

- (2) 1. As one proceeds from ultraviolet radiation to microwave radiation, the frequency (increases, decreases, remains the same) and the wavelength (increases, decreases, remains the same).
- (3) 2. A representative element that is distinctly metallic is:  
a) Si    b) Bi    c) Ge    d) As    e) Sb
- (4) 3. An atom of arsenic (At. no. 33) has:  
a) 5 electrons in 4p atomic orbitals  
b) 10 electrons in 4d atomic orbitals  
c) 6 electrons in 3p atomic orbitals  
d) 14 electrons in 4f atomic orbitals  
e) None of the above choices is correct
- (4) 4. How many unpaired electrons are there in a fluoride ( $F^{-1}$ ) ion?  
a) 0    b) 1    c) 2    d) 3    e) 6
- (4) 5. The highest first ionization energy of the following elements is that for:  
a) Li    b) Se    c) Mg    d) Cl    e) Ne
- (4) 6. The total number of electrons in all the d-atomic orbitals of an atom of silver (At. no. 47) is:  
a) 14    b) 17    c) 19    d) 20    e) 47
- (4) 7. Which energy level transition would produce an emission line with the shortest wavelength?  
a) 7s to 4d    b) 3d to 4f    c) 3p to 1s    d) 1s to 4s    e) 5f to 6d

- (4) 8. A  $\text{Ga}^{+3}$  ion would have the following ground state electron configuration:
- a)  $[\text{Ar}]4s^23d^8$    b)  $[\text{Ar}]3d^{10}$    c)  $[\text{Ar}]3d^8$    d)  $[\text{Ar}]$    e)  $[\text{Kr}]$
- (4) 9. All electrons that occupy a d-atomic orbital must have the quantum number:
- a)  $n = 2$    b)  $m_l = +2$    c)  $l = 2$    d)  $n = 3$    e)  $m_s = +1/2$
- (4) 10. Which one of the following atoms has a valence electron configuration of  $4s^24p^2$ ?
- a) Ti   b) Si   c) Ca   d) Sn   e) Ge
- (4) 11. The total number of atomic orbitals possible for  $n = 2$  is:
- a) 4   b) 9   c) 10   d) 16   e) 32
- (4) 12. Atom X forms  $X^{+2}$  whose electron configuration is  $[\text{Xe}]6s^25d^{10}$ . Element X is:
- a) Rn   b) Po   c) Pb   d) Hg   e) Pt
- (4) 13. Transition elements are those whose valence electrons may come from:
- a) atomic orbitals that differ in both their  $n$  and  $m_l$  values  
 b) atomic orbitals that differ in their  $m_l$  values but not their  $n$  values  
 c) only s-atomic orbitals   d) only d-atomic orbitals  
 e) only d- and f-atomic orbitals
- (4) 14. Transition metal Z forms  $Z^{+3}$ . If  $Z^{+3}$  has five unpaired electrons, transition metal Z could be:
- a) Co   b) Mn   c) Cr   d) Fe   e) Ni
- (4) 15. Which one of the following ions is diamagnetic?
- a)  $\text{Co}^{+2}$    b)  $\text{Co}^{+3}$    c)  $\text{Cr}^{+3}$    d)  $\text{Cu}^{+2}$    e)  $\text{Zn}^{+2}$
- (3) 16. Erbium (At. no. 68) is an example of a(n) \_\_\_\_\_ element.
- a) transition metal   b) lanthanide   c) actinide   d) metalloid

(3) 17. If an oxygen atom gains two electrons, the resulting species is:

- a) a cation isoelectronic with a neon atom.
- b) an anion isoelectronic with an argon atom.
- c) smaller than an oxygen atom.
- d) larger than an oxygen atom.
- e) None of the above choices is valid.

(4) 18. Which one of the following species has the largest radius?

- a)  $\text{Sc}^{+3}$       b)  $\text{P}^{-3}$       c)  $\text{Ar}^0$       d)  $\text{K}^{+1}$       e)  $\text{Cl}^{-1}$

(3) 19. "An individual atomic orbital can hold a maximum of two electrons but, to do so, the electrons must be of opposite spin" is a statement of the:

- a) Aufbau principle
- b) Bohr theory of the atom
- c) Heisenberg Uncertainty principle
- d) Hund's rule
- e) Pauli Exclusion principle

(4) 20. A set of quantum numbers that could represent the 55th (the last) electron in a cesium (Cs) atom is:

- |    | n                                    | l | $m_l$ | $m_s$ |
|----|--------------------------------------|---|-------|-------|
| a) | 5                                    | 0 | 0     | +1/2  |
| b) | 6                                    | 0 | 0     | +1/2  |
| c) | 6                                    | 1 | 1     | -1/2  |
| d) | 6                                    | 1 | 0     | -1/2  |
| e) | None of the above choices is correct |   |       |       |

4) 21. Which one of the following combinations of quantum numbers is not permissible?

- |    | n | l | $m_l$ | $m_s$ |
|----|---|---|-------|-------|
| a) | 3 | 1 | 1     | + 1/2 |
| b) | 3 | 0 | 0     | - 1/2 |
| c) | 3 | 1 | -2    | - 1/2 |
| d) | 3 | 1 | -1    | + 1/2 |
| e) | 3 | 2 | 0     | - 1/2 |

(3) 22. Specify whether each one of the following atomic electron configurations represents a ground state, excited state, or an impossibility:

a)  $[\text{Kr}]5s^25d^1$  \_\_\_\_\_

b)  $[\text{Ar}]4s^23f^{10}$  \_\_\_\_\_

c)  $[\text{Kr}]5s^14d^5$  \_\_\_\_\_

(19) 23. Complete the following abbreviated Periodic table of elements using the fictitious elements described below:


- Elements **Er**, **Y**, **G**, and **S**, and **Me** comprise the group of inert gases and are listed in order of **decreasing atomic size**.
- Elements **It**, **V** and **In** are halogens. Element **It** is more electronegative than element **V**, but **It** is less electronegative than element **In**.
- Elements **Fo**, **Ee**, and **Sc** are alkaline earth metals. The atomic weight of **Sc** is greater than that of **Ee**, but is lower than that of **Fo**.
- Element **Fa** has a  $1s^1$  electronic configuration.
- Elements **Is**, **Ob**, **Fl**, and **I** are alkali metals and are listed in order of **increasing ionization energy**.
- Elements **T**, **Ur**, and **Re** are transition metals and are listed in order of **increasing metallic character**.