

13. Electromagnetic Induction

Starter Quiz · 课前小测

AP Physics C: Electricity and Magnetism

Name: _____ Score: _____

1. Magnetic flux through a flat loop is:

☐ $BA \cos \theta$

☐ $BA \sin \theta$

☐ B/A

☐ $B + A$

2. Faraday's law says the induced EMF depends on:

☐ the flux itself

☐ the rate of change of flux

☐ the wire's resistance

☐ the coil's colour

3. The induced current in a coil always flows so that its magnetic field:

☐ helps the change in flux

☐ opposes the change in flux

☐ points north always

☐ does nothing

4. The self-induced EMF of an inductor is:

☐ $-L \, dI/dt$

☐ $-L I$

☐ $-I/L$

☐ $-L/t$

5. The time constant of an LR circuit is:

☐ RC

☐ L/R

☐ R/L

☐ LR

6. A 2 T field passes straight through ($\theta = 0$) a 0.3 m^2 loop. Find the flux (in Wb).

_____ Wb

7. A coil in a strong but steady magnetic field has zero induced EMF.

☐ True ☐ False

8. A 4 H inductor's current changes at 2 A/s. Find the induced EMF magnitude (in V).

_____ V

9. An LR circuit has $L = 10 \text{ H}$ and $R = 5 \, \Omega$. Find τ (in s).

_____ s

10. An LC circuit has $L = 4 \text{ H}$ and $C = 1 \text{ F}$. Find ω (in rad/s).

_____ rad/s

AP Physics C: Electricity and Magnetism

1. $BA \cos \theta$

$$\Phi_B = \vec{B} \cdot \vec{A} = BA \cos \theta.$$

2. **the rate of change of flux**

$$\varepsilon = -N d\Phi_B/dt \text{ — the rate of change of flux.}$$

3. **opposes the change in flux**

Lenz's law: the induced field always opposes the change.

4. $-L dI/dt$

$$\varepsilon = -L dI/dt \text{ — proportional to the rate of current change.}$$

5. L/R

For an LR circuit $\tau = L/R$.

6. **0.6 Wb**

$$\Phi_B = BA \cos 0 = 2 \times 0.3 \times 1 = 0.6 \text{ Wb.}$$

7. **True**

No change in flux means no induced EMF, however strong the field.

8. **8 V**

$$|\varepsilon| = L dI/dt = 4 \times 2 = 8 \text{ V.}$$

9. **2 s**

$$\tau = L/R = 10/5 = 2 \text{ s.}$$

10. **0.5 rad/s**

$$\omega = 1/\sqrt{LC} = 1/\sqrt{4} = 0.5 \text{ rad/s.}$$