

**University of Al-Mustaqbal**

**College of Science**

**Department of Medical Physics**

**Electricity**

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**first stage**

**Electric potential, Potential and the electric field and A group of point charges**

**Lecture Six**

***Outline***

1. **Electric potential**
2. **Potential and the electric field**
3. **A group of point charges**
4. **References**


# Electric potential

When a test charge q0 is placed in an electric field E created by some other charged object, the electric force acting on the test charge is q0E.

The force q0 E is conservative, because the force between charges describe

by Coulomb’s law is conservative. If the test charge is moved in the field by some external agent from point A to point B by a displacement ds, the work done by the electric field on the charge is equal to the negative of the work done by the external agent causing the displacement.

For an infinitesimal displacement ds, the work done by the electric field on the charge is:

As this amount of work is done by the electric field, the potential

energy of the charge field system is decreased by an amount:

The change in potential energy of the system is:

The potential energy per unit charge U/q0 is independent of the value of q0 and has a value at every point in an electric field. This quantity U/q0 is called the **electric potential V**.

Thus, the electric potential at any point in an electric field is

**Note:** The fact that potential energy U is a scalar quantity means that electric potential V also is a scalar quantity.

# Potential and the electric field

When the electric field E is directed downward as shown in Figure 1, a point B is at a lower electric potential than point A. When a positive test charge moves from point A to point B, its loses

electric potential energy.

**Electric field lines** always point in the direction of decreasing electric potential, as shown in

Figure 1.

Now suppose that a test charge q0 moves from A to B. We can calculate the change in its **potential energy**

From this result, if q0 is **positive**, then **ΔU** is **negative**. We conclude that a **positive** charge **loses** electric potential energy when it moves in the direction of the electric field. While q0 is **negative**, then ΔU is **positive** and the situation is reversed: A **negative** charge **gains** electric potential energy when it moves in the direction of the electric field.


# A group of point charges

