Which of the following principles of classical physics is violated in the Bohr model?

(A) Opposite charges attract with a force inversely proportional to the square of the distance between them.

(B) The force on an object is equal to its mass times its acceleration.

(C) Accelerating charges radiate energy.

(D) Particles always have a well-defined position and momentum.

(E) All of the above.

Consider the Bohr model for the hydrogen atom and compare

the total energy (smaller in 2nd)

the potential energy (smaller in 2nd)

the kinetic energy (larger in 2nd)

$$E_n = \frac{E_1}{n^2} \quad \text{with} \quad E_1 = -\frac{1}{2}\frac{mk^2e^4}{\hbar^2}$$

$$PE_n = 2E_n$$

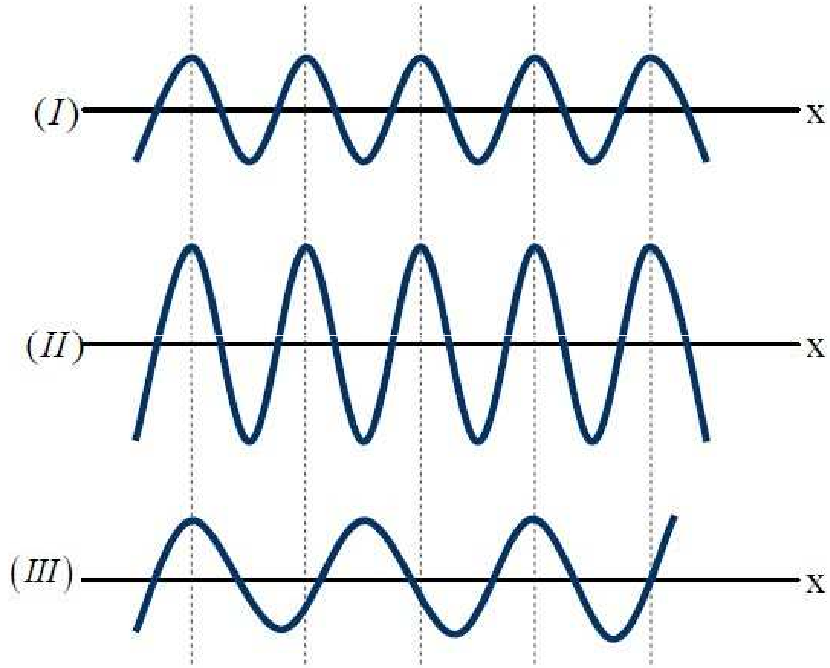
$$KE_n = -E_n$$

of an electron in the 2nd stationary orbital to that of an electron in the 3rd stationary orbital.

Larger / smaller / equal / not enough information

Three particles of equal mass are traveling in the same direction. The de Broglie waves of the three particles are as shown.

Rank the kinetic energies of the particles I, II and III.



(A) $E_{II} > E_{I} > E_{III}$

(B) $E_{II} < E_{III} < E_{I}$

(C) $E_{I} = E_{II} < E_{III}$

(D) $E_{III} < E_{I} = E_{II}$

(E) $E_{II} > E_{I} = E_{III}$

Three types of particles with the same momentum – electron, protons and C_{60} molecules – were sent through a double-slit and detected on a screen. Which showed the greatest spacing between nodes?

(A) Electrons

(B) Protons

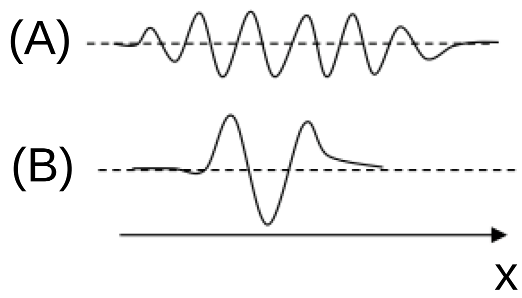
(C) C_{60} molecules

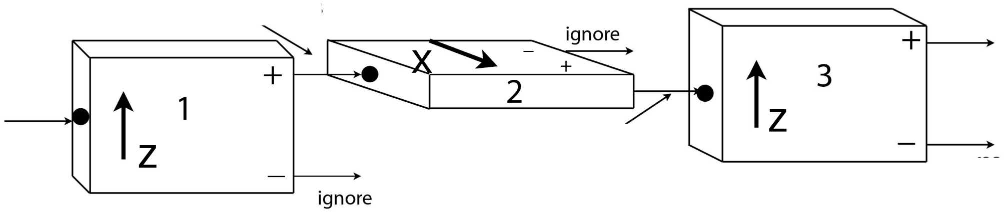
(D) They were all the same, since the momentum is the same.

Wave functions for two different electron wave packets are as shown.

Which of the two is made up of less frequency components? (A)

Which of the two has a larger uncertainty in position? (A)





Possible questions:

- State after 2nd analyzer? $|\uparrow_x>$
- Average value $<m_z>$ for 3rd analyzer? 0
- Probability to leave + channel of 3rd analyzer, if

  initially spin state is prepared as $|\uparrow_z>$ 25%

  initially spin state is random

  50% x 50% x 50% = 12.5%