Atomic Structure & Periodicity

$h = 6.626 \times 10^{-34}\ J \cdot s$

Planck

1) $\boxed{E = h\nu}$ $\quad \nu = c/\lambda$ $\quad C = 2.9979 \times 10^{8}\ m/s$

ν = frequency, units $1/s$ or Hz

2) $\boxed{E = mc^2}$

Einstein

① & ② $\quad h\nu = mc^2$

$h\frac{c}{\lambda} = mc^2$

$\lambda = \frac{h}{mc} \cong \frac{h}{mv} = \frac{h}{p}$ $\quad p$ = momentum

deBroglie

Bohr's Model

FOR H-ATOM!!

$E = -2.178 \times 10^{-18} J \cdot \left(\frac{Z^2}{n^2}\right)$

$Z = 1 \Longrightarrow \Delta E = -2.178 \times 10^{-18} J \left(\frac{1}{(n_f)^2} - \frac{1}{(n_i)^2}\right)$

Heisenberg's Uncertainty principle (7.59)

$\Delta x \cdot m\Delta v \geq h/4\pi \quad \Delta x \cdot \Delta p \geq \hbar/2 \quad \hbar = h/2\pi$

Schrödinger (Eigenvalue) Equation

$\hat{H}\Psi = E\Psi$

Ψ = function psi, wavefunction

$\hat{H}$ = Hamiltonian operator

E = Energy eigenvalue.

$\hat{O} f = o f$ → eigen function

↙ operator ↙ eigen value

$\hat{O} = \frac{d}{dx}$

$f = e^{ax}$

$o = a$

<u>quantum numbers</u>

n → level, period in p.t. // principal } 1, 2, 3...

l → orbital name, angular momentum } $n-1 = \{\underset{s}{0}, \underset{p}{1}, \underset{d}{2} \dots$

m_l → magnetic } $-l, \dots, 0, \dots l$ → $\left\{ \begin{matrix} l = 2 \\ m_l = -2, -1, 0, 1, 2 \end{matrix} \right\}$ How many e^-

m_s → $\pm 1/2$

Keller's Table (electronic configurations)

1s			
2s	2p		
3s	3p	3d	
4s	4p	4d	4f
5s	5p	5d	5f
6s	6p	6d	6f

Aufbau (filling principle)

Hund (order principle)

C: $1s^2 2s^2 2p^2$

$\underset{1s}{\boxed{\uparrow\downarrow}}$ $\underbrace{\underset{2s}{\boxed{\uparrow\downarrow}} \; \underset{2p_x}{\boxed{\uparrow}} \; \underset{2p_y}{\boxed{\uparrow}} \; \underset{2p_z}{\boxed{}}}_{\text{valence } e^-}$

7. Exercises

39. → λ 47. → $\lambda = h/p$ becareful with units

41. → E   49. → same

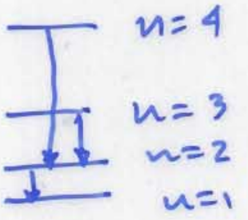
45 → E/e^-

---

51. $\Delta E = K\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right) = h\frac{c}{\lambda}$

$$\lambda = \frac{hc}{\Delta E}$$

53.



scale?

55. $\Delta E_e = ?$ $\Delta E_p = \left[h \cdot \frac{c}{400} ; h \cdot \frac{c}{700}\right]$ $\Delta E_e = K\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$

$\Delta E_p > \Delta E_e$?   true → then excitation possible
false → non possible

57. $\Delta E = h \cdot \frac{c}{\lambda} , \cancel{\lambda}, \rightarrow \Delta E = K\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$ ν (given)

$\Downarrow$ n

115. $\Delta E \rightarrow \lambda \rightarrow$ table

---

59. $\Delta x \cdot m \Delta v \geq h/4\pi$ quick dimensional

61. Already done in class.

63. follow 61

67. $n=5,\ l=1$ $ml = -1, 0, 1$ } 3

$n=4,\ l=2$ $ml = -2, -1, 0, 1, 2$ } 5

69. $n=4$ $l=0$ $ml=0 \longrightarrow *2 = 2$

$=1$ $ml = -1, 0, 1 \longrightarrow 3*2 = 6$

$=2$ $ml = -2, -1, 0, 1, 2 \longrightarrow 5*2 = 10$

$=3$ $ml = -3, -2, -1, 0, 1, 2, 3 \rightarrow 7*2 = 14$

$32e^-$ or just $2n^2$

71. $Si(14e^-)\ 1s^2 2s^2 2p^6 3s^2 3p^2$ $[Ne]\ 3s^2 3p^2$

$Ge(\ )$

73. Eu $[Xe]\ 6s^2 4f^7$

Pt $[Xe]\ 6s^1 4f^{14} 3d^9$

77. Which compound(s) have one unpaired 5p e^-

a. In $[Kr]\ 5s^2 5p^1$

I $[Kr]\ 5s^2 4d^{10} 5p^5$

covalent: non-metal - non-metal

so I & F I $[Kr]\ 5s^2 4d^{10}$ $\underbrace{\boxed{\uparrow\downarrow}\ \boxed{\uparrow\downarrow}\ \boxed{\uparrow}}_{5p}$

b. element 120

$[Rn]\ 7s^2 5f^{14} 6d^{10} 7p^6 8s^2$

81. $O(8e^-)$

	1s	2s	$2p_x$	$2p_y$	$2p_z$	
Aufbau & Hund	$\boxed{\uparrow\downarrow}$	$\boxed{\uparrow\downarrow}$	$\boxed{\uparrow\downarrow}$	$\boxed{\uparrow}$	$\boxed{\uparrow}$	$\rightarrow$ "lowest" energy
Given	$\boxed{\uparrow\downarrow}$	$\boxed{\uparrow\downarrow}$	$\boxed{\uparrow\downarrow}$	$\boxed{\uparrow\downarrow}$	$\boxed{\ }$	