ASSIGNMENT 17

27 Marks Total

The Rutherford and Bohr Models of the Atom

This assignment is worth 27 marks. The value of each question is noted in the left margin in parenthesis. Note: The answer areas will expand to fit the length of your response.

1. According to Maxwell's Laws of electromagnetism, the orbital frequency (the number of complete orbits per second) of an electron will match the frequency of the emitted radiation.

(1) a. If an electron spirals into the nucleus, what would happen to the electron's orbital frequency?

Answer:

(1) b. If an electron spirals into the nucleus, what would happen to the frequency of the emitted radiation?

Answer:

(2) c. If an electron spirals into the nucleus, what kind of spectrum would be produced – a continuous spectrum or a line spectrum? Explain.

Answer:

2. Review the emission spectrum of hydrogen below and answer the two questions that follow.

(1) a. What kind of spectrum is this?

Answer:

(1) b. Does Rutherford's model predict the correct spectrum?

Answer:

(1) **3.** According to Bohr, why did an atom not collapse in on itself while its electrons traveled around the nucleus?

Answer:

(1) **4.** According to Bohr, what is happening in the atom when a photon of light is emitted?

Answer:

(1) **5.** According to Bohr, what is happening in the atom when a photon of light is absorbed?

Answer:

6. When you learned about the energy levels of hydrogen, an energy level diagram was introduced. On this diagram, the n = ∞ energy level was represented. Go to the Hydrogen Atom simulation (Unit D), and complete the n = 1 to n = ∞ transition. Observe the energy state data.

a. (1) What is the energy of the n = ∞ energy level?

Answer:

b. (1) If an electron is initially in the ground state, how much energy must be absorbed by the atom for its transition to the ∞ energy level?

Answer:

7. In a hydrogen atom, the electron jumps from the n = 1 level to the n = 4 level.

a. (1) During the transition from n = 1 to n = 4, is a photon emitted or absorbed?

Answer:

b. (1) What is the change in energy of the electron?

Answer:

(1) c. Identify the transition on the energy level diagram below **or** state in words what the transition is.

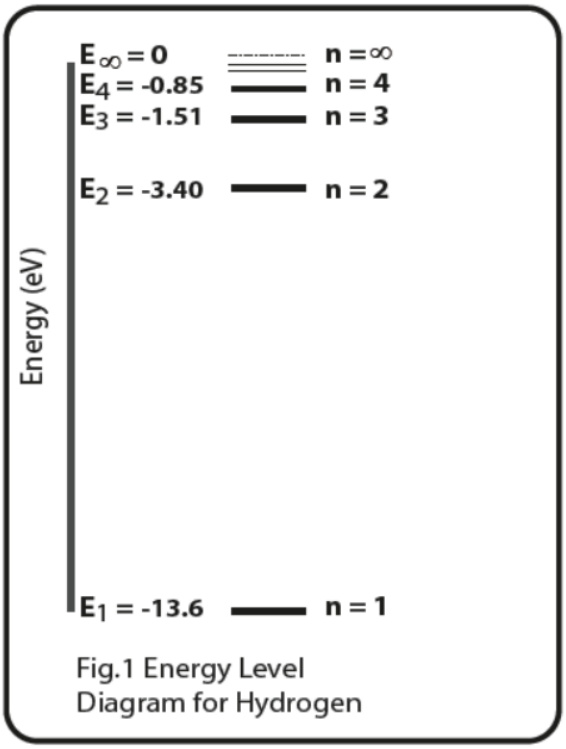

Fig.1 Energy Level Diagram for Hydrogen

Answer:

(2) d. What is the wavelength of the emitted or absorbed photon?

Answer:

(3) **8.** An electron in the 3rd stationary state around a hydrogen atom has an energy value of -1.512 eV. What will the electron's energy be if the hydrogen atom absorbs a photon with a wavelength of 1090 nm?

Answer:

(2) **9.** Calculate the shortest wavelength photon that is emitted in the hydrogen atom.

Answer:

(1) **10.** Regarding the shortest wavelength photon emitted in the hydrogen atom, what energy transition emits this photon?

Answer:

(2) **11.** Rutherford concluded that the nucleus of an atom is very tiny compared to the entire atom. Why did he think this?

Answer:

(2) **12.** Describe the major problem with Rutherford's Planetary Model.

Answer:

(1) **13.** An absorption spectrum is produced when white light is passed through a cool gas and then is viewed through a diffraction grating. The EMR for an absorption spectrum of an element is produced by _____.

A. centripetal acceleration of the electron within the element
B. electrons within the element dropping from the exited state as they absorb energy
C. electrons within the element moving to an excited state as they absorb energy
D. the nucleus of an atom moving from a low energy state to a high energy state as it absorbs energy

Of the four choices above that could complete the statement, which is correct?

Answer:

When you have completed all of the questions in this assignment, submit your work.