Deep Space 1 was a space probe, launched on October 24, 1998, and it used a type of engine called a ion propulsion drive. This engine generates a weak force, but it can do so over a long period of time and using only a small amount of fuel. The probe has a mass of 474 kg and is traveling with an initial speed of 275 m/s. The only force acting on the probe is from the ion drive, at a force of 0.056N parallel to the probe’s displacement, which is 2.42 million km. What is the final speed of the probe?

**Solution**

In this problem, we’re looking for a change in speed, which tells us that we’re looking for a change in the kinetic energy. With the only force on the probe being the ion drive, we can use the work-energy theorem to find the change in energy:

Then, we can expand the energy:

Since the only energy in this system is the kinetic energy, we can substitute the energies with our definition of kinetic energy:

Since it’s the final velocity that we’re looking for, we can solve this equation for the final velocity:

The mass and the initial velocity are both given, but we need to find the work done on the probe. We can use our definition of work to calculate it:

Substituting our values and calculating the final velocity: