



Asking Scientific Questions about Europa's Habitability

1. Watch the video about scientific questions.

A scientific question has three parts. Write the parts in the boxes by summarizing the video.

2. Practice asking scientific questions

In the 2030s NASA will start sharing the results publicly from the instruments of the rocket Europa Clipper. NASA is investigating habitability, which is how likely life can be supported in a location. The Clipper is not looking for life itself, just signs of whether life could exist on this moon Europa.

The Europa Clipper's instruments are looking for the three things life needs:

1. liquid water for life
2. chemical building blocks of life
3. an energy source (either light or energy from chemicals)

The Claim

NASA scientists claim that Europa is habitable. This is a **testable** claim: yes Europa is habitable OR no Europa is not.

NASA does not have to find life, just the ability to support it.

We will practice developing scientific questions for three of Clipper's instruments.

1. Liquid water for life

The Clipper has ice-penetrating radar (REASON) that will send radio waves through the ice to measure its thickness and look for pockets of liquid water or cracks. The cracks might let nutrients circulate with the liquid water under the ice, supporting habitability.

A scientific question for the REASON instrument could be:

How thick is Europa's icy shell, and does it allow liquid ocean water and surface chemicals to mix?

This is a scientific question because it is:

Testable with clear evidence (yes there is liquid water that could be habitable OR no the ice is solid and does not mix).

Measurable with numbers and data (ice thickness).

Relational connections: the question connects the presence of liquid water to habitability. Habitability needs liquid water.

2. Chemical building blocks of life: the atmosphere “sniff test”

The Clipper mission’s ultraviolet spectrograph (Europa-UVS) and cameras will search for plumes (jets) of water vapor and chemicals shooting into space from Europa’s cracked surface. Detecting them would let scientists test whether ocean material reaches the surface containing chemical building blocks for life like amino acids (in soy sauce).

Now it is your turn! Write a testable question for the Europa-UVS instrument. We have put sentence starters for you.

<p><i>Does the Europa-UVS detect</i></p> <p><i>and do these contain</i></p>

This is (hopefully) a scientific question because it is:

Testable with clear evidence (yes there are water plumes with chemicals for life or there are none).

Measurable with numbers and data (measuring how many plumes and what chemicals).

Relational: because the question connects the presence of chemical building blocks of life in liquid water to habitability.

3. Chemical energy for life

Clipper instruments like the Mapping Imaging Spectrometer for Europa (MISE) will map the surface chemical composition. This could provide information about whether there are building blocks of life and chemicals that could provide energy for microbes. These chemicals include carbon compounds and salts.

Now on your own! Write a testable question for the MISE instrument.

This is a scientific question because it is:

Testable with clear evidence of:

Measurable with numbers and data of:

Relational because the question connects habitability to:

If you get stuck, don't worry! We will have more time to practice asking questions about earth-bound life soon.

You can go online to see if there is any data as the Clipper reaches Europa, and see if **your** questions have real answers! Is it there yet?