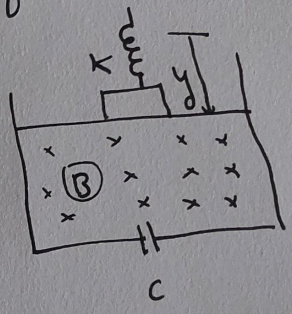
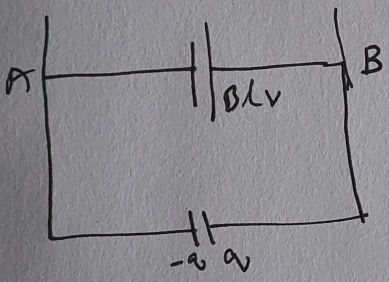
A heavy block is attached to the ceiling by a spring that has a force constant 'k'. A conducting rod is attached to block. The combined mass of the block and the rod is m. The rod can slide without friction along two vertical parallel rails, which are a distance L apart. A capacitor of known capacitance C is attached to the rails by the wires. The entire system is placed in a uniform magnetic field B. Find the time period T of the vertical oscillations of the block. ~~Neglect~~ Neglect the electrical resistance of the ~~rod~~ rod and all wires.



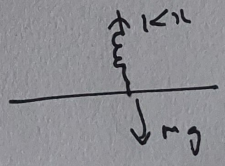


$$BLv - \frac{q}{C} = 0 \qquad q = CBLv$$

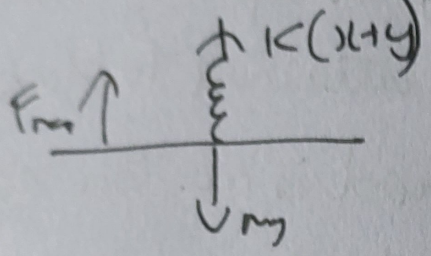
$$i = CBL\frac{dv}{dt}$$

$$F_{mag} = BiL$$

$$= B^2L^2C\frac{dv}{dt}$$



For equilibrium $Kx = mg$



$$mg - K(x+y) - B^2 L^2 C \frac{dv}{dt} = ma$$

$$a = \frac{-K}{m + B^2 l^2 C} y$$

$$\omega = \sqrt{\frac{K}{m + B^2 l^2 C}}$$

$$T = 2\pi \sqrt{\frac{m + CB^2 l^2}{K}}$$