Atomic Structure and Electron Configurations Multiple Choice
PSI Chemistry Name:_____

1. Rutherford's Nuclear Model of the atom
    A. is the currently accepted atomic model.
    B. explains the unique emission spectra of different elements.
    C. does not account for the stability of most atoms since accelerating electrons would quickly lose energy and fall into the nucleus, causing the atom to collapse.
    D. Both b and c

2. When an excited electron in an atom moves from the ground state, the electron
    A. absorbs energy as it moves to a higher energy state.
    B. absorbs energy as it moves to a lower energy state.
    C. emits energy as it moves to a higher energy state.
    D. emits energy as it moves to a lower energy state.
    (NY Regents June 2014)

3. During a flame test, a lithium salt produces a characteristic red flame. This red color is produced when electrons in excited lithium atoms
    A. are lost by the atoms.
    B. are gained by the atoms.
    C. return to lower energy states within the atoms.
    D. move to higher energy states within the atoms.
    (NY Regents June 2014)

4. Bohr's atomic model
    A. proposes that electrons occupy specific energy levels.
    B. explains the emission spectra of hydrogen atoms.
    C. predicts the energy levels of multi-electron atoms.
    D. Both a and b

5. The quantum-mechanical model of the atom
    A. describes an electron probability distribution that determines the most likely location of an electron.
    B. is the currently accepted atomic model.
    C. makes predictions based on Schrodinger's wave equation.
    D. All of the above

6. In the quantum-mechanical model of the atom, which of the following is NOT one of the four quantum numbers needed to specify the probable location of an electron?
    A. Principal quantum number (n) which describes the energy level/distance from the nucleus
    B. Heisenberg number (H) which describes the electron's position and momentum.
    C. Angular quantum number (l) which describes the shape of an electron's orbital
    D. Magnetic quantum number (m_l) which describes the orbitals orientation in space

7. The Heisenberg Uncertainty Principle
    A. assumes that the electrons take positions predicted by Bohr's theory.
    B. states that the position of an electron can be found by measuring its momentum.
    C. states that the position and momentum of an electron in an atom cannot be found precisely because measuring the electron changes its momentum.
    D. both a and b

8. In the quantum-mechanical model of the atom, an orbital is defined as a
    A. region of the most probable proton location.
    B. region of the most probable electron location.
    C. circular path traveled by an electron around an orbital.
    D. circular path traveled by a proton around an orbital.
    (NY Regents June 2014)

9. _____ orbitals are spherically symmetrical.
    A. s
    B. p
    C. d
    D. f

10. _____ orbitals are dumbbell shaped
    A. s
    B. p
    C. d
    D. f

11. s orbitals can have how many different orientations in space?
    A. 1
    B. 3
    C. 5
    D. 7

12. d orbitals can have how many different orientations in space?
    A. 1
    B. 3
    C. 5
    D. 7

13. All orbitals can hold a maximum of _____ electrons
    A. 1
    B. 2
    C. 3
    D. 4

14. All of the orbitals in a given electron shell have the same value for the _____ quantum number.
    A. Principal (n)
    B. Angular (l)
    C. Magnetic (m_l)
    D. Spin (m_s)

15. The _____ quantum number defines the shape of an orbital.
    A. Spin (m_s)
    B. Magnetic (m_l)
    C. Principal (n)
    D. Angular (l)

16. The n = 1 shell contains _____ p sub-orbitals. All the other shells contain _____ p sub- orbitals.
    A. 3, 6
    B. 0, 3
    C. 6, 2
    D. 3, 3

17. There are _____ orbitals in the second shell.
    A. 1
    B. 2
    C. 4
    D. 8

18. The lowest energy shell that contains d orbitals is the shell with n = _____.
    A. 3
    B. 2
    C. 4
    D. 1

19. The principal quantum number of the first d orbital is _____.
    A. 1
    B. 2
    C. 3
    D. 4

20. Which of the orbitals below do <u>not</u> exist due to the constraints upon the angular quantum number?
    A. 3f
    B. 2s
    C. 2p
    D. all of the above

21. Which of the orbitals below do <u>not</u> exist due to the constraints upon the angular quantum number?
    A. 3f
    B. 3d
    C. 3p
    D. 3s

22. Which one of the following is an incorrect orbital notation?
    A. 4f
    B. 2d
    C. 3s
    D. 2p

23. There are _____ sub-orbitals in the 3rd shell.
    A. 25
    B. 4
    C. 9
    D. 16

24. All of the sub-orbitals in a given orbital have the same value of the _____ quantum number.
    A. Principal
    B. Angular
    C. Magnetic
    D. A and B

25. The p-orbital can accommodate a maximum of _____ electrons.
    A. 6
    B. 2
    C. 10
    D. 3

26. How many quantum numbers are necessary to designate a particular electron in an atom?
    A. 3
    B. 4
    C. 2
    D. 1

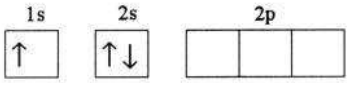
27. At a maximum, an f-orbital can hold_____ electrons, a d-orbital can hold_____ electrons and a p-orbital can hold _____ electrons.

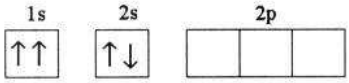
A. 14, 10, 6
B. 2, 8, 18
C. 14, 8, 2
D. 2, 12, 21

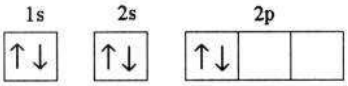
28. The lowest orbital energy is reached when the number of electrons with the same spin is maximized. This statement describes _____.

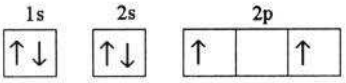
A. Pauli Exclusion Principle
B. Hund's Rule
C. deBroglie hypothesis
D. Heisenberg Uncertainty Principle

29. Which electron configuration correctly denotes an atom in its ground state?

A. 

B. 

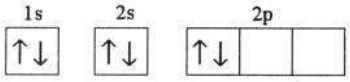
C. 

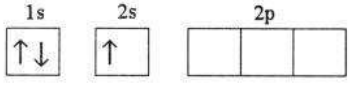
D. 

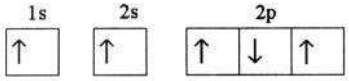
30. The word Aufbau means building up in German. The Aufbau Principle describes that

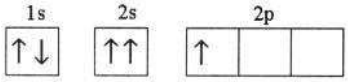
A. electrons with the same spin cannot occupy the same orbital.
B. Since electrons repel each other, electrons will occupy single orbitals within and energy level before doubling up.
C. electrons fill lower energy levels first before occupying higher energy levels.
D. None of the above.

31. Which ground state electron configuration represents a violation of the Aufbau Principle?

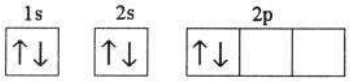
A. 

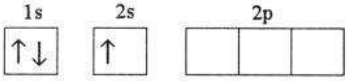
B. 

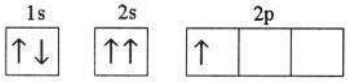
C. 

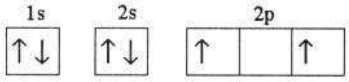
D. 

32. Which electron configuration represents a violation of the Pauli Exclusion Principle?

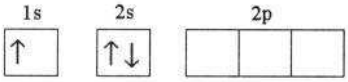
A. 

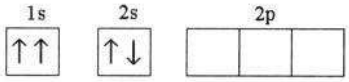
B. 

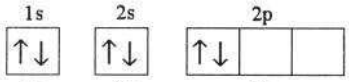
C. 

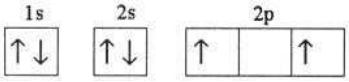
D. 

33. Which electron configuration represents a violation of the Pauli Exclusion Principle?

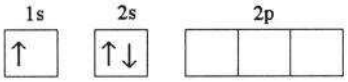
A. 

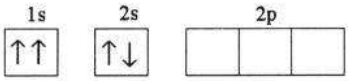
B. 

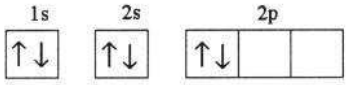
C. 

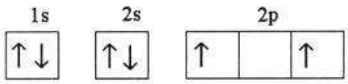
D. 

34. Which electron configuration represents a violation of Hund's rule for an atom in its ground state?

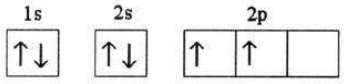
A. 

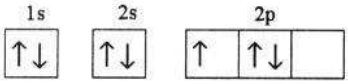
B. 

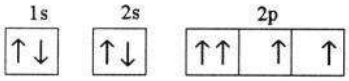
C. 

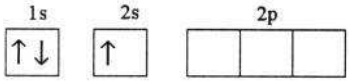
D. 

35. Which electron configuration represents a violation of Hund's rule for an atom in its ground state?

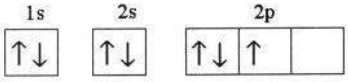
A. 

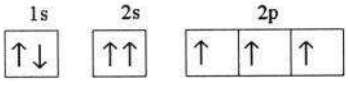
B. 

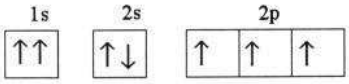
C. 

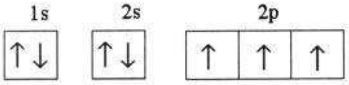
D. 

36. Which one of the following is the correct electron configuration for a ground-state nitrogen atom?

A. 

B. 

C. 

D. 

37. Which two elements have the same ground-state electron configuration?

A. I and S
B. Cu and Ag
C. Li and Na
D. No two elements have the same ground-state electron configuration

38. The ground state electron configuration of Fe is _____.

A. $1s^2\ 2s^2\ 3s^2\ 3p^6\ 3d^6$
B. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^6$
C. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$
D. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 4d^6$

39. The ground state electron configuration of Ga is _____.

A. $1s^2\ 2s^2\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^1$
B. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 4d^{10}\ 4p^1$
C. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^1$
D. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4d^1$

40. The 2p orbital in the ground state of atomic Neon contains _____ electrons.

A. 2
B. 6
C. 8
D. 10

41. The second shell in the ground state of atomic Argon contains _____ electrons.

A. 2
B. 6
C. 8
D. 18

42. The _____ orbital is partially filled in the Manganese atom.

A. 3s
B. 4s
C. 4p
D. 3d

MC Answer Key

1. C
2. A
3. C
4. D
5. D
6. B
7. C
8. B
9. A
10. B
11. A
12. D
13. B
14. A
15. D
16. B
17. B
18. A
19. C
20. A
21. D
22. B
23. C
24. D
25. A
26. B
27. A
28. B
29. D
30. C
31. C
32. D
33. B
34. C
35. B
36. D
37. D
38. B
39. C
40. B
41. C
42. D