UESTC1019 English for Engineering Studies B
Project 2025-26, Week 13

An Investigation of Electrostatic Forces of Attraction & Repulsion

This Project involves doing an experiment, making a video and writing two documents: a lab report and a reflection on the project. The purpose of the Project is to work collaboratively with other students in a group of 3 (or 4 if necessary) to write a well-organised report of a technical nature, following the IEEE referencing style.

You will be randomly grouped with other students and must work collaboratively with them in your Project group, but you must not work with students from another Project group. Additionally, you must **not** copy the work of other people **or** use AI to generate any part of your work. Please see the Academic Integrity statement in the template document for more information.

This assessment shows evidence of meeting the following ILOs of the course:

- analyse, evaluate and synthesize engineering-related written texts
- incorporate technical and sub-technical vocabulary with accuracy and flexibility when producing written texts
- write well-organised reports of a technical nature, following discipline-specific academic conventions
- reflect on individual or/and group work

This assessment also works towards meeting the following AHEP 4 criteria:

- C16 Teamwork - Function effectively as an individual, and as a member or leader of a team.
- C17 Communicate effectively on complex engineering matters with technical and non-technical audiences

1. Materials Required for the Experiment

- some balloons
- some string or thread
- an empty drinks can
- a piece of material or clothing made of wool
- a large flat surface (such as a table or a floor)
- a room with low levels of air flow
- a measuring tape or ruler
- a stopwatch or timer

WARNING! Most balloons contain a material called **latex**. If an individual is **allergic** to latex, exposure to it can cause serious skin irritation, eye irritation, and breathing difficulties. If you are allergic to latex, or even if you are unsure whether or not you are allergic to latex, then do not touch

or be anywhere near the balloons. Instead: help with setting up the experiment, noting results, and/or filming, but **avoid contact** with the balloons and **keep well away** from them when they are being blown up and being charged.

2. Experimental Procedure

Step 1

- Close all the windows and doors of the room and ensure no fans or air conditioning systems are operating.
- Blow up two balloons to approximately the same size, and small enough that each one can be held using one hand.
- Tie their ends so that no air can escape.
- Use 3 pieces of string to create the set-up shown in **Figure 1**.

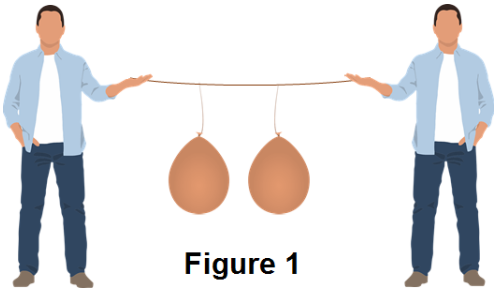

Figure 1

- Rub each balloon against the hair on your leg, arm or head, or by rubbing them against woollen fabric or clothing:
    - **WARNING!** If rubbing against your arm, leg, or head hair, ensure no watches, jewellery, or hair pins/clasps are worn – these could cause the balloon to burst.
    - Make sure you charge the parts of the balloons that will be facing each other when they are suspended, as in **Figure 1**.
    - Make sure each balloon is charged for the same amount of time.
    - Note how long the balloons are charged for.
- Return the balloons to the positions shown in **Figure 1** – at their closest point, the balloons should be 5–8cm apart.
- Note any change in position of the balloons and time how long that continues for.
- Consider how many times you should repeat this Step 1 experiment to increase the reliability of your results. (Repeat at least 2 times)

Step 2

- Close all the windows and doors of the room and ensure no fans or air conditioning systems are operating.

- Test that the surface to be used is flat by placing the can (on its side) on various parts of the surface, checking that the can does not begin to roll without any force being applied to it.

Figure 2

- Place the can on its side in the centre of the flat surface, as shown in **Figure 2.**
- Blow up a balloon so it is small enough to be held using one hand.
- Rub the balloon against the hair on your leg, arm or head, or by rubbing them against woollen fabric or clothing for the same amount of time as the balloons in Step 1 and using the same method.
- Hold the balloon close to the can, so that the charged section of the balloon's surface is closest to the can – do **not** allow the balloon to touch the can.
- Note any movement in the can.
- If the can moves, attempt to move it as far as possible.
- Measure the total distance the can travels.
- Again, consider how many times you should repeat this Step 3 experiment to increase the reliability of your results.

IMAGES SOURCE: Images royalty free from www.pixabay.com.

3. Video Report

The video is not assessed but this is the evidence of working together to complete the experiment, so you must submit the video with the lab report to receive a grade.

Make a **video**. It should contain the following:

- an explanation of the methodology used in each step of the experiment – this could be someone speaking to the camera while displaying the different items used, or it could be a voice-over with images of the different items used
- an explanation of what you believe will happen and your reasons for those hypotheses (see **Class Session 20 and Section 6 – Source Extracts** below)
- footage of the experiment being carried out, with a narrator explaining what is happening

- comments on whether or not the actual results matched the predicted ones and possible reasons those results were obtained.

Additional requirements:

- The video should be **3-4 minutes** long.

- Each group member should be visibly present in the video to evidence collaboration and group work. Each group member should speak for a minimum of **1 minute** in the video. You should upload the video together with your report to Moodle.

- You should bring it on a memory card or USB stick to the first **Class Session** in Week 14.

4. Laboratory Report

Write a full **laboratory report** as a group. **One** group member must upload it to Moodle. Use the **PR template doc** on Moodle to type your report on. Use **Arial font size 12 bold** for headings and **Arial font size 11** for the content of each section. It should contain the following sections:

- Title (already provided on the template)
- Introduction
- Objective(s)
- Methodology
- Results (containing appropriate tables/charts)
- Discussion
- Conclusion
- References

Sources of information can be found in **Section 6 – Source Extracts**. You must use either four of the sources or all five. You should **not** use information from any other sources: only use the sources provided here.

There is no word limit given for this assessment, but you need to write as full a lab report as you can. You have also analysed other sample lab reports which give an indication of the length that is required.

Submit the report on Moodle by **11pm on Sunday 30th November (Beijing time):** Project Submission_Group Lab Report FINAL VERSION. You may also use the Project Submission (DRAFT) version (not assessed) on Moodle to check your report through Turnitin. **You must name this draft file in exactly the same way as your final version. It must be the same student that uploads the assignment in the draft submission and in the final submission areas – otherwise Turnitin will find a match between the 2 documents! Also, you are only allowed to upload your final submission ONCE.** Therefore, you must be 100% certain that you have uploaded the correct document before final submission.(Draft 可以根据查重率整改后再次上传，Final只能传一次)

Only **ONE** group member uploads the report. Remember that you all take responsibility for what is uploaded to Moodle. You must organise your time so that you submit your report **before the deadline**. After submitting, you must check that your lab report has successfully uploaded and that you have uploaded the correct document. **You must submit a Word document, i.e. a file that ends with .doc or .docx.**

Name your document as follows:
PR_Student1SurnameGivenName_Student2SurnameGivenName_Student3SurnameGivenName
(eg PR_ZhangBohan_LiHao_ShiJiwei – ie no spaces, just capital letters + underscores)

5. Reflection

In the first Class Session of Week 14, you will complete a short reflective report by answering 3 questions in writing. **You must not miss this part of the assessment.** (1.lab report (in groups;20);2.Vedio(no score);3.reflection(individualy on papers in the class;have individual score;10)

6. Source Extracts

Source 1

Have you ever rubbed a balloon on your head and stuck it on the wall? If so, you have seen a demonstration of an electrostatic field. The action of rubbing the balloon caused your head to end up with charge on it and the opposite charge on the balloon. The act of rubbing these materials together caused some electrons to move from one surface to the other, charging both your head and the balloon. Remember, opposite charges attract, whereas the same charges repel.

SOURCE TYPE: Electronic Book **AUTHOR**: D. Ashby
BOOK TITLE: Electrical Engineering 101 **EDITION NUMBER**: Three **PAGE**: 5
CHAPTER: One **DATE OF PUBLICATION**: 2009
PUBLISHER: Newnes Elsevier (Oxford, UK)
DATABASE: https://www-sciencedirect-com.ezproxy.lib.gla.ac.uk

Source 2

Electrostatics – Objects can be positively charged, negatively charged or neutral. A substance that gains electrons becomes negatively charged, while a substance that loses electrons becomes positively charged. For example, when a plastic rod is rubbed with a cotton cloth, electrons are transferred from the rod onto the cloth, making the rod positively charged. It is the friction between the rod and the cloth that results in the transfer of electrons.

When a charged object comes near to another object, the two objects will either attract or repel each other. If the charges are the same, they repel. If the charges are opposite, they attract. If one is charged and the other is not, they may attract depending on the nature of the substances. This can be a nuisance, for example, when dust and dirt are attracted to insulators such as TV screens and computer monitors.

SOURCE TYPE: Website **AUTHOR**: BBC Bitesize **WEBSITE TITLE**: BBC.co.uk
WEBPAGE TITLE: Uses and dangers of static electricity **DATE OF PUBLICATION**: 2020
WEB ADDRESS: https://www.bbc.co.uk/bitesize/guides/z77ycdm/revision/2

Source 3

A nonconductive material that gives up an electron will gain a positive electrostatic charge. A nonconductive material that takes extra electrons will become negatively charged. Electrostatic charges with like signs repel while charges with opposite signs attract. This ability of nonconductive materials to acquire electrostatic charges is known as triboelectricity.

Once the type of materials present is known, the most important factor is humidity. It is well known that, during winter and spring seasons, all integrated circuit manufacturers have recorded an increased rate of “infant mortality” in their chips, and field engineers report an increasing number of service calls for computer failures.

SOURCE TYPE: Electronic Book **AUTHOR**: M. Mardiguian
BOOK TITLE: Electrostatic Discharge: Understand, Simulate, and Fix ESD Problems
EDITION NUMBER: Three **PAGES**: ix-15 **CHAPTER**: One **DATE OF PUBLICATION**: 2009
PUBLISHER: IEEE Press/John Wiley & Sons Inc. (Hoboken, New Jersey, USA)
DATABASE: https://ieeexplore-ieee-org.ezproxy.lib.gla.ac.uk

Source 4

Electrostatic charge (ESC) is the result of an imbalance between the number of negatively charged electrons and positively charged protons in the atoms comprising the surface of a material. If the material has fewer electrons than protons on its surface, the surface is positively charged. If the surface has more electrons than protons on its surface, the surface is negatively charged. Tribocharging occurs any time that dissimilar materials are placed in contact with one another and then separated. Rubbing tends to increase the charge generation caused by contact between dissimilar materials. However, over an extended period, electrostatic charge can be dissipated gradually among molecules in the surrounding air.

It has long been known and documented that elevated humidity plays an important role in reducing the amount of static charge that is generated on items in the environment. In humid environments, when two dissimilar materials are brought in contact with one another, some areas will actually be water molecules in contact with water molecules. When the water molecules are separated, no charge will be generated. At high relative humidity, the surface becomes more or less continuously covered by a film of water molecules, in some places several atomic layers thick. So, as the humidity of the air goes up, the atomic composition of the two contacting surfaces becomes more alike and the amount of tribocharge that is generated goes down.

Electrostatic charge on surfaces has an effect on the accumulation of contamination by surfaces. This phenomenon, referred to as electrostatic attraction, is a critical problem in clean environments, as it causes the attraction of contamination to an item that has a high static charge on its surface. Good examples are the manufacture of compact disks and DVDs, and the production of precision optical components such as lenses, mirrors, and contact lenses.
SOURCE TYPE: Electronic Book **AUTHORS**: R. W. Welker, R. Nagarajan, and C. E. Newberg
BOOK TITLE: Contamination and ESD Control in High-Technology Manufacturing
EDITION NUMBER: One **PAGES**: 48-116 **CHAPTER**: Two **DATE OF PUBLICATION**: 2006

PUBLISHER: IEEE Press/John Wiley & Sons Inc. (Hoboken, New Jersey, USA)
DATABASE: https://ieeexplore-ieee-org.ezproxy.lib.gla.ac.uk

Source 5

KEY IDEAS TO REMEMBER:

- Some substances can hold their charges for extended periods of time; however, other materials may dissipate their charges into the surrounding air, or even across open spaces to nearby objects, relatively quickly.
- Many industries face difficulties due to materials developing ESC and then pushing away from each other. A simple example is when goods are being packed using adhesive tape. It is common for adhesive tapes to become charged as they are removed from their rolls. If the object the piece of tape is to be attached to has a similar charge, then the tape will push away from it and, in many cases, adhere itself to the worker or machine doing the packing.

SOURCE TYPE: Tutorial handout **TUTOR**: Dr. S. Beckett
HANDOUT TITLE: Week 3 Tutorial Handout **SEMESTER**: 2020/21, Autumn
COURSE: UESTC10888 Evaluating Approaches in Electrical Engineering
UNIVERSITY: Glasgow College, University of Electronic Science and Technology of China
LOCATION: Chengdu, PRC

Other important information

You must submit your report by the deadline. A late submission will receive a penalty for each working day it is late according to the regulations as set out in the Undergraduate Student Handbook. See the Handbook for further information:

https://www.gla.ac.uk/media/Media_1206867_smxx.pdf

If the submission is more than 5 days late, it will receive a mark of 0.

If you are aware that you cannot meet the deadline, you must contact the course leader Qi Linyi (Martha) by email to request an extension, providing the reason for this request, at least 24 hours before the deadline. You must also copy in your teacher to this email. Martha will then decide if an extension can be granted. Note that extensions cannot be granted if you make the request after the deadline.

The Project is a summative assessment. It contributes to your final grade for the course. Failure to submit the Project will mean that you do not meet the Course Requirements for EfES B and will have to resit the component at resit time. Remember that resitting a summative assessment component of the course will also mean that your grade for the course is capped at 60%.

Your report will be automatically processed through Turnitin, which checks documents for similarity with other texts, including those of other students. You must not copy the source texts directly in your report or copy the work of others. Please see the Academic Integrity statement in the template document for further information.