

*Group number: 07*

*Project title: Electromagnetic Train*

*Client &/Advisor: Professor Song Jimming*

*Team Members/Role:*

- 1. Yap Yong Sheng (Team Leader)*
  - 2. Norfarahin Nordin (Communication Leader)*
  - 3. Chung Sheng Su (Webmaster)*
  - 4. Shi Xiang Lim, Larry (Concept Key Holder 1)*
  - 5. Mustafa Hafez(Concept Key Holder 2)*
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○ **Weekly Summary**

Throughout this week, we have an official meeting with our advisor. The aim of the meeting is to finalize and specify the lists of the item that we want to purchase from the supplier. Every member in this group did their best in finding the best item that will be utilized in the project. Comparisons are made in terms of the shipment of the item, the cost of item, and minimum quantity of purchase that needed for item shipment. Our main goal is to receive all the item needed especially the magnet in 2 weeks, so that we start set up and conduct our parameters.

● **Past week accomplishments**

In this part, every group members describe specifically on what they contribute for the project progression:

### ***Yong Shen***

For this week, I distributed the group work with pair and send the information to Professor Song (latest by Sunday). Chung Sheng and Mustafa are in charge of the magnet. Larry and I are in charge of the copper wire. Fara is in charge with the electric contact. Larry and I are planning to get 10 AWG and 20 AWG copper wires for our project. In this way, we can compare the reaction of the train between two copper wires. At first, we are planning to get 6 AWG and 10 AWG copper wires for our project. But not many companies sell 6 AWG because it is too small. The lists below are the companies that replied me and the information is on their website. Many companies did not reply us such as Rea wire and magnet wire manufacturer. Next, I emailed Professor Song about the detail of the magnet and the copper wire that our group agreed.

No	Company	AWG	Cost (\$)	length	Shipping (days)
1.	Digi-Key	20 AWG	81.86	216.7m	1 -2
2.	Ebay	10 AWG	61.05	157ft	2-4
3.	Powerwerx	20 AWG	27.74	315ft	2-3

Links:

- <http://www.digikey.com/product-detail/en/cnc-tech/610220/1175-1709-ND/4924055>
- <http://www.ebay.com/itm/Magnet-Wire-10-AWG-Gauge-Enameled-Copper-5lb-157ft-200C-Magnetic-Coil-Winding-/251068829681?hash=item3a74de4ff1:g:9xkAAOSwtnpXlpAR>
- <https://powerwerx.com/magnet-wire>

### ***Larry Lim***

- Managed to get in touch with supplier.
- Got quotes from the remaining companies
- Found out that magnets have to be in electrical contact with wires to work

### ***Chung Sheng Su***

- This week I am in charged in researching the electromagnets which we will be using in building the electromagnetic train. First, I started up with researching the types of magnets which we will be using. I found out the neodymium magnets are the strongest permanent magnets that are available commercially.
- After that, I researched deeper into the grades of the neodymium magnets. The common grades of neodymium magnets are ranged from N35 to N52 where the increase in the value of number will indicate a stronger magnets. Since the magnets plays a major role in our experiment, N52 neodymium magnet would be the most suitable grade to be used as it is not too pricey in small size. The size of the magnet would be dependent on the size of the battery used which will be explained later.
- The most common used batter used for this experiment is AAA batteries. From the website by Wayne Schmidt in "How to Build the Simplest Electric Train" (1), it says that AAA

batteries are used because the size of it is small which allow it to perform tight curves as compared to larger batteries. But on the other hand, larger batteries such as AA battery can run faster and have a longer lifespan as compared to AAA battery. So for our experiment, it is best to order sizes of magnets for both AA and AAA battery so that we have a wider variety and create multiple condition for the research.

- Besides that, the step of 4 of the World’s Simplest Electric Train by KJMagnetics(3) states the dimension that is most suitable for different sizes of batteries. It recommends ½” diameter for AAA battery and 5/8” for AA battery. As for the thickness of the magnet, based on the website from kjmagnetics in “Doubled Forces”(2), it shows that if two magnets are stacked together, the pull force is approximately doubled. But when more magnets are stack together, the increase will slowly diminish as the magnet will be farther away for the attracted material, which will decrease its pull force. Thus, I think that a total of five 1/8” thicknesses on each side of the battery will be sufficient for us to create multiple conditions for our research.
- From above, we have decided to get a minimum of 10 magnets for each dimension of ½” and 5/8”. After looking up in the internet, I found that magnet4less offers the most reasonable price for N52 magnets in the dimension we need. The information for the price and delivery duration is shown on the table below.

Link	Cost	Diameter (in)	Thickness (in)	Batteries
<a href="http://www.magnet4less.com/product_info.php?cPath=1_11&amp;products_id=1278">http://www.magnet4less.com/product_info.php?cPath=1_11&amp;products_id=1278</a>	\$4.5 for 10 magnets	5/8	1/8	AA
<a href="http://www.magnet4less.com/product_info.php?cPath=1_11&amp;products_id=1115">http://www.magnet4less.com/product_info.php?cPath=1_11&amp;products_id=1115</a>	\$4.5 for 10 magnets	1/2	1/8	AAA
Delivery	\$15		Minimum order	\$5
Total Cost	\$24.00			

\*Assume 6 Day Shipping (UPS Ground Delivery)

Other delivery costs

Shipping Thru:	Receive Date	Shipping Cost	Total Cost
UPS - United Parcel Service (Ground)	6 days	\$15.00	\$24.00

UPS - United Parcel Service	3 days	\$21.88	\$30.88
UPS - United Parcel Service (Air)	2 days	\$28.03	\$37.03
UPS - United Parcel Service	Next day	\$64.78	\$73.78

Lastly, I would want to add on that we could add a washer in the positive electrode of the battery to prevent the magnet from tilting as shown in "How to Build the Simplest Electric Train" by Wayne Schmidt.

#### Citation

1. Schmidt, Wayne . "How To Build The Simplest Electric Train." How to Build the Simplest Electric Train. N.p., n.d. Web. 20 Feb. 2017.  
<<http://www.waynesthisandthat.com/How%20To%20Build%20The%20Simplest%20Electric%20Train.html>>
2. "Doubled Forces." K&J Magnetics Blog. N.p., n.d. Web. 20 Feb. 2017.  
<<http://www.kjmagnetics.com/blog.asp?p=doubled-forces>>
3. KJMagnetics. "Experiment." Instructables.com. N.p., 01 Nov. 2016. Web. 20 Feb. 2017.  
<<http://www.instructables.com/id/Worlds-Simplest-Electric-Train/step4/Experiment/>>

#### ***Mustafa Hafez***

- Chung and I were assigned with researching which types of batteries and magnets we needed along with what dimensions they needed to be. We decided to go with neodymium magnets and both AA and AAA batteries (so we could test which of the two would be best for our purpose). I found out that, ideally, we'd want to have the battery (which I'll refer to as 'd') to be tall enough so that the radius of the magnetic field emitted from one magnet is less than 'd'/2. We would also want the radius of the magnet to be greater than that of the battery. We decided that, for the magnet, we'd want a radius of about 5/8 inches and a thickness of around 1/8 inches.

#### ***Norfarahin Nordin***

##### **Summary**

- In this week, we have a detail discussion with the team members about the items that we want to purchase.
- I worked on ensuring the information update about the item that we have assigned to each member. This is important as I have to make sure the items that we purchase are in the dimension and size that we expected.

- For my parts, we have ensured the electrical contact between the coil and the battery is compulsory. Thus, we decided to locate the clear tube that acts as a sturdy support for the coil turns, to be at the outside of the coil, battery and magnet.
  - This tube sizing will be determine once our group has decided the coil and the magnet size.
- **Pending issues**
- Mustafa and Chung Shen: confirm the size of the magnet that supposed to match the diameter of the battery.
  - Larry and Yong Shen: Waiting for one more company replies regarding the coil shipment duration issue, buy the materials needed for the project, and research more on topic.
  - Norfarahin: Calculate the sizing of the tube needed, includes the thickness of the tube.
- **Individual contributions**

<b><u>NAME</u></b>	<b><u>Individual Contributions</u></b>	<b><u>Hours this week</u></b>	<b><u>HOURS cumulative</u></b>
Yong Shen	Set up meeting, calculate the coils length needed, compare the cost and shipment duration, and meet with advisor.	4	13
Farah Nordin	Find materials related: tube sizing, report write up, provide some materials information.	4	13
Larry Lim	Find materials related: coil, provides list of material, calculate the coils length needed, compare the cost and shipment duration.	4	13
Chung Sheng	Confirm all the details and information regarding the magnet used; size, materials, and strength.	5	10
Mustafa Hafez	Confirm all the details and information regarding the magnet used; size, materials, and strength.	5	10

- **Comments and extended discussion**
- The project is progress as following the timeline of the group project. We are in last phase of setting up all the materials needed for the parameters test out. The parameter is expected to be conduct in 2 more weeks (mid March).

- **Plan for coming week (please describe as what, who, when)**

All team members contribute and finalize all the information of the item shipment with the advisor. The item should start to be purchase by next week.

- **Summary of weekly advisor meeting**

A few issues are discussed during the meeting:

- Due date for the item list submission to the department

- Procedure of purchasing item

- The compatibility of magnet sizing and the battery use.