Chemistry 141 Name KEY

Cary Willard

Quiz 7a (20 points) October 23, 2013

All work must be show to receive credit. Remember, significant figures are important!

$$c=νλ, E=hν, N\_{A}=6.022×10^{23}/mol, c=3.00×10^{8}m/sec , h=6.626 ×10^{-34}J sec$$

1. (6 points) How did Neils Bohr explain the atomic spectrum of hydrogen? Be complete.

Bohr said that the hydrogen atom had planetary orbits where the electrons existed. When an electron absorbed energy, it could move to a higher energy orbit. Because only certain orbits are allowed, hydrogen will only absorb or emit very specific amounts of energy corresponding to the colors of light in the atomic spectrum of hydrogen.

1. (14 points) The ionization energy of lithium is 520 kJ/mol.
	1. What is the energy required to ionize 1 atom of lithium?

$$\frac{520 kJ}{mol e^{-}}×\frac{1000 J}{1 kJ}×\frac{1 mol e^{-}}{6.022×10^{23} e^{-}}=\frac{8.64×10^{-19}J}{e^{-}}\left(=\frac{8.64×10^{-22}kJ}{e^{-}}\right)$$

* 1. What is the minimum frequency of light which will ionize lithium?

$$E=hν ⟹ ν=\frac{E}{h}=\frac{8.64×10^{-19}J}{6.626 ×10^{-34}J sec}=1.30×10^{15}/sec$$

* 1. What frequency of light is required to ionize 100 atoms of lithium?(Explain your answer.)

The same frequency of light is needed. You just need more photons

* 1. What is the maximum wavelength of light which will ionize lithium?

$$c=νλ \gg \gg λ=\frac{c}{ν}=\frac{3.00×10^{8}m/sec}{1.30×10^{15}/sec}=2.30×10^{-7}m or 230 nm$$

* 1. What frequency of light is required to ionize an atom of lithium with an electron having a kinetic energy of 4.7 x 10-20 J?

$$total energy required= 8.64×10^{-19}J+4.7×10^{-20}J=9.11×10^{-19}J$$

$$ν=\frac{E}{h}=\frac{9.11×10^{-19}J}{6.626 ×10^{-34}J sec}=1.37×10^{15}/sec$$

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$$c=νλ, E=hν, N\_{A}=6.022×10^{23}/mol, c=3.00×10^{8}m/sec , h=6.626 ×10^{-34}J sec$$

1. (6 points) How did Neils Bohr explain the atomic spectrum of hydrogen? Be complete.

Bohr said that the hydrogen atom had planetary orbits where the electrons existed. When an electron absorbed energy, it could move to a higher energy orbit. Because only certain orbits are allowed, hydrogen will only absorb or emit very specific amounts of energy corresponding to the colors of light in the atomic spectrum of hydrogen.

1. (14 points) The ionization energy of potassium is 419 kJ/mol.
	1. What is the energy required to ionize 1 atom of potassium?

$$\frac{419 kJ}{mol e^{-}}×\frac{1000 J}{1 kJ}×\frac{1 mol e^{-}}{6.022×10^{23} e^{-}}=\frac{6.96×10^{-19}J}{e^{-}}\left(=\frac{6.96×10^{-22}kJ}{e^{-}}\right)$$

* 1. What is the minimum frequency of light which will ionize potassium?

$$E=hν ⟹ ν=\frac{E}{h}=\frac{6.96×10^{-19}J}{6.626 ×10^{-34}J sec}=1.05×10^{15}/sec$$

* 1. What frequency of light is required to ionize 100 atoms of lithium?(Explain your answer.)

The same frequency of light is needed. You just need more photons

* 1. What is the maximum wavelength of light which will ionize potassium?

$$c=νλ \gg \gg λ=\frac{c}{ν}=\frac{3.00×10^{8}m/sec}{1.05×10^{15}/sec}=2.85×10^{-7}m or 285 nm$$

* 1. What frequency of light is required to ionize an atom of potassium with an electron having a kinetic energy of 5.2 x 10-20 J?

$$total energy required= 6.96×10^{-19}J+5.2×10^{-20}J=7.48×10^{-19}J$$

$$ν=\frac{E}{h}=\frac{7.48×10^{-19}J}{6.626 ×10^{-34}J sec}=1.13×10^{15}/sec$$