

6 הק'ו'ב'א ס'ב'ט

$$\frac{F_q}{F_g} \text{ ?} \quad \text{:on' } \textcircled{1}$$

$$F_q = k \frac{e^2}{r^2}$$

$$F_g = G \frac{m_p m_e}{r^2}$$

$$\frac{F_q}{F_g} = \frac{k \frac{e^2}{r^2}}{G \frac{m_p m_e}{r^2}} = \frac{k e^2 \cancel{r^2}}{G m_p m_e \cancel{r^2}} = \frac{k e^2}{G m_p m_e}$$

$$= \frac{8.99 \times 10^9 \frac{\text{kg} \cdot \text{m}^3}{\text{s}^2 \cdot \text{C}^2} \times (-1.6 \times 10^{-19} \text{C})^2}{6.77 \times 10^{-11} \frac{\text{m}^3}{\text{kg} \cdot \text{s}^2} \times 1.67 \times 10^{-27} \text{kg} \times 9.11 \times 10^{-31} \text{kg}}$$

$$= \frac{23.014}{103} \times 10^{40} \approx 2 \times 10^{39} \leftarrow \text{on'}$$

$$r = n^2 \left(\frac{\hbar^2}{k m_e e^2} \right)$$

$\textcircled{2}$

• $n = 2$

• $k = 8.99 \times 10^9 \frac{\text{kg} \cdot \text{m}^3}{\text{s}^2 \cdot \text{C}^2}$

• $m_e = 9.11 \times 10^{-31} \text{kg}$

• $\hbar = 1.05 \times 10^{-34} \text{J} \cdot \text{s}$

• $e = -1.6 \times 10^{-19} \text{C}$

$$1 \text{ J} = 1 \text{ kg} \frac{\text{m}^2}{\text{s}^2}$$

-2-

$$r = 2^2 \times \frac{1.05 \times 10^{-34} \text{ kg} \frac{\text{m}^2}{\text{s}^2} \cdot \text{s}}{8.99 \times 10^9 \frac{\text{kg} \cdot \text{m}^3}{\text{s}^2 \text{C}^2} \times 9.11 \times 10^{-31} \text{ kg} \times (-1.6 \times 10^{-19} \text{ C})^2}$$

$$= 4 \times \frac{1.1 \times 10^{-68} \text{ m}}{209.6 \times 10^{-60}} \approx 2.1 \times 10^{-10} \text{ m} \approx \frac{2.1}{10^{10}} \text{ m}$$

$$\boxed{v = \lambda \cdot \nu}$$

③

$$\nu = 6 \text{ s}^{-1} = 6 \text{ Hz}$$

$$\lambda = 12 \text{ cm} = 0.12 \text{ m}$$

$$v = \lambda \cdot \nu = 0.12 \text{ m} \times 6 \text{ s}^{-1}$$

$$= 0.72 \frac{\text{m}}{\text{s}}$$

$$v = 0.72 \frac{\text{m}}{\text{s}} = 72 \frac{\text{cm}}{\text{s}} = 7.2 \times 10^{-4} \frac{\text{km}}{\text{s}}$$

$$= \frac{7.2 \times 10^{-4} \frac{\text{km}}{\text{s}}}{\frac{1}{3600}} \frac{\text{km}}{\text{h}} \approx 2.6 \frac{\text{km}}{\text{h}}$$