

Guided Exploration: AR Model of a Parallel Plate Capacitor

Group ID:		Date:	
Student Name			
Members present			

Objective

To explore uniform electric fields and equipotential surfaces in a parallel-plate capacitor using an Augmented Reality (AR) model.

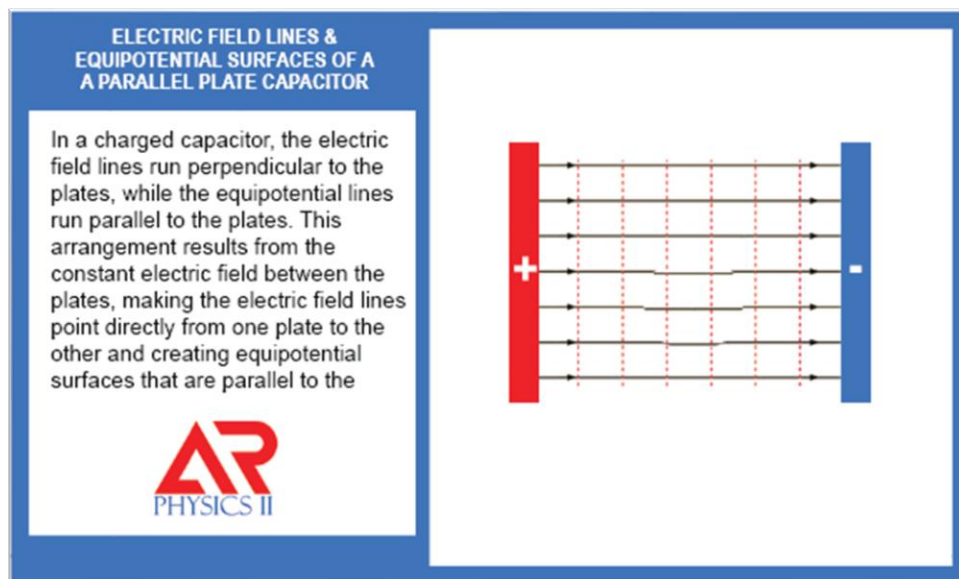


Figure 1: AR Marker for the parallel plate capacitor

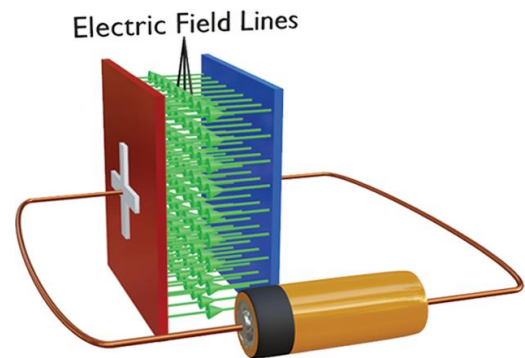
Part A: Getting Started with the AR Capacitor

1. Launching the Model

- Open the AR application.
- Scan the above marker
- Move around to view the plates, field lines and the equipotential surfaces from multiple angles.

2. What you should see

- Two large conducting plates: one positively charged, one negatively charged connected to a battery
- Straight electric field lines between the plates.
- Equipotential surfaces represented as parallel planes to the conducting plates



Guided Exploration: AR Model of a Parallel Plate Capacitor

Part B: Guided Exploration and discussions

3. Properties of the Electric Field Lines

- Move your device to view the region directly between the plates. Are the field lines straight and evenly spaced? (Yes/No)
 - Is the field uniform between the plates (Yes/No) (note: Edge effects are not depicted in the model for simplicity)
 - Observe the arrow direction of the field lines. Which way do they point?
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- Are the field lines perpendicular to the charge plates? (Yes/No)
 - Are there field lines outside the capacitor? (Yes/No). What does this suggest about the electric field outside of an ideal capacitor?
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4. Properties of the Equipotential Surfaces

- Observe the equipotential surfaces from different angles and positions between the plates.
- Are the equipotential surfaces perpendicular to the electric field lines? (YES / No)
- Do the equipotential surfaces appear parallel to the plates? (Yes/No)
- Observe how the magnitude of the electric potential change from the positive plate to the negative plate
- Is the spacing of the equipotential surfaces uniform (Yes/No)

Think Pair Share

Imagine you are a tiny positive test charge placed inside the parallel plate capacitor, right on one of the electric field lines. Which direction would you naturally begin to move? As you travel along the field line, how does the electric potential change, does it increase or decrease? What happens to your kinetic energy as you move? Now imagine you somehow can drift perpendicular to the electric field lines. Would the electric potential change in that direction, or would it remain the same? Describe your journey to a friend, explaining how both the potential and your kinetic energy change as you move inside the capacitor.

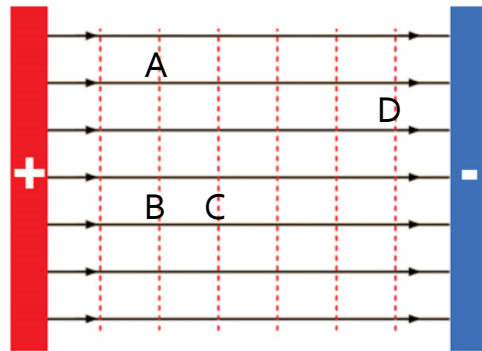
Guided Exploration: AR Model of a Parallel Plate Capacitor

Part C: Applying Knowledge (Near & Far Transfer)

- 1) The electric field between the plates of a parallel plate capacitor is:
 - a) Radially outward from the center of the plates.
 - b) Uniform and perpendicular to the plates.
 - c) Stronger near the edges of the plates and weaker at the center.
 - d) Parallel to the plates and varies in strength.

- 2) In a parallel plate capacitor, the equipotential surfaces are:
 - a) Concentric spheres centered at the midpoint of the plates.
 - b) Parallel planes perpendicular to the electric field lines.
 - c) Curved surfaces that converge near the edges of the plates.
 - d) Cylindrical surfaces oriented along the plate edges.

Consider the following diagram of a parallel plate capacitor.



- 3) In the above figure, the potential difference between points is minimum/zero between
 - a) B and C
 - b) B and D
 - c) A and B
 - d) C and D

- 4) In the above figure, the electric field strength is strongest at
 - a) A
 - b) B
 - c) C
 - d) They are the same at all points

Guided Exploration: AR Model of a Parallel Plate Capacitor

- 5) The order of potential from largest to smallest
 - a) D, C, B, A
 - b) A, B, C, D
 - c) B = C, A, D
 - d) A = B, C, D

- 6) The spacing of equipotential surfaces between the plates of a parallel plate capacitor (ignore edge effects):
 - a) Increases with distance from the plates.
 - b) Decreases with distance from the plates.
 - c) Is uniform, indicating a constant potential gradient.
 - d) Is irregular.

- 7) If a positive test charge is placed between the plates of a parallel plate capacitor, how will it move?
 - a) Along a circular path between the plates.
 - b) Tangentially along the equipotential surfaces.
 - c) Perpendicularly to the equipotential surfaces toward the negative plate.
 - d) Randomly, depending on the charge distribution.

- 8) The strength of the electric field between the plates of a parallel plate capacitor is proportional to:
 - a) The distance between the plates.
 - b) The charge density on the plates.
 - c) The thickness of the plates.
 - d) The shape of the plates.

- 9) Two parallel plates have charges of equal magnitude but opposite sign. What change could be made to increase the field strength between the plates?
 - a) Increase the magnitude of the charge on both plates.
 - b) Decrease the magnitude of the charge on both plates.
 - c) Increase the distance between the plates.
 - d) Decrease the distance between the plates.

- 10) At any point inside a capacitor, the electric field vectors are:
 - a) Perpendicular to the electric field lines
 - b) Tangent to the equipotential surface at that point.
 - c) Tangent to the electric field lines at that point.
 - d) Parallel to the equipotential surface at that point.