Name: _____ Class: _____ Date: _____ ID: A

Chapter 4 Electrons--Common Summative Assessment

Multiple Choice

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

1. For electromagnetic radiation, *c* (the speed of light) equals
   a. frequency minus wavelength.
   b. frequency plus wavelength.
   c. frequency divided by wavelength.
   d. frequency times wavelength.

2. According to the particle model of light, certain kinds of light cannot eject electrons from metals because
   a. the mass of the light is too low.
   b. the frequency of the light is too high.
   c. the energy of the light is too low.
   d. the wavelength of the light is too short.

3. As it travels through space, electromagnetic radiation
   a. exhibits wavelike behavior.
   b. loses energy.
   c. varies in speed.
   d. releases photons.

4. 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.

5. The distance between two successive peaks on adjacent waves is its
   a. frequency.
   b. wavelength.
   c. quantum number.
   d. velocity.

6. A quantum of electromagnetic energy is called a(n)
   a. photon.
   b. electron.
   c. excited atom.
   d. orbital.

7. Max Planck proposed that a hot object radiated energy in small, specific amounts called
   a. quanta.
   b. waves.
   c. hertz.
   d. electrons.

8. The emission of electrons from metals that have absorbed photons is called the
   a. interference effect.
   b. photoelectric effect.
   c. quantum effect.
   d. dual effect.

9. A line spectrum is produced when an electron moves from one energy level
   a. to a higher energy level.
   b. to a lower energy level.
   c. into the nucleus.
   d. to another position in the same sublevel.

10. Because excited hydrogen atoms always produce the same line-emission spectrum, scientists concluded that hydrogen
    a. had no electrons.
    b. did not release photons.
    c. released photons of only certain energies.
    d. could only exist in the ground state.

11. For an electron in an atom to change from the ground state to an excited state,
    a. energy must be released.
    b. energy must be absorbed.
    c. radiation must be emitted.
    d. the electron must make a transition from a higher to a lower energy level.

12. If electrons in an atom have the lowest possible energies, the atom is in the
    a. ground state.
    b. inert state.
    c. excited state.
    d. radiation-emitting state.

13. The equation $E = h\nu$ 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.

14. The region outside the nucleus where an electron can most probably be found is the
    a. electron configuration.
    b. quantum.
    c. *s* sublevel.
    d. electron cloud.

15. The size and shape of an electron cloud are most closely related to the electron's
    a. charge.
    b. mass.
    c. spin.
    d. energy.

16. All of the following describe the Heisenberg uncertainly principle *except*
    a. it states that it is impossible to determine simultaneously both the position and velocity of an electron or any other particle.
    b. it is one of the fundamental principles of our present understanding of light and matter.
    c. it helped lay the foundation for the modern quantum theory.
    d. it helps to locate an electron in an atom.

17. A three-dimensional region around a nucleus where an electron may be found is called a(n)
    a. spectral line.
    b. electron path.
    c. orbital.
    d. orbit.

18. The main energy levels of an atom are indicated by the
    a. orbital quantum numbers.
    b. magnetic quantum numbers.
    c. spin quantum numbers.
    d. principal quantum numbers.

19. The number of sublevels within each energy level of an atom is equal to the value of the
    a. principal quantum number.
    b. angular momentum quantum number.
    c. magnetic quantum number.
    d. spin quantum number.

20. The spin quantum number indicates that the number of possible spin states for an electron in an orbital is
    a. 1.
    b. 2.
    c. 3.
    d. 5.

21. Each atomic orbital is described by its principal quantum number followed by the
    a. value of the electron's spin state.
    b. magnetic quantum number.
    c. number of electrons in the sublevel.
    d. letter of the sublevel.

22. A spherical electron cloud surrounding an atomic nucleus would best represent
    a. an *s* orbital.
    b. a p_x orbital.
    c. a combination of p_x and p_y orbitals.
    d. a combination of an *s* and a p_x orbital.

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

24. The *p* orbitals are shaped like
    a. electrons.
    b. circles.
    c. dumbbells.
    d. spheres.

25. An orbital that can never exist according to the quantum description of the atom is
    a. 3*d*.
    b. 8*s*.
    c. 6*d*.
    d. 3*f*.

26. The number of orbitals for the *d* sublevel is
    a. 1.
    b. 3.
    c. 5.
    d. 7.

27. The *total* number of orbitals that can exist at the second main energy level is
    a. 2.
    b. 3.
    c. 4.
    d. 8.

28. How many orientations can an *s* orbital have about the nucleus?
    a. 1
    b. 2
    c. 3
    d. 5

29. How many electrons can occupy the *s* orbitals at each energy level?
    a. two, if they have opposite spins
    b. two, if they have the same spin
    c. one
    d. no more than eight

30. A single orbital in the $3d$ level can hold ____ electrons.
    a. 10
    b. 2
    c. 3
    d. 6

31. The statement that an electron occupies the lowest available energy orbital is
    a. Hund's rule.
    b. the Aufbau principle.
    c. Bohr's law.
    d. the Pauli exclusion principle.

32. "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.

33. The statement that no two electrons in the same atom can have the same four quantum numbers is
    a. the Pauli exclusion principle.
    b. Hund's rule.
    c. Bohr's law.
    d. the Aufbau principle.

34. Which of the following lists atomic orbitals in the correct order they are filled according to the Aufbau principle?
    a. $1s\ 2s\ 2p\ 3s\ 4s\ 3p\ 3d\ 4p\ 5s$
    b. $1s\ 2s\ 2p\ 3s\ 3p\ 4s\ 3d\ 4p\ 5s$
    c. $1s\ 2s\ 2p\ 3s\ 3p\ 4s\ 4p\ 3d\ 4d$
    d. $1s\ 2s\ 2p\ 3s\ 3p\ 3d\ 4s\ 4p\ 5s$

35. Both copper (atomic number 29) and chromium (atomic number 24) appear to break the pattern in the order of filling the $3d$ and $4s$ orbitals. This change in pattern is expressed by
    a. an increase in the number of electrons in both the $3d$ and $4s$ orbitals.
    b. a reduction in the number of electrons in both the $3d$ and $4s$ orbitals.
    c. a reduction in the number of electrons in the $3d$ orbital and an increase in the $4s$ orbital.
    d. a reduction in the number of electrons in the $4s$ orbital and an increase in the $3d$ orbital.

36. The electron notation for aluminum (atomic number 13) is
    a. $1s^2\ 2s^2\ 2p^3\ 3s^2\ 3p^3\ 3d^1$.
    b. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 2d^1$.
    c. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$.
    d. $1s^2\ 2s^2\ 2p^9$.

37. An element with 8 electrons in its highest main energy level is a(n)
    a. octet element.
    b. third period element.
    c. Aufbau element.
    d. noble gas.

38. The electron configurations of the noble gases from neon to radon in the periodic table make these elements part of the
    a. f block.
    b. d block.
    c. s block.
    d. p block.

39. The elements whose electron configurations end with $s^2 p^5$ in the highest occupied energy level belong to Group
    a. 3.
    b. 7.
    c. 10.
    d. 17.

Problem

Use the periodic table below to answer the following questions.

	Group 1	Group 2	Group 13	Group 14	Group 15	Group 16	Group 17	Group 18
1	1 H Hydrogen 1.01							2 He Helium 4.00
2	3 Li Lithium 6.94	4 Be Beryllium 9.01	5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18
3	11 Na Sodium 22.99	12 Mg Magnesium 24.30	13 Al Aluminum 26.98	14 Si Silicon 28.08	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95
4	19 K Potassium 39.10	20 Ca Calcium 40.08	31 Ga Gallium 69.72	32 Ge Germanium 72.64	33 As Arsenic 74.92	34 Se Selenium 78.96	35 Br Bromine 79.90	36 Kr Krypton 83.80
5	37 Rb Rubidium 85.47	38 Sr Strontium 87.62	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.60	53 I Iodine 126.90	54 Xe Xenon 131.29
6	55 Cs Cesium 132.90	56 Ba Barium 137.33	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
7	87 Fr Francium (223)	88 Ra Radium (226)						

40. Write the noble-gas electron configuration for silicon.