

Question 1

Consider an electron, with mass m_e , orbiting a proton in a circle with radius r . Let F be the magnitude of the force on the electron and U the electric potential energy of the electron.

Which of the following is true as r increases?

1. F increases, U increases.
2. F increases, U decreases.
3. F decreases, U increases.
4. F decreases, U decreases.

Question 2

Consider an electron, with mass m_e , orbiting a proton in a circle with radius r . Let v be the speed of the electron.

Which of the following does Newton's second law yield?

1. $m_e v = \frac{1}{4\pi\epsilon_0} \frac{e^2}{r}$

2. $m_e v = \frac{1}{4\pi\epsilon_0} \frac{e^2}{r^2}$

3. $m_e v^2 = \frac{1}{4\pi\epsilon_0} \frac{e^2}{r}$

4. $m_e v^2 = \frac{1}{4\pi\epsilon_0} \frac{e^2}{r^2}$

Question 3

In the Bohr model, the energy levels can be labeled with an integer n . Visible light is emitted when the atom undergoes a transition from a level with $n > 2$ into one with $n = 2$.

$$-0.85 \text{ eV} \text{ — } n = 4$$

$$-1.51 \text{ eV} \text{ — } n = 3$$

$$-3.40 \text{ eV} \text{ — } n = 2$$

$$-13.6 \text{ eV} \text{ — } n = 1$$

The frequency of blue light is larger than the frequency of red light. Which of the following is true?

1. Blue light and red light are each produced from a transition involving the same energy level to the $n = 2$ level.
2. Blue light is produced from a transition from a level that is closer in energy (than for red light) to the $n = 2$ level.
3. Red light is produced from a transition from a level that is closer in energy (than for blue light) to the $n = 2$ level.