

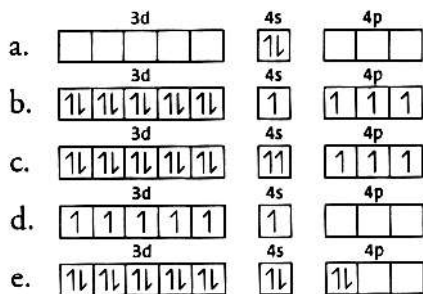
## 8 • Electron Configurations & Periodicity

### STUDY QUESTIONS

“No human investigation can be called real science if it cannot be demonstrated mathematically.”

Leonardo da Vinci (1452 – 1519)

- Write the electron configurations of the following elements using the shorthand notation for the noble gas cores.
  - phosphorus
  - nickel
  - osmium
  - californium
  - titanium
- Which orbital is filled following these orbitals?
  - 3d
  - 4s
  - 5p
  - 5f
- How many electrons can be accommodated in
  - a d subshell
  - a set of f orbitals
  - the  $n = 4$  shell
  - the 7s orbital
  - a  $p_x$  orbital?
- What is wrong with the following ground state electron configurations?



- How many unpaired electrons are there in
  - a nitrogen atom
  - an iodine atom
  - a nickel (II) cation
  - an oxide ion?

6. Which of the following sets of quantum numbers describe an impossible situation? Explain why.
- $n = 2, \ell = 1, m_\ell = 2, m_s = +\frac{1}{2}$
  - $n = 5, \ell = 2, m_\ell = 1, m_s = -\frac{1}{2}$
  - $n = 6, \ell = 5, m_\ell = 0, m_s = 0$
  - $n = 3, \ell = 3, m_\ell = 1, m_s = -\frac{1}{2}$
  - $n = 4, \ell = 2, m_\ell = 1, m_s = +\frac{1}{2}$
7. Arrange the elements S, Ge, P, and Si in order of increasing atomic size.
8. Arrange the ions  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Cl}^-$ , and  $\text{Br}^-$  in order of increasing size.
9. Arrange the elements Be, Ca, N, and P in order of increasing ionization energy.
10. Which one of each of the following pairs would you expect to have the higher electron affinity?
- Cl or  $\text{Cl}^-$
  - Na or K
  - Br or I
12. Which elements fit the following descriptions:
- the smallest alkaline earth metal
  - has a valence shell configuration  $4f^{14} 5d^{10} 6s^1$
  - the halogen with the lowest ionization energy
  - has 13 more electrons than argon
  - the smallest non metal
  - the Group 4A element with the largest ionization energy
  - its 3+ ion has the electron configuration  $[\text{Kr}] 4d^{10}$