

Needs["ErrorBarPlots`"]

```
En $\alpha$  = {{22, Quantity[{4.6, .2}, "Kiloelectronvolts"]},
  {26, Quantity[{6.5, .2}, "Kiloelectronvolts"]},
  {28, Quantity[{7.6, .2}, "Kiloelectronvolts"]},
  {29, Quantity[{8.1, .2}, "Kiloelectronvolts"]},
  {30, Quantity[{8.7, .2}, "Kiloelectronvolts"]},
  {40, Quantity[{15.8, .2}, "Kiloelectronvolts"]},
  {42, Quantity[{17.4, .2}, "Kiloelectronvolts"]},
  {47, Quantity[{21.8, .2}, "Kiloelectronvolts"]}}
{{22, {4.6 keV, 0.2 keV}}, {26, {6.5 keV, 0.2 keV}},
 {28, {7.6 keV, 0.2 keV}}, {29, {8.1 keV, 0.2 keV}}, {30, {8.7 keV, 0.2 keV}},
 {40, {15.8 keV, 0.2 keV}}, {42, {17.4 keV, 0.2 keV}}, {47, {21.8 keV, 0.2 keV}}}
```

```
En $\beta$  = {{26, Quantity[{7.1, .2}, "Kiloelectronvolts"]},
  {28, Quantity[{8.4, .2}, "Kiloelectronvolts"]},
  {29, Quantity[{9.0, .2}, "Kiloelectronvolts"]},
  {30, Quantity[{9.7, .2}, "Kiloelectronvolts"]},
  {40, Quantity[{17.6, .2}, "Kiloelectronvolts"]},
  {42, Quantity[{19.4, .2}, "Kiloelectronvolts"]},
  {47, Quantity[{24.5, .3}, "Kiloelectronvolts"]}}
{{26, {7.1 keV, 0.2 keV}}, {28, {8.4 keV, 0.2 keV}},
 {29, {9. keV, 0.2 keV}}, {30, {9.7 keV, 0.2 keV}}, {40, {17.6 keV, 0.2 keV}},
 {42, {19.4 keV, 0.2 keV}}, {47, {24.5 keV, 0.3 keV}}}
```

Ry = Quantity[13.6, "Electronvolts"]

13.6 eV

a =

```
With[{En = First[#],  $\Delta$ En = Last[#]}, {Sqrt[En / Ry],  $\frac{\Delta En}{2 \text{ Sqrt}[En Ry]}$ }] & /@ Last /@ En $\alpha$ 
{{18.3912, 0.399808}, {21.8619, 0.336336},
 {23.6394, 0.311045}, {24.4047, 0.301292}, {25.2924, 0.290717},
 {34.0847, 0.215726}, {35.7689, 0.205568}, {40.0367, 0.183655}}
```

b =

```
With[{En = First[#],  $\Delta$ En = Last[#]}, {Sqrt[En / Ry],  $\frac{\Delta En}{2 \text{ Sqrt}[En Ry]}$ }] & /@ Last /@ En $\beta$ 
{{22.8486, 0.321811}, {24.8525, 0.295863},
 {25.7248, 0.285831}, {26.7065, 0.275324},
 {35.9738, 0.204397}, {37.7686, 0.194684}, {42.4437, 0.25986}}
```

sa = With[{n1 = 1, n2 = 2, En = First[Last[#]], Δ En = Last[Last[#]], Z = First[#]},

```
{Z - Sqrt[ $\frac{En}{Ry \left(\frac{1}{n1^2} - \frac{1}{n2^2}\right)}$ ],  $\frac{\Delta En}{2 \text{ Sqrt}[En Ry \left(\frac{1}{n1^2} - \frac{1}{n2^2}\right)]}$ }] & /@ En $\alpha$ 
{{0.763701, 0.461659}, {0.756092, 0.388368},
 {0.703516, 0.359164}, {0.819907, 0.347902}, {0.794843, 0.335691},
 {0.642414, 0.249099}, {0.697671, 0.23737}, {0.769546, 0.212066}}
```

```

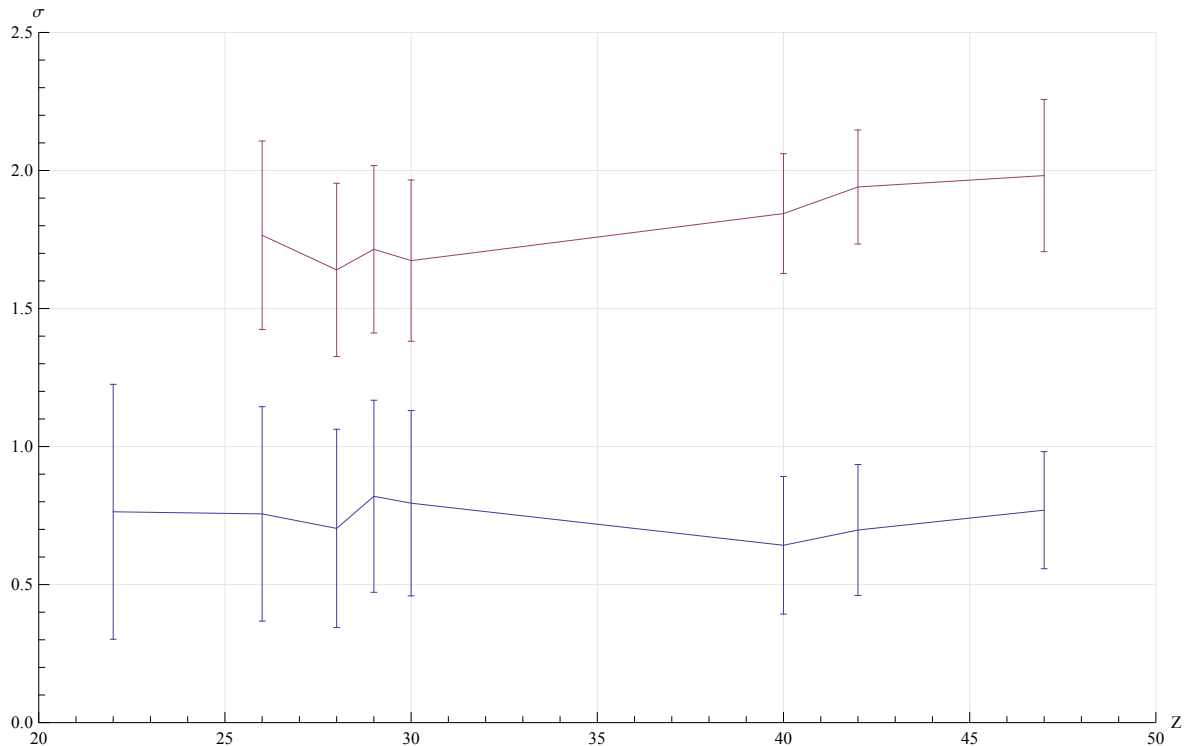
sb = With[{n1 = 1, n2 = 3, En = First[Last[#]], ΔEn = Last[Last[#]], Z = First[#]},
  {Z - Sqrt[ $\frac{En}{Ry \left(\frac{1}{n1^2} - \frac{1}{n2^2}\right)}$ ],  $\frac{\Delta En}{2 \text{ Sqrt}\left[En Ry \left(\frac{1}{n1^2} - \frac{1}{n2^2}\right)\right]}$ ]} & /@ Enβ
{{1.76539, 0.341332}, {1.63994, 0.31381}, {1.71474, 0.30317}, {1.67352, 0.292026},
{1.84397, 0.216796}, {1.9403, 0.206493}, {1.98162, 0.275623}}

σα = Table[With[{Z = First[Enα[[i]]], σ = First[sa[[i]]], Δσ = Last[sa[[i]]]},
  {{Z, σ}, ErrorBar[Δσ]}], {i, Length[sa]}]
{{{22, 0.763701}, ErrorBar[0.461659]}, {{26, 0.756092}, ErrorBar[0.388368]},
{{28, 0.703516}, ErrorBar[0.359164]}, {{29, 0.819907}, ErrorBar[0.347902]},
{{30, 0.794843}, ErrorBar[0.335691]}, {{40, 0.642414}, ErrorBar[0.249099]},
{{42, 0.697671}, ErrorBar[0.23737]}, {{47, 0.769546}, ErrorBar[0.212066]}}

σβ = Table[With[{Z = First[Enβ[[i]]], σ = First[sb[[i]]], Δσ = Last[sb[[i]]]},
  {{Z, σ}, ErrorBar[Δσ]}], {i, Length[sb]}]
{{{26, 1.76539}, ErrorBar[0.341332]},
{{28, 1.63994}, ErrorBar[0.31381]}, {{29, 1.71474}, ErrorBar[0.30317]},
{{30, 1.67352}, ErrorBar[0.292026]}, {{40, 1.84397}, ErrorBar[0.216796]},
{{42, 1.9403}, ErrorBar[0.206493]}, {{47, 1.98162}, ErrorBar[0.275623]}}

ErrorListPlot[{σα, σβ}, Joined → True, PlotRange → {{20, 50}, {0, 2.5}},
  AxesLabel → {"Z", "σ"}, PlotLegends → {"σα", "σβ"}, ImageSize → Full,
  GridLines → Automatic, GridLinesStyle → Directive[Lighter[LightGray]]]

```



```

Style[Grid[Join[{"Z", " $\sigma_\alpha$ ", " $\sigma_\beta$ "},
  Table[With[{Z = First[En $_\alpha$ [[i]]],  $\sigma_\alpha$  = First[sa[[i]]],  $\Delta\sigma_\alpha$  = Last[sa[[i]]],
    ob = If[i  $\geq$  2, First[sb[[i - 1]]],  $\Delta ob$  = If[i  $\geq$  2, Last[sb[[i - 1]]]],
    {Z, PlusMinus[NumberForm[ $\sigma_\alpha$ , {2, 2}], NumberForm[ $\Delta\sigma_\alpha$ , {2, 2}]},
    If[i  $\geq$  2, PlusMinus[NumberForm[ob, {3, 2}], NumberForm[ $\Delta ob$ , {2, 2}], ""]}],
  {i, Length[sa]}], Alignment  $\rightarrow$  {Center, Automatic},
  Dividers  $\rightarrow$  {None, {2  $\rightarrow$  GrayLevel[0.7]}},
  Spacings  $\rightarrow$  {{2  $\rightarrow$  2, 3  $\rightarrow$  2}, {2  $\rightarrow$  0.75}},
  "DialogStyle", FontSize  $\rightarrow$  11]

```

Z	σ_α	σ_β
22	0.76 \pm 0.46	
26	0.76 \pm 0.39	1.77 \pm 0.34
28	0.70 \pm 0.36	1.64 \pm 0.31
29	0.82 \pm 0.35	1.71 \pm 0.30
30	0.79 \pm 0.34	1.67 \pm 0.29
40	0.64 \pm 0.25	1.84 \pm 0.22
42	0.70 \pm 0.24	1.94 \pm 0.21
47	0.77 \pm 0.21	1.98 \pm 0.28