KEY

Electrons Unit Review

E 1. hertz
H 2. quantum of energy
B 3. spectrum
D 4. energy level
G 5. atomic orbital
I 6. amplitude
J 7. wavelength
C 8. atomic emission spectrum
A 9. Aufbau principle
F 10. frequency
N 11. ground state
P 12. photon
L 13. Heisenberg uncertainty principle
K 14. Planck's constant
M 15. de Broglie's equation

A. electrons enter orbitals of lowest energy first
B. a range of colors seen when light passes through a prism
C. lines of colored light obtained by passing the light emitted by an element through a prism
D. the region around an atomic nucleus where electrons are likely to be moving
E. the SI unit of frequency
F. the number of wave cycles to pass a given point per unit of time
G. a region in space where there is a high probability of finding an electron
H. the amount of energy required to move an electron from one energy level to the next higher one
I. the height of a wave from the origin to the crest
J. the distance between crests of waves
K. 6.6262×10^{-34} J s
L. It is impossible to know both the velocity and the position of a particle at the same time.
M. predicts that all matter exhibits wavelike motions
N. the lowest energy level
O. a process in which electrons are ejected by metals when light shines on them
P. light quantum

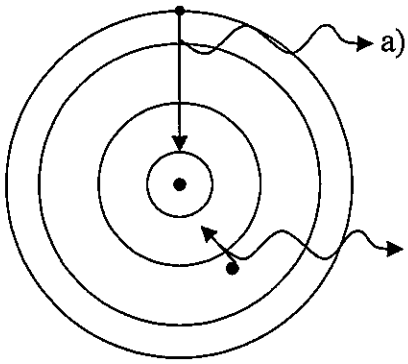
16. What is the frequency of radiation that has a wavelength of 4.7×10^{-5} cm ?

4.7×10^{-7} m.

$C = \lambda\nu$ $\quad 3.00 \times 10^{8}\ m/s = 4.7 \times 10^{-7}\ m\,(\nu)$ $\quad \nu = 6.4 \times 10^{14}\ Hz$

17. Calculate the wavelength of a photon of blue light whose frequency is $6.3 \times 10^{14}\ s^{-1}$. $C = \lambda\nu$ $\quad 3.00 \times 10^{8}\ m/s = \lambda\,(6.3 \times 10^{14}\ Hz)$

18. Find the wavelength of each of these transitions in the hydrogen atom.



a) $E = 2.04 \times 10^{-18}$ J $\quad E = h\nu$ $\quad 2.04 \times 10^{-18}\ J = 6.6 \times 10^{-34}\ J \cdot s\,(\nu)$ $\quad 3.09 \times 10^{15}\ Hz = \nu$ $\quad \lambda = 9.71 \times 10^{-8}$ m. $\quad C = \lambda\nu$ $\quad 3.00 \times 10^{8} = \lambda\,(3.09 \times 10^{15}\ Hz)$

b) $E = 1.63 \times 10^{-18}$ J $\quad 1.63 \times 10^{-18}\ J = 6.6 \times 10^{-34}\ J \cdot s\,(\nu)$ $\quad 2.47 \times 10^{15}\ Hz = \nu$ $\quad C = \lambda\nu$ $\quad 3.00 \times 10^{8}\ m/s = \lambda\,(2.47 \times 10^{15}\ Hz)$ $\quad \lambda = 1.21 \times 10^{-7}$ m.

19. An inexpensive laser that is available to the public emits light that has a wavelength of 670 nm. What is frequency of the radiation? $670\ nm = 6.70 \times 10^{-7}\ m$ $\quad C = \lambda\nu$ $\quad 3.00 \times 10^{8}\ m/s = 6.70 \times 10^{-7}\ m\,(\nu)$ $\quad \nu = 4.48 \times 10^{14}\ Hz$

True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

AT 20. Electrons must have a certain minimum amount of energy called a quantum in order to move from one energy level to the next higher energy level.
ST 21. The electron probability clouds for atomic orbitals are spherical in shape.
AT 22. The higher the energy level occupied by an electron the more energetic it is.

NT 23. The photoelectric effect will occur no matter what frequency of light strikes a metal.

AT 24. The principal quantum number equals the number of sublevels within that principal energy level.

ST 25. The orbitals of a principal energy level are lower in energy than the orbitals in the next higher principal energy level.

NT 26. As many as four electrons can occupy the same orbital.

NT 27. The Pauli exclusion principle states that an atomic orbital may describe at most two electrons.

NT 28. The speed of light is a constant that can be obtained by dividing the frequency of light by its wavelength.

NT 29. The amplitude of a wave is the distance between the crests.

ST 30. The energy of a body can change only in small discrete units.

NT 31. The position and velocity of an electron in an atom can be determined with great certainty.

~~32. The photoelectric effect will occur no matter what frequency of light strikes a metal.~~ Repeat of #23

33. What is the location of an electron with the following quantum numbers
    a. 4, 1, 0, +1/2 4TH EL, P sublevel, 2nd orbital, clockwise
    b. 4, 3, -2, -1/2 4TH EL, f sublevel 2nd orbital, counterclockwise
    c. 1, 0, 0. +1/2 1ST EL, S " , only orbital, clockwise
    d. 3, 2, +1, -1/2 3rd EL, d " -4TH " , counterclockwise

34. Are the following set of quantum numbers possible? If not, why not?
    a. 2, 1, 0, +1/2 Yes
    b. 2, ~~1~~, -1, -1/2 No no d sublevel in 2nd EL
    c. 1, ~~1~~, 0, +1/2 No no p sublevel in 1st EL
    d. 5, 2, ~~-3~~, +1/2 No no -3 orbital in d sublevel

35. What are the quantum number for the following electrons
    a. 2nd energy level, p sublevel, 3rd orbital , spinning clockwise 2, 1, 1, +1/2
    b. 3rd energy level, s sublevel, 1st orbital, spinning counterclockwise 3, 0, 0, -1/2
    c. 4th energy level, d sublevel, 4th orbital, spinning counterclockwise 4, 2, 1, -1/2