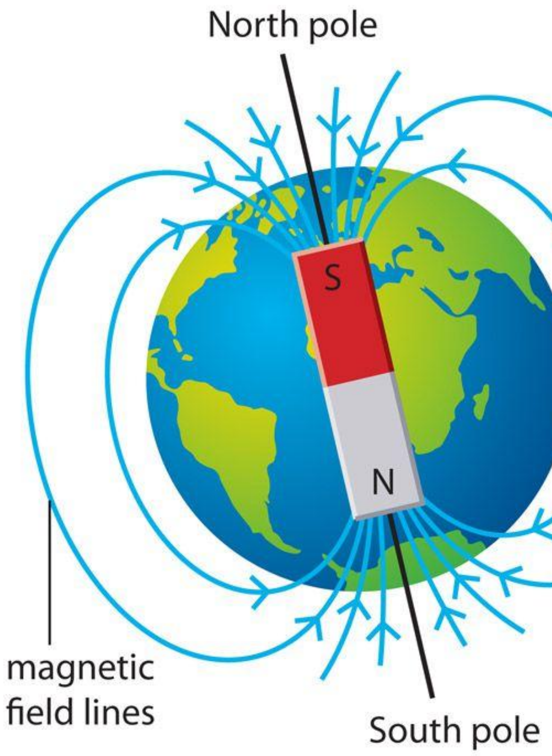
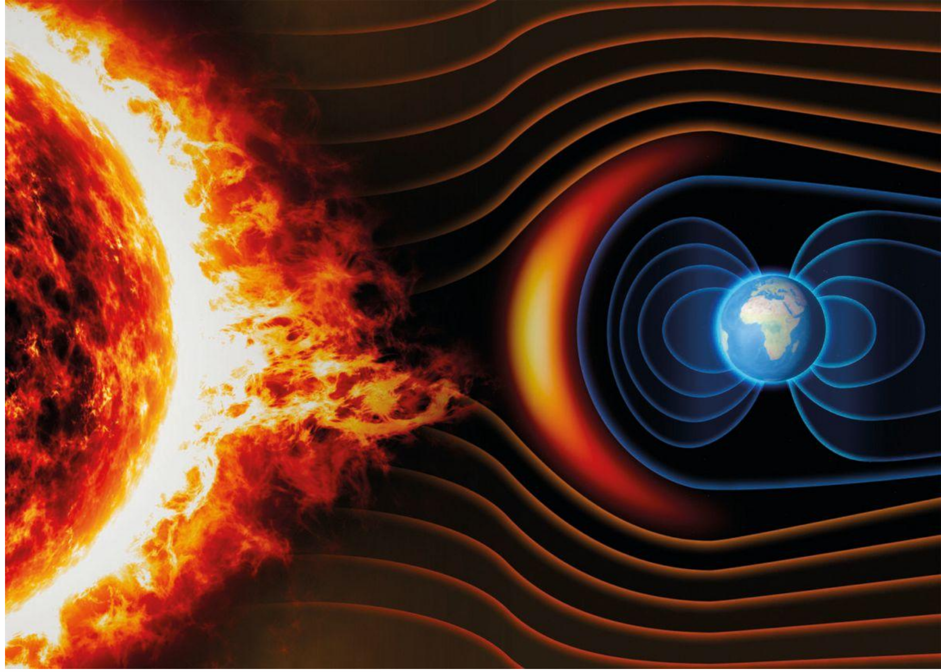
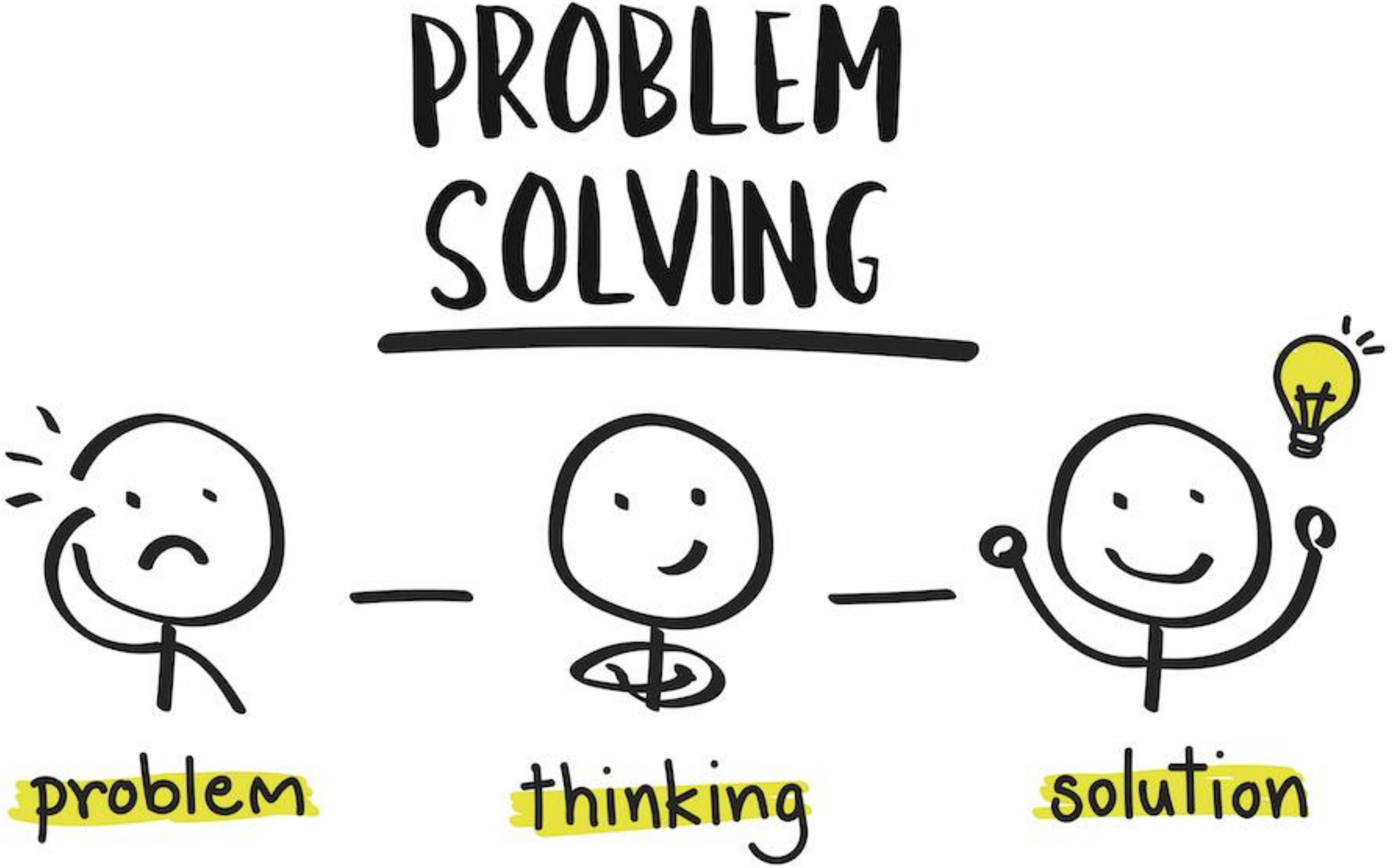




Chapter 17

Magnetic field

Prepared & Presented by: Mr. Mohamad Seif

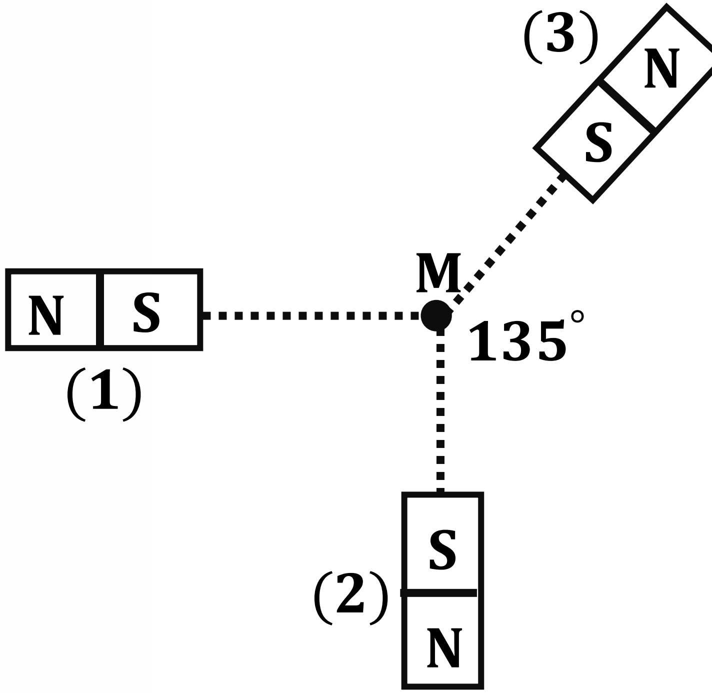

PROBLEM
SOLVING
problem
thinking
solution

Exercise 1

Three bar magnets are placed as shown in the adjacent figure.

The magnitudes of the magnetic fields created by these three bar magnets at point M are $B_1 = B_2 = 0.5T$ and $B_3 = 0.3T$. Take $\sqrt{2} = 1.4$

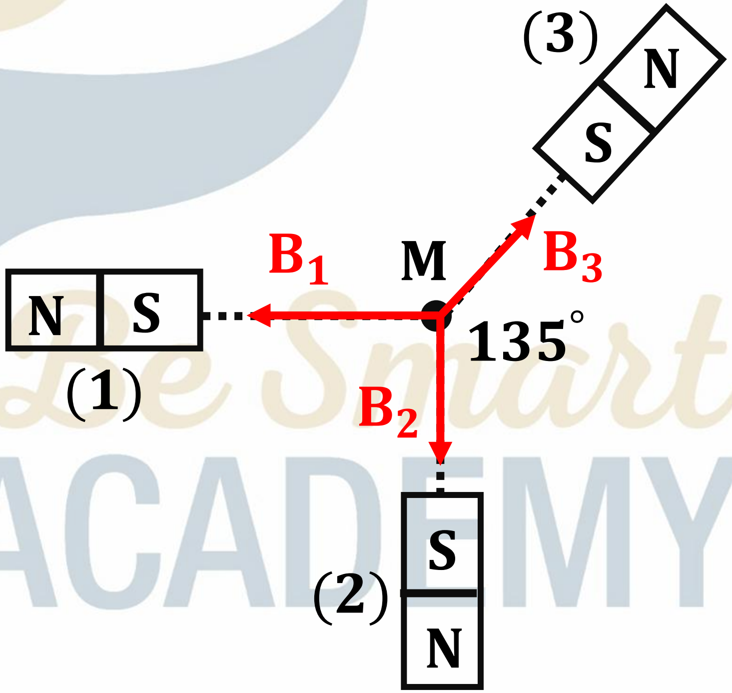
1) **Represent the three magnetic field vectors created by these three magnets at M.**
2) **Determine the characteristics of the resultant magnetic field $\vec{B}$ due to these three magnets.**



Exercise 1

$B_1 = B_2 = 0.5T$ and $B_3 = 0.3T$. Take $\sqrt{2} = 1.4$

1) Represent the three magnetic field vectors created by these three magnets at M.

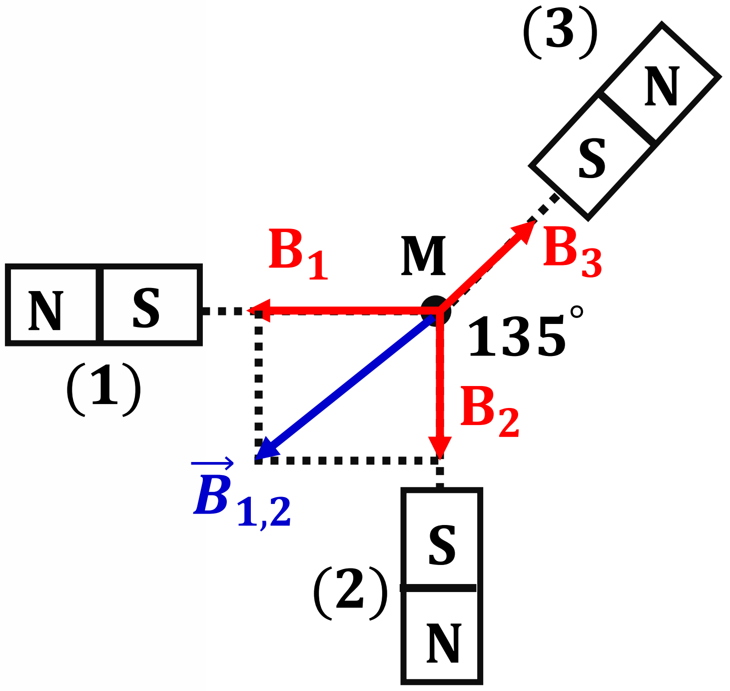


Exercise 1

$B_1 = B_2 = 0.5T$ and $B_3 = 0.3T$. Take $\sqrt{2} = 1.4$

2) Determine the characteristics of the resultant magnetic field $\vec{B}$ due to these three magnets.

$$\vec{B}_{1,2} = \vec{B}_1 + \vec{B}_2$$



$$B_{1,2} = \sqrt{B_1{}^2 + B_2{}^2} = \sqrt{(0.5)^2 + (0.5)^2}$$

$$B_{1,2} = 0.7T$$

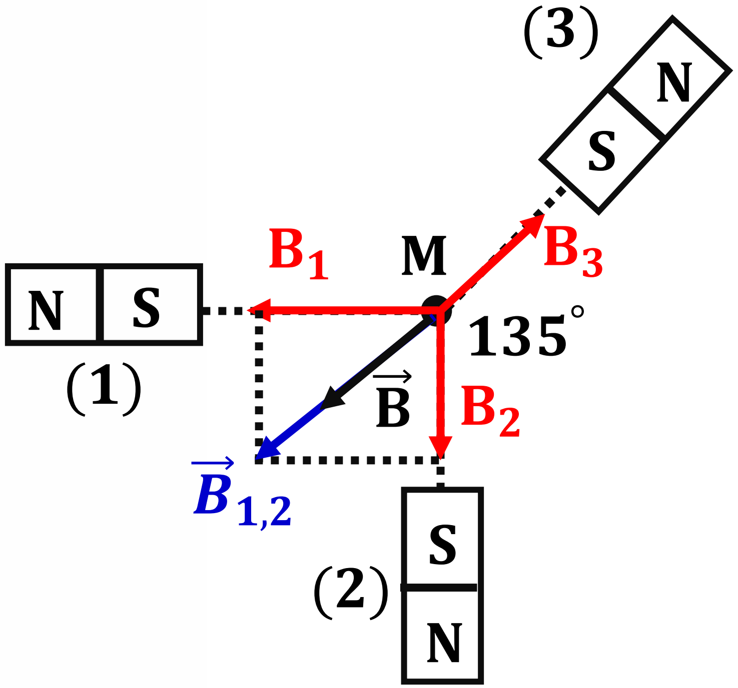
Exercise 1

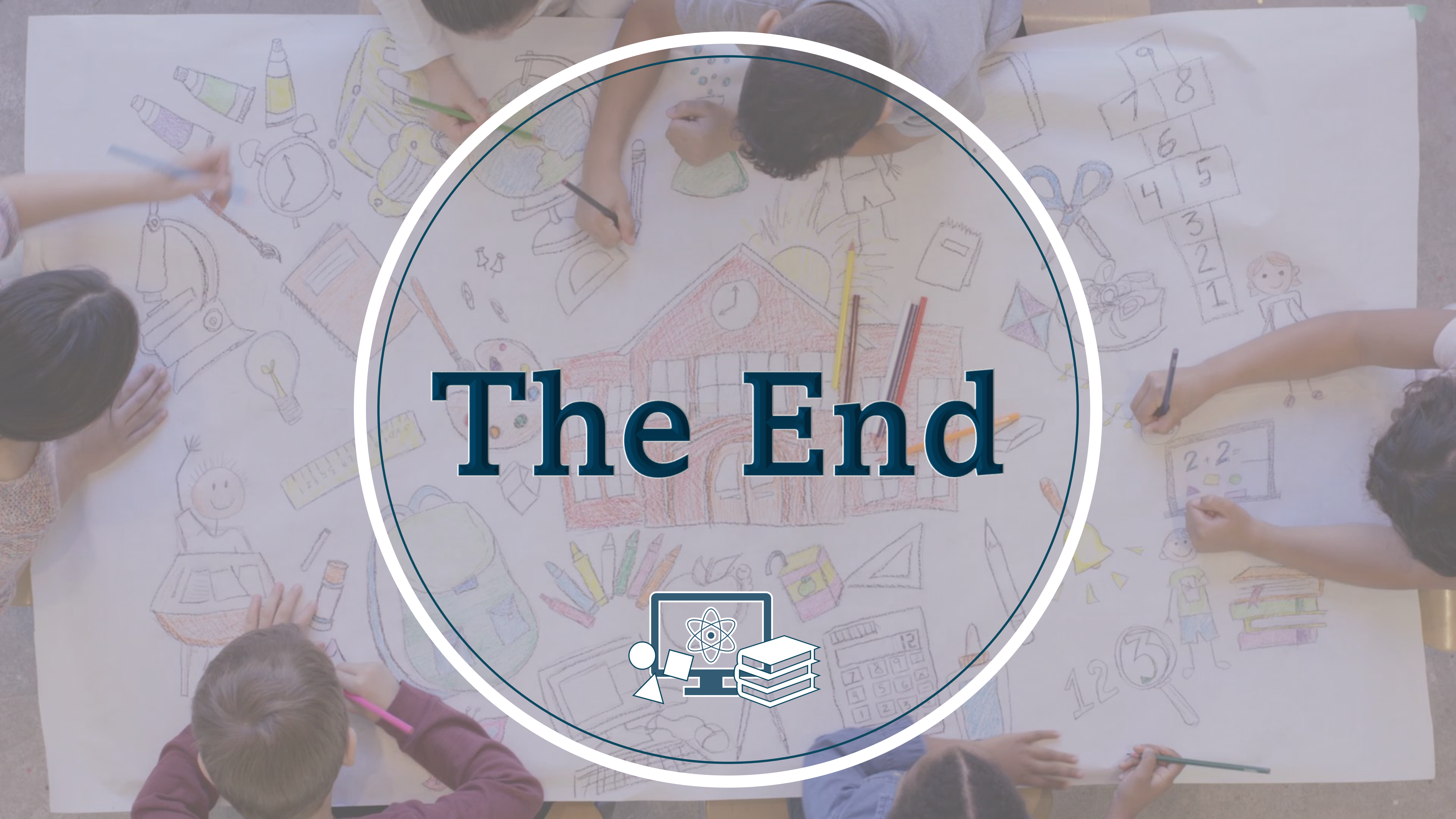
$B_1 = B_2 = 0.5T$ and $B_3 = 0.3T$. Take $\sqrt{2} = 1.4$

$$\vec{B} = \vec{B}_{1,2} + \vec{B}_3$$

$$B = B_{1,2} - B_3 = 0.7 - 0.3 = 0.4T$$

$$B = 0.4T$$





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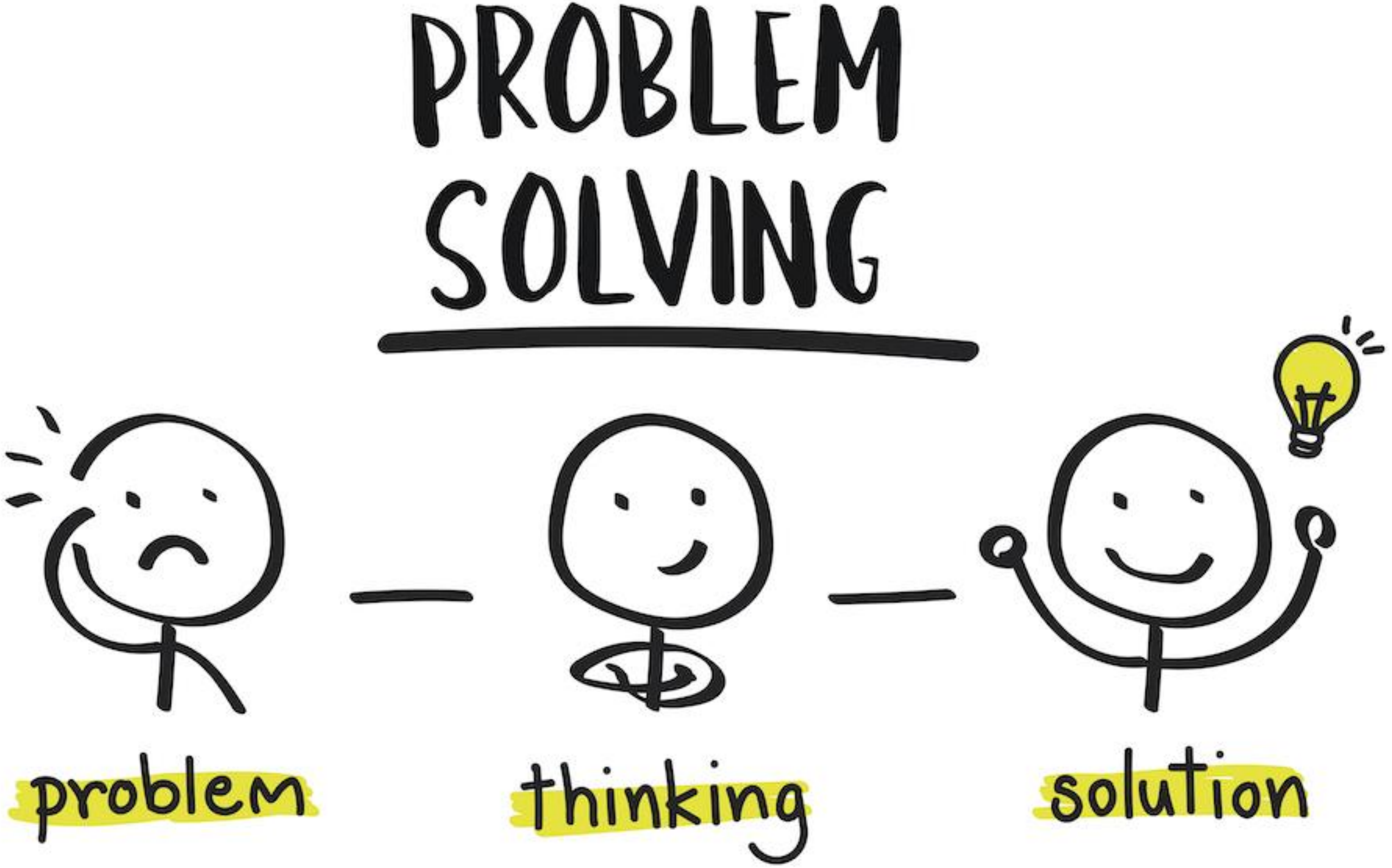
PROBLEM
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problem
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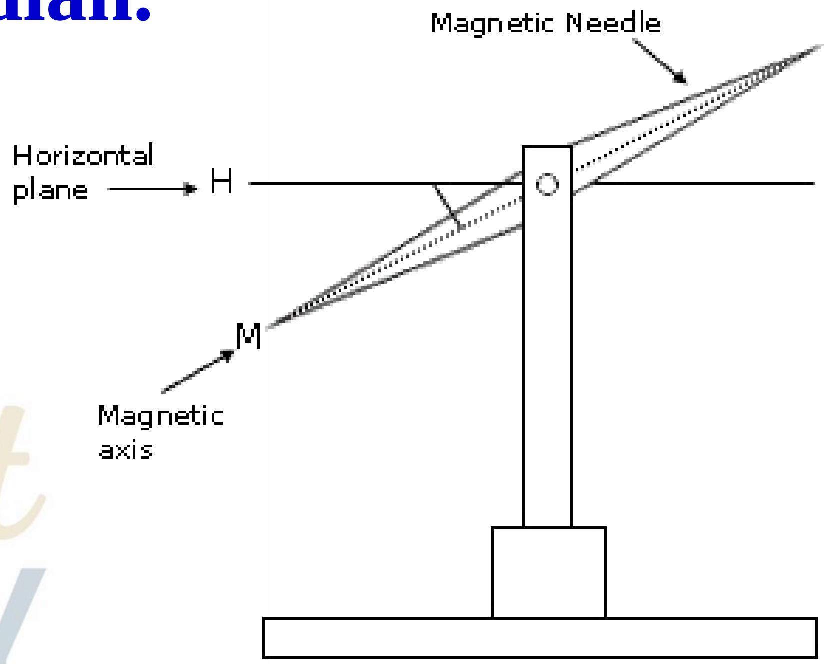
solution

Exercise 2

A magnetic needle movable around a vertical axis, is under the action of a magnetic field, of magnitude $B = 3.46 \times 10^{-5} T$, perpendicular to the plane of the magnetic meridian.

Under its influence, the needle deviates by an angle of 60° w.r.t the plane of the magnetic meridian.

1) How to specify, using the needle, the magnetic meridian in the place of the experiment ?



Exercise 2

2) Draw a figure, showing the direction of the needle and the magnetic fields acting on it.
3) Calculate the value of the B_h of the terrestrial magnetic field.
4) The magnetic inclination in the place of the experiment is: $I = 62^\circ$. Calculate the magnitude of the terrestrial magnetic field.

Exercise 2

$B = 3.46 \times 10^{-5} T, 60^{\circ}$

1) **How to specify, using the needle, the magnetic meridian in the place of the experiment ?**

The needle can rotate around a vertical axis, in the absence of the magnetic field $\vec{B}$, it is directed along $\vec{B}_H$ of the terrestrial magnetic field.

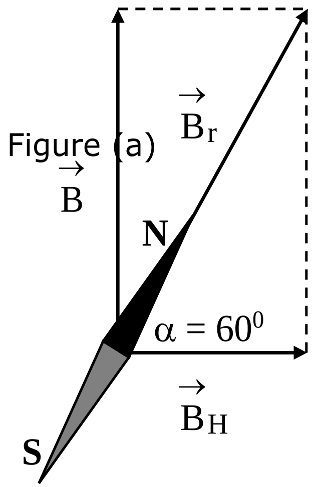
The plane of the magnetic meridian is the vertical plane parallel to the direction of the needle or containing this needle.

Exercise 2

$\boldsymbol{B = 3.46 \times 10^{-5} T, 60^{\circ}}$

2) **Draw a figure, showing the direction of the needle and the magnetic fields acting on it.**

The needle is under the action of two horizontal magnetic fields field $\vec{B}$ and $\vec{B}_H$.
Then the needle turns in the horizontal plane by an angle α to take the direction of the resultant $\vec{B}_r$ as shown in the figures.

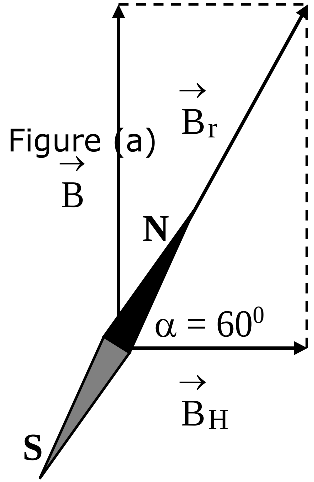


Exercise 2

$\boldsymbol{B = 3.46 \times 10^{-5} T, 60^{\circ}}$

3) Calculate the value of the B_h of the terrestrial magnetic field.

Using the geometry of figure (a) :



$$\tan\alpha = \frac{B}{B_h} \Rightarrow B_h = \frac{B}{\tan\alpha} = \frac{3.46 \times 10^{-5}}{\tan(60)}$$

$$\Rightarrow B_h = 1.997 \times 10^{-5} T \Rightarrow B_h = 2 \times 10^{-5} T$$

Exercise 2

$B = 3.46 \times 10^{-5} T, 60^{\circ}$

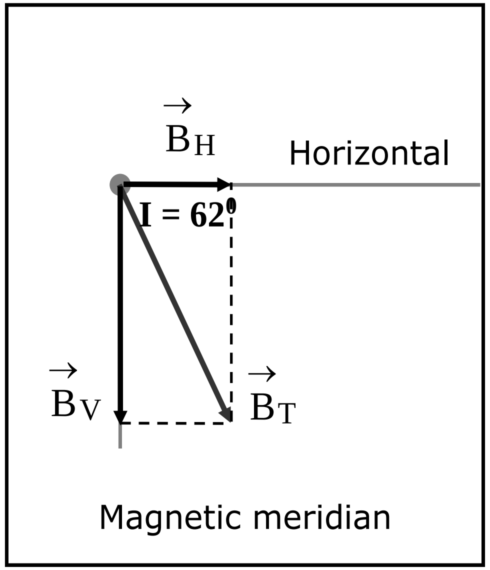
4) The magnetic inclination in the place of the experiment is: $I = 62^{\circ}$. Calculate the magnitude of the terrestrial magnetic field.

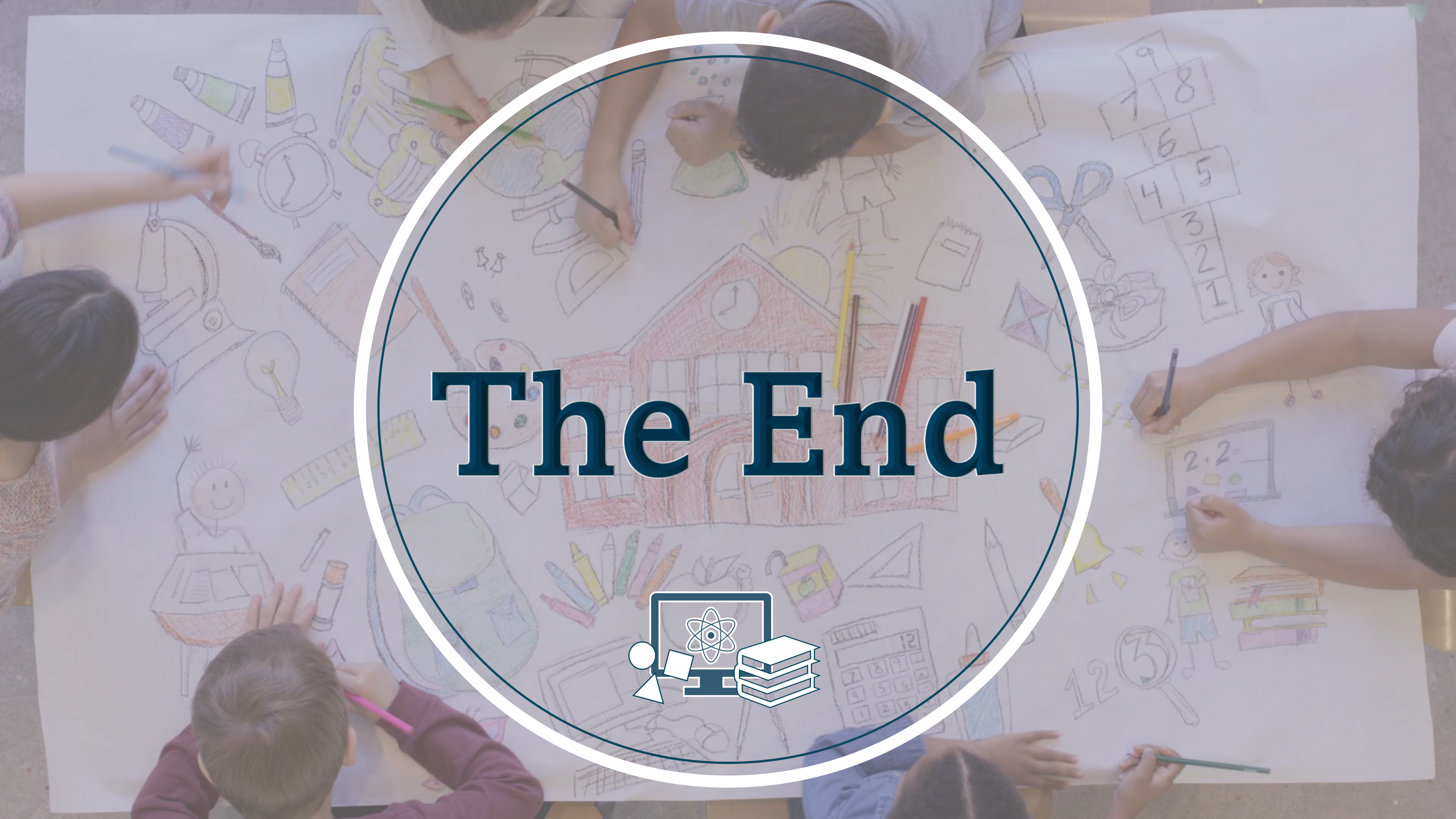
Using the geometry of figure (b) :

$$CosI = \frac{B_H}{B_T} \Rightarrow B_T = \frac{B_H}{CosI} = \frac{2 \times 10^{-5}}{cos(62)}$$

$$\Rightarrow B_T = 4.26 \times 10^{-5} T$$

Figure (b)





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