CAS PY 106

Pre-Session 6 Note

Electric Potential Energy

1. Electric potential energy (uniform field)
2. For object with mass in uniform gravitational field, charge in gravitational potential energy is Change in Ug = mgh
3. Similarly, for a charge q moving distance d parallel to electric field, the change in potential energy is Change in Ue = qEd where d is distance we move object opposite to the direction of the force.
4. In other words, moving the object up, when electric force is down, increases electric potential energy of system
5. In all cases, change in potential energy is positive if the object is moved opposite to the force applied by the field, and negative if it is moved in the same direction as the force applied by the field
6. When electric field is uniform and downward and you move positive charge up in the field, potential energy increases. However, if you move negative charge up in electric field at the same downward field, moving up the negative charge causes electric potential energy to decrease
7. Neglecting gravity, when ball of mass m with charge q is released from rest into uniform electric field E, we can find the speed using energy conservation. If potential energy is 0 at the final point, we use kinetic energy 1/2mv^2.

qEh = 1/2mv^2

v = (2qE/m)^.5

1. Which way does it go?
2. Masses and positive charges behave similarly, but negative charges move opposite in direction to positive charges. In all cases, object accelerates in the direction of decreasing potential energy, whether the field is uniform or non-uniform
3. Another way to say is that the object accelerates in the direction of the force applied by the field.
4. That force always points in the direction of decreasing potential energy
5. Electric potential energy (for point charges)
6. There is an electric potential energy associated with two charged objects, of charge q and Q, separated by distance r

Ue = kqQ/r

1. Note that potential energy is defined zero when r = infinity
2. Potential energy is positive if the signs on charges are the same (repel) or negative if the signs on the charges are different (attract)