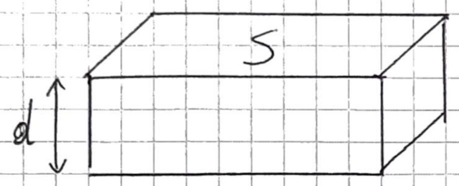
#1.1 QUANTE CELLULE IN UN TESSUTO?

$S = 1{,}00\ cm^2$ SUPERFICIE PORZIONE DI TESSUTO

$d = 0{,}10\ mm$ SPESSORE PORZIONE DI TESSUTO



$S = 1{,}00 \cdot (10^{-2}\,m)^2 = 1 \cdot 10^{-4}\,m^2$ (perché $1\ cm = 10^{-2}\,m$)

$d = 0{,}10 \cdot 10^{-3}\,m = 1 \cdot 10^{-1} \cdot 10^{-3}\,m = 1 \cdot 10^{-4}\,m$ (perché $1\ mm = 10^{-3}\,m$)

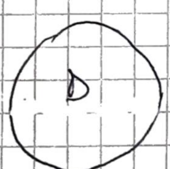
VOLUME PORZIONE TESSUTO:

$\Rightarrow V_T = S \cdot d = 1 \cdot 10^{-4}\,m^2 \cdot 1 \cdot 10^{-4}\,m = 1 \cdot 10^{-8}\,m^3$

DIAMETRO CELLULA:

$D = 25{,}0\ \mu m = 25{,}0 \cdot 10^{-6}\,m = 2{,}5 \cdot 10 \cdot 10^{-6}\,m = 2{,}5 \cdot 10^{-5}\,m$ (perché $1\ \mu m = 10^{-6}\,m$)

VOLUME CELLULA:



$$V_C = \frac{4}{3}\pi \underbrace{R^3}_{\text{RAGGIO}} = \frac{4}{3}\pi\left(\frac{D}{2}\right)^3 = \frac{\cancel{4}}{3}\pi \frac{D^3}{\cancel{8}_2} = \frac{\pi}{6}D^3$$

$$= \frac{\pi}{6} \cdot (2{,}5 \cdot 10^{-5}\,m)^3 = \frac{\pi}{6} \cdot 2{,}5^3 \cdot 10^{-15}\,m^3 =$$

$$= 8{,}18 \cdot 10^{-15}\,m^3$$

PARTE DEL VOLUME DI TESSUTO OCCUPATO DA CELLULE:

$$V = 90\%\,V_T = \frac{95}{100} \cdot 1 \cdot 10^{-8}\,m^3 = 0{,}95\,10^{-8}\,m^3 = 9{,}5\,10^{-1} \cdot 10^{-8}\,m^3 = 9{,}5 \cdot 10^{-9}\,m^3$$

$$\#\ \text{cellule}\ N = \frac{V}{V_C} = \frac{9{,}5 \cdot 10^{-9}\,\cancel{m^3}}{8{,}18 \cdot 10^{-15}\,\cancel{m^3}} = 1.2 \cdot 10^6 \rightarrow \sim 1200000\ \text{cellule}$$

#12 CORSETTA

VOLUME DI SANGUE AL SECONDO: $40 \frac{cL}{s}$

$1\ cL = 1 \cdot 10^{-2} L$ ma $1\ L = 1\ dm^3$

$\Rightarrow 1\ cL = 1 \cdot 10^{-2}\ dm^3 = 1 \cdot 10^{-2} (1 \cdot 10^{-1} m)^3 = 1 \cdot 10^{-2} \cdot 1 \cdot 10^{-3} m^3$

$\Rightarrow 1\ cL = 1 \cdot 10^{-5}\ m^3 \Rightarrow 40 \frac{cL}{s} = 40 \cdot \frac{1 \cdot 10^{-5} m^3}{s} = 4 \cdot 10^{1} \cdot 10^{-5} \frac{m^3}{s}$

$= 4 \cdot 10^{-4} \frac{m^3}{s}$.

QUANTI SECONDI IN MEZZ'ORA? $30\ min = 30 \cdot 60\ s = 1800\ s$.

VOLUME DI SANGUE IN MEZZ'ORA: $4 \cdot 10^{-4} \frac{m^3}{\cancel{s}} \cdot 1800 \cancel{s} =$

$= 4 \cdot 10^{-4} \cdot 1{,}8 \cdot 10^3\ m^3 = 7{,}2 \cdot 10^{-1}\ m^3$.

DENSITA' DEL SANGUE: $1{,}05 \frac{g}{cm^3} = \frac{1.05 \cdot 10^{-3}\ Kg}{(10^{-2} m)^3} =$

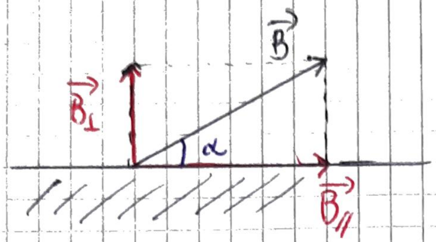
$= 1.05 \cdot \frac{10^{-3} Kg}{10^{-6}\ m^3} = 1{,}05 \cdot 10^3\ Kg/m^3 = \rho \qquad \left(\rho = \frac{m}{V}\right)$

$\Rightarrow$ MASSA DI SANGUE IN MEZZ'ORA:

$m = \rho \cdot V = 1{,}05 \cdot 10^3 \frac{Kg}{\cancel{m^3}} \cdot 7{,}2 \cdot 10^{-1} \cancel{m^3} = 7{,}6 \cdot 10^2\ Kg$.

#13 MAGNETO RICEZIONE

a)



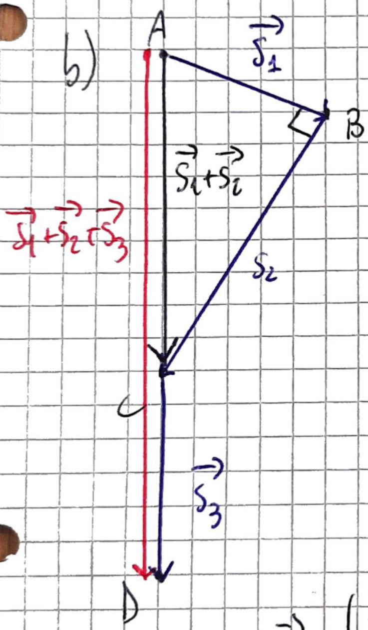
$\alpha = 30°$

$|\vec{B}| = 2{,}5 \cdot 10^{-5}\ T$

$$|\vec{B}_\parallel| = |\vec{B}| \cdot \cos\alpha = 2{,}5 \cdot 10^{-5}\ T \cdot \cos 30° = 2{,}2 \cdot 10^{-5}\ T$$

$$|\vec{B}_\perp| = |\vec{B}| \cdot \sin\alpha = 2{,}5 \cdot 10^{-5}\ T \cdot \sin 30° = 1{,}3 \cdot 10^{-5}\ T$$

b)



$|\vec{S}_1| = 30\ m$

$|\vec{S}_2| = 70\ m$

$|\vec{S}_3| = 60\ m$

$$\vec{S}_1 \perp \vec{S}_2 \Rightarrow |\vec{S}_1 + \vec{S}_2| = \sqrt{|\vec{S}_1|^2 + |\vec{S}_2|^2} =$$

$$= \sqrt{(30\ m)^2 + (70\ m)^2} \simeq 76\ m$$

$\vec{S}_1 + \vec{S}_2$, $\vec{S}_3$ paralleli e concordi:

$$\Rightarrow |\vec{S}_1 + \vec{S}_2 + \vec{S}_3| = |\vec{S}_1 + \vec{S}_2| + |\vec{S}_3| =$$

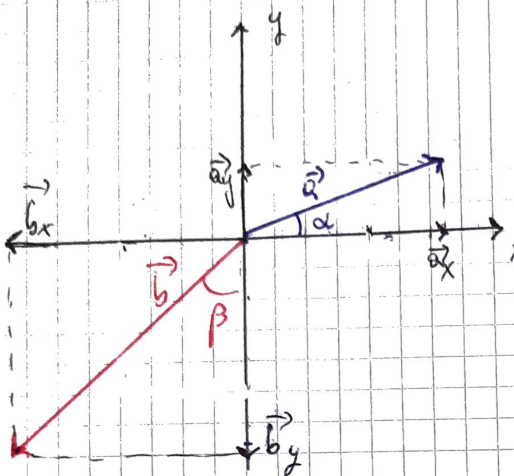
$$= 76\ m + 60\ m = 136\ m.$$

NB: $|\vec{S}_1 + \vec{S}_2 + \vec{S}_3| \neq |\vec{S}_1| + |\vec{S}_2| + |\vec{S}_3|$!

#1.4 VETTORI NEL PIANO CARTESIANO

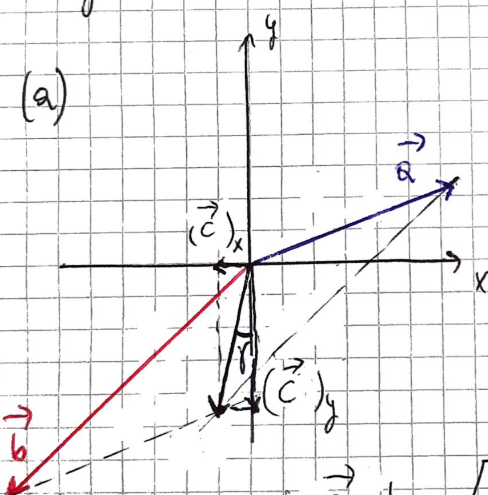
$\alpha = 20^\circ$ $\quad \beta = 50^\circ$

$|\vec{a}| = 10\ m \quad |\vec{b}| = 15\ m$



COMPONENTI CARTESIANE DI $\vec{a}$ e $\vec{b}$

- $a_x = |\vec{a}| \cdot \cos 20^\circ = $
  $= 10\ m \cdot \cos 20^\circ = 9{,}4\ m$
- $a_y = |\vec{a}| \cdot \sin 20^\circ =$
  $= 10\ m \cdot \sin 20^\circ = 3{,}4\ m$
- $b_x = -|\vec{b}| \cdot \sin 50^\circ = -15\ m \cdot \sin 50^\circ = -11\ m$
- $b_y = -|\vec{b}| \cdot \cos 50^\circ = -15\ m \cdot \cos 50^\circ = -9{,}6\ m$



COMPONENTI DI $\vec{a} + \vec{b} \equiv \vec{c}$

$(\vec{c})_x = a_x + b_x = 9{,}4\ m - 11\ m =$
$= -1{,}6\ m$

$(\vec{c})_y = a_y + b_y = -6{,}2\ m$

MODULO DI $\vec{a} + \vec{b}$:

$$|\vec{c}| = \sqrt{(\vec{c})_x + (\vec{c})_y} = \sqrt{(-1{,}6\ m)^2 + (-6{,}2\ m)^2} =$$
$$= 6{,}4\ m.$$

DIREZIONE DI $\vec{c} \rightarrow \gamma$

$$\tan \gamma \overset{(*)}{=} \frac{(\vec{c})_x}{(\vec{c})_y} \Rightarrow \gamma = \arctan \frac{(\vec{c})_x}{(\vec{c})_y} = \arctan \frac{-1{,}6\ \cancel{m}}{-6{,}2\ \cancel{m}} \simeq 1$$

$\vec{c} = \vec{a} + \vec{b}$ punta a 14° rispetto direzione negativa asse y.

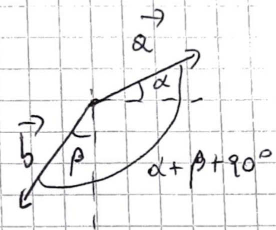
(*) NB: posso anche usare $\sin \gamma = \frac{(\vec{c})_x}{|\vec{c}|}$ o $\cos \gamma = \frac{(\vec{c})_y}{|\vec{c}|}$.

b) $\vec{c} = -2\vec{a} + \vec{b}$

$\Rightarrow c_x = -2a_x + b_x = -2 \cdot 9{,}4\,m + (-11\,m) = -30\,m$

$c_y = -2a_y + b_y = -2 \cdot 3{,}4\,m + (-9{,}6\,m) = -16\,m$

$\Rightarrow \vec{c} = (-30\,m)\hat{i} + (-16\,m)\hat{j}$



c) $\vec{a} \cdot \vec{b} = |\vec{a}| \cdot |\vec{b}| \cdot \cos(\alpha + \beta + 90°) =$

$= 10\,m \cdot 15\,m \cdot \cos(50° + 20° + 90°) =$

$= 150\,m^2 \cdot \cos(160°) = -140\,m^2$

oppure $\vec{a} \cdot \vec{b} = a_x b_x + a_y b_y = 9{,}4\,m \cdot (-11\,m) + (3{,}4\,m) \cdot (-9{,}6\,m)$

$\simeq -140\,m^2$.

d) $|\vec{a} \times \vec{b}| = |\vec{a}| \cdot |\vec{b}| \cdot \sin 160° = 10\,m \cdot 15\,m \cdot \sin(160°) =$

$\simeq 51\,m^2$.

oppure: $(\vec{a} \times \vec{b})_x = a_y \cancel{b_z} - b_y \cancel{a_z} = 0\,m^2$.

$(\vec{a} \times \vec{b})_y = -a_x \cancel{b_z} + b_x \cancel{a_z} = 0\,m^2$.

$(\vec{a} \times \vec{b})_z = a_x b_y - b_x a_y = 9{,}4\,m \cdot (-9{,}6\,m) - (-11\,m) \cdot 3{,}4$

$\simeq -53\,m^2$

$\Rightarrow |\vec{a} \times \vec{b}| = \sqrt{\cancel{(\vec{a} \times \vec{b})_x^2} + \cancel{(\vec{a} \times \vec{b})_y^2} + (\vec{a} \times \vec{b})_z^2} = \sqrt{(-53\,m^2)^2} = 53\,m$

(risultati non in accordo causa approssimazioni).

$\Rightarrow \vec{a} \times \vec{b} = (53\,m^2)\hat{k}$