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

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

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

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

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

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

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

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

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

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

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

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

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

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60. 1p: $n = 1, \ell = 1$ is not possible; 3f: $n = 3, \ell = 3$ is not possible; 2d: $n = 2, \ell = 2$ is not possible; In all three incorrect cases, $n = \ell$. 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. $n = 2, \ell = 2$: This combination is not possible ($\ell \neq 2$ for $n = 2$). Zero electrons in an atom can have these quantum numbers.

e. $n = 1, \ell = 0, m_\ell = 0$: These define a 1s orbital which can hold 2 electrons.

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76. a. As: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$

b. Element 116 will be below Po in the periodic table: $[Rn]7s^2 5f^{14} 6d^{10} 7p^4$

c. Ta: $[Xe]6s^2 4f^{14} 5d^3$ or Ir: $[Xe]6s^2 4f^{14} 5d^7$

d. At: $[Xe]6s^2 4f^{14} 5d^{10} 6p^5$

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80. The number of unpaired electrons are in parentheses.

a. excited state of boron	(1)	b. ground state of neon	(0)
B ground state: $1s^2 2s^2 2p^1$	(1)		
c. exited state of fluorine	(3)	d. excited state of iron	(6)
F ground state: $1s^2 2s^2 2p^5$	(1)	Fe ground state: $[Ar]4s^2 3d^6$	(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.