STAWA SET 7 UNIT 3+4

14. **Plastic**: When I flows in a magnetic field the coil experiences a force + Rotate (like motor) A spring restricts rotation.

Metal: When I flows in magnetic field the coil experiences a force + Rotates. But the metal experiences a changing magnetic field produced by current in coil so eddy currents induced in metal that produces a magnetic field of its own that opposes coil's B, thus SLOWING IT.

15. $l = 64.0m$

$v = 920km/h = 255.56ms^{-1}$

$B = 1.02 \times 10^{-5}T$

$Emf = ?$

$Emf = vBl$

$= 255.56 \times 1.02 \times 10^{-5} \times 64$

$= 0.1668V$

$= \underline{0.167V}$

16. $N = 45.0$

$R = 12.8\Omega$

$r = 0.08m$

$B = 0.850T @ 30°$

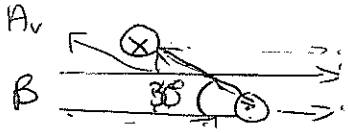
$\downarrow$

$3.95T$

$t = 450ms$

a) $Emf = ?$

b) I_{MAX}



Find shadow of area.

$$Emf = \frac{-N\Delta BA}{\Delta t}$$

$$= \frac{45 \times (\sin 30° \times \pi (0.08)^2 \times 0.850) - (\sin 30° \times \pi (0.08)^2 \times 3.95}{450 \times 10^{-3}}$$

$$= \frac{45 \times \sin 30° \times \pi (0.08)^2 [0.850 - 3.95]}{450 \times 10^{-3}}$$

$$= \underline{-3.12V}$$

b) I_{MAX} $\quad I = \frac{V}{R} = \frac{3.12}{12.8} = \underline{0.243A}$

B changed at constant rate.

17. $d = 6.80cm$

$N = 60$

$B = 250mT$

$Emf = ?$

$t = 3.50s$

a) $Emf = \frac{N\Delta\Phi}{\Delta t}$

$A = \pi r^2 = \pi \left(\frac{6.80 \times 10^{-2}}{2}\right)^2 = 3.631681 \times 10^{-3} m^2$

$$Emf = \frac{60(0.250 \times 3.631681 \times 10^{-3} - 0)}{3.50}$$

$= 0.01556V$

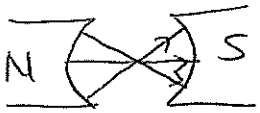
$= \underline{15.6mV}$

18. $N = 300$
$l = 0.05m$
$r = 0.018m$
$B = 0.180T$
$f = 60Hz$

a) $Emf_{MAX} = -2\pi N B A_{\perp} f$
$= 2\pi \times 300 \times 0.180 \times (0.05 \times (2 \times 0.018) \times 60$
$= \underline{36.6V}$

b) $Emf_{RMS} = \frac{36.644}{\sqrt{2}} = \underline{25.9V}$

c) The magnetic field is radial and so coil induces maximum Emf for the whole sweep theagh it as it cuts accross the flux



19. $N = 85$
$A = 3.10 \times 10^{-2} m^2$
$f = \frac{3600 RPM}{60}$
$= \underline{60Hz}$
$B = 0.250T$

a) $Emf_{MAX} = Emf_{(peak)}$
$= -2\pi N B A_{\perp} f$
$= 2\pi (85)(0.250)(3.10 \times 10^{-2})(60)$
$= \underline{248V}$

b) $Emf_{RMS} = \frac{248.34}{\sqrt{2}} = \underline{176V}$

20. $N = 240$
$d = 12cm$
$f = \frac{2400}{60}$
$= \underline{40Hz}$
$B = 0.860T$

$Emf_{MAX} = -2\pi N B A_{\perp} f$ ($A = 0.0113m^2$)
$= 2 \times \pi \times 240 \times 0.860 \times \left(\pi \left(\frac{0.12}{2}\right)^2\right) \times 40$
$= \underline{587V}$

21. $d = 0.240m$
$N = 1500$
$t = 2.50ms$
Emf_{MAX}
$B = 51 \times 10^{-6} T$
$T = 5 \times 10^{-3} s$
$f = \frac{1}{T} = 200Hz$

$Emf_{MAX} = -2\pi N B A_{\perp} f$
$= 2 \times \pi \times 1500 \times 51 \times 10^{-6} \times \left(\pi \times \left(\frac{0.24}{2}\right)^2\right) \times 200$
$= \underline{4.35V}$

22. $d = 7.60cm$

$r = \frac{7.6 \times 10^{-2}}{2}$

$=$

$l = 0.1m$

$Emf_{RMS} = 240V$

$f = 50Hz$

$B = 0.3T$

$N = ?$

$Emf_{MAX} = Emf_{RMS} \times \sqrt{2}$

$= 240 \times \sqrt{2}$

$= 339V.$

$Emf = -2\pi NBA_{\perp} f$

$339.411 = 2\pi N \times 0.3 \times (0.076 \times 0.1) \times 50$

$N = \underline{474 \text{ turns}}$

23. $N = 400$

$l = 0.06m$

$w = 0.08m$

$V_p = 20V/coil$

$f = \frac{400rpm}{60}$

$= 6.6667Hz.$

$B = ?$

$Emf = -2\pi N BA_{\perp} f$

$-20 = 2\pi \times 400 \times B \times (0.06 \times 0.08) \times 6.6667$

$B = \underline{0.249T}$