Chem 30 Unit 1 MS1 Practice Test

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. According to Dalton's atomic theory, atoms
   a. are destroyed in chemical reactions.
   b. can be divided.
   c. of each element are identical in size, mass, and other properties.
   d. of different elements cannot combine.

2. Which of the following statements is true?
   a. Atoms of the same element may have different masses.
   b. Atoms may be divided in ordinary chemical reactions.
   c. Atoms can never combine with any other atoms.
   d. Matter is composed of large particles called atoms.

3. When an electrical current passed through a glass tube, a paddle wheel placed between the electrodes moved. Scientists concluded that
   a. a magnetic field was produced.
   b. particles were passing from the cathode to the anode.
   c. there was gas in the tube.
   d. atoms were indivisible.

4. Experiments with cathode rays led to the discovery of the
   a. proton.
   b. nucleus.
   c. neutron.
   d. electron.

5. Because any element used in the cathode produced electrons, scientists concluded that
   a. all atoms contained electrons.
   b. only metals contained electrons.
   c. atoms were indivisible.
   d. atoms carried a negative charge.

6. The deflection of cathode rays in Thomson's experiments was evidence of the ____ nature of electrons.
   a. wave
   b. charged
   c. particle
   d. spinning

7. In Rutherford's experiments, very few positively charged particles
   a. were slightly deflected as they passed through the metal.
   b. were greatly deflect back from the metal.
   c. passed straight through the metal.
   d. combined with the metal.

8. The forces that hold the particles in the nucleus together are called
   a. nuclear forces.
   b. gravitational forces.
   c. magnetic forces.
   d. electron clouds.
9. If electromagnetic radiation A has a lower frequency than electromagnetic radiation B, then compared to B the wavelength of A is
   a. longer.
   b. shorter.
   c. equal.
   d. exactly half the length of B's wavelength.

10. The wave model of light did not explain
    a. the frequency of light.
    c. interference.
    b. the continuous spectrum.
    d. the photoelectric effect.

11. A bright-line spectrum of an atom is caused by the energy released when electrons
    a. jump to a higher energy level.
    b. fall to a lower energy level.
    c. absorb energy and jump to a higher energy level.
    d. absorb energy and fall to a lower energy level.

12. The Bohr model of the atom was an attempt to explain hydrogen's
    a. density.
    c. mass.
    b. flammability.
    d. line-emission spectrum.

13. According to the Bohr model of the atom, the single electron of a hydrogen atom circles the nucleus
    a. in specific, allowed orbits.
    b. in one fixed orbit at all times.
    c. at any of an infinite number of distances, depending on its energy.
    d. counterclockwise.

14. The electron in a hydrogen atom has its lowest total energy when the electron is in its
    a. neutral state.
    c. ground state.
    b. excited state.
    d. quantum state.

15. All of the following are true about Louis de Broglie's research EXCEPT
    a. it led to a revolution in our basic understanding of matter.
    b. it pointed out that the behavior of quantized electron orbits was similar to the behavior of waves.
    c. it combined two well-known equations.
    d. it explained the photoelectric effect.

16. The equation $E = hf$ helped Louis de Broglie determine
    a. how protons and neutrons behave in the nucleus.
    b. how electron wave frequencies correspond to specific energies.
    c. whether electrons behave as particles.
    d. whether electrons exist in a limited number of orbits with different energies.

17. Which model of the atom explains why excited hydrogen gas gives off certain colors of light?
    a. the Bohr model
    c. Rutherford's model
    b. the quantum model
    d. Planck's theory
18. With the quantum model of the atom, scientists have come to believe that determining an electron’s exact location around the nucleus
   a. is impossible.
   b. can be done before 2025.
   c. can be done easily.
   d. can be done only with specialized equipment.

19. The solutions to the Schrödinger wave equation are
   a. quantum numbers.  
   b. wave functions.  
   c. energy levels.  
   d. orbitals.

20. How many quantum numbers are needed to describe an electron in an atom?
   a. 1  
   b. 2  
   c. 3  
   d. 4

21. Quantum numbers are sets of numbers that describe the properties of
   a. the atomic nucleus.  
   b. atomic orbitals.  
   c. atoms.  
   d. molecules.

22. The possible values of an electron’s spin quantum number are
   a. $-1, 0, 1$.  
   b. $\frac{1}{2}$ or $-\frac{1}{2}$  
   c. $+1$ or $-1$.  
   d. $0$ or $1$.

23. The major difference between a 1s orbital and a 2s orbital is that
   a. the 2s orbital can hold more electrons.
   b. the 2s orbital has a slightly different shape.
   c. the 2s orbital is at a higher energy level.
   d. the 1s orbital can have only one electron.

24. For $n = 4$, the number of possible orbital shapes is
   a. 1.
   b. 4.
   c. 16.
   d. 32.

25. Which of the following sets of quantum numbers is not allowed?
   a. $n = 3, l = 2, m_l = +2$  
   b. $n = 3, l = 1, m_l = -1$  
   c. $n = 3, l = 0, m_l = 0$  
   d. $n = 3, l = 3, m_l = 2$

26. "Orbitals of equal energy are each occupied by one electron before any is occupied by a second electron, and all electrons in singly occupied orbitals must have the same spin" is a statement of
   a. the Pauli exclusion principle.
   b. the Aufbau principle.
   c. the quantum effect.
   d. Hund’s rule.

27. The Aufbau principle states that an electron
   a. can have only one spin number.
   b. occupies the lowest available energy level.
   c. must be paired with another electron.
   d. must enter an s orbital.
28. The Pauli exclusion principle states that
   a. once an electron is ejected from an atom, it may not return.
   b. 2 particles in quantum entanglement must have opposite quantum states.
   c. hadrons may be baryons or mesons but not both at the same time.
   d. no two electrons in an atom can have identical quantum numbers.

29. Which of the following could be called a meson?
   a. up quark, up quark, and down quark
   b. down quark and antistrange quark
   c. charm quark and bottom quark
   d. protons and neutrons

30. In the alkaline-earth group, atoms with the smallest radii
   a. are the most reactive.
   b. have the largest volume.
   c. are all gases.
   d. have the highest ionization energies.

31. The energy required to remove an electron from an atom ___ as you move left to right from potassium through iron.
   a. generally increases
   b. generally decreases
   c. does not change
   d. varies unpredictably

32. As you move across a period left to right in the periodic table, the ionization energy
   a. increases
   b. decreases
   c. remains the same
   d. is not predictable

33. As you move up a group on the periodic table, the electron affinity
   a. generally increases
   b. generally decreases
   c. remains the same
   d. is not predictable

34. As you move up across a period right to left in the periodic table, the electronegativity
   a. increases
   b. decreases
   c. remains the same
   d. is not predictable

35. Which of the following is the correct Lewis structure for OF₂, which is a molecular compound?
   a. \( :\overset{\text{F}}{\text{F}} - :\overset{\text{O}}{\text{O}} - :\overset{\text{F}}{\text{F}} \)
   b. \( :\overset{\text{F}}{\text{F}} = :\overset{\text{F}}{\text{F}} \)
   c. \( [:\overset{\text{F}}{\text{F}}]^+ \overset{\text{O}}{\text{O}} ^2 [:\overset{\text{F}}{\text{F}}]^+ \)
   d. \( [:\overset{\text{F}}{\text{F}}] :\overset{\text{O}}{\text{O}} [:\overset{\text{F}}{\text{F}}] \)
Chem 30 Unit MS1 Practice Test

1. Calculate the energy of a photon with a wavelength of 6397 nm. (5 marks)

2. What is the binding energy of a metal that ejects an electron with a kinetic energy of $4.58 \times 10^{-18}$ J when light with a wavelength of $5.27 \times 10^{-5}$ m shines on its surface? (5 marks)

3. Write the electron configuration for tantalum (atomic number 73). (2 marks)

4. Use arrows to draw the orbital notation for selenium (atomic number 34). (2 marks)

5. Write the noble gas notation for tungsten (atomic number 74) (2 marks)

6. Lithium has 2 stable isotopes: Lithium-6 (atomic mass 6.015122 amu) and Lithium-7 (atomic mass 7.016004 amu). If the average atomic mass of lithium is 6.941 amu, find the abundance of each isotope. (5 marks)

7. Complete (24 marks)

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<th>Electron Group Geometry</th>
<th>Molecular Geometry</th>
<th>Bond Angle ($^\circ$)</th>
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## MULTIPLE CHOICE

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1. \(3.11 \times 10^{-20}\) J
2. \(3.31 \times 10^{-17}\) J
3. \(1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^3\)
4. 
   \[
   \begin{array}{ccccccccc}
   1s & 2s & 2p & 3s & 3p & 4s & 3d & 4p \\
   \uparrow \downarrow & \uparrow \downarrow & \uparrow \downarrow & \uparrow \downarrow & \uparrow \downarrow & \uparrow \downarrow & \uparrow \downarrow & \uparrow \downarrow \\
   \end{array}
   \]
5. \([\text{Xe}] 6s^2 4f^{14} 5d^4\)
6. Lithium-6 7.5%  
   Lithium-7 92.5%
7. 

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    \text{H}
\end{array}\hspace{1cm}O⁻ | trigonal planar | trigonal planar | 120           | (charged)      | Y              |
| NCl₃     | :Cl=N-Cl:      | tetrahedral            | trigonal pyramidal | <109.5       | P              | N              |
| PF₅      | \begin{array}{c}
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\end{array}\hspace{1cm}\begin{array}{c}
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\end{array}| trigonal bipyramidal | trigonal bipyramidal | 90 and 120 | NP             | N              |