

3.5 Great Scientists

Warming up!

Students can share the inputs from this activity with their teachers in the form of a written note.

Chit-Chat

- What would you like to learn about in your Science period?
- Have you ever tried to do an experiment on your own?
If yes, tell me about it.
If no, tell me why you've never tried.
- What would you like to learn about in your English classes?



Inventions

- ♦ Choose any one machine or device and prepare a short note about it. It should include
 - The structure of the device
 - How it works (functions)
 - A labelled diagram
 - One or two lines about when and how it evolved.

- (a) Think of as many examples of the following as you can within five minutes and write them in the appropriate column.

Type of machine	Examples
Simple machines that are operated by hand	
Machines that run on electricity	
Electronic devices	

- (b) Write as many uses of the following as you can. Form groups of four. Compare your lists. Make a long list by putting together the lists of all members.

- (a) A cloth bag (b) a wicker basket
(c) a glass bottle or jar (d) a steel bowl
(e) a thick string or rope

Great Scientists

Great scientists are persevering and never deterred by difficulties.

Michael Faraday is regarded as one of the most distinguished scientists and inventors of modern times, and his work on electricity is still a subject of study, in the form of Faraday's Laws. But few know his inspirational life story, which is all about courage and fighting against the odds.

Michael Faraday was born into a poverty-stricken family in a dirty London suburb. He suffered from a speech defect as a child. He would pronounce 'rabbit' as 'wabbit'. He could not even say his own name and would call himself 'Fawaday'. Other children laughed at him and teachers did not help him either. When he was twelve, his mother was forced to take him out of school, thus putting an end to his formal education.

At thirteen, however, he started working with a bookbinder, binding hundreds of books during the day and staying up all night to read them. Reading thus became his obsession. One day he came across a book on electricity which had been sent to his master for binding. He started reading it and was completely hooked. That was his first introduction to the subject of electricity, which soon became a lifelong fascination.

Faraday was still poor at twenty-one. Once, a friend gave him a free ticket to a public lecture and demonstration by the renowned chemist Humphry Davy at London's Royal Institution. Davy's work on chemicals and electrical lighting was the subject of conversation among the scientists of that age. Seventy

- ◆ Before you read further, guess what the passage is about.

Listen, read and answer :

- ◆ What were the odds against Faraday in his childhood?

What is meaning of :

- Reading became his obsession.
- Electricity became a lifelong fascination.

Think and answer :

- ◆ Why do you think Faraday's friend gave him a free ticket to Davy's programme?

Find the answer on this page :

- ♦ What was the subject of Davy's lecture?

- ♦ What actions and thoughts of Faraday show that he was inspired by Davy?

Guess the meaning of :

- mentor

- ♦ Why did Davy choose Faraday as his secretary?
- ♦ Was Davy fair in his treatment of Faraday?
- ♦ How did Faraday respond to that treatment?

years later, across the Atlantic Ocean in the USA, the same work enabled Thomas Edison to produce the first consistent light bulb.

That day in 1812 Faraday was spellbound by Davy's lecture. He kept taking notes about the 'mysterious force of electric fluid'. He was so engrossed in the lecture that he forgot to applaud with the rest of the crowd. When he went back, his notes were so comprehensive that he bound them into a book, meaning to gift it to Davy some day. Faraday decided that day that he didn't just want to sell books, he wanted to be a great scientist – good enough to write his *own* books. Davy became his role model. But there was a problem. He did not have the social status, money or the education to pursue science. Faraday thought it would be wonderful if Davy became his mentor, but Davy did not agree initially. Faraday was not dejected; he just kept trying.

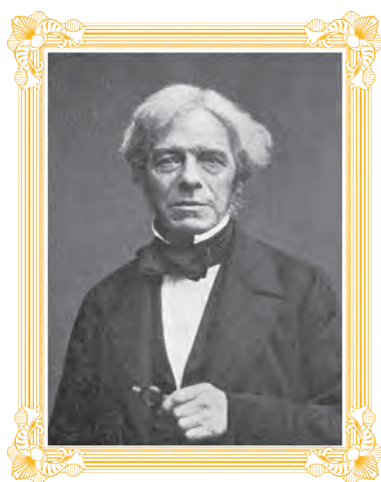
Destiny had a strange plan in store for him. A few years later, a chemical explosion happened inside Davy's lab and he was temporarily blinded. He now needed an assistant with an excellent memory to help him. He was reminded of Faraday and decided to hire him as his secretary. Davy never believed Faraday could do anything in the field of science going by his social status and education. He therefore dismissed Faraday's aspirations and advised him to stick to bookbinding. But Faraday was relentless. He worked day and night and learnt as much as he could about Davy's experiments. Soon Faraday became indispensable to Davy, and was promoted to his lab assistant. This was his first step towards a scientific career. Though much of his job now was cleaning labs, at least he got to see some of Davy's leading experiments.

Even then Davy did not have much hope for Faraday. Then Faraday got another chance to prove himself. One day Davy tried to re-create a famous electromagnetism experiment with fellow chemist William Wollaston, exploring why when an electric current is applied to a wire, it causes that wire to behave like a magnet. Obviously, the forces were

connected but nobody had figured out how to make it happen continuously. Davy believed that if he could find out why it happened and controlled it, there could be many practical applications of the force. But he was unable to figure it out and was frustrated. He then teased Faraday, asking him to try his hand at it after he was done cleaning the lab.

Within a few days, Faraday solved the problem. In fact, he went further and the result was the first induction motor, which converted electrical current into continuous mechanical motion.

The induction motor spurred a revolution. Fans, air conditioning, sewing machines, photographs, power tools, cars and even trains and aeroplane engines grew out of this simple device which was born out of mockery directed at Faraday.



Faraday became a celebrity scientist overnight. Nobody now cared about his social status or education; this young man had just created a revolution. One would think, as a teacher Davy was happy at his pupil's achievement. But in reality he was jealous. People started telling Davy that of all his discoveries, the best was Faraday himself; this made him even more jealous. An angry Davy gave Faraday an impossible task to keep him out of his way. He handed him a piece of Bavarian glass, which was used in the lenses in telescopes and microscopes, and asked him to reverse engineer it. Bavarian glass was manufactured by a secret complicated process and Davy knew that with the equipment available in the lab Faraday would never be able to accomplish the task. This piece of glass became a significant thing in his life.

Faraday had a never-give-up attitude and he respected Davy. So he accepted the assignment, despite

- ♦ What happens when an electric current is applied to a wire?



- ♦ An induction motor is a commonly used electrical machine. What examples of its use are given here?

Give one example each to show that

- ♦ Faraday was a good pupil.
- ♦ Davy was not a good mentor.

Guess the meaning of :

- reverse engineer it.

Think about it :

Faraday kept a souvenir of his failure as a source of inspiration.

- ♦ Write the idea behind an electrical generator.

‘In order to succeed, your desire for success should be greater than your fear of failure’.

– *Michael Faraday*

- ♦ Why were Faraday’s drawings not accepted?
- ♦ Does it mean they were wrong?

knowing that it would be very difficult. He toiled for four years, with no help from Davy, and, as expected, failed. Faraday never learned the secret, and this remained his first failure as a scientist. To remind himself of these difficult times, he kept a single glass brick on his shelf as a souvenir. This would inspire him during difficult times.

In 1829, Davy died and Faraday succeeded him as head of the laboratory. He was free to pursue whatever he liked, and he made another revolutionary discovery. He noticed that if he moved a magnet, it could produce electrical current; thus he could now convert motion into electricity. This is how the electrical generator was born, something still used today to generate all kinds of power, like dynamos and other devices.

Faraday was now a legend. In 1840, he developed memory loss, which continued for the rest of his life. But the disease did not stop him. He persevered, starting a complicated experiment to prove that light was closely related to electricity and magnetism – a novel thought in those times.

Remember that piece of Bavarian glass Faraday had kept on his shelf? He was determined to convert the reminder of his first major failure to an instrument of great success. He used the same glass now to show that in the presence of a magnet, light could be isolated into a single wave rather than spreading out randomly in all directions, a concept called polarization.

He then took the age-old experiment of sprinkling iron filings on a sheet of paper near a magnet, making circular patterns. He went on to prove that these patterns were not a property of the iron filings; in fact they were due to the invisible magnetic fields that filled the empty space around the magnet and hence disturbed the filings. This is where his lack of formal education went against him. Faraday did not know much about advanced mathematics, so he just copied the iron filing patterns with his hand. He was unable to explain them in the form of mathematical equations. He made hundreds of such drawings but without equations, they were not accepted.

Fortune favoured the brave Faraday once again when he met James Maxwell, a wealthy, educated physicist well versed in mathematics. He was willing to work with Faraday. It was Maxwell who translated Faraday's idea into a set of equations that are now called Maxwell's equations. Their combined work has helped us in many ways. Electronics and communication system today are designed around their discoveries. Some day, we might even be able to communicate with aliens across different galaxies using the products of these discoveries.

Faraday's life started with difficulties, but as a great scientist he met each difficulty with perseverance and conviction. He was given impossible tasks, which he undertook as challenges and opportunities. He epitomises what the Walt Disney character Pinocchio said :

'When you wish upon a star
It does not matter who you are'.

— From the Introduction to 'Reignited'
by A.P.J. Abdul Kalam and Srijan Pal Singh

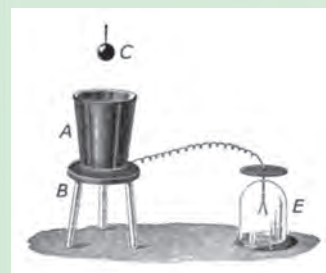
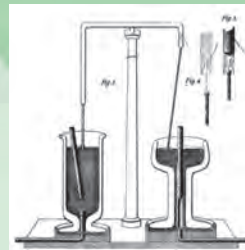
ENGLISH WORKSHOP



1. **Write what is implied** in the following sentences.

- But few know his inspirational life story, which is all about courage and fighting against the odds. (What does it tell you about Faraday's life?)
- Even then Davy did not have much hope for Faraday. (What do the words 'even then' suggest?)
- People started telling Davy that of all his discoveries, the best was Faraday himself. (What does it suggest about Davy's work?)

- ◆ Try out the experiment of the iron filings and the magnet.
- epitomises : is a perfect example of



2. Break the passage into convenient smaller sections.
Give **sub-headings or titles** to each section.
3. List the different gadgets and instruments mentioned in the passage. Find more information about at least 3 of them, using the internet.
4. Find out more about the following scientists with the help of the internet.
 - (a) Michael Faraday
 - (b) Humphry Davy
 - (c) Thomas Edison
 - (d) James Maxwell

Language Study

5. Find the following matter in the passage and copy the missing words.
 - (a) When he was twelve, school
 - (b) One day he came across a book on
 - (c) Faraday decided that scientist –
 - (d) Davy never believed science
 - (e) People started telling Davy that discoveries, ...
 - (f) He handed him a piece of Bavarian glass, which
microscopes, ...
 - (g) He went on to prove that filings;
 - (h) It was Maxwell who equations
6. Now complete the following sentences using your own words.
 - (a) When he was twelve,
 - (b) One day he came across a book on
 - (c) He decided that
 - (d) He never believed
 - (e) People started telling that
 - (f) He handed him which
 - (g) He went on to prove that
 - (h) It was who

