

CHECK-IN

科幻 >>> 宇航

SCIENCE FICTION

VOYAGE TO THE EDGE OF IMAGINATION

TEACHERS' GUIDE

VOYAGE TO THE EDGE OF IMAGINATION

LESSON PLAN

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Aims

- ✓ To cultivate the capacity for scientific and creative thinking

Expected outcomes

- 👍 Be aware of the practical applications of science in society, as well as its social, ethical and environmental implications
- 👍 To develop sensitivity and responsibility in striking a balance between human needs and environmental sustainability

Nature of Science

“Logic will get you from A to B.
Imagination will take you everywhere.”
Albert Einstein

Science is the blend of logic and imagination. Science often involves cycles of observation, hypothesis formation, experimentation, and analysis. Logic helps scientists to make sense of data and draw logical conclusions, while imagination enables the generation of new hypotheses, and encourages thinking beyond existing knowledge.

➤ Before the Visit

- Provide an overview of science fiction as a genre and its key characteristics. Explain how it combines scientific concepts with imaginative storytelling.
- Identify specific scientific concepts or topics covered in the curriculum, such as space exploration, genetics, robotics, and climate change. Choose science fiction works that incorporate these concepts and delve into the scientific principles behind them.
- Connect science fiction with other subjects, such as literature, history, and art. Explore how science is integrated into the story plot using nonfiction texts, and analyse the literary techniques employed in the storytelling process.

➤ At the Museum

- Encourage students to find a theme that captivates their interest, such as space exploration, time travel, or imaginary technological advancements.

After the Visit ◀

- Ask students to write a science fiction story or create an alternative scenario based on any existing science fiction works.
- Ask students to evaluate the scientific concepts depicted in science fiction works and assess their alignment with the real-world science. Discuss the accuracy and feasibility of the fictional science portrayed in these works.
- Ask students to discuss the potential impacts (including ethical dilemmas) of scientific discoveries in relation to society, individuals, and the environment.
- You are welcome to share the work of your class with the Museum!




TEACHING NOTES



↑ A Trip to the Moon (1902) is widely considered as the first Sci-Fi film.

What is Science Fiction?

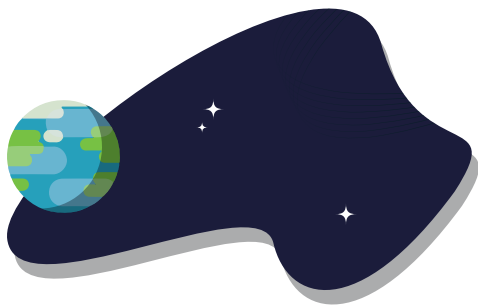
Science Fiction (Sci-Fi) is a genre of literature, film, and other forms of media which **combines scientific concepts with imaginative storytelling**. The word “science” implies that science fiction extends beyond fantasy (not real), and incorporates scientific and technological elements that have significant implications for the narrative.

Setting	Characters	Plot
 <ul style="list-style-type: none"> • Imagined future • Space exploration • Time travel • Alternative world (parallel universes) 	 <ul style="list-style-type: none"> • Aliens • Mutants • Artificial intelligence (AI) and robotics • Time travellers • Astronauts • Superheroes • Cyborgs 	 <ul style="list-style-type: none"> • Natural and energy crises • Genetic engineering • Use of futuristic technologies • Teleportation • Mind control

↑ Some common Sci-Fi elements

What is Science Fiction for?

- **Inspiration and innovation:** Science fiction is a hotbed of creativity. Ideas presented in the stories have often inspired scientists and engineers, leading to the development of scientific discoveries and technological breakthroughs.
- **Reflection on the present:** Science fiction often serves as a mirror to society by examining current issues, trends, and concerns through the lens of a fictional world. It can offer commentary on social, cultural, and ethical issues, providing a platform for critical thinking and discussion.
- **Reflection on humanity:** One of the significant topics in science fiction is the exploration of the future of humankind, and the investigation of identity, morality, consciousness, and the nature of existence.



Voyages into Space

Class inspiration

At launch, the hot exhaust gas produced from fuel combustion is expelled from the rear of the rocket. This results in an equal and opposite reaction force being exerted on the rocket, propelling it upwards in accordance with Newton's Third Law of Motion.

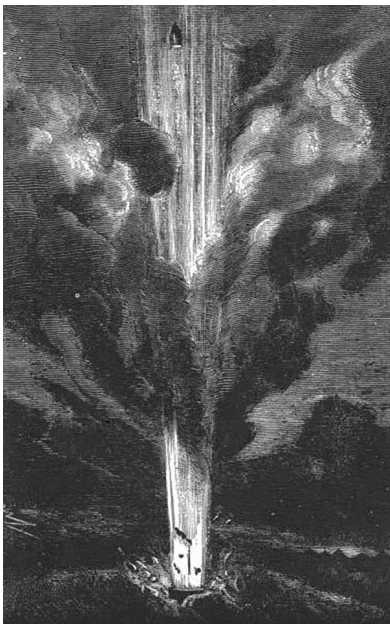
Class inspiration

The minimum speed needed for an object to escape from the gravitational pull of a massive body is known as the "escape velocity". Earth's escape velocity is 11.186 km/s.

Space is a boundless realm of possibilities and mysteries yet to be unveiled. Humans have an inherent desire to explore and venture into uncharted territories. Science fiction provides us with a canvas that empowers us to imagine and speculate about the prospective discoveries that lie in space. We might encounter new life forms, uncover enigmatic civilisations, or unlock the secrets of the universe!

Escape from Earth

Rockets, spaceships, and, interestingly, space cannons are depicted as vehicles for space travel in science fiction. To achieve interplanetary travel, the spacecraft must move fast enough to overcome the planet's gravitational pull. In reality, **propulsion systems** are used to generate thrust and propel vehicles in space. Chemical energy, nuclear energy and solar energy are some top choices of energy sources to generate thrust.



↑ The firing of the projectile, illustration of *From the Earth to the Moon*, engraving from the 1872 illustrated edition.



The concept of a space gun was first introduced in the classic science fiction novel *From the Earth to the Moon* (1865) by Jules Verne. This cannon-like device used explosive propulsion to launch a projectile into space, analogous to the mechanism by which a gun propels a bullet. It relied on the principle of projectile motion and aimed to achieve escape velocity in order to overcome Earth's gravitational pull.

Inspired by Verne's concept, some initial experiments have been carried out using explosion propulsion and electromagnetic force as alternative energy sources. These non-rocket methods showcase tangible advancements in bringing fictional technologies to life.

Life beyond Earth

The search for life on other habitable planets is an intriguing concept often explored in science fiction. The fascination with extraterrestrial life in science fiction mainly originates from our curiosity about the unknown.

Exploring the possible interactions between humans and extraterrestrial life provides a platform to examine our values, prejudices, and our own place in the vast universe.



Class inspiration

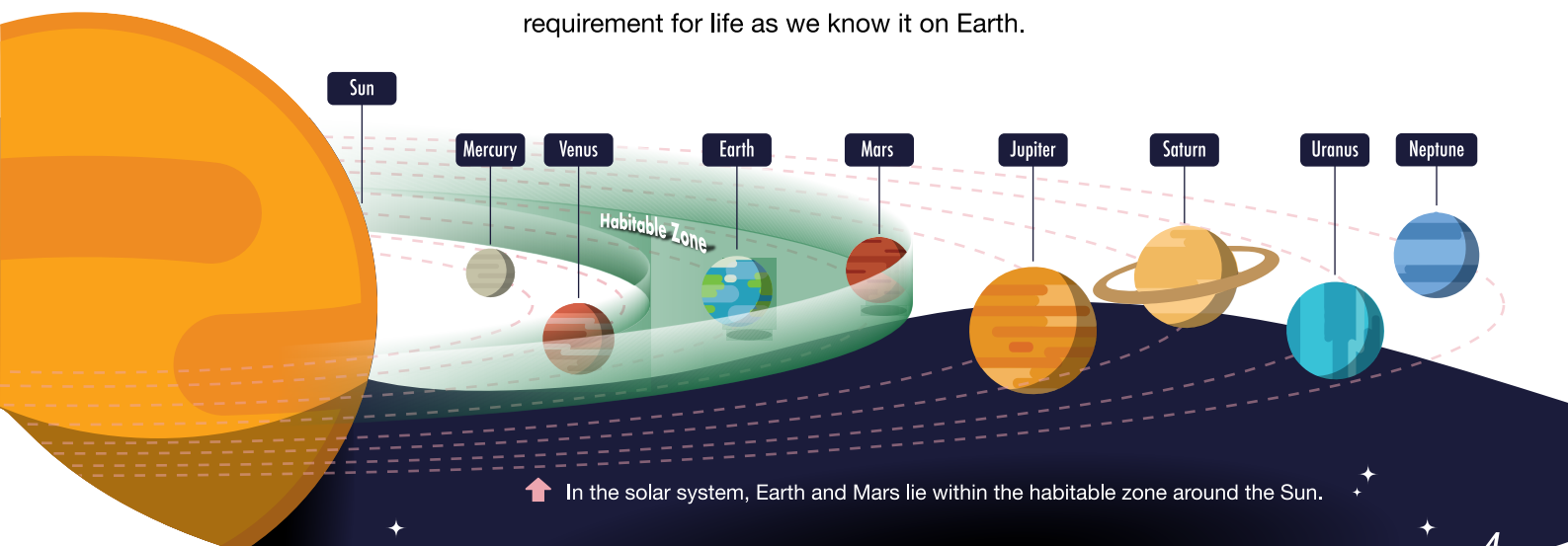
Why is water essential for life?

- It is an excellent solvent for biochemical reactions.
- It serves as a medium for metabolic processes in cells.
- It helps regulate temperature due to its high specific heat capacity.
- It is crucial for the synthesis of biomolecules, such as proteins and lipids.



↑ Are you ready to encounter other intelligences? (Imagine where you live alongside extraterrestrial life.)

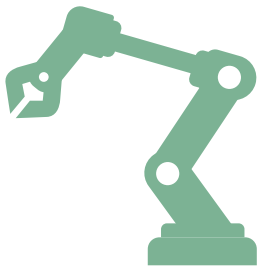
While science fiction captures our imagination about extraterrestrial life, the scientific quest for life beyond Earth continues. In astrobiology, the **habitable zone** refers to the orbital region around a star where **liquid water** could exist on planets' surfaces. Scientists consider the presence of liquid water as a key indicator for the potential existence of extraterrestrial life because water is a fundamental requirement for life as we know it on Earth.



↑ In the solar system, Earth and Mars lie within the habitable zone around the Sun.

Pandora's Box – Human and Machine

The word “robot” is derived from the Czech word “robota”, meaning “forced labour”. It was first introduced by Czech playwright Karel Čapek in his science fiction play *Rossum's Universal Robots (R.U.R.)* in 1920. Ever since the industrial revolution, mechanisation has become an integral component of efficient production. The rapid evolution of labour-saving mechanical inventions triggered technological anxieties among people. Stories, which revolve around artificial creations going out of control, reflect the fear that machines may surpass human capabilities.



Class inspiration

The creators of the first mobile phones drew inspiration from various sources, including science fiction, to envision a future where wireless communication would be possible from any location.

It's time for students to unleash their imaginations and ponder the groundbreaking ideas that might shape the next wave of technological advancement!

Imaginations Come True

Many imaginative inventions in science fiction have become a reality and are now integrated into our everyday lives. Here are some examples:

Communication

- Smart gadgets



- Video conferencing
- Universal translator

Transportation

- Autonomous cars
- Maglev trains



- Supersonic jets

Biomedical

- Gene editing
- Bionic limbs
- Artificial organs and implants
- Robotic surgery



Technology

- 3D printing



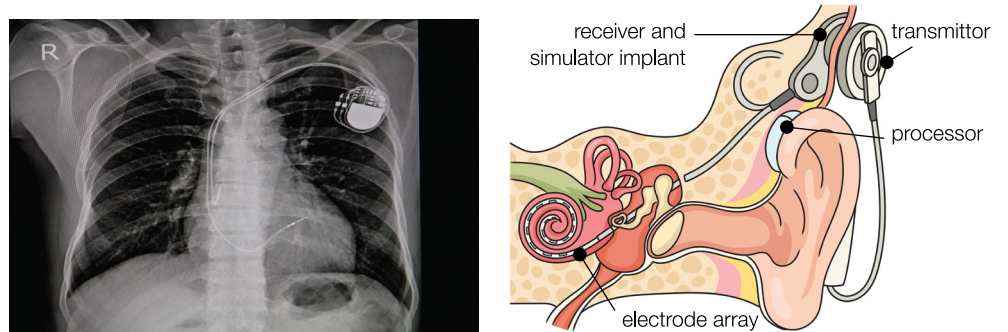
- Artificial intelligence
- Biometric authentication
- Nanotechnology



Cyborgs

Cyborgs – a term combining the words “cybernetic” and “organism” – refer to organisms enhanced with machinery parts. Darth Vader from the *Star Wars* films stands as one of the most renowned cyborgs. He has mechanical limbs and a life-sustaining breathing apparatus embedded in his helmet. Cyborgs represent a fusion of biological and technological elements, blurring the boundaries between the **organic** and the **artificial**.

The biological components of cyborgs can be living tissues and organs, while the artificial components include electronic devices, implants, and prosthetic limbs.



↑ Would you consider people with pacemakers or cochlear implants as cyborgs? (Left: X-ray of a cardiac pacemaker; Right: Structure of a cochlear implant)

Artificial Intelligence

Artificial intelligence (AI) is a widely used term that refers to the development of computer systems capable of performing tasks that can exhibit intelligent behaviour. Through analysing large data sets and recognising patterns, AI can iteratively improve themselves through **machine learning**.

Science fiction has extensively explored the concept of AI robots, often focusing on themes of:

- **Interaction with humans** – R2-D2 and C-3PO from the *Star Wars* films accompanied and assisted the human characters throughout their adventures. In real life, AI can interactively communicate and help **problem-solving** by offering insights derived from vast quantities of data.
- **Ethical dilemmas** – Sonny from the movie *I, Robot* was designed with individuality and free will. The movie raises awareness of AI ethics concerning **robot consciousness** and the potential for robots to make **moral** choices.

Class inspiration

AI development is subject to careful research, ethical considerations, and safety protocols.

Guide students to think about the pros and cons of AI technology, and the circumstances that developers should be aware of.

Our Future

Science fiction often reflects the concerns and fears prevalent during the time of its creation. Taking **nuclear technology** as an example, after the atomic bombings of Hiroshima and Nagasaki, Godzilla emerged as a symbol through which the Japanese people expressed their apprehensions about radiation-induced mutations and the destructive power of nuclear weapons.



↑ From fears to environmental issues, will the radiation threats portrayed in science fiction come true?

In recent times, science fiction has increasingly focused on the climate crisis, highlighting the consequences of environmental issues and natural disasters. While science fiction alone cannot solve the natural crisis, it plays a vital role in **envisioning the future, raising awareness, and inspiring action**. By capturing our imagination and evoking our emotions, science fiction can help us better understand the urgency of addressing climate change, and motivate us to take meaningful steps toward building a sustainable future.



← Can science fiction awaken us to the reality of climate change? (Imagine a city enclosed in domes due to pollution and environmental degradation.)