Non Sibi High School

Andover's Chem 550/580: Advanced Chemistry

Chapter 7, Review Quiz 1 Answers

1

Determine the number of protons, neutrons, and electrons in:

    a. a neutral platinum-198 atom
    b. $^{126}\text{Te}^{2-}$
    c. $^{54}\text{Cr}^{3+}$

    a. platinum-198 = ^{198}Pt: Pt = 78 p, 198 - 78 p = 120 n, neutral = 78 e^-
    b. Te = 52 p, 126 - 52 p = 74 n, 52 p + 2 = 54 e^-
    c. Cr = 24 p, 54 - 24 p = 30 n, 24 p - 3 = 21 e^-

2

Write a symbol that includes atomic number, mass number, and charge for the species with 51 protons, 72 neutrons, and 54 electrons.

    51 p = Sb, mass number = 51 p + 72 n = 123, charge = 51 p - 54 e^- = 3-
    symbol = $^{123}_{51}\text{Sb}^{3-}$

3

Copper has two naturally occurring isotopes, copper-63 and copper-65. Calculate the average atomic mass of copper using the information in the table below:

isotope	mass	% natural abundance
^{63}Cu	62.930	69.12%
^{65}Cu	64.928	30.88%

(62.930 amu)(0.6912) + (64.928 amu)(0.3088) = 63.55 amu

4

Write the complete electron configuration and specify the number of valence electrons for bismuth.

$Bi = 83\,e^- : 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 \underline{6}s^2 4f^{14} 5d^{10} \underline{6}p^3$, 5 valence electrons

5

Write the shorthand noble gas electron configuration and specify the number of valence electrons for zirconium.

$Zr = 40\,e^- : [Kr]\, \underline{5}s^2 4d^2$, 2 valence electrons

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Write the shorthand noble gas electron configuration for:

a. As^{3-}
b. Pb^{2+} and Pb^{4+}

a. $As = 33\,e^- : [Ar]\, 4s^2 3d^{10} 4p^3$
$As^{3-} = 36\,e^- : [Ar]\, 4s^2 3d^{10} 4p^6$

b. $Pb = 82\,e^- : [Xe]\, \underline{6}s^2 4f^{14} 5d^{10} \underline{6}p^2$
remove two valence 6p electrons, so $Pb^{2+} = 80\,e^- : [Xe]\, \underline{6}s^2 4f^{14} 5d^{10}$
then remove two valence 6s electrons, so $Pb^{4+} = 78\,e^- : [Xe]\, 4f^{14} 5d^{10}$
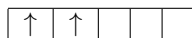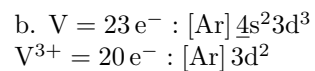
7

For each of the following, write the orbital diagram, determine the number of unpaired electrons, and state whether the atom or ion is paramagnetic or diamagnetic:

a. Po
b. V^{3+}

a. $Po = 84\,e^- : [Xe]\, 6s^2 4f^{14} 5d^{10} 6p^4$

| ↑↓ | | ↑↓ | ↑↓ | ↑↓ | ↑↓ | ↑↓ | ↑↓ | ↑↓ | | ↑↓ | ↑↓ | ↑↓ | ↑↓ | ↑↓ | | ↑↓ | ↑ | ↑ |

2 unpaired electrons, paramagnetic

b. $V = 23\,e^- : [Ar]\,\underline{4}s^2 3d^3$
$V^{3+} = 20\,e^- : [Ar]\,3d^2$

↑	↑			

2 unpaired electrons, paramagnetic

8

State whether each set of quantum numbers is acceptable or not acceptable. For those that are not acceptable, explain why:

a. (1, 0, 1, +1/2)
b. (2, 2, 1, -1/2)
c. (3, 1, -1, 0)
d. (5, 3, -3, +1/2)

a. not acceptable, $m_l = 1$ but should be 0
b. not acceptable, $l = 2$ but should be either 0 or 1 (no 2d orbital)
c. not acceptable, $m_s = 0$ but should be +1/2 or -1/2
d. acceptable