Name: _____ Class: _____ Date: _____ ID: A

Atomic/Bonding: Spectroscopy

Problem

Sometimes called → ν

$E = hf$

$6.626E-34 \cdot 6.15E14$

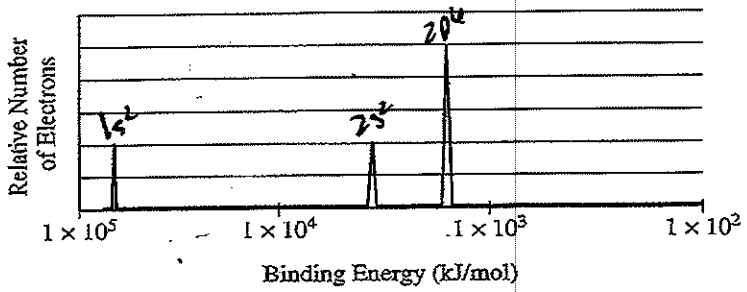
$4.07E-19\,J$

1. Calculate the energy, in joules, of a photon of violet light that has a frequency of 6.15 E14/s.
2. Calculate the length of a wave coming from 1150kHz AM WHBY..
3. Calculate the Energy of a wave coming form 107.5FM.

$E = hf$ $6.626E-34 \cdot 107.5E6$ → $7.12E26\,J$

$c = \lambda\nu$ $\lambda = \frac{c}{\nu}$ $\frac{3.0E8\,m/s}{1150E3}$ → 260m

PHOTOELECTRON SPECTRUM



Peak 1	Peak 2	Peak 3
6.72×10^4 kJ/mol	3.88×10^3 kJ/mol	1.68×10^3 kJ/mol

The complete photoelectron spectrum of an unknown element is shown above. The frequency ranges of different regions of the electromagnetic spectrum are given in the table below.

Region of Electromagnetic Spectrum	Frequency Range (s^{-1})
Infrared (IR)	1×10^{12} to 4×10^{14}
Ultraviolet/visible (UV/vis)	4×10^{14} to 5×10^{16}
X-rays	5×10^{16} to 1×10^{19}
Gamma rays	$> 1 \times 10^{19}$

$E = hf$

$6.626E-34 \cdot 1.E12 = 6E-22\,J$ too low

$6.626E-34 \cdot 1.E19 = 6.E$ too low −15

(a) To generate the spectrum above, a source capable of producing electromagnetic radiation with an energy of 7×10^4 kJ per mole of photons was used. Such radiation is from which region of the electromagnetic spectrum? Justify your answer with a calculation.

$E = hf$ $7E4 \rightarrow 7E7\,J$ / $6.626E-34 = 1.0E41$ Gamma

(b) A student examines the spectrum and proposes that the second ionization energy of the element is 3.88×10^3 kJ/mol. To refute the proposed interpretation of the spectrum, identify the following.

(i) The subshell from which an electron is removed in the second ionization of an atom of the element

(ii) The subshell that corresponds to the second peak of the photoelectron spectrum above 2p

4. 2p

2s

Not just "s" Need