

CHEMISTRY 123-01

Practice exam #5

November 09, 2007

Mass of electron = 9.11×10^{-31} kg $h = 6.63 \times 10^{-34}$ J.s $R = 2.18 \times 10^{-18}$ JSpeed of light = 3.00×10^8 m/s**All questions are multiple choice!**

1. The relationship between the speed, wavelength, and frequency of electromagnetic radiation is
- a. $\nu = \frac{c}{\lambda}$
- b. $\nu = \frac{\lambda}{c}$
- c. $\nu = c + \lambda$
- d. $\nu = \frac{\lambda + c}{\lambda}$
- e. $\nu = 1 + \frac{\lambda}{c}$
2. Which radiation has the lowest frequency?
- a. gamma rays
- b. x rays
- c. blue light
- d. red light
- e. radio waves
3. Blue light has a **lower** frequency and a **longer** wavelength than x-rays.
- a. higher, shorter
- b. higher, longer
- c. lower, lower
- d. lower, longer
- e. lower, shorter
4. According to the quantum theory, what is the energy contained in a single quantum of orange light with a frequency of $5.00 \times 10^{14} \text{ s}^{-1}$?
- a. 1.25×10^{-48} J
- b. 3.32×10^{-19} J
- c. 1.88×10^5 J
- d. 3.13×10^{13} J
- e. 6.02×10^{23} J
5. What is the energy of **ONE MOLE** of photons with a wavelength of 285 nm?
- a. 6.98×10^{-19} J
- b. 3.50×10^{-18} J
- c. 3.15×10^5 J
- d. 4.20×10^5 J
- e. 2.11×10^6 J
6. Which of the following statements is (are) **TRUE**?
1. The product of wavelength and frequency of light is a constant.
2. As the energy increases, the frequency of the radiation decreases.
3. As the wavelength of light increases, the frequency increases.
- a. 1 only
- b. 2 only
- c. 3 only
- d. 1 and 3 only
- e. 2 and 3 only
7. What is the wavelength of light emitted when the hydrogen atom undergoes a transition from level $n = 5$ to level $n = 2$?
- a. 663 nm
- b. 833 nm
- c. 546 nm
- d. 521 nm
- e. 434 nm
8. From the Bohr model of the hydrogen atom we can conclude that the energy required to excite an electron from $n = 2$ to $n = 3$ is **greater than** the energy to excite an electron from $n = 3$ to $n = 4$.
- a. less than
- b. greater than
- c. equal to
- d. either equal to or less than
- e. either equal to or greater than

9. Einstein's work on the photoelectric effect made extensive use of the equation
- $E = mc^2$.
 - $v = c/\lambda$
 - $E = -\frac{R_H}{n^2}$.
 - $E = h\nu$.
 - $\Delta E = -R_H \left(\frac{1}{n_2^2} - \frac{1}{n_1^2} \right)$
10. Which quantum number describes the orientation in space of an orbital?
- n
 - l
 - m_s
 - m_l
 - any of these
11. All the following statements about the quantum numbers are true **EXCEPT**
- n has integral values from 1 to ∞ .
 - l has values from 1 to ∞ .
 - m_l has $2l + 1$ values.
 - m_l has values of +1 to -1, including zero.
 - m_s has values of $+\frac{1}{2}$ and $-\frac{1}{2}$.
12. How many values are there for the magnetic quantum number when the value of the angular momentum quantum number is 4?
- 1
 - 3
 - 5
 - 7
 - 9
13. The contribution for which de Broglie is remembered in modern science is
- his statement that an electron can exist in an atom only in discrete energy levels.
 - his statement that no electron can have identical values for all four quantum numbers.
 - his proposal that particles of matter should be associated with wavelike behavior.
 - his statement that elements show periodic repetition of properties.
 - his statement that electrons occupy all the orbitals of a given sublevel singly before pairing begins.
14. Which of the following sets of quantum numbers is **NOT** permissible?
- $n = 1, l = 0, m_l = 0, m_s = +\frac{1}{2}$
 - $n = 4, l = 0, m_l = 0, m_s = +\frac{1}{2}$
 - $n = 3, l = 3, m_l = -3, m_s = -\frac{1}{2}$
 - $n = 2, l = 1, m_l = 1, m_s = -\frac{1}{2}$
 - $n = 2, l = 0, m_l = 0, m_s = +\frac{1}{2}$
15. All the following statements are true **EXCEPT**
- the $n = 3$ energy level has no f orbitals.
 - the 2p orbitals can have a maximum of 6 electrons.
 - the s orbital has a spherical shape.
 - there are five d orbitals in a set.
 - the third principal energy level has one set of f orbitals.
16. What orbital has the quantum numbers $n=3, l=2, m_l=-1$?
- s
 - p
 - d
 - f
 - g
17. Which of the following sets of quantum numbers refers to a 3d orbital?
- $n = 2, l = 2, m_l = 2, m_s = +1/2$
 - $n = 3, l = 2, m_l = 2, m_s = +1/2$
 - $n = 4, l = 2, m_l = 2, m_s = -1/2$
 - $n = 4, l = 3, m_l = 3, m_s = -1/2$
 - $n = 5, l = 4, m_l = 3, m_s = +1/2$

18. The value of l for a 4f electron is
- 0.
 - 1.
 - 2.
 - 3.
 - 4.
19. The principal quantum number of the valence electrons in an atom of lead is
- 2.
 - 3.
 - 4.
 - 5.
 - 6.
20. The maximum number of electrons that can occupy a d orbital is
- 2.
 - 4.
 - 8.
 - 10.
 - 18.
21. The maximum number of electrons that can occupy the 5f orbitals is
- 5.
 - 7.
 - 10.
 - 14.
 - 18.
22. The Pauli exclusion principle requires that
- both the position of an electron and its momentum cannot be known simultaneously very accurately.
 - the wavelength and mass of a subatomic particle are related by $\lambda = h/mv$.
 - the wavelength of a photon of light times its frequency is equal to the speed of light.
 - no two electrons in the same atom can have the same set of four quantum numbers.
 - an electron can have either particle character or wave character.
23. Which of the following sets of the four quantum numbers $n, l, m_l,$ and m_s describes one of the outermost electrons in a ground-state radium atom?
- 6, 1, 1, $\frac{1}{2}$
 - 7, 0, 1, $-\frac{1}{2}$
 - 7, 0, 0, $-\frac{1}{2}$
 - 7, 1, 0, $\frac{1}{2}$
 - 7, 2, 1, $-\frac{1}{2}$
24. An element that has the same valence electron configuration as phosphorus is
- antimony.
 - tellurium.
 - sulfur.
 - selenium.
 - bromine.
25. From a consideration of electronic configurations, which of the elements indicated below would be classified as a **TRANSITION** element?
- $1s^2 2s^2 2p^2$
 - $1s^2 2s^2 2p^6 3s^2 3p^5$
 - $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
 - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$
 - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$
26. Which ground-state electron configuration is **INCORRECT**?
- Cr: [Ar] 3d⁶
 - Ca: [Ar] 4s²
 - Na: $1s^2 2s^2 2p^6 3s^1$
 - Zn: [Ar] 3d¹⁰ 4s²
 - Kr: [Ar] 3d¹⁰ 4s² 4p⁶
27. The ground-state electron configuration of a Fe^{3+} ion is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$. Therefore, Fe^{3+} is
- diamagnetic.
 - paramagnetic with one unpaired electron.
 - paramagnetic with two unpaired electrons.
 - paramagnetic with three unpaired electrons.
 - paramagnetic with five unpaired electrons.

28. Which of the following atoms in its ground state is diamagnetic?
- | | |
|------------------------|-------|
| a. F | d. O |
| b. $\boxed{\text{Ne}}$ | e. Si |
| c. B | |
29. Which of the following atoms has the **LARGEST** atomic radius?
- | | |
|------------------------|-------|
| a. $\boxed{\text{Na}}$ | d. P |
| b. B | e. Cl |
| c. O | |
30. Which of the following atoms designated by electronic configurations has the highest ionization energy?
- | | |
|------------------------------------|--|
| a. $\boxed{[\text{Ne}] 3s^2 3p^2}$ | d. $[\text{Kr}] 4d^{10} 5s^2 5p^3$ |
| b. $\boxed{[\text{Ne}] 3s^2 3p^3}$ | e. $[\text{Xe}] 4f^{14} 5d^{10} 6s^2 6p^3$ |
| c. $[\text{Ar}] 3d^{10} 4s^2 4p^3$ | |
31. Which of the following elements has the highest first ionization energy?
- | | |
|-----------------------|-------|
| a. Be | d. Na |
| b. B | e. Ba |
| c. $\boxed{\text{C}}$ | |
32. Which of the series of elements listed below would have most nearly the same atomic radius?
- | | |
|-----------------------------------|-------------------|
| a. $\boxed{\text{Sc, Ti, V, Cr}}$ | d. F, Cl, Br, I |
| b. Na, K, Rb, Cs | f. Na, Mg, Al, Si |
| c. B, Si, As, Te | |
33. Which **ONE** of the following atoms should have the largest electron affinity?
- | | |
|-------------------------------|---|
| a. $1s^2 2s^2 2p^6 3s^1$ | d. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$ |
| b. $\boxed{1s^2 2s^2 2p^3}$ | e. $1s^2 2s^2 2p^6$ |
| c. $1s^2 2s^2 2p^6 3s^2 3p^2$ | |