

## Understanding Concepts

50. a. Ar b. Ru c. Gd
51.  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^3$ ; level 1, 2; level 2, 8; level 3, 18; level 4, 5; The fourth energy level is not filled.
52. a. 2 b. 4 c. 10 d. 6
53.  $1s^2 2s^2 2p^3$  nitrogen; 3
54.  $2.61 \times 10^4$  cm
55. a.  $4.36 \times 10^{-5}$  cm b. visible  
c.  $6.88 \times 10^{14} s^{-1}$
56. a.  $5.890 \times 10^{-5}$  cm and  
 $5.896 \times 10^{-5}$  cm  
b.  $5.090 \times 10^{14} s^{-1}$  (Hz) and  
 $5.085 \times 10^{14} s^{-1}$  (Hz)  
c. yellow
57. a. Na, sodium  
b. N, nitrogen  
c. Si, silicon  
d. O, oxygen  
e. K, potassium  
f. Ti, titanium
58. The frequency is inversely proportional to the wavelength, so if the frequency increases by a factor of 1.5, the wavelength will decrease by a factor of 1.5.
59. It is not possible to know both the position and the velocity of a particle at the same time.
60. 2
61. c
62. c
63. a
64. a

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50. Give the symbol for the atom that corresponds to each electron configuration.
- $1s^2 2s^2 2p^6 3s^2 3p^6$
  - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^7 5s^1$
  - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 4f^7 5s^2 5p^6 5d^1 6s^2$
51. Write the electron configuration for an arsenic atom. Calculate the total number of electrons in each energy level and state which energy levels are not full.
52. How many paired electrons are there in an atom of each element?
- helium
  - boron
  - sodium
  - oxygen
53. An atom of an element has two electrons in the first energy level and five electrons in the second energy level. Write the electron configuration for this atom and name the element. How many unpaired electrons does an atom of this element have?
54. Suppose your favorite AM radio station broadcasts at a frequency of 1150 kHz. What is the wavelength, in centimeters, of the radiation from the station?
55. A mercury lamp, such as the one below, emits radiation with a wavelength of  $4.36 \times 10^{-7}$  m.



- What is the wavelength of this radiation in centimeters?
- In what region of the electromagnetic spectrum is this radiation?
- Calculate the frequency of this radiation.

56. Sodium vapor lamps are used to illuminate streets and highways. The very bright light emitted by these lamps is actually due to two closely spaced emission lines in the visible region of the electromagnetic spectrum. One of these lines has a wavelength of  $5.890 \times 10^{-7}$  m, and the other line has a wavelength of  $5.896 \times 10^{-7}$  m.
- What are the wavelengths of these radiations in centimeters?
  - Calculate the frequencies of these radiations.
  - In what region of the visible spectrum do these lines appear?
57. Give the symbol and name of the elements that correspond to these configurations of an atom.
- $1s^2 2s^2 2p^6 3s^1$
  - $1s^2 2s^2 2p^3$
  - $1s^2 2s^2 2p^6 3s^2 3p^2$
  - $1s^2 2s^2 2p^4$
  - $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$
  - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^2 4s^2$
58. Describe how the wavelength changes if the frequency of a wave is multiplied by 1.5.
59. State the Heisenberg uncertainty principle.
60. What is the maximum number of electrons that can be found in any orbital of an atom?
61. Pieces of energy are known as
- isotopes
  - particles
  - quanta
  - line spectra
62. The lowest sublevel in each principal energy level is represented by the symbol
- f
  - p
  - s
  - d
63. Which electron transition results in the emission of energy?
- 3p to 3s
  - 3p to 4p
  - 2s to 2p
  - 1s to 2s
64. Which is the ground state configuration of a magnesium atom?
- $1s^2 2s^2 2p^6 3s^2$
  - $1s^2 2s^2 2p^6 3s^1$
  - $1s^2 2s^2 3s^2 2p^6$
  - $1s^2 2s^2 2p^4 3s^2$