Bohr model in variable dimensionality

Optimal configurations are calculated for different cartesian dimensionalities of the configuration space. For each dimensionality, we list the distances between electrons and the nucleus R and the minimal energy E.

I. HELIUM ATOM - 2 ELECTRONS.

Electron configuration $1s^2$.

Electron shell configuration $\{2\}$.

Number of shells: 1

He. Dimensionality 1

Energy: $E = -3.0625$. Shell No. 1 (2 electrons)

$$R = 0.571428571 \text{ (2 electrons)}$$

II. LITHIUM ATOM - 3 ELECTRONS.

Electron configuration [He]$2s^1$.

Electron shell configuration $\{2, 1\}$.

Number of shells: 2

Li. Dimensionality 1

Energy: $E = -7.6836946$. Shell No. 1 (2 electrons)

$$R = 0.362229875$$

$$R = 0.364715112$$

Shell No. 2 (1 electrons)

$$R = 4.1865451$$

Li. Dimensionality 2

Energy: $E = -7.690457$. Shell No. 1 (2 electrons)

$$R = 0.363805896 \text{ (2 electrons)}$$

Shell No. 2 (1 electrons)

$$R = 3.84895086$$

III. BERYLLIUM ATOM - 4 ELECTRONS.

Electron configuration [He]$2s^2$.

Electron shell configuration $\{2, 2\}$.

Number of shells: 2

Be. Dimensionality 1

Energy: $E = -10.0967816$. Shell No. 1 (2 electrons)

$$R = 0.250843169$$

$$R = 1.14473213$$

Shell No. 2 (2 electrons)

$$R = 1.86460736$$

$$R = 3.19482214$$

Be. Dimensionality 2

Energy: $E = -14.8403479$. Shell No. 1 (2 electrons)

$$R = 0.266904962 \text{ (2 electrons)}$$

Shell No. 2 (2 electrons)

$$R = 2.23196083 \text{ (2 electrons)}$$

Be. Dimensionality 3

Energy: $E = -14.8403479$. Shell No. 1 (2 electrons)

$$R = 0.266904962 \text{ (2 electrons)}$$

Shell No. 2 (2 electrons)

$$R = 2.23196083 \text{ (2 electrons)}$$

IV. BORON ATOM - 5 ELECTRONS.

Electron configuration [He]$2s^2 2p^1$.

Electron shell configuration $\{2, 3\}$.

Number of shells: 2

B. Dimensionality 1

Energy: $E = -16.8309465$. Shell No. 1 (2 electrons)

$$R = 0.200347725$$

$$R = 0.834039204$$

Shell No. 2 (3 electrons)

$$R = 1.25416359$$

$$R = 1.88683349$$

$$R = 4.78878644$$

B. Dimensionality 2

Energy: $E = -24.7525419$. Shell No. 1 (2 electrons)

$$R = 0.210435194$$

$$R = 0.21048555$$

Shell No. 2 (3 electrons)

$$R = 1.6113783 \text{ (2 electrons)}$$

$$R = 1.77417096$$

B. Dimensionality 3

Energy: $E = -24.7935809$. Shell No. 1 (2 electrons)

$$R = 0.210813591 \text{ (2 electrons)}$$

Shell No. 2 (3 electrons)

$$R = 1.6177747 \text{ (3 electrons)}$$

B. Dimensionality 4

Energy: $E = -24.7935809$. Shell No. 1 (2 electrons)

$$R = 0.210813591 \text{ (2 electrons)}$$

Shell No. 2 (3 electrons)

$$R = 1.6177747 \text{ (3 electrons)}$$

V. CARBON ATOM - 6 ELECTRONS.

Electron configuration [He]$2s^2 2p^2$.

Electron shell configuration $\{2, 4\}$.

Number of shells: 2

C. Dimensionality 1

Energy: $E = -25.0513012$. Shell No. 1 (2 electrons)

$$R = 0.166151583$$

$$R = 0.742585065$$

Shell No. 2 (4 electrons)

$$R = 0.896414785$$

$$R = 2.05113595$$

$$R = 2.42461683$$

$$R = 7.85917318$$

C. Dimensionality 2

Energy: $E = -37.6742454$. Shell No. 1 (2 electrons)

$$R = 0.173862144 \text{ (2 electrons)}$$

Shell No. 2 (4 electrons)

$$R = 1.22487523 \text{ (2 electrons)}$$

$$R = 1.4410191 \text{ (2 electrons)}$$

C. Dimensionality 3

Energy: $E = -37.8167994$. Shell No. 1 (2 electrons)

$$R = 0.173983756 \text{ (2 electrons)}$$

Shell No. 2 (4 electrons)

$$R = 1.29353426 \text{ (4 electrons)}$$

C. Dimensionality 4

Energy: $E = -37.8662499$. Shell No. 1 (2 electrons)

$$R = 0.17421343 \text{ (2 electrons)}$$

Shell No. 2 (4 electrons)

$$R = 1.27545582 \text{ (4 electrons)}$$

C. Dimensionality 5

Energy: $E = -37.8662499$. Shell No. 1 (2 electrons)

$$R = 0.17421343 \text{ (2 electrons)}$$

Shell No. 2 (4 electrons)

$$R = 1.27545582 \text{ (4 electrons)}$$

VI. NITROGEN ATOM - 7 ELECTRONS.

Electron configuration [He]$2s^2 2p^3$.

Electron shell configuration $\{2, 5\}$.

Number of shells: 2

N. Dimensionality 1

Energy: $E = -52.4819748$. Shell No. 1 (2 electrons)

$$R = 0.147555963$$

$$R = 0.147648947$$

Shell No. 2 (5 electrons)

$$R = 0.825156332$$

$$R = 0.838103117$$

$$R = 2.21681865$$

$$R = 2.35172426$$

$$R = 8.35223488$$

N. Dimensionality 2

Energy: $E = -53.817805$. Shell No. 1 (2 electrons)

$$R = 0.148043293$$

$$R = 0.148077018$$

Shell No. 2 (5 electrons)

$$R = 0.930251899$$

$$R = 0.975919672$$

$$R = 1.02208634$$

$$R = 1.06793964$$

$$R = 4.04988688$$

N. Dimensionality 3

Energy: $E = -54.1609863$. Shell No. 1 (2 electrons)

$$R = 0.148219971$$

$$R = 0.148272837$$

Shell No. 2 (5 electrons)

$$R = 1.05175462 \text{ (2 electrons)}$$

$$R = 1.06095105 \text{ (2 electrons)}$$

$$R = 1.15886845$$

N. Dimensionality 4

Energy: $E = -54.3127825$. Shell No. 1 (2 electrons)

$$R = 0.148274473$$

$$R = 0.148280081$$

Shell No. 2 (5 electrons)

$$R = 1.05538495 \text{ (3 electrons)}$$

$$R = 1.07788564 \text{ (2 electrons)}$$

N. Dimensionality 5

Energy: $E = -54.3720983$. Shell No. 1 (2 electrons)

$$R = 0.148445972 \text{ (2 electrons)}$$

Shell No. 2 (5 electrons)

$$R = 1.05454746 \text{ (5 electrons)}$$

N. Dimensionality 6

Energy: $E = -54.3720983$. Shell No. 1 (2 electrons)

$$R = 0.148445972 \text{ (2 electrons)}$$

Shell No. 2 (5 electrons)

$$R = 1.05454746 \text{ (5 electrons)}$$

VII. OXYGEN ATOM - 8 ELECTRONS.

Electron configuration [He]$2s^2 2p^4$.

Electron shell configuration $\{2, 6\}$.

Number of shells: 2

O. Dimensionality 1

Energy: $E = -48.758197$. Shell No. 1 (2 electrons)

$$R = 0.124408678$$

$$R = 0.516206934$$

Shell No. 2 (6 electrons)

$$R = 0.586675353$$

$$R = 1.14039332$$

$$R = 1.25454015$$

$$R = 2.65974325$$

$$R = 2.8970517$$

$$R = 10.1660756$$

O. Dimensionality 2

Energy: $E = -73.4891511$. Shell No. 1 (2 electrons)

$$R = 0.12895004 \text{ (2 electrons)}$$

Shell No. 2 (6 electrons)

$$R = 0.816675922$$

$$R = 0.833661241 \text{ (2 electrons)}$$

$$R = 0.944014055 \text{ (2 electrons)}$$

$$R = 4.31604657$$

O. Dimensionality 3

Energy: $E = -74.1779887$. Shell No. 1 (2 electrons)

$$R = 0.129100856 \text{ (2 electrons)}$$

Shell No. 2 (6 electrons)

$$R = 0.877695033 \text{ (4 electrons)}$$

$$R = 1.02673634 \text{ (2 electrons)}$$

O. Dimensionality 4

Energy: $E = -74.3831777$. Shell No. 1 (2 electrons)

$$R = 0.129152182$$

$$R = 0.129189528$$

Shell No. 2 (6 electrons)

$$R = 0.891723819 \text{ (3 electrons)}$$

$$R = 0.908168726 \text{ (2 electrons)}$$

$$R = 0.986739013$$

O. Dimensionality 5

Energy: $E = -74.5551102$. Shell No. 1 (2 electrons)

$$R = 0.129187175$$

$$R = 0.129194372$$

Shell No. 2 (6 electrons)

$$R = 0.896793357 \text{ (4 electrons)}$$

$$R = 0.923257205 \text{ (2 electrons)}$$

O. Dimensionality 6

Energy: $E = -74.6246524$. Shell No. 1 (2 electrons)

$$R = 0.129320746 \text{ (2 electrons)}$$

Shell No. 2 (6 electrons)

$$R = 0.899544323 \text{ (6 electrons)}$$

O. Dimensionality 7

Energy: $E = -74.6246524$. Shell No. 1 (2 electrons)

$$R = 0.129320746 \text{ (2 electrons)}$$

Shell No. 2 (6 electrons)

$$R = 0.899544323 \text{ (6 electrons)}$$

VIII. FLUORINE ATOM - 9 ELECTRONS.

Electron configuration [He]$2s^2 2p^5$.

Electron shell configuration $\{2, 7\}$.

Number of shells: 2

F. Dimensionality 1

Energy: $E = -64.0053901$. Shell No. 1 (2 electrons)

$$R = 0.110668773$$

$$R = 0.440299591$$

Shell No. 2 (7 electrons)

$$R = 0.511570324$$

$$R = 0.893046531$$

$$R = 1.06722378$$

$$R = 1.8947348$$

$$R = 2.42452498$$

$$R = 4.46910845$$

$$R = 7.43620352$$

F. Dimensionality 2

Energy: $E = -96.9418695$. Shell No. 1 (2 electrons)

$$R = 0.11419593 \text{ (2 electrons)}$$

Shell No. 2 (7 electrons)

$$R = 0.66423929$$
$$R = 0.696747338 \text{ (2 electrons)}$$
$$R = 0.761129914 \text{ (2 electrons)}$$
$$R = 2.61701182$$
$$R = 2.62778672$$

F. Dimensionality 3

Energy: $E = -98.0590348$. Shell No. 1 (2 electrons)

$$R = 0.114325952$$
$$R = 0.114327718$$

Shell No. 2 (7 electrons)

$$R = 0.716026787 \text{ (2 electrons)}$$
$$R = 0.735057035 \text{ (2 electrons)}$$
$$R = 0.801661901$$
$$R = 0.805188543$$
$$R = 3.65641704$$

F. Dimensionality 4

Energy: $E = -98.4631944$. Shell No. 1 (2 electrons)

$$R = 0.114414901$$
$$R = 0.114463853$$

Shell No. 2 (7 electrons)

$$R = 0.787308847 \text{ (6 electrons)}$$

$$R = 0.853300307$$

F. Dimensionality 5

Energy: $E = -98.665202$. Shell No. 1 (2 electrons)

$$R = 0.114445806$$

$$R = 0.114454689$$

Shell No. 2 (7 electrons)

$$R = 0.783850924 \text{ (3 electrons)}$$

$$R = 0.797020264 \text{ (2 electrons)}$$

$$R = 0.799323448 \text{ (2 electrons)}$$

F. Dimensionality 6

Energy: $E = -98.8580776$. Shell No. 1 (2 electrons)

$$R = 0.114459331$$

$$R = 0.114461689$$

Shell No. 2 (7 electrons)

$$R = 0.785390664 \text{ (4 electrons)}$$

$$R = 0.792226507 \text{ (3 electrons)}$$

F. Dimensionality 7

Energy: $E = -98.93738$. Shell No. 1 (2 electrons)

$$R = 0.114562165 \text{ (2 electrons)}$$

Shell No. 2 (7 electrons)

$$R = 0.784569025 \text{ (7 electrons)}$$

F. Dimensionality 8

Energy: $E = -98.93738$. Shell No. 1 (2 electrons)

$$R = 0.114562165 \text{ (2 electrons)}$$

Shell No. 2 (7 electrons)

$$R = 0.784569025 \text{ (7 electrons)}$$

IX. NEON ATOM - 10 ELECTRONS.

Electron configuration [He]$2s^2 2p^6$.

Electron shell configuration $\{2, 8\}$.

Number of shells: 2

Ne. Dimensionality 1

Energy: $E = -81.5903384$. Shell No. 1 (2 electrons)

$$R = 0.0996092822$$

$$R = 0.386129552$$

Shell No. 2 (8 electrons)

$$R = 0.447801184$$

$$R = 0.742651707$$

$$R = 0.89553411$$

$$R = 1.46006537$$

$$R = 1.9490997$$

$$R = 3.1863024$$

$$R = 8.57114165$$

$$R = 34.1585601$$

Ne. Dimensionality 2

Energy: $E = -124.343234$. Shell No. 1 (2 electrons)

$$R = 0.102471778$$

$$R = 0.102471831$$

Shell No. 2 (8 electrons)

$$R = 0.58011791 \text{ (2 electrons)}$$

$$R = 0.611974687 \text{ (2 electrons)}$$

$$R = 0.636471572$$

$$R = 1.89673088$$

$$R = 1.95173587 \text{ (2 electrons)}$$

Ne. Dimensionality 3

Energy: $E = -126.053064$. Shell No. 1 (2 electrons)

$$R = 0.10260885$$

$$R = 0.102624759$$

Shell No. 2 (8 electrons)

$$R = 0.656297239 \text{ (2 electrons)}$$

$$R = 0.664119484 \text{ (2 electrons)}$$

$$R = 0.666956376$$

$$R = 0.692749352$$

$$R = 0.713479588$$

$$R = 3.78111269$$

Ne. Dimensionality 4

Energy: $E = -126.776214$. Shell No. 1 (2 electrons)

$$R = 0.102671729$$

$$R = 0.10277851$$

Shell No. 2 (8 electrons)

$$R = 0.657088946 \text{ (6 electrons)}$$

$$R = 0.725602205$$

$$R = 2.18245197$$

Ne. Dimensionality 5

Energy: $E = -127.096779$. Shell No. 1 (2 electrons)

$$R = 0.102728964 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.701134387 \text{ (4 electrons)}$$

$$R = 0.705665874 \text{ (4 electrons)}$$

Ne. Dimensionality 6

Energy: $E = -127.320317$. Shell No. 1 (2 electrons)

$$R = 0.10271976$$

$$R = 0.102744277$$

Shell No. 2 (8 electrons)

$$R = 0.690971421 \text{ (4 electrons)}$$

$$R = 0.696311021 \text{ (3 electrons)}$$

$$R = 0.762786357$$

Ne. Dimensionality 7

Energy: $E = -127.534125$. Shell No. 1 (2 electrons)

$$R = 0.102743312$$

$$R = 0.102746821$$

Shell No. 2 (8 electrons)

$$R = 0.695011938 \text{ (5 electrons)}$$

$$R = 0.704061119 \text{ (3 electrons)}$$

Ne. Dimensionality 8

Energy: $E = -127.623726$. Shell No. 1 (2 electrons)

$$R = 0.10282773 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.695804347 \text{ (8 electrons)}$$

Ne. Dimensionality 9

Energy: $E = -127.623726$. Shell No. 1 (2 electrons)

$$R = 0.10282773 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.695804347 \text{ (8 electrons)}$$

X. SODIUM ATOM - 11 ELECTRONS.

Electron configuration [Ne]$3s^1$.

Electron shell configuration $\{2, 8, 1\}$.

Number of shells: 3

Na. Dimensionality 1

Energy: $E = -146.881149$. Shell No. 1 (2 electrons)

$$R = 0.0925496751$$

$$R = 0.0925771112$$

Shell No. 2 (8 electrons)

$$R = 0.419973678$$

$$R = 0.422503427$$

$$R = 0.817091312$$

$$R = 0.828424034$$

$$R = 1.65674933$$

$$R = 1.7198528$$

$$R = 3.97725523$$

$$R = 5.05152161$$

Shell No. 3 (1 electrons)

$$R = 17.0367776$$

Na. Dimensionality 2

Energy: $E = -155.776654$. Shell No. 1 (2 electrons)

$$R = 0.0929422795$$

$$R = 0.0929591926$$

Shell No. 2 (8 electrons)

$$R = 0.528077989 \text{ (2 electrons)}$$

$$R = 0.536186872 \text{ (2 electrons)}$$

$$R = 0.620979907$$

$$R = 0.626692773$$

$$R = 1.67764625 \text{ (2 electrons)}$$

Shell No. 3 (1 electrons)

$$R = 7.66199208$$

Na. Dimensionality 3

Energy: $E = -158.4273$. Shell No. 1 (2 electrons)

$$R = 0.0930558653$$

$$R = 0.0930577125$$

Shell No. 2 (8 electrons)

$$R = 0.609793596 \text{ (4 electrons)}$$

$$R = 0.611740229 \text{ (4 electrons)}$$

Shell No. 3 (1 electrons)

$$R = 8.92708091$$

Na. Dimensionality 4

Energy: $E = -159.653042$. Shell No. 1 (2 electrons)

$$R = 0.0931127863 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.587885733 \text{ (3 electrons)}$$

$$R = 0.589290359 \text{ (3 electrons)}$$

$$R = 0.644945754 \text{ (2 electrons)}$$

Shell No. 3 (1 electrons)

$$R = 8.83485293$$

Na. Dimensionality 5

Energy: $E = -159.998498$. Shell No. 1 (2 electrons)

$$R = 0.0931913086$$

$$R = 0.0931944519$$

Shell No. 2 (8 electrons)

$$R = 0.596053276 \text{ (4 electrons)}$$

$$R = 0.598431634 \text{ (2 electrons)}$$

$$R = 0.600044831 \text{ (2 electrons)}$$

Shell No. 3 (1 electrons)

$$R = 8.66492707$$

Na. Dimensionality 6

Energy: $E = -160.263996$. Shell No. 1 (2 electrons)

$$R = 0.0931913583$$

$$R = 0.093207821$$

Shell No. 2 (8 electrons)

$$R = 0.592776708 \text{ (3 electrons)}$$

$$R = 0.593881346 \text{ (3 electrons)}$$

$$R = 0.603283444 \text{ (2 electrons)}$$

Shell No. 3 (1 electrons)

$$R = 8.61110244$$

Na. Dimensionality 7

Energy: $E = -160.515154$. Shell No. 1 (2 electrons)

$$R = 0.0932066154$$

$$R = 0.0932090882$$

Shell No. 2 (8 electrons)

$$R = 0.593491957 \text{ (4 electrons)}$$

$$R = 0.594471072 \text{ (4 electrons)}$$

Shell No. 3 (1 electrons)

$$R = 8.6475276$$

Na. Dimensionality 8

Energy: $E = -160.632323$. Shell No. 1 (2 electrons)

$$R = 0.0932829505$$

$$R = 0.0932871546$$

Shell No. 2 (8 electrons)

$$R = 0.591990675 \text{ (8 electrons)}$$

Shell No. 3 (1 electrons)

$$R = 8.49580255$$

Na. Dimensionality 9

Energy: $E = -160.632373$. Shell No. 1 (2 electrons)

$$R = 0.0932850947 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.591990831 \text{ (8 electrons)}$$

Shell No. 3 (1 electrons)

$$R = 8.48368389$$

Na. Dimensionality 10

Energy: $E = -160.632373$. Shell No. 1 (2 electrons)

$$R = 0.0932850947 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.591990831 \text{ (8 electrons)}$$

Shell No. 3 (1 electrons)

$$R = 8.48368389$$

XI. MAGNESIUM ATOM - 12 ELECTRONS.

Electron configuration [Ne]$3s^2$.

Electron shell configuration $\{2, 8, 2\}$.

Number of shells: 3

Mg. Dimensionality 1

Energy: $E = -124.124575$. Shell No. 1 (2 electrons)

$$R = 0.0830556223$$

$$R = 0.309158738$$

Shell No. 2 (8 electrons)

$$R = 0.361986879$$

$$R = 0.550718642$$

$$R = 0.69203114$$

$$R = 0.979083404$$

$$R = 1.71097694$$

$$R = 1.85158432$$

$$R = 3.69958801$$

$$R = 4.07689406$$

Shell No. 3 (2 electrons)

$$R = 8.60618402$$

$$R = 30.8253561$$

Mg. Dimensionality 2

Energy: $E = -191.485652$. Shell No. 1 (2 electrons)

$$R = 0.0850311297 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.467384255 \text{ (4 electrons)}$$

$$R = 0.54373979 \text{ (2 electrons)}$$

$$R = 1.23024422 \text{ (2 electrons)}$$

Shell No. 3 (2 electrons)

$$R = 4.83849107 \text{ (2 electrons)}$$

Mg. Dimensionality 3

Energy: $E = -195.304768$. Shell No. 1 (2 electrons)

$$R = 0.0851416639 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.529762991 \text{ (8 electrons)}$$

Shell No. 3 (2 electrons)

$$R = 5.10077792 \text{ (2 electrons)}$$

Mg. Dimensionality 4

Energy: $E = -196.7281$. Shell No. 1 (2 electrons)

$$R = 0.0851966294 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.522526637 \text{ (8 electrons)}$$

Shell No. 3 (2 electrons)

$$R = 5.01959631 \text{ (2 electrons)}$$

Mg. Dimensionality 5

Energy: $E = -197.142371$. Shell No. 1 (2 electrons)

$$R = 0.0852769565 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.518576913 \text{ (4 electrons)}$$

$$R = 0.520687574 \text{ (4 electrons)}$$

Shell No. 3 (2 electrons)

$$R = 4.8956006 \text{ (2 electrons)}$$

Mg. Dimensionality 6

Energy: $E = -197.440949$. Shell No. 1 (2 electrons)

$$R = 0.0852793096 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.514293976 \text{ (4 electrons)}$$

$$R = 0.522380087 \text{ (4 electrons)}$$

Shell No. 3 (2 electrons)

$$R = 4.8986961 \text{ (2 electrons)}$$

Mg. Dimensionality 7

Energy: $E = -197.73868$. Shell No. 1 (2 electrons)

$$R = 0.0852898944 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.51686284 \text{ (8 electrons)}$$

Shell No. 3 (2 electrons)

$$R = 4.88220714 \text{ (2 electrons)}$$

Mg. Dimensionality 8

Energy: $E = -197.888772$. Shell No. 1 (2 electrons)

$$R = 0.085359838 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.51532652 \text{ (8 electrons)}$$

Shell No. 3 (2 electrons)

$$R = 4.77198212 \text{ (2 electrons)}$$

Mg. Dimensionality 9

Energy: $E = -197.889176$. Shell No. 1 (2 electrons)

$$R = 0.0853600897 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.515327381 \text{ (8 electrons)}$$

Shell No. 3 (2 electrons)

$$R = 4.76346909 \text{ (2 electrons)}$$

Mg. Dimensionality 10

Energy: $E = -197.889176$. Shell No. 1 (2 electrons)

$$R = 0.0853600897 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.515327381 \text{ (8 electrons)}$$

Shell No. 3 (2 electrons)

$$R = 4.76346909 \text{ (2 electrons)}$$

Mg. Dimensionality 11

Energy: $E = -197.889176$. Shell No. 1 (2 electrons)

$$R = 0.0853600897 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.515327381 \text{ (8 electrons)}$$

Shell No. 3 (2 electrons)

$$R = 4.76346909 \text{ (2 electrons)}$$

XII. ALUMINUM ATOM - 13 ELECTRONS.

Electron configuration [Ne]$3s^2 3p^1$.

Electron shell configuration $\{2, 8, 3\}$.

Number of shells: 3

Al. Dimensionality 1

Energy: $E = -147.1587$. Shell No. 1 (2 electrons)

$$R = 0.0765854105$$

$$R = 0.293426745$$

Shell No. 2 (8 electrons)

$$R = 0.32459898$$
$$R = 0.534192368$$
$$R = 0.598110707$$
$$R = 1.15805647$$
$$R = 1.36976527$$
$$R = 1.96178439$$
$$R = 2.64489372$$
$$R = 3.85486485$$

Shell No. 3 (3 electrons)

$$R = 5.04709408$$
$$R = 9.69345732$$
$$R = 14.4837624$$

Al. Dimensionality 2

Energy: $E = -231.449093$. Shell No. 1 (2 electrons)

$$R = 0.0783201421$$
$$R = 0.0783802337$$

Shell No. 2 (8 electrons)

$$R = 0.405879411 \text{ (2 electrons)}$$
$$R = 0.43767103 \text{ (2 electrons)}$$
$$R = 0.470817897 \text{ (2 electrons)}$$
$$R = 0.955751686 \text{ (2 electrons)}$$

Shell No. 3 (3 electrons)

$$R = 3.59221657 \text{ (2 electrons)}$$
$$R = 4.11634888$$

Al. Dimensionality 3

Energy: $E = -236.53478$. Shell No. 1 (2 electrons)

$$R = 0.0784668457$$

$$R = 0.0784672621$$

Shell No. 2 (8 electrons)

$$R = 0.467415128 \text{ (2 electrons)}$$

$$R = 0.467702592 \text{ (4 electrons)}$$

$$R = 0.468088321 \text{ (2 electrons)}$$

Shell No. 3 (3 electrons)

$$R = 3.65535659$$

$$R = 3.73069298 \text{ (2 electrons)}$$

Al. Dimensionality 4

Energy: $E = -238.162975$. Shell No. 1 (2 electrons)

$$R = 0.0785201509 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.462008325 \text{ (4 electrons)}$$

$$R = 0.462097604 \text{ (4 electrons)}$$

Shell No. 3 (3 electrons)

$$R = 3.61810122 \text{ (2 electrons)}$$

$$R = 3.65732625$$

Al. Dimensionality 5

Energy: $E = -238.653362$. Shell No. 1 (2 electrons)

$$R = 0.0785941069$$

$$R = 0.0786014257$$

Shell No. 2 (8 electrons)

$$R = 0.459066472 \text{ (4 electrons)}$$

$$R = 0.460331294 \text{ (2 electrons)}$$

$$R = 0.460502371 \text{ (2 electrons)}$$

Shell No. 3 (3 electrons)

$$R = 3.50013167$$

$$R = 3.55722383 \text{ (2 electrons)}$$

Al. Dimensionality 6

Energy: $E = -239.000821$. Shell No. 1 (2 electrons)

$$R = 0.0785956271$$

$$R = 0.0786093482$$

Shell No. 2 (8 electrons)

$$R = 0.457007789$$

$$R = 0.457372377 \text{ (3 electrons)}$$

$$R = 0.458092587 \text{ (2 electrons)}$$

$$R = 0.461979579 \text{ (2 electrons)}$$

Shell No. 3 (3 electrons)

$$R = 3.47291301$$

$$R = 3.55524231$$

$$R = 3.56115832$$

Al. Dimensionality 7

Energy: $E = -239.331892$. Shell No. 1 (2 electrons)

$$R = 0.0786092787$$

$$R = 0.0786100734$$

Shell No. 2 (8 electrons)

$$R = 0.456478004$$

$$R = 0.457675476 \text{ (4 electrons)}$$

$$R = 0.457822654 \text{ (3 electrons)}$$

Shell No. 3 (3 electrons)

$$R = 3.49849489$$

$$R = 3.52934346$$

$$R = 3.53097439$$

Al. Dimensionality 8

Energy: $E = -239.514066$. Shell No. 1 (2 electrons)

$$R = 0.0786733096 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.455744705$$

$$R = 0.456424048 \text{ (7 electrons)}$$

Shell No. 3 (3 electrons)

$$R = 3.42757966 \text{ (2 electrons)}$$

$$R = 3.57902694$$

Al. Dimensionality 9

Energy: $E = -239.525223$. Shell No. 1 (2 electrons)

$$R = 0.0786731914$$

$$R = 0.0786732439$$

Shell No. 2 (8 electrons)

$$R = 0.456414338 \text{ (8 electrons)}$$

Shell No. 3 (3 electrons)

$$R = 3.41705208 \text{ (2 electrons)}$$

$$R = 3.42893911$$

Al. Dimensionality 10

Energy: $E = -239.525918$. Shell No. 1 (2 electrons)

$$R = 0.0786735563 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.456415461 \text{ (8 electrons)}$$

Shell No. 3 (3 electrons)

$$R = 3.4173539 \text{ (3 electrons)}$$

Al. Dimensionality 11

Energy: $E = -239.525918$. Shell No. 1 (2 electrons)

$$R = 0.0786735563 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.456415461 \text{ (8 electrons)}$$

Shell No. 3 (3 electrons)

$$R = 3.4173539 \text{ (3 electrons)}$$

Al. Dimensionality 12

Energy: $E = -239.525918$. Shell No. 1 (2 electrons)

$$R = 0.0786735563 \text{ (2 electrons)}$$

Shell No. 2 (8 electrons)

$$R = 0.456415461 \text{ (8 electrons)}$$

Shell No. 3 (3 electrons)

$$R = 3.4173539 \text{ (3 electrons)}$$