Hall effect in graphene

In this experiment you are going to measure graphene's Hall coeffient at room temperature. Graphene, two dimensional crystal of carbon atoms, was synthesized by chemical vapor deposition method, and transferred on a polymer film. Then four wires were connected to the copper contacts. Figure 2 illustrates the schematic view of the prepared sample that you are going to use. Since graphene can be easily damaged and the contacts are loose, you must take extra care when using the sample.

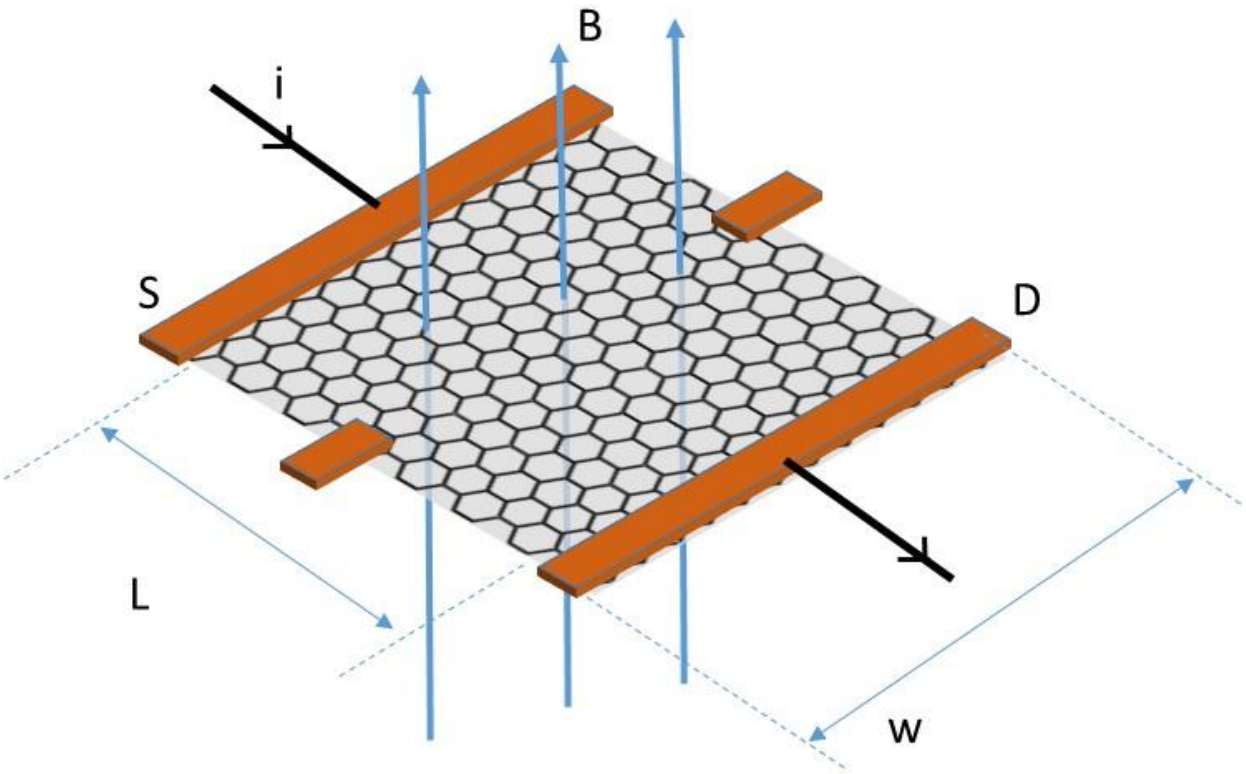


Figure 1. Scheme of the graphene Hall device. You are going to measure the Hall voltage by applying magnetic field as shown.

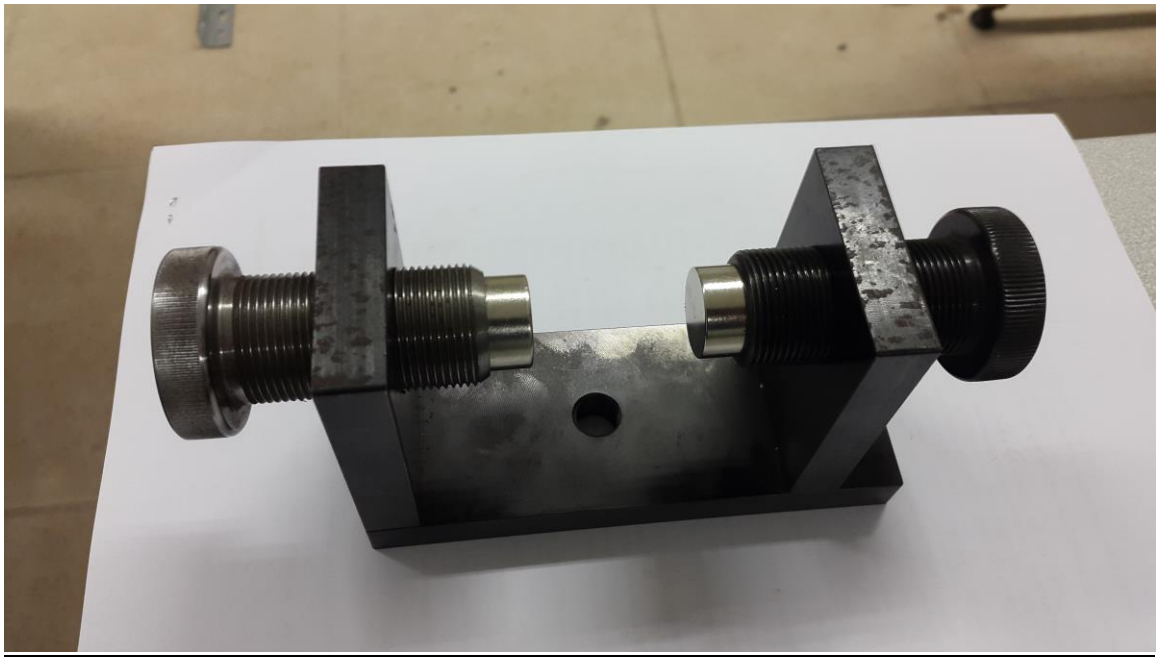
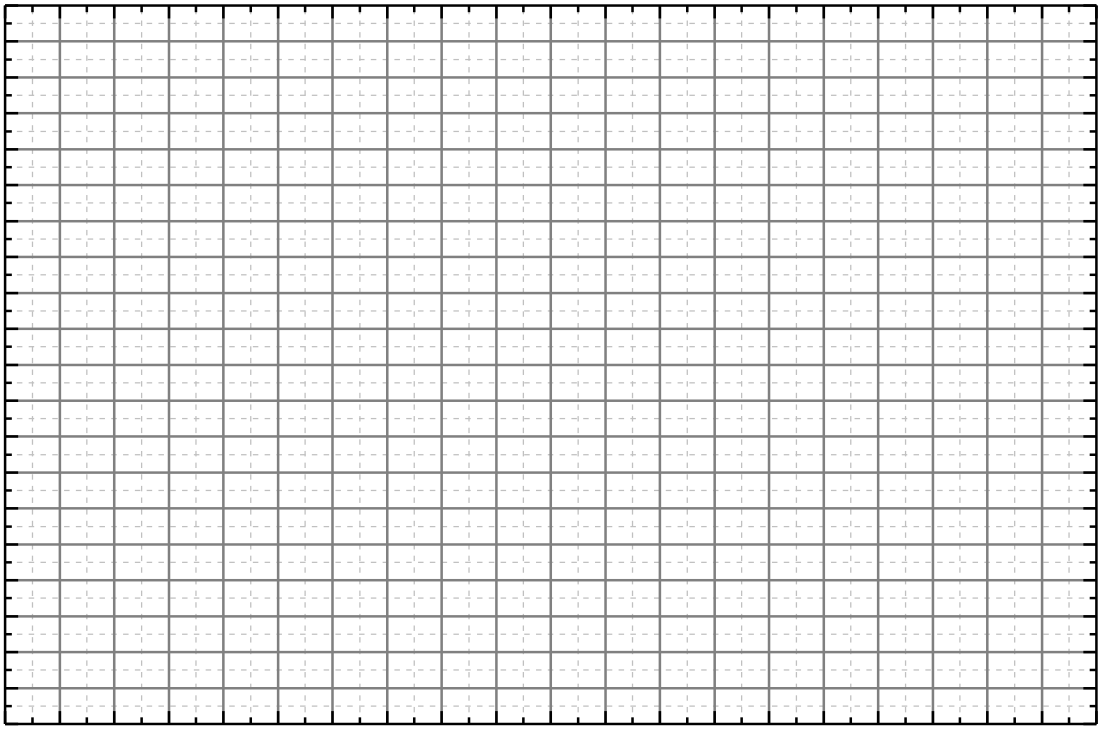


Figure 2. The magnets that are used to apply magnetic field.

Question 1: Determine the direction of magnetic field, fig.2. Explain your approach. (2 points)

Question 2: Measure the magnetic field intensity by slowly increasing the distance between two magnets, fig.2. Plot your results below on the gridded area. You are going to need these results at later stages of the experiment.



Question 2: Measure the dimensions of graphene sample, fig.1. (2 points):

W =	L =

Question 3: Apply 2V to S and D electrodes, fig.3. Quantify the current density, J, by measuring the current, I, passing through the graphene. (2 points):

I =	J =

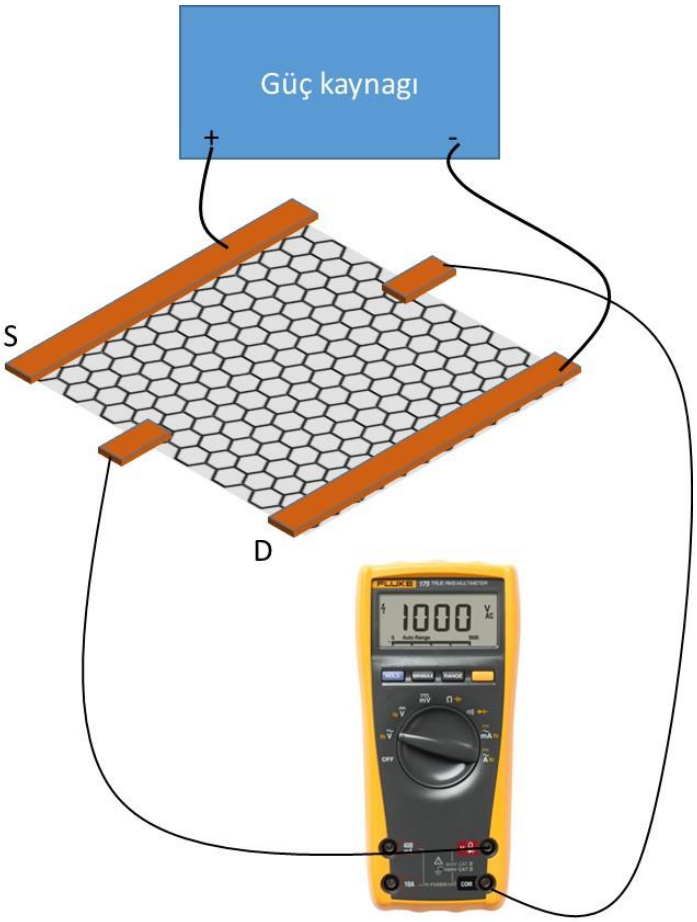
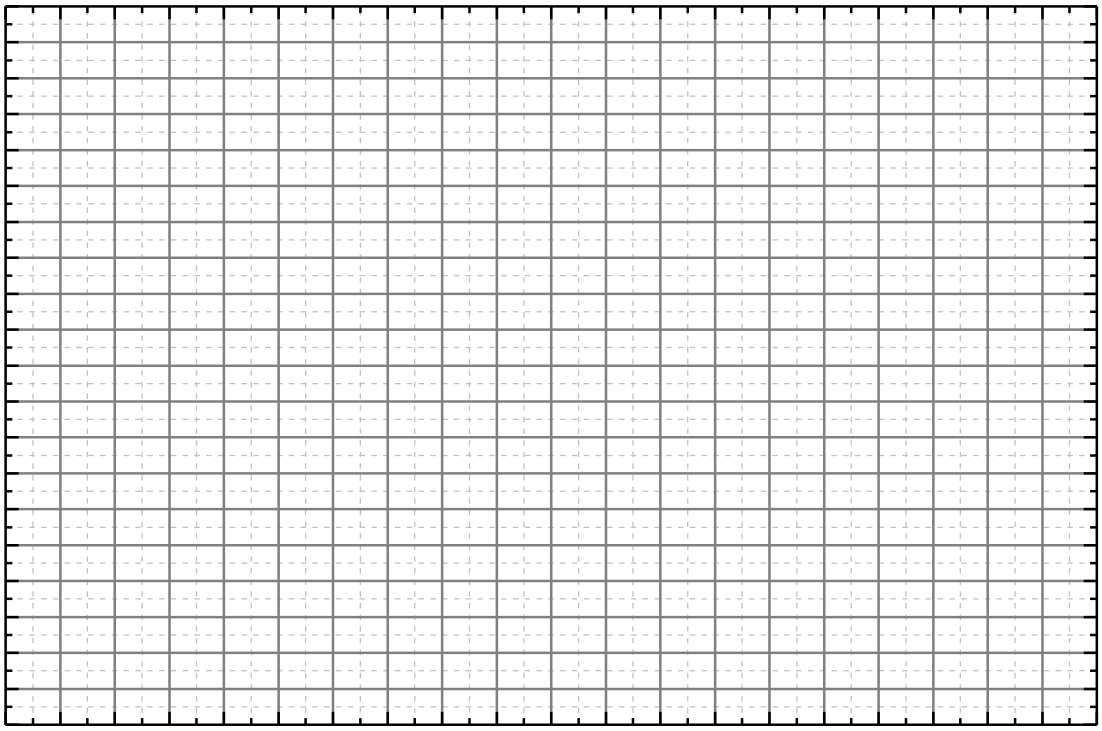


Figure 3. Connecting the power supply and reading the voltage values.

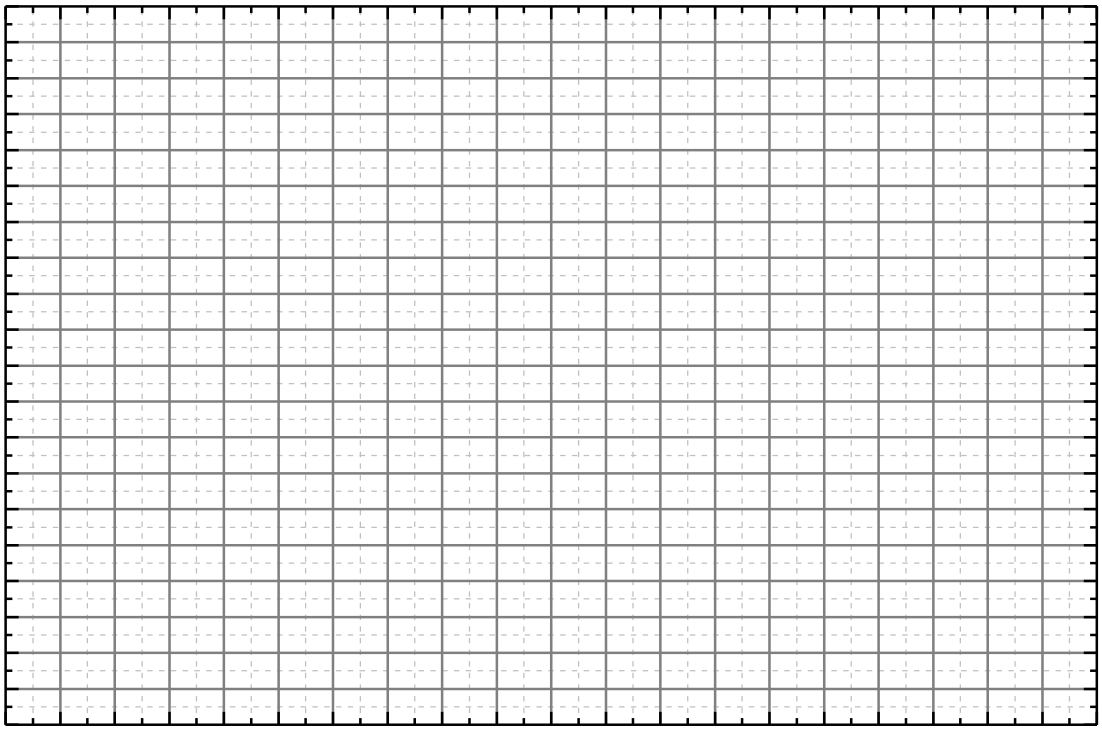
Question 4: Meaure the Hall voltage by varying the magnetic field intensity on graphene sample. Plot the Hall voltage as a function of magnetic field. (4 points)

Distance	**Magnetic field**	**Hall voltage**



Question 5: Repeat the measurement by reversing the magnetic field direction, plot your results. (4 points):

Distance	Magnetic field	Hall voltage



Question 5: Calculate the voltage value when the magnetic filed intersity is zero. Explain your results. (2 points)

Question 6: Extract the Hall coefficient using the graphs. E_y is the electric field created perpendicular to currect flow, B is the magnetic field intensity, and J is the current density on graphene. (4 points)

$$R_H = \frac{E_y}{B\,J}$$