

PHOTOELECTRON SPECTROSCOPY

Using PES data and other data to understand:

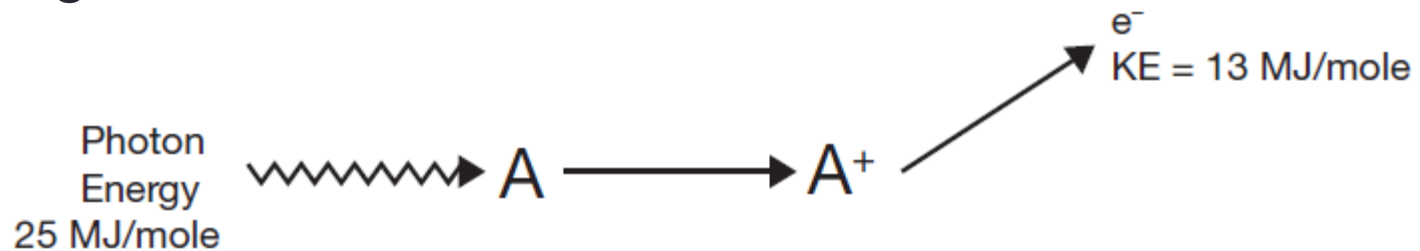
- Atomic structure
- Electron configurations
- Ionization energy
- Periodic trends

What is PES?

- Photoelectron spectrophotometers use high-energy radiation (UV or X-rays) to eject electrons from an atom
- The photoelectron spectrophotometer inputs only one type of radiation (with a specific energy)
- Because electrons within an atom are in different energy levels, different electrons can require different amounts of energy to eject
 - Electrons that are closer to the nucleus are HARDER to remove (More attraction between protons and electrons)
 - Valence electrons (outer level) are the EASIEST to remove
- The photoelectron spectrophotometer removes electrons from multiple atoms, so electrons from all levels will be observed (& graphed)

What is measured?

- The “input” energy removes the electron from the atom
- Any “leftover” energy determines how fast the electrons is moving when it leaves the atom



- If only a small amount of energy is needed to remove an electron, a lot of energy is “leftover”
 - These electrons will be moving fast
- If a lot of amount of energy is needed to remove an electron, not much energy is “leftover”
 - These electrons will be moving slow

Reading PES Graphs

Y- axis label(s);

- Signal intensity
- Number of electrons
- Relative # of electrons

X- axis label(s):

- Ionization energy
- Binding energy
- ΔU_E

Units:

MJ/mol or eV

1000

100

10

1

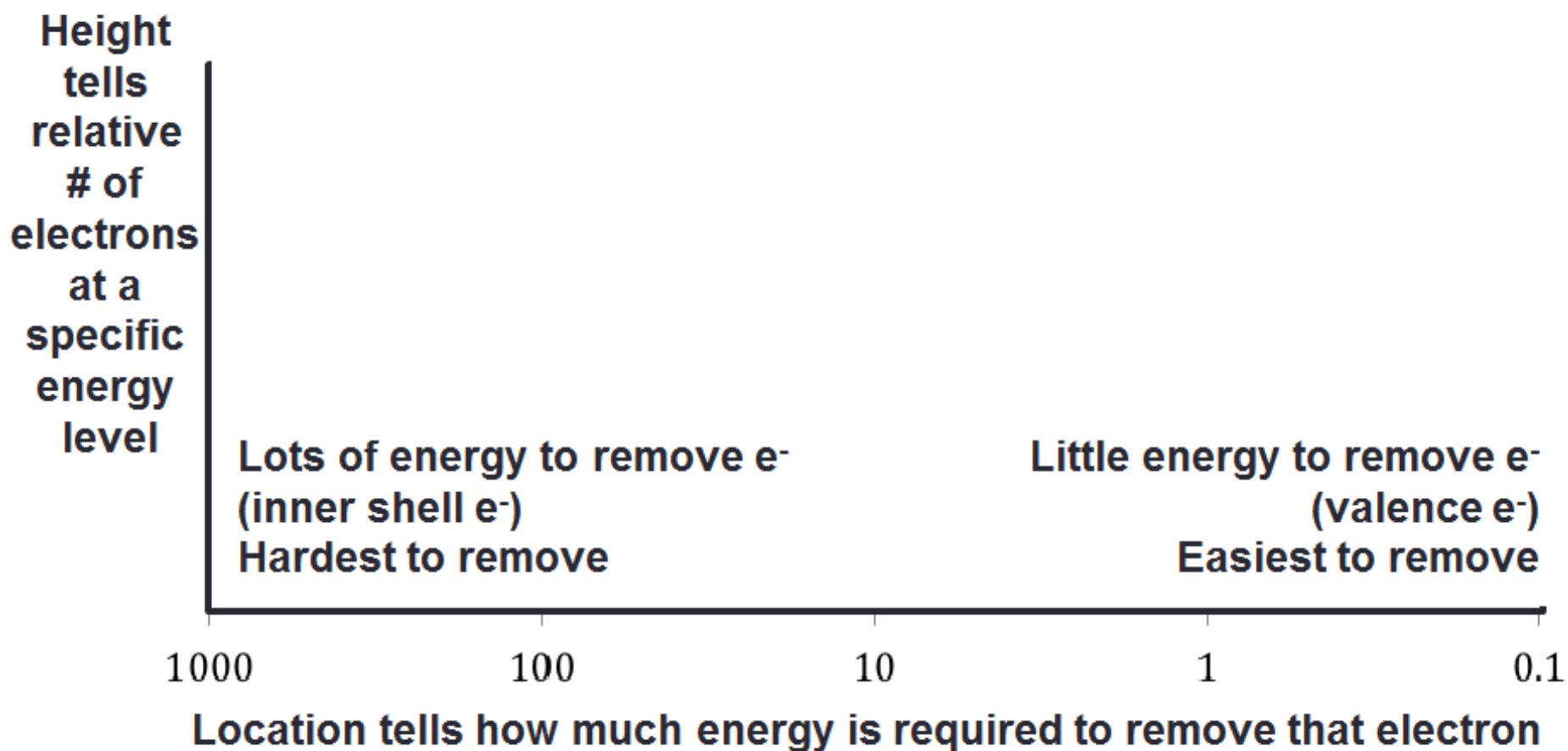
0.1

X-axis is numbered “backwards”

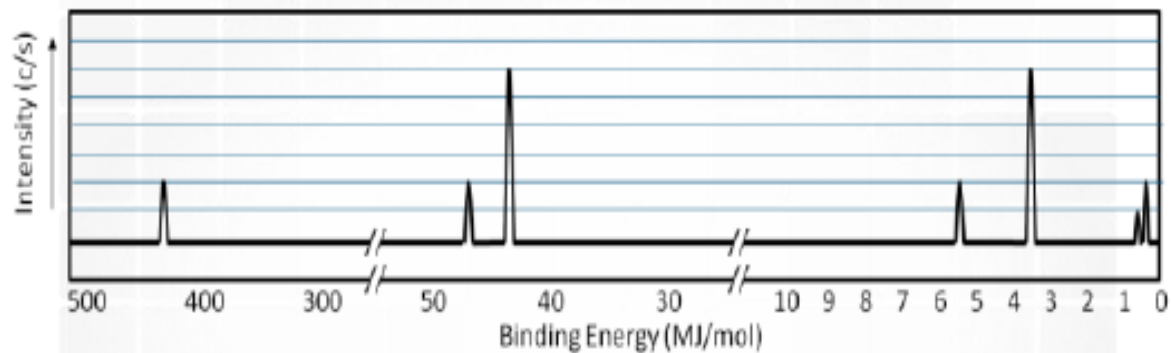
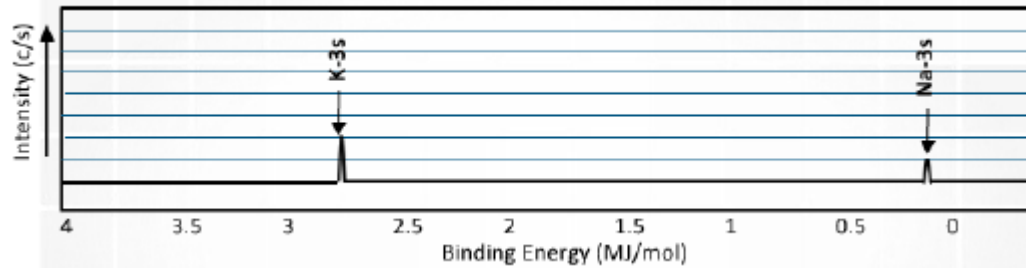
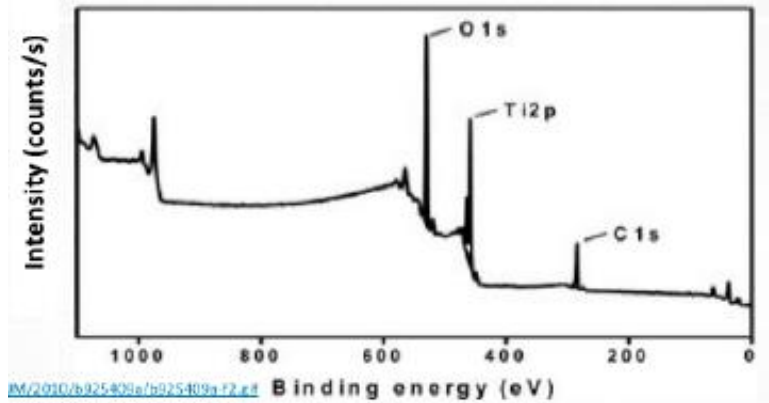
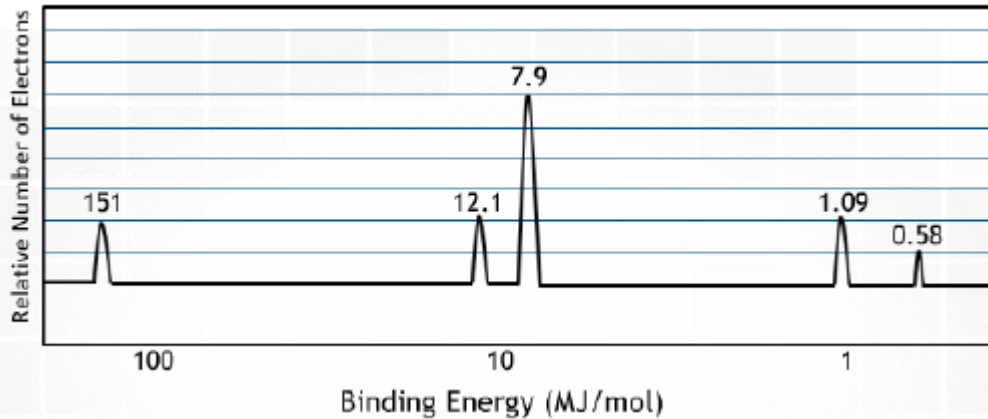
Large \rightarrow Small (0 at far right)

Often log scale or “breaks” in line

Reading PES Graphs

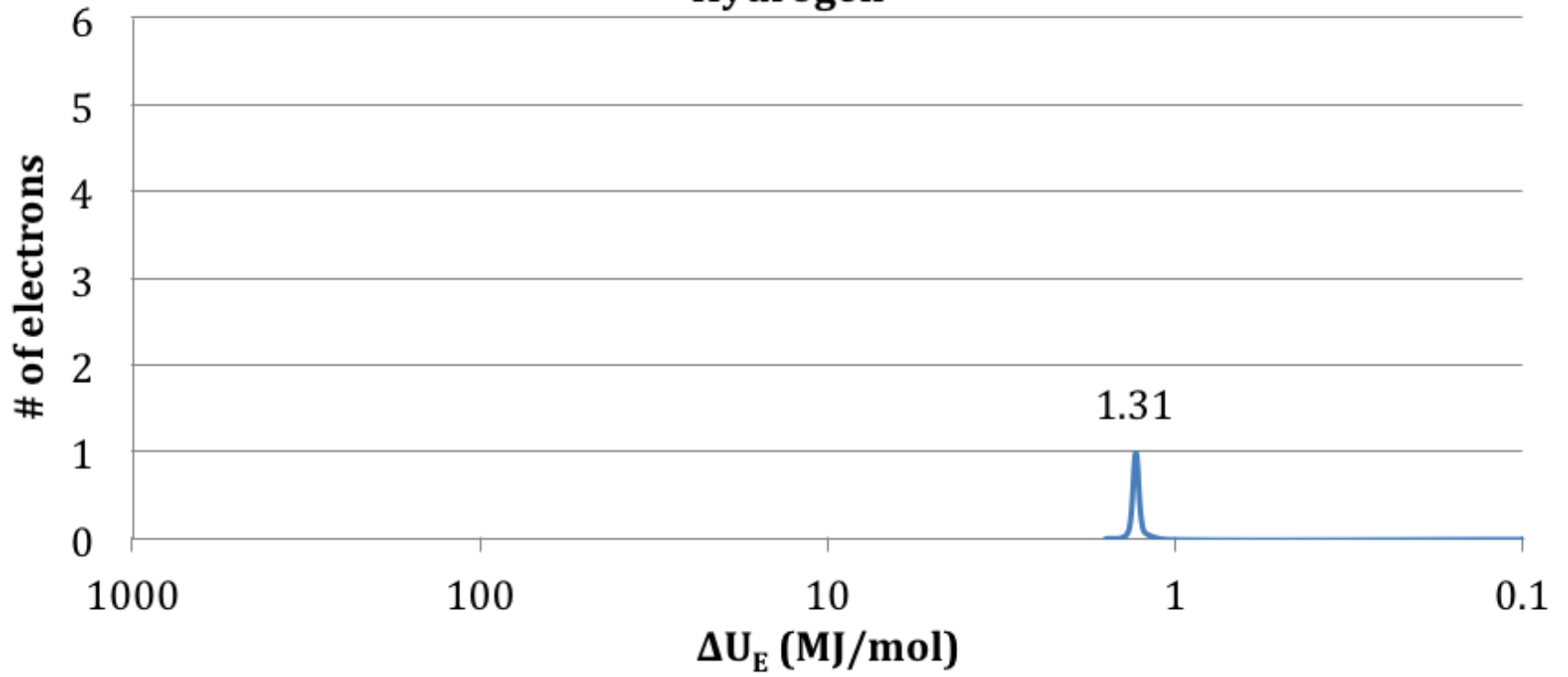


Sample Graphs

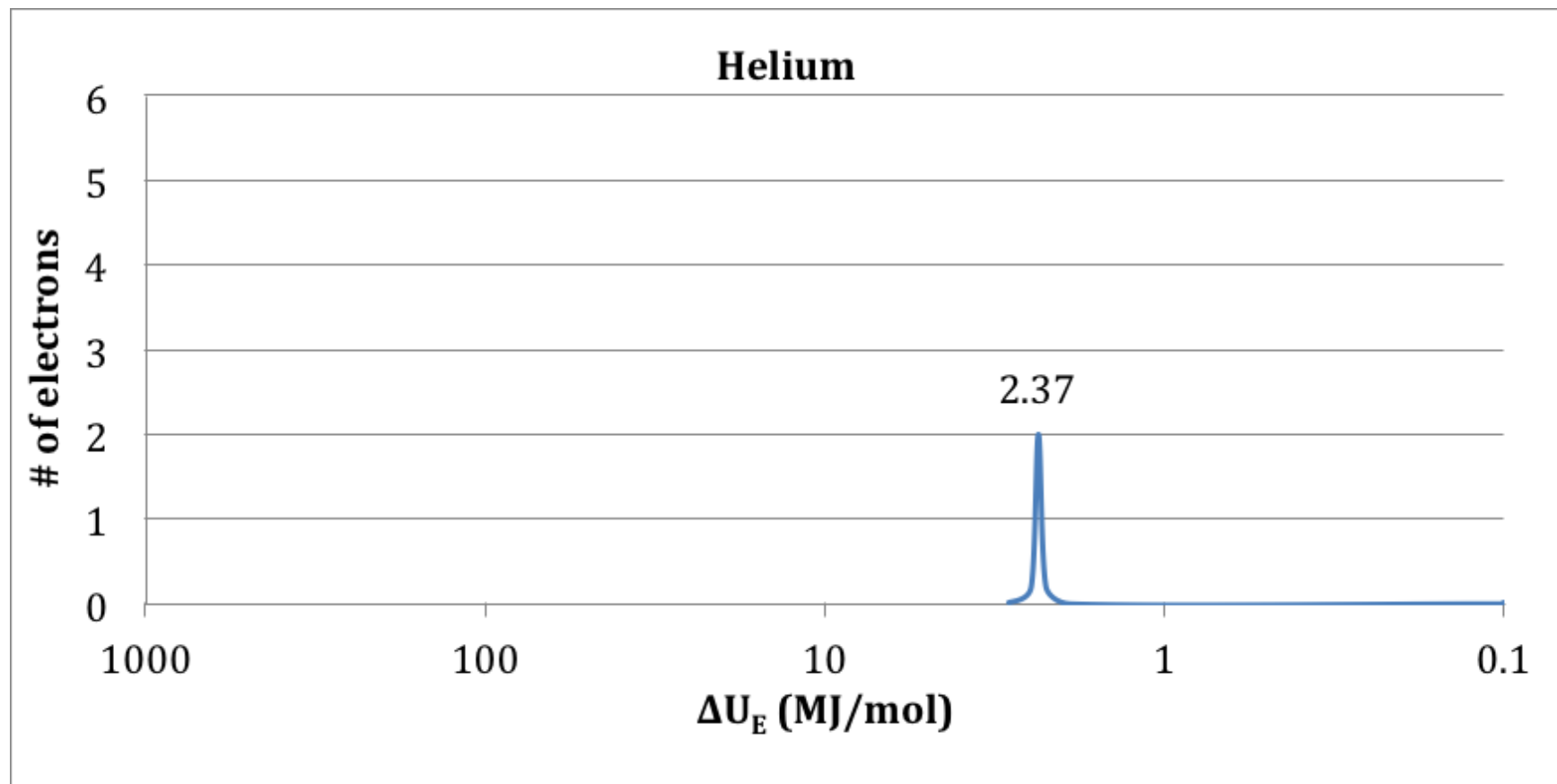


1

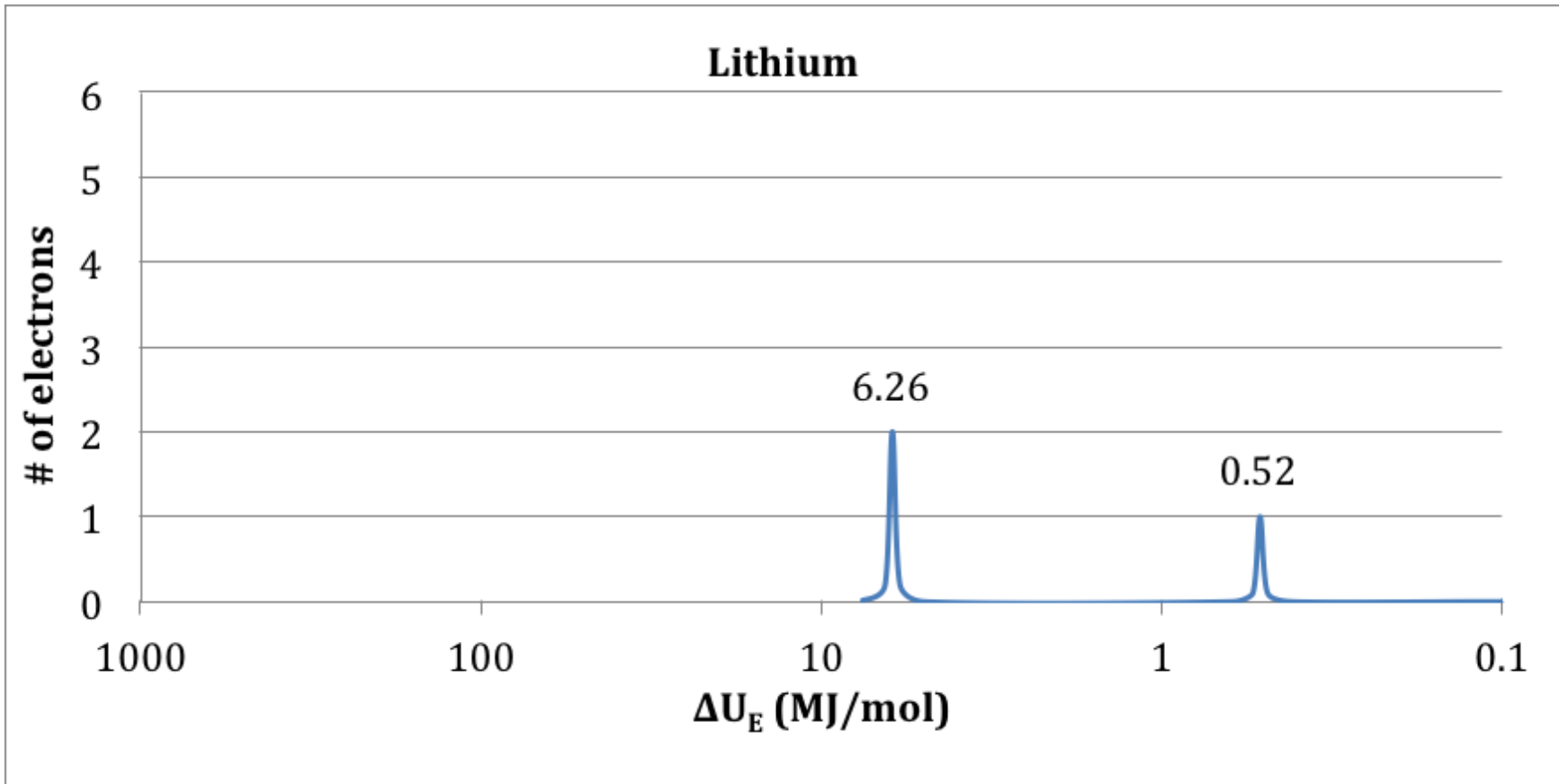
Hydrogen



2

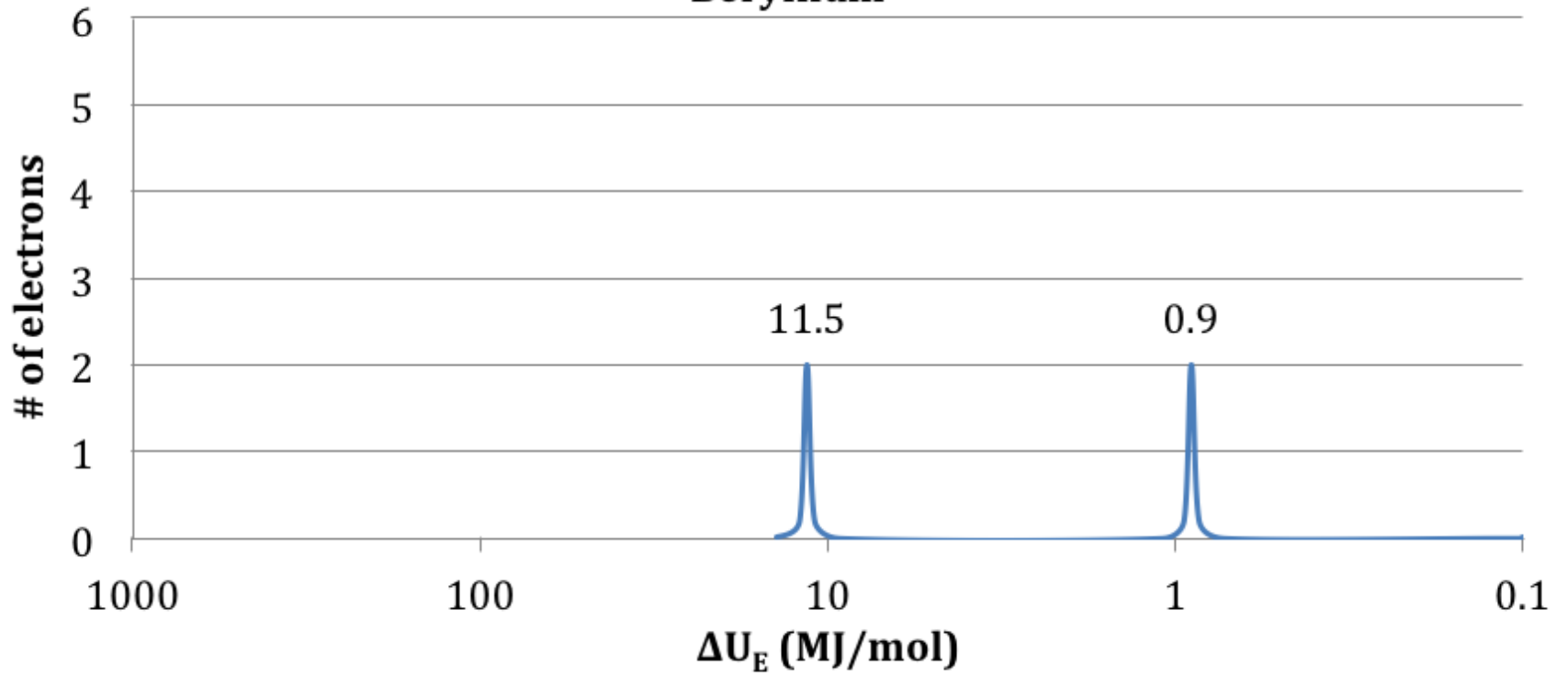


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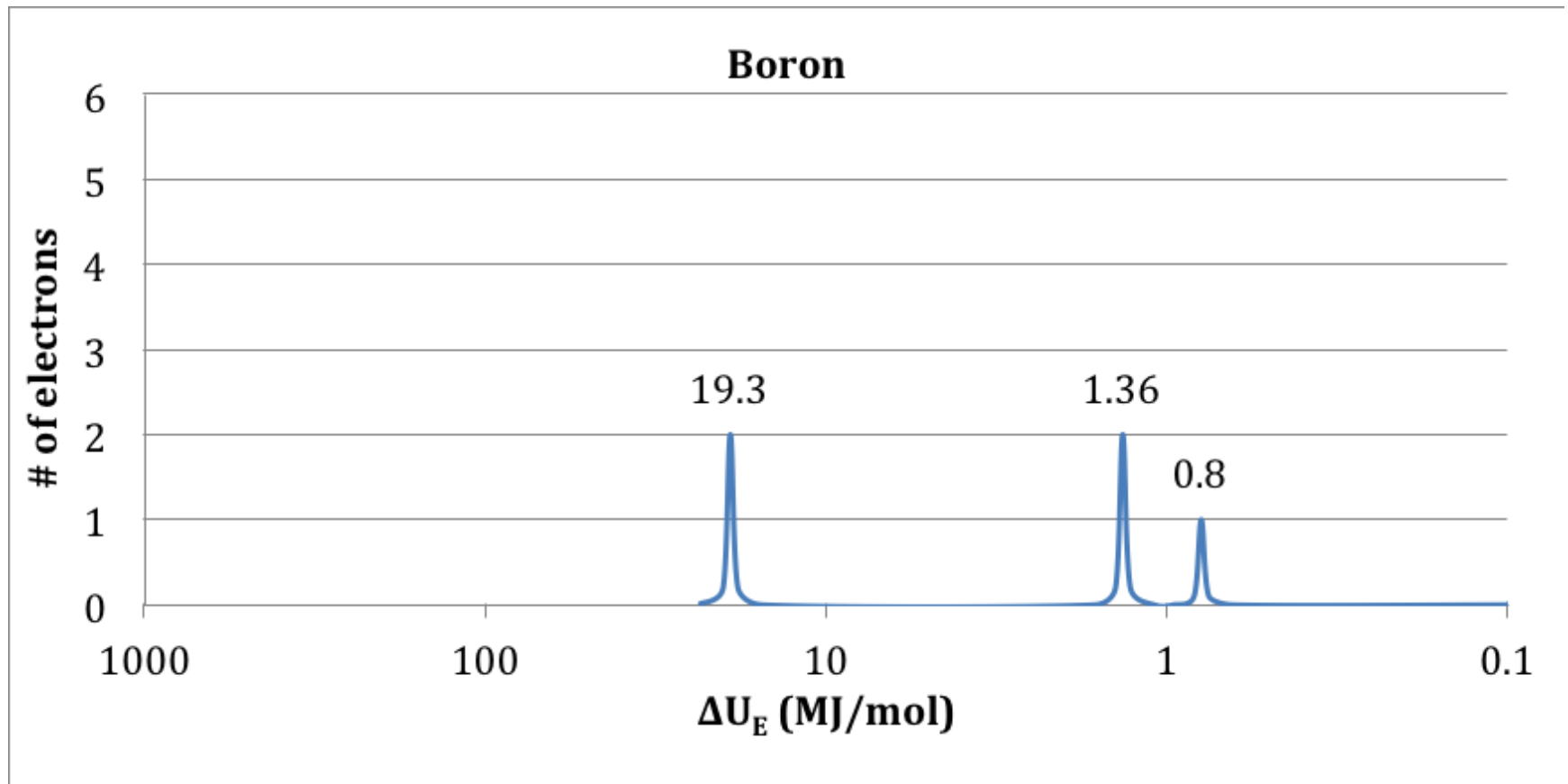


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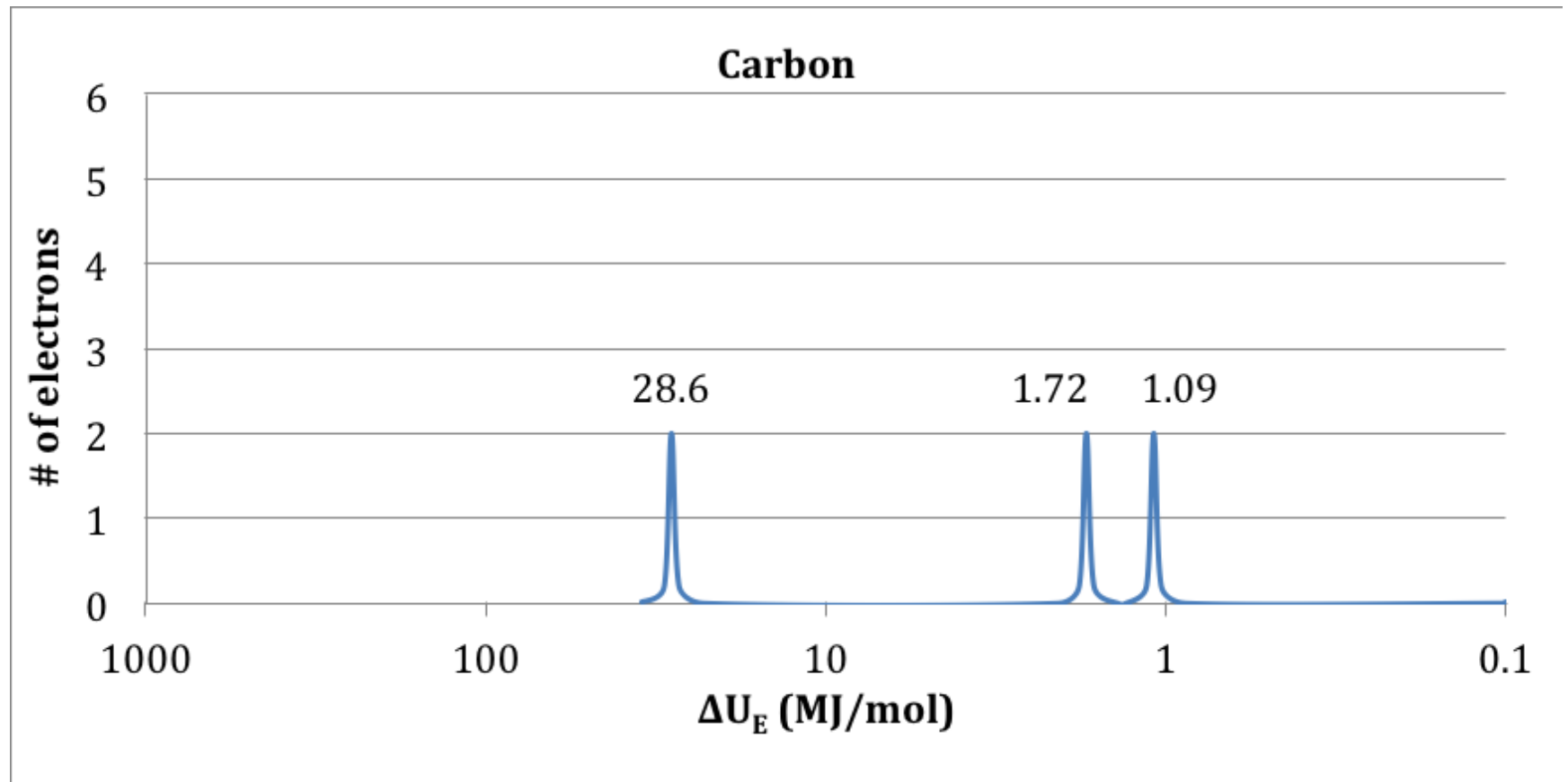
Beryllium



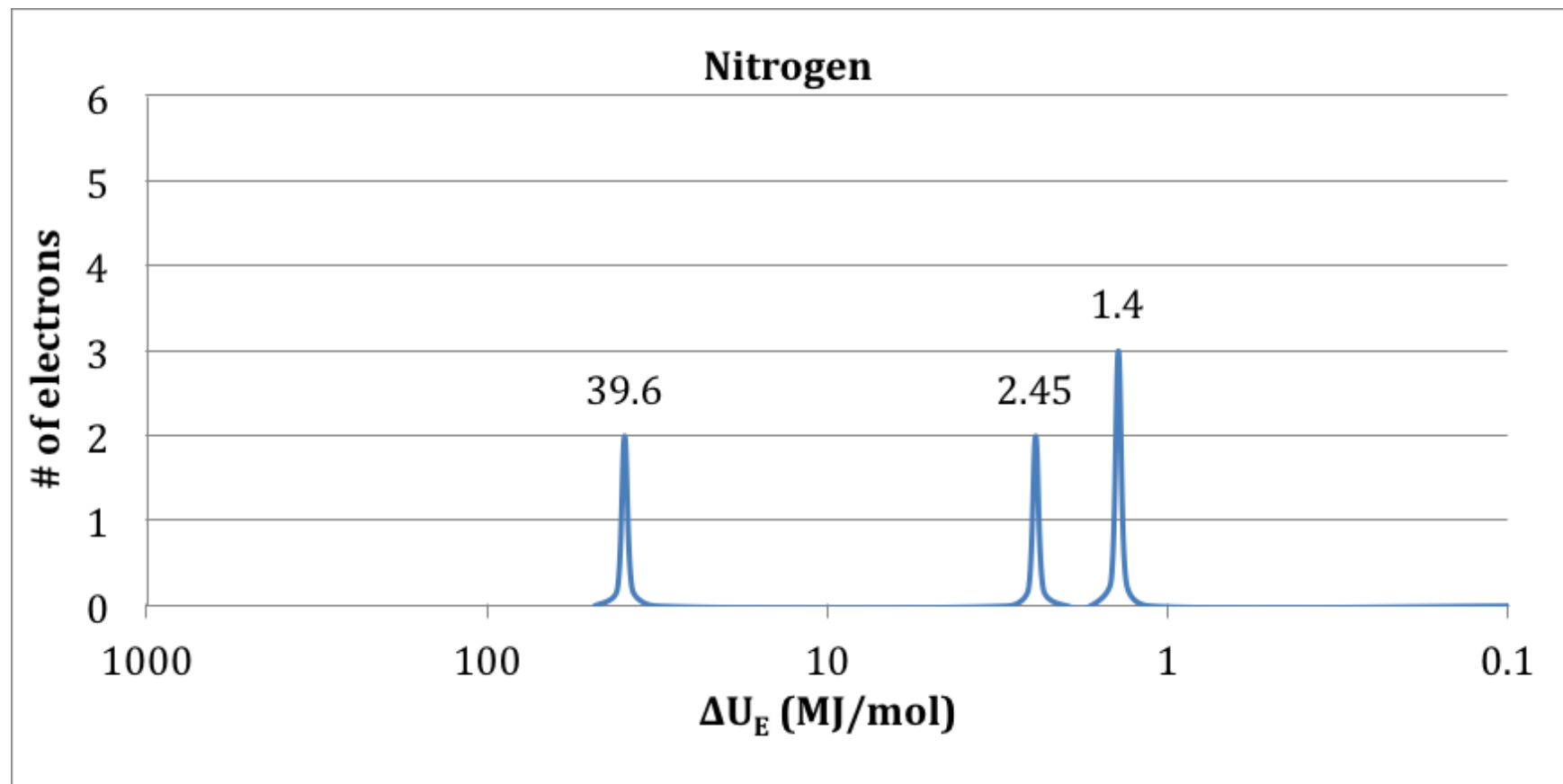
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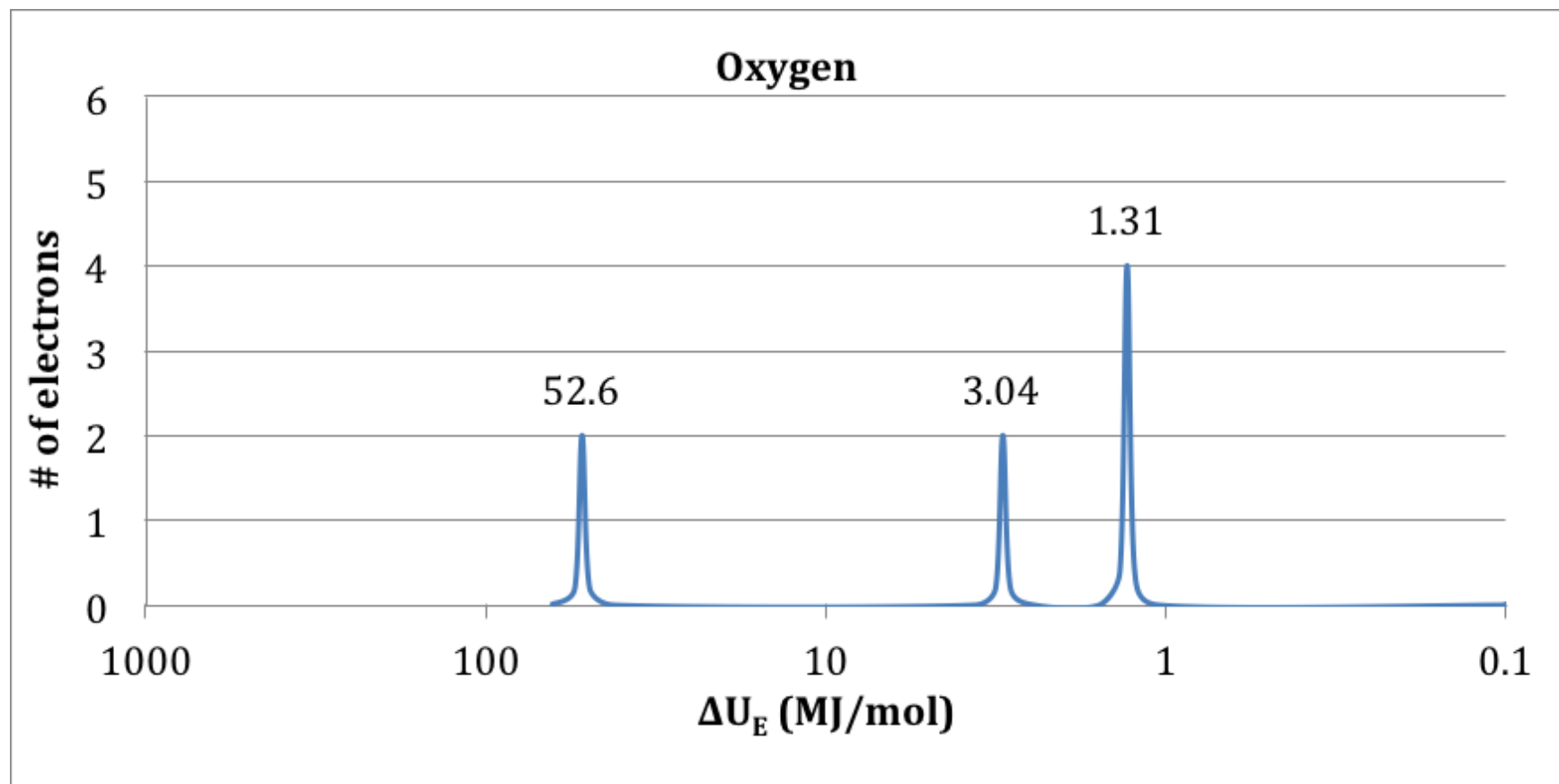
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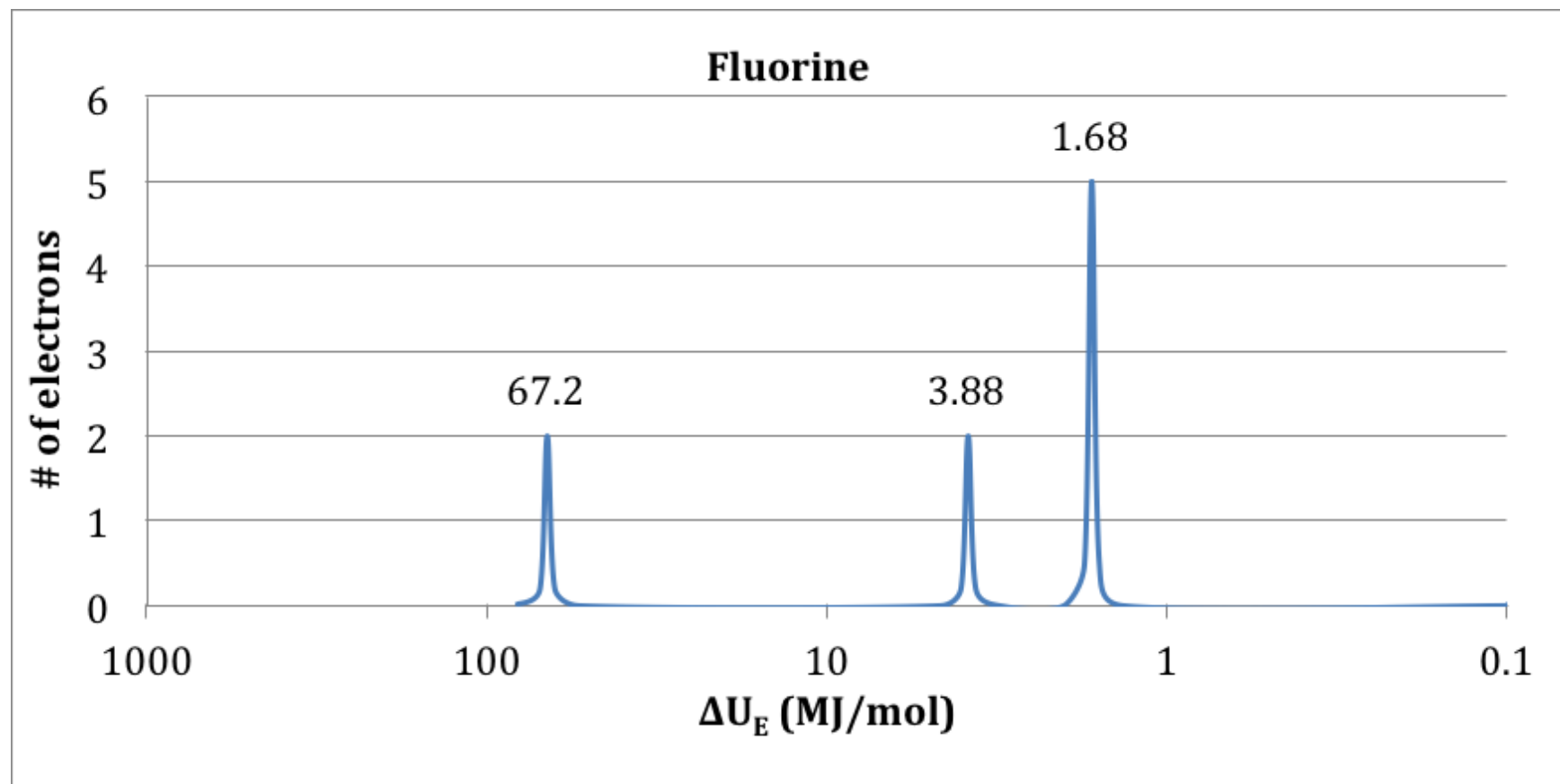
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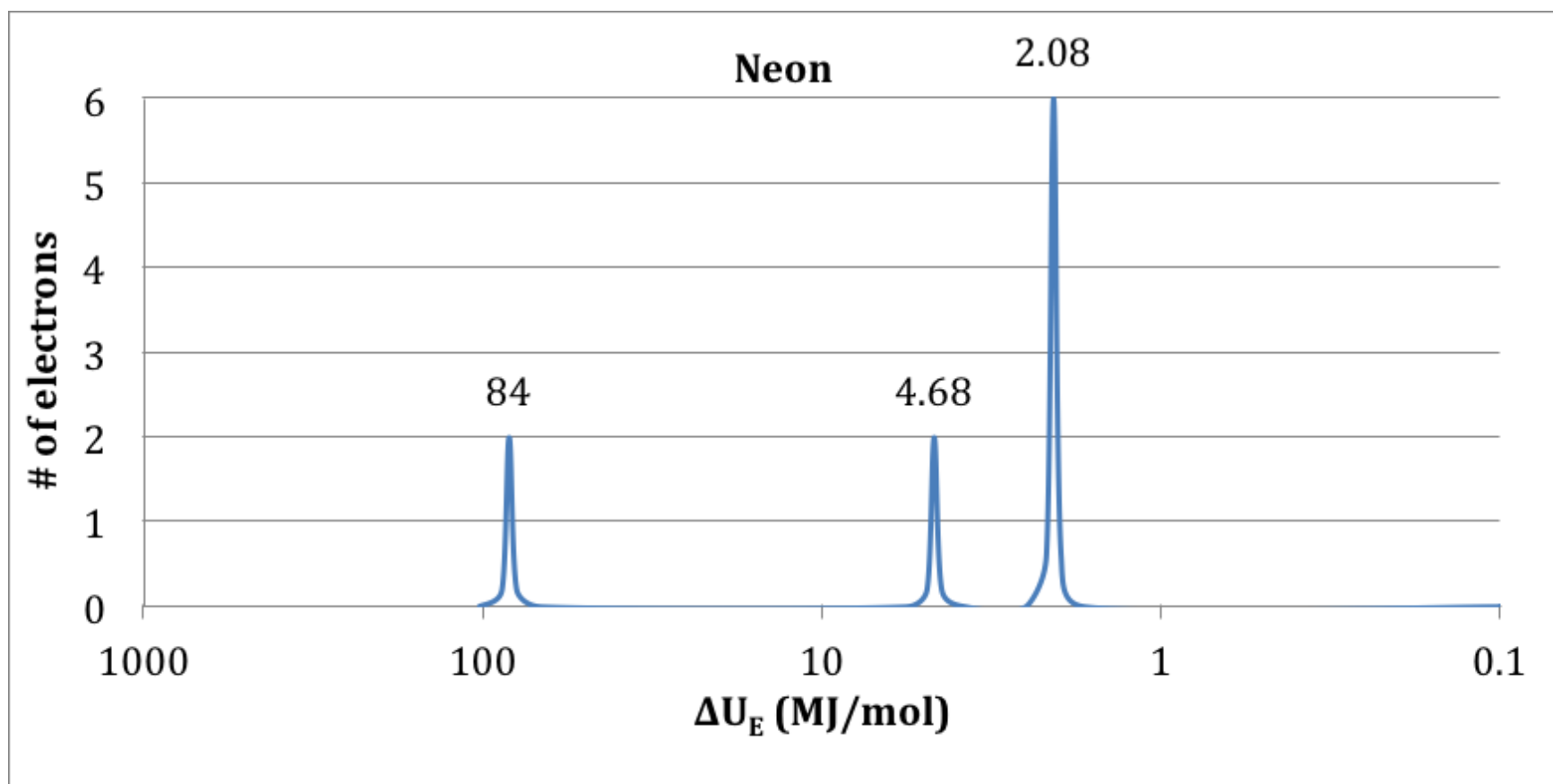
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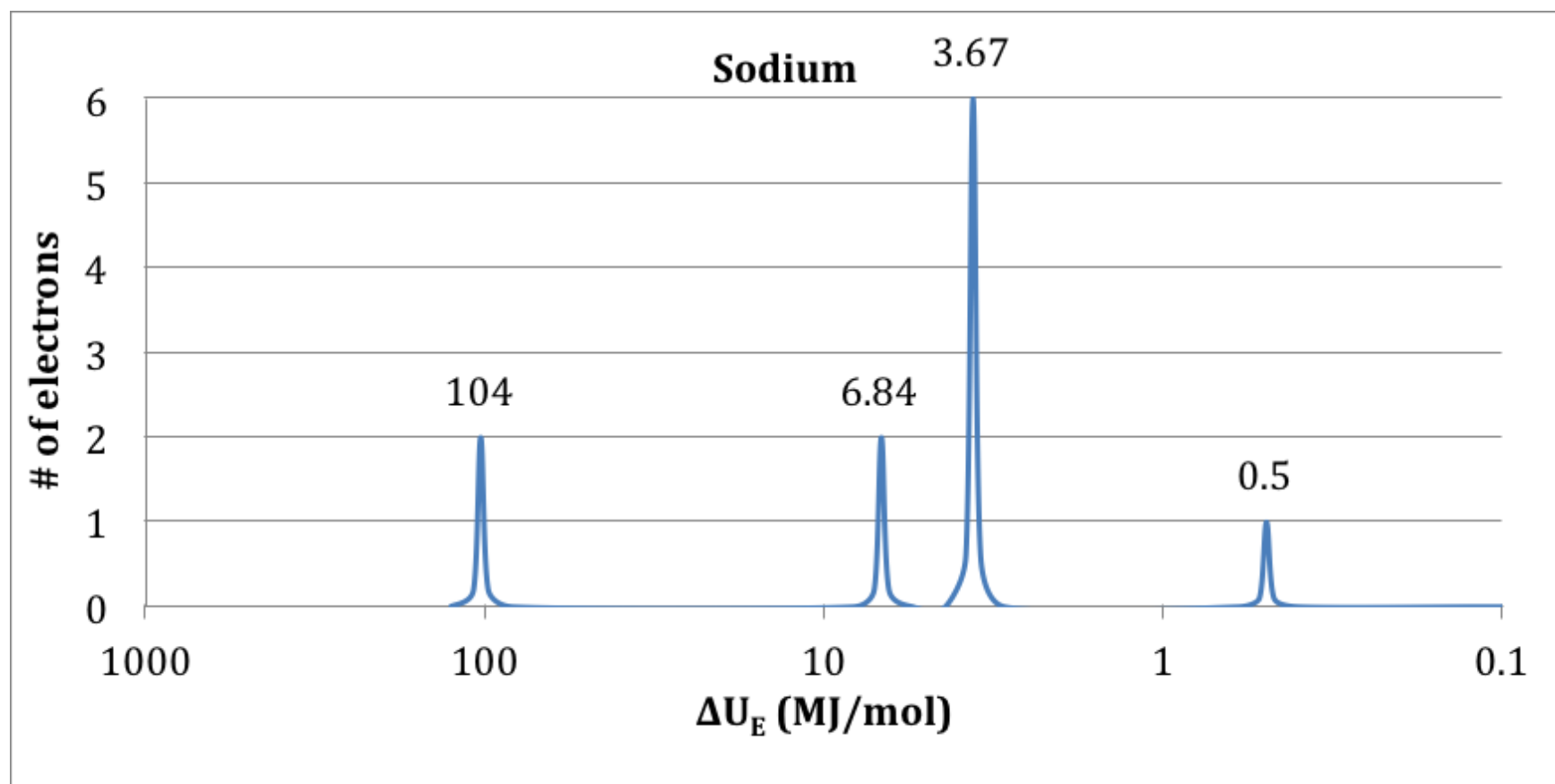
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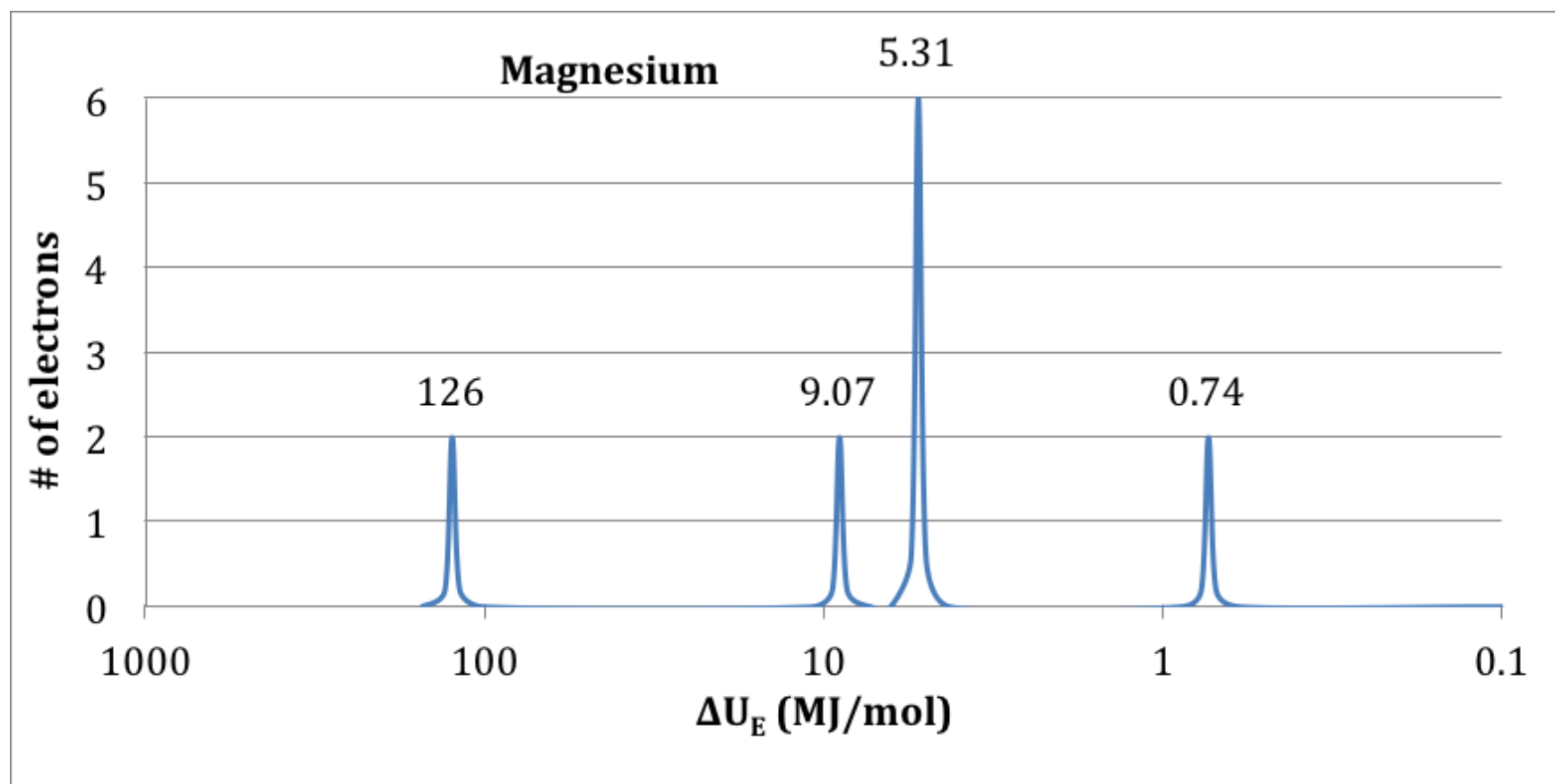
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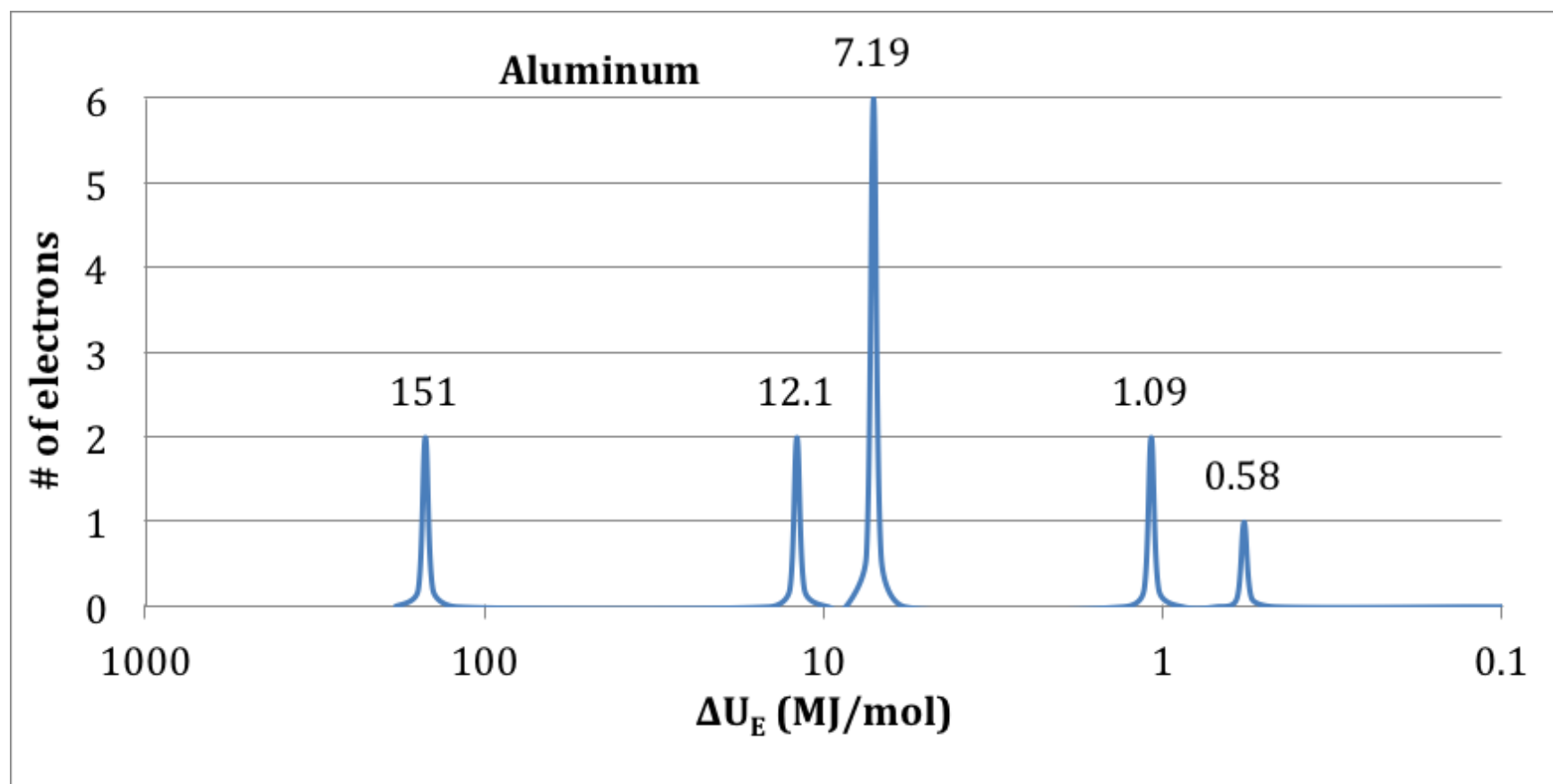
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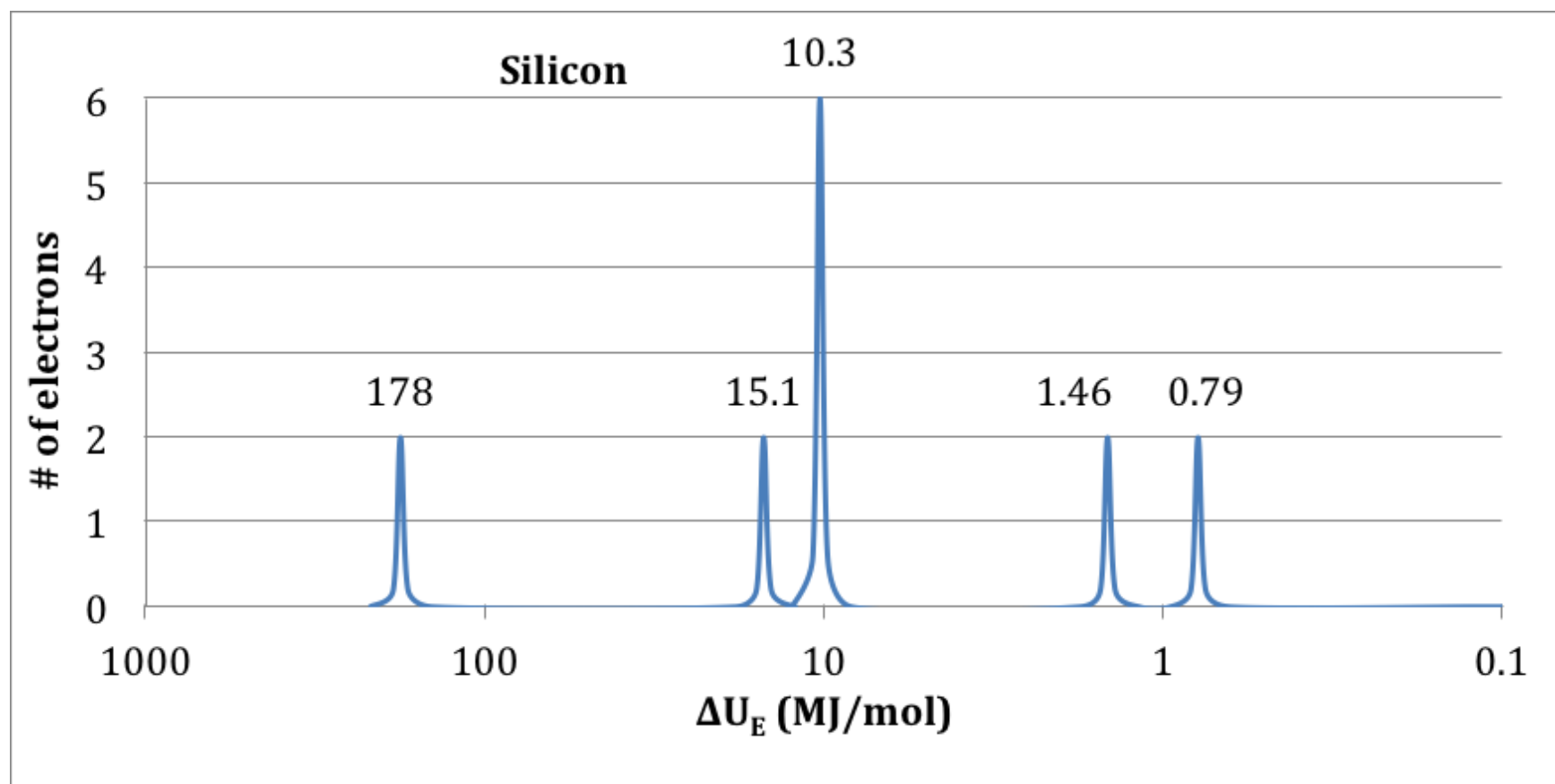
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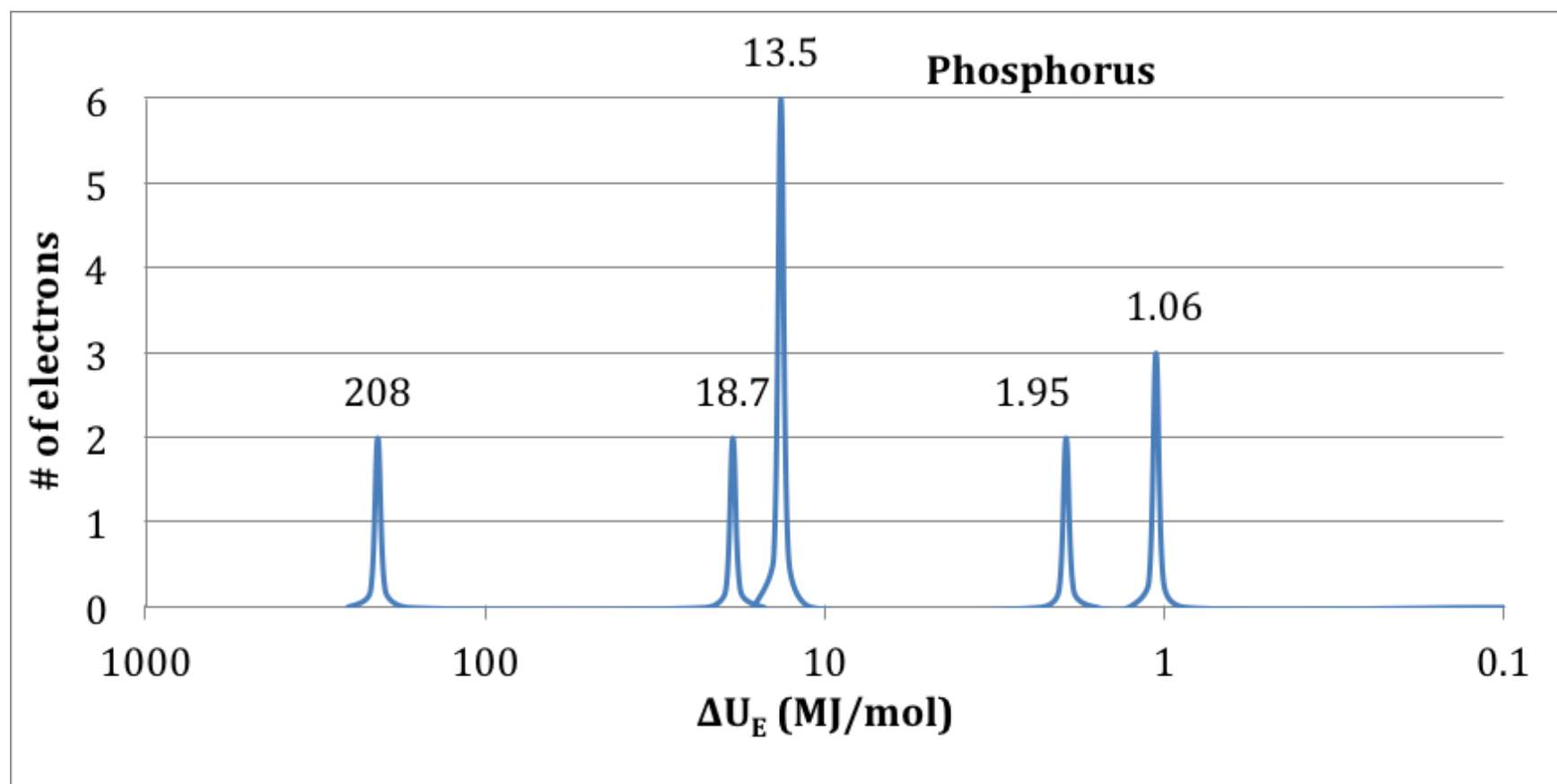
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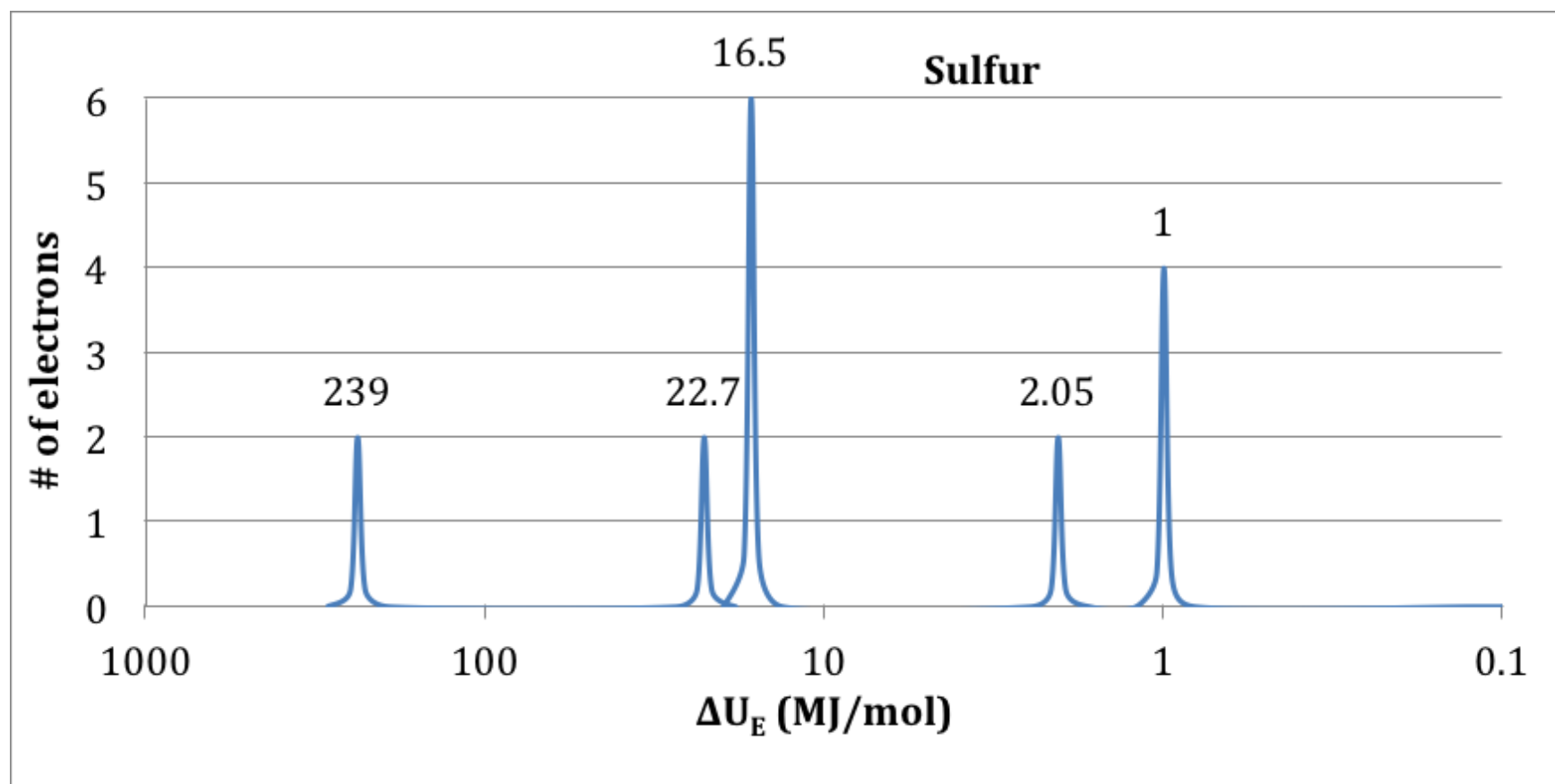
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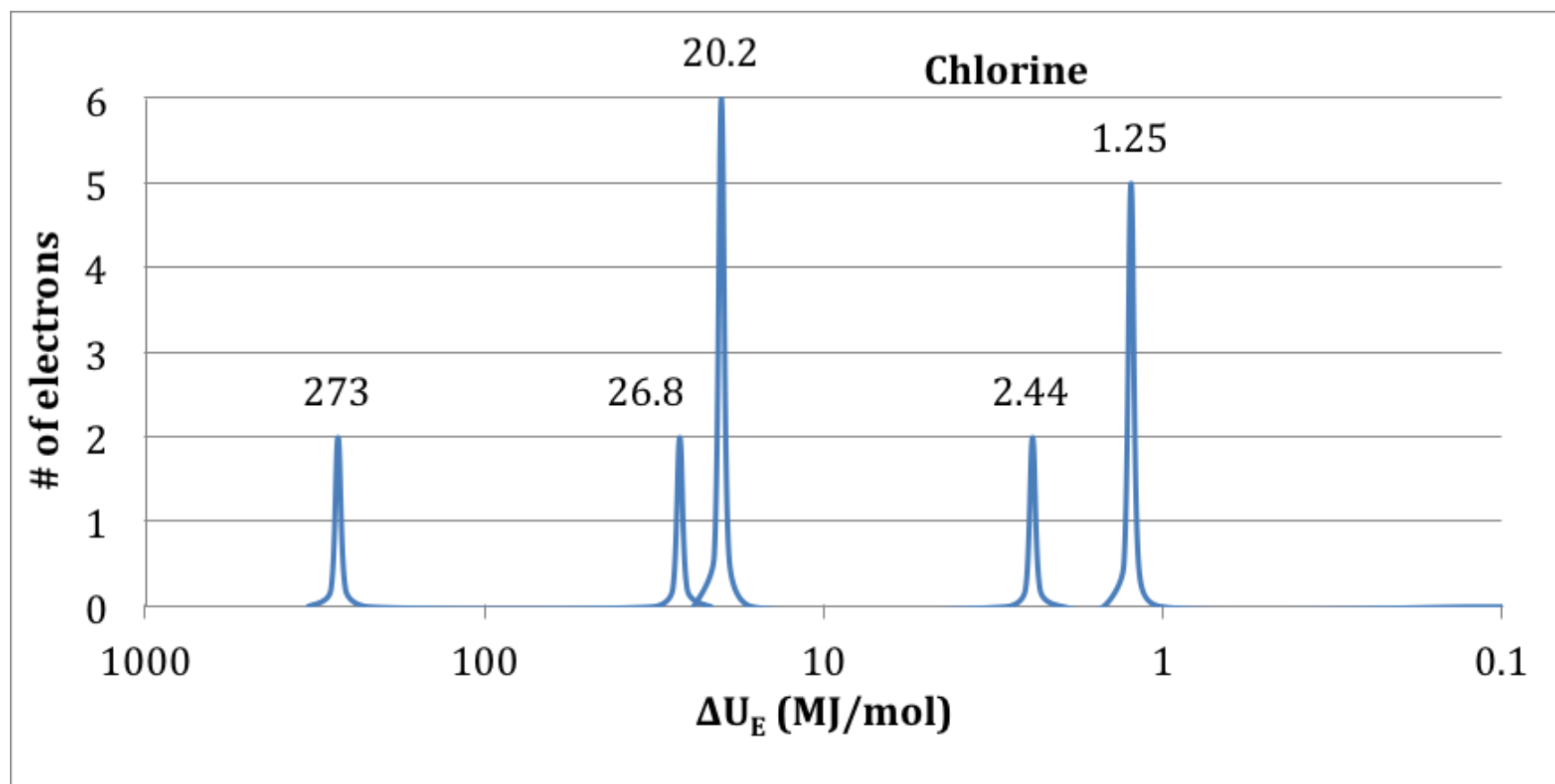
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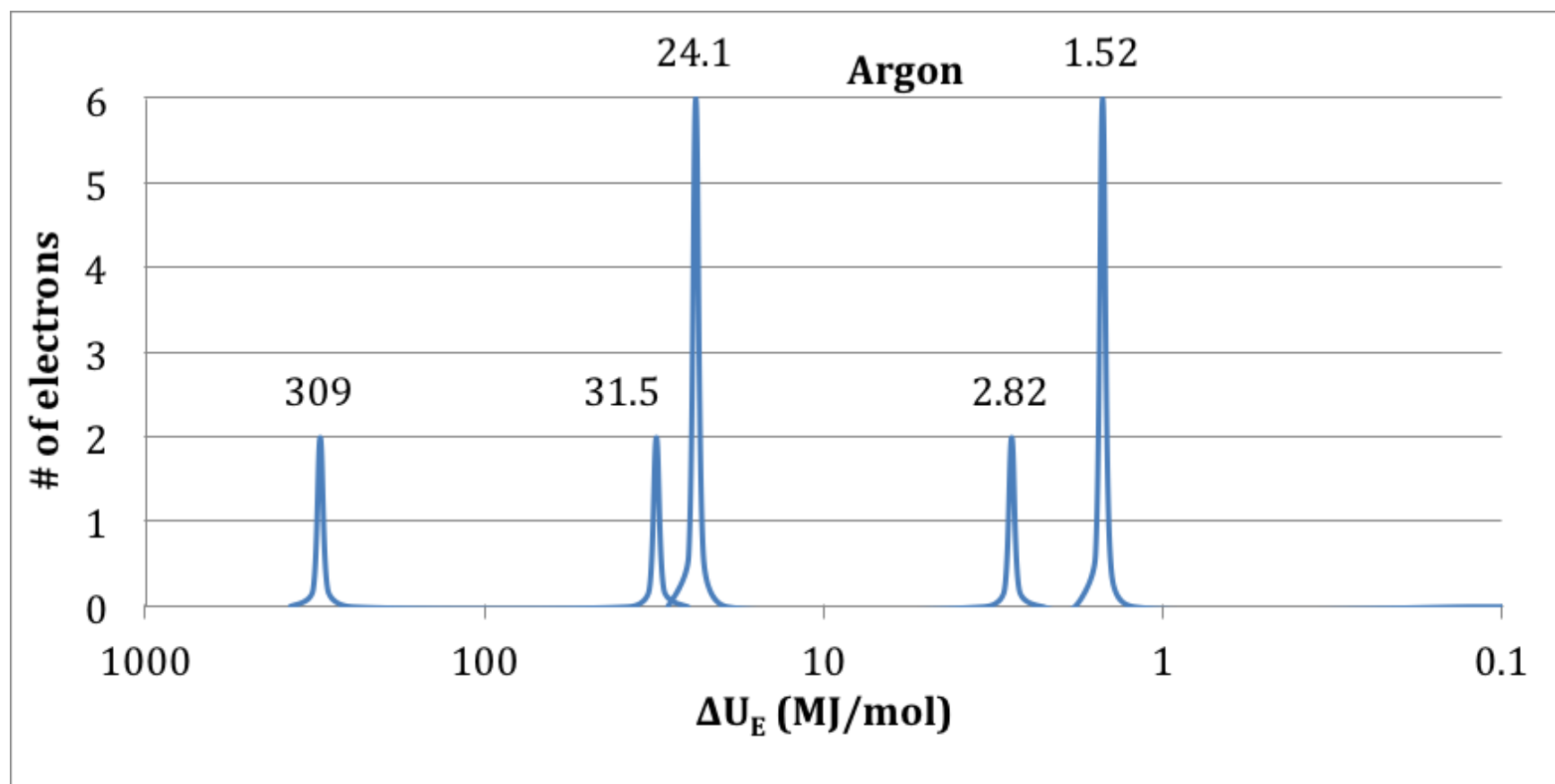
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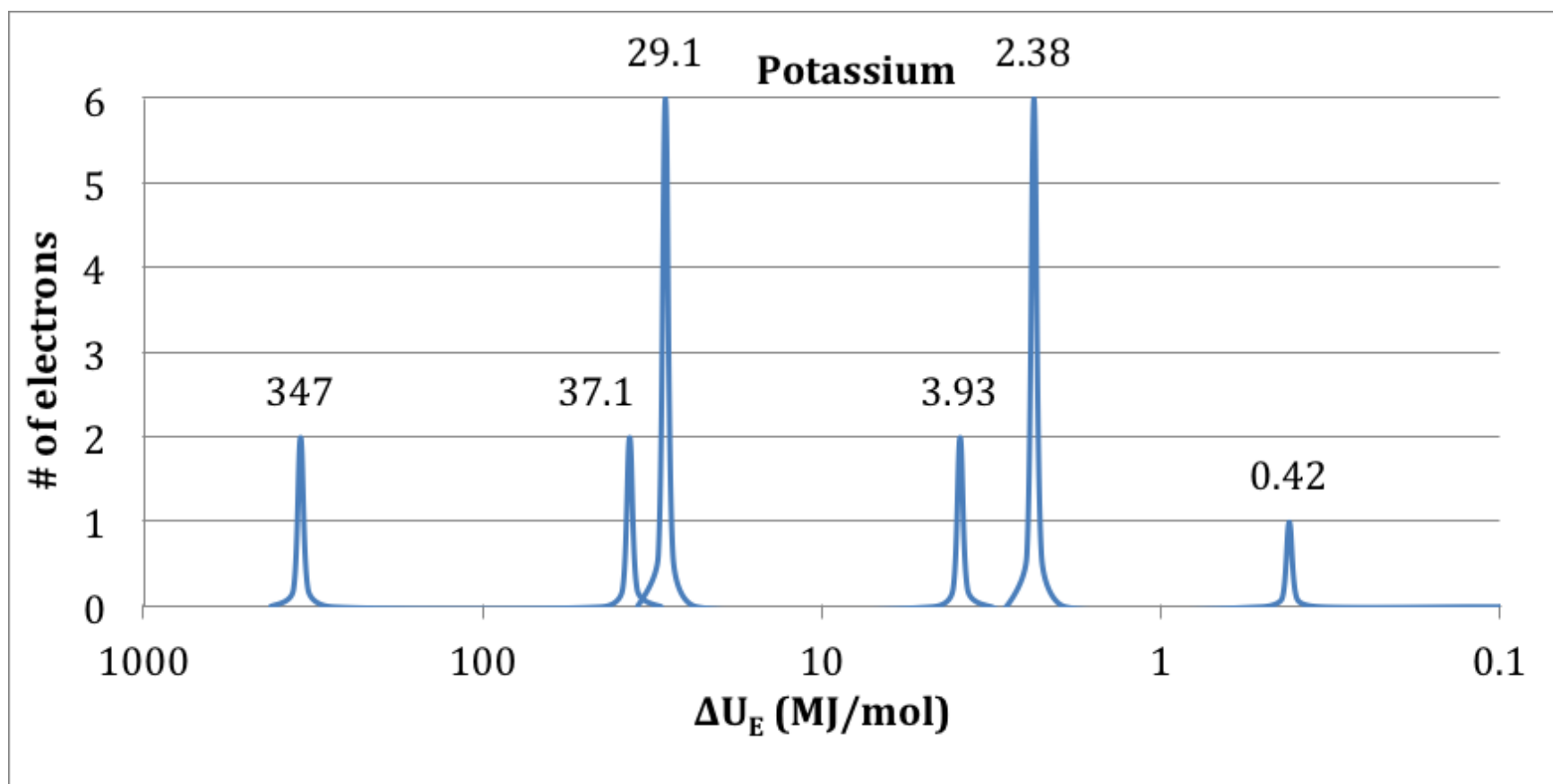
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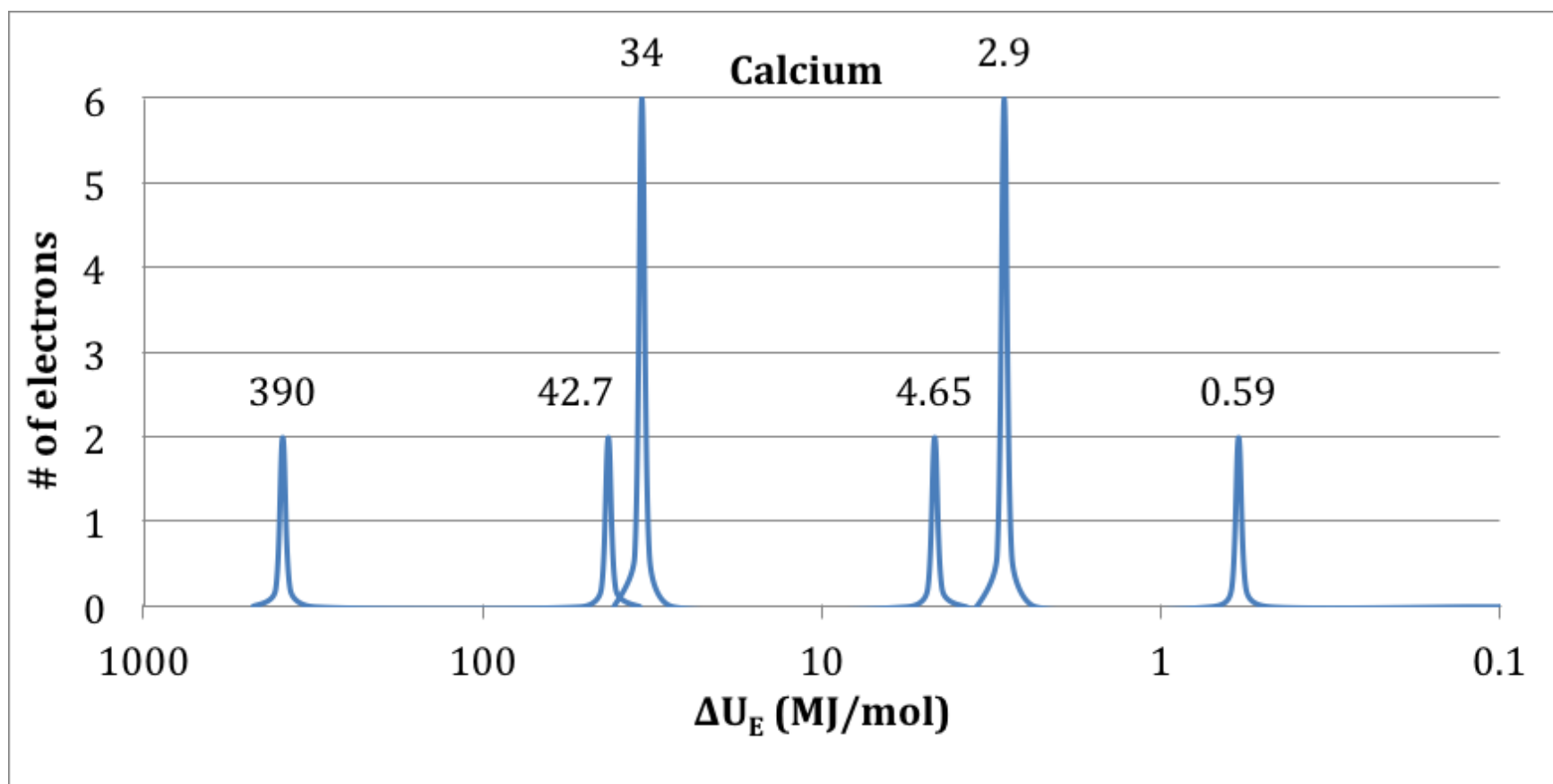
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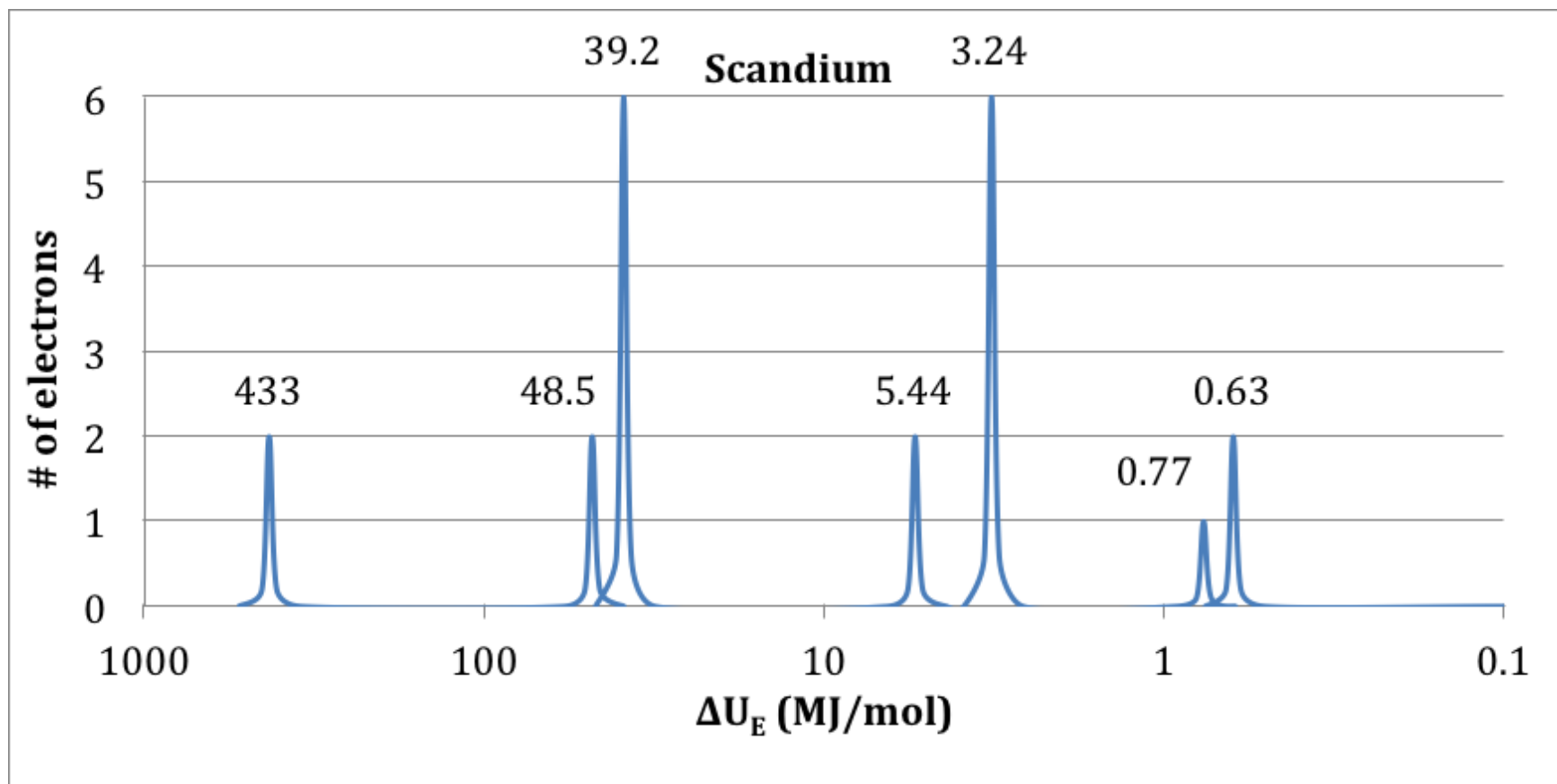
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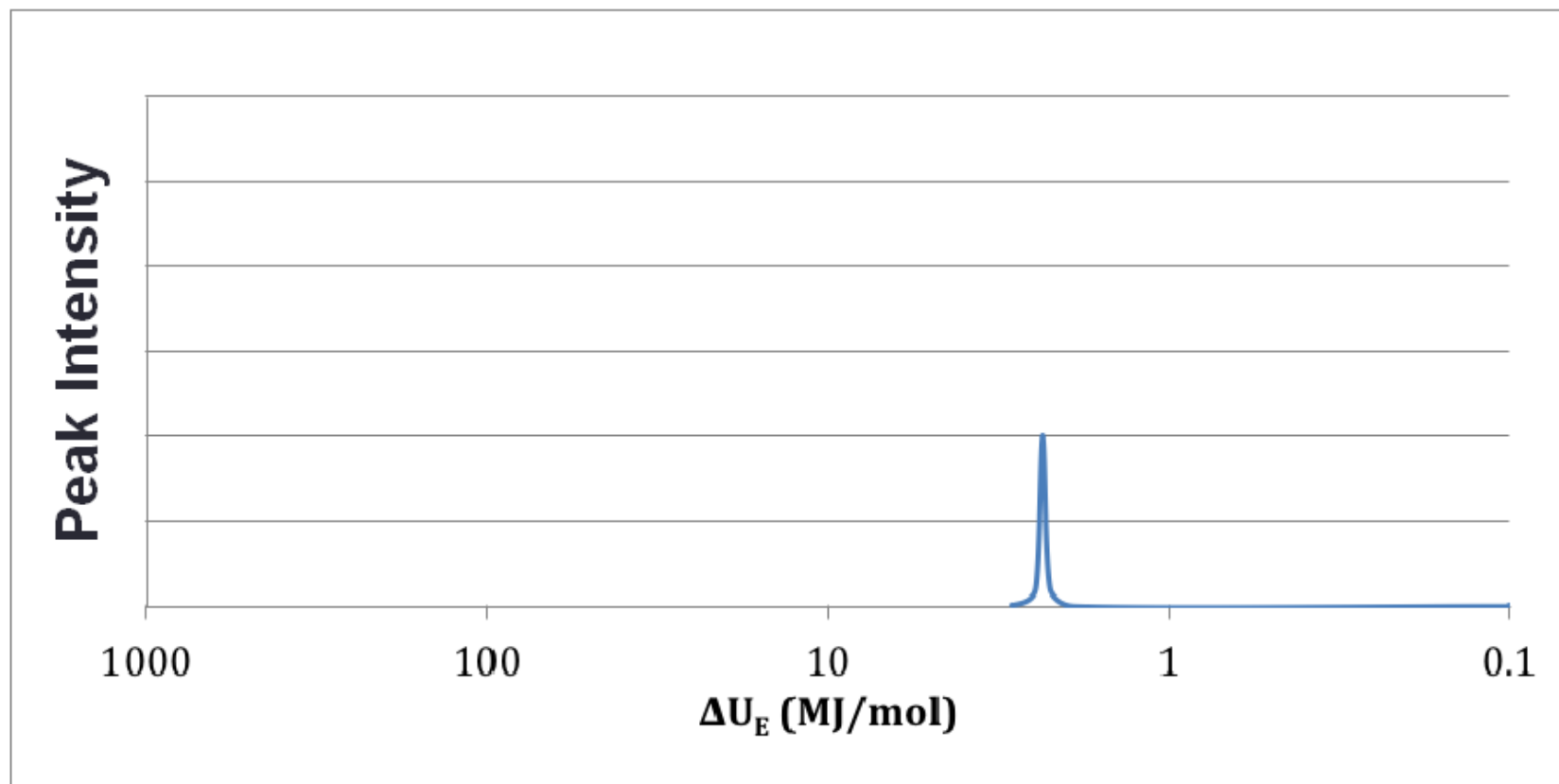
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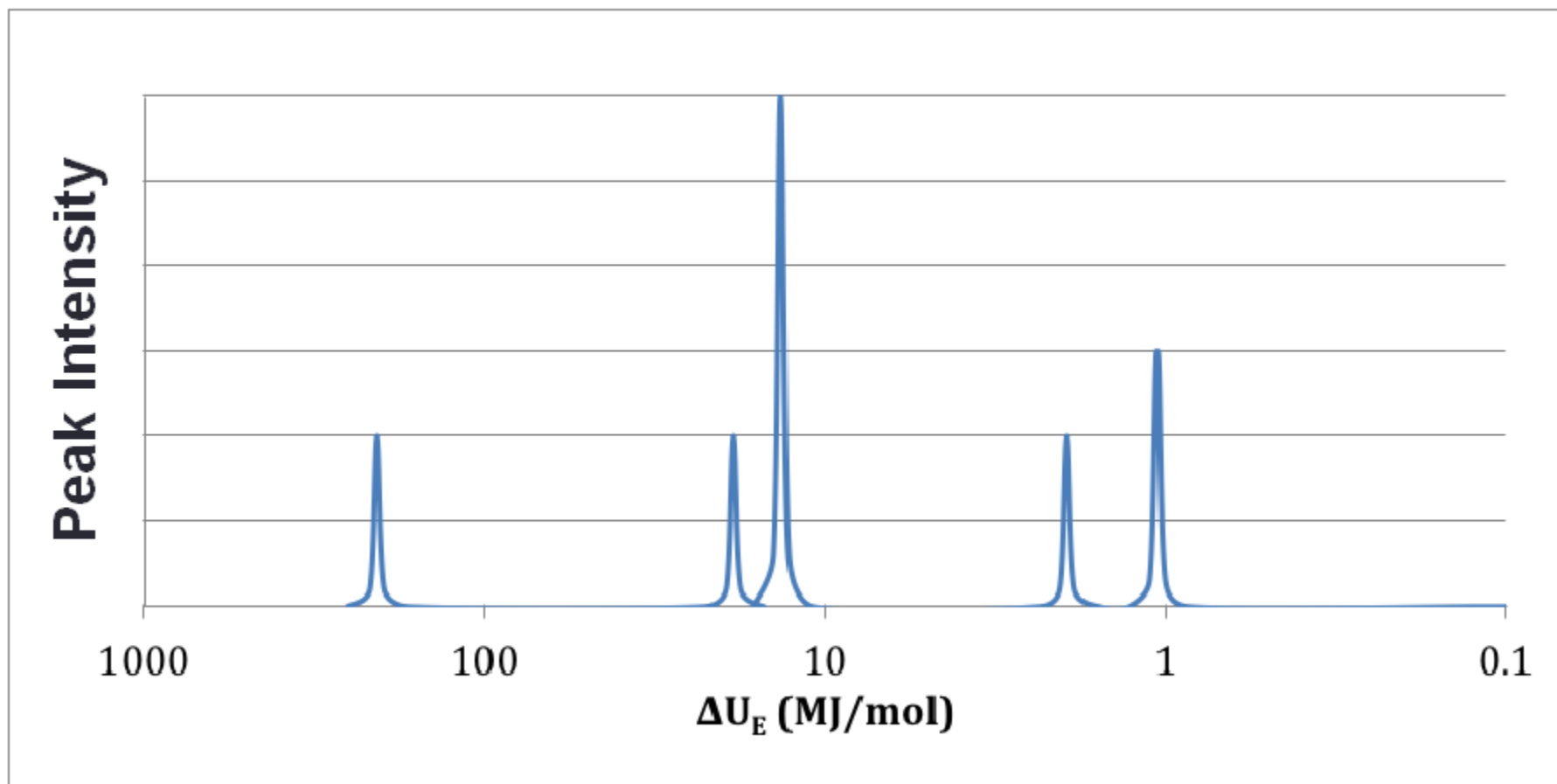
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Which element?



Which element?



Real Spectra

