

CHEM 103

R&R 12

17 June 2024

Adapted from a 22 June 2021 document

1. In the ground state of cadmium (Cd):

a. Write the full and noble gas notation ground state electron configuration.

b. How many electrons have $l = 2$ as one of their quantum numbers?

c. How many electrons have $n = 4$ as one of their quantum numbers?

d. How many electrons have $m_l = -1$ as one of their quantum numbers?

2. Write the full and noble gas notation ground state electron configuration for the following elements:

a. Tellurium

b. Cesium

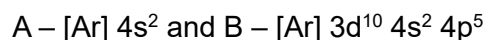
c. Arsenic

d. Iridium

e. Copper

3. The successive ionization energies for an unknown elements are $I_1 = 896 \text{ kJ mol}^{-1}$; $I_2 = 1752 \text{ kJ mol}^{-1}$; $I_3 = 14807 \text{ kJ mol}^{-1}$; $I_4 = 17948 \text{ kJ mol}^{-1}$. To which group in the periodic table does the unknown element most likely belong?

4. Two elements, A and B, have the electron configuration shown:



- Which element is a metal?
- Which element has the greater ionization energy?
- Which element has the larger atomic radius?
- Which element has the greater electron affinity?

5. Write the noble gas notation ground state electron configuration of mercury:

- How many electrons occupy atomic orbitals with $n = 3$?
- How many electrons occupy d atomic orbitals?
- How many electrons have spin "up" ($m = +\frac{1}{2}$)?

6. Write a complete set of quantum numbers for each of the electrons in the Cu valence shell:

a. Write the complete electron configuration for the Cu^{2+} ion:

b. If the first and second ionizations of copper are $745.4 \text{ kJ mol}^{-1}$ and $1957.9 \text{ kJ mol}^{-1}$ respectively, what are the wavelengths of the photons emitted upon ionization?

7. Within any period, noble gases have the highest ionization energy. Why?

Fun fact: noble gases are called “noble” for the same reason that “noble metals” (Ru, Rh, Pd, Os, Ir, Pt, and Au) are—not because they are expensive (though they can be!), but rather because they can be resistant to reacting. The idea is that these “noble” elements are too stuck-up to mingle with the commoner elements. (This may be apocryphal, but I think it’s fun.)