STATIC ELECTRICITY	
Respective blueprint	Flying tinsel loop
Description	With various manipulations and experiments using a statically charged object, pupils will learn about static electricity.
Learning Objectives	1. What is static electricity? 2. What causes static electricity? Pupils will learn about the charges and how positive and negative charges interact. 3. Examples of static electricity.
Related curricular subject(s)	Physics.

Prerequisites / preparatory actions for teachers

Preparing the materials for the flying tinsel experiment.

To demonstrate the principles of static electricity, the teacher can present an additional experiment: How to separate mixed salt and pepper with a plastic spoon? For this experiment the teacher prepares one teaspoon of black pepper, one teaspoon of salt, a plastic spoon and cloth (the cloth from the flying tinsel experiment can be used) and a black piece of paper. For the best outcome, the teacher can prepare the experiment on the table for the pupils to observe standing around the table together.

It is recommended to read additional information in science background and be prepared for answering pupil's questions.

Static electricity

It is one of the most common forms of electricity. It occurs when an imbalance of electric charges within or on the surface of a material or between materials is formed. In current electricity, the electric charge flows through an electrical conductor or space, and transmits energy. In contrast, in static electricity the charge remains on the surface of an object until it is able to move away by means of an electric current or electrical discharge.

Atoms are made up of neutrons, protons, and electrons. The protons and neutrons make the positively charged nucleus, surrounded by a cloud of negatively charged electrons.

A static charge happens when two surfaces touch each other and the electrons move from one object to another. One of the objects will have a positive (+) charge and the other a negative (-) charge.

If you rub an object quickly, like a balloon, or your feet on the carpet, these will build up a rather large charge, caused by friction.

Uses of static electricity:

- printers and photocopiers where static electric charges attract the ink, or toner, to the paper.
- paint sprayers, air filters, dust removal

Static electricity can also cause damage:

- Some electronic chips in computers are very sensitive to static electricity, so they have to be stored in special bags and be carefully protected.
- Attracting dust particles can cause problems in the industrial output, as the final product must be clean and dust-free to achieve the highest quality.
- If static electricity causes a spark in an explosive area, it could cause a fire or an explosion, even if it produces a small amount of energy.

A spark of static electricity can measure thousands of volts, but has very little current and only lasts for a short while. It has small amounts of power or energy.

There are specific ways in which static electricity can be stopped or minimized. Skin shows signs of static when it comes in contact with a

charged object. But when there is optimum humidity, the electrons do not stick to the body. Since the humidity levels decrease as winters approach, the static charges attach themselves to objects and the human body more frequently, what we can feel like a strike of static electricity.	
Prerequisites / preparatory actions for students	None.
Age of students	10-15
Duration	1-2 hours
Level of difficulty	Medium

Step by step description of the tasks

1. Experiment: How to separate salt and pepper?

This experiment is used as an introduction, to present the topic of the lesson to the pupils.

The teacher sprinkles salt and pepper on the black paper, so it can be well seen.

The teacher asks the pupils if the salt and pepper can be separated, and how?

The teacher rubs the plastic spoon with the cloth for about 10 seconds. Afterwards, the spoon part (rounded end) is held above the salt and pepper mixture. Pupils can observe when a few particles jump from the paper up to the spoon. Both salt and pepper are attracted to the static spoon, but pepper is lighter - it jumps first and clings longer to the spoon.

2. Research question: What makes the salt and pepper stick to the plastic spoon?

The teacher now asks the pupils, why has the plastic spoon attracted the salt and pepper particles.

The teacher presents another example. If the spoon is held above the mixture, nothing happens. But if the spoon is rubbed with cloth, particles are attracted to it. Teachers can guide pupils by giving some extra examples from the real-life. This is **Static electricity.**

3. Make the tinsel fly. With the help of the respective blueprint, pupils can make the tinsel loops and charge the pipe to make them fly! Teachers should encourage pupils to try different shapes of the loops and make them levitate. Have the pupils noticed that tinsels are attracted also to other surfaces and themselves? Why does this happen?

4. What is static electricity?

The teacher afterwards discusses with pupils and ask them, what is static electricity and why it can cause the moving, levitation of objects.

Static electricity is the build-up of an electrical charge on the surface of an object when positive and negative charges aren't balanced. Items with different charges (positive and negative; + -) will attract each other, while items with similar charges (positive and positive; + + or - -) will push away from each other. It's kind of like a magnet!

The teacher also asks pupils, if they can give some examples of static electricity. Have they ever been shocked with it, especially in the winter, when they touch some metal surface? Or do they experience their hair was standing up?

5. Explanation of the experiment

1. When the plastic pipe was rubbed with the cloth, the pipe became negatively charged (-).

2. The plastic pipe attracts the tinsels at first because they are positively charged (+). The tinsels also fall down towards the pipe also because of gravity's force.

3. When the tinsels touch the surface of the plastic pipe for a moment, the tinsels also become negatively charged (-).

4. Now the plastic pipe and the tinsels are both negatively charged (-). They are not attracted anymore but they move away from each other. This makes the tinsels fly.

5. All of the tinsels in a tinsel loop are now negatively charged, so they move away from each other, which makes the loop look like a ball.

6. The majority of objects (including us) are positively charged. Because the tinsels are negatively charged, they are attracted also to us.

Assessment activities

Possible questions:

1. Why is this type of electricity called static?

2. What causes the negative and positive charge?

3. If two things attract each other – do they have a similar charge or an opposite one?

4. Can you give some examples of static electricity from real life?

5. Most of the objects in our environment are charged with positive or negative charge?

6. Can you explain, why the tinsel loop flies above the plastic pipe in the experiment? Or why the salt and pepper are attracted to the plastic spoon?