-8.76
159	1311.64	8.25	1302.02	8.19	-9.62
160	1318.62	8.24	1309.45	8.18	-9.17
161	1325.57	8.23	1316.09	8.17	-9.48
162	1332.51	8.23	1324.1	8.17	-8.41
163	1339.43	8.22	1330.37	8.16	-9.06
164	1346.33	8.21	1338.03	8.16	-8.3
165	1353.22	8.20	1344.25	8.15	-8.97
166	1360.08	8.19	1351.56	8.14	-8.52
167	1366.93	8.19	1358	8.13	-8.93
168	1373.76	8.18	1365.77	8.13	-7.99
169	1380.57	8.17	1371.78	8.12	-8.79
170	1387.36	8.16	1379.03	8.11	-8.33
171	1394.13	8.15	1385.42	8.10	-8.71
172	1400.88	8.14	1392.76	8.10	-8.12
173	1407.62	8.14	1399.13	8.09	-8.49

174	1414.34	8.13	1406.59	8.08	-7.75
175	1421.04	8.12	1412.41	8.07	-8.63
176	1427.72	8.11	1419.28	8.06	-8.44
177	1434.38	8.10	1425.46	8.05	-8.92
178	1441.02	8.10	1432.8	8.05	-8.22
179	1447.64	8.09	1438.9	8.04	-8.74
180	1454.25	8.08	1446.29	8.03	-7.96
181	1460.84	8.07	1452.24	8.02	-8.6
182	1467.41	8.06	1459.33	8.02	-8.08
183	1473.96	8.05	1465.52	8.01	-8.44
184	1480.49	8.05	1472.94	8.01	-7.55
185	1487	8.04	1478.69	7.99	-8.31
186	1493.5	8.03	1485.88	7.99	-7.62
187	1499.98	8.02	1491.88	7.98	-8.1
188	1506.43	8.01	1499.09	7.97	-7.34
189	1512.87	8.00	1505.01	7.96	-7.86
190	1519.29	8.00	1512.8	7.96	-6.49
191	1525.7	7.99	1518.56	7.95	-7.14
192	1532.08	7.98	1526.12	7.95	-5.96
193	1538.44	7.97	1532.06	7.94	-6.38
194	1544.79	7.96	1539.58	7.94	-5.21
195	1551.12	7.95	1545.68	7.93	-5.44
196	1557.43	7.95	1553.6	7.93	-3.83
197	1563.72	7.94	1559.45	7.92	-4.27
198	1569.99	7.93	1567	7.91	-2.99
199	1576.25	7.92	1573.48	7.91	-2.77
200	1582.48	7.91	1581.18	7.91	-1.3
201	1588.7	7.90	1587.41	7.90	-1.29
202	1594.9	7.90	1595.16	7.90	0.26
203	1601.07	7.89	1601.16	7.89	0.09
204	1607.24	7.88	1608.65	7.89	1.41
205	1613.38	7.87	1615.07	7.88	1.69
206	1619.5	7.86	1622.32	7.88	2.82
207	1625.61	7.85	1629.06	7.87	3.45
208	1631.69	7.84	1636.43	7.87	4.74
209	1637.76	7.84	1640.37	7.85	2.61
210	1643.81	7.83	1645.55	7.84	1.74
211	1649.84	7.82	1649.97	7.82	0.13
212	1655.85	7.81	1655.77	7.81	-0.08
213	1661.85	7.80	1660.13	7.79	-1.72
214	1667.82	7.79	1666.01	7.79	-1.81
215	1673.78	7.79	1670.16	7.77	-3.62
216	1679.72	7.78	1675.9	7.76	-3.82
217	1685.64	7.77	1680.58	7.74	-5.06
218	1691.54	7.76	1687.05	7.74	-4.49
219	1697.42	7.75	1691.51	7.72	-5.91
220	1703.28	7.74	1697.79	7.72	-5.49
221	1709.13	7.73	1702.42	7.70	-6.71
222	1714.95	7.73	1708.66	7.70	-6.29

223	1720.76	7.72	1713.82	7.69	-6.94
224	1726.55	7.71	1720.3	7.68	-6.25
225	1732.32	7.70	1725.21	7.67	-7.11
226	1738.07	7.69	1731.6	7.66	-6.47
227	1743.8	7.68	1736.71	7.65	-7.09
228	1749.52	7.67	1743.08	7.65	-6.44
229	1755.21	7.66	1748.33	7.63	-6.88
230	1760.89	7.66	1755.13	7.63	-5.76
231	1766.55	7.65	1760.25	7.62	-6.3
232	1772.19	7.64	1766.69	7.62	-5.5
233	1777.81	7.63	1771.93	7.60	-5.88
234	1783.41	7.62	1778.57	7.60	-4.84
235	1789	7.61	1783.86	7.59	-5.14
236	1794.56	7.60	1790.41	7.59	-4.15
237	1800.11	7.60	1795.53	7.58	-4.58
238	1805.64	7.59	1801.69	7.57	-3.95
239	1811.15	7.58	1806.97	7.56	-4.18
240	1816.64	7.57	1813.45	7.56	-3.19
241	1822.11	7.56	1818.69	7.55	-3.42
242	1827.56	7.55	1825	7.54	-2.56
243	1833	7.54	1830.03	7.53	-2.97
244	1838.41	7.53	1836.05	7.52	-2.36
245	1843.81	7.53	1841.36	7.52	-2.45
246	1849.19	7.52	1847.82	7.51	-1.37
247	1854.55	7.51	1852.98	7.50	-1.57
248	1859.89	7.50	1859.19	7.50	-0.7
249	1865.21	7.49	1864.02	7.49	-1.19
250	1870.52	7.48	1869.99	7.48	-0.53
251	1875.8	7.47	1875.09	7.47	-0.71
252	1881.07	7.46	1881.27	7.47	0.2
253	1886.32	7.46	1886.07	7.45	-0.25
254	1891.55	7.45	1892.1	7.45	0.55
255	1896.76	7.44	1896.64	7.44	-0.12
256	1901.95	7.43	1902.54	7.43	0.59
257	1907.12	7.42	1907.5	7.42	0.38
258	1912.28	7.41	1911.69	7.41	-0.59
259	1917.41	7.40	1906.33	7.36	-11.08
260	1922.53	7.39	1909.07	7.34	-13.46
261	1927.63	7.39	1923.93	7.37	-3.7
262	1932.71	7.38	1923.39	7.34	-9.32
263	1937.77	7.37	1929.63	7.34	-8.14
264	1942.81	7.36	1937.23	7.34	-5.58
265	1947.84	7.35	1943.25	7.33	-4.59
266	1952.84	7.34	1950.31	7.33	-2.53
267	1957.83	7.33	1956.31	7.33	-1.52
268	1962.8	7.32	1963.37	7.33	0.57
269	1967.74	7.32	1968.54	7.32	0.8
270	1972.67	7.31	1974.78	7.31	2.11
271	1977.59	7.30	1979.66	7.31	2.07

272	1982.48	7.29	1985.87	7.30	3.39
273	1987.35	7.28	1990.44	7.29	3.09
274	1992.21	7.27	1994.17	7.28	1.96
275	1997.05	7.26	2000.08	7.27	3.03
276	2001.86	7.25	2004.86	7.26	3
277	2006.66	7.24	2009.64	7.26	2.98
278	2011.44	7.24	2013	7.24	1.56
279	2016.21	7.23	2019.4	7.24	3.19
280	2020.95	7.22	2023.56	7.23	2.61
281	2025.68	7.21	2028.82	7.22	3.14
282	2030.38	7.20	2031.81	7.21	1.43
283	2035.07	7.19	2038.45	7.20	3.38
284	2039.74	7.18	2042.53	7.19	2.79
285	2044.39	7.17	2047.73	7.19	3.34
286	2049.02	7.16	2050.33	7.17	1.31
287	2053.63	7.16	2057.22	7.17	3.59
288	2058.22	7.15	2060.64	7.16	2.42
289	2062.8	7.14	2066.06	7.15	3.26
290	2067.36	7.13	2068.28	7.13	0.92
291	2071.89	7.12	2075.12	7.13	3.23
292	2076.41	7.11	2078.16	7.12	1.75
293	2080.91	7.10	2083.52	7.11	2.61
294	2085.39	7.09	2085.34	7.09	-0.05
295	2089.86	7.08			
296	2094.3	7.08			
297	2098.73	7.07			
298	2103.13	7.06			
299	2107.52	7.05			
300	2111.89	7.04			
301	2116.24	7.03			
302	2120.57	7.02			
303	2124.88	7.01			
304	2129.18	7.00			
305	2133.45	6.99			
306	2137.71	6.99			
307	2141.95	6.98			
308	2146.17	6.97			
309	2150.37	6.96			
310	2154.55	6.95			
311	2158.71	6.94			
312	2162.86	6.93			
313	2166.98	6.92			
314	2171.09	6.91			
315	2175.18	6.91			
316	2179.25	6.90			
317	2183.3	6.89			
318	2187.33	6.88			
319	2191.34	6.87			
320	2195.34	6.86			

321	2199.31	6.85
322	2203.27	6.84
323	2207.21	6.83
324	2211.13	6.82
325	2215.03	6.82
326	2218.91	6.81
327	2222.77	6.80
328	2226.62	6.79
329	2230.44	6.78
330	2234.25	6.77
331	2238.04	6.76
332	2241.81	6.75
333	2245.56	6.74
334	2249.29	6.73
335	2253.01	6.73
336	2256.7	6.72
337	2260.38	6.71
338	2264.03	6.70
339	2267.67	6.69
340	2271.29	6.68

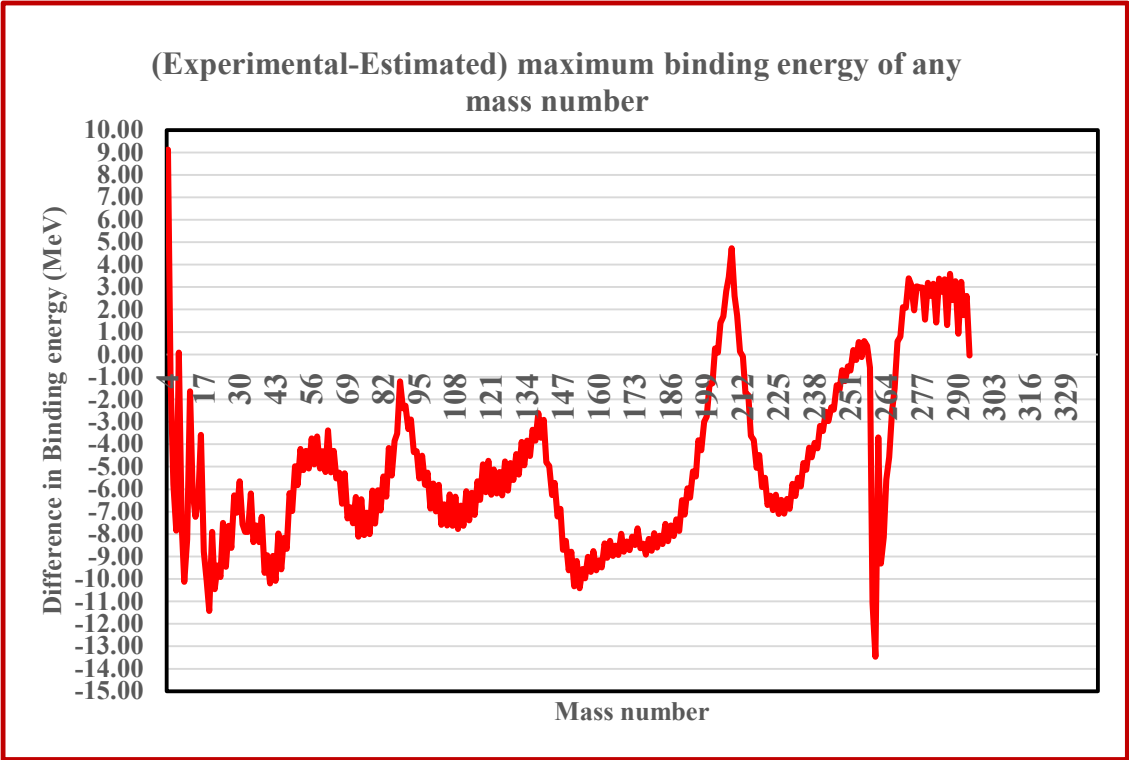


Figure 1. Difference of experimental and estimated maximum binding energy of A.

Close to the maximum binding energy of any mass number, number of free nucleons can be expressed as, $A_{free} \cong 0.000935 A^2$. It may be noted that,

- a) For A=45, Z=21 $\rightarrow$ A-2Z=3 and $A_{free} \cong 1.89 \cong 2$.
- b) For A=63, Z=29 $\rightarrow$ A-2Z=5 and $A_{free} \cong 3.7 \cong 4$.

c) For $A=112, Z=50 \rightarrow A-2Z=12, A_{free} \cong 11.7 \cong 12$.

d) For $A=206, Z=82 \rightarrow A-2Z=40, A_{free} \cong 39.7 \cong 40$.

e) For $A=235, Z=92, \rightarrow A-2Z=51, A_{free} \cong 51.6 \cong 52$.

Thus, by assuming a simple relation of the following form, proton number of the assumed (stable) mass number can be estimated approximately. It needs further study with respect to even-odd corrections.

$$\left. \begin{aligned} (A-2Z) &\approx 0.000935 A^2 \\ Z &\cong \left(\frac{A - 0.000935 A^2}{2} \right) \pm (0, 2) \end{aligned} \right\} \quad (11)$$

Proceeding further, considering relation (10), maximum binding energy associated with any mass number can be expressed as,

$$\frac{BE}{A} \cong \frac{1}{A} \left\{ A - 0.000935 A^2 - A^{1/3} - A^{-1/2} \right\} 10.1 \text{ MeV} \quad (12)$$

Following relations (10) and (12), currently believed Unified atomic mass unit [2,22] can be estimated in a very simple approach.

$$\begin{aligned} M_u c^2 &\cong \left\{ \left(\frac{m_n c^2 + m_p c^2}{2} \right) - \text{mean} \left\langle \frac{BE}{A} \right\rangle_{A=4}^{A \approx 340} \right\} + m_e c^2 \quad (13) \\ &\cong 938.918755 - \langle 7.956 \rangle + 0.511 \cong 931.473755 \text{ MeV} \end{aligned}$$

where (m_n, m_p, m_e) represent neutron, proton and electron rest masses respectively.

Now the most complicated Avogadro number [22,23] can be expressed as,

$$\begin{aligned} N_A &\cong \left(\frac{1}{M_u c^2} \right) \frac{\text{atoms}}{\text{kg-mole}} \text{ Or } \frac{\text{atoms}}{\text{gram-mole}} \quad (14) \\ &\cong 6.0222726 \times 10^{26} \frac{\text{atoms}}{\text{kg-mole}} \cong 6.0222726 \times 10^{23} \frac{\text{atoms}}{\text{gram-mole}} \end{aligned}$$

With further study and estimating the average of maximum binding energy per nucleon of $A=4$ to 400, Avogadro number can be estimated accurately.

8. Discussion

Following our approach,

- 1) Even though they are having wide scope and very accurate, currently believed semi empirical mass formulae are having many complicated energy coefficients with different terms and different concepts [17-21]. We would like to emphasize the point that, clarity is missing in coupling or interpreting the terms and coefficients with strong and weak interactions. Similarly, energy coefficients associated with recently developed relativistic continuum Hartree-Bogoliubov (RCHB) theory having relativistic density functions are much more complicated [19].
- 2) Conceptually, relations (9) and (10) are very simple in understanding and having deep inner meaning. Relation (9) can be expressed as,

$$(BE)_{(Z,A)} \cong (A - A_{free} - A_{rad} - A_{asy}) 10.1 \text{ MeV} \quad (15)$$

- 3) Relation (10) can be expressed as,

$$(BE)_A \cong (A - A_{free} - A_{rad} - A_x) 10.1 \text{ MeV} \quad (16)$$

where A_x is a term that needs a review.

It needs a review with respect to $A=4$ and $A > 200$. We are working in this new direction. With even-odd corrections, shell corrections and other microscopic corrections, it can be refined.

- 4) Best possible range of super heavy atomic nuclides [24] can be understood and corresponding experimental design, set up and trial runs can be carried out with confidence.
- 5) Avogadro like most complicated numbers can be estimated in a very simplified approach.

9. Conclusion

We would like to emphasize the point that, strong and weak interactions play a vital role in basic nuclear structure and further study may help in exploring the atomic nucleus in a unified approach. Based on the above concepts and data presented in Table 1, Table 2, Table 3 and Figure 1, it seems possible to understand super heavy mass numbers and maximum binding energy associated with any mass number with our 4G model of final unification. With further study, Unified atomic mass unit and Avogadro number can be estimated with best possible accuracy.

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