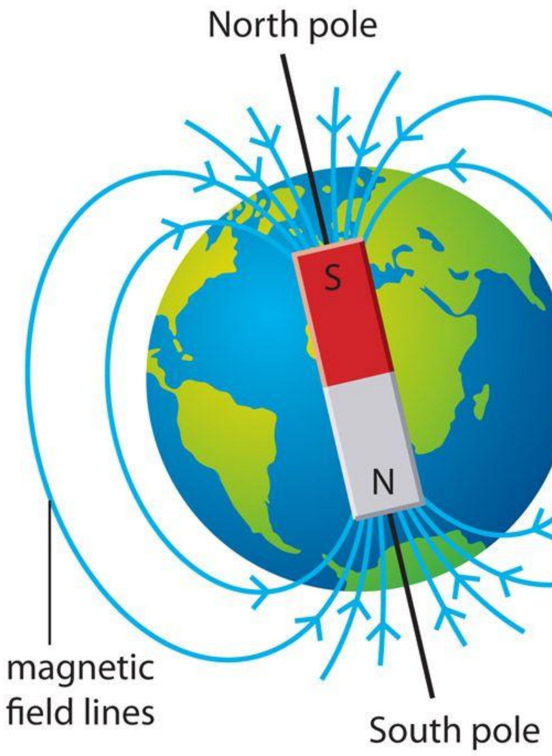
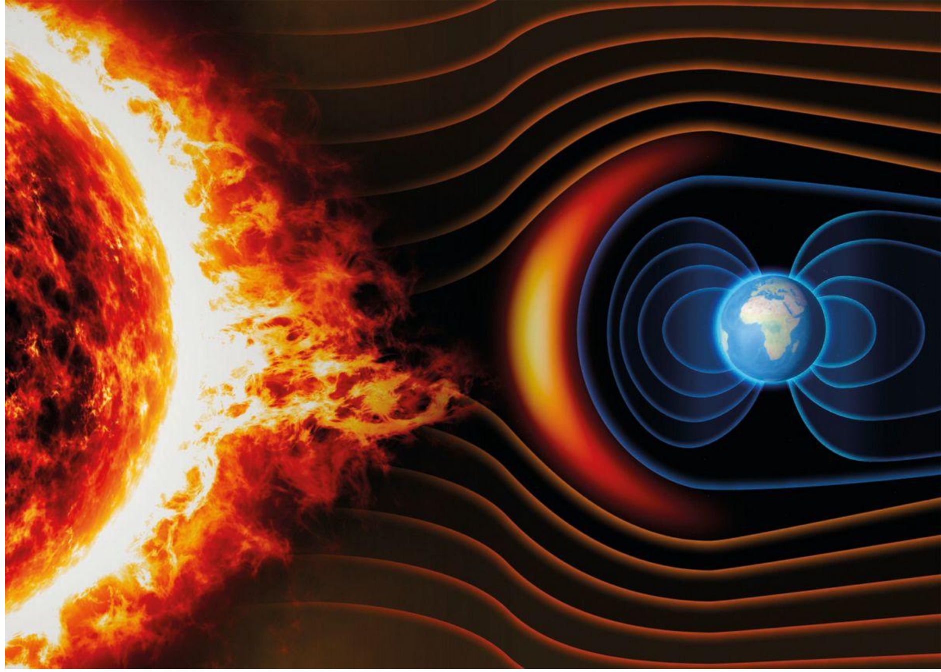


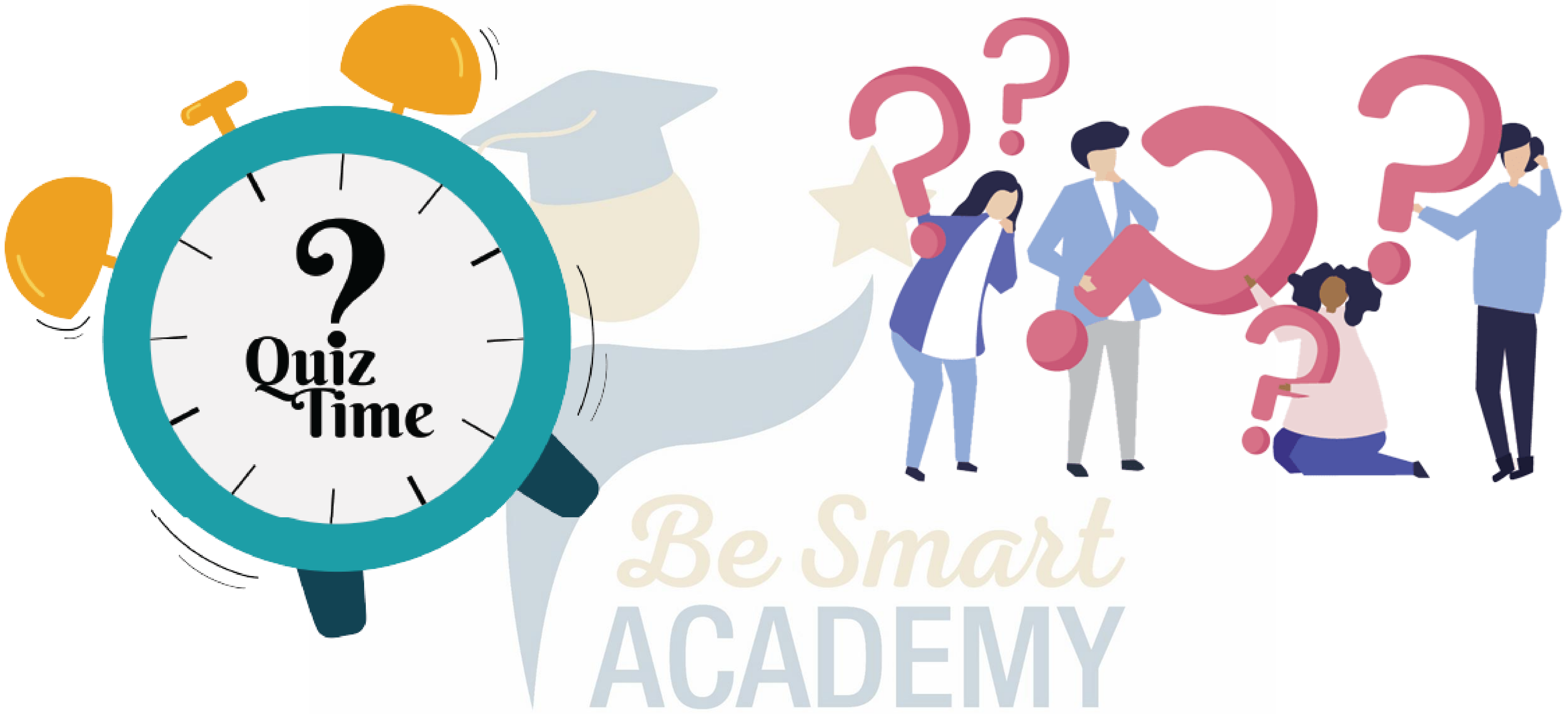



# Chapter 17

## Magnetic field



Prepared & Presented by: Mr. Mohamad Seif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# Exercise 3

## Part I: Superposition of magnetic fields:

Three magnets are arranged as shown in figure 1. The intensities of the magnetic fields created by the three magnets at point A are $B_1 = 0.5T$, $B_2 = 0.1T$, and $B_3 = 0.3T$ respectively.

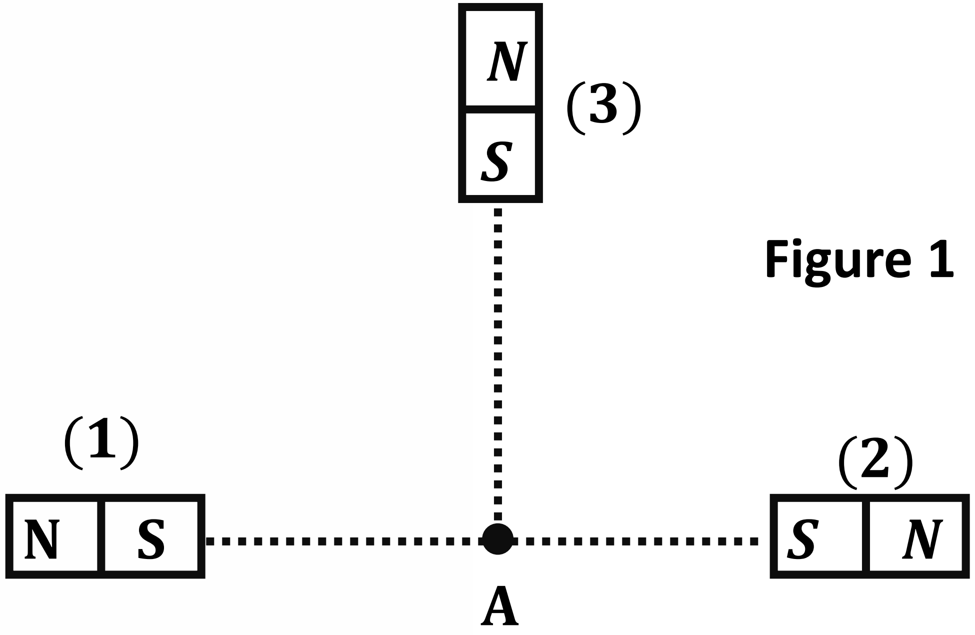


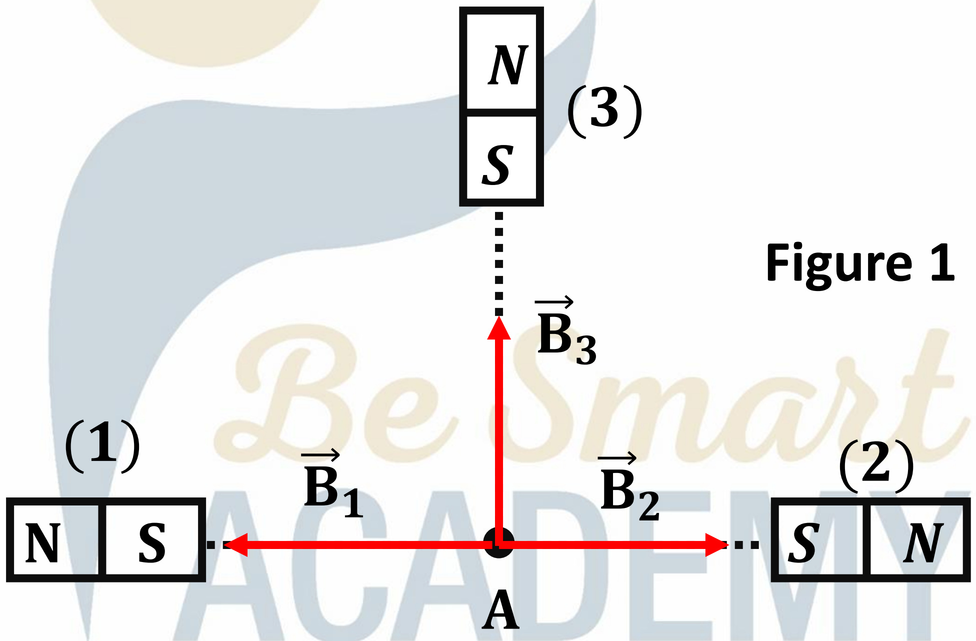

Figure 1

1) Represent at A, the magnetic field vector created by these magnets.
2) Determine the magnitude of the resultant magnetic field $\vec{B}_r$ at point A due to these three magnets. Represent it on the figure.

# Exercise 3

$B_1 = 0.5T$, $B_2 = 0.1T$, and $B_3 = 0.3T$

1) Represent at A, the magnetic field vector created by these magnets.



# Exercise 3

$B_1 = 0.5T$, $B_2 = 0.1T$, and $B_3 = 0.3T$

2) Determine the magnitude of the resultant magnetic field $\vec{B}_r$ at point A due to these three magnets. Represent it on the figure.

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

$$B_{1,2} = B_1 - B_2 = 0.5 - 0.1$$

$$B_{1,2} = 0.4T$$

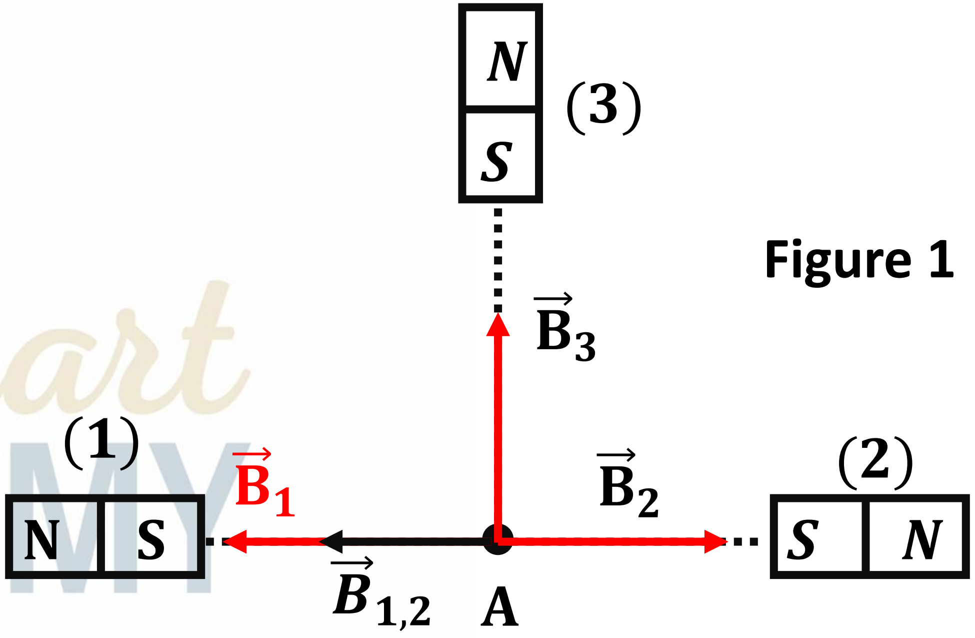


Figure 1

# Exercise 3

$B_1 = 0.5T$, $B_2 = 0.1T$, and $B_3 = 0.3T$

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

$$\Rightarrow B_r = \sqrt{(0.4)^2 + (0.3)^2}$$

$$\Rightarrow B_r = 0.5T$$

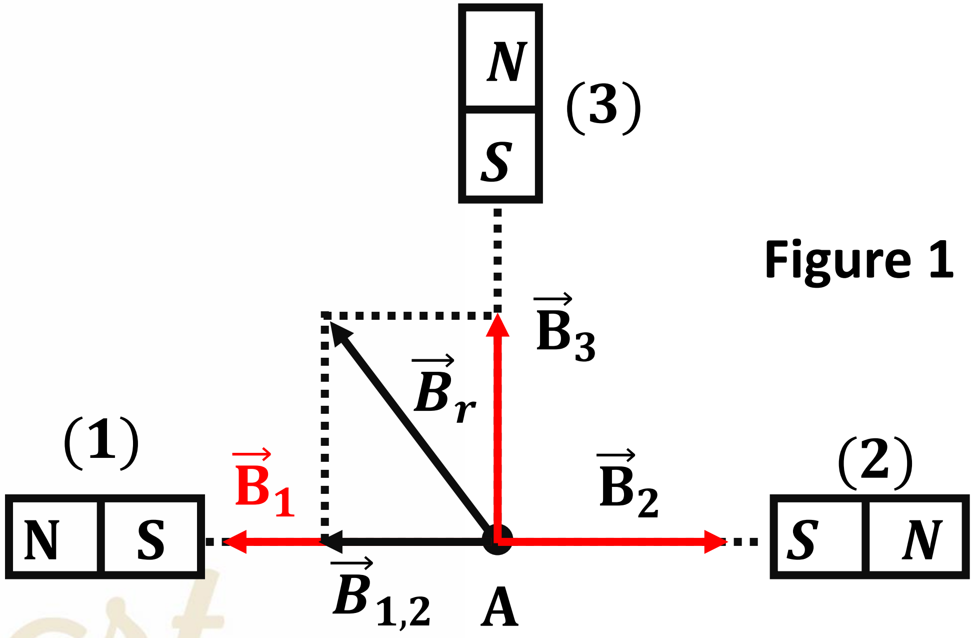


Figure 1

# Exercise 3

**Part II: Geomagnetism:** A magnetic needle, free to rotate in the horizontal plane about a vertical axis, is placed at point M in a region where the intensity of the horizontal component of the terrestrial magnetic field is $B_H = 2 \times 10^{-5} T$. The needle deviates by an angle $\alpha = 60^{\circ}$ when it is submited to an external magnetic field of intensity B that is perpendicular to the magnetic meridian as shown in figure .

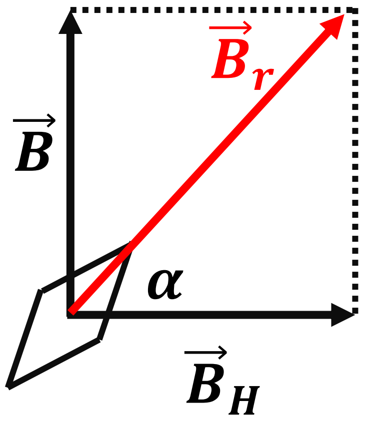


Figure 2

1) Calculate the values of B and $B_r$.
2) The intensity of the vertical component of the terrestrial magnetic field at this region is $B_V = 4 \times 10^{-5} T$.
   a) Calculate the intensity of the terrestrial magnetic field.
   b) Calculate the magnetic inclination.

# Exercise 3

$B_H = 2 \times 10^{-5}T, \alpha = 60^{\circ}$

**1) Calculate the values of B and $B_r$.**

$$tan\alpha = \frac{B}{B_h} \Rightarrow B = B_h \times \tan\alpha$$

$$\Rightarrow B = 2 \times 10^{-5} \times tan(60)$$

$$\Rightarrow B = 3.46 \times 10^{-5}T$$

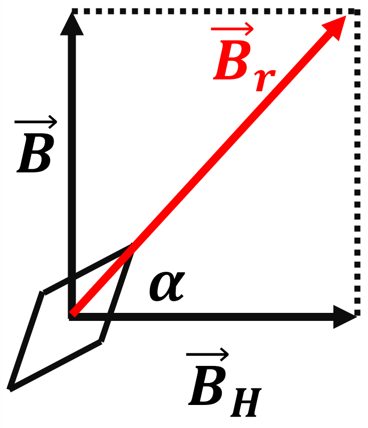


Figure 2

## Exercise 3

$B_H = 2 \times 10^{-5} T, \alpha = 60^{\circ}$

1) Calculate the values of B and $B_r$.

$$sin\alpha = \frac{B}{B_r} \Rightarrow B_r = \frac{B}{sin\alpha} = \frac{3.46 \times 10^{-5}}{sin60}$$

$$\Rightarrow B_r = 3.4 \times 10^{-5} T$$

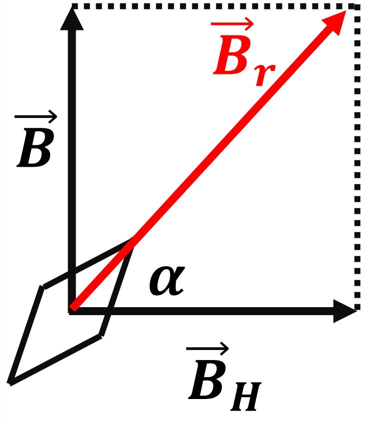



Figure 2

# Exercise 3

$B_H = 2 \times 10^{-5}T, \alpha = 60^{\circ}$

2) The intensity of the vertical component of the terrestrial magnetic field at this region is $B_V = 4 \times 10^{-5}T$.

a) Calculate the intensity of the terrestrial magnetic field.

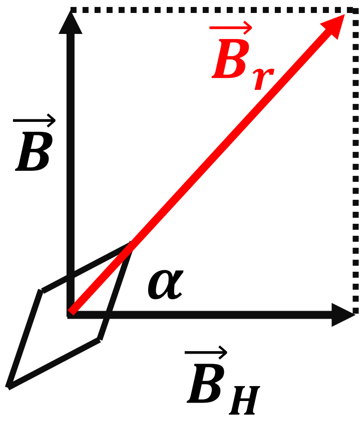


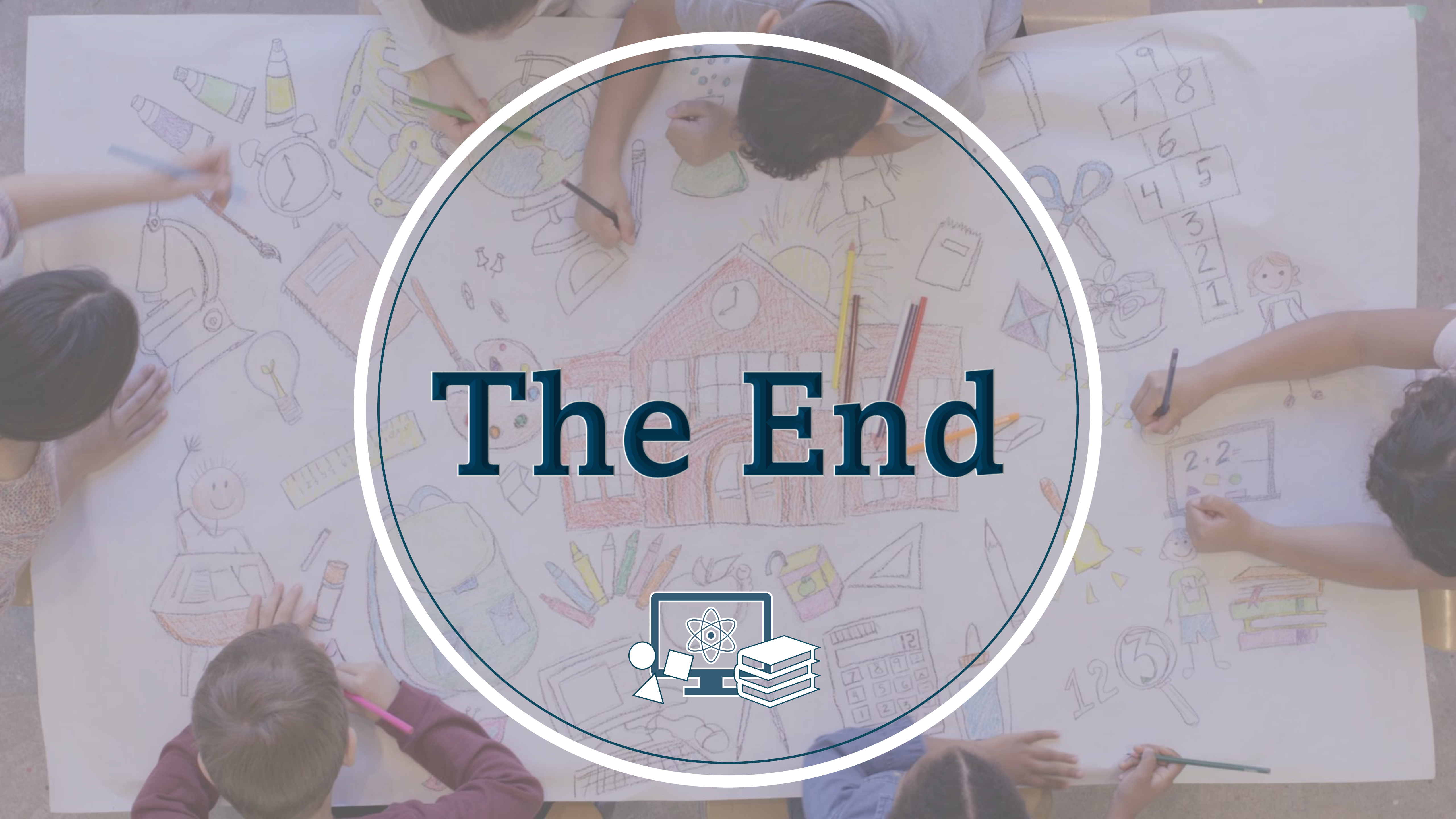

Figure 2

$$B_T = \sqrt{B_V^2 + B_H^2} \Rightarrow B_T = \sqrt{(4 \times 10^{-5})^2 + (2 \times 10^{-5})^2}.$$

$$\Rightarrow \quad B_T = 4.5 \times 10^{-5} T$$

b) Calculate the magnetic inclination.

$$\tan(I) = \frac{B_V}{B_H} = \frac{4 \times 10^{-5}T}{2 \times 10^{-5}T} \Rightarrow I = 63.4^{\circ}$$



# The End

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