38. $99.5 \text{ MHz} = 99.5 \times 10^6 \text{ Hz} = 99.5 \times 10^6 \text{ s}^{-1}$; $\lambda = \dfrac{c}{\nu} = \dfrac{2.998 \times 10^8 \text{ m/s}}{99.5 \times 10^6 \text{ s}^{-1}} = 3.01 \text{ m}$

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42. $\dfrac{208.4 \text{ kJ}}{\text{mol}} \times \dfrac{1 \text{ mol}}{6.0221 \times 10^{23}} = 3.461 \times 10^{-22} \text{ kJ} = 3.461 \times 10^{-19} \text{ J}$ to remove one electron

$E = \dfrac{hc}{\lambda}$, $\lambda = \dfrac{hc}{E} = \dfrac{6.6261 \times 10^{-34} \text{ J s} \times 2.9979 \times 10^8 \text{ m/s}}{3.461 \times 10^{-19} \text{ J}} = 5.739 \times 10^{-7} \text{ m} = 573.9 \text{ nm}$

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46. a. $\lambda = \dfrac{h}{mv} = \dfrac{6.626 \times 10^{-34} \text{ J s}}{1.675 \times 10^{-27} \text{ kg} \times (0.0100 \times 2.998 \times 10^8 \text{ m/s})} = 1.32 \times 10^{-13} \text{ m}$

b. $\lambda = \dfrac{h}{mv}$, $v = \dfrac{h}{\lambda m} = \dfrac{6.626 \times 10^{-34} \text{ J s}}{75 \times 10^{-12} \text{ m} \times 1.675 \times 10^{-27} \text{ kg}} = 5.3 \times 10^3 \text{ m/s}$

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50. a. $\Delta E = -2.178 \times 10^{-18} \text{ J} \left(\dfrac{1}{3^2} - \dfrac{1}{4^2} \right) = -1.059 \times 10^{-19} \text{ J}$

$\lambda = \dfrac{hc}{|\Delta E|} = \dfrac{6.6261 \times 10^{-34} \text{ J s} \times 2.9979 \times 10^8 \text{ m/s}}{1.059 \times 10^{-19} \text{ J}} = 1.876 \times 10^{-6} \text{ m} = 1876 \text{ nm}$

b. $\Delta E = -2.178 \times 10^{-18} \text{ J} \left(\dfrac{1}{4^2} - \dfrac{1}{5^2} \right) = -4.901 \times 10^{-20} \text{ J}$

$\lambda = \dfrac{hc}{|\Delta E|} = \dfrac{6.6261 \times 10^{-34} \text{ J s} \times 2.9979 \times 10^8 \text{ m/s}}{4.901 \times 10^{-20} \text{ J}} = \lambda = 4.053 \times 10^{-6} \text{ m} = 4053 \text{ nm}$

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56. To ionize from n = 4, $\Delta E = E_\infty - E_4 = 0 - E_4 = 2.178 \times 10^{-18} \left(\dfrac{1}{4^2} \right) = 1.361 \times 10^{-19} \text{ J} = E_{photon}$

$\lambda = \dfrac{hc}{E} = \dfrac{6.6261 \times 10^{-34} \text{ J s} \times 2.9979 \times 10^8 \text{ m/s}}{1.361 \times 10^{-19} \text{ J}} = 1.460 \times 10^{-6} \text{ m} = 1460. \text{ nm}$

To ionize from n = 10, $\Delta E = 2.178 \times 10^{-18} \left(\dfrac{1}{10^2} \right) = 2.178 \times 10^{-20} \text{ J}$

$\lambda = \dfrac{hc}{\Delta E} = \dfrac{6.6261 \times 10^{-34} \text{ J s} \times 2.9979 \times 10^8 \text{ m/s}}{2.178 \times 10^{-20} \text{ J}} = 9.120 \times 10^{-6} \text{ m} = 9120. \text{ nm}$

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60. 1p: n = 1, ℓ = 1 is not possible; 3f: n = 3, ℓ = 3 is not possible; 2d: n = 2, ℓ = 2 is not possible; In all three incorrect cases, n = ℓ. The maximum value ℓ can have is n - 1, not n.

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68. a. It is impossible for n = 0. Thus, no electrons can have this set of quantum numbers.

b. The four quantum numbers completely specify a single electron.

c. n = 3: 3s, 3p and 3d orbitals all have n = 3. These orbitals can hold up to 18 electrons.

d. n = 2, ℓ = 2: This combination is not possible ($\ell \neq 2$ for n = 2). Zero electrons in an atom can have these quantum numbers.

e. n = 1, ℓ = 0, m_ℓ = 0: These define a 1s orbital which can hold 2 electrons.

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76. a. As: $1s^22s^22p^63s^23p^64s^23d^{10}4p^3$

b. Element 116 will be below Po in the periodic table: $[Rn]7s^25f^{14}6d^{10}7p^4$

c. Ta: $[Xe]6s^24f^{14}5d^3$ or Ir: $[Xe]6s^24f^{14}5d^7$

d. At: $[Xe]6s^24f^{14}5d^{10}6p^5$

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80. The number of unpaired electrons are in parentheses.

a. excited state of boron (1)

B ground state: $1s^22s^22p^1$ (1)

b. ground state of neon (0)

c. exited state of fluorine (3)

F ground state: $1s^22s^22p^5$ (1)

d. excited state of iron (6)

Fe ground state: $[Ar]4s^23d^6$ (4)

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84. a. Be < Na < Rb b. Ne < Se < Sr c. O < P < Fe (All follow the general radii trend.)

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88. a. Cs b. Ga c. In d. Tl

e. O^{2-}; When comparing ions of the same element, the ion with the most electrons will have the largest amount of electron-electron repulsions. This makes it the largest ion with the smallest ionization energy.

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96. a. More favorable EA: K and Cl; Mg has a positive EA value and F has a more positive EA value than expected from its position relative to Cl.

b. Higher IE: Mg and F

c. Larger radius: K and Cl

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108. a. Li_3P; lithium phosphide b. RbH; rubidium hydride

c. Na_2O or Na_2O_2; Sodium oxide and sodium peroxide can both form.