



**PLTW Engineering**

# **12/Ion Engine Design**

**May 11, 2020**



12/EDD

Lesson: 5/11/2020

**Objective/Learning Target: Students will be able to explain the theory regarding how ion engines produce thrust.**



## What is an ion engine?

Ion engines, used in space flight, work by accelerating ions to produce thrust.

Ion engines are very efficient; they don't require much fuel, which can help keep down the mass and cost of a spacecraft.

One common fuel used to power ion engines is xenon gas.



## What is an ion engine?

Take a look at the history of ion propulsion history.

[Dawn spacecraft and the engineering behind it](#) video (3:46)



## Can an ion engine be used on earth?

Ion engines cannot generate enough thrust to launch a rocket on Earth.

However, in the low-friction environment of space, and given a long period of time to accelerate, the small thrust from an ion engine is very effective.



## How does an ion engine work?

In the ionization chamber, electrons knock electrons free from xenon atoms to produce positively charged xenon ions.

Two electrically charged grids at the rear of the engine accelerate the xenon ions.

The first grid is more negatively charged than the walls of the engine but is more positively charged than the second grid.



## How does an ion engine work?

The first grid attracts the xenon ions, helping line them up so that they can pass through the grid; once the ions are near the first grid, the potential difference between the two grids accelerates them to very high speeds.

This stream of ions is also known as a thrust beam.



## Quiz yourself

1. Why would ion thrusters be unsuitable for rockets launched from Earth?
2. Why did the *Dawn* scientists and engineers choose an ion engine?
3. How do you think ion engine-driven spacecraft can achieve such high velocities?
4. How does the distance between the grids affect the thrust?
5. Why do you suppose xenon was chosen as fuel for the *Dawn* spacecraft?





## Helpful links

Take a look at these 2 videos regarding ion engines powering flight:

[How do ion engines work?](#)

[Ion engine prototypes DIY](#)