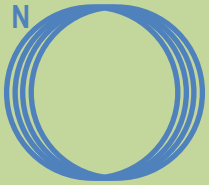
CONCEPT: FARADAY'S LAW

- Changing magnetic field through conducting loops creates an _____.
  - This is actually due to a changing MAGNETIC FLUX →
  - Faster changes → Higher induced EMFs & currents! →

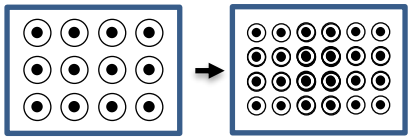
- **Faraday's Law:** Induced EMF is the **rate** at which the magnetic flux changes with time.

$\mathcal{E}_{ind} = i_{ind}R =$ _____ → Units: ___



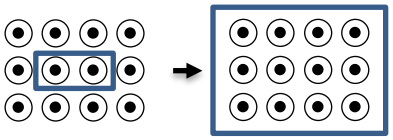
- Remember! $\Phi_B = BA\cos\theta$
  - In problems, one variable will always _____ while the other two remain _____.

Changing _____



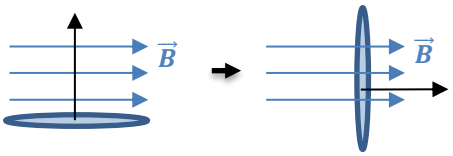
B	A	Cos Θ
Changing	Constant	Constant

Changing _____



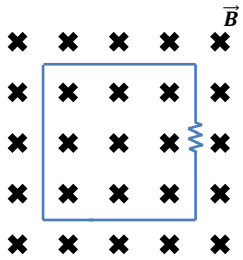
B	A	Cos Θ
Constant	Changing	Constant

Changing _____



B	A	Cos Θ
Constant	Constant	Changing

EXAMPLE: **a)** What is the induced EMF in the following circuit, with an area of 50 cm^2, if the magnetic field changes from 3T to 6T in 5s? **b)** What is the induced current, if the resistor in the circuit has a resistance of 2 Ω?



PRACTICE: FARADAY'S LAW AND SOLENOIDS

A tightly-wound 200-turn rectangular loop has dimensions of 40cm by 70cm. A constant magnetic field of 3.5T points in the same direction as the normal of the loop. If the dimensions of the loop change to 20cm by 35cm over 0.5s, with the number of turns remaining the same, what is the induced EMF on the rectangular loop?

EXAMPLE: FARADAY'S LAW AND TWO CIRCULAR LOOPS

A small circular loop of wire with radius r = 5cm and resistance 10mΩ is centered inside a larger circular loop of wire with radius r = 5m. The larger loop carries an initial current of 6A. The larger loop is then disconnected from its voltage source, and the current steadily decreases to 0 over a time of 20μs.

a) What is the change in the magnetic flux through the smaller circular loop during this time?
b) What is the magnitude of the induced EMF on the smaller loop?
c) What is the induced current on the smaller loop?

PRACTICE: INDUCTION IN A ROTATING LOOP

A square conducting wire of side length 4 cm is in a 2 T magnetic field. It rotates such that the angle of the magnetic field to the normal of the square increases from 30^{o} to 60^{o} in 2 s. What is the induced current on the wire if its resistance is 5 mΩ?