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Q1. Write down the Maxwell's equations in differential form and explain the physical significance of each.

Ans. Maxwell's equations are a set of four equations that describe the behavior of electric and magnetic fields. They are:

1. Gauss's law for electricity: $\nabla \cdot \mathbf{E} = \frac{\rho}{\varepsilon_0}$

This equation states that the electric flux through a closed surface is proportional to the charge enclosed by the surface.

2. Gauss's law for magnetism: $\nabla \cdot \mathbf{B} = 0$

This equation states that there are no magnetic monopoles.

3. Faraday's law of induction: $\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$

This equation states that a changing magnetic field induces an electric field.

4. Ampere's law with Maxwell's correction: $\nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \mu_0 \varepsilon_0 \frac{\partial \mathbf{E}}{\partial t}$

This equation states that a changing electric field induces a magnetic field.