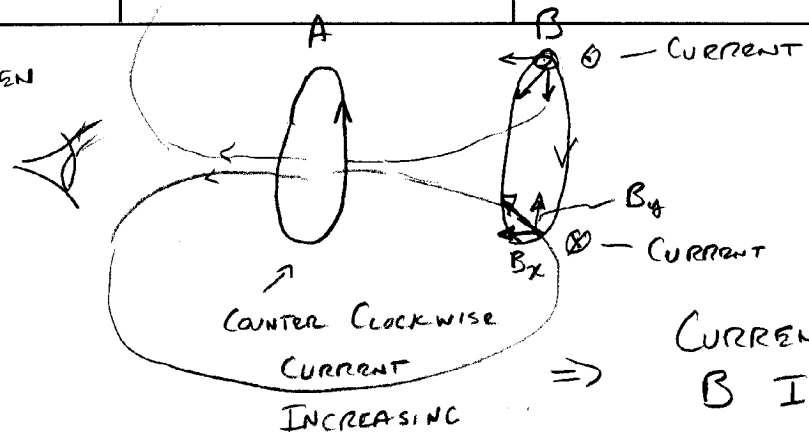
28-7 GIVEN



⇒ CURRENT IN B IS CLOCKWISE

(CREATES A FIELD TO THE RIGHT)

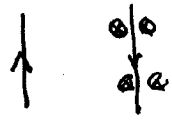
INDUCED CURRENT IS OUT OF THE PAGE AT THE TOP AND INTO THE PAGE AT THE BOTTOM OF LOOP B

THIS CURRENT WORKS WITH THE VERTICAL COMPONENT OF B. TO CREATE A FORCE TO THE RIGHT

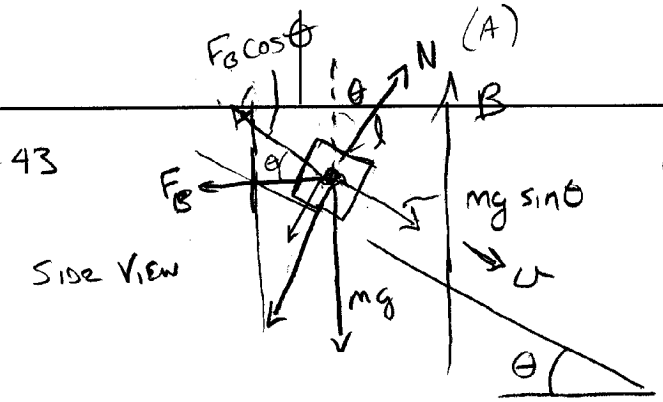
TOP ⊙ → FORCE
↓ B_{VERT}

↑ B_{VERT}
BOTTOM ⊗ → FORCE

THIS IS TRUE ALL AROUND THE CIRCUMFERENCE OF B SO THE LOOPS REPEL.



28-43



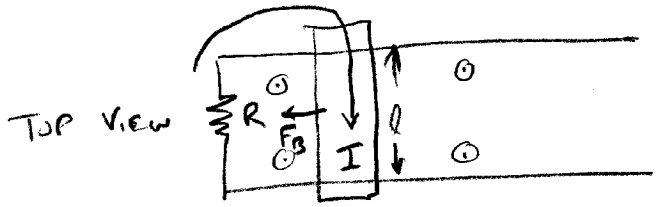
GIVEN: m, B, θ, l, R

$v_0 = 0$

FIND: RETARDING FORCE

TERMINAL VELOCITY

(FRICTIONLESS SURFACE)



$$\Phi = B \cdot A = BA\cos\theta = Blx\cos\theta$$

$$\mathcal{E} = \frac{d\Phi}{dt} = Bl\frac{dx}{dt}\cos\theta = Blv\cos\theta$$

$$I = \frac{\mathcal{E}}{R} = \frac{Blv\cos\theta}{R}$$

$$F_B = IlB = \frac{Blv\cos\theta}{R}lB = \frac{B^2l^2\cos\theta}{R}v$$

$$F_B\cos\theta = \frac{B^2l^2\cos^2\theta\, v}{R}$$

$$\Sigma F = -F_B\cos\theta + mg\sin\theta = m\frac{dv}{dt}$$

$$\left(\frac{B^2l^2\cos^2\theta}{R}\right)v + mg\sin\theta = m\frac{dv}{dt}$$

$$-bv + mg\sin\theta = m\frac{dv}{dt}$$

WITH $b = \dfrac{B^2l^2\cos^2\theta}{R}$

(DAMPING COEFFICIENT)

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

$$-\frac{bv}{m} + g\sin\theta = \frac{dv}{dt}$$

LET $u = -\frac{bv}{m} + g\sin\theta$

$$\frac{du}{dt} = -\frac{b}{m}\frac{dv}{dt} \Rightarrow \frac{dv}{dt} = -\frac{m}{b}\frac{du}{dt}$$

$$u = -\frac{m}{b}\frac{du}{dt}$$

$$-\frac{b}{m}\,dt = \frac{du}{u}$$

$$-\frac{b}{m}\int_0^t dt = \int_{g\sin\theta}^{-\frac{bv}{m}+g\sin\theta} \frac{du}{u}$$

$$-\frac{b}{m}t = \ln\left(\frac{g\sin\theta - \frac{bv}{m}}{g\sin\theta}\right) = \ln\left(1 - \frac{bv}{mg\sin\theta}\right)$$

$$e^{-\frac{b}{m}t} = 1 - \frac{bv}{mg\sin\theta}$$

$$\frac{bv}{mg\sin\theta} = 1 - e^{-\frac{b}{m}t}$$

$$v = \frac{mg\sin\theta}{b}\left(1 - e^{-\frac{b}{m}t}\right)$$

$$v = \frac{mg\sin\theta}{\frac{B^2\ell^2\cos^2\theta}{R}}\left(1 - e^{-\frac{b}{m}t}\right)$$

v_t

$$\boxed{v_t = \frac{mgR\sin\theta}{B^2\ell^2\cos^2\theta}}$$

3-0235 — 50 SHEETS — 5 SQUARES
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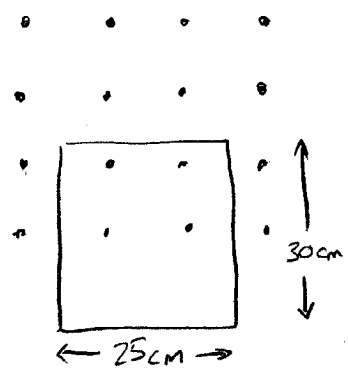
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

28-78 GIVEN:



$N = 80$

$B = 0.14\,T$

$R_{coil} = 24\,\Omega$

FIND I_{IND}

a) $v = 2\,m/s$ RIGHT

b) $v = 2\,m/s$ UP

c) $v = 2\,m/s$ LEFT

d) $v = 2\,m/s$ DOWN

FOR $v = 2\,m/s$ RIGHT OR LEFT, $\frac{d\Phi}{dt} = \boxed{0 = \mathcal{E} = I}$

FOR $v = 2\,m/s$ UP, $\mathcal{E} = NBlv$

$$I = \frac{NBlv}{R} = \frac{(.14T)(.25m)(2m/s)(80)}{24\Omega}$$

$$= \boxed{0.233\,A} \quad \boxed{\text{CLOCKWISE}}$$

THIS CURRENT WILL EXIST FOR

$$t = \frac{.15\,m}{2\,m/s} = \boxed{0.075\,s} \quad \text{THEN } I = 0$$

FOR $v = 2\,m/s$ DOWN $\boxed{I = 0.233\,A}$ $\boxed{\text{COUNTER CLOCK WISE}}$

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET