Class 15: Maxwell's Equations—Problem Solving

AP Physics

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Olympiads School

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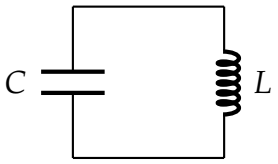
Circuits



An ideal circuit consists of a capacitor C and inductor L. The capacitor is fully charged. The switch is closed at time $t = 0$. Which of the following statements is true of the behavior of the circuit after the switch is closed?

(a) The capacitor will discharge through the inductor, and the current will decrease to zero.

(b) The capacitor will discharge through the inductor, transferring potential energy to kinetic energy.

(c) The capacitor will discharge through the inductor, transferring energy to the inductor, then the inductor will recharge the capacitor.

(d) The capacitor will discharge through the inductor, and the inductor will store the charge.

(e) The capacitor will not discharge through the inductor, so there will be no current.

Files for You to Download

Download from the school website:

1. `17-emReview.pdf`—This presentation. The slides only contain the problems that we are solving in class, but you will have to follow (and write) the solution yourself.

Maxwell's Equations

Which of the Maxwell's equations below indicates that there are no magnetic monopoles?

(a) $\int \mathbf{E} \cdot d\mathbf{A} = \frac{q}{\varepsilon_0}$

(b) $\int \mathbf{B} \cdot d\mathbf{A} = 0$

(c) $\int \mathbf{B} \cdot d\ell = \mu_0 I_{\text{inc}}$

(d) $\int \mathcal{E} = \mathbf{E} \cdot d\ell = -\frac{d\Phi}{dt}$

(e) $\int \mathbf{g} \cdot d\mathbf{A} = -4\pi GM$

Maxwell's Equations

Which of the Maxwell's equations below relates electric flux to charge enclosed in a closed surface?

(a) $\int \mathbf{E} \cdot d\mathbf{A} = \frac{q}{\varepsilon_0}$

(b) $\int \mathbf{B} \cdot d\mathbf{A} = 0$

(c) $\int \mathbf{B} \cdot d\ell = \mu_0 I_{\text{inc}}$

(d) $\int \mathcal{E} = \mathbf{E} \cdot d\ell = -\frac{d\Phi}{dt}$

(e) $\int \mathbf{g} \cdot d\mathbf{A} = -4\pi G M$

Maxwell's Equations

Which of the Maxwell's equations below relates the electric field produced to a changing magnetic flux?

(a) $\int \mathbf{E} \cdot d\mathbf{A} = \frac{q}{\varepsilon_0}$

(b) $\int \mathbf{B} \cdot d\mathbf{A} = 0$

(c) $\int \mathbf{B} \cdot d\ell = \mu_0 I_{\text{inc}}$

(d) $\int \mathcal{E} = \mathbf{E} \cdot d\ell = -\frac{d\Phi}{dt}$

(e) $\int \mathbf{g} \cdot d\mathbf{A} = -4\pi GM$