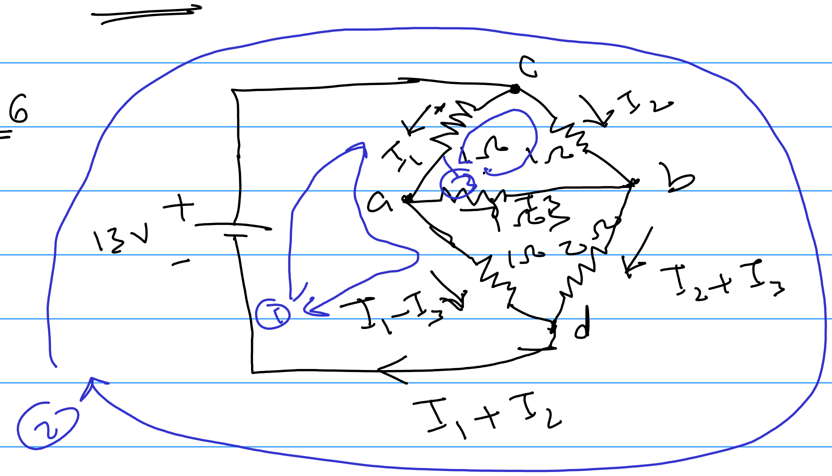
P 853

Ex 26.6



$I_1 = ?$

$I_2 = ?$

$I_3 = ?$

① $13 - I_1(1) - (I_1 - I_2)\,1 = 0$

③ $-I_3(1) + I_2(1) - I_1(1) = 0$ (c3

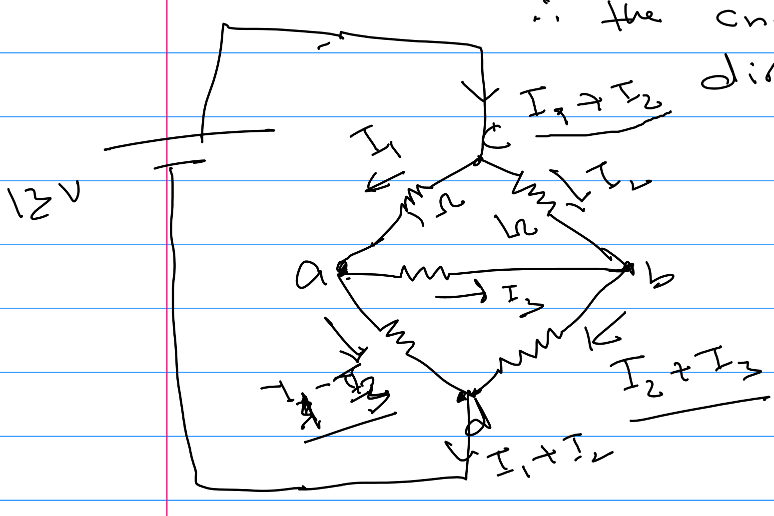
② $13 - I_2(1) - (I_2 + I_3)\,2 = 0$

3 equations
3 variables

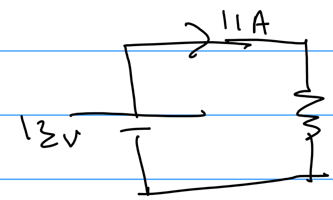
$I_1 = \underline{6A}$, $I_2 = \underline{5A}$, $I_3 = -1A$

the direction of the current is wrong.

∴ the current direction should be from b to a.



Junction rule

= 

V = 13V

Requiv = V/I

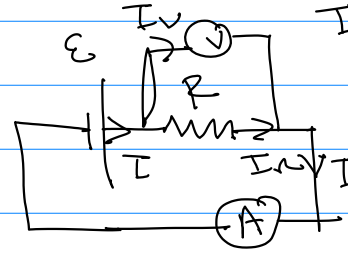
= 13V/11A ≅ 1.2Ω

Ammeters measure current

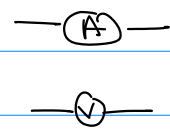
Voltmeters measure potential difference

Resistance of ammeters should be negligible.

Resistance of voltmeter should be infinite



$I = I_V + I_R$



$I_V = \frac{\varepsilon}{R_V}$

voltmeters are connected in parallel

$R_{equiv} = R + R_A$ → ammeter resistance

$I = \varepsilon / (R + R_A)$

we want $I = \varepsilon / R$

ammeters are connected in series.

If R_V is not high, some current will flow through the voltmeter.

$I_R R < IR$ → voltmeter reading will be low if its resistance is low.

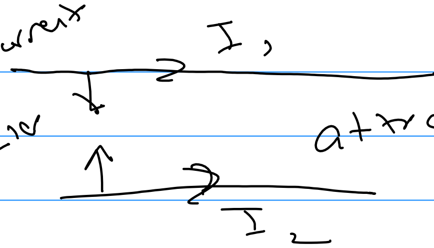
$$\boxed{\begin{array}{l}\text{ideal voltmeter} \rightarrow \text{infinite resistance} \\ \text{ideal ammeter} \rightarrow \text{zero resistance}\end{array}}$$

MAGNETIC FIELD + MAGNETIC FORCE

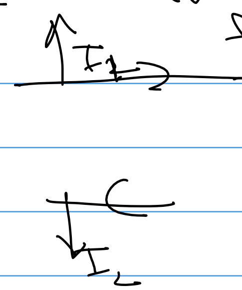
CH 27 - 28

force depend on the currents

direction of current is perpendicular to the direction of the ~~force~~.



attraction



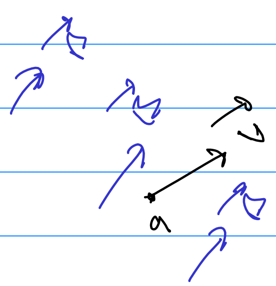
force depend on the distance apart.

$$F = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}$$

Force is due to moving charges and acts on moving charges.

$\boxed{\text{Magnetic force}}$

$\vec{B}(x, y, z)$: magnetic field is a vector field.



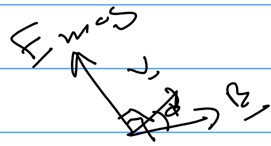
$$\vec{F}_{mag} = q\vec{v} \times \vec{B}$$

$$\vec{v} = v_1\hat{i} + v_2\hat{j} + v_3\hat{k}$$

$$\vec{B} = B_1\hat{i} + B_2\hat{j} + B_3\hat{k}$$

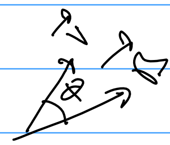
$$\vec{F}_{mag} = q\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ v_1 & v_2 & v_3 \\ B_1 & B_2 & B_3 \end{vmatrix}$$

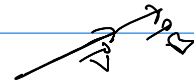
$$= q\left[\hat{i}(B_3v_2 - B_2v_3) - \hat{j}(v_1B_3 - v_3B_1) + \hat{k}(v_1B_2 - v_2B_1)\right].$$



$$|\vec{F}_{mag}| = |q||\vec{v}||\vec{B}| \sin\phi.$$

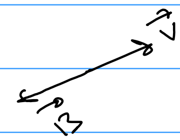
max when $\phi = \pi/2$ or $90°$





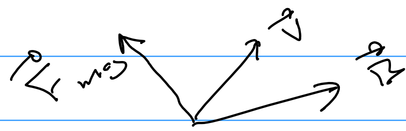
$$|\vec{F}_{mag}| = 0$$

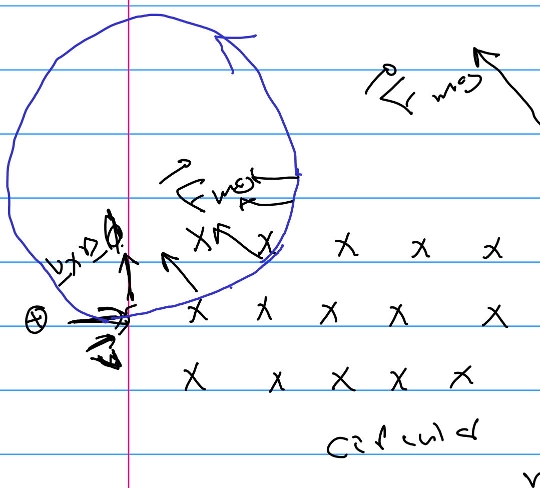
$$|\vec{F}_{mag}| = 0$$



$$\vec{F}_{mag} = q\vec{v}\times\vec{B}$$

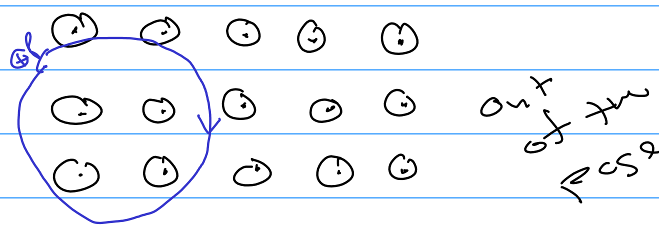
cross products never work in 2D.

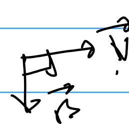




$\vec{B}$-field can ~~goes~~ go into the page

$\vec{B}$-field can come out of the page





$$\vec{F}_{mag} = q\vec{v}\times\vec{B}$$

$\vec{v} = \vec{0}$

$\vec{F}_{mag} = 0.$

$$|\vec{F}_{mag}| = qvB\sin\phi$$
$$= qvB$$

force is constant and perpendicular to velocity => circular motion

$F_{mag} = qvB = m\frac{v^2}{R}$

centripetal force formula

$\boxed{v = \frac{qBR}{m}}$

$v = R\omega$

ω : angular speed

$\boxed{\omega = \frac{qB}{m}}$

$\omega = 2\pi f$

$\boxed{f = \frac{qB}{2\pi m}}$

frequency of circular motion

$T = \frac{2\pi}{\omega}$

$\boxed{T = \frac{2\pi m}{qB}}$