Atomic Structure MCQs

Multiple Choice Questions

1. What is the radius of the first orbit (n=1) of the hydrogen atom according to Bohr's model?
   a) 0.53 nm
   b) 0.53 Å
   c) 5.3 Å
   d) 53 nm
2. The energy of an electron in the n-th orbit of a hydrogen atom is given by:
   a) $\frac{-13.6\,\text{eV}}{n^2}$
   b) $\frac{13.6\,\text{eV}}{n^2}$
   c) $\frac{-13.6\,\text{eV}}{n}$
   d) $\frac{13.6\,\text{eV}}{n}$
3. The angular momentum of an electron in the nth orbit according to Bohr is:
   a) nh
   b) $\frac{nh}{2\pi}$
   c) $\frac{nh}{4\pi}$
   d) $\frac{nh}{\pi}$
4. The wavelength of the photon emitted during a transition from $n = 3$ to $n = 2$ in hydrogen is found using:
   a) $\frac{1}{\lambda} = R_H \left(\frac{1}{2^2} - \frac{1}{3^2}\right)$
   b) $\frac{1}{\lambda} = R_H \left(\frac{1}{3^2} - \frac{1}{2^2}\right)$
   c) $\lambda = R_H \left(\frac{1}{2^2} - \frac{1}{3^2}\right)$
   d) $\lambda = R_H \left(\frac{1}{3^2} - \frac{1}{2^2}\right)$
5. The Rydberg constant R_H has a value of:
   a) $1.097 \times 10^7\,\text{m}^{-1}$
   b) $1.097 \times 10^5\,\text{m}^{-1}$
   c) $1.097 \times 10^{-7}\,\text{m}^{-1}$
   d) $1.097 \times 10^{-5}\,\text{m}^{-1}$
6. What is the energy of the electron in the second orbit (n=2) of the hydrogen atom?
   a) -3.4 eV
   b) -1.51 eV
   c) -13.6 eV
   d) -0.85 eV
7. Which series in the hydrogen spectrum is in the visible region?
   a) Lyman series
   b) Balmer series
   c) Paschen series
   d) Brackett series

8. The transition from n=4 to n=2 in the hydrogen atom corresponds to which spectral line?
   a) Lyman alpha
   b) Balmer alpha
   c) Balmer beta
   d) Paschen alpha
9. The formula for the radius of the n-th orbit in a hydrogen atom is:
   a) $r_n = n^2 \times 0.529\,\text{Å}$
   b) $r_n = n \times 0.529\,\text{Å}$
   c) $r_n = n^2 \times 5.29\,\text{Å}$
   d) $r_n = n \times 5.29\,\text{Å}$
10. According to Bohr's model, the speed of an electron in the n-th orbit:
    a) Decreases with increasing n
    b) Increases with increasing n
    c) Remains constant
    d) Is independent of n
11. Calculate the energy of a photon emitted when an electron transitions from $n = 4$ to $n = 2$ in a hydrogen atom.
    a) 2.55 eV
    b) 3.4 eV
    c) 1.89 eV
    d) 0.85 eV
12. The angular momentum of an electron in the third orbit (n=3) is:
    a) $\frac{3h}{2\pi}$
    b) $\frac{h}{2\pi}$
    c) $\frac{9h}{2\pi}$
    d) $\frac{h}{4\pi}$
13. Which of the following is not a postulate of Bohr's model?
    a) Electrons revolve in discrete orbits
    b) Energy is radiated when electrons jump orbits
    c) Electrons can have any energy while revolving
    d) The angular momentum is quantized
14. The energy of an electron in the fourth orbit (n=4) of the hydrogen atom is:
    a) -13.6 eV
    b) -3.4 eV
    c) -0.85 eV
    d) -1.51 eV
15. What is the wavelength of the photon emitted during a transition from $n = 5$ to $n = 2$ in hydrogen?
    a) 121.6 nm
    b) 434 nm
    c) 486 nm
    d) 656 nm
16. The potential energy of an electron in the nth orbit is given by:
    a) $\frac{-Ze^2}{4\pi\epsilon_0 r_n}$
    b) $\frac{Ze^2}{4\pi\epsilon_0 r_n}$

c) $\frac{-Ze^2}{4\pi\epsilon_0 n}$
d) $\frac{Ze^2}{4\pi\epsilon_0 n}$

17. The kinetic energy of an electron in the nth orbit of hydrogen is:
a) $\frac{-Ze^2}{8\pi\epsilon_0 r_n}$
b) $\frac{Ze^2}{8\pi\epsilon_0 r_n}$
c) $\frac{-Ze^2}{4\pi\epsilon_0 r_n}$
d) $\frac{Ze^2}{4\pi\epsilon_0 r_n}$
18. The term "Bohr radius" refers to:
a) The radius of the first orbit in a hydrogen atom
b) The radius of any orbit in a hydrogen atom
c) The average radius of an electron cloud
d) The maximum radius of an electron orbit
19. Which spectral series involves transitions to the n=1 orbit in hydrogen?
a) Balmer series
b) Lyman series
c) Paschen series
d) Brackett series
20. The principal quantum number n is associated with:
a) The shape of the orbit
b) The size of the orbit
c) The orientation of the orbit
d) The spin of the electron

Answer Key

1. b
2. a
3. b
4. a
5. a
6. a
7. b
8. c
9. a
10. a
11. c
12. a
13. c
14. c
15. d
16. a
17. b
18. a
19. b
20. b