

Quiz 3: Electric Potential

$$\Delta V = |\vec{E}| |\Delta \vec{x}| \quad \Delta PE = q\Delta V \quad KE = \frac{1}{2}mv^2 \quad F = ma \quad F = qE$$
$$e = 1.6 \times 10^{-19} \text{ [C]} \quad m_e = 9.11 \times 10^{-31} \text{ [kg]} \quad m_p = 1.67 \times 10^{-27} \text{ [kg]}$$

1. It takes $3 \times 10^6 \text{ J}$ of energy to fully recharge a 9 V battery. How many electrons must be moved across the $\Delta V = 9 \text{ V}$ potential difference to fully recharge the battery? One electron has a charge of $-e$, given above.

2. An electron initially at rest is accelerated through a potential difference of 1 V, and gains kinetic energy KE_e . A proton, also initially at rest, is accelerated through a potential difference of -1 V , and gains kinetic energy KE_p . Is the electron's kinetic energy larger, smaller, or the same compared to the protons? Justify your answer. Note that the proton mass m_p is about 1000 times the electron mass m_e .

3. A "free" electron and a "free" proton are placed in an identical electric field. Which of the following statements are true? *Check all that apply.*

- Each particle is acted on by the same electric force and has the same acceleration.
- The electric force on the proton is greater in magnitude than the force on the electron, but in the opposite direction.
- The electric force on the proton is equal in magnitude to the force on the electron, but in the opposite direction.
- The magnitude of the acceleration of the electron is greater than that of the proton.
- Both particles have the same acceleration.