This print-out should have 8 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

LDE Electronic configuration 001
001 5.0 points

What is the electronic configuration of a Selenium atom (Se)?

1. [Kr] $4s^2\,4f^{14}\,4d^{10}\,4p^4$

2. [Kr] $4s^2\,4d^{10}\,4p^4$

3. [Kr] $4s^2\,3d^{10}\,4p^4$

4. [Ar] $4s^2\,4d^{10}\,4p^4$

5. [Ar] $4s^2\,3d^{10}\,4p^4$ **correct**

Explanation:

Se has 34 electrons, 18 of which are accounted for by the shorthand notation [Ar], and the remaining 16 of which much first fill the $4s$ subshell (2 electrons), the $3d$ subshell (10 electrons) and finally the $4p$ subshell (the last 4 electrons).

LDE Electronic configuration 002
002 5.0 points

What is the electronic configuration of a monovalent Calcium cation (Ca^+)?

1. [Ne] $3s^2\,3p^6$

2. [Ar]

3. [Ar] $4s^2\,3d^1$

4. [Ar] $4s^2$

5. [Ar] $4s^1$ **correct**

6. [Ar] $4s^2\,4p^1$

Explanation:

Ca^+ has 19 electrons, 18 of which are accounted for by the shorthand notation [Ar], and the single remaining electron must be put into $4s$ subshell.

LDE Ranking trends 001
003 5.0 points

Rank the following species in terms of decreasing atomic radius: Chlorine (Cl), Thallium (Tl), Arsenic (As), Tin (Sn), Lead (Pb)

1. Not enough information

2. Cl > As > Sn > Tl > Pb

3. Tl > Sn > Pb > As > Cl

4. Cl > As > Pb > Sn > Tl

5. Tl > Pb > Sn > As > Cl **correct**

6. Cl > As > Sn > Pb > Tl

Explanation:

The atomic radius trend is very smooth. Elements atomic radii decrease to the right across a given period and up a given group. Therefore Pb is smaller than Tl, Sn is smaller than Pb, As is smaller than Sn, and lastly Cl is smaller than As.

LDE Ranking trends 002
004 5.0 points

Rank the following species in terms of increasing electron affinity: Sulfur (S), Rubidium (Rb), Germanium (Ge), Krypton (Kr), Floruine (F)

1. Ge < Rb < S < F < Kr

2. Kr < Ge < Rb < S < F

3. Not enough information

4. F < Ge < S < Rb < Kr

5. Rb < Ge < S < F < Kr

6. Kr < Rb < Ge < S < F **correct**

Explanation:

Elements electron affinities increase across a given period and up and given group. Noble gases (i.e. Kr) have an electron affinity of essentially zero. Rb is greater than zero, Ge is greater than Rb, S is greater than Ge, and F is greater than P.

LDE Effective nuclear charge
005 5.0 points

Calculate the effective nuclear charge (Z_{eff}) experienced by the 2s electrons of the Sulfur atom (S).

1. 2

2. 6

3. 14 **correct**

4. 10

5. 8

6. 16

Explanation:

The effective nuclear charge is equal to the number of protons minus the number of shielding electrons Z_{eff} = protons − shielding electrons. S has 16 protons and its 2s electrons are shielded only by the two 1s electrons, therefore they experience an effective nuclear charge, $Z_{\text{eff}} = 16 - 2 = 14$.

LDE filled and half filled 001
006 5.0 points

What is the electronic configuration of a Copper atom (Cu)?

1. [Ne] $4s^1\,4d^{10}$

2. [Ar] $4s^1\,4d^9$

3. [Ar] $4s^2\,3d^9$

4. [Ar] $4s^2\,3d^5\,4p^3$

5. [Ar] $4s^1\,3d^{10}$ **correct**

Explanation:

The enhanced stability afforded by a filled d subshell results in a single 4s electron being "borrowed" to fill Copper's 3d subshell; therefore, Cu is [Ar] $4s^1\,3d^{10}$.

LDE filled and half filled 002
007 5.0 points

What is the electronic configuration of a trivalent Indium cation (In^{3+})?

1. [Kr] $5s^2\,4d^8$

2. [Kr] $5s^0\,4d^{10}$ **correct**

3. [Kr] $5s^2\,5d^8$

4. [Kr] $5s^2\,5d^5\,5p^3$

5. [Kr] $5s^1\,4d^9$

Explanation:

In^{3+} is isoelectronic with Pd (it has 46 electrons). The enhanced stability afforded by a filled d subshell results in a both 5s electron being "borrowed" to fill In^{3+}'s 4d subshell; therefore, In^{3+} is [Kr] $5s^0\,4d^{10}$.

LDE filled and half filled 003
008 5.0 points

The ionization energy of an Oxygen atom (O) is (equal to/greater than/less than) what you would predict based on simple effective nuclear charge arguments because the half-filled 2p orbital for O^+ is (more/less) stable.

1. equal to, less

2. less than, more **correct**

3. less than, less

4. greater than, less

5. equal to, more

6. greater than, more

Explanation:

O^+'s 2p subshell is half-filled, affording additional stability. As a consequence, less energy is required to remove an electron from O than one would predict simply based on effective nuclear charge and Oxygens's place in the IE trend reflects this with a diminsihed ionization energy.