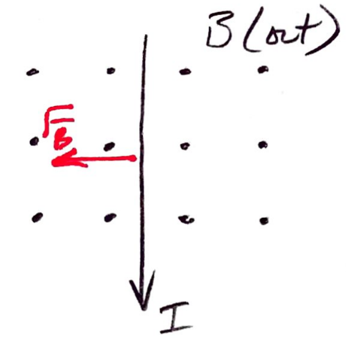
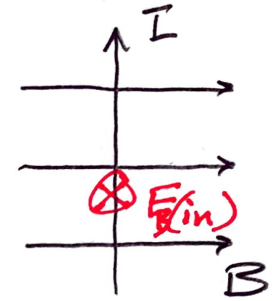
11.33 Direction of magnetic force on current-carrying wire?

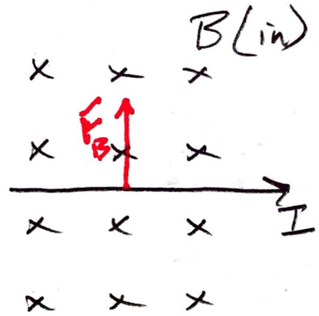
a)



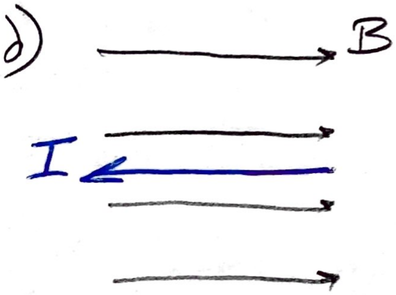
b)



c)

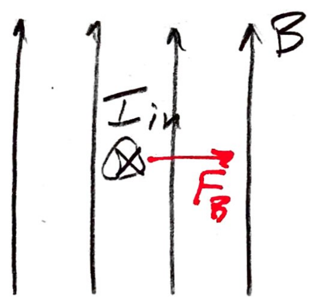


d)

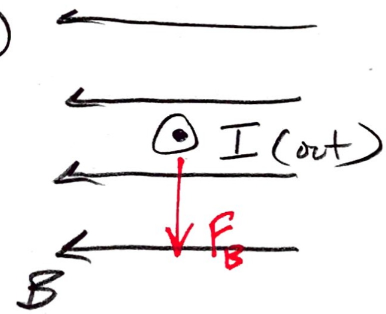


$$F_B = I l \times B$$
$$= I l B \sin \theta$$
$$= I l B \sin 180$$
$$\boxed{= 0\ N}$$

e)



f)



11.37 Direct Current (DC) power line

current travels in one direction, constantly.

Not required to solve problem

as opposed to Alternating Current (AC), in which current alternates its direction of flow, usually 50-60 times a second (50-60 Hz)

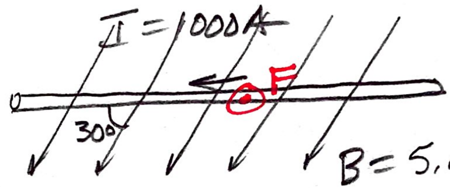
$t = 0.0000s$

$t = 0.0083s$

$t = 0.0167s$

60x/sec

a)



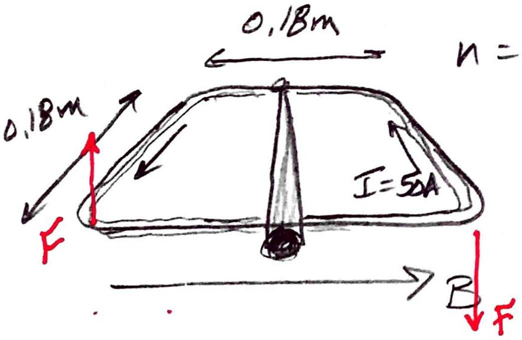
$L = 100\,m$

$B = 5.0e{-5}\,T$

$$F = I\ell \times B = I\ell B \sin\theta$$
$$= (1000A)(100m)(5.0e^{-5}) \sin 30$$
$$= 2.50N$$ out of the page (as drawn)

b) Practical concerns might be that any other wires in the area, if exposed, might be short circuited.

11.40



$n = 150$ turns

$A = (0.18\,m)^2 = \underline{0.0324\,m^2}$

$I = 50\,A$

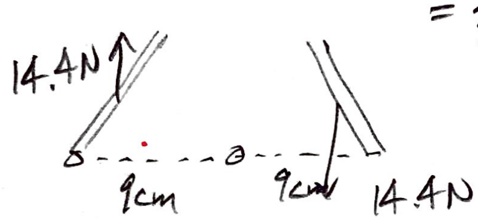
$B = 1.60\,T$

a) $F = I\ell \times B$ (one wire $\perp$ to field)

$(50A)(0.18m)(1.60)(\sin 90)$ ← max

$= 14.4N \times 150$ turns

$= \underline{2160N}$



$\tau = r \times F = rF(\sin 90)$ ← max

$= (0.09\,m)(2160\,N) \times 2$ (for each side)

$= \boxed{389\ N\cdot m}$

If using derivation from class:

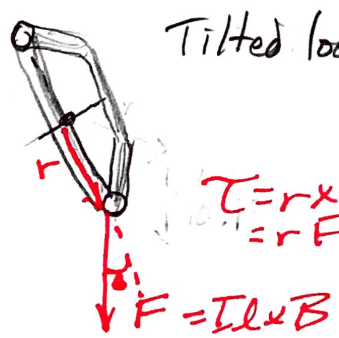
$\tau = I\vec{A} \times B$

$= (150)(50)(0.0324)(1.6)$

$= \boxed{389N}$

b) If loop/coil is tilted the torque is less (although force on wires is the same.

Tilted loop



$\tau = r \times F$

$= rF\sin\theta = (0.09\,m)(2160N)(\sin 10.9) \times 2$ ← two sides

$= \boxed{73.5\,N\cdot m}$