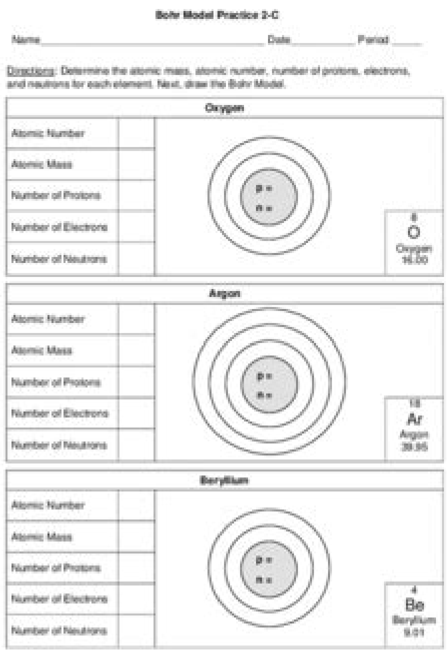
Bohr Model Practice 2 A Answer Key



Bohr Model Practice 2 A Answer Key is an essential resource for students studying atomic structure and the behavior of electrons in atoms. The Bohr model, proposed by Niels Bohr in 1913, revolutionized the understanding of atomic physics and laid the groundwork for modern quantum mechanics. This article delves into the key concepts of the Bohr model, the significance of Practice 2 A, and provides a comprehensive answer key to enhance student comprehension and application of the model.

Understanding the Bohr Model

The Bohr model of the atom represents a significant advancement in the field of atomic theory. It introduces several important concepts that help explain the arrangement of electrons around the nucleus.

Key Features of the Bohr Model

1. Quantized Energy Levels: Electrons orbit the nucleus in specific, quantized energy levels, rather than in continuous paths. Each orbit corresponds to a specific energy state.
2. Stable Orbits: Electrons in these stable orbits do not radiate energy, which means they do not spiral into the nucleus.
3. Energy Absorption and Emission: When an electron moves from a lower energy level to a higher one, it absorbs energy. Conversely, when it falls from a

higher to a lower energy level, it emits energy in the form of light.
4. Angular Momentum: Bohr introduced the quantization of angular momentum, which states that the angular momentum of an electron in orbit is an integer multiple of $\frac{h}{2\pi}$ (where h is Planck's constant).

Introduction to Practice 2 A

Practice 2 A is a set of exercises designed to reinforce the understanding of the Bohr model. It typically includes problems that focus on calculating energy levels, determining wavelengths of emitted or absorbed light, and applying the principles of the Bohr model to various scenarios.

Objectives of Practice 2 A

The main goals of Practice 2 A include:
- Enhancing problem-solving skills in atomic physics.
- Encouraging the application of theoretical concepts to practical problems.
- Building confidence in using the equations associated with the Bohr model.

Answer Key for Practice 2 A

Below is a detailed answer key for Practice 2 A, including explanations for each solution. This section will guide students through the problems and provide insight into the reasoning behind each answer.

Problem 1: Calculate the Energy Levels

Question: Calculate the energy of the electron in the n=2 level of a hydrogen atom. Use the formula:

$$
E_n = - \frac{13.6 \, \text{eV}}{n^2}
$$

Answer:

Substituting $n = 2$:

$$
E_2 = - \frac{13.6 \, \text{eV}}{2^2} = - \frac{13.6 \, \text{eV}}{4} = -3.4 \, \text{eV}
$$

Explanation: The energy of the electron in the second energy level is -3.4 eV. This negative value indicates that the electron is bound to the nucleus.

Problem 2: Wavelength of Emitted Light

Question: An electron transitions from the n=3 level to the n=1 level in a hydrogen atom. Calculate the wavelength of the emitted photon. Use the Rydberg formula:

$$
\frac{1}{\lambda} = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)
$$

where $R_H = 1.097 \times 10^7 \, \text{m}^{-1}$.

Answer:

Substituting $n_1 = 1$ and $n_2 = 3$:

$$
\frac{1}{\lambda} = 1.097 \times 10^7 \left(\frac{1}{1^2} - \frac{1}{3^2} \right) = 1.097 \times 10^7 \left(1 - \frac{1}{9} \right) = 1.097 \times 10^7 \left(\frac{8}{9} \right)
$$

Calculating:

$$
\frac{1}{\lambda} = 1.097 \times 10^7 \times \frac{8}{9} \approx 9.76 \times 10^6 \, \text{m}^{-1}
$$

Thus:

$$
\lambda \approx \frac{1}{9.76 \times 10^6} \approx 1.02 \times 10^{-7} \, \text{m} = 102 \, \text{nm}
$$

Explanation: The wavelength of the emitted photon is approximately 102 nm, which falls within the ultraviolet range of the electromagnetic spectrum.

Problem 3: Comparison of Energy Levels

Question: Compare the energy difference when an electron transitions from n=4 to n=2 and from n=3 to n=1. Use the energy level formula provided earlier.

Answer:

1. Transition from n=4 to n=2:

$$
E_4 = - \frac{13.6}{4^2} = -0.85 \, \text{eV}
$$

$$
E_2 = -3.4 \, \text{eV}
$$

Energy difference:

$$
\Delta E_{4 \to 2} = E_2 - E_4 = -3.4 - (-0.85) = -2.55 \, \text{eV}
$$

2. Transition from n=3 to n=1:

$$
E_3 = - \frac{13.6}{3^2} = -1.51 \, \text{eV}
$$

$$
E_1 = -13.6 \, \text{eV}
$$

Energy difference:

$$
\Delta E_{3 \to 1} = E_1 - E_3 = -13.6 - (-1.51) = -12.09 \, \text{eV}
$$

Explanation: The energy difference for the transition from n=4 to n=2 is 2.55 eV, while the transition from n=3 to n=1 is 12.09 eV. This indicates that larger transitions release more energy, which corresponds to shorter wavelengths of emitted light.

Conclusion

The Bohr Model Practice 2 A Answer Key serves as an invaluable tool for students looking to solidify their understanding of atomic structure. By working through the problems and utilizing the answer key, students can learn to apply the principles of the Bohr model effectively. The practice not only aids in mastering the calculations associated with energy levels and transitions but also deepens the comprehension of how atomic behavior is influenced by quantized energy states. As students progress in their studies, a firm grasp of these foundational concepts will be critical for tackling more advanced topics in quantum mechanics and atomic theory.

Frequently Asked Questions

What is the Bohr model primarily used to explain?

The Bohr model is primarily used to explain the structure of atoms, particularly the behavior of electrons in hydrogen-like atoms.

What does the '2' in 'Bohr model practice 2' refer to?

'2' typically refers to the second set of practice problems or exercises related to the Bohr model.

How do you calculate the energy levels of an electron in a hydrogen atom using the Bohr model?

The energy levels can be calculated using the formula $E_n = -13.6 \text{ eV}/n^2$, where n is the principal quantum number.

What is the significance of the principal quantum number 'n' in the Bohr model?

The principal quantum number 'n' represents the energy level of the electron, with higher values of 'n' corresponding to higher energy levels.

What is one limitation of the Bohr model?

One limitation of the Bohr model is that it only accurately describes hydrogen and hydrogen-like atoms, failing for multi-electron atoms.

What does the term 'quantization' mean in the context of the Bohr model?

Quantization refers to the idea that electrons can only occupy certain discrete energy levels, and cannot exist in between these levels.

In practice problems related to the Bohr model, what type of calculations are commonly required?

Common calculations include finding the wavelength of emitted or absorbed light during electron transitions, and calculating energy differences between levels.

What role does the Rydberg constant play in the Bohr model?

The Rydberg constant is used in the Rydberg formula to predict the wavelengths of spectral lines in hydrogen and other hydrogen-like atoms.

How can the Bohr model be applied to understand atomic spectra?

The Bohr model explains atomic spectra by showing how electrons transition between energy levels, emitting or absorbing photons at specific wavelengths.

What is a common method for verifying answers in 'Bohr model practice 2'?

Answers can be verified by cross-referencing with the established formulas of the Bohr model and checking spectral data for accuracy.

Bohr Model Practice 2 A Answer Key

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