13. Electromagnetic Induction

Starter Quiz ·

AP Physics C: Electricity and Magnetism Name: _____ Score: _____

1. Magnetic flux through a flat loop is:

   ☐ B/A

   ☐ $BA\cos\theta$

   ☐ $B + A$

   ☐ $BA\sin\theta$

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

   ☐ the wire's resistance

   ☐ the flux itself

   ☐ the rate of change of flux

   ☐ 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

   ☐ does nothing

   ☐ points north always

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

   ☐ $-L/t$

   ☐ $-L\,dI/dt$

   ☐ $-L\,I$

   ☐ $-I/L$

5. The time constant of an LR circuit is:

   ☐ RC

   ☐ L/R

   ☐ LR

   ☐ R/L

6. An LC circuit has $L = 4$ H and $C = 1$ F. Find ω (in rad/s).

   _____ rad/s

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

   _____ Wb

8. A coil in a very strong but steady magnetic field has a large induced EMF.

   ☐ True ☐ False

9. The induced current creates a force that opposes the motion causing it (a drag).

   ☐ True ☐ False

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

    _____ V

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**

   $\varepsilon = -N\,d\Phi_B/dt$ – the rate of change of flux.

3. **opposes the change in flux**

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

4. $-L\,dI/dt$

   $\varepsilon = -L\,dI/dt$ – proportional to the rate of current change.

5. L/R

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

6. **0.5 rad/s**

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

7. **0.6 Wb**

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

8. **False**

   False. Induced EMF depends on the rate of change of flux. A steady field, however strong, gives no change in flux and so no EMF.

9. **True**

   The opposition acts as a drag; your work becomes electrical energy.

10. **8 V**

    $|\varepsilon| = L\,dI/dt = 4\times 2 = 8$ V.