Chapter 8 Tro

1. Which one of the following situations is not ever encountered in the ground state configuration of an atom?
   A) a . . . $3d^4$ with 4 unpaired electrons
   B) a . . . $3d^7$ with 7 unpaired electrons
   C) a . . . $3p^1$ with 1 unpaired electron
   D) a . . . $3d^9$ with 1 unpaired electron
   E) a . . . $4f^7$ with 7 unpaired electrons

2. Which one of the following situations is not ever encountered in the ground state configuration of an atom?
   A) a . . . $4p^4$ with 4 unpaired electrons
   B) a . . . $4d^5$ with 5 unpaired electrons
   C) a . . . $4f^6$ with 6 unpaired electrons
   D) a . . . $4f^3$ with 3 unpaired electrons
   E) a . . . $4p^3$ with 3 unpaired electrons

3. A correct description for the ground state configuration of the chromium atom is
   A) [Ar] $4s^1$ $3d^5$, paramagnetic
   B) [Ar] $4s^2$ $3d^4$, paramagnetic
   C) [Ar] $4s^3$ $3d^3$, paramagnetic
   D) [Ar] $3d^6$, paramagnetic
   E) [Ar] $3s^2$ $3d^4$, paramagnetic

4. Using X to indicate a filled inner core and an arrow for a valence shell electron, indicate which of the following choices is the correct ground state electronic configuration for the vanadium atom.

	[Ar]	4s	3d			
A)	X	↑↓	↑↓	↑		
B)	X	↑↓	↑	↑	↑	
C)	X	↑	↑	↑	↑	↑
D)	X		↑	↑	↑	↑ ↑
E)	X		↑↓	↑↓	↑	

5. Which one of the following configurations represents a non-existent state?
   A) [Ar] $4s^1\ 3d^5$
   B) [Ar] $4s^2\ 3d^4$
   C) [Xe] $5s^2\ 5p^1$
   D) [Xe] $6s^2\ 4f^7$
   E) [Rn] $7s^2$

6. A possible set of quantum numbers for an electron in the partially filled subshell in the gallium atom in its ground state configuration would be

	n	l	m_l	m_s
A)	3	1	0	–½
B)	3	1	1	½
C)	4	0	0	–½
D)	4	1	0	½
E)	4	2	1	½

7. Which one of the species below should have the largest radius?
   A) Ca
   B) Ba
   C) Al
   D) Mg
   E) C

8. Based on the position in the periodic table, which one of the following atoms would you expect to be the most electronegative?
   A) Ba
   B) Ga
   C) Mn
   D) N
   E) Si

9. Which one of the following is the least electronegative element of the set presented?
   A) F
   B) N
   C) C
   D) O
   E) H

10. For which one of the processes below is ΔH largest in magnitude?
   A) $Li(g) \rightarrow Li^+(g) + e^-$
   B) $B(g) \rightarrow B^+(g) + e^-$
   C) $B^{2+}(g) \rightarrow B^{3+}(g) + e^-$
   D) $B^{3+}(g) \rightarrow B^{4+}(g) + e^-$
   E) $Be^+(g) \rightarrow Be^{2+}(g) + e^-$

11. The number of orbitals in a shell with $n = 3$ is _____

12. Which one of the atoms in the set: Y, Cr, Mg, N, Ba, Se, Sn has the largest first ionization energy? _____

13. Which one of the atoms in the set: Mg, Cr, N, Sn, Ba, Sn, Se would you expect to have the smallest first ionization energy? _____

14. When one thinks of an atom as being related to the region occupied by the electron cloud for the outermost electrons, a "radius" can be imagined. Typically, for an atom this "radius" would be about
   A) 2.00 picometers
   B) 20.0 picometers
   C) 200 picometers
   D) 2.00 nanometers
   E) 20.0 nanometers

15. A correct description for the ground state configuration of the iron atom is
   A) [Ar] $3s^2\ 3d^6$, paramagnetic
   B) [Ar] $4s^2\ 3d^6$, diamagnetic
   C) [Ar] $4s^1\ 3d^7$, paramagnetic
   D) [Ar] $3d^8$, paramagnetic
   E) [Ar] $4s^2\ 3d^6$, paramagnetic

16. A correct description for the ground state configuration of the selenium atom is
    A) [Ar] $4s^1\ 3d^{10}\ 4p^5$, paramagnetic
    B) [Ar] $4s^2\ 3d^{10}\ 4p^4$, paramagnetic
    C) [Ar] $4s^2\ 3d^8\ 4p^6$, paramagnetic
    D) [Ar] $3d^{10}\ 4p^6$, diamagnetic
    E) [Ar] $4s^1\ 3d^9\ 4p^6$, paramagnetic

17. An atom is described as having the ground state electronic configuration, [Ar] $4s^2\ 3d^5\ 4f^2$. Which element fits the description?
    A) one of the chalcogen family
    B) one of the halogen family
    C) one of the alkaline earth family
    D) one of the lanthanide elements
    E) there is no element which fits the description listed above

18. Using X to indicate a filled inner core and an arrow for a valence shell electron, indicate which of the following choices is the correct ground state electronic configuration for the sulfur atom.

	[Ne]	3s	3p		
A)	X	↑↓	↑	↑	↑
B)	X	↑↓	↑↓	↑	↑
C)	X	↑	↑↓	↑	↑↓
D)	X	↑↓	↑↓	↑↓	
E)	X		↑↓	↑↓	↑↓

19. Based on the Aufbau principle and other applicable guiding principles, what ground state electronic configuration would one reasonably expect to find for technetium (Z = 43)?
    A) [Kr] $4s^2\ 3d^5$
    B) [Kr] $4s^2\ 4d^5$
    C) [Kr] $4d^7$
    D) [Kr] $5s^2\ 4d^5$
    E) [Kr] $5s^2\ 5d^5$

20. Using X to indicate a filled inner core and an arrow for a valence shell electron, indicate which of the following choices is the correct ground state electronic configuration for the cobalt atom.

	[Ar]	4s	3d			
A)	X	↑↓	↑↓	↑↓	↑↓	↑
B)	X	↑	↑↓	↑↓	↑↓	↑↓
C)	X	↑	↑↓	↑↓	↑↓	↑ ↑
D)	X		↑↓	↑↓	↑↓	↑↓ ↑
E)	X	↑↓	↑↓	↑↓	↑	↑ ↑

21. An otherwise unidentified element is known to have an electronic configuration, [X]ns^2, in its ground state. This element must be in the same family as
    A) rubidium
    B) radium
    C) radon
    D) arsenic
    E) lead

22. A possible set of quantum numbers for an electron in the partially filled subshell in the technetium atom in its ground state configuration would be

	n	l	m_l	m_s
A)	3	1	0	–½
B)	3	2	1	½
C)	4	0	0	–½
D)	4	1	0	½
E)	4	2	1	½

23. Which one of the following statements is true?
    A) A 3f orbital is larger (extends farther) than a 3 p orbital in a particular atom.
    B) A 3p orbital has four lobes, one in each of the four quadrants.
    C) A $3f_{xyz}$ has eight lobes, one in each octant.
    D) All 3d orbitals have the same shape, just different orientations.
    E) The 7s orbital can be represented by a sphere.

24. Which one of the species below should have the largest radius?
    A) Rb
    B) Na
    C) Al
    D) Ne
    E) O

25. Which one of the atoms listed below has the largest value for its first ionization energy?
    A) Al
    B) Sr
    C) Ga
    D) Cr
    E) Fr

26. Which one of the atoms listed below has the largest value for its electron affinity?
    A) O
    B) He
    C) Ga
    D) Cr
    E) F

27. For which one of the processes below is ΔH largest in magnitude?
    A) $Be^{+}(g) \rightarrow Be^{2+}(g) + e^{-}$
    B) $Be^{2+}(g) \rightarrow Be^{3+}(g) + e^{-}$
    C) $B^{2+}(g) \rightarrow B^{3+}(g) + e^{-}$
    D) $C(g) \rightarrow C^{+}(g) + e^{-}$
    E) $C^{2+}(g) \rightarrow C^{3+}(g) + e^{-}$

28. A particular energy level in a multielectron atom has a value of 3 for the secondary quantum number. What is the maximum number of electrons that can occupy this energy level? _____

29. How many unpaired electrons are there in the ground state electronic configuration for an iron atom? _____

30. A phototube in a photoelectric device has a photosensitive element. When this element is beamed with radiation having a wavelength of 374.2 nm, electrons are emitted. The maximum kinetic energy observed for these electrons is 1.488×10^{-19} J/electron. What is the wavelength of a laser which will turn the photocell on and cause electrons to be ejected which have absolutely no excess energy? _____

Answer Key

1. B
2. A
3. A
4. B
5. C
6. D
7. B
8. D
9. E
10. D
11. 9
12. N
13. Ba
14. C
15. E
16. B
17. E
18. B
19. D
20. E
21. B
22. E
23. E
24. A
25. A
26. E
27. B
28. 14
29. 4
30. 520 nm