Force on a Conductor

1) $F = BIL \sin\theta$

$= (0.25)(12)(0.3)\sin 90$

$F = \boxed{0.9\ N}$

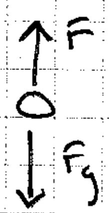
2) $F = BIL \sin\theta$

$I = \dfrac{F}{BL\sin\theta}$

$= \dfrac{2.5}{(0.5)(475)\sin 90}$

$I = \boxed{0.011\ A}$

3)



$F = F_g$

$BIL = mg$

$I = \dfrac{mg}{BL}$

$= \dfrac{(0.05)(9.8)}{(2)(1)}$

$I = \boxed{0.245\ A}$

④ Parallel to the field lines. ($\theta = 0$)

$$F = BIL \sin 0$$

$$F = 0$$

⑤ a) $F = BIL \sin \theta$

$$= (5 \times 10^{-5})(225)(1) \sin 90$$

$$F = 0.011 \text{ N}$$

$\therefore$ the force is $\boxed{0.011 \text{ N/m}}$

b) down

c) Probably not. The force is insignificant compared to the weight of the cables.

Charges in a Magnetic Field

① $F = qvB \sin\theta$

$= (1.6 \times 10^{-19})(8.6 \times 10^{4})(1.2) \sin 90$

$F = \boxed{1.65 \times 10^{-14} \text{ N [E]}}$

② $F = qvB \sin\theta$

$= (1.6 \times 10^{-19})(4.3 \times 10^{4})(1.5) \sin 90$

$F = \boxed{1.03 \times 10^{-14} \text{ N [S]}}$

③ $F = qvB \sin\theta$

$B = \dfrac{F}{qv \sin\theta}$

$B = \dfrac{5.1 \times 10^{-14}}{(1.6 \times 10^{-19})(2 \times 10^{6}) \sin 90}$

$B = \boxed{0.16 \text{ T [horizontal, towards observer]}}$

④ $F = qvB \sin\theta$

$v = \dfrac{F}{qB \sin\theta}$

$= \dfrac{3.2 \times 10^{-12}}{(1.6 \times 10^{-19})(2.5) \sin 90}$

$v = \boxed{8.0 \times 10^{6} \text{ m/s}}$

⑤ $\Sigma F = F_B$

$$\frac{mv^2}{r} = qvB$$

$$r = \frac{mv}{qB}$$

$$= \frac{(6.7\times10^{-27})(1.5\times10^{7})}{(3.2\times10^{-19})(2.4)}$$

$$r = \boxed{0.13\ m}$$

⑥ $r = \frac{mv}{qB}$

$$v = \frac{rqB}{m}$$

$$= \frac{(0.08)(1.6\times10^{-19})(1.5)}{1.67\times10^{-27}}$$

$$v = \boxed{11\ 497\ 006\ m/s}$$

$W = \Delta E_k$ $\qquad$ $W = q\Delta V$

$$q\Delta V = \frac{1}{2}mv_f^2$$

$$(1.6\times10^{-19})\Delta V = \frac{1}{2}(1.67\times10^{-27})(11\ 497\ 006)^2$$

$$\Delta V = \boxed{689\ 820\ V}$$

⑦ $F = qvB \sin\theta$

$= (100)(200)(5\times10^{-5}) \sin 90$

$F = \boxed{1.0 \text{ N}}$

⑧ $r = \dfrac{mv}{qB}$

$= \dfrac{(9.11\times10^{-31})(1.5\times10^{7})}{(1.6\times10^{-19})(0.02)}$

$r = \boxed{0.0043 \text{ m}}$ (4.3 mm)

⑨ $q = 1.6\times10^{-19}$ C

$r = \dfrac{mv}{qB}$

$0.03 = \dfrac{(6.68\times10^{-27})(1\times10^{4})}{(1.6\times10^{-19})B}$

$B = \dfrac{(6.68\times10^{-27})(1\times10^{4})}{(1.6\times10^{-19})(0.03)}$

$B = \boxed{0.014 \text{ T [towards the observer]}}$

(10)

$$r = \frac{mv}{qB}$$

$$v = \frac{rqB}{m}$$

$$= \frac{(6.38 \times 10^6 + 1000000)(1.6 \times 10^{-19})(4 \times 10^{-8})}{(1.67 \times 10^{-27})}$$

$$v = \boxed{28\ 282\ 635\ \text{m/s}}$$