

What Bohr proposed:

1. The electron on the hydrogen atom can exist only in certain spherical orbits.
2. As the distance from the nucleus increases, the energy of an electron in that orbit increases.
3. The closest orbit (energy level) is called the ground state. Higher energy levels are called excited states.
4. When an electron falls from a higher energy level to a lower energy level, it emits a definite amount of energy that is equal to the difference in the energy of the two levels.

The energy of the n^{th} level $\longrightarrow E_n = \frac{-2.179 \times 10^{-18} \text{ J/particle}}{n^2} = \frac{-13.6 \text{ eV/particle}}{n^2}, n = 1, 2, 3$

For an electronic transition from a higher to lower level in which a photon is emitted

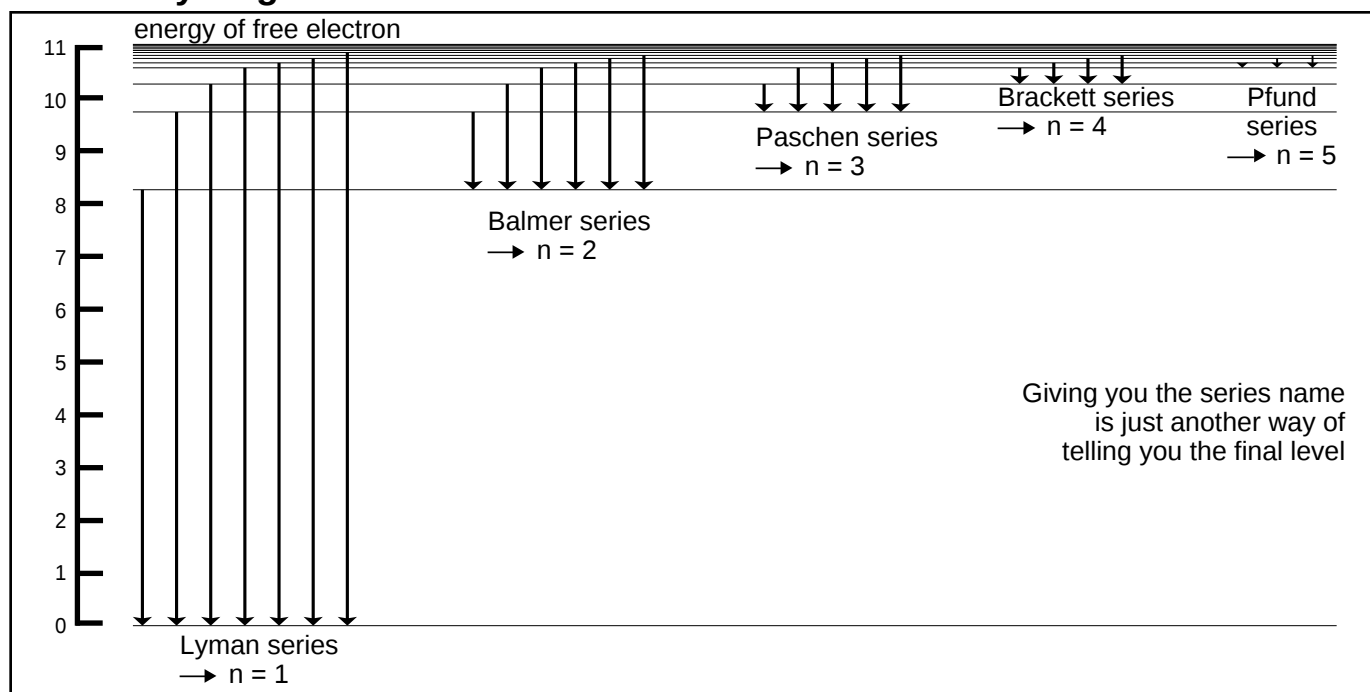
$$\Delta E = E_2 - E_1$$

$$\Delta E = h\nu = \frac{hc}{\lambda} = R_h \left[\frac{1}{n_2^2} - \frac{1}{n_1^2} \right]$$

emitted photon

$R_h = \text{Rydberg constant} = 2.18 \times 10^{-18} \text{ J}$

$n_2 = \text{final energy level}$
 $n_1 = \text{initial energy level}$

For Hydrogen:

Student Packet: 1.2: The Bohr Model: AssessMe questions

- 1) Which of the following combinations of particles represents an ion of net charge -1 and of mass number 82?
- A) 46 neutrons, 35 protons, 36 electrons
B) 46 neutrons, 36 protons, 35 electrons
C) 46 neutrons, 36 protons, 36 electrons
D) 47 neutrons, 35 protons, 36 electrons
E) I'm clueless
- 2) A neutral atom has an atomic number of 30 and a mass number of 62. The atom must contain:
- A) 92 neutrons
B) 62 electrons
C) 29 neutrons
D) 30 electrons
E) I'm clueless
- 3) A neutral atom which has 42 electrons and a mass number of 93 has
- A) an atomic number of 51.
B) a nucleus containing 51 neutrons.
C) a nucleus containing 40 neutrons.
D) a nucleus containing 51 protons.
E) I'm clueless
- 4) The symbol for a particular ion is ${}_{26}\text{M}^{2+}$. The number of electrons contained in one of these ions is:
- A) 2 B) 10 C) 12 D) 24 E) I'm clueless
- 5) What is the shape of the electron orbitals according to the Bohr model?
- A) hyperbolic B) circular C) elliptical D) parabolic E) I'm clueless
- 6) The maximum number of electrons in one Bohr atom orbit is:
- A) 1 B) 2 C) 3 D) unlimited E) I'm clueless

Student Packet: 1.2: The Bohr Model: ShowMe questions

- 1) Given that the Rydberg constant is 2.18×10^{-18} J, calculate the energy and wavelength of light required to move an electron from $n = 2$ to $n = 5$ in the hydrogen atom.

- 2) Which is more stable, a hydrogen atom with an electron in the $n = 2$ orbital or the same hydrogen atom with an electron in the $n = 1$ orbital?

- 3) What is the Heisenberg Uncertainty Principle?

- 4) What is the characteristic wavelength of an electron traveling with velocity 6.0×10^6 m/s? (mass of an electron is 9.11×10^{-31} kg)

Student Packet: 1.2: The Bohr Model: TestMe questions

- 1) Given that the Rydberg constant is 2.18×10^{-18} J, how much energy is required to move an electron from the $n = 2$ orbit out to ∞ ?
- A) 4.31×10^{-20} J
B) 8.26×10^{-17} J
C) 4.90×10^{-18} J
D) 5.45×10^{-16} J
E) 5.45×10^{-19} J
- 2) Energy is absorbed in which of the following electronic transitions in hydrogen?
- I. moving an electron from $n = 1$ to $n = 3$
II. moving an electron from $n = 3$ to $n = 1$
III. moving an electron from ∞ to $n = 1$
- A) I only
B) II only
C) III only
D) I and II
E) II and III
- 3) The Bohr model can be used to explain which of the following phenomena:
- A) the line spectrum of hydrogen
B) the wave-particle duality of electrons
C) the hybridization of atomic orbitals
D) electron density in s,p,d orbitals
E) screening of d electrons from the nucleus
- 4) What is the characteristic wavelength of a helium atom moving at a speed of 8×10^5 m/s?
- A) 1.25×10^{-10} m
B) 1.25×10^{-13} m
C) 1.25×10^{-16} m
D) 9.09×10^{-10} m
E) 9.09×10^{-13} m
- 5) Which of the following processes requires the most input of energy?
Hydrogen atom:
- A) moving an electron from $n=1$ to $n=4$
B) moving an e^- from $n=4$ to $n=10$
C) moving an e^- from $n=10$ to $n=1$
D) moving an e^- from $n=3$ to $n=6$
E) moving an e^- from $n=6$ to $n=3$