

Easy

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Consider the following statements regarding Dielectrics: 1. Dielectric materials reduce electric field within them due to polarization effects. 2. Relative

A

2 and 3 only

B

1 and 4 only

C

1, 2 and 3 only

Correct

D

All of the above

Correct Answer: C

Full Detailed Explanation

Correct Answer: C - 1, 2 and 3 only Quick Concept Explanation Bound charges created by polarization oppose the applied field inside the material and increase capacitance for a fixed geometry. Relative permittivity is the ratio ϵ_r / ϵ_0 and is at least unity for ordinary passive dielectrics in elementary electrostatics. Key relation: $C = \epsilon_r C_0 = \epsilon_r A/d$. Exam focus: Higher permittivity raises capacitance; it does not do so by increasing the internal electric field. Common trap: Do not confuse increased capacitance with increased field strength. Statement-wise Verification Statement 1 - Correct. Dielectric materials reduce electric field within them due to polarization effects. A dielectric polarizes in an electric field. Statement 2 - Correct. Relative permittivity is always greater than or equal to unity for dielectric materials. Relative permittivity is the ratio ϵ_r / ϵ_0 and is at least unity for ordinary passive dielectrics in elementary electrostatics. Statement 3 - Correct. Polarization results from alignment of dipoles within the material. Bound charges created by polarization oppose the applied field inside the material and increase capacitance for a fixed geometry. Statement 4 - Incorrect. Dielectrics increase capacitance by increasing electric field strength. A dielectric increases capacitance through higher permittivity/polarization; for fixed free charge it reduces the internal field.